ACHIEVEMENT AWARD WINNERS
Julian O’Connell, Dan Schlea, Troy Stokes and Grahame Turnbull are profiled.

BRIGHT LIGHTS, BIG SEWER
Paradise Whitney Interceptor project in Las Vegas comprises more than 5 miles of trenchless installation.

MEET IN THE MIDDLE
J.F. Fowler completes a tricky tunnel in California by joining a microtunnel drive with a rock tunnel drive.
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EDITOR’S MESSAGE
Despite its status as a mature technology, the value of microtunneling – and trenchless installation in general – is still not fully understood.
By Jim Rush

MICROTUNNELING ACHIEVEMENT AWARDS
Industry veterans Grahame Turnbull, Julian O’Connell, Dan Schitea and Troy Stokes are honored for their contributions to the market.
By Jim Rush

MEET IN THE MIDDLE
James W. Fowler Co. combines microtunneling and conventional tunneling to complete tricky project in California.

MICROTUNNELING OR GUIDED BORING?
How to choose the most appropriate method for your project.
By Gerald Lowe

BRIGHT LIGHTS, BIG SEWER
Paradise Whitney Interceptor Project in Las Vegas includes 25,000 ft of trenchless construction.
By Jim Rush

ROYAL YORK REPLACEMENT
Microtunneling proves to be optimal solution for sewer installation in Toronto.
By Mai-Linh Ho, Anton Croos and Bashir Ahmed

PILOT TUBE MAINTENANCE AND BEST PRACTICES
Guided or pilot tube boring can be a great way to install pipe. But to do so, the equipment needs to be in good working order.

JOB LOG
A recap of recently completed and ongoing microtunneling projects in North America.

PRODUCTS
A look at some the newest equipment to help successfully complete your next boring job.

DIRECTORY
A listing of microtunneling contractors and suppliers operating in the United States and Canada.

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EDUCATION STILL NEEDED TO GROW THE MICROTUNNELING MARKET

Welcome to the seventh edition of the North American Microtunneling Industry Review. Since you are reading this, you are probably well versed in trenchless methods and their numerous advantages over open-cut construction – less disruption, less mess, less cost, less time. Why wouldn’t you go trenchless?

But in compiling this issue, I was reminded again that in the overall utility sector, the value of trenchless isn’t always fully understood or appreciated. In talking to the four Microtunneling Achievement Award winners – all of whom have been involved in the market for more than two decades – they cited the need for education within the market even though microtunneling projects have been completed in the United States since the mid-1980s.

Troy Stokes, International Sales Manager for Akkerman and one of this year’s awards recipients, stated: “The future of the market still hinges upon education, just the same as it did 20 years ago. We have made a lot of strides, but I still run into people in the utility sector who have no idea that microtunneling exists.”

Two of the other winners – Grahame Turnbull, an independent consultant, and Julian O’Connell, Area Manager for North America and the Caribbean for Herrenknecht – agree that the use of microtunneling is much more common overseas vs. North America. “My experience in other parts of the world, including South America, the Middle East, Far East and Europe, is that microtunneling is everywhere. You don’t even get off the airport property and you will see a microtunneling machine working. It is very widely used. But it is still very much a specialty here in the United States … I don’t think it is utilized to its full potential,” Turnbull said.

Evidence of that can be seen on the Paradise Whitney Interceptor project in Las Vegas. While the project boasts an impressive 25,000 ft of microtunneling and trenchless utility tunneling, open-cut still accounts for half of the total footage – all which requires digging up roads in residential and commercial parts of town. Interestingly, portions of the project were converted from open-cut to trenchless because residents demanded it, according to Robert Marshall, project manager for Frontier-Kemper, which is constructing the trenchless portions of the project. It makes sense. Why tear up streets and block driveways when a better alternative exists? If residents can recognize the benefits, why can’t utility owners?

But according to Dan Schitea of Vadnais and another Microtunneling Achievement Award winner, the use of microtunneling is spreading to markets beyond the utility sector – which is a positive sign. “We are starting to see new utilities and clients, both public and private, begin to show a real interest in the technology,” he said. “I see a very bright future.”

There have also been some other positives over the past year – new contracting and equipment manufacturing firms are entering the market, and successful completion of curved and other technically challenging projects help continue to prove the technology for owners who may perhaps be risk averse.

So while the market is growing – perhaps at a rate slower than we would like – there are untapped opportunities for microtunneling in the United States and Canada. There has been a lot of development in the sector over the seven years we have been publishing the North American Microtunneling Industry Review, and we look forward to seeing its continued growth.

To read more about this year’s Microtunneling Achievement Award winners – Grahame Turnbull, Julian O’Connell, Troy Stokes and Dan Schitea – see pages 6 through 12. They are well deserving of the honor. To read about the Paradise Whitney Project in Las Vegas, see pages 20 through 23.

Jim Rush | Editor
Microtunneling Short Course
February 9-11, 2016

Now entering its 23rd year, the Microtunneling Short Course has trained over 2,500 course students. The hallmark of the program is the presentations, which are given by real-world professionals including contractors, consulting engineers, utility owners and equipment manufacturers.

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MICROTUNNELING ACHIEVEMENT AWARDS:
INDUSTRY VETERANS O’CONNELL, SCHITEA, STOKES AND TURNBULL RECOGNIZED

BY JIM RUSH

Since its introduction to the U.S. market in the 1980s, microtunneling has steadily grown and become an accepted method for installing pipelines, particularly in urban areas or when roads or environmentally sensitive areas need to be crossed. It is largely because of the success of some of the early projects that the method began to take root. Interestingly, many of the pioneers in the market are still active in the market.

To recognize the individuals who have worked toward successfully completing complicated projects and advancing the industry, the Microtunneling Achievement Awards were created. The awards were established by Microtunneling Short Course organizers Tim Coss, Microtunneling Inc., and Levent Ozdemir, Tunneling Consultant.

The winners this year are Grahame Turnbull, an independent consultant, Julian O’Connell, Herrenknecht, Dan Schitea, Vadnais Trenchless Services, and Troy Stokes, Akkerman Inc. These individuals have careers that date back to the early stages of microtunneling in the United States, helping build the market from the ground up.

In the following space, we take a look back at the careers of these men, their experiences and where they see the market heading.

GRAHAME TURNBULL

A native of the United Kingdom, Turnbull spent 10 years in the British Army before setting out on his career in the private sector in 1989. He had mechanical engineering background with the Royal Electrical and Mechanical Engineers while in the Army, and put his training to good use when he joined Sillars B & CE, based in Hartlepool in Northeast England, upon the end of his military commitment.

Sillars had purchased a Soltau/Decon RVS 250 – one of the first microtunneling systems to cross the English Channel (it would have had to come by boat – the opening of the Chunnel was still a few years away). Turnbull worked for a few other contractors, including Manchester Area Contractors, J.F. Donelon, and A.E. Yates, before making a huge career change. In 1995, Turnbull took on the position of Technical Service Manager for microtunneling machine manufacturer Soltau. Not only did he leave world of contracting, but his new role at Soltau brought him to the United States, where he has lived ever since.

“My time with Soltau was an enjoyable period of my career,” Turnbull said. “It was a big change in coming to the United States, and technology was still fairly new then – it was really cutting-edge stuff. Because of my role with the company, I was able to get involved on some really interesting projects.”

Turnbull spent seven years with Soltau, before leaving in 2002 to join Affholder. Turnbull spent three years at Affholder, seven with Bradshaw Construction, and three years with The Robbins Company before setting out on his own as a consultant in June 2015. Currently, Turnbull is working with JR CRUZ Corp. and Nada Pacific on projects in the New York metropolitan area.

While working for Affholder, Turnbull specifically recalls one project – a lake tap in Summerville, West Virginia – that was a particular challenge. “The project was a raw water intake that was designed as two microtunnels, one on top of the other, bored from a drilled shaft 110 ft into the rock. The rock was portrayed as sandstone in the range of 12,000 to 14,000 psi but it ended up being quartzite in the range of 30,000 to 42,000 psi. We ended up completing that project by drill-and-blast. The rock was too hard to cut.”

Turnbull says the technology has come a long way since he first got involved in the business. “Back when I first started out there were limitations with a number of things,” he said. “The machines were all auger driven, which had its limitations.
Congratulations to Julian O’Connell, Dan Schitea, Troy Stokes and Grahame Turnbull, the recipients of this year’s “Microtunneling Achievement Awards.” Their contributions over the past two decades have greatly enhanced where we are today as an industry. They are some of the best we have. Their efforts have made our jobs easier, safer and more economical over the years. The Microtunneling Achievement Award is the highest honor the microtunneling industry has to recognize their excellence. Our industry is a better place because of them and we’re pleased to call them friends.

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When slurry microtunneling was introduced it revolutionized the distances you could go and the materials you could deal with. Probably the biggest development was in the guidance systems and automation. The first machine I worked on had a control panel that was just a bank of numbers – it was kind of scary to look at when you first saw it. Nowadays operating the machine is like playing a video game."

While the microtunneling market has grown in the United States, it has yet to achieve the level of popularity that it has in Europe and elsewhere. "It is a slow growth area here," he said. "My experience in other parts of the world, including South America, the Middle East, Far East and Europe, is that microtunneling is everywhere. You don’t even get off the airport property and you will see a microtunneling machine working. It is very widely used. But it is still very much a specialty here in the United States for whatever reason. I don’t think it is utilized to its full potential."

The recent completion of curved drives in North America has begun to open some doors for microtunneling here, he said. "The rest of the world has been doing some curved drives and compound curves very successfully, and they are starting to catch on here. Of course there is an added element of risk, but it is just a matter of taking on the level of risk you are comfortable with. The sophistication of the guidance systems and the equipment itself has allowed these types of projects to be completed successfully and it is quite encouraging that a lot of the engineering firms are recognizing this capability."

JULIAN O’CONNELL

O’Connell also got his start in the tunneling market in the United Kingdom. The son of a tunneler, O’Connell has spent practically his entire lifetime underground. "Ever since I was about 5 or 6 years old, I remember visiting some of the tunneling jobsites with my father and climbing down shafts on wobbly old ladders with Irish miners there to catch me if I fell," he said.  

It is no surprise then that O’Connell went on the study civil engineering before entering the tunneling market on his own. Starting off as a junior site engineer, O’Connell hit the ground running on projects that included pipe jacking, slurry shield tunneling, compressed air tunneling, hand mining, rock TBM and...
roadheader tunneling, in addition to shaft construction, while working for companies including Costain Civil Engineering, J.F. Donelon and J. Gallagher London Ltd.

In 1995, he made the leap from the United Kingdom to South America. Working for Japan-based Iseki Inc., one of the pioneering MTBM manufacturers operating in the United States, O’Connell left the United Kingdom to work as a project manager in Chile. Surprisingly, with all the different excavation techniques and machinery he was involved with in England, O’Connell had not been involved with a conventional microtunneling project before joining Iseki.

From Chile, O’Connell went to work on a project in Barbados, which was in the midst of a major infrastructure upgrade program. In total, O’Connell was involved with companies (Iseki, Why Dig Technologies and Soares Da Costa) that completed more than 6 km of microtunneling and 18 miles of open-cut, along with the construction of more than 50 shafts.

The next step for O’Connell was heading to the United States to join James W. Fowler Co., where he helped the company launch its tunneling division in 2002, beginning with the challenging Spanaway Loop Bypass Interceptor project near Seattle. That project included high groundwater and mixed face conditions that included up to 60,000 psi cobbles. After working on several other projects on the West Coast and Midwest, O’Connell joined Herrenknecht in 2007 where he works as Area Manager for North America and the Caribbean.

So what is it about the industry that keeps him motivated? “With tunneling and microtunneling, there is never a dull day,” O’Connell said. “There is always a problem to solve that requires a different technical solution, and you then you need the teamwork to get the project done. It is just a very interesting and exciting business that has kept me attached to it for so long.”

For O’Connell, the biggest change in the technology is not in the machines themselves, but the guidance and lubrication systems. “If you look at a Herrenknecht
AVN today vs. 20 years ago, you have some advances like face access, but the basic principles are the same; the improvements over time have been more in the way of making the machines more reliable and more robust," he said. "The biggest jump in technology has been the navigation systems and the automatic bentonite systems. The gyro systems have made it a lot easier to negotiate curved projects and the lubrication systems have played a key role in the development of longer drives."

O'Connell says his background as a junior-level engineer was an important part in his professional development. "In my early days I was fortunate to be involved with different types of equipment and different tunneling and shaft sinking techniques," he said. "When you are in the field, you can see firsthand what can go wrong and the ways to do it right. I would spend maybe 10 hours in the field and an hour or two in the office after the shift writing up records and planning for the next day. That was a really good way to learn. There are certain things that can only be learned in the field."

As far as the future of microtunneling in North America, O'Connell sees growth potential. "I don't think the United States has realized the full potential of microtunneling," he said. "There are still places that have no interest in it. And, we are seeing a lot of growth with our DirectPipe microtunneling system that is expanding the use of the technology beyond the typical municipal sewer projects. But there have been some positive developments. Ten years ago I think North America lagged behind Europe and the rest of the world in terms of using the technology to its fullest extent, but now I would say they are pretty much on par."

DAN SCHITEA

Like some of the other Microtunneling Achievement Award winners, Dan Schitea's entry into the microtunneling market was circuitous. After studying architecture for four years at Cal Poly, he realized that a job that required him to be cooped up indoors was probably not what he wanted to do, so he changed his major and earned a degree in construction management.

His first job involved working for a civil construction company building wastewater treatment plants, but when an opportunity to work for Vadnais Trenchless Services arose in 1997, Schitea took advantage, launching himself into the microtunneling market where he has been involved ever since.

Coincidently, his first assignment was a project engineer on a large microtunneling job in downtown Los Angeles, a project where he first met industry people including Troy Stokes and Grahame Turnbull.

"I knew nothing about microtunneling back in 1997," Schitea recalled. "However, I really enjoyed the challenge associated with this new type of construction. From that point on I have been involved with microtunneling, overseeing the installation of nearly 200,000 lf of microtunneled pipelines."

Schitea says that daily challenges and unique problems associated with the work are what draws him to the field. "I enjoy the challenges that come with microtunneling," he said. "Every project is different and every day within each of those projects presents a new set of challenges. Microtunneling is not easy. It takes a certain type of personality to succeed, and I am proud to say that I've been able to develop my career within the industry. I also find it rewarding to know that each of our completed projects have delivered significant benefits to society. By providing new utilities without disruption to the environment and the public, microtunneling is one of the least obtrusive construction methods out there."

Schitea said that he remembers each project that he has been involved with, but two stand out above the others. "I can remember every project we have done as if it were yesterday. They are all so memorable for a variety of different reasons. But, there are two projects in particular that are very memorable. In 1999, the Bajamont Way Membrane Plant in Carmichael, California, was a project that consisted of several deep shafts and three separate microtunnels well beneath the American River. It was the first project where I had constructed sunken concrete caissons and drilled CMP shafts. The other was the UNWI Section 9 project in Citrus Heights, California, built from 2007 to 2009. This project consisted of 27,431 lf of microtunneling over 40 separate drives. I will never forget the extensive planning, multiple headings and several obstacles that were overcome while working with a top-notch project team."

The biggest changes to the microtunneling market that Schitea sees are those related to spoils separation. "Back when I
started, the separation process was relatively crude,” he said. “We were using skip tanks, settling ponds, direct discharge of the drilling fluids, etc. We were just starting to get mechanical separation equipment from the oilfield industry at that time and we could see the benefits of those devices right away. As time went on, environmental restrictions got tougher and machinery became more efficient. Today, the separation process is just as important, if not more so, than the actual mining of the tunnel.”

Schitea is bullish about the future of microtunneling in the United States. “Now that the ‘Great Recession’ is behind us, and utility operators are starting to invest in their infrastructures again, I see a bright future,” he said. “We are starting to see new utilities and clients, both public and private, begin to show a real interest in the technology.”

For the growth to occur, however, there need to be some changes. “The key to sustaining this growth is to have all parties – owners, engineers, contractors and manufacturers – be a lot more realistic about the capabilities,” Schitea said. “The industry continues to be overly optimistic about what can be achieved, how quickly it can be achieved and what the costs should be. Further, project owners continue to provide smaller footprints with which contractors are expected to set up and operate. I would like to see a much more collaborative effort between contractors and consulting engineers during the design phase which would result in realistic expectations.”

Asked for his advice in achieving a successful project, Schitea’s response was: “Proper project planning! The success of any microtunnel project depends on how much effort you put into the project before you begin the actual construction work.”

TROY STOKES

Born and raised in Florida, Stokes has been immersed in the construction industry since Day 1. With his father working in construction, Stokes would often find himself at jobsites. “I have always been fascinated with construction,” he said. “I could drive a bulldozer before I could drive a car, and I always knew that I wanted to do that type of work as a career.”

Although his father was involved in vertical and development construction projects, Stokes migrated toward the utility sector, where cut-and-cover pipeline projects were prevalent at a time when trenchless was beginning to make inroads in the United States. Stokes’ introduction to trenchless came through a family friend who was
working with Soltau Microtunneling as the German company was establishing a presence in the United States. “They were looking for someone to handle logistics, make sure equipment was where it needed to be and make sure the pits were dug – basically getting projects off the ground and seeing them through,” Stokes recalled. “Before I knew it, the company took off and I was helping build projects all over the country.”

In the early days, Soltau was the solid leader in the U.S. microtunneling market. However, Soltau went through a transition – company founder Gerd Soltau sold the company in 2000, and passed away suddenly a few years afterward. Six years later, Stokes decided to join Akkerman. “I had known Maynard Akkerman since I first got involved in the trenchless market. I would see him on various jobs and he came across a very respectable guy. It was also impressive to see him out in the field; typically, you would never see company owners out on the jobsite,” Stokes said. “At first I was reluctant to leave Soltau, but the more I knew about Akkerman Inc. the more I liked. They were a family company as opposed to a big conglomerate, and all they did was trenchless, which meant they had to do it well or they wouldn’t survive. I also liked the fact that they surrounded themselves with technical people, not slick salesmen.”

On the technology side, Stokes sees advances in electronics and separation equipment as two aspects of the market that have changed the most. “One of the first changes to come along was the move from analog to digital control systems using PLCs (programmable logic controllers),” he said. “With the digital systems, the operator and ultimately the owner had much more data available that allowed you to really understand and control what was going on. Not too long after that, digital guidance systems started becoming common, which has taken the industry into a whole other level with how far you can go and what you can do with drives, in particular curved tunnels.”

In the beginning, slurry separation technology was very basic. “In those days, we would simply pipe the returns into a tank and get new water when the tank filled up,” Stokes said. “We started improving the process little by little by bringing in some oilfield technology like shakers and centrifuges. Today’s purpose-built separation systems are a far cry from what we started with.”

Of his time in the market, Stokes recalls a project for the Natural Energy Laboratory of Hawaii Authority (NELHA) in Kona, Hawaii, as his most memorable. The project involved driving twin 1,040-ft intake pipelines 80 ft under the Pacific Ocean, but was fraught with challenges; the seabed geology has treacherous lava holes, and, at the surface, wave action nearly shut the site down. It was also the first U.S. project to have an underwater recovery of a microtunneling machine. “No one had ever done anything like that before,” Stokes said. “We were out there pretty much on our own facing huge hurdles, including bad ground conditions and bad weather. It was pretty amazing that we were able to overcome all the obstacles and get the project completed.”

When asked what he thinks is the most important aspect in completing a project successfully, Stokes answer was simple: Planning. “The No. 1 key with microtunneling – anything else for that matter – is preparation. Projects don’t always go as planned. Things happen fast and at the most inopportune times, but when you are prepared, it tends to lessen the severity of the impact. Preparation can include having spare parts on site and developing contingency plans. Also, geotechnical information is crucial.”

JIM RUSH IS EDITOR OF TRENCHLESS TECHNOLOGY.

MICROTUNNELING ACHIEVEMENT AWARD WINNERS
Past winners of the Microtunneling Achievement Award:
- Northwest Boring (2002)
- Dr. James Kwong, Yogi Kwong Engineers (2007, 2013)
- Stefan Trumpi-Althaus, Jack Control Inc. (2008)
- Matt Roberts, Kiewit (2009)
- Dennis Molvik, Northwest Boring (2011)
- Gary Huber, Permalok (2012)
- Rick Turkopp, Hobas (2012)
- James W. Fowler Co. (2014)
- Greg Raines, MWH (2015)
- Julian O’Connell, Herrenknecht (2016)
- Dan Schitea, Vadnais Trenchless Services (2016)
- Troy Stokes, Akkerman Inc. (2016)
- Grahame Turnbull, Consultant (2016)
In 2010, the Southern California city of Victorville was inundated with record-setting rainfall that peaked at 8 in. in 24 hours in many cities in the area, and up to 12 in. in the surrounding mountains. The rapid rainfall caused the Mojave River to flood its banks, inflicting damage to much of Victorville’s infrastructure.

Among the destruction was a sewer pipeline running below the Mojave River that conveyed 14 million gallons per day (gpd). The damaged sewer line was replaced in just eight days following the flooding with 5,000 ft of temporary sewage conveyance facilities to service surrounding areas. The work required a pipe bridge and transferred the wastewater to a section of undamaged pipe. However, the setup was deemed inadequate for long-term use and the Federal Emergency Management Agency (FEMA) and California Office of Emergency Services (Cal OES) set up funding for a permanent solution.

The Upper Narrows Pipeline Replacement Project, proposed by owner Victor Valley Wastewater Reclamation Authority, is just such a plan. The new pipeline measures 6,430 ft in length and is being placed deep below the riverbed. A portion of the pipeline is also being relocated out of the riverbed and constructed along streets adjacent to Victorville.

James W. Fowler Co. (JWF) was awarded a $38 million contract for pipeline construction, including all of the various pre-specified trenchless methods.

JWF, a family-run business since 1972, was well-versed in the various methods and felt confident it could overcome project challenges. “This project has all the different facets of trenchless technology. You usually don’t see that in a project of this size,” said Jeff Anderson, project manager for JWF.

The pipeline travels through a variety of geologies, from clay to granite. The contractor first tackled twin HDD drives measuring 1,740 ft each. It then followed up with 60-in. microtunneled drives with steel casing, measuring 865 ft and 1,850 ft in length.

Because of the varying geology and limited access from the surface, JWF combined microtunneling and conventional rock tunneling to complete a 3,100-ft section of pipeline. First, JWF used a rebuilt Soltau microtunnel boring machine with an mts operator station and VMT guidance, to complete the 1,850-ft drive through soft ground to a rock-soil interface. Next, JWF launched a Robbins Rockhead from the other direction, driving 1,250 ft to meet the MTBM that was left in place.
“We had very tight tolerances in order to meet the existing tunnel, so the survey was really important,” said John Fowler, executive vice president of JWF. “Fortunately, we were able to hit the hole dead center.”

The 60-in. OD microtunneling equipment was then jacked forward into the 76-in. ID rock tunnel and removed. “There was some environmental concerns about placing a shaft at the rock-soil interface, and it was 110 ft deep at that point so a shaft would have been expensive, so we decided to build it without a shaft,” Fowler said.

Hayward Baker was contracted to improve the ground in the area where the MTBM and Rockhead would meet using permeation grouting. Crews were able to drive the MTBM about 60 ft into the rock section, so that the MTBM and tail section were contained within rock or the section of improved ground. After the machines met underground, a vertical well was drilled from the surface for ventilation.

ROCK TUNNELING

The project was initially designed envisioning a pipe jack through the rock tunnel section to meet the microtunnel section. The unexpected discovery of varying lenses of hard rock and soil throughout the rock tunnel section, however, caused the project team to rethink the plan. Eventually, it was decided that a rock machine with the capability to install either liner plate or rib and board liner would be best. The machine could be equipped with the ability to propel itself either by thrust from the erected liner system or through the grippers.

JWF turned to The Robbins Co. for supply of its largest Rockhead to date — a 78-in. diameter, heavy duty tunneling machine with 14-in. diameter disc cutters that was capable of excavating very hard rock conditions. The rugged machine functions much like a hard rock, shielded TBM. Grippers push against the tunnel walls, propelling the machine forward so that it does not require launch with an ABM or pipe jacking unit. A variety of types of tunnel lining can be installed in the tail shield, from ring beam and board to four-flange liner plate. The self-propelled machine is capable of excavating distances of 2,000 ft or more, depending on the conditions. The machine was engineered and assembled in Robbins’ Solon, Ohio, facility by a small but specialized crew and shipped to the jobsite in early 2015.

The Robbins Rockhead launched in January and completed its drive in June. A crew of eight to nine members ran the machine 24 hours per day, six days per week. The seventh day is used for maintenance. Advance rates reached as high as 30 ft in two 10-hour shifts.

In the softer ground, cutter changes were minimal. “We have changed two gauge cutters and one twin cutter at the 100 ft mark, which was during the first cutterhead check,” said Matt Weaver, Robbins field service technician onsite.

IN MEMORIAM: DAVID PADILLA

David Padilla, a 38-year-old Pahrump, Nevada, resident and FoxFire Constructors employee, was killed on June 24 while working on the Upper Narrows Pipeline Replacement Project. FoxFire provided labor for the rock tunnel portion of the project. Padilla was operating a winch that was removing equipment from the excavated tunnel, when according to reports, the winch malfunctioned and came loose.

According to a report in the Daily Press, Daniel Gonzalez, a contract worker for FoxFire who had worked with Padilla on other projects, said that Padilla, a father of two daughters, was a hard worker and a leader. Gonzalez erected a cross that included a pick and shovel as a memorial at the job site.

“The cross is more than a piece of art, it’s a way of remembering and saying goodbye to a good friend,” Gonzalez was quoted as saying in the Daily Press.

“We are happy to see that David’s co-workers have honored him in this way,” VVWRA spokesman David Wylie told the Daily Press. “We remain saddened by his passing and sincerely appreciate the hard work that the crews continue to do at the Upper Narrows site.”
“Just shy of halfway we changed four gauge cutters and six face cutters that took us to the end of the tunnel. This is a front-loading cutterhead so cutters can only be changed in stable geology. With changing ground conditions cutter checks can’t always be done at scheduled footage and you have to make the best judgment calls you can to be prepared for what lies ahead.”

Throughout the challenges, JWF has been grateful for the presence of Robbins field service technicians onsite: “We’ve had two operators come out to help; when we first started the job there was one operator. They have been helpful and very knowledgeable about the machine,” said Anderson.

As the machine excavated, crews erected two different types of primary liner behind it. Four-flange liner plates were specified at either end of the tunnel, for the first 100 ft and the last 70 ft. The remainder of the tunnel is lined with ribs and lagging from Dywidag. “We have the liner plate to make sure the ends of the tunnel can be sealed up afterward and any water won’t migrate,” said Anderson. “As for the ribs and lagging, we did that in 5-ft sets, but we sometimes had to go down to 2.5-ft sets when the ground was very soft.”

After completion of the tunnels, JWF installed a new 48-in. HDPE line to complete the pipeline. The new section of sewer went online this fall helping to prevent further weather-related damage in the future.

THIS ARTICLE USES INFORMATION FROM AN ARTICLE WRITTEN BY DESIREE WILLIS, TECHNICAL WRITER FOR THE ROBBINS CO., THAT APPEARED IN THE MAY 2015 ISSUE OF TRENCHLESS TECHNOLOGY.
MICROTUNNELING OR GUIDED BORING?
HOW TO CHOOSE THE MOST APPROPRIATE METHOD FOR YOUR PROJECT
BY GERALD LOWE

The debate regarding what method of mining to select for infrastructure pipe installation continues to grow. Debate over construction means and methods is healthy for the industry. However, an accurate and realistic discussion of means and methods concerning when to select the guided boring method or microtunneling based on drive length, soil conditions and other project constraints is key to project success and the real value to the construction community as well as the municipalities and respective tax payers funding the projects.
AN ADVANTAGE OF THE GUIDED BORING METHOD IS THAT IT CAN BE USED IN SMALL JACKING AND RECEIVING SHAFTS.

DEFINITION OF METHODS

Microtunneling is a “trenchless construction method for installing pipelines” with four key attributes: 1) remote control is used in operating the microtunneling boring machine, 2) a guidance system is used, 3) pipe jacking is used to install pipelines, and 4) continuous pressure is exerted at the excavation face to balance groundwater and earth pressures (ASCE/CI 36-14).

By contrast, guided boring method (GBM), also known as pilot tube method and errantly as pilot tube microtunneling, employs an auger boring power unit with a pilot tube’s...
guidance and steering system. Originally designed for sewer laterals, GBM has been used for jacking casing sizes up to 60 in., when combined with hydraulic powered reaming heads or conventional auger boring rigs. The guided boring method requires multiple passes that upsize from the pilot tube in order to install the casing or carrier pipe. GBM, however, is not microtunneling or any variation thereof (ASCE/CI 36-14). Guided boring method is simply auger boring with pipe jacking.

**LIMITATIONS**

Like almost any construction method there are pros and cons that help guide the owner and engineer in selecting the method best suited for the project. As noted above, GBM is not microtunneling as defined by ASCE, and is limited in its application.

Negatives of GBM include limited drive length, limited compatible ground conditions, deflection and/or obstruction of the pilot tube. While drives using GBM can reach 600-700 linear feet (lf), the recommended drive lengths are between 200-400 lf in order to maintain accuracy of line and grade and reduce the risk of possibly failing to complete the drive. This is considerably shorter drive lengths than possible with microtunneling.

GBM is best suited for cohesive soils above the water table. It is incompatible for ground with gravel, cobbles, boulders, or rock, whereas microtunneling is suitable for most all ground conditions. Bony or rocky ground conditions can cause obstructions or deflections of the pilot tube that can limit the accuracy of GBM. Microtunneling can be used in mixed face and mixed reach soil conditions. Additionally, GBM typically uses extremely short lengths of jacking pipe which requires more pipe joints. This creates a greater potential for leaks and problems along the pipeline.

**POSITIVES**

So now that we have discussed the limitations for GBM, it is time to look at what conditions are conducive for the method. For short drives (less than 300 lf), GBM can work out of jacking and receiving shafts as small as 8 ft ID. Larger GBMs used for attempts at long drives (greater than 300 lf), typically require 12- to 14-ft jacking pits, which are small and well suited for urban settings. However, using conventional auger boring equipment to upsize casing from pilot tube requires conventional jack outs 24 to 34 ft long, negating much of the GBM shaft benefit.

Costs are almost always drivers when selecting the means and methods for pipeline construction. For this reason, using GBM can yield lower costs. When vitrified clay pipe (VCP) is the carrier pipe, for example, GBM costs are especially low. Another cost savings is in the equipment itself, which is less costly compared to microtunneling. The lower investment cost allows for more competition since the capital investment cost barrier is lower. The U.S. market is huge and, consequently, there are many contractors from which one can choose.

There are several other factors that lower costs for GBM, including fast and easy setup, bore, and recovery compared to microtunneling projects. Personnel required for GBM projects are relatively unskilled except for the GBM operator, which also keeps costs lower. Finally, boom trucks may be used for support equipment instead of cranes.

**CONCLUSION**

When selecting between microtunneling and the guided boring method, the owner is best served to not consider cost alone, but the conditions (ground, groundwater, drive length, pipeline diameter and material) that impact the means and methods and ultimate success of trenchless pipeline installations. As noted, both GBM and microtunneling have pros and cons.

The greatest attributes of GBM are lower costs and excellent accuracy, especially for shorter drives. Alternatively, microtunneling is far better suited for difficult and varied ground conditions, working in groundwater, longer drives and a broader range of pipeline dimensions and materials while still being able to maintain accuracy in line and grade. In short, guided boring methods are not microtunneling and should not be considered a suitable substitute for the same without a realistic and viable assessment to the existing project conditions and constraints.

GERALD LOWE, PMP, IS PROJECT MANAGER FOR BRADSHAW CONSTRUCTION CORP.
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The name “Las Vegas” conjures images of the famous Strip with its high-rise hotels, casinos and blinking lights. Tourists from all over the globe flock to the city to take in world-class entertainment, gaming and dining.

But outside the Strip, Las Vegas looks pretty much like any other U.S. city with quiet streets framing single family homes connected to thoroughfares with shops, restaurants, parks and schools. In order to support the development outside of the Strip, the Clark County Water Reclamation District (CCWRD) strives to ensure the reliability of the sewer system through a program of rehabilitation and new construction.

One of the district’s major undertakings right now is the construction of the Paradise Whitney Interceptor (PWl). The PWl is a multi-year project that consists of 13 miles of large diameter pipeline constructed from Valley View Boulevard and Serene Avenue in the southwest valley to Nellis Boulevard and Flamingo Road in the southeast valley. The project alignment is generally southwest to northeast in the area to south of the Strip and McCarran Airport.

Portions of the collection system in the project area are at, and even above capacity. The project will ensure adequate capacity and a more reliable system into the future.

The project will be constructed in three segments:

Eastern Segment (Project No. 669): The eastern segment, currently under construction, includes 5 miles of 54-, 60-, 66- and 72-in. diameter pipe within Nellis Boulevard, Hacienda Avenue, Lamb Boulevard, Oquendo Road, Pearl Street and Patrick Lane. It also includes installation of the sewer within the Grapevine Springs Park boundary. The
Speakers were interesting and presented impressive, new technology as an alternative way of handling different situations. It was good to meet people in other regions and learn about their ways of doing things.

Dean Walker, City of Dryden

www.catttrenchlessroadshow.ca
designer was Carollo Engineers with input from Brierley Associates.

Central Segment (Project No. 668): The central segment, also under construction, includes 4 miles of 60-in. diameter pipe within McLeod Drive, Sunset Road, Eastern Avenue, Warm Springs Road, Tamarus Street and Eldorado Lane. This segment will also include installation of one mile of 12- and 15-in. diameter pipe within Eastern Avenue and Big Top Drive. The designer for this segment was Black and Veatch.

Western Segment (Project No. 670): The western segment, which was scheduled to begin in 2015, includes 4 miles of 48- and 54-in. diameter pipe within Eldorado Lane, Bermuda Road, Wigwam Avenue and Valley View Boulevard. It also includes approximately 1 mile of 15-in. diameter pipe within Las Vegas Boulevard and Ford Avenue. There will also be sewer work along Fairfield Avenue, Robindale Road and Gillespie Street. This majority of this project is open cut. The designer was MWH.

Projects 668 and 669 combined comprise 55,000 lf of pipeline, including 25,000 lf of trenchless construction, making it one of the most significant trenchless new installation programs in terms of footage undertaken in the United States. The trenchless portions of both projects are being completed by a joint venture of Pipe Jacking Unlimited Inc. and Frontier-Kemper Constructors Inc.

“This project and the 25,000 lf of trenchless work is very significant, especially considering how slow the trenchless new installation market had been over the past few years,” said Robert Marshall, project manager for Frontier-Kemper. “Many fine, experienced companies have far too much equipment parked in their yard. Hopefully this marks an upward trend.”

Many challenges existed, including working in residential and commercial areas along heavily traveled roads with varying ground conditions. The ground varied from very soft, saturated material to hard materials, including full face caliche in excess of 5,000 psi that required the use of disc cutters. Groundwater was also an issue throughout. Because of the variability, Pipe Jacking Unlimited/Frontier-Kemper performed some additional geotechnical investigation to better identify conditions.

The logistical challenges were also significant. “Satisfying two prime contractors and their schedules, while maintaining and coordinating three tunnel headings with four separate crews stretched out over nearly 12 miles of project was a challenge in itself,” Marshall said.

For the trenchless installations, Pipe Jack Unlimited/Frontier-Kemper used a combination of earth pressure balance machine (EPBM) and slurry microtunnel boring machine (MTBM). The EPBMs (60-, 66- and 72-in.) were designed and manufactured by Tony DeAguiar and Pipe Jacking Unlimited while the MTBM (60-in.) was manufactured by Akkerman Inc.

The SL60 MTBM from Akkerman includes a 250-hp drive train as opposed to a standard 150-hp drive train. “Having more horsepower allows the machine to work in more challenging geology and on longer drives,” said Chris Sivesind, Sales Engineer for Akkerman. “The other benefit is that the customer has a great degree of flexibility on future projects; having the higher horsepower allows for a larger increase kit to be fitted on the machine so that a much larger diameter than 60 in. can be installed.”

The MTBM has an automatic lube can...
just behind the main shield that allows for continuous timed bentonite to be pumped on the entire circumference of the tunnel, leading to reduced jacking loads.

Additionally, Pipe Jacking Unlimited/Frontier-Kemper used a slurry separation system from Derrick. All of the trenchless pipe installed was Flowtite fiberglass reinforced pipe (FRP) manufactured by Thompson Pipe Group.

Project 668 – the Central Segment – was awarded to prime contractor Contri Construction, which is completing the open-cut sewer installation as well as the access pit construction for tunneling work. The open-cut work comprises 9,350 lf of 60-in. FRP at depths of 20 to 28 ft, and 7,000 lf of 8- to 27-in. sewer at 8 to 20 ft deep.

The trenchless portion of 668 comprises 10,160 lf of 60-in. direct jack Flowtite by EPBM and MTBM and 1,460 of 76-in. casing for 60-in. FRP, installed by EPBM. The combined 11,620 ft of installations were completed in 16 drives in depths ranging from 20 to 45 ft deep.

Additionally, Pipe Jacking Unlimited/Frontier-Kemper installed 600 lf of 16- and 27-in. FRP via auger boring (using 32- and 42-in. auger boring machines). In total, four auger bores were completed at depths of 10 to 18 ft deep.

Project 669 – the Eastern Segment – was awarded to Las Vegas Paving Corp., which again was responsible for open-cut installations and pit construction. The trenchless portion of this segment, which was closest to the treatment plant, included 6,730 lf of 60-in. fiberglass pipe via microtunneling (nine drives); 2,873 lf of 66-in. fiberglass pipe via EPBM (four drives); 2,648 lf of 72-in. fiberglass pipe via EPBM (four drives); and 1,220 ft of 76-in. casing by EPBM (one drive). This segment included 5,800 lf of compaction grouting for ground improvement, which was performed by Malcolm Drilling.

“We are excited to be the construction partner supplying FRP to one of the largest and most significant trenchless projects in decades. We believe this shows the continued acceptance of FRP as a viable jacking product and the commitment of both CCWRD and the engineering team to a strong and sustainable infrastructure,” said Mike Leathers, Executive Vice President of Thompson Pipe Group.

For CCWRD, the benefits of trenchless construction became apparent. In fact, two portions of the project were changed from open cut to trenchless to minimize traffic disruption and impacts on residents. These included a single 830-lf drive on Warm Springs Road and three drives totaling 2,700 lf along East Eldorado Lane.

“The CCWRD has been an excellent owner to work for,” Marshall said. “When issues arise, they are addressed promptly and as a team we work through them together to find the best solution for the project without posturing or wasting time. The sign of a good working relationship isn’t only when things go as expected, the true test is how everyone works together when there is an issue, and I can say that the CCWRD, Las Vegas Paving, Corp. and Contri Construction team that we are a part of is one of the best I have worked with in many years.”

**THE PARADISE WHITNEY INTERCEPTOR, CONTRACTS 668 AND 669, COMprise MORE THAN 25,000 LF OF 60- TO 84-IN. PIPELINE CONSTRUCTION IN VARIABLE GEOLOGY WITH DEPTHS REACHING 45 FT.**
ROYAL YORK REPLACEMENT

MICROTUNNELING PROVES TO BE OPTIMAL SOLUTION FOR SEWER INSTALLATION

BY MAI-LINH HO, E.I.T., ANTON CROOS, P.ENG., PMP, AND BASHIR AHMED, M.ENG., P.ENG, PMP

The replacement of a sanitary sewer along Royal York Road was identified by the City of Toronto as required replacement due to poor structural condition of the existing sewer. This work was part of the City’s 2014 Capital Works Program.

The scope of this project was the replacement of 165 m of 525-mm sanitary sewer with new 525- and 600-mm sanitary sewer along the west embankment of Royal York Road in Toronto, Ontario. The existing sanitary sewer ran under the west embankment, crossing an existing railway bridge behind the west abutment.

The bridge crossing over Royal York Road was constructed by the railway company to provide a grade separation between the rail traffic and vehicular traffic in 1956. Due to the grade separation, the existing sewer was diverted through the west embankment.

EXISTING SITE CONDITION

The land use of the surrounding area is a mix of residential and commercial use. The geotechnical borehole data collected for this site identified high groundwater. Additionally, Palaeozoic bedrock (shale) was found to be 8 m below ground along the proposed alignment.

The project area is a wooded embankment with residential properties backing onto the construction zone. During design, it was identified that the potential location of the shaft would impede onto a residential property. Therefore, an easement was obtained for these works. Extensive site clearing through the wooded area was required to allow access for all the machinery required to construct the shafts.

Additionally, a fiber-optic cable was found during design to be in-line with the proposed tunneling shaft. It was determined that the fiber would be pulled back during construction and reinstated afterward.

PROPOSED INSTALLATION

The proposed sewer was installed perpendicular to the railway bridge, with the launching and receiving shafts on either side of the bridge. The proposed invert elevations of the sewer were below the water table. Therefore, a hydrogeological study was performed. The study recommended that a “Permit to Take Water” from the Ministry of Environment, Ontario, was required. The study also recommended microtunneling as the most feasible option for the sewer installation to reduce possible track settlement due to dewatering and due to the prevalent soil conditions.

Sewer bypass was required to divert flow because the alignment of the proposed sewer was in conflict with the existing sewer. Sewer bypass pipes were re-routed through the existing railway underpass and were encased in a metal pipe for protection and prevention of any spillage.

The proposed pipe installation methods included:

• Conventional Open-Cut Installation: Borehole logs from the geotechnical investigation conducted indicated the presence of a high water table above the proposed pipe profile. Open-cut installation would require extensive dewatering that would result in adverse track settlements. The railway company would not allow open-cut in its right of way. Therefore, open-cut installation was not recommended as an option.

• Pipe Ramming: The project location was close to residential properties. Also, the existing sewer is located behind the bridge abutment and near the pile/caisson foundation.
of a wireless transmission tower. Pipe ramming may have impacted the existing bridge abutment and foundation of the transmission tower and hence was also not recommended as an alternative.

- Horizontal Directional Drilling (HDD): The grades for the proposed sanitary sewer were governed and restricted by the existing pipe inverts in the upstream and downstream maintenance holes. The proposed sewer grade was to be as low as 0.1% or less. The current technology available in the market would not be able to achieve such grades with precision. Also, special exemption approval was needed from the railway authority for use of HDD at the railway crossing. Therefore, construction by HDD was also not recommended as a feasible alternative.

- Tunneling by Jack-and-Bore Method: The proposed sanitary sewer construction was anticipated to be below the groundwater table. Tunneling by the jack-and-bore method would require extensive dewatering. This would increase the risk of settlement near/under the railway tracks along with structural issues for the private dwellings. Therefore, construction by jack-and-bore was also not recommended as a feasible alternative.

- Microtunneling: Microtunneling using earth pressure equalization methods was employed as recommended in the hydrogeological study report. With this recommendation, extensive dewatering was not required due to static groundwater levels being maintained.

**PROJECT CONSTRUCTION**

The total length for microtunneling was 42 m using a mixed-face cutterhead, which was recommended due to the rapid raveling or flowing soil type found in this area. Class 140-D, 600-mm ID reinforced concrete microtunneling pipe was used for the trenchless crossing.

The launch shaft was located at the south end of the project, installing the pipe from the downstream end. A rectangular shaft was constructed of dimensions 4 m by 5 m to a depth of 5 m. The shaft bottom was sealed by a 0.5-m thick concrete slab creating a watertight shaft. Some dewatering was used during the shaft construction.

Due to the proximity, the railway authority required track settlement monitoring. Subsurface monitoring points were installed 1 m above the crown of the tunnel bore. Readings were recorded on a continuous basis, and settlements of the voids above the tunnel bore were measured to determine the impact and potential movement of the tracks above.

The contractor, Ward and Burke, used a Herrenknecht microtunneling system for this installation. The system consisted of an AVN600 MTBM, control container including guidance system, the jacking frame and slurry pumps, settlement tank including water circuit, and bentonite pumps and high-pressure water pumps.

The AVN600 MTBM provided a closed full face excavation, which helped maintain stability in the tunneling work. Continuous monitoring was carried out to ensure the appropriate jacking force and slurry pressure was applied to maintain the correct stresses. The control container, located next the launch shaft, housed the power pack and electrical equipment to operate the system.

Ward and Burke completed the microtunneling installation without any untoward issues. The track settlement was found to be insignificant and within the acceptable limits.

**CONCLUSION**

Microtunneling proved to be the optimal solution for the installation of this sewer due to the existing poor soil condition, high groundwater table and space constraints. The risks associated with conventional open-cut, pipe ramming, HDD and jack-and-bore, including possible track settlement and adverse impact to the public and private property due to the extensive dewatering required, were too great to consider as a viable solution.

Mai-Linh Ho and Anton Croos are with RV Anderson, and Bashir Ahmed is with the City of Toronto. This article originally appeared in the October issue of Trenchless Technology Canada, a sister publication to TBM.
Guided Boring Machine (GBM) systems have countless project applications, and each year brings new accounts of contractor ingenuity with their machines. Integral to the GBM system’s performance is the integrity of its pilot tube inventory. Pilot tubes are used for many miles of linear footage, and proper maintenance intervals and use in the recommended geological profiles will see contractors through to this end. However, there comes a time when it is necessary to cycle out pilot tube inventory to achieve the most accuracy and success. Terry Fisher, GBM Product Manager with pipe jacking and tunneling equipment manufacturer Akkerman, Brownsdale, Minnesota, shares the indicators of when it may be time to rejuvenate your pilot tube supply.

PILOT TUBE DESIGN

Akkerman’s dual-walled pilot tubes allow for fluid passage to the steering head through a 1.3-in. (33 mm) outside ring and visibility of the illuminated target in the 2-in. (51 mm) inner tube. When connected, O-rings prevent water from entering the inner tube and a corrosion-resistant coating on the interior helps maintain visibility of the target.

The pilot tubes are designed for up to 10,500 lbf-ft of rotational torque. The ability to withstand high rotational torque, combined with proper steering head selection and lubrication has greatly extended the average drive distances, and thus furthered industry expectations. Fisher comments, “Today, the average pilot tube drive length is around 500 lf (152 m) and in ideal ground conditions, lengths in excess of 600 lf (183 m) have been achieved. Compare this to the early days following our GBM system’s introduction in 2001 where 200 lf (61 m) was considered a great accomplishment.”

At installation, a steering head mounted on the steering head adapter connects to the lead pilot tube’s male end. The first tube is threaded onto the female end of the steering head adapter and houses the guidance system’s LED target.

As pilot tubes are added and advance along the bore path, the jacking frame’s cylinders advance and retract. Line and grade is maintained when the operator views the LED target image on the guidance system monitor, which is mounted on the jacking frame, and the operator makes steering corrections as necessary. The pilot tubes are followed by the application’s upsizing process to form a continuous string. As the tooling string advances, pilot tubes are simultaneously unthreaded in the reception pit and placed in storage racks.

At the conclusion of the drive and before debris has a chance to solidify, the pilot tube racks are hoisted to the surface and then prepared for the next drive. This preparation includes a visual inspection, washing, drying, O-ring replacement (if applicable) and lubrication.
THREAD CONNECTION

Thread wear and ballooning is what transpires over time and is caused by excessive side-loading and high torque. Ballooning reduces the thread’s engagement and this loss of face adds additional stress to the female end of the pilot tube.

When pilot tubes are in good condition, the exterior joint region should be smooth. Fisher states, “When running your finger along this area there should be no step or overlap. When threads are worn and ballooning has occurred, there will be a noticeable overlap in this region. If you look at a cutaway view of two mated pilot tubes where ballooning has occurred, you will notice that the thread teeth show rounding at each crest. The rounding diminishes the rigidity of the connection, lessens the maximum rotational torque capacity and could fatigue the tube to failure.” He added, “A thread gauge tool is available from Akkerman to compare the threads to new pilot tubes, making thread wear more apparent.”

Another tell-tale indicator of worn threads is noticed when separating them at breakout. If the tube does not thread apart easily during removal in the reception shaft, it may simply require lubrication, however, this could also be an indicator of excessive wear and it may have the potential for ballooning. When tubes are difficult to separate, Fisher recommends that the crew mark and set these pilot tubes aside for further inspection, cleaning and lubrication following the bore.

STEERING HEAD SELECTION

Pilot tube side loading and ballooning is most likely to occur when the tubes are used in hard geology requiring high jacking forces. Therefore, proper selection of the steering head is key to reducing side loading and rotation torque.

Akkerman’s steering head kit provides four steering head configurations for a range of ground conditions. The bullet steering head has the least amount of surface area and is used in high blow counts situations. Conversely, the blunt 30-degree head is used in soft geology. When turned, a more refined tip will excavate and displace hard soil and in softer conditions, the blunt tip will force its way through the ground.

The project’s soil report should determine which steering head to select but when in doubt, Fisher suggests starting with 45-degree or medium range steering head. Once contractors become more familiar with their GBM system, appropriate steering selection will become second nature.

MAINTENANCE

A solid practice of cleaning pilot tubes at the end of each bore will ensure that they are ready to facilitate the most productive installation rate on the next drive. The operator should simultaneously rotate the tube and flush the annular space to prevent settlement of contaminants, then allow them to dry at an angled or vertical position.

After the tubes are clean and dry, the next step is to inspect the threads and relubricate with Baker Hughes Copper Guard-4, or equivalent, on a regular basis. The lubricant deters dirt from settling in the threads to reduce seizing. Lubricant should be applied directly to the threads or sprayed into the caps and plugs before storage.

The pilot tubes contain two O-rings on the female end. If they are in place, they should be sprayed with the lubricant, if not, new ones must be inserted then sprayed. It is advised that contractors keep a plentiful inventory of O-rings on hand.

The last maintenance interval is to replace each tube’s cap and plug prior to rack storage. As mentioned, this is also an opportunity to lubricate by spraying into the caps and plugs in lieu of spraying directly onto the threads. During storage, caps and plugs keep the pilot tube threads clean, minimize moisture to ensure a clean line of site to the target and keep contaminants out of the inner tube.

When the pilot tubes are installed on the next drive, Fisher suggests that operators visually inspect each one for moisture in the inner tube and lubrication on the threads. Moisture build up in the inner tube will impede the visibility of the target. The operator may clean the inner tube with a cleaning tool, which is a simple combination of a cloth attached to a sturdy rod.

RACK ROTATION

Another good practice for GBM operators to assume is rack rotation. Fisher explains, “The first 10 ft (3 m) of pilot tubes in the string are susceptible to the most stress, and therefore the most likely to sustain thread damage and ballooned joints.”

The best way to overcome this situation is to rotate the lead rack of tubes. One way to do this is to number all the pilot tube racks. Operators should keep track of their rack’s cycling in their project notes. This first rack should be used last on the subsequent drive. This rotation will extend the life of the pilot tubes by distributing wear equally throughout the complete inventory.

Fisher concludes, “Over time, seasoned operators will become familiar with the indicators for pilot tube replacement based on performance and visual inspection. Following these recommendations and consistent observation of maintenance intervals will help contractors realize great distances to foster further GBM innovation.”

This article was contributed by Akkerman, which has been designing and manufacturing equipment for underground infrastructure since 1973.
CALIFORNIA

CAPITOLA

Noble Gulch Trunkline Relocation Project

Vadnais Trenchless

This $2.15 million project involved four separate tunnel drives totaling 1,800 ft of 42-in. OD Permalok casing with 15-in. fusible PVC carrier pipe. Drive lengths varied from 220 to 820 ft. Shafts were between 14 to 40 ft deep. Tunnels were installed in mixed ground conditions with silty sands and weathered bedrock well below the groundwater table.

Challenges included extremely tight work areas within existing mobile home communities and the City of Capitola Corporation Yard. One reach was beneath Highway 1 (Pacific Coast Highway), a heavily trafficked scenic highway in Northern California. Work was performed between May and October 2015 using a 42-in. OD Iseki TCS900.

Owner: Santa Cruz County Sanitation District; Prime Contractor: McGuire & Hester; Engineer: Carollo.

CARLSBAD

Carlsbad Seawater Desalination

Vadnais Trenchless

This $2.08 million project involved a single tunnel drive of 790 ft of 78-in. OD Permalok casing. The launch shaft was a secant pile/shotcrete configuration approximately 70 ft deep. The groundwater table was 20 ft above the tunnel horizon. The drive was installed with the use of a mixed-ground cutter head.

Challenges included working from a small diameter (17-ft) launch shaft and intercepting and retrieving through a conventional rib and lagged horseshoe tunnel. Work was performed between January and May 2015 using a 78-in. OD Sottau RVS800AS.

Owner: Poseidon Channelside; Prime Contractor: FoxFire Constructors; Engineer: Tetra Tech.

Daly city

PG&E Martin Substation

Vadnais Trenchless

This $1.25 million project includes four tunnel drives totaling approximately 1,400 ft of 24-in. ID steel casing. Drive lengths vary from 250 LF – 470 LF. Shafts for the microtunneling will be approximately 18-35 feet deep. The microtunnel will be installed in silty clays and sands approximately 5-15 feet below the groundwater table.

The tunnels will be installed inside an existing PG&E facility. This project utilizes a sacrificial steel casing that will be displaced with the permanent gas pipeline. Work is scheduled to be performed between February and April 2016 using a 26-in. OD Iseki TCC500.


Fremont

PG&E L-107 Pipeline Replacement (Fremont Blvd. Crossing)

Vadnais Trenchless

This $692,340 project includes a 393-ft microtunnel drive of 36-in. ID steel casing. Shafts for the microtunneling will be approximately 20 to 25 feet deep. The microtunnel will be installed in sandy clay approximately 15 ft below the groundwater table.

The tunnel will be installed underneath Fremont Blvd., and an environmentally sensitive area 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 March and April 2016 using a 38-in. OD Iseki TCC800.


IMPERIAL BEACH

Annual Mainline Repairs by Microtunneling

Vadnais Trenchless

This $183,000 project involved a single tunnel drive of 165 ft of 16-in. OD steel casing pipe with 8-in. fusion-welded PVC carrier pipe. Shafts were approximately 20 to 24 ft deep.

This tunnel was installed under Highway 75 with an extremely limited work area. Work was performed in April 2015 using a 16-in. OD Iseki TCC300.

Owner: City of Imperial Beach; Prime Contractor: Blue Pacific Engineering & Construction; Engineer: Tran Engineering.

LA MIRADA

I-5 Widening Segment 2 – Pipeline Relocation Project

Vadnais Trenchless

This $1.15 million project includes two parallel 300-ft tunnel drives (600 ft total) of 36-in. ID welded steel casing. Shafts will be approximately 25 ft deep. The tunnels will be installed in primarily silty sand and clay approximately 5 ft below the groundwater table.

Tunnels will be installed underneath a heavily traveled section of Interstate 5 in Southern California. Work is scheduled to be performed between June and August 2016 using a36-in. OD Iseki TCC800.

Owner: Chevron; Prime Contractor: ARB Inc.; Engineer: EDM Services, Inc.

Newark

PG&E L-153 Interstate 880 Crossing

Vadnais Trenchless

This $1 million project includes a 380-ft microtunnel drive of 30-in. ID steel casing, and a 160-ft auger bore of 30-in. ID steel casing. Shafts for the microtunneling will be approximately 36 ft deep and must be constructed using watertight methods. The auger bore shaft will be 15 ft deep. The microtunnel will be installed in clay approximately 5 ft below the groundwater table. The auger bore will be installed in clay above the groundwater table.

Tunnels will be installed underneath a heavily traveled section of Interstate 880 in Northern California. This project utilizes a sacrificial steel casing that will be displaced with the permanent gas pipeline. Crews will use a 32-in. ID Iseki TCC600 for microtunneling. Work is scheduled to be performed between February and March 2016.


Newport beach

Newport Force Main Rehabilitation

Vadnais Trenchless

This $2.24 million project ended up being a single 700-ft tunnel drive of 42-in. OD Permalok casing with 32-in. HDPE carrier pipe. The tunnel encountered garbage and multiple wood piles underneath Highway 55, and eventually had to be terminated when a live 10-in. gas line was discovered. The groundwater table was approximately 12 ft above of the tunnel horizon. The drive was installed with a mixed-ground cutterhead in clay, siltstone and running sands.

There were very tight working conditions in the center median of Highway 1 (Pacific Coast Highway), a heavily trafficked thoroughfare in Southern California. The alignment was severely congested with existing utilities. It was also a high-visibility project as it was constructed in affluent area of Orange County.

Work was performed between February and May 2015 using a 42-in. OD Iseki TCS900.

Owner: Orange County Sanitation District; Prime Contractor: Kiewit Infrastructure West; Engineer: Brown & Caldwell.

San Diego

NSU Storm Drain Trunk

Vadnais Trenchless

This $800,000 project consisted of a single 566-ft tunnel drive of 42-in. OD Permalok casing. Shafts were between 15 to 20 ft deep. The tunnel was installed primarily silty sands and clay approximately 5 ft below the groundwater table.

The tunnel on this project was installed under an active runway at the San Diego International Airport using a 42-in. OD Iseki TCC800. Work was performed be-
between June and August 2015.
Owner: San Diego County Regional Airport Authority; Prime Contractor: Orion Construction Corp.; Engineer: Kimley-Horn & Associates Inc.

**SANTA MONICA**
Santa Monica Bay Low Flow Diversion
Vadnais Trenchless
This $2.05 million project involved a single tunnel drive of 846 ft of 63-in. OD Permalok casing. Shafts were approximately 18 to 20 ft deep. Groundwater was observed at springline of the tunnel. The drive was installed with a mixed-ground cutterhead in beach deposits with silty sands, gravel and cobbles. This project also included the installation of 50.8-in. OD Hobas carrier pipe inside the 63-in. OD Permalok casing.
There were extremely tight work areas along Hihway 1 (Pacific Coast Highway), a heavily trafficked thoroughfare in Southern California. The alignment is severely congested with existing utilities.
Work was performed between November 2014 and March 2015 using a 63-in. OD
Owner: City of Los Angeles; Prime Contractor: Ford E.C. Inc.; Engineer: Psomas.

**VICTORVILLE**
Upper Narrows Pipeline Replacement Project
James W. Fowler Co.
The Upper Narrows Pipeline Replacement Project for the Victory Valley Watershed Reclamation Authority measures 6,430 ft in length and is being placed deep below the Mojave River. The project includes two 60-in. microtunnel drives (865 and 1,850 ft). JWF used a Soltau MTBM with an mts operating station and VMT guidance. The 1,850-ft drive was completed as a rock soil interface, where it was met by a 76-in. Robbins Rockhead that drove a 1,250-ft hard-rock section of tunnel. The equipment was then removed through the completed rock tunnel.

**COLORADO**
**BRIGHTON**
South Platte Interceptor
Bradshaw Construction Corp.
Bradshaw has completed the last two drives on a microtunnel project in Brighton. This portion of the project consisted of three shafts along the South Platte River and 1,002 ft (two drives) x 96-in. steel casing containing a 78-in. FRP sewer line. Steel sheeting was used to construct the 32-ft deep launch shaft as well as the 43.5-ft and 28-ft deep recovery shafts. Soils consisted of fine and coarse alluvium with cobbles. Several challenges were overcome to include constant discharge of water, and an existing pipe jutting into a recovery shaft inhibiting groundwater control in the shaft. Information: Gerald Lowe, Project Manager, glowe@bradshawcc.com.

**COMMERCE CITY**
Kenwood Outfall Storm Sewer and Roadway Improvements Project
B-Trenchless Inc.
In early March 2015, general contractor B-Trenchless Inc., a division of BT Construction, completed a 288-ft. microtunnel installation of 78-in. Permalok steel casing using its Akkerman SL74 MTBM with an increase kit on the Kenwood Outfall Storm Sewer and Roadway Improvements Project in Commerce City. The pipeline parallels and crosses under US 85, a Union Pacific Railroad track, and Interstate I-76. At 28-ft. deep, it required extensive dewatering and contamination treatment. B-Trenchless also installed an 84-in. open-cut tunnel. The contractor has completed three phases on this project and previously microtunnel ed a 240-ft. 54-in. storm sewer under Interstate I-76 and an 84-in. hand tunnel near O’Brian Canal in 2011. This 10-year project involves four tunnels, 13,000-plus ft of open-cut pipelines, road improvements, and construction of a water retention dam. The project owners are Urban Drainage and Flood Control District and Adams County Public Works Department.

**DENVER**
Kenwood Outfall Phase 2
B-Trenchless Inc.
This $1.8 million project for the Urban Drainage and Flood Control District and Adams County involved the installation of 300 ft of 78-in. Permalok casing using an Akkerman SL 74 MTBM (skinned up to 78 in.). The drive crossed Highway 85 through running sands, gravels and cobbles 25 ft deep. Due to the running sands and light work areas, the jack ing shafts were built using a slide-rail storing system from GME. The project crossed underneath a large sanitary main, water main, two high-pressure gas mains, and eight lanes of highway traffic. No traffic was interrupted during the installation of the tunnel, which was completed in May 2015. Engineer: ICON Engineering, Inc.

**DENVER**
Union Pacific Railroad Undercrossing
Underground Infrastructure Technologies
This project, for Denver Water, comprised installation of a 36-in steel casing over 400 ft undercrossing Union Pacific Railroad tracks near Union Station. The micro tunneled drive passed underneath multiple tracks in a busy area. The Iseki MTBM was launched on July 20 and completed the 410-ft drive on August 4 within 1/8th of an inch of the bull’s eye. Soils included fine and coarse alluvium and the potential for boulders up to 12 in.

**HAWAII**
**HONOLULU**
Ala Moana Force Main
Frank Coluccio Construction Co.
This project involves driving 1,400 ft of tunnel 100 ft across Honolulu Channel to connect Ala Moana Wastewater Pump Station to the Sand Island Wastewater Treatment Plant. All tunneling is complete.

**KANEHOE**
Kanehoe-Kauela Sewer Pipeline
James W. Fowler Co.
The Kanehoe-Kauela Sewer Tunnel for the City and County of Honolulu will increase the reliability of the aging Windward Oahu sewerage system by conveying flows by gravity from the Kanehoe Wastewater Treatment Plant to the Kauela 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 is the microtunnel subcontractor for the South landMole JV and will install 1,540 feet of 60-in. sewer pipe and steel casing in four drives of 177, 360, 425 and 578 ft.
Floors from the existing Kauela Regional Wastewater Treatment Plant will be diverted to a new pump station by a new near-surface pipeline installed via microtunneling. The microtunnel pipe will be located under/ near an existing DAFT Control building supported by shallow spread footings, existing 24-in. 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 coraline sands and gravel with extremely weathered basalt gravel and basalt. The estimated completion date is December 2015.

**MARYLAND**
**ELKRIDGE**
36-in. Southwest Transmission Main
Bradshaw Construction Corp.
Bradshaw Construction Corp. has completed the installation of 380 ft of 60-in. steel casing and 36-in. PCCP under I-195 as part of the Howard County’s 36-in. Southwest Transmission Main Project. The casing was jacked behind a microtunnel boring machine in silty sand below the ground water table. Bradshaw also installed the 32-ft diameter mining and receiving shafts to an average depth of 30 ft. Information: Doug Piper, dpiper@bradshawcc.com.

**waldorf**
US 301 Force Main Project
Bradshaw Construction Corp.
Bradshaw Construction Corp. is preparing to install 355 ft of 43-in. steel casing and 24-in. DIP under Small wood Road as part of Charles County’s US 301 Force Main Project. The casing will be jacked behind a microtunnel boring machine in silty sand. Information: Doug Piper, dpiper@bradshawcc.com.

**NEVADA**
**LAS VEGAS**
Paradise Whitney Interceptor (PWI)
Pipe Jacking Unlimited/Frontier-Kemper JV
PWI contracts 668 and 669 comprise 55,000 ft of...
pipeline, including 25,000 lf of trenchless construction, making it one of the most significant trenchless new installation programs in terms of footage undertaken in the United States. For the microtunnelled portions, crews are using an Akkerman MTBM and Derrick slurry equipment to install Flowtite fiberglass pipe. The drives were 20 to 45 ft through variable ground including high groundwater table.

NEW YORK
BRONX
Subaqueous Water Main Extension and High-Pressure Gas Main from the Bronx to Randall’s Island
Cruz Contractors LLC
This $9.4 million project for the New York City Department of Design and Construction (DDC) involves two 600-ft long bores with 36-in. steel casing in glacial till and weathered rock at 55 ft deep. Crews will tunnel under multiple railroad tracks and the Bronx Kill. The job is scheduled to start November 2015. The owner and engineer is the New York City Department of Design and Construction.

LONG ISLAND CITY
MTA/LIRR East Side Access CH054A- Harold Structures Part 2A
Cruz Contractors LLC
This was a $4.89 million project for MTA Capital Construction, part of the overall East Side Access megaproject. Cruz’s project involved construction of three microtunnel 1,100-ft drives, and three open-shield 500-ft hand excavation crossings under railway and roadways. Crews used 42-in. ID (52.5-in. OD) RCP jacking pipe to accommodate various electrical cables and drainage pipe. The project began in November 2012 and was completed in April 2015. The engineer was Parsons Brinckerhoff/STV Inc. Crews used a Herrenknecht AVN1000XC for microtunneling. Ground conditions consisted of sand, gravel and cobbles.

STATEN ISLAND
Construction of Water Mains and Appurtenances in Richmond Valley Road
Cruz Contractors LLC
Cruz used a Herrenknecht AVN1000 and Bohrtec BM 600LS to complete four drives for the New York City Department of Design and Construction (DDC). The drives included: 900 ft of 42-in. RCP in sandy soil 20 to 35 ft deep; 400 ft of 42-in. RCP in sandy soil 20 to 35 ft deep; 400 ft of 42-in. RCP in sandy soil 30 to 45 ft deep; and 400 ft of 24-in. Denlok clay pipe using pilot tube in sandy soil 20 to 30 ft deep. The 1,400-ft drive is the longest completed to date using the AVN1000. DDC was also the engineer for this $5 million project.

STATEN ISLAND
Construction of Water Mains and Appurtenances in Woodrow Road
Cruz Contractors LLC
Cruz used a Herrenknecht AVN 1000 to complete three 620-ft long drives with 42-in. RCP in sandy soil. The depth of bore varied from 20 to 45 ft. The project was for the New York City Department of Design and Construction (DDC). DDC was also the engineer for this $2.47 million project.

RALEIGH
Crabtree & Upper Pigeon House Interceptor Tunnels Project
Bradshaw Construction Corp.
Bradshaw has begun construction on a $21 million sewer project consisting 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 weathered and unweathered hard granitic rock and mixed face. Information: Mike Wanhatalo, Project Manager; mwannahatalo@bradshawcc.com.

BUEHLA
Southwest Pipeline Project – Raw Water Intake Caisson, Intake Pipe & Screen
James W. Fowler Co.
The Southwest Pipeline Project (SWPP) is part of the North Dakota State Water Commission’s regional rural water distribution system that provides potable water service for both domestic and livestock use in southwestern North Dakota. Located adjacent to Renner Bay in Lake Sakakawea, the project site is approximately 300 ft from the banks of the bay.

The microtunnel launch shaft was originally designed as a concrete caisson shaft. JWF offered an alternative method of shaft support using a ground freezing system to provide ground water control. The shaft is 26.5 ft in diameter and 150 ft deep. Pipelines were drilled vertically into the ground around the circumference of the shaft and cooled was pumped into the pipes. When the walls were completely frozen, concrete caisson segments were lowered into place and the shaft was excavated. The precast concrete segments were specially manufactured in Europe and could either be sunk as a conventional caisson or underpinned. The segments served as the support of excavation during construction and will remain as the permanent liner for the wet well.

The tunnel will be one of the longest microtunnel drives in the United States at 2,700 ft. The 73.5-in. microtunnel with a 60-in. concrete intake pipe, will require recovery of the microtunnel boring machine in Lake Sakakawea at a depth of approximately 100 ft. JWF is using a Herrenknecht AVN 1500 with concrete pipe supplied by Vianini.

PHILADELPHIA
Philadelphia Airport Project
Cruz Contractors LLC
This $2.69 million project for the City of Philadelphia’s Department of Commerce-Division of Aviation Design and Construction Engineering involves the construction of two 60-in. OD PermaLoK steel casing pipe runs to accommodate two 20-in. fuel lines, approximately 1,100 ft under runway 27L and 370 ft under taxiways. The engineers are Urban Engineers and Burns McDonnell. Crews will use a Herrenknecht AVN1200TB to tunnel through silty sand. The project is anticipated to start in January 2016 and end in April 2016.
POCONO & HAMILTON TOWNSHIPS
Route 611 Sanitary Sewer Replacement
Cruz Contractors LLC
This $1.9 million project for Pocono Township involves construction of 900 lf of 48-in. ID (60-in. OD) RCJP at a depth of 25 ft. Crews will tunnel through sandstone using a Herrenknecht AVN1200TB. The project is expected to begin in November 2015 and be complete before the 2016. T & M Associates Inc. is the engineer.

YORK
I-83 Exit 18 Sanitary Sewer Realignment, Contract 2014-01
Cruz Contractors LLC
Between March 2015 and May 2015 Cruz completed construction of two 70-in. OD Peralmalok steel casing pipes to accommodate 48-in. DIP gravity sewer line. One drive was approximately 190 lf under Mount Rose Ave and the other was 280 lf under I-83. Three different ground conditions were encountered under I-83 – sand and gravel, clay and weathered rock. The owner was Springettsbury Township. The engineer was Buchart Horn Inc. The value of the microtunneling was $1.2 million.

TEXAS
HOUSTON
Bintliff, Eppes and Frawley Force Main Replacement
Vadnais Trenchless
This $2.35 million project involves five tunnel drives totaling 2,180 lf of 30-in. OD Hobas and a 355 lf tunnel drive of 42-in. OD Peralmalok steel casing with 30-in. carrier pipe. Drive lengths range from 210 to 570 lf. Shafts are approximately 20 to 30 ft deep. Tunneling is being performed below the groundwater table in predominately stiff clay using an Isoki TCC680 30-in. OD and TCC800 42-in. OD. Work started in June 2015, and the project is currently 80% complete. Vadnais anticipates completion of this project in November 2015.
Owner: City of Houston; Prime Contractor: Huff & Mitchell Inc.; Engineer: Ch2M Hill.

LIVINGSTON
Livingston WTP Intake Tunnels
Bradshaw Construction Corp.
Bradshaw has completed installation of twin 36-in. line Segment 2B
Bradshaw Construction Corp.
Construction of the Medina River 70-ft deep launch shaft is complete and the 105-ft deep receiving shaft is nearing completion, and both will support the first drive (726 ft) of two tunnels of 72-in. steel casing totaling 1,269 ft with 60-in. welded steel carrier pipe. Construction of the second launch shaft for the Medio Creek drive has started. The subsurface conditions consist of claystone below the water table. Microtunneling commenced in September 2015. Information: Project Manager Gerald Lowe; email: glowe@bradshawccc.com.

VIRGINIA
PORTSMOUTH
Division C Sewer Improvements
Bradshaw Construction Corp.
Bradshaw Construction Corp. has completed the installation of 110 ft of 43-in. steel casing and 30-in. HDPE waterline Under I-664 as part of the Hampton Road Sanitation District's (HRSD) Division C Sewer Improvements Project. The casing was jacked behind a microtunnel boring machine in sand below the ground water table. Information: Doug Piper, dpiper@bradshawccc.com.

SUFFOLK
College Drive Waterline – Phase I
Bradshaw Construction Corp.
Bradshaw Construction Corp. has completed the installation of 380 ft of 30-in. steel casing and 16-in. DIP waterline Under I-64 as part of the College Drive Waterline Project. The casing was jacked behind a microtunnel boring machine in sand and clay below the ground water table. Information: Doug Piper, dpiper@bradshawccc.com.

WISCONSIN
GREEN BAY
De Pere-Suamico, Memorial Drive – CTH M, IH 43 Early Structures/Early Fill, USH 41 Project Super Excavators
In August 2013, Super Excavators was elected to execute a subcontract to Lunda Construction on the DePere-Suamico, Memorial Drive – CTH M, IH 43 Early Structures/Early Fill, USH 41 Project near Green Bay. The project’s scope of work includes the construction of five new bridges, four retaining walls, and related grading and storm sewer work. Super Excavators’ subcontract included open-cut and tunnel excavated utilities. In total, Super Excavators constructed 33,656 lf of 12- to 54-in. reinforced concrete pipe storm sewer, including 1,456 lf of 48-in. RCP microtunnel constructed in three runs. Super Excavators’ sister company, SX Foundations, was responsible for constructing sound mounted posts for sound walls.
Construction for this project began in September 2013, and substantial completion was May 2015. Super Excavators’ contract was worth approximately $10 million.

CANADA
MILTON
Wastewater Main Construction on Britannia Road from Tremaine Road to RR 25
Ward and Burke Microtunneling Ltd.
Ward and Burke used three Herrenknecht AVN1200Ts to install 2,500 m (8,200 ft) of 1,200 mm (47.25-in.) ID pipe in glacial tills. The $16 million project began in March 2015 and was completed in August. The owner was the Region of Halton. The Municipal Infrastructure Group was the engineer. Kapp Contracting was the prime contractor with Ward and Burke performing the microtunneling.

TORONTO
Twinning of Etobicoke Creek Trunk Sanitary Sewer Project
CRS Tunnelling Canada
On April 22, 2015, Dibco-CRS, a joint venture, was low bidder for the Region of Peel’s Twinning of Etobicoke Creek Trunk Sanitary Sewer Project. This $16.7 million dollar project includes the construction of approximately 612 m of 1,800-mm ID sanitary trunk sewer underneath active operating surfaces at Lester B. Pearson International Airport. The trunk sewer will be constructed primarily using MTBM tunneling methods. The project also includes the construction of four new maintenance holes, modifications to two existing maintenance holes, and all associated appurtenances and fittings, and temporary bypass pumping as necessary to complete the works.

MEXICO
LA PAZ
Collector Los Reyes de la Paz Project
Grupo Covasa
The first Akkerman slurry microtunneling system was shipped to Mexico in mid-2014 for a project that would begin later that year. In mid-March 2015, Contractor Grupo Covasa finished its first 235 m (771-ft) run. The Collector Los Reyes de la Paz project is owned by the La Comision del Agua Del Estado de Mexico (CAEM), When complete, 537 m (1,762 ft) of 1.83 m (72-in.) ID RCP will be microtunnelled in three drives. Grupo Covasa began construction on another portion of the project with an Akkerman TBM 720 when operators discovered a region within the project zone that transitioned from clay to saturated fine volcanic sand. To finish the project, they purchased a complete microtunneling system including an SL74 MTBM, with an increase kit for 86-in. OD pipe, a control container, and MT8102K keyhole jacking frame. Crews began with construction of a 67-m (220-ft) drive with instruction from an Akkerman field technician, followed by the last 235-m (771-ft) installation.
**AKKERMAN INC.**

Akkerman slurry microtunneling systems have been manufactured in the United States for over 20 years. The company’s MTBMs are a fusion of high productivity, dependability and accuracy to install gravity flow pipelines requiring exact line and grade in virtually any ground condition. Standard MTBMs are available in 30- to 96-in. (762- to 2,438-mm) OD, can be fitted with an increase kit and feature a project-appropriate cutterhead. The complete system comprises the MTBM, microtunneling control container housing the operator’s control console, motor control centers for the slurry pumps, MTBM drive motor and bulkhead panel for electrical and communication connections, guidance system with active target, remote hydraulic power pack, keyhole jack frame, pumps, water cooling tank, slurry trunk and high pressure jetting lines, and a slurry separation plant.

**DERRICK**

Backed by over 60 years of cost-effective solutions plus award-winning service, the Derrick Hyperpool shaker is the latest in a long line of products designed expressly to exceed the demanding needs of today’s underground construction operations. With its compact footprint, industry-leading processing capacity, solids bypass prevention, and low maintenance cost, the Hyperpool is well suited for all drilling applications where performance and modularity are required. Derrick, a family-owned and operated company founded in 1951, has a 25-year history of offering solids control equipment to the worldwide microtunneling, horizontal directional drilling, slurry wall and foundation drilling, tunneling, water well drilling, and various other underground construction industries. All Derrick machines, screen panels, and tanks systems are manufactured in-house at the Buffalo, New York, headquarters.

**EZEBREAK**

The Ezebreak Micro-Blaster IIx3 System allows users to break rock and concrete in almost any location, quickly and economically. Extremely portable, weighing only 20 lbs, the system requires only 5/16-in. diameter drilled holes 10 to 16 in. deep. With excellent scalablity users have the option of using a single head or all three with 1 to 4 Micro-Blaster cartridges in each hole. Utilizing proprietary cartridge technology, the system is capable of breaking competent material from a few hundred to several thousand pounds. Micro-Blaster Systems solve difficult demolition problems quickly and easily. Micro-Blaster systems are exempted from Canadian and U.S. Federal Blasting Regulations and do not require licensing in most locations. Micro-Blasters are available in single head versions for smaller projects.

**FLOWTITE FRP**

Flowtite FRP has the anti-corrosion you need already built-in, eliminating the need for liners or coatings, 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.

**HAYWARD BAKER INC.**

Hayward Baker Inc., North America’s leader in geotechnical construction and a member of the worldwide Keller Group of companies, is ranked No. 1 among excavation/foundation contractors by ENR. The company has decades of experience with the full range of geotechnical construction techniques to solve a variety of microtunneling issues. Jet grouting and soil mixing stabilize soft soils prior to tunneling. Jet grouting and soil mixing create tangent or secant pile shafts for tunnel access. Jet grouting, chemical grouting and cement grouting stabilize soils around break-ins and break-outs and control groundwater. Anchors, shotcrete and grouting techniques stabilize tunnel liners. Compaction grouting densifies loose soil under tunnel alignments, and helps relieve MTBMs. Fracture grouting, chemical grouting and compaction grouting control settlement of overlying structures during tunnel boring. Whatever the size of the project, Hayward Baker has the experience and technology to provide an innovative, robust and cost-effective solution.

**HERRENKNECHT**

It is important to maintain and keep up the supply of bentonite lubricant along the entire pipe string. The new volume-controlled bentonite lubricating system from Herrenknecht does this automatically. The system makes it possible to introduce the bentonite into the annular space in a precise and targeted manner. The tunneling route is supplied with defined injection volumes exactly to the meter. Depending on the tunneling advance rate and the geology, bentonite is injected in the required quantities to the corresponding places in the pipe string. The automatic release of defined quantities of bentonite for the individual sections thus avoids an over- and under-supply and assures efficient lubrication. In addition, the system offers functions, such as the interactive pipe sequence plan, the calculation and presentation of the specific skin friction as well as the option of controlling four lubrication cycles at the same time.

**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: slippining, jacking, microtunneling, two-pass tunnel and casing carrier. Hobas offers pipes ranging from 18 to 126 in. in diameter and is ISO 9001 and 14001 certified.

**MCLAUGHLIN**

The McLaughlin ON Target auger boring steering system allows contractors to control horizontal directional changes, and allows for lateral changes in 360 degrees of adjustment. Until now, auger boring contractors were limited to a steering head that offered only horizontal or grade (up and down) direction changes during the bore. The ON Target system allows contractors to also control the direction of the bore in a lateral (left to right) movement, providing more accuracy for difficult on-grade bores. The cutting path — grade and lateral movement — of the steering head is controlled by hydraulically actuated panels that open and close to help keep the bore on the intended path. A control station features a hydraulic pump to control the movement of the steering head, and a built-in water level monitors grade. More contractors are discovering that auger boring is a cost-efficient way to install steel casings between 12 and 70 in.

**MICHAEL BYRNE MANUFACTURING**

Michael Byrne Manufacturing has designed a cutter-head to work in hard material for pilot and guided bore applications. The cutting head is designed to handle the high thrust loads often required to complete those long tough bores. A swivel is designed to let the head cut the material like traditional auger bores while the tapered insert holds steady inside the pilot bore tube. The extreme duty of the thrust and radial bearings enable the head to be used over and over again and not just a one-time use often associated with swivel heads and weld on reamers. The head can also be retracted and pulled through the casing if needed. The base of the swivel is designed to be interchangeable with multiple size and styles of cutting heads.

**MORETRENCH GEOTECHNICAL CONSTRUCTION**

With an unparalleled range of geotechnical construction options in our toolbox, coupled with in-depth engineering and field operations experience, Moretrench is in the forefront of resolving the subsurface challenges that may impact the installation or repair of microtunnel projects. Moretrench’s portfolio includes jet grouting for launch and retrieval shaft bottom seals; jet and permeation grouting for soil stabilization behind the tunnel eye; compaction grouting for pipeline settlement control; and wellpoint and deep well dewatering to ensure shaft excavation in the dry. The company’s solutions allow installation below the water table without the need for groundwater control along the tunnel alignment and can be accomplished in low headroom and congested urban or industrial environments with minimal disturbance. With Moretrench on the team for your next microtunneling project, you can be confident that you’re in experienced hands.

**MTS PERFORATOR**

Tunnel equipment manufacturer mts Perforator GmbH (Germany and North America) has introduced its PBA 125 thrust boring machine for the construction of sewer lines. The PBA 125 features 125 tonnes of jacking force for steerable pipe jacking. The PBA 125 is capable of installing pipes up to 630 mm (24 in.) OD from a 2-m diameter pit. The first practical assignment for the PBA 125 was in March 2015 for a sewer project in Bitterfeld, Germany. The project included a 200 mm diameter clay pipe sewer installation with a length of 280 m installed via pilot jacking. Driven by an HS 156 hydraulic power pack, a PBA 125 unit was tested in the first construction phase of the project for a total length of 63 m. Upon successful completion of the project, the PBA 125 got a very positive feedback from the contractor.

**THE ROBBINS COMPANY**

Robbins’ latest innovation, the Remote Controlled Small Boring Unit (SBU-RC), is a game-changer. The SBU-RC is setting new standards with the ability to excavate small diameter hard rock tunnels at long distances on line and grade. The SBU-RC is manufactured in the 36-in. diameter range, but can be customized as small as 30 in. in diameter. Equipped with a smart guidance system and pinpoint steering controlled from an operator’s station on the surface, the SBU-RC is ideal for difficult crossings such as gravity sewers. Muck removal is accomplished through a vacuum system, making the Robbins SBU-RC more cost-effective than slurry microtunneling machines, which require a separation plant onsite. The simplified operation and stellar performance of the machine — up to 50 ft per day in basalt rock — provide contractors with a solution that saves both time and money. The result is a successful machine with a price tag that wins bids.

**VERMEER**

The AXIS guided boring system, developed by Vermeer, is designed to install 10- to 14-in. pipe at lengths up to 350 ft, and can maintain grades of less than 0.5 percent. Made up of four main components, the AXIS system includes a power unit, rack, vacuum pump and vacuum tank. The power unit contains the engine and hydraulic pumps and connects to the rack to power thrust and pull back of the drill stem. The rack includes the thrust/pullback carriage assembly and gearbox. As the thrust/pullback carriage assembly moves up the rack, the gearbox simultaneously provides rotation to the cutter bit at the front of the drill head. The drill head uses a flat-face cutter that combines with a laser guidance system to complete flat grades accurately. The displaced material is simultaneously removed by a high-power vacuum system and diverted to a vacuum storage tank.
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