North American Microtunneling

Huber, Turkopp Help Forge a Path to Success

Industry Vets to Receive Achievement Award

2011 Industry Review
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Cover Story

8 Huber, Turkopp Help Forge a Path to Success
To recognize the role of pipe development and technology, two microtunneling pipe pioneers are being recognized for their contributions. Rick Turkopp of Hobas Pipe USA (on the right in the photo) and Gary Huber of Permalok will receive the Microtunneling Achievement Award at the annual Microtunneling Short Course in February 2012.

Features

12 Microtunneling Short Course: Leading Edge Education
Entering its 19th year in 2012, the Microtunneling Short Course has established itself as the premier instructional venue for microtunneling worldwide, having already trained more than 1,900 professionals.

14 Technical Article: Design Considerations
The design process has four stages: planning, risk assessment, design and contract documents. Each stage must be carefully considered to ensure a successful microtunneling project.

18 Rasa Gains Foothold in North American Market
Tokyo-based Rasa Industries, which has produced 1,000 microtunneling systems worldwide, is the newest entrant into the growing North American market.

20 Microtunneling the Balch Consolidation Conduit
The microtunneling project is one of the final elements of Portland’s CSO program that will convey combined sewer and stormwater flows from northwest Portland to the Swan Island Pump Station.

22 Guided Boring in Houston
Houston-based contractor Boyer Inc. used the guided boring method to install 7,000 ft of 30-in. conduit for CenterPoint Energy.

24 Long Distance for Small-bore TBM
Midwest Mole is using a 72-in. hard-rock TBM to excavate 9,430 ft of tunnel in seven runs as part of the Shayler Run Segment C Sewer Replacement Project near Cincinnati.

26 Pilot Tube Tunneling in New York
Cruz Contractors LLC successfully completes its first pilot tube microtunneling project in Hawthorne, N.Y., using ICON Tunnel Systems.

Departments

28 Job Log
A look at some of the recently completed and current microtunneling jobs in North America.

30 Products
Innovative new products available in the market are showcased.

32 Directory
A who’s who of microtunneling manufacturers, suppliers and contractors.
PLEASE PRINT CLEARLY

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Title ____________________________________________________________
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State/Prov __________________________________________________________
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Which title group best describes your job title? (check only one)

A. ☐ Owner/Partner
B. ☐ President
C. ☐ Vice President
D. ☐ C.E.O.
E. ☐ C.O.O./C.F.O.
F. ☐ Manager/Coordinator/ Admin.
G. ☐ Supv./Foreman/Insp.
H. ☐ Superintendent
I. ☐ Engineer/Estimator/Consultant
J. ☐ Director/Commissioner
K. ☐ Safety
L. ☐ Operator/Field
M. ☐ Other; Specify:

How would you describe your primary trenchless activity?
☐ Rehabilitation  ☐ New Installation  ☐ Both

What is your company’s primary function? (check only one)

CONTRACTING FIRMS
A. ☐ Utility
B. ☐ Distribution
C. ☐ Road Boring/Directional Drilling
D. ☐ Tunneling
E. ☐ Pipeline
F. ☐ Cable
G. ☐ General
H. ☐ Pipe Cleaning
I. ☐ Other; Specify:

GOV./PW
O. ☐ Water and Sewer
P. ☐ Gas and Electric
Q. ☐ Other; Specify:

UTILITY COMPANIES
R. ☐ Water and Sewer
S. ☐ Electric
T. ☐ Gas
U. ☐ Cable/Telephone
V. ☐ Other Utilities; Specify:

ENGINEERING FIRMS
J. ☐ Construction
K. ☐ Geotechnical
L. ☐ Environmental
M. ☐ Pipeline
N. ☐ Other; Specify:

INDUSTRIAL FACILITY
W. ☐ In-House Contracting
X. ☐ In-House Construction
Y. ☐ In-House Engineering
Z. ☐ Other; Specify

MFG/SUPPLIER
1. ☐ Manufacturer
2. ☐ Rehabilitation Systems
3. ☐ Pipe Manufacturer
4. ☐ Pipe Cleaning, Mfg/Supplier
5. ☐ Other; Specify

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7. ☐ Library
8. ☐ Student/Professor
9. ☐ Other; Specify

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MT1111
Continuous Improvement

Since its introduction in the United States in 1984, microtunneling has continued to gain acceptance as a trenchless installation method. The past few years have seen a remarkable uptick in innovation as contractors and engineers have better understood the capabilities of the equipment, and perhaps as important, its limitations. The results have produced longer drives with greater successes.

Portland, Ore., has been a hot spot for microtunneling in recent years. In 2008, Kiewit-Bilfinger Berger garnered Trenchless Technology Project of the Year honors with a record-breaking 3,055-ft drive of 84-in. RCP as part of the East Side CSO project for the City of Portland Bureau of Environmental Services. That drive set a new U.S. standard for drive length, exceeding the previous mark of 1,625 ft established in by E.E. Cruz on the Hylan Boulevard project that began in 1989.

Northwest Boring’s Portsmouth Force Main Segment 1 project involved a 1,903-ft drive – the second-longest completed in the United States (this project was profiled in the 2010 North American Microtunneling supplement). What was remarkable about that project was the fact that it was completed at an average jacking force of 130 tons under 40 ft of cover and an outside diameter of 81.6 in. In addition, crews bored through difficult geology including sands, silts and gravels with a host of wooden piles, logs and fill materials that crossed the alignment. Despite the challenges, the job was completed safely, on time and on budget – effectively showcasing the benefits and capabilities of microtunneling when carefully planned and executed.

In this issue, we focus on the Balch Consolidation Conduit project completed by James F. Fowler Co. The project involved more than 8,000 ft of microtunnels, 6,900 ft of 84-in. and 1,115 ft of 54-in. The longest drive was 1,690 ft with the minimum being 1,100 ft. The longest drive marks the third-longest in the United States, with all three of those drives in Portland.

It is also interesting to note that the 2011 Trenchless Technology Project of the Year, which is featured in the October 2011 issue, was another microtunneling project – the East Boston Branch Sewer. (The Portsmouth Force Main Segment 1 project was an Honorable Mention.) The microtunneling on the East Boston job was completed by Cruz Contractors and involved more than 12,000 ft of microtunneling in a very urban area through difficult ground that included hard tills, soft clays and large areas of fill.

Microtunneling Achievement Awards

The staff at Benjamin Media would like to congratulate the recipients of the Micotunneling Achievement Awards, who are presented in the cover story of this issue. Rick Turkopp of Hobas Pipe USA and Gary Huber of Permalok have played key roles in getting their products accepted and used, and in the process have helped lead the charge for the industry itself. These two individuals will receive the award at the 2012 Microtunneling Short Course, which is being held Feb. 7-10 at the Colorado School of Mines campus in Golden.

Regards,

Jim Rush, Editor
Microtunneling Short Course
February 8 – 10, 2012

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Course Directors
Timothy Coss
Levent Ozdemir

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www.microtunneling.com or
www.csmspace.com/events/microtunnel/
Oftentimes technological advances in the field of microtunneling are associated with equipment — microtunnel boring machines, cutters, guidance systems, slurry cleaning systems, etc. Yet one of the most critical links in the chain is sometimes overlooked — the pipe.

Advances in pipe manufacturing and joints are instrumental in helping make microtunneling projects successful. Pipes engineered specifically with microtunneling in mind led to higher reliability, improved productivity and less cost.

To recognize the role of pipe development and technology, two microtunneling pipe pioneers are being recognized for their contributions. Rick Turkopp, Hobas Pipe USA, and Gary Huber, Permalok, will receive the Microtunneling Achievement Award at the annual Microtunneling Short Course in February. The awards were established by course organizers Tim Coss, Microtunneling Inc., and...
Since its introduction in 1997, over one million feet of Permalok interlocking pipe have been installed on jobs where failure was not an option. That’s why Permalok stands as the product of choice for trenchless contractors and engineers for their most important and challenging projects.

Microtunneling
Pipe Jacking
Pipe Ramming
Auger Boring
Horizontal Directional Drilling
Levent Ozdemir, Ozdemir Engineering, to recognize leading individuals or companies who have made a lasting impact on the field. Award winners will be officially recognized at the Short Course banquet on Thursday, Feb. 9, 2012, in Golden, Colo.

When microtunneling was first introduced in the United States in 1984, contractors, engineers and owners had to live through the dreaded “learning curve.” One of the lessons learned was that conventional pipe for direct-bury projects was not ideally suited for microtunneling projects. Improved geometries, joints and ability to withstand jacking forces were key properties for the pipe. And considering that microtunneling is a pipe jacking operation, one pipe failure can bring the whole tunneling process to a standstill.

Hobas Pipe USA and Permalok have been at the forefront of the market by producing pipe specifically engineered for microtunneling, and Turkopp and Huber have played key roles in helping those products gain acceptance. Along with that acceptance and success, the microtunneling market has continued to offer owners with a method of installing pipe with minimal disruption in urban or environmentally sensitive areas. Turkopp

Rick Turkopp has been with Hobas Pipe USA from the beginning as the European-based fiberglass pipe manufacturer was entering the North American market. An engineer by training who had previously worked in the fiberglass business, Turkopp was tasked with understanding the needs of the pipe from the installation and end-use point of view, then engineering a product that would meet those needs.

The year was 1985, and microtunneling was still brand new in the United States. “Just as we were getting started, microtunneling was in its infancy in the United States,” Turkopp said. “We were getting in on the ground floor, and we knew our pipes would be good for microtunneling so we pursued that opportunity.

“My role immediately was to understand our product: how people used it, what did they need from the products to be successful, how do we meet those needs relative to other products on the market. Immediately I noticed that microtunneling was a much more risky way to install pipe –much more complex and difficult. It solves certain problems and there was a need for it in the industry and the real key to its

Past Award Winners
Microtunneling Achievement Award Winners

The Microtunneling Achievement Awards were established by Microtunneling Short Course organizers Tim Coss, Microtunneling Inc., and Levent Ozdemir, Ozdemir Engineering, to recognize leading individuals or companies who have made a lasting impact on the field. The awards are formally presented at the annual Short Course held in Golden, Colo. This year’s winners – Gary Huber of Permalok and Rick Turkopp of Hobas Pipe USA – will be recognized at the Short Course banquet on Thursday, Feb. 9, 2012.

Past recipients of the Microtunneling Achievement Award are:
• Northwest Boring
• Franco Coluccio, Frank Coluccio Construction Co.
• Glenn Boyce, Jacobs
• Dr. James Kwong, Yogi Kwong Engineers
• Stefan Trumpi-Althaus, Jack Control Inc.
• Matt Roberts, Kiewit
• Dennis Molvik, Northwest Boring

Both Permalok and Hobas have figured prominently in the trenchless industry over the years. In fact, both companies have been cover stories for Trenchless Technology magazine. Permalok (shown with company founder Mike Argent) was profiled in April 1998, and Hobas (with Turkopp shown among the management team) was featured in February 2010.
success was reliability – the product had to work.”

Aside from the challenges associated with engineering a pipe that would meet the needs of the installer and the owner, spreading the word and getting the pipe approved for use was another, according to Turkopp. “For a pipe to get used on a project, you must have approval of the agency where it is going to end up, you have to get the engineer to specify your product, and you have to get the contractor to buy it. If you fail on any one of those three fronts, you have no business.”

Getting the buy-in of the engineers was particularly challenging, Turkopp said. “Engineers are trained in concrete and steel. They understand those products, but they don’t know much about fiberglass. So, you have to show them the benefits: the constant outside diameter that reduces drag, lightweight for decreased jacking loads, good hydraulics, and corrosion resistance. Additionally, our pipe is resilient, which helps provide a uniform load on the joints when jacking.”

With the right product in hand, the company needed the right project to help showcase it. That came in the form of the Hylan Boulevard project on Staten Island. The project, which began in 1989, involved nearly 6,000 ft of 60-in. pipe installed by microtunneling, including jacking runs of 1,625, 1,450, 1,325 and 1,250 ft.

“That job was originally specified as concrete pipe, but the contractor (E.E. Cruz) had just completed a project using concrete pipe that had some problems and issues, so he ended up choosing our pipe,” Turkopp said.

The project was a success. In fact, the 1,625-ft drive set a U.S. record that wasn’t surpassed until 2008. Then came the Greater Houston Wastewater Program, which would earn Houston the nickname “the Microtunneling Capital of the United States.” The work in Houston accounted for about half of all microtunneling completed in the United States through the mid-1990s.

“With those kinds of successes, microtunneling began to grow and grow,” Turkopp said.

In addition to his work with Hobas, Turkopp has been active in ASTM, ASCE (including work on the ASCE Microtunneling Guidelines), AWWA and the Trenchless Technology Center Industry Advisory Board.

Huber

Huber had spent many years working in the steel piping industry when he was approached by Permalok to help start up the new company and its distribution process for its trenchless steel casing.

For more information visit www.trenchlessonline.com/info
Permalok was formed in 1993 by Mike Argent as an alternative to welded steel pipe. Permalok features a joint that snaps into place when jacked, helping to increase the production rate of installation. With labor cost a significant portion of the overall job cost, the ability to maximize production is critical for microtunneling contractors.

As with any new product, acceptance was slow. "People were skeptical when the product was first introduced, and it was a difficult process to get it used on projects," Huber said. "The first thing we had to do was get the contractors to understand the benefits of the Permalok joint. They had to see it in the field and see the benefits of not having to weld the steel casing."

But it didn’t stop there. Permalok still needed to gain acceptance in the engineering and owner communities as well. "The design engineers at the time had no idea what Permalok was," Huber added. "Of course the first reaction was, 'If it’s not welded, it can’t be as strong.' It was an education and learning process. We had to go out and talk to the cities and the engineering companies, and go to the conferences and seminars to demonstrate the product."

Now that the product has been established in the marketplace, it is well accepted, Huber said. In fact, more than 1.2 million ft of Permalok pipe has been installed by microtunneling, and the company is supplying 18,000 ft of 81-in. pipe for an upcoming project in Hawaii. "We are getting spec’d left and right now," Huber said. "The contractors, engineers and owners see the benefits of the pipe. More than 90 percent of the steel pipe used for microtunneling is Permalok."

Through the years, technical advances, increased experience and a better understanding of the process have expanded the scope of microtunneling. Early projects started small, with drives in the range of 300 to 400 ft, Huber said. Now, drives of 1,000 ft are not uncommon. "Advanced technology is evolving daily in this market," he said. "It is making microtunneling a better option with increased capabilities."

Technological advances, however, do not take the place of proper planning. "It is important to do your homework before any job," Huber said. "You have to make sure you understand the scope, and what will get you where you need to complete the project as designed. I see many contractors try to take shortcuts and end up costing them more time and money in the end."

With the well-documented infrastructure needs in the United States, microtunneling is likely to play a key role for urban utility construction. "It is a fact that the infrastructure of this country needs to be updated," Huber said. "Each day, new and better installation ideas are developed by contractors along with input of the new designs of the machine manufacturers. The potential of this industry is unlimited."

Jim Rush is editor of Trenchless Technology.
The Microtunneling Short Course has established itself as the premier instructional venue for microtunneling worldwide. Entering its 19th year in 2012, the course has already trained more than 1,900 professionals, ranging from contractors and engineers to owner agency representatives.

The Microtunneling Short Course was established at a time when microtunneling was still gaining acceptance in the utility construction industry, and has helped grow the market through education and understanding. It has continued to evolve along with the industry, offering high-level education on leading-edge technologies and topics.

The 2012 Microtunneling Short Course, which will be held Feb. 8-10 with a one-day Pilot Tube seminar on offerd on Feb. 7, covers the latest in emerging technologies from this growing field. With more and more demand for underground services in urban areas, the need to use minimally invasive construction techniques like microtunneling will only increase.

The Microtunneling Short Course is a three-day, intensive course presented by a panel of international experts and organized by Prof. Levent Ozdemir of Ozdemir Engineering and Timothy Coss of Microtunneling Inc. It will be held at the Green Center on the campus of the Colorado School of Mines in Golden, 40 miles west of Denver International Airport.

The course covers all aspects of microtunneling including site investigation, ground stabilization, shaft construction, pipe considerations, microtunneling and slurry equipment advances, case studies, and more. It is intended for public works and utility officials, engineers, planners, managers, contractors, and equipment manufacturers involved in any phase of trenchless technology.

In addition to classroom sessions, the Microtunneling Short Course offers participants the chance to network with peers from across the country, and around the world.
Successful design of microtunneling projects can be achieved by paying attention to the following:

1. Developing, understanding and defining project needs and requirements,
2. Exploring and defining ground conditions,
3. Superimposing the project “in the ground”, and
4. Creating a project “environment” that will allow for Contractor success.

The design process has four stages: planning, risk assessment, design and contract documents. Each stage is discussed in detail in the rest of this paper.

Planning
Planning questions must begin with “Is this a microtunnel project?” There are many excellent trenchless construction methods to consider in addition to microtunneling: auger boring, pipe jacking, guided auger boring, pipe ramming, guided pipe ramming, horizontal directional drilling and conventional tunneling. Depending on the project length, diameter, ground conditions, groundwater conditions, access restrictions, allowable pipe material, permits, available right of way and available shaft locations, microtunneling may not be the preferred construction method. In fact, of the alternative trenchless methods, microtunneling represents “the Cadillac” method: costly, but capable of successfully excavating within tight alignment tolerances in cohesionless soils below groundwater.

If it is determined microtunneling is the best alternative, the question “Can a microtunnel boring machine (MTBM) handle the project requirements and anticipated ground conditions?” must be answered. Experienced tunnel engineers are needed to evaluate the drive length, tunnel/shaft depth, hydrostatic head, anticipated ground conditions, potential for obstructions and contractor access and laydown areas to determine if the project can be designed and built using microtunneling methods. Contingencies must be considered to handle hard obstructions, mixed face ground conditions, hard rock or refuse fill if they occur.

If it is determined that an MTBM can handle project conditions, the question “Can the Owner afford the project?” must be answered. Before the project design begins, a planning level cost estimate must answer this question. Project risks and the resultant “risk pricing” anticipated for contingencies, potential third-party impacts or project parameters must be evaluated. In addition to cost estimates for shafts and microtunnel drives, the designer should consider the cost for contingencies including: dewatering, if needed, for shaft construction; and ground modification (chemical grouting, compaction grouting...
or ground freezing) for shaft and/or microtunneling. Additional costs to cover potential impacts to third parties such as buried utilities or structure foundations above the microtunnel; or simply neighbors who may be inconvenienced by the project, must also be considered.

If the answer from all of this planning is still “Yes, this is a microtunnel project,” then let the design phase begin!

**Risk Assessment**

An effective Project Risk Assessment is a powerful tool to identify, assess and develop design control strategies to minimize project risks. Performed early in the design process, the Risk Assessment can engage key project participants and encourage open communication about project risk. Risk Assessment is well-explained in an excellent document entitled “A Code of Practice for Risk Management of Tunnel Works” published by the International Tunneling Insurance Group in 2006. The reader is referred to this document for a thorough description of the Risk Management process and a discussion of its advantages.

Basically, a Risk Management process will ask the following questions: “What is uncertain?;” “What can change?;” “What scenarios would keep you up at night with worry?;” “What problems/mistakes have been encountered elsewhere?;” and “What’s unacceptable to the project?.” Using a rigorous methodology for identifying each risk, the probability that it could occur on the project and communicating the severity of the outcome of the risk to the project, the project risks can be ranked in a table like that shown in Figure 1.

The high, very high and extreme risk factors resulting from this process can then be mitigated with design solutions and communicated effectively to all project stakeholders.

**Design**

Design is a process that ultimately communicates the minimum acceptable project technical requirements and optimizes the opportunities for project success. Design is usually iterative, comprising four phases each with an increasing level of specificity – preliminary (30 percent), 60 percent, 90 percent and final design. The key design elements include

*Figure 1: Qualitative Risk Rating where RISK = Probability x Consequence*

<table>
<thead>
<tr>
<th>Probability</th>
<th>Insignificant</th>
<th>Minor</th>
<th>Moderate</th>
<th>Major</th>
<th>Catastrophic</th>
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<tr>
<td>Rare</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td>Unlikely</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Possible</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Likely</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Very High</td>
</tr>
<tr>
<td>Frequent</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>Very High</td>
<td>Extreme</td>
</tr>
</tbody>
</table>
defining the ground conditions through subsurface investigations, determining project layout and alignment, defining shaft locations and logistics, specifying acceptable materials/equipment and determining cost/schedule.

**Defining Ground Conditions/Subsurface Investigation**

Good definition of anticipated subsurface conditions is key to contractor and project success. The project stakeholders, including the designer, are urged to:

- Be thorough — more subsurface information is usually better
- Be thoughtful — small diameter borings are not always the best tool
- Engineers! Communicate your results in language contractors can understand
- Contractors! Ask questions and get help if you don’t understand the representation of ground conditions in the contract documents

**Layout and Alignment**

A well conceived project layout and alignment, both horizontally and vertically, will allow the contractor to make optimum use of the microtunneling equipment, match equipment to anticipated ground conditions, minimize the required number and type of shafts and avoid buried utility interferences. “Shortcuts” should be taken if right-of-way permits and access will allow. Sometimes microtunnel design projects begin as “open cut” and the alignment follows existing streets or other rights of way. Microtunneling does not need to follow these traditional rights of way and significant pipeline length can be eliminated if alternatives are explored. Shaft locations and resultant drive length must be determined.

Shaft locations and tunnel drive length should be determined, first and foremost, based on establishing consistent ground conditions for each tunnel drive whenever shaft site access, future manhole locations, service and other connections and permitting restrictions will allow. Drive lengths are typically in the range of 300 to 1,500 ft and depend on ground conditions, pipe diameter, pipe type (its roughness/adhesion affects jacking performance), pipe annulus lubrication and use of intermediate jacking stations.

Because of the excellent grade control with microtunneling, most microtunnel projects are for gravity pipelines. Most often the vertical alignment is fixed by project hydraulic constraints. However, vertical alignment optimization should be considered during design including:

- include as much slope in the pipeline as possible
- avoid mixed face or “tough” ground conditions
- identify and “solve” any utility interferences

**Shafts**

Shaft locations must also provide enough room for contractor access and egress; manageable haul and delivery routes; muck storage and removal; and work hour limitations. Final shaft design is usually left to the contractor, but should be nominally addressed in the design and specifications; e.g. use of entry/exit seals and bottom heave avoidance measures. The design should also provide anticipated ground behavior and maximum standup time/unsupported shaft depth. The design might provide anticipated lateral ground pressure and/or propose a “buildable” shaft design or menu of preferred options.

**Pipe Alternatives**

The project owner often provides input on acceptable pipe types based on his preferences. Pipe selection is typically based on familiarity/favorable past experience, research results and product standards with documented loading/stresses within an allowable range for the project. There are currently several good jacking pipe alternatives available for microtunneling:

- Vitrified Clay Pipe (VCP)
- Reinforced Concrete Pipe (RCP)
- Steel Pipe
- Fiberglass Reinforced Polymer Mortar (FRPM)
- Polymer Concrete Pipe (PCP)

All of the above pipe products meet the industry tolerances for circumference, exterior roundness, end squareness, straightness and length.

**MTBM Requirements**

Ultimately, the final choice of an MTBM is a critical contractor project decision. However, the design should provide minimum machine requirements: diameter, power and torque, cutting head configuration, face stabilization capabilities and slurry system configuration. The design documents should leave room for innovation by equipment manufactur-
ers and contractors, therefore the designer is encouraged to only document minimum machine requirements.

**Slurry System**

Slurry system selection should be left to the contractor. Minimum slurry system performance requirements should be included in the design documents. The amount and character of fines (minus 200-sieve fraction) in the project soils should be provided to the contractors during project bidding to enable them to design the slurry separation system. Hydrometer tests are necessary to provide the detail required for slurry separation system design.

**Settlement/Heave and Third-Party Impacts**

The potential settlement and heave from microtunneling should be estimated during design to enable a risk evaluation of potential impacts to third parties – owners of nearby buildings, utilities and roadway surfaces. Settlement can be calculated for soft ground microtunneling using standard predictive equations. These rely on estimates of ground losses at the face, shield and tail sections of the MTBM. Larger ground losses, potentially resulting in sinkhole formations or large settlements at the ground surface, often accompany mixed face conditions where a harder/stiffer soil occurs in the lower portion of the tunnel face or where obstructions are encountered in the lower portion of the tunnel face.

**Contract Documents**

Contract documents, i.e. the business terms/plans/and specifications, must clearly communicate expectations and minimum technical project requirements to prospective bidders. Contract documents should include:
- General conditions – the typical ‘boiler plate’ contractual/business terms
- Special conditions – any unique contractual/business terms for this contract, such as any contractor prequalification, differing site conditions (DSC) clause, and/or dispute resolution parameters
- Technical provisions, such as plans and specifications
- Subsurface information, typically in the form of geotechnical data reports (GDR) and geotechnical baseline reports (GBR)
- Payment details and schedule

**Closing Thoughts**

Good design is an extremely efficient form of communication. Each element of project design results from conscious deliberation and optimization to produce project success. It answers the questions:
- Is it a microtunnel project?
- What are the project requirements?
- What are the ground conditions?
- How will the ground behave in response to microtunneling?
- What are the risks of that behavior and are they acceptable to the owner?
- What can be done to reduce the project risks to acceptable levels for the owner?
- What can be done to provide a project plan that maximizes the contractor’s opportunity to succeed?
- What can be done to deliver an acceptable project to the owner at a fair price?

The design process requires planning and communication between the owner, engineer and any potentially affected third parties. Good design requires an understanding of what the project is “up against,” and clearly delineates the minimum technical requirements needed to achieve project success. Good design doesn’t ignore risk, but rather plans for potential problems and seeks to minimize the potential adverse impacts of those problems on the construction process.

In summary, successful design comes down to:
- Keep it simple
- Don’t skimp on subsurface information
- Plan carefully for risk mitigation and project (and contractor) success
- Communicate clearly

Tracy Lyman, P.G., P.E., is a Senior Consultant with Brierley Associates LLC. He has over 35 years of experience in geological and geotechnical engineering specializing in rock and soil engineering and hydrogeology. He has applied this expertise to a variety of tunneling, water and wastewater infrastructure, trenchless technology, highway and bridge, mass transit, water development, hydroelectric, power, mining, and industrial waste management and remediation projects throughout the United States and abroad.

For more information visit www.trenchlessonline.com/info
Rasa Industries, based in Tokyo, Japan, is the newest entrant into the growing North American microtunneling market. The company got its start in microtunneling in about 1980 and has since produced 1,000 microtunneling systems. Microtunneling is part of the company’s Machinery Division. It also has a Chemicals Division and an Electronic Materials Division. Rasa’s company goal is to “produce many kinds of industrial products that helps create a comfortable living environment for people everywhere.”

Rasa was founded in 1907 when the company’s founder discovered phosphate on an uninhabited remote island called Rasa, which is located southeast of Okinawa. The company thus took its name from that island where phosphate ore was mined as a key ingredient of fertilizer. Rasa is a publicly traded company on the Tokyo Stock Exchange. It has revenue of over $400 million.

Rasa’s microtunneling and pipejacking systems have developed an excellent track record around the world with a focus on Southeast Asia, the Middle East, and China. Thus, the company’s expansion into North America brings with it extensive experience.

In meeting with Tadao Ando, Overseas Section of Rasa Industries, and Noboru Kiyota, Construction Machinery Division of Rasa Corporation, recently in Tokyo, they discussed that most Asian microtunneling projects include curved drives. In fact, they discussed that outside
of North America probably 90 percent of the microtunneling projects include a curved drive. Recent difficult projects have included long curved drives in Hong Kong and Korea in difficult ground conditions. Besides North America, Rasa is entering markets in Qatar and India.

Pipe diameters typically installed by Rasa machines have been in the range of 40 to 104 in. in diameter. Pipe typically installed in Japan is concrete with some clay. A unique feature of Rasa microtunneling system is the Tokyo Keiki Gyro Guidance System (Compass Mode). This innovative system provides real time data with a laser guides system. The Tokyo Keiki system includes an alarm and continues to operate the microtunneling system should it go off target.

The first two Rasa microtunneling systems brought into North America were acquired by Bradshaw Construction, based in Eldersburg, Md., and Frank Coluccio Construction Co. of Seattle. Both companies have a long history in tunneling and underground construction projects.

Bradshaw has used its Rasa system on projects in Alabama, Indianapolis and Florida. The system is a Unicorn 1900. Bradshaw purchased a system that was custom built for a project in Alabama that had requirements regarding allowable overcut. Due to the varying size of pipes to be installed — 78 and 96 in. — a custom-built 82.87-in. MTBM allowed the contractor to skin up the machine and use the same equipment for both tunnel runs.

“We looked around the world for any manufacturer we could find, and Rasa committed to building the size we needed within the timeframe we needed it,” Bradshaw Construction microtunneling manager Grahame Turnbull said.

The Rasa Unicorn 1900 slurry machine features an electrically driven cutterhead with face access to change the cutters. The base machine had a diameter of 2,105 mm (82.87 in.) with a factory-built skin set and cutterhead that enlarged the diameter to 2,470 mm (97.25 in.). The machine provides 340,000 Newton meters of torque. The main jacks provided 1,000 metric tons of maximum thrust, upgradeable to 1,500 metric tons.

The project consisted of four microtunnel drives and eight shafts — four launch shafts 24 ft in diameter and four receiving shafts 16 ft in diameter. The drives ranged from 114 to 213 ft under railroad tracks and busy roadways with shallow cover, in some cases as little as 4 ft.

Frank Coluccio Construction Co. has its 82-in. Rasa MTBM currently on the Beachwalk Force Main project in Hawaii for the City and County of Honolulu. The $37 million project involves the installation of 5,800 lf of 72-in. pipe to replace temporary pipelines that were installed after a massive pipeline break in 2006. Four of the five drives have been completed using Hobas pipe, with the final drive being a 1,240-ft curved drive that will use Meyer Polycrrete pipe.

Because of the need to cross under the canal (twice) with no allowances for rescue shafts, the machine was built with access to the face and the ability to employ compressed air to maintain pressure. When complete, the project will allow removal of the temporary piping and provide a redundant means of transporting wastewater out of Waikiki.

Microtunneling in North America continues to gain traction and now Rasa provides another equipment solution and guidance system for contractors to choose.

Bernie Krzys is publisher of Trenchless Technology.
The City of Portland (Ore.) Bureau of Environmental Services (BES) is in the final phase of constructing an underground tunnel network to reduce combined sewer overflow (CSO) into the Willamette River. Portland’s program includes several other landmark projects, such as the West Side and East Side CSO Tunnels. The Balch Consolidation Conduit is one of the final elements of Portland’s CSO program that will convey combined sewer and stormwater flows from northwest Portland to the Swan Island Pump Station. When the program is complete, CSOs will have been reduced from approximately 6 billion gallons to 250 million gallons annually.

What Lies Beneath
The soil along the Balch Consolidation Conduit was characterized by the geotechnical engineer as Guilds Lake Alluvium, which consists of very soft to medium stiff silt, clayey silt, and clay with minor constituents of fine grained sand. When the initial borings were drilled throughout this section, some of the vertical borings had blow counts that were less than 3 blows per ft at the planned elevation of the pipeline. Other variable and challenging subsurface conditions encountered along the 8,000 ft of microtunnel alignment included gravel, cobbles and boulders and a cemented gravel unique to Portland called Troutdale formation; a former lake filled in with a variety of soft lake sediments, sand, sluiced gravel and wood railroad trestles; and a former landfill.

High, variable groundwater pressures were also present. The groundwater levels ranged from 10 to 15 ft below the ground surface, fluctuating seasonally. The water levels of the nearby Willamette River also influence the groundwater pressures. Contaminated groundwater was also present along the alignment from sources associated with historic industrial activity in the project area, including incineration and metals processing activities.

Digging It
The project included 6,900 ft of 84-in. microtunneling in five drives and 1,115 ft of 54-in. microtunneling in a single drive. All microtunnel drives were a minimum of 1,100 ft with the longer drive of the project of 1,690 ft beneath a heavily traveled highway. This drive through aggressive gravels had proven difficult to microtunnel on previous projects in the Portland area. During the drive, the machine hit a large object, presumed to be a boulder or rock shelf. Instead of digging a rescue shaft, the project team working together to continue tunneling.

Five launch and reception shafts were constructed at depths ranging from 35 to 75 ft deep in soil zones where de-watering has to be minimized to prevent the movement of
contamination plumes. The shafts were constructed using the cutter soil mixing (CSM) method. This flexible method had never been used in Oregon and would prove to be adaptable to the wide range of ground conditions and shaft configurations required on the project. The project is also the first known use of CSM panels for ground support. Utilities in the project area were known to be a major concern during construction. Early identification and coordination with a variety of service providers enabled waterline, gas pipelines, overhead power, underground telecommunications and railroad lines to be adjusted or protected prior to construction.

**Teamwork**

The Balch project was awarded under a variant of the typical construction manager/general contractor contract known as the Portland Method. This approach, originally implemented by Portland BES for the West Side CSO project, results in a true partnership between the owner, designer and contractor where risk is shared equitably and the parties are participants in the decision-making process. The impact of the collaborative working relationship resulted in significant savings to the city.

During the pre-construction services agreement (PSA) phase, the project team reviewed specific high-cost elements and offered a number of value engineering solutions resulting in significant changes and savings. In terms of economic sustainability, the overall cost of the project was reduced by over $15 million during the PSA phase and by over $3.725 million in the construction phase. Major cost savings realized during the PSA phase included the decision to microtunnel rather than open-cut the 54-in. line, revisiting the need for sewer improvements on a portion of the alignment and the redesign and reconfiguration of several shafts.

**Expanding Boundaries**

During the construction phase, the contractor submitted a method for support of shaft excavation and ground improvement that was untested in Oregon. Rather than using secant piles and sheet piles for support of the shaft excavation, cutter soil mixing (CSM) was proposed. The method had no track record of success in the types of soils on site – a very aggressive, hard fluvial deposition of basalt and quartzite gravels, cobbles and boulders overlain by a stratified sand/silt.

Without prior experience in similar soils, the owner was reluctant to approve this change. The contractor proposed to use CSM for the temporary support of excavation of the six shafts and for ground improvement outside of the shafts and on one tunneling run through very low strength soils. The CSM was initially proposed for cost and schedule savings. Further investigation, however, revealed that it would also reduce the amount of waste generated. The elimination of 13,200 tons of waste to go to landfills also reduced fuel consumption by over 8,000 gallons. Re-use of the tunnel tailings for shaft backfill also reduced waste destined for landfills. This translated into over 4,900 gallons of fuel saved, over 7,000 tons of material no longer destined for a landfill, and a corresponding reduction in the transportation of import fill to the project site.

**Equal Opportunity**

The City of Portland prides itself on its city-wide program to promote the use of minority, women, emerging small businesses (MWESBs). The Balch Consolidation Conduit project is primarily a microtunneling project, with few opportunities for using MWESBs. The Portland Method allowed the city to work closely with the contractor to develop an MWESB plan during the PSA Phase. This plan initially identified $3.4 million of opportunities for MWESB participation. The Portland Method also allowed the city to work closely with the contractor throughout construction to explore non-traditional opportunities for optimizing MWESB participation. With the project complete, MWESB participation exceeded 450 percent (more than $14.7 million) of the goal set at the start of construction. More than 100 contract awards have been made to MWESB firms.

- **Project Owner**: City of Portland Bureau of Environmental Services
- **Engineer**: Kennedy/Jenks Consultants
- **Contractor**: James W Fowler Co.
- **MTBM Supplier**: Herrenknecht
In the 1990s, Houston was known as the “Microtunneling Capital of the United States” because of the ambitious Great Houston Wastewater Program. The program represented the first large-scale use of microtunneling in the United States and helped establish it as a viable trenchless method.

Fast-forward 20 years and Houston is now employing guided boring/pilot tube microtunneling on a large scale, and with similar successes. In this case, though, it is not being used for wastewater. CenterPoint Energy, provider of electrical service to 2 million businesses and residences in the Houston area, is upgrading overhead lines with approximately 10,400 ft of pipe.

CenterPoint hired Houston-based Boyer Inc. to install more than 2 miles of 30-in. pipe to house 138 kV cables via three individual 8-in. HDPE and one 4-in. HDPE conduit lines with a thermally conductive grout fill. Boyer chose guided boring to install about 7,000 ft of 30-in. Hobas pipe using an Akkerman GBM under the streets of Houston.

It was Boyer’s first time using the guided boring method, but installation went off without a hitch, according to Boyer project manager Barry Buse. “We have several Akkerman boring machines so we knew the Akkerman product and knew its reliability, so we decided to use the Akkerman GBM for this project,” he said. “We also knew that Akkerman had the support systems in place so that if we had any questions they could definitely help us out. When we got the machine, one of their technicians came in and he gave us some pointers and we started drilling. But we had some experienced crews and they were able to get started boring right away.”

The guided boring method consists of a three-pass system. The first phase involves drilling a pilot hole using a theodolite guidance system, followed by a reaming pass using augered casings. Finally, a Powered Cutting Head is used to expand the hole to its final diameter. The product pipe is pulled behind the Powered Cutting Head.
In Boyer’s case, crews reamed the hole to 16 in. in diameter and used a 32-in. Powered Cutting Head to leave room for the 30-in. diameter pipe. Boyer worked with Baroid in customizing a drilling fluid recipe for lubricating and maintaining the hole in the Beaumont clay that was encountered along most of the alignment.

In all, Boyer completed 16 shots using the guided boring method, averaging around 400 ft per shot. Boyer reported a long drive of 470 ft, and a best day of 180 ft, which was accomplished on several occasions, Buse said. “The productivity we were able to achieve was probably double what we would get with conventional equipment,” he said.

Pit depths ranged from 20 to 30 ft deep to help alleviate utility conflicts. Boyer used three crews on the project: a boring crew, a crew building pits in advance of the boring crew, and a pit deconstruction crew that followed. Groundwater encountered in the pits was removed using dewatering pumps.

The pits were typically 12 ft wide and 30 ft long. The length of the pit was determined by the length of pipe – in this case 20-ft lengths of Hobas were installed. “One of the key factors in doing this is making sure you have a large enough pit to get your product in the ground,” Buse said. “We were using 20 ft joints so our bore pits were 30 ft in length so we had room to work.”

Buse said the boring crew was typically in a location 8 to 10 days before completing the bore and moving to the next launching pit location. Staging equipment was critical in keeping the operation moving while also minimizing disruption to the traffic.

Boyer Inc. began boring in April 2011 and finished in October. Buse sees an opportunity for more work involving electric in the future. “It is becoming more and more common to put these types of cables in urban areas,” he said.

In fact, phase two of the project will begin next year, and will include 1.5 miles of pipe across downtown Houston, the majority of which will be microtunneled. “The City of Houston was very happy with us using the guided boring machine because we didn’t disturb their major thoroughfares, other than where we had our pits. Traffic was able to flow pretty regularly at all times,” Buse said.

Jim Rush is editor of Trenchless Technology.
Ohio’s Shayler Run Segment C Sewer Replacement project near Cincinnati was identified as a priority project due to severe pipeline erosion at Shayler Creek. An existing sewer pipe was installed in 1978 directly into the creek, and since then the environment has exposed the pipe to the elements, putting some sections at high risk of failure. The pipe has now dumped raw sewage into the creek on several occasions.

The Clermont County Water Resources Department is working to remedy the situation with a $15 million project — one of the largest in the agency’s history — that will replace and upgrade the exposed sewer system while protecting the environmentally sensitive area.

General contractor Midwest Mole Inc., Indianapolis, Ind., is responsible for construction of a new and higher capacity pipeline far below the creek bed. The project consists of seven gravity sewer tunnels crisscrossing the waterway. Each crossing is connected by a 32 ft diameter launch and receiving shaft, with a total of eight shafts in all. The shafts will eventually become fiberglass manhole structures to access the new pipeline.

All seven of the tunnels and the eight manhole shafts are expected to be complete by May 2012. The contractor is utilizing a 72-in. diameter hard rock, self-propelled TBM, to excavate 9,430 ft of tunnel in total, with seven individual bores ranging from 816 to 2,014 ft long. Original plans called for microtunneling or two-pass tunneling with a conventional TBM. Midwest Mole opted to use a conventional TBM with a Robbins Rockhead.

“The Rockhead was the best suited to the project conditions based on our previous experience with similar Robbins machines. Two-pass tunneling with a Double Shield Rockhead was also more cost effective than microtunneling when we prepared our estimates,” said Steve Abernathy, vice president of operations at Midwest Mole.
The Double Shield Rockhead was designed with a mixed ground cutterhead that can be changed out for a hard rock cutterhead later on. The mixed ground cutterhead features 6.5-in. single disc cutters and carbide bits, combined with large openings in the cutterhead to ingest mixed ground and to allow for cutter changes. The hard rock cutterhead is dressed with 11.5-in. diameter single disc cutters and abrasion-resistant muck scrapers, as well as a cutterhead opening for cutter changes. Crews can switch out the cutterhead between crossings in one of the launch/receiving shafts, based on the ground conditions encountered while tunneling.

Tunnel design called for a primary liner of ring beams and lagging, which is set every 5 ft following each machine push. After each ring is built, a muck train consisting of a battery-operated locomotive and three muck cars removes spoils from the tunnel. The muck will be used as back-fill around some of the shaft sites after project completion, and potentially as fill on private property in the area.

Crews have the option to switch out the cutterhead between crossings in one of the launch/receiving shafts, based on the ground conditions encountered while tunneling.

The Midwest Mole crew reported advance rates averaging 6 in. per minute in low strength shale using the mixed ground cutterhead. Production rates have been as high as 70 ft in one 12-hour shift, and are consistently in the range of 40 to 60 ft per shift, thus producing 80 to 120 ft per day. The swift advance comes despite some unforeseen difficulties — the crew tunneled just 4 ft below a creek bed into highly saturated ground, requiring temporary diversion of the waterway. Crews cleaned the machine several times and carefully monitored gripper slippage in the soft, wet ground during machine pushes.

This project is an excellent example of all parties working together — project owner, contract, and equipment manufacturer. Original plans called for 11 shafts and 10 tunnels, but Midwest Mole worked with the project owner to obtain new easement rights, change the alignment and reduce the number of bores. The value engineering resulted in substantial cost savings — lowering the estimated construction price from $15.2 million to $14.5 million — and a shortened project schedule. Midwest Mole also worked extensively with the machine manufacturer to optimize and modify the machine based on the ground conditions encountered in the first tunnel. Changes included modifying the hydraulic system for increased gripper strength and roll correction in extremely soft, often wet rock. Other modifications were made to the muck haulage system — specifically to increase the volume of the muck car boxes. The greater capacity boxes allowed the machine to be ready to mine after one ring set was completely built, resulting in greater production and less downtime.
Cruz Contractors LLC of Holmdel, N.J., successfully completed the installation of a 36-in. steel casing under the Taconic Parkway and Metro North Railway with the assistance of ICON Tunnel Systems and its pilot tube microtunneling technology for the first time.

Cruz is no stranger to microtunneling projects. Since 1951, the company has been a major player for infrastructure projects, including microtunneling throughout New Jersey, New York, New Hampshire, Massachusetts, Delaware, Connecticut, North Carolina and Virginia.

Cruz was subcontracted by Arben Group LLC of Pleasantville, N.Y., to handle the trenchless portion of the water system distribution improvements. The project called for 210 lf of 36-in. steel casing to be installed under the Taconic Parkway and Metro North Railway. Originally, the project specifications called for a remote-controlled microtunneling machine in order to handle the native soil, which was thought to consist of stones, rocks and large cobles.

However, the soil boring logs did not show this soil condition being present.
The logs actually indicated soft sands, traces of small gravel and clay silts. In addition, the work area would be very tight as the jacking pit for the microtunnel would be placed at the edge of a cemetery. Because of this, Cruz felt the remote-controlled microtunneling equipment would not be the solution because of the amount of equipment needed and large jobsite layout required.

Cruz contacted ICON Tunnel Systems for advice and inquired about the Bohrtec pilot tube microtunneling system. ICON reviewed the soil reports and determined that pilot tube microtunneling was a feasible alternative to the remote-controlled microtunneling machine specified.

David Crandall, Vice President of ICON Tunnel Systems, along with Cruz and Arben worked with engineering firm Malcolm Pirnie, of Fair Lawn, N.J., and Westchester County to successfully modify the pipe installation method on the project specification to allow for pilot tube microtunneling.

“We worked closely with all parties in order to properly incorporate the pilot tube microtunneling pipe installation method into the project specification,” says Crandall. “We recommended the BM600LS pilot tube machine for the project due to its powerful 262 tons of jacking force and 22,186.83 ft-lbs of torque in case we encountered any unforeseen difficult soil conditions.”

“Having the specification modified to meet the pilot tube pipe installation method was a huge advantage and saved everyone time and money on the project,” says Dominic Pillari, Chief Project Manager of Cruz Contractors LLC.

Being heavily involved in rental, sale and lease of trench shoring equipment, ICON also supplied Arben Group LLC with the required slide rail jacking and receiving pits for the pilot tube microtunneling operation. In addition, ICON provided site specific engineering submittals with paper calculations and drawings with a New York P.E. stamp for our slide rail shoring systems used on the project.

The jacking pit size was 20.5 ft long by 13.12 ft wide by 14 ft deep and the receiving pit was 24 ft long by 13.12 ft wide by 12 ft deep. ICON supplied their new Transformer Rails for the side rail system, which are 30 to 40 percent stronger than other rail systems and versatile enough to handle three different types of bracing including; fixed rail, roller rail and angled raker bracing.

Andrew Kerry, ICON Tunnel Systems Pilot Tube Operator, and Rob Langenbach, Operations Manager for ICON Tunnel Systems, were on site to assist with the proper installation of both jacking and receiving pits and worked side-by-side with Cruz during the pilot tube machine setup and operation.

“ICON worked seamlessly with Arben in setting the shoring for the tunnel access pits and worked carefully with our crew during the pilot tube machine setup and operation, keeping the project on schedule,” says Pillari.

Large double wall pilot tube rods with an outside diameter of 5.5 in. and a length of 4.92 ft were used for the initial pilot bore. “We experienced relatively low jacking and torque pressures while installing the pilot rods,” says Langenbach.

Once the pilot rods were installed on line and grade, Cruz and ICON would attach a steel adapter head to the last pilot rod. The steel adapter head would increase the bore from 5.5 in. to 36 in. Once the adapter head was attached, they attached the first auger and steel casing to the adapter head. “The augers are placed inside the steel casing and can be moved independently from the casing to assist with the material removal process,” says Langenbach.

During the installation of the 36-in. casing, crews encountered several areas with large boulders, some of which were 14 in. in diameter. “The large opening of the 36-in. casing allowed the larger material and potential obstructions to enter the casing at which point the augers would pull all of the material back to the jacking pit where it was then removed,” says Langenbach.

“We were able to muscle our way through these difficult areas using the sheer power of the BM600LS and successfully install the steel casing on line and grade without disruptions to the highway or Metro North Railway.”

“The pilot tube machine was the perfect fit for this project and has allowed us to expand our services for future short run pipe installations on line and grade,” says Pillari. “ICON was with us every step of the project and really showcased their services from engineering and planning to shoring and tunneling. They made our first pilot tube project a true success.”

Since 1982, ICON has steadily grown in technology and expertise to become a full-service trench shoring and pilot tube guided boring company and industry-leader in underground construction projects. ICON has the in-house resources to handle projects of any size in any location across North America and provide a comprehensive line of services that include consulting, design, engineering, manufacturing and distribution, leasing and equipment rentals.

This article was supplied by ICON Tunnel Systems.
CALIFORNIA
San Francisco
The $37.5 million Sunnydale Auxiliary Sewer includes a 617-ft drive of 84-in. Hobas pipe. Super Excavators completed the drive using an Akkerman SL 74. The San Francisco Public Utilities Commission was the owner and Jacobs Associates was the designer. The job began on June 20 and completed on Sept. 16.

COLORADO
Adams County
BTrenchless Inc., a division of BT Construction Inc., has completed the $2.2 million Dahlia Ponds and Kenwood Outfall project for the Adams County Urban Drainage using an Akkerman SL 51 MTBM. ICON Engineering was the engineer. The job involved 240 lf of 54-in. microtunnel in running sands, gravels and cobbles, and in contaminated groundwater. It also included 60 lf of 84-in. rescue handtunnel in running sands, cobbles and gravels. The tunnel was constructed under I-76 with shallow cover and contaminated groundwater system up to 2,000 gpm. The rescue handtunnel was required as a result of failed attempt by a previous contractor. The shafts reached depths of 28 ft. The tunnel crossed under a live 25-mgd sewer line with 18 in. of cover and met with previous tunnelled casing on line and grade.

Aurora
BTrenchless Inc. is about 60 percent complete on the $14 million Tollgate North project for the City of Aurora. The project involves constructing a sanitary sewer main under I-225 and includes three crossings of Tollgate Creek. The project is located in tight construction corridors with remnants of the old Fitzsimmons army hospital located throughout the project. Crews are using a 54-in. Akkerman SL 51 MTBM to complete six drives through soft, mixed ground conditions. Drive lengths are 520 lf, 750 lf, 234 lf, 945 lf, 480 lf and 215 lf. Crews will push in 42-in. Hobas pipe as a carrier pipe. CDM is the engineer. The project began in April and is expected to be complete by August 2012.

CONNECTICUT
Hartford
The Granby Street Area Sewer Separation Project 2/5 for the Metropolitan District Commission involves one 900-lf drive of 60-in. RCP at an average depth of 25 ft through extremely soft silt/clay below water table; and one 140-lf drive of 42-in. RCP at an average depth of 20 ft through extremely soft silt/clay below water table. Bradshaw Construction is using three different MTBMs to complete the work: a Herrenknecht AVN-1500 (73.5 in.); Herrenknecht AVN-1200 (60 in.); and an Akkerman-420 (52.5 in.). Additional slurry separation efforts were required due to high percentage of fine soils. Additionally, the work site is residential street with restrictions on working space and working hours. Work began in July 2011 and is scheduled for a February 2012 completion. The engineer is Tighe & Bond.

Hartford
Northeast Remsco Construction has completed the Garden Street Relief Sewer Project for the Metropolitan District Commission. The project consisted of a single 740-lf drive of 48-in. RCP through weak silts and clays using a Herrenknecht AVN 1200T. The project was completed in August 2011.

FLORIDA
Fort Lauderdale
Huxted Tunneling completed the I-595 Corridor Roadway Improvements microtunnels for the Florida Department of Transportation in September 2011. Huxted, working as a subcontractor to Dragados, completed 550 ft of 60-in. RCP and 550 ft of 72-in. RCP storm water pipes. The drives ranged from 15 to 30 ft deep through lime rock. The tunnels included a crossing of the Florida Turnpike with just 6 ft of cover. Crews used a 74-in. OD Iseki Unclemole and an 89-in. OD Herrenknecht AVN.

Jacksonville
Huxted Tunneling completed the Royal Lakes 24-in. Force main project for the Jacksonville Electric Authority in November 2011. The project consisted of 280 ft of 42-in. Permalok steel casing installed under a state highway 20 ft deep in sand. Huxted used a 43-in. Iseki Unclemole to complete the job.

Miami
Huxted Tunneling in March completed the Port of Miami Sewer Relocation project for the Miami Dade Water and Sewer Department working as a subcontractor to Bouygues Civil Works. Huxted used a 31-in. Iseki Unclemole to install 290 ft of 50-in. Permalok steel casing in two drives to relocate a 10-in. sanitary sewer main that conflicts with the alignment of the new Port of Miami Tunnel connecting the mainland and Watson Island. Both drives were 20 ft deep through lime rock.

Sarasota
Huxted Tunneling is working on the Lift Station 87 project for the City of Sarasota as a subcontractor to Westra Construction. The project consists of 1,400 ft of 36-in. vitrified clay pipe (VCP) in three drives, 20 ft deep in siltstone, and 1,000 ft of 24-in. VCP in two drives. 15 ft deep in sand and silt. The 36-in. drives began in September with an anticipated completion date of January 2012, while the 24-in. drives are expected to begin in April 2012 and end in June 2012. Crews are using Iseki Unclemoles, one 43-in. OD and one 31-in. OD, to complete the work.

Venice
Huxted Tunneling completed a water main crossing for the Peace River Manasota Regional Water Supply Authority as a subcontractor to Garney Construction. Huxted used a 61-in. OD Iseki Unclemole to install 210 ft of 60-in. Permalok steel casing 50 ft deep in sand, clay and limestone. A 42-in. water main will be placed in the casing. The project was completed in January 2011.

HAWAII
Honolulu
Frank Coluccio Construction Co. is using a 82-in. Rasa MTBM to build the Beachwalk Force Main project for the City and County of Honolulu. The $37 million project involves the installation of 5,800 lf of 72-in. pipe to replace temporary pipelines that were installed after a massive pipeline break in 2006. Four of the five drives have been completed using Hobas pipe, with the final drive being a 1,240-ft curved drive (1,000 ft radius) that will use Meyr Polycrete pipe. Because of the need to cross under the canal (twice) with no allowances for rescue shafts, the machine was built with access to the face and the ability to employ compressed air to maintain pressure.

ILLINOIS
Chicago
Super Excavators has completed microtunneling on the Calumet Area Systems, Contract No. 1-2, Section 2 project for the City of Chicago Department of Water Management. The general contractor was Di Paolo. Microtunneling included the installation of 2,120 lf of 72-in. reinforced concrete pipe installed in three drives. The job started on Dec. 6, 2010, and ended on July 20.
INDIANA

Indianapolis

The Castleton Relief Sewer Project – Phase 1 for Citizens Energy Group (formerly the City of Indianapolis Department of Public Works) involved installation of 2,740 lf of 42-in. RCP (52.5 in. OD) in four drives: 805 lf, 780 lf, 675 lf and 480 lf. The drives had an average cover of 10 to 20 ft and traversed coarse sand, gravel, cobbles and boulders below the groundwater table (+/-5 ft below ground surface). Bradshaw Construction was the general contractor, United Consulting was the engineer, and Black & Veatch was the tunneling consultant. Bradshaw used a Herrenknecht AVN 1200 for the tunneling. The general contract was bid at $5,988,200, with microtunneling comprising $3.5 million and shafts $1.75 million. Microtunneling was conducted in the Ravenswood neighborhood of Indianapolis beneath Howland Ditch and Riverwood Park, featuring a newly constructed public Spray Park. An additional crossing beneath Keystone Avenue Bridge went between the bridge’s foundations. Works is about 66 percent complete.

NEW JERSEY

Carteret

Cruz Contractors LLC is building the $2.2 million Turnpike Sanitary Sewer Crossing project for the Borough of Carteret. The project generally consists of microtunnel installation of approximately 760 lf of 30-in. sanitary sewer interceptor in a 48-in. casing under the New Jersey Turnpike, installation of approximately 155 lf of 8-, 21- and 30-in. gravity sewers in the adjacent area, and lining an existing 24-in. sanitary sewer.

NEW YORK

New York

Cruz Contractors LLC was hired by Tutor Perini to install 2,200 lf of 48-in. RCP by microtunneling for 15 crossings under the MTA railroad in Queens. This subcontact is valued at $6.9 million.

OHIO

Akron

Michels Tunneling is installing 42- and 48-in. sewer pipe for the City of Akron. The project includes the construction of seven 35-ft deep shafts and six tunnel runs totaling 4,253 ft — 1,328 ft of 48-in. and 2,925 ft of 42-in. Each run ranged from 300 ft to more than 1,000 ft. The project, which is a major upgrade to the sanitary sewer system in Akron, is estimated to be completed in spring 2012.

WASHINGTON

Cleveland

Super Excavators completed the $6 million Walworth Run Interceptor project for the Northeast Ohio Regional Sewer District using an Ackerman SL 60 MTBM. The project involved the installation of 1,209 lf of 60-in. Hobas fiberglass pipe at an average depth of 50 ft. There was a total of three drives. The ground conditions were saturated sands and silts with many boulders and cobbles. DLZ Ohio Inc. was the engineer. The project began Nov. 6, 2010, and was completed in June 2011.

WISCONSIN

Carteret

Cruz Contractors LLC is building the $2.2 million Turnpike Sanitary Sewer Crossing project for the Borough of Carteret. The project generally consists of microtunnel installation of approximately 760 lf of 30-in. sanitary sewer interceptor in a 48-in. casing under the New Jersey Turnpike, installation of approximately 155 lf of 8-, 21- and 30-in. gravity sewers in the adjacent area, and lining an existing 24-in. sanitary sewer.
Akkerman 5000 Series II Pump Unit

The original 5000 Series Pump Unit, the flagship product for Akkerman and the heart of its all-in-one 5000 Series pipejacking system, has been a powerful companion on a vast number of pipejacking jobs over the last 30 years. The completely revamped and enhanced 5000 Series II Pump Unit features streamlined operation and functions, an incorporated dual-feed pump to power all TBM sizes, a raised operator’s station with ergonomic controls, many safety provisions and improved maintenance accessibility. The 5000 Series II Pump Unit requires less pit height than its predecessor due to an integrated dual pump feed. The two, low-pressure, 100-hp (74-kW) Totally Enclosed Fan Cooled (TEFC) electric motors provide low-pressure power for the TBM and conveyor at 3,000 psi (207 bar) and up to 120 gpm (454 L/min).

Barbco PATHFINDER/TRIBOR

Barbco’s PATHFINDER Pilot Tube Steering System is specifically designed for accuracy when installing line and grade critical casing. The PATHFINDER is powered by the existing power pack of a conventional auger boring machine, eliminating the need for a secondary power source. Pilot tube boring is a two-step process. The first step is to establish the bore path with pilot tubes utilizing video surveillance to monitor line and grade. The second step is to follow the pilot tube with larger diameter casing. In addition to the Pathfinder system, Barbco recently unveiled the TRIBOR System, which combines three common methods of trenchless installation. A hybrid built for directional drilling, auger boring and guided pilot tube boring creating one very versatile drilling machine. TRIBOR’s strongest mode of operation is directional drilling. TRIBOR is available in models that are comparable to 150,000 to 750,000 lb directional drills.

Bohrtect Auger Boring Machine

Bohrtect GMBH launches the newest addition to its already impressive product line. The BM400LSC machine has been designed to install large diameter jacking pipes with a maximum outside diameter of 36 in. from a 13.5-ft shaft for a 2-m long pipe and a 10.5-ft shaft for a 1-m long pipe with 224 tons of jacking force, 101 tons of pull back force and 21,020 ft-lbs of torque. The BM400LSC is specially designed to work in conjunction with a 75 kW or 100-hp hydraulic variable speed power pack. Unlike other machines on the market the jacking frame of the BM400LSC can be easily extended to accommodate a variety of pipe and lengths up to 60 ft. The products are serviced and handled by ICON Tunnel Systems, USA.

Derrick Equipment Centrifuge

Derrick Equipment’s DE-7200 VFD (Variable Frequency Drive) Centrifuge provides a new concept in centrifuge operation and control. Automatic load sensing and feed pump control enables automated performance up to 500 gpm volumetric capacity and 12-14 T/Hr of fine solids discharge. High capacity fine solids removal enables contractors to more efficiently maintain desired drilling fluid properties, with reduced mud disposal costs and increased production. The inverter duty drive system has a 150-hp bowl drive and 60-hp conveyor drive powered by AC drives. Motor drives and peripheral devices are controlled by an environmentally hardened PLC that offers operating flexibility and data storage. The PLC controls the feed pump through an AC drive and is automatic or manual. Automatic control maximizes centrifuge throughput by employing a Proportional-Integral-Derivative (PID) loop. As feed slurry properties change, the PID loop dynamically adjusts pump output to maintain the torque set-point.

Can-Clay Denlok Pipe

Denlok jacking pipes offer unsurpassed proven life in sanitary sewer installations. Denlok pipes have resulted in successful projects now on six continents. Ceramic pipe is combined with 29 psi joints of 316 stainless steel which results in water tight performance to depths of greater than 70 ft. Denlok’s high compression strengths of greater than 10,875 psi results in high jacking strengths of up to 2,800 tons. World record lengths of microtunneling drives have been performed when using Denlok pipes. Denlok is offered in sizes from 4 to 48 in. diameters and lengths to 10 ft. Choose Denlok for unsurpassed installation success and sustainable low cost ownership. Manufactured under a certified ISO 9001:2008 quality control system. Supplied with factory manufactured cushion rings.
HOBAS Jacking Pipe

HOBAS centrifugally cast, fiberglass-reinforced, polymer mortar pipe is ideal for nearly every trenchless application including microtunneling/jacking, slippinling and tunnel lining for both pressure and gravity applications. It provides inherent corrosion resistance, superior hydraulics and a long, maintenance-free life. Key applications are sanitary sewers, potable water and corrosive environments. Sections join with push-together, leak-free, gasket-sealed couplings. After more than 50 years of reliable service, the use of HOBAS pipe is expanding faster than ever and it can be found in most U.S. municipalities.

iNTERpipe Jacking Pipe

iNTERpipe offers pipe, jacking pipe, manholes, tunnel segments and custom castings. iNTERpipe Polymers has technical expertise with decades of polymer concrete experience in acid containment and corrosive applications. iNTERpipe has demonstrated superior durability over existing products by combining inherent corrosion resistance with steel reinforcement per ASTM and industry standards. iNTERpipe partners with local precast producers to reduce freight costs and increase availability of a full line of corrosion resistant polymer products. When service conditions call for high performance materials choose iNTERpipe, the leader in polymer concrete product technology.

McLaughlin Steering Head

The McLaughlin ON Target auger boring system steering head allows contractors to not only control horizontal directional changes, but also allows for lateral changes. 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 contractor 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 hydraulic actuated panels that open and close to keep the head on the intended path. A control station features a hydraulic power pack to control the movement of the steering head, and a built-in water level helps monitor grade throughout the bore.

NO-DIG Jacking Pipe

NO-DIG Vitrified Clay Jacking Pipe is manufactured in Pittsburg, Kan., by Mission Clay Products. This gravity flow sewer pipe has been used for slurry microtunneling, pilot tube microtunneling (GBM), static pipe bursting, and slippinling casing pipe. This vitrified clay pipe is manufactured from 100 percent natural materials — a blend of clays, shales and slate. NO-DIG is manufactured with a Precision Ground Joint, a Polysoprene, EPDM, or Nitrile Elastomer gasket, and a Series 316 Stainless Steel Collar. Chipboard compression rings, for axial load transfer during installation, are supplied and used at each joint. NO-DIG Pipe meets the specification requirements of ASTM C1208/C; 1208M and EN 295-7.

NO-DIG Vitrified Clay Jacking Pipe has been the predominant tunneling pipe material used in the 8 through 36 in. size range due to its high compressive strength (18,000 psi average), low-profile zero-leakage joint, and affordability in the typical 1 or 2 m pipe lengths.

Permalok Jacking Pipe

Permalok Steel Pipe with its patented Interlocking Press-Fit Connection requires no field welding. This makes it the ideal solution for all trenchless steel pipe installations, including microtunneling, auger boring, pipe ramming, pipe jacking and guided boring. Newer joint types allow Permalok Steel Pipe to be used in pressure applications and HDD installations. It is available in sizes from 6 to 144 in. diameter and wall thickness up to 1.75 in.

Vermeer AXIS Guided Boring System

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 and when combined with the laser guidance system, the AXIS system is capable of completing flatter grades more accurately. As the drill stem cuts its way through the soil, the displaced material is simultaneously removed by a high-power vacuum system. Spoil is then diverted to a vacuum storage tank.

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ADVERTISER INDEX

Akkerman ............................................................................................................................................................11
Barbco ....................................................................................................................................................Back Cover
BMI Online Buyer’s Guides .................................................................................................................................34
BMI Resource Center ...........................................................................................................................................35
Bradshaw Construction ........................................................................................................................................19
Brierley Associates LLC ........................................................................................................................................12
Colorado School of Mines ......................................................................................................................................7
Herrenknecht Tunneling Systems ............................................................................................................................2
Midwest Mole ......................................................................................................................................................17
NASTT’s 2012 No-Dig Show ..................................................................................................................................3
Northeast Remsco Construction ...........................................................................................................................15
Permalok Corp. ......................................................................................................................................................9
U.S. Composite Pipe South, LLC (USCPS) ............................................................................................................23

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