Material handling
Dust control
Tunnel monitoring
Hand protection for mining hazards
June Contents

Cover Story

In This Issue

Muck removal and disposal is one of the more mundane but necessary aspects of any tunnel or underground construction project. Increases in environmental considerations have added additional challenges to material handling while recent innovations have moved the process forward. On page 14, experts from Kiewit share their thoughts about the challenges and innovations in material handling. Cover photo courtesy of Robbins.

Feature Articles

16 Material-handling innovations and challenges
William Gleason

20 Environmentally friendly soil conditioning for EPB TBM's — The state of environmental considerations around the world
C. Oñate and T. Murt

24 Innovative approach for dust control in tunnel construction
Andrew Fanning and Craig Allan

29 Wireless optical displacement sensor for convergence and divergence monitoring

In This Issue

Muck removal and disposal is one of the more mundane but necessary aspects of any tunnel or underground construction project. Increases in environmental considerations have added additional challenges to material handling while recent innovations have moved the process forward. On page 14, experts from Kiewit share their thoughts about the challenges and innovations in material handling. Cover photo courtesy of Robbins.

Feature Articles

16 Material-handling innovations and challenges
William Gleason

20 Environmentally friendly soil conditioning for EPB TBM's — The state of environmental considerations around the world
C. Oñate and T. Murt

24 Innovative approach for dust control in tunnel construction
Andrew Fanning and Craig Allan

29 Wireless optical displacement sensor for convergence and divergence monitoring
Reflections on my term as Chair

Michael Rispin
2022-2023 UCA Chair

And … WHAM! … all of a sudden, it’s time for my last column as our association’s Chair. The term has flown by and so, per the adage, I must’ve been having fun (most of that is thanks to being able to spend time with all of you). I’m also feeling a strong sense of accomplishment at everything this administration has been able to progress. I thank you all for your belief in me, your support, stepping up to volunteer, providing feedback, participating in conferences and moving the industry forward.

It’s traditional that this edition of the column looks back — to establish the benchmark for going forward yet again — and I’m choosing to highlight items from the most recent first rather than chronologically.

In recognition that, from lessons learned, we need to begin impressing the importance of and opportunities within our industry to potential entrants before they hit their final years of college, when decisions may already have been made, we have just established a task force to focus on making an impact with those in kindergarten through grade 12. This is a brand-new initiative that will be led by Sarah Wilson of Delve Underground, and she is looking for motivated volunteers.

This will operate in parallel with and hopefully emulate the flourishing Down for That. The Student Outreach Committee just supported its first tunneling workshop, complementing a plethora of tunnel tours that have been held in the last half-year.

The Owner’s Forum, once only active during conferences, recently completed its first “in-between” web-based meeting. We recognize that it can be challenging for owners to participate in UCA as other members do, due to the constraints of the responsibility of their positions, and I am appreciative that this important group is growing and becoming more active.

The Government and Public Affairs Committee (GPAC) is growing, and members participated with the American Society of Civil Engineers (ASCE) in the recent legislative fly-in to Washington, D.C. While the committee is in its early days, I believe that this will be a very important initiative in addressing our strategic ambitions with stakeholder awareness. We simply need to be more structured and persistent with educating decision-makers in the wisdom of underground investment.

The newly expanded UCA Awards program at the North American Tunneling (NAT) Conference received a tremendous amount of positive feedback. It highlighted our industry’s achievements and, with its structure, also positioned our winners to compete for recognition on the global stage with the ITA Awards. More expansion is planned, so please stay tuned.

We held a record-setting George A. Fox Conference in January. That was hot on the heels of a record-setting Cutting Edge Conference in November. This reinforces our strategic goal of industry education.

Sandwiched in between, we closed 2022 with the highest-ever level of membership in UCA. This is important as one of our strategic

(continued on page 8)
Two TBMS pass milestone on HS2 project

Two Herrenknecht tunnel boring machines (TBMs) have passed the 8.8-km (5.5-mile) mark of their 16-km (10-mile) drive under the Chilterns in England as part of the HS2 tunnel project.

HS2 confirmed that the TBMs called Florence and Cecilia have spent almost two years excavating the twin tunnels between the M25 and South Heath in Buckinghamshire that will help the high-speed rail project protect the environment while improving connections between London, Birmingham and the north.

Each 170-m (560-ft) long TBM is lining the project with 56,000 concrete segments to form rings, and grouting them into place as it moves forward.

Designed specifically for the geology of the Chilterns, the first TBMs were launched in summer 2021 from a site near the M25 and have excavated more than 1.8 million m³ of chalk and flint.

As well as digging and lining the tunnels, engineers have also completed the excavation of five shafts that will provide ventilation and emergency access near Chalfont St Peter, Chalfont St Giles, Amersham, Little Missenden and an intervention shaft at Chesham Road.

The 44-m (144-ft) deep shaft at Amersham — which the TBMs have now passed — will be in the

(continued on page 10)
Reliable® Tunnel Deluge Systems protect your most critical infrastructure assets

*Reliable deluge systems are the perfect solution for the challenges of tunnel environments:*

- The Model DDV Diaphragm Deluge Valve is simple to maintain and rated for pressures up to 400 psi (27.6 bar). Available with a remote resetting pressure regulating option, the Model DDV features a compact footprint and can be installed in any orientation.

- The industry-leading low-pressure/high density TNL280 nozzle features a corrosion-resistant Electroless Nickel PTFE (ENT) finish and anti-reflective black paint topcoat.

Over 100 Years of Reliable Experience

Reliable Automatic Sprinkler Co., Inc. has been a trusted source for high-risk fire protection solutions since 1920. Our manufacturing headquarters are in Liberty, South Carolina, USA, while our Sales and Technical Services teams span the globe.

Contact our Technical Services team to identify the ideal solution to your specific need—no matter what the challenge.

reliablesprinkler.com/tunnels
The tunnel boring machine (TBM) that was halted last year when a 9-m (27-ft) deep hole formed on the surface above it in Australia’s Kosciuszko National Park will remain in place until the Snowy Hydro project can prove to the New South Wales (NSW) environment department that moving the TBM will not cause “further damage.”

Australia’s ABC News reported that the NSW Department of Planning and Environment (DPE) said it was investigating the incident and has now placed further environmental conditions on the boring operation.

“Snowy Hydro must prepare a modification report that demonstrates how the project can safely progress without further environmental damage,” the department said in a statement. “Tunnel boring at the Tantangara location is on hold until the department gives approval for operations to continue.”

The tunnel being drilled by the TBM named Florence is one of three major tunnels that will form the Snowy 2.0 project, a large hydro-electricity project in southern NSW that is one of the centerpieces of Australia’s transition to renewable energy. Snowy Hydro announced in early May that Snowy 2.0 would be delayed by up to two years and was expected to be fully operational by 2029. One of the four main reasons cited by the company for the delay was the issue with TBM Florence.

Snowy Hydro said it took its environmental responsibilities “very seriously” and had been working with the DPE and others since what it called a “surface depression” was identified in December 2022.

“Snowy Hydro has also been working closely with the DPE to provide a scope of works and to progress a modification of the Snowy 2.0 main works planning approval to allow the rectification of this area and provide assurance around future tunneling works,” it said in a statement.

It said it expected to submit its modification report to the department “within a week” and was confident the information would “satisfactorily address concerns around future subsidence issues.”

Across North America, the Barnard team that bids the work builds the work. Our underground experts are determined to do the best for their communities and be the best in the industry.
Metrolinx releases RFQ for Yonge North Subway Extension tunnel project

The Ontario government announced on April 27 that the search for expert teams interested in building the Yonge North Subway Extension tunnels has begun with the release of a request for qualifications (RFQ). This important milestone brings the project one step closer to getting shovels in the ground on major construction.

The advance tunneling RFQ offers interested companies an opportunity to be included in the bidding process by asking them to present their qualifications and construction expertise.

“The Yonge North Subway Extension is a critical project for York Region that will provide much-needed access to reliable public transit and connect more people to major employment centers in Markham, Vaughan and Richmond Hill,” said Caroline Mulroney, minister of Transportation.

“Together with our partners in Ottawa, York region and the City of Toronto, we’re demonstrating real progress to make this project a reality and delivering on our plan to build a strong Ontario,” she said.

The package of work includes designing the tunnels, supplying the tunnel boring machines (TBMs), and building the launch shaft and extraction shaft that will be used to lower the TBMs into the ground and bring them to the surface again.

The RFQ also includes design and construction of the walls that will support the underground stations and emergency exit buildings and relocating existing utilities along the route.

The Yonge North Subway Extension will put 26,000 more people within a 10-min walk of transit and is expected to reduce daily travel times for commuters by up to 22 minutes. It will cut the distance traveled by personal vehicles by 7,700 km (4,789 miles) during rush hour and reduce greenhouse gas emissions by more than 4.8 kt (5,300 st) each year.

Through detailed plans and careful construction, the successful tunneling team will dig out the tunnel for the subway extension that will bring TTC Line 1 service to Vaughan, Markham and Richmond Hill.

The announcement follows news of important progress on the approximately 8-km (5-mile) extension. Work has started at Finch Station on early upgrades to accommodate future subway service.

Metrolinx and Infrastructure Ontario will review the submissions made through the advance tunneling RFQ and will create a shortlist of qualified teams that will be invited to bid on the tunneling contract through a request for proposals.

Ontario is investing $70.5 billion over the next decade to transform public transit in the province, which includes the largest subway expansion in Canadian history, the Ontario Line, the Scarborough Subway Extension, the Eglinton Crosstown West Extension and the Yonge North Subway Extension.
Chair’s column: Much was accomplished in two years
(continued from page 2)

goals is industry and association growth and the hard numbers tell a story.

Additionally, it contributes to a virtuous cycle: more members lead to more volunteers that lead to more contributions that lead to more value creation that leads to more members.

The 2022 World Tunnel Congress and ITA General Assembly saw our member nation organization candidate, Sanja Zlatanic, elected to the Executive Council. Exemplified with her efforts, the United States continues to be recognized as a very strong contributor on the international industry scene.

We got back last year to a post-COVID, in-person NAT Conference, which was highly successful by all accounts. Of note, during that conference, we also held the inaugural Past Chairs Meeting, whereby a forum was established to garner feedback and receive experienced counsel from those past leaders still active in the industry.

The first Project Watch List was published 1.5 years ago, with the intent of highlighting for society’s stakeholders the importance of projects needing to be approved, funded and built.

The Rapid Excavation & Tunneling Conference (RETC) was our first conference back in-person, going all the way back to June 2021. At that meeting, we began our mentoring program for scholarship winners. That program continues at all NAT, RETC and Cutting Edge conferences now, and the efforts of motivated mentors will continue those relationships between conference events.

Volunteer leaders continue to foster relationships with liaison organizations across the industry, leveraging our association’s efforts with those of other stakeholders, with the intent of maximizing exposure and progress with all stakeholders.

Finally, I’d like to recognize the “as-yet-unreferenced in this column” groups in our Workforce Sustainability category — Women in Tunneling, Young Members and Teach the Professors — all of which continue to get stronger and more active and make differences for the industry.

I thank my employer, Strata Worldwide, for the unconditional support of my work time spent as UCA Chair. The next column will come from incoming Chair, Erika Moonin, and I look forward to continuing to serve our association as Past Chair.

I have great gratitude for Bob Goodfellow, as he steps down from the rank of officers, for all that he has done and the support he has given me. Thanks also to the stalwart SME staff who do a lot of heavy lifting and support all us volunteers in our support of our association.

Tunnel on! ■

DAVID R. KLUG & ASSOCIATES, INC.

Specialty Products and Services for the
North American Tunneling and Mining Industries

Jonathan D. Klug - Vice President
www.drklug.com

1994 Lumber Ave.
Wheeling, WV 26003
Email: jklug@drklug.com
Tel (304) 905-8932
Fax (304) 905-0154
Cell (304) 281-4239
Amtrak announced that construction activities for its B&P Tunnel Replacement Program launched on March 10 in the Halethorpe and West Baltimore areas. The work includes replacing aging wooden ties with new concrete ties, installing new rail, and completing track drainage improvements.

“This initial project will directly reduce impacts during later construction phases and maximize the benefits of the new Frederick Douglass Tunnel with higher track speeds and greater system capacity,” said Amtrak executive vice president, Capital Delivery, Laura Mason. “Our partners at the Federal Railroad Administration recognize the importance and urgency of this project and have provided $8 million in key funding to help us complete this critical infrastructure work. We are also grateful to Baltimore Mayor Brandon Scott and the state of Maryland for their partnership and support.”

This project is funded by a grant from the FY 2019 Federal-State Partnership for State of Good Repair Program. These upgrades will enable high-speed operations on all four tracks along this track segment.

“The collaboration between the state of Maryland, Amtrak, our federal partners and Baltimore is making the long-awaited replacement of the B&P Tunnel a reality,” said Maryland Transportation Secretary Paul J. Wiedefeld. “This initial work by Amtrak is laying the foundation for the new Frederick Douglass Tunnel, and will help us improve mobility, access and service for riders throughout the region.”

The overnight work associated with track and tie replacement will take place on Track A from Winans to Bridge interlockings and is not expected to impact rail service. Bridge interlocking is located north of West Baltimore Station, and Winans interlocking is at the south end of Halethorpe Station. This first phase of the project is targeted for completion early this summer, with additional project work related to the replacement of an existing turnout in Winans with a new high-speed turnout in a future phase.

At nearly 150 years old, the B&P Tunnel is Amtrak’s oldest tunnel on the Northeast Corridor and a single point of failure for both MARC and Amtrak trains. The 1.4-mile tunnel, connecting Baltimore to Washington, D.C., suffers from a variety of age-related issues such as excessive water infiltration, a deteriorating structure, and delays that impact more than 10 percent of weekday trains.

The $6 billion program will eventually be advanced by Amtrak and its partners using federal funding provided by the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL). The program consists of several investment projects to construct new bridges, rail systems and track, an ADA-accessible West Baltimore MARC station and the new Frederick Douglass Tunnel, which will include two new high-capacity tubes for electrified passenger trains.

By combining superior craftsmanship with innovative tunnel engineering and construction technology, Bradshaw Construction Corporation successfully provides cost effective tunneling solutions to the utility and transportation industries.

**PROVIDING INNOVATIVE SOLUTIONS FOR TUNNELING PROJECTS**

- Microtunneling
- TBM Tunneling
- Hand Tunneling
- Shaft Work
middle of a road junction just outside the Buckinghamshire town. A “headhouse” will be built on top of the shaft to house safety equipment, with a flint-faced boundary wall and a prepatinated zinc roof to help match the natural tones of the surrounding landscape.

Once complete, trains will pass through the tunnel at speeds of up to 320 km/h, providing zero-carbon journeys between London, Birmingham and the north while freeing up capacity on the existing rail network.

“The Chiltern tunnel will take HS2 underground and safeguard the woodlands and wildlife habitats above the tunnel as well as significantly reducing disruption to communities during construction and operation of the new railway,” said Martyn Noak, HS2 Ltd’s head of Tunnel Engineering. “I’ve been very impressed with the progress made by Florence and Cecilia as they make their way unseen beneath the Chiltern Hills. It’s great to see how much progress they and the teams excavating the five shafts have made and I’d like to thank everyone involved in getting us this far.”

The two TBMs are operated by, Align, a joint venture formed by Bouygues Travaux Publics, Sir Robert McAlpine and VolkerFitzpatrick.

Each machine has a crew of 17 people working in shifts and supported by more than 100 people on the surface managing the logistics and maintaining the smooth progress of the tunneling operation.

“Florence and Cecilia reaching our third shaft at Amersham is a great achievement for not only the tunneling team and the team involved in excavating and preparing the shaft, but also the supporting teams on the surface at the South Portal, manufacturing the concrete segments required to line the tunnel and processing the spoil from the tunnels,” Coralie Peroux, tunnel manager for Align, said. “In particular, I would like to pay credit to the Align Shafts team, working with our supply-chain partners KVJV and Keltbray, who have been working tirelessly over the last few months to ensure the shaft is ready for the arrival of Florence and Cecilia.”

Approximately 2.7 million m³ of material — mostly chalk and flint — will be excavated during the construction of the tunnels and used for landscaping. Once construction is complete, the temporary buildings at the south portal will be removed and the site landscaped with around 90 ha of new wildlife-rich chalk grassland habitats.

Chalk grassland used to be widespread across the hills of southeast England and are considered habitat of international conservation significance with just 700 ha left across the Chilterns.

HS2 currently has five TBMs in the ground with a further five due to be launched over the coming years. Together they will create 64 miles of tunnel between London and the West Midlands, including major tunnels on the approach to London and Birmingham.
Following a successful procurement of the Green Line project, Calgary’s new light rail transit (LRT) system, the Green Line board has approved the development-phase agreement and selected Bow Transit Connectors (BTC) as Green Line’s development partner.

The Green Line project is the largest infrastructure investment in Calgary’s history. It comes with $5.5 billion in commitments from the government of Canada, government of Alberta and the city of Calgary. BTC includes Barnard Constructors of Canada LP, Flatiron Constructors Canada Ltd and WSP Canada Inc., along with their financial advisor EllisDon Capital Inc. Collectively, they will bring shared expertise in underground, aboveground structures and LRT design and construction to deliver phase 1 of the Green Line LRT project.

In addition to the lead construction and design team, BTC are proposing their subconsultants, which, to date, include:

- Delve Underground.
- Platinum Engineering Ltd.
- Egis.
- IBI.
- GEC Architecture.
- Architecture 49.

As additional agreements are finalized, Green Line will share updates about this dedicated group of subcontractors who will be working collaboratively with the Green Line team through the development and implementation phases.

The development phase is scheduled to begin in May 2023 and be an approximately 16-month process. The timeframe was negotiated with BTC during final negotiations of the development-phase agreement as the more advanced the design is, the higher confidence there is in costs.

At the conclusion of the development phase, the goal is to sign the project agreement and begin the implementation phase. This goal remains on track for 2024.

Dr. Gary S. Brierley, P.E.

50 years of experience providing consulting services to Owners, Contractors, Attorneys and Engineering firms.

- Subsurface Planning, Design and Construction
- TBM Selection and Evaluation
- Prebids
- Design/Build
- Dispute Resolution
- Claims

gbrierley@drmoleinc.com • 303.704.6955

Renew your membership today!
www.smenet.org/UCAhome
Thank you to the Corporate and Sustaining member companies of UCA for their membership and support in 2023.

Your support of the UCA demonstrates corporate leadership for advancement in technology, skill and innovation in the industry.

SUSTAINING MEMBERS

AECOM
ANSER
ANTRAQUIP
DSI UNDERGROUND
GRANITE
GZA
HNTB
KELLER
Kiewit
MacLean
MOTT MACDONALD
Robbins
Sika

CORPORATE MEMBERS

Akkerman Inc
Aldea Services
Canary Systems Inc
CDM Smith
David R Klug & Associates Inc
Delve Underground
Dyno Nobel Inc
Geokon Inc
Harvey Parker & Assoc
IOT Automation
McNally Tunneling Corp
MST Global
M | R | C | E
Northern Dewatering Inc
Obayashi Corporation
Thank you to the Corporate and Sustaining member companies of UCA for their membership and support in 2023. Your support of the UCA demonstrates corporate leadership for advancement in technology, skill and innovation in the industry.

Learn more about UCA Corporate and Sustaining Members online at smenet.org/UCA/UCA-Membership-Benefits/Corporate-Sustaining-Membership
<table>
<thead>
<tr>
<th>TUNNEL NAME</th>
<th>OWNER</th>
<th>LOCATION</th>
<th>STATE</th>
<th>BID YEAR</th>
<th>TUNNEL USE</th>
<th>LENGTH (FEET)</th>
<th>WIDTH (FEET)</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potomac River CSO Tunnel</td>
<td>DC Water and Sewer Authority</td>
<td>Washington DC</td>
<td>DC</td>
<td>2023</td>
<td>CSO</td>
<td>24,000</td>
<td>18</td>
<td>Proposal bid 4/23/2023</td>
</tr>
<tr>
<td>Minneapolis Central City Parallel Tunnel</td>
<td>City of Minneapolis</td>
<td>Minneapolis MN</td>
<td>MN</td>
<td>2023</td>
<td>CSO</td>
<td>4,200</td>
<td>10-19</td>
<td>Final planning</td>
</tr>
<tr>
<td>I-70 Floyd Hill Highway Tunnel</td>
<td>Colorado Dept. of Transportation</td>
<td>Denver CO</td>
<td>CO</td>
<td>2023</td>
<td>Highway</td>
<td>15,840</td>
<td>60 x 25</td>
<td>Under design</td>
</tr>
<tr>
<td>Folsom Area Storm Water Improvement</td>
<td>SFPUC</td>
<td>San Francisco CA</td>
<td>CA</td>
<td>2023</td>
<td>CSO</td>
<td>4,000</td>
<td>12</td>
<td>Under design</td>
</tr>
<tr>
<td>Downtown Extension (DTX)</td>
<td>TJPA</td>
<td>San Francisco CA</td>
<td>CA</td>
<td>TBD</td>
<td>Transit</td>
<td>TBD</td>
<td>TBD</td>
<td>Under design</td>
</tr>
<tr>
<td>CA High Speed Rail (Northern Section)</td>
<td>CA High Speed Rail Authority</td>
<td>Fresno CA</td>
<td>CA</td>
<td>2023</td>
<td>Transit</td>
<td>TBD</td>
<td>TBD</td>
<td>Design 3Q 2023</td>
</tr>
<tr>
<td>CA High Speed Rail (Southern Section)</td>
<td>CA High Speed Rail Authority</td>
<td>Bakersfield CA</td>
<td>CA</td>
<td>2023</td>
<td>Transit</td>
<td>TBD</td>
<td>TBD</td>
<td>Design 3Q 2023</td>
</tr>
<tr>
<td>West Santa Ana Line</td>
<td>LACMTA</td>
<td>Los Angeles CA</td>
<td>CA</td>
<td>2023</td>
<td>Transit</td>
<td>TBD</td>
<td>20</td>
<td>RFQ pending</td>
</tr>
<tr>
<td>Ontario Airport Tunnel</td>
<td>San Bernardino Co. Trans. Authority</td>
<td>San Bernardino CA</td>
<td>CA</td>
<td>2023</td>
<td>Transit</td>
<td>22,000</td>
<td>24</td>
<td>Under design</td>
</tr>
<tr>
<td>Gateway Tunnel Project</td>
<td>Amtrak</td>
<td>Newark/New York NJ/NY</td>
<td>NJ/NY</td>
<td>2023/2024</td>
<td>Transit</td>
<td>14,600</td>
<td>28</td>
<td>PDP Procurement ongoing</td>
</tr>
<tr>
<td>2nd Ave. Phase 2</td>
<td>NYS-MTA</td>
<td>New York NY</td>
<td>NY</td>
<td>2023</td>
<td>Subway</td>
<td>16,000</td>
<td>20</td>
<td>Fed approval process ongoing</td>
</tr>
<tr>
<td>2nd Ave Phase 3-4</td>
<td>NYS-MTA</td>
<td>New York NY</td>
<td>NY</td>
<td>2024-2029</td>
<td>Transit</td>
<td>89,600</td>
<td>20</td>
<td>Under study</td>
</tr>
<tr>
<td>Fredrick Douglas Tunnel</td>
<td>Amtrak</td>
<td>Baltimore MD</td>
<td>MD</td>
<td>2023</td>
<td>Rail</td>
<td>40,000</td>
<td>32</td>
<td>SOQs submitted 5/19/23</td>
</tr>
<tr>
<td>Alum Creek Relief Tunnel Phase 1</td>
<td>City of Columbus</td>
<td>Columbus OH</td>
<td>OH</td>
<td>2023</td>
<td>Sewer</td>
<td>30,000</td>
<td>18</td>
<td>Under design</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2024</td>
<td></td>
<td>21,000</td>
<td>14</td>
<td>Under design</td>
</tr>
<tr>
<td>Ontario Line North Extension</td>
<td>Metro Linx</td>
<td>Toronto ON</td>
<td>ON</td>
<td>2023</td>
<td>Subway</td>
<td>29,500</td>
<td>20</td>
<td>RFP in 2023</td>
</tr>
<tr>
<td>West Vaughn Sewage Servicing Project</td>
<td>York Region</td>
<td>Toronto ON</td>
<td>ON</td>
<td>2023</td>
<td>Sewer</td>
<td>36,000</td>
<td>10</td>
<td>RFQ shortlist completed</td>
</tr>
<tr>
<td>Yonge North Subway Extension</td>
<td>Metro Linx</td>
<td>Toronto ON</td>
<td>ON</td>
<td>2023</td>
<td>Transit</td>
<td>40,000</td>
<td>20</td>
<td>RFQ Pending</td>
</tr>
<tr>
<td>Blue Line Extension</td>
<td>Societe de transport de Montreal</td>
<td>Montreal QC</td>
<td>QC</td>
<td>2023</td>
<td>Transit</td>
<td>19,000</td>
<td>33</td>
<td>Under design</td>
</tr>
<tr>
<td>REM-S Project</td>
<td>Societe de transport de Montreal</td>
<td>Montreal QC</td>
<td>QC</td>
<td>2023</td>
<td>Transit</td>
<td>23,000</td>
<td>33</td>
<td>Under design</td>
</tr>
<tr>
<td>Southerly Storage Tunnel</td>
<td>NEORSD</td>
<td>Cleveland OH</td>
<td>OH</td>
<td>2023</td>
<td>CSO</td>
<td>18,000</td>
<td>23</td>
<td>Under design</td>
</tr>
<tr>
<td>DELCOR A Wastewater Tunnel</td>
<td>DELCOR A</td>
<td>Chester PA</td>
<td>PA</td>
<td>2023</td>
<td>CSO</td>
<td>45,500</td>
<td>13</td>
<td>Under design</td>
</tr>
<tr>
<td>Enbridge Line 5 Tunnel</td>
<td>Enbridge</td>
<td>Traverse City MI</td>
<td>MI</td>
<td>2023</td>
<td>Oil</td>
<td>23,760</td>
<td>12</td>
<td>Proposals received</td>
</tr>
<tr>
<td>Mill Creek Trunk Improvements</td>
<td>City of Nashville</td>
<td>Nashville TN</td>
<td>TN</td>
<td>2023</td>
<td>CSO</td>
<td>13,800</td>
<td>10</td>
<td>Under design</td>
</tr>
<tr>
<td>Green Line LRT</td>
<td>City of Calgary</td>
<td>Calgary AB</td>
<td>AB</td>
<td>2023</td>
<td>Transit</td>
<td>9,000</td>
<td>40</td>
<td>RFP submitted</td>
</tr>
<tr>
<td>Nose Hill Project</td>
<td>City of Calgary</td>
<td>Calgary AB</td>
<td>AB</td>
<td>2023</td>
<td>CSO</td>
<td>10,800</td>
<td>10</td>
<td>Under design</td>
</tr>
<tr>
<td>Kensico-Eastview Connection Tunnel</td>
<td>NYC-DEP</td>
<td>New York NY</td>
<td>NY</td>
<td>2024</td>
<td>Water</td>
<td>11,000</td>
<td>27</td>
<td>Under design</td>
</tr>
<tr>
<td>TUNNEL NAME</td>
<td>OWNER</td>
<td>LOCATION</td>
<td>STATE</td>
<td>BID YEAR</td>
<td>TUNNEL USE</td>
<td>LENGTH (FEET)</td>
<td>WIDTH (FEET)</td>
<td>STATUS</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>-----------------------------</td>
<td>----------</td>
<td>-------</td>
<td>----------</td>
<td>------------</td>
<td>---------------</td>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Silver Line Extension</td>
<td>Boston Transit Authority</td>
<td>Boston</td>
<td>MA</td>
<td>2023</td>
<td>Transit</td>
<td>8,400</td>
<td>22</td>
<td>Under design</td>
</tr>
<tr>
<td>Yonge North Subway Extension</td>
<td>Metro Linx</td>
<td>Toronto</td>
<td>ON</td>
<td>2023</td>
<td>Transit</td>
<td>40,000</td>
<td>20</td>
<td>RFQ Pending</td>
</tr>
<tr>
<td>Stanley Park Water Supply Tunnel</td>
<td>City of Vancouver</td>
<td>Vancouver</td>
<td>BC</td>
<td>2023</td>
<td>Water</td>
<td>5,000</td>
<td>15</td>
<td>RFQ Q4 2023</td>
</tr>
<tr>
<td>ALCOSAN CSO Ohio River Monongahela River</td>
<td>Allegheny Co. Sanitary Authority</td>
<td>Pittsburgh</td>
<td>PA</td>
<td>2025 2028 2030</td>
<td>CSO CSO CSO</td>
<td>20,000 28,000 28,000</td>
<td>18 18 18</td>
<td>Under design  Under design  Under design</td>
</tr>
<tr>
<td>Germantown Winghocking Relief</td>
<td>City of Philadelphia Water</td>
<td>Philadelphia</td>
<td>PA</td>
<td>2025</td>
<td>CSO</td>
<td>28,000</td>
<td>20</td>
<td>Under design</td>
</tr>
<tr>
<td>Project Connect Subway Program</td>
<td>City of Austin</td>
<td>Austin</td>
<td>TX</td>
<td>2025</td>
<td>Transit</td>
<td>8,500</td>
<td>20</td>
<td>Design delayed</td>
</tr>
<tr>
<td>West Seattle to Ballard Extension</td>
<td>Sound Transit</td>
<td>Seattle</td>
<td>WA</td>
<td>2025</td>
<td>Transit</td>
<td>10,500</td>
<td>20</td>
<td>Under design</td>
</tr>
<tr>
<td>Northside Interceptor Tunnel</td>
<td>City of Akron</td>
<td>Akron</td>
<td>OH</td>
<td>2023</td>
<td>CSO</td>
<td>6,600</td>
<td>16.5</td>
<td>Bidding</td>
</tr>
<tr>
<td>Taylor Massey Tunnel</td>
<td>City of Toronto</td>
<td>Toronto</td>
<td>ON</td>
<td>2025</td>
<td>CSO</td>
<td>20,000</td>
<td>15</td>
<td>Under study</td>
</tr>
<tr>
<td>Quebec City - Levis Tunnel</td>
<td>Quebec Trans. Ministry</td>
<td>Quebec</td>
<td>QC</td>
<td>2025</td>
<td>Transit</td>
<td>27,230</td>
<td>60</td>
<td>Under study</td>
</tr>
<tr>
<td>Del Mar Bluffs Tunnel</td>
<td>SANDAG</td>
<td>San Diego</td>
<td>CA</td>
<td>2025</td>
<td>Rail</td>
<td>TBD</td>
<td>TBD</td>
<td>Under study</td>
</tr>
<tr>
<td>Fraser River Tunnel</td>
<td>BC Ministry of Transportation</td>
<td>Vancouver</td>
<td>BC</td>
<td>2025</td>
<td>Highway</td>
<td>3,000</td>
<td>TBD</td>
<td>RFP expected</td>
</tr>
<tr>
<td>Queensway Tunnel</td>
<td>Region of Peel</td>
<td>Toronto</td>
<td>ON</td>
<td>2025</td>
<td>Sewer</td>
<td>18,000</td>
<td>9</td>
<td>RFP Ongoing</td>
</tr>
<tr>
<td>Stormwater Control Program</td>
<td>Harris Co. Flood Control District</td>
<td>Houston</td>
<td>TX</td>
<td>2026</td>
<td>CSO</td>
<td>52,800</td>
<td>25-40</td>
<td>Under study</td>
</tr>
<tr>
<td>LA Metro Sepulvada Pass Corridor</td>
<td>Los Angeles MTA</td>
<td>Los Angeles</td>
<td>CA</td>
<td>2026</td>
<td>Transit</td>
<td>55,000</td>
<td>TBD</td>
<td>Under design</td>
</tr>
<tr>
<td>D2 Subway - 2nd Light Rail Alignment</td>
<td>Dallas Area Rapid Transit</td>
<td>Dallas</td>
<td>TX</td>
<td>2026</td>
<td>Transit</td>
<td>7,230</td>
<td>22</td>
<td>Delayed</td>
</tr>
<tr>
<td>Flushing Bay CSO Tunnel</td>
<td>NYC-DEP</td>
<td>New York</td>
<td>NY</td>
<td>2026</td>
<td>CSO</td>
<td>16,500</td>
<td>22</td>
<td>Under study</td>
</tr>
<tr>
<td>Cross Harbor Freight Tunnel</td>
<td>PANYNJ</td>
<td>New York</td>
<td>NY</td>
<td>TBD</td>
<td>Rail</td>
<td>25,000</td>
<td>30</td>
<td>Under study</td>
</tr>
<tr>
<td>Superconducting Maglev Project - Northeast Corridor</td>
<td>TNEM/BWRR</td>
<td>Washington</td>
<td>DC</td>
<td>TBD</td>
<td>Rail</td>
<td>146,500</td>
<td>43</td>
<td>Under design</td>
</tr>
<tr>
<td>Big Creek Storage Tunnel</td>
<td>NEORSD</td>
<td>Cleveland</td>
<td>OH</td>
<td>2026</td>
<td>CSO</td>
<td>22,450</td>
<td>20</td>
<td>Under design</td>
</tr>
<tr>
<td>Metropolitan Tunnel Program - Northern Tunnel Southern Tunnel</td>
<td>MWRA</td>
<td>Boston</td>
<td>MA</td>
<td>2027 2028</td>
<td>Water Water Water</td>
<td>23,760 55,000 55,000</td>
<td>10 10 10</td>
<td>Under design  Under design  Under design</td>
</tr>
<tr>
<td>Horizon Lateral Tunnel</td>
<td>Southern Nevada Water Authority</td>
<td>Las Vegas</td>
<td>NV</td>
<td>2027</td>
<td>Water</td>
<td>42,000</td>
<td>9</td>
<td>Delayed</td>
</tr>
<tr>
<td>Inner Harbour West Tunnel</td>
<td>City of Toronto</td>
<td>Toronto</td>
<td>ON</td>
<td>2027</td>
<td>CSO</td>
<td>18,400</td>
<td>20</td>
<td>Under design</td>
</tr>
</tbody>
</table>

To have your major tunnel project added to the Tunnel Demand Forecast, or to update information on a listed project, please contact Sanja Zlatanic at szlatanic@hntb.com.
When a major tunneling project commences in an urban area there is often a great deal of attention paid to the tunnel boring machine (TBM) that will be used to create the tunnel. These massive machines capture the attention of the general public and naming competitions are a great way to engage the public in a positive manner. What gets much less attention but is of great importance is what happens to the material that is removed from the earth by the TBM to create the tunnel.

According to Shane Yanagisawa, principal at Osprey Engineers, muck removal and disposal is one of the more mundane but difficult tasks with every tunnel project no matter the size or end use of the tunnel. Advancements in conveyor-belt technology, such as retractable-belt technology, and vertical-belt storage technology has allowed for more consistent production from TBMs and improved efficiencies. The introduction of multiservice vehicles (MSVs) and rubber-tired transportation vehicles has also helped increase efficiencies in regard to the removal of muck as well as the delivery of materials to the tunnel face. However, the issue of muck remains a challenge. Increased environmental concerns add another level of complexity to the process.

T&UC recently reached out to material-handling experts at Kiewit, including Abner da Silva, Kiewit underground tunnel superintendent; Christof Metzger, Kiewit underground construction manager; Kurt Kroner, environmental compliance manager, CP2 project and Tee Galbraith, Kiewit logistics coordinator at Fermi to learn more about the innovations and challenges in material handling and muck removal and disposal.

T&UC: What are the primary challenges regarding material (muck) handling in the tunneling and underground construction industry?

da Silva: The transportation of tunnel muck presents a number of challenges in urban areas, especially in densely populated areas. Heavy trucks can contribute to the worsening of the traffic, they bring an extra risk on public roads, pollution and if not cleaned properly, they can bring dirt from the site onto public areas. Hence, a comprehensive planning of the transport routes, identification of adverse conditions and its impacts (are needed). For example, is there a stadium near the job site? How is it going to be on game days? A contingency

William Gleason, Editor
plan needs to be in place to minimize problems and risks when handling muck.

In addition, in soft-ground tunneling, the soil needs to be conditioned with products to reduce cutterhead torque and friction, improve face stability, reduce torque on the screw conveyor, and reduce adhesion to metal surfaces, among other benefits. Different types of products can be used in the same tunnel project, depending on the geology of the face, and the treated soil can have a different consistency from the in situ soil. The tunnel spoil will then need to be tested to determine potential reuse and/or disposal as waste according to its classification.

**T&UC:** How many projects use conveyors versus muck cars and how has that changed in the past 10 years?

**Metzger:** It may not have changed significantly within the last 10 years. It is a project-specific decision process, and many factors need to be considered. Both methods come with advantages and disadvantages.

Whether a conveyor belt is used or not, it does not change the need for a different, and in the case of a conveyor belt usage, additional logistic concept. The TBM will need material supply and tunnel liner segments, and the crew also needs to be brought in to the TBM.

The conveyor belt assembly is often a critical path operation. For this reason, a conveyor belt needs to bring performance-related advantages. A rail-bounded system or the use of muck cars can be used universally. Here are some considerations for the use of conveyor belts:

- **Length of the tunnel:** In most cases the effort to assemble and remove a conveyor belt is not economical, and muck cars might be a more economical approach. However, the longer the tunnel, the more advantages a conveyor belt will bring to the table.

- **Alignment, especially tight and changing radii:** Conveyor belts can cause challenges in curves, especially S-curves. A train is guided by tracks.

- **Access to the tunnel:** If shafts are in place, a vertical conveying system needs to be installed. Using a train and muck cars will require a cycle study to get the muck cars dumped on time. A vertical conveyor promises a higher performance based on the continuous operation. In that case, it is much easier to feed the vertical conveyor with a tunnel conveyor as transferring the muck material from tracks to the belt.

- **U.S. Mine Safety and Health Administration (MSHA) requirements.** In gassy conditions, equipment may need to be explosion proof. Both systems need to be checked for their pros and cons accordingly.

- **Emission:** Conveyor belts are usually “clean air” equipment. In the case of locomotives, the difference between e-locomotives (battery) and diesel will make a significant difference. Diesel locomotives will require a more extensive ventilation as well.
Multiservice vehicles (MSV) are not yet widely used in North America, what are the possibilities for more MSV usage?

Metzger: The availability of MSVs in North America is limited. The more projects utilizing this approach, the more used equipment will be on the market allowing for the option to become more competitive. MSVs are not a shelf product, and are typically manufactured to meet the specific project requirements. This results in a relatively long lead time. A growing demand will end up in a wider product portfolio and may reduce the specific design phase and lead time. The big advantage for MSVs is the capability of managing steeper grades and tighter radii. The more projects on the market with steeper grades, the higher the demand for MSVs will be. Generally, it will still be a project-to-project decision.

T&UC: In what situation are MSVs a better choice than a rail car system?

da Silva: MSVs are a better option when there is site layout restriction, steep ascents/descents, and when other activities need to be performed in the invert of the tunnel concurrently with the excavation; since they don’t need a track system and have excellent mobility, they can avoid the double handling of material, saving time and cost. As an example, in the new metro line for the Olympic Games in 2016 in Rio de Janeiro, Brazil, the tunnel was excavated using an earth pressure balance (EPB) TBM supported by MSV and a belt conveyor system. The ability to pour roller-compacted concrete in the invert of the tunnel as the TBM excavated was crucial to delivering the project on schedule. The metro line was operational in only four months after the TBM hole through — it wouldn’t be possible to achieve such a tight schedule if a rail track system supporting the TBM had yet to be removed after the hole through, pour roller-compacted concrete, and then perform the works for the permanent rail system.

T&UC: What innovations are you aware of that are taking place in material handling?

da Silva: The use of vertical conveyor belts to dispose of muck in shafts. The Shoreline project in Ohio is using a vertical conveyor belt with buckets to transport the material out of the shaft. The alternative to using muck buckets requires a complex hoist system to be efficient.
While conveyors can often be used for changes in elevation, it requires a specific amount of floor space per increase in elevation. The vertical belt conveyor rises straight up to the surface, fully enclosed, with a minimal ground footprint.

**T&UC:** Environmental considerations play a crucial role in the planning and execution of underground construction projects. How have these considerations altered your work on recent and/or current projects?

**Kroner:** Proper planning and early strategic positioning on environmental issues have offset impacts. Owners now invest in extensive characterization of soil and groundwater conditions to establish environmental baselines. Rather than confine the risk to the contractor or delivery team, the environmental scope can be well defined and supported by ample environmental data. Owners also engage with regulatory agencies early to establish agreements and to obtain permits for the handling of groundwater and soil. This preplanning helps mitigate cost and schedule impacts by having conditions and requirements well defined. Most projects now have a specification requirement for an environmental compliance manager. This level of expertise is necessary whether specified or voluntarily provided by the contractor to navigate the voluminous data available and to strategically plan. This environmental professional will direct the project using available and new data.

The BART Silicon Valley Extension Phase 2 project performed prebid environmental investigations along the project alignment and worked collaboratively with regulatory agencies to review and approve procedures for the management of potentially contaminated materials generated during construction. The procedures contained thresholds for excavated material reuse and export. Areas containing contaminants requiring special handling were fully characterized to allow assessment by the project team for ensuring worker health and safety, and to properly estimate offsite disposal options.

By engaging in capable and knowledgeable environmental support early in the process, the environmental risks could be effectively managed and be an overall benefit to the owner and contractor.

**T&UC:** What are the greatest environmental challenges regarding material handling?

**Kroner:** Worker health and safety. The environmental investigations performed along the project alignment reveal not only a great deal of information to develop disposal costs but also the necessary worker health and safety requirements. The environmental soil sampling data identify contaminant concentrations in the soil from previous industrial activities, and also naturally occurring substances such as asbestos, silica and arsenic. Engineering controls, primarily ventilation, are necessary to minimize employee exposures. Personal protective equipment designed for the known contaminants is specified for workers that come into direct contact with excavated materials. Monitoring is performed to verify the effectiveness of the control measures and to make adjustments to ensure that work is performed within permissible exposure levels for substances present during construction.

**Material disposal.** Material disposal is constrained by many factors including truck count restrictions, trucking hours, fuel cost, labor issues, distance, weather closures, disposal costs and environmental screening. Screening of the soil is important to secure disposal at sites that are most desirable based on vicinity, cost and sustainability. If the environmental baseline data are insufficient to classify the soil for disposal, additional sampling will be required prior to construction or during construction. Early discussion with landfills and disposal sites is necessary to determine if lower-cost options can be utilized. If sampling is required during excavation, a sampling program must identify sample turnaround time and adequate soil holding areas while results are pending. Alternative disposal sites must also be ready if disposal is rejected due to exceedance of the screening criteria. Sustainable disposal options, such as quarry reclamation, wetlands creation and landfill capping may have strict soil screening criteria that will need to be evaluated to determine if project soils can be considered.

**T&UC:** Can you explain the material-handling innovations taking place at the LBNF project at Homestake Mine in South Dakota, and those at the Rondout Project in New York?

**da Silva:** At Rondout the spoil was loaded on muck cars and hauled from the tunnel to the shaft by train. The shaft is 300 m (900 ft) deep and a comprehensive hoisting system was developed to transport personnel and material supply and fly out the spoil of the excavation. The collar-mounted, base-frame structure was able to fly out a 20-cu yd loaded muck box, dump it on the surface, fly it back down and set it back on the train car all in seven minutes. Each train composition had seven muck cars making the total cycle in less than an hour, enough to keep up with the excavation.

**Galbraith:** At Fermi LBNF, the project required the refurbishment of the material hoisting and handling system largely idle since the early 2000s. Underground, the work involved the rehabilitation of an ore pass to and loading pockets at the 5,000-ft level. On the surface, the project team refurbished the surface crusher system and then installed a 1,700-ft conveyor system crossing an active highway to the previous mines open pit. The system is designed to handle a maximum of 2.7 kt/d (3,000 stpd) and has processed approximately 453 kt (500,000 st) to date.
Environmental considerations are widely present in the modern world, and there is a global push in most industries for sustainability and environmental consciousness. In the tunneling market, many projects being built are intended to benefit the environment.

One critical aspect of tunnel projects that must be considered is muck handling and disposal. Tunnel boring machines (TBMs) generate a lot of muck. Earth pressure balance (EPB) machines are one of the most common TBMs, especially in urban areas. Chemical products such as foaming agents and polymers are added to the soil to allow for the safe and effective operation of EPB machines. When it exits the TBM the muck produced is laden with these soil-conditioning chemicals. These residual chemicals may pose an environmental impact if improperly managed.

Special disposal restrictions on EPB muck can add logistical challenges and increase the overall cost of a project, as acceptable disposal sites may be farther away with the possibility of more expensive disposal fees.

Several countries in Europe have developed programs intended to minimize the environmental impact of tunnel muck. As a direct response, MAPEI has developed innovative new foaming agents with significantly lower ecotoxicity and higher biodegradability, and their use has been widely adopted in these countries.

Many localities around the world have limits for substances such as heavy metals and hydrocarbons but these are not used in the formulation of foaming agents, while other potentially harmful ingredients common in foaming agent formulations like alcohol and glycol remain unregulated.

Soil-conditioning overview

With the addition of water, air and special soil conditioning agents, including foams and/or polymers, soil conditioning is used to modify the characteristics of the ground, making it more suitable for tunneling with EPB TBMs. Well-conditioned soil improves face stability, reduces wear on machines, improves the flow of material out of the chamber, increases productivity and reduces downtime. Proper soil conditioning is critical to the success of any EPB TBM project.

Foaming agents. The most common type of soil conditioners are foaming agents. They are concentrated solutions that are first mixed with water and then passed through a foam generator with the addition of air to create a foam. The foam is injected into the cutting head, mixing chamber and/or screw conveyor. There are several parameters of the soil conditioning that may be adjusted including:

• Concentration (cf) — the volumetric ratio of foaming agent to water.
• Foam expansion ratio (FER) — the volumetric ratio of air to foam solution.
• Foam injection ratio (FIR) — the volumetric ratio of foam to soil.

On an EPB TBM, the operator of the soil-conditioning system will adjust these parameters as needed for the specific ground conditions.

Composition of foaming agents. Foaming agents are typically formulated with the following ingredients:

• Surfactants.
• Polymers.
• Solvents.

Surfactants are the main component of most soil conditioners. They lower the surface tension of water to aid in the generation of foam. Different foaming agents may contain different types of surfactants, such as cationic, anionic and others.

Polymers are included in foaming agents to enhance the technical properties of the foam, such as half-life, lubrication and dispersion characteristics. Polymers may be of either synthetic or natural origin. Solvents are used in some foaming agents and include chemicals like alcohols, glycols, dichloromethane and more. Although solvents, if present, are typically present in low quantities, they are not rapidly degradable and are toxic to the environment.
**Technical aspects.** With the proper balance of ingredients, foaming agents are designed to meet technical requirements for excavating with EPB TBMs. In choosing which soil conditioners to use, preliminary analysis and testing is typically done before the start of the project. First, relevant project information is analyzed, including review of TBM characteristics, tunnel alignment, geotechnical baseline report (GBR), hydrological aspects of the tunnel route and past projects in the area. Next, preliminary laboratory testing is performed with soil samples acquired along the alignment, typically from investigative borings. Testing done on the natural soil include moisture content, density, grain size distribution and Atterberg limits. Next, soil conditioning agents are mixed with the soil, which is then tested for slump, flow, visual consistency, stickiness and impermeability.

Soil-conditioning parameters and doses are adjusted until the soil exhibits behavior ideal for EPB tunneling. These tests are useful to find the most suitable products for conditioning, and to determine the initial soil conditioning parameters. Once tunneling begins, the soil conditioning parameters are optimized on the TBM. As the geology changes along the alignment, the parameters are further adjusted and refined.

Technical performance is a critical aspect of soil conditioners, but as the construction industry moves to more environmentally conscious practices, the impact of soil conditioners must be considered.

---

**Environmental impact of soil conditioning**

A tunnel project can create an enormous amount of spoil. As an example, a tunnel 10 km (6 miles) long with a diameter of 10 m (33 ft) would require the removal of approximately 1,000,000 cu yd of soil. Conditioning this soil for excavation would require 757,000 to 908,000 L (200,000 to 240,000 gal) of foaming agent, given typical dosing.

**Management of muck.** Muck is often thought of as waste that needs disposal, but in the right conditions, muck can be a valuable resource. While excavated material from hard-rock tunnels is widely considered the most valuable and easiest to process type of spoil, soft-ground muck can be valuable too, and engineers and contractors are continually looking for ways to better utilize soft-ground spoils. In a 1977 handbook sponsored by the U.S. Department of Transportation titled “Muck Utilization Planning,” many of the possible uses for tunnel muck were considered (see Table 1). Table 1 summarizes information from the publication and demonstrates some of the best uses for different types of soft-ground tunnel muck.

Today, these various uses remain relevant to soft-ground muck; however, it is important to note that the handbook was published before EPB TBMs became popular or their use in tunneling became widespread. The presence of soil conditioners and how they would affect the muck was not considered. Today, research programs like the DRAGON Project (a collaboration between the governments of Austria, France, Germany, Switzerland and the UK) and the “Re-Muck” program in Italy continue to push for efficient reuse of muck as a resource (International Tunneling and Underground Space Association ITA report No. 21, April 2019). These programs envision a more sustainable future of tunneling.

Rather than disposing of tunnel muck in a landfill, these programs advocate for repurposing and reuse. Efficient use and recycling of tunnel muck can reduce the need for mining of mineral resources while sending less material to landfills. Often, carbon emissions can be reduced by minimizing material handling and transportation. Environmentally friendly soil conditioners play a critical role in this process, allowing for more options and flexibility in the reuse of EPB TBM muck.

**Development of environmentally friendly soil conditioners**

Many manufacturers are working to develop soil conditioners that are less harmful to the environment. With large investments in research and development, MAPEI has developed one such new product line of

---

**Table 1**

Muck utilization suitability chart.

<table>
<thead>
<tr>
<th>Category</th>
<th>Soft-ground muck</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sand and</td>
<td>Silt and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gravel*</td>
<td>clay*</td>
<td></td>
</tr>
<tr>
<td>A. Construction material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineered, compacted fill</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Controlled fill</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Uncontrolled fill</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sanitary landfill (cover material)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily cover material</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Permanent cover material</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B. Specialized material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bituminous concrete aggregate</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Portland cement aggregate</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Pavement base and subbase aggregate</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Lightweight aggregate</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Portland cement</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Fired-clay product</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>


1 = Excellent, 2 = Satisfactory, 3 = Poor
foaming agents called Polyfoamer ECO.

These new foaming agents are based on biodegradable anionic surfactants in combination with a natural biodegradable polymer. They contain no glycols or other solvents with low biodegradability (common to many traditional foaming agents). While significantly less harmful to the environment, with minimum ecotoxicity and high biodegradability, the foaming agent maintains a high technical performance standard, comparable to that of traditional foaming agents.

**Environmental impact.** When considering the environmental impact of soil conditioners, criteria for comparison testing must be defined. Two important environmental benchmarks for soil conditioners are ecotoxicity and biodegradability.

**Ecotoxicity.** Ecotoxicity is defined as the amount of a chemical product required to have an adverse effect on populations of living organisms exposed to it. Exposure testing is done on a variety of aquatic and terrestrial organisms. Adverse effects are recorded including lethality, inhibition of growth, movements or reproduction.

The ecotoxicity of the newly developed foaming agents is far lower than those of traditional foaming agents. Figures 1, 2 and 3 show comparisons with selected soil conditioners’ toxicities to the planktonic crustacean *Daphnia magna*, fish *Danio rerio*, and green algae, respectively. The toxicity toward *Daphnia magna* (Fig. 1) is measured according to the Organization for Economic Cooperation and Development (OECD) Test No. 202, and the values registered are EC50, the concentration of each product at which 50 percent of the initial population of *Daphnia magna* is immobilized in 48 hours.

The toxicity toward *Danio rerio* (Fig. 2) is measured according to OECD Test No. 203, and the values registered are LC50, the lethal concentration of each product at which 50 percent of the population is killed in 96 hours.

The toxicity toward green algae (Fig. 3) is measured according to OECD Test No. 201, and the values registered are IC50, the inhibitory concentration of the test substance that results in 50 percent inhibition of growth rate of the green algae in 72 hours.

These figures demonstrate that the new foaming agent is 10 to 15 times less toxic toward these living organisms than traditional foaming agents.

**Biodegradability.** Biodegradability is the ability of a material to break down over time. Biodegradability of chemicals is typically evaluated considering the chemical oxygen demand (COD) and the biochemical oxygen demand (BOD), which measures how much oxygen is consumed to degrade the organic content. The lower the organic content of the foaming agent introduced to the soil, the lower the oxygen demand will be.

**The state of environmental considerations.** Around
the world, no one standard exists for quantifying the environmental impact of tunnel spoils or the soil conditioners contained in them. When considering the environmental impact of soil conditioners, much of the world has some catching up to do.

The most common testing done on tunnel muck does not consider soil-conditioning agents. For example, European guidelines 2008/98/CE establish a test known as lixiviation, which determines the concentration of several harmful substances that may present in soil. Most are naturally occurring in trace quantities, and include heavy metals like lead, cadmium and mercury, as well as hydrocarbons. However, since soil conditioners do not contain these materials, the environmental impact of soil conditioners themselves is not considered or evaluated.

Projects in the United States, like many other countries around the world, generally do not consider biodegradability or ecotoxicity of soil conditioners present in muck. Limitations are typically related to hydrocarbons and heavy metals only. Because regulations do not exist, traditional soil-conditioning agents are widely used, even those with a high dose of solvents that may be particularly harmful to the environment.

On the other hand, countries such as Italy, Denmark, the UK and others use a holistic, case-by-case process. In practice, testing of soil conditioners begins in the design phase of a project. First, the biodegradability and ecotoxicity of potential soil conditioning agents are evaluated alone in their pure state at an independent laboratory. This establishes baseline values for the soil-conditioning products that are being considered. In the next phase, laboratory work begins with soil samples from the tunnel, where soil conditioning parameters and dosages are determined and the conditioned soil is evaluated for both technical attributes and environmental aspects (ecotoxicity and biodegradability). Finally, as the excavation begins, and throughout the course of the job, regular tests are conducted on the muck to ensure compliance with biodegradability and ecotoxicity guidelines established by respective environmental regulatory agencies.

Once the muck leaves the tunnel, it must be stockpiled until it has been deemed safe for transport for final disposal or reuse. Tests on the conditioned soil are carried out at different times (after one day, three days, seven days, and so on) to measure biodegradation. Curves can then be plotted to determine when the muck has reached an acceptable threshold for biodegradation and ecotoxicity. This way, muck conditioned with rapidly biodegradable, low-toxicity foaming agent is able to pass the tests for removal from the site in shorter time. Reducing this waiting time through the use of environmentally friendly soil conditioners is of particular benefit to jobs in urban areas with small site footprints.

Conclusion

Excavated material disposal is a critical part of any tunneling job and is especially important for EPB TBMs. In general, soft-ground spoils are less desirable for reuse than rock. In addition, the chemicals present in the conventional EPB muck make disposal even more difficult, and it is not uncommon for projects to be negatively impacted due to the limited muck disposal options and cost.

Global regulations, protocols or standards should be studied and instituted for TBM muck management. The use of environmentally friendly soil conditioners is not only about respect for the environment and sustainability, but may also reduce project costs. In some cases, the use of environmentally friendly soil conditioners may allow reuse of the excavated soil, while also avoiding longer trucking distances needed for special muck disposal. Several miles of EPB TBM tunnels have already been completed using new environmentally friendly soil conditioners. This demonstrates that eco-friendly soil conditioners bring an exceptional opportunity because they are formulated with natural ingredients that provide the high technical performance of traditional foaming agents, but greatly decrease the impact of EPB TBM muck on the environment.

References


Innovative approach for dust control in tunnel construction

Airborne disease-causing dusts are found throughout the tunnel construction process, including in excavation, shotcreting and material loading and transporting. Not only does dust cause immediate jobsite challenges of reduced visibility, lost materials, lower productivity and additional wear and tear on equipment, respirable crystalline silica (RCS) exposure at hazardous levels can also lead to a myriad of health problems for tunnel workers including lung cancer, silicosis, pulmonary disease and kidney disease. Silicosis is the most common occupational lung disease worldwide and is often referred to as the “modern-day asbestos.”

It is estimated that up to two million construction workers in the United States are exposed to RCS in 600,000 workplaces (OSHA, 2017). The risk of dust-related diseases increases with exposure levels.

Workplace health and safety legislation now place strict requirements on the management of dust, with many countries lowering the workplace exposure limits for RCS. For example, Australia recently lowered limits to 0.05 μg/m³ over an eight-hour working day (Safe Work Australia, 2020).

In 2016, the U.S. Occupational Safety and Health Administration (OSHA) reduced the limit for exposure levels for construction workers to 25 μg/m³ as an eight-hour time-weighted average under any foreseeable conditions (OSHA, 2016). Restrictions continue to tighten as awareness of the dangers of RCS increases worldwide, resulting in significant impacts on construction projects.

Many known methods exist for dust control in tunnel construction, including dilution and displacement ventilation, water spray, foam, respirators and wet and dry dust collectors that operate onboard but separate from excavation equipment. The effectiveness of each method is determined by many factors. Identifying these factors is critical in designing a successful dust control program.

In accordance with the National Institute of Occupational Safety and Health (NIOSH) (CDC, 2015) global hierarchy of controls, dust collectors and water suppression are both engineering controls that can help isolate workers from hazardous dust. While these methods can be more costly up front compared to administrative controls or personal protective equipment (PPE), they are generally more effective over the long term and can provide cost and operational savings over time.

Water suppression uses spray systems to apply water and/or chemicals that weigh down dust particles and make it less likely for them to become airborne. The effectiveness of spray systems depends on the applied water’s velocity, the orientation of the sprayers, the size and location of the spray nozzles, and the type and size of the dust particulates in the air. These low-tech systems are simple to design and operate, and the equipment is relatively low cost. However, there are several drawbacks to the water-suppression method. These include:

- Many materials are hydrophobic and fail to mix with water.
- Water cannot be used in freezing temperatures.
- Overwetting is common due to the large volume of water needed, causing excessive moisture in the working area and material buildup on equipment and transfer points.
- Droplet size of the water mist also must correctly match the size of the dust particulates, or it cannot adhere to dust and effectively suppress it.

Mobile dry dust collectors provide an effective alternative. By collecting dust at its source when using a roadheader, hydraulic hammer and/or drill and blast, they keep the job site clean and dry, while improving air quality and visibility for workers. They can collect a wider size range of dust particulates and are more effective at limiting RCS and other dangerous contaminants. Furthermore, mobile dust collectors can be configured to work in a variety of ways to conserve space in the working area while keeping workers protected. Such configurations will be explored in this article with the introduction of Grydale mobile dust collectors and key projects that have used them to provide effective ventilation and at source dust control for station, shaft, cross passage and adit excavation.

Ventilation design systems in tunneling

Ventilation and dust control determinant factors. A critical aspect of tunnel construction is ventilation design, so that workers’ exposure to fumes, dust and silica are reduced to safe and acceptable levels. There are many types of ventilation designs and as each tunnel is unique, so too is each ventilation design. Every ventilation system has limitations in terms of dust control, with the selection of the system being dependent upon:

- Geology.
- Climate.
- Tunnel dimensions.
- Location and site access.

Andrew Fanning and Craig Allan

Andrew Fanning is CEO Grydale and Craig Allan, member UCA, e-mail andrew.fanning@grydale.com.au.
• Construction method and sequence.
• Excavation rate targets.
• Cost of materials.
• Ease of maintenance.

There are three main factors affecting the typical volume of air flow required within tunnel construction works. Safe Work Australia and several other safety organizations in other countries have adopted standards for these areas. They include:

• Air flow: a minimum of 0.5 m/s (1.64 fps).
• Diesel plant: calculated at 0.066 m/s (0.217 fps) per kW of diesel.
• People: calculated at 0.25 m/s (0.082 fps) per person working within the tunnel.

These all combine to determine the type and capacity required for a ventilation and dust extraction system.

**Common ventilation systems.** A forced ventilation system is the most common type of ventilation system used in tunnels under construction. Much like a forced-air system for a personal residence, air outside the tunnel is forced into the tunnel via a system of ducting and fans, creating a pressure differential between the tunnel and outside atmosphere. The higher atmospheric pressure at the tunnel face causes air to flow through the tunnel and back out into the environment, carrying with it all the dust, diesel particulates and other airborne contaminants. This also means that the contaminants are drawn past workers and equipment as air makes its way out of the tunnel, making this system the least effective way to control exposure to dust.

Another common ventilation system is the overlap ventilation system. In overlap ventilation systems, air is pushed into the tunnel using a fan, and the dust scrubber is overlapped with the ventilation outlet. Negative pressure is used to pull air through the tunnel and create two air flows within the tunnel. As air flows need to be balanced, it is critical when using this system to have a ventilation design that works with the construction sequence. An overlap ventilation system is normally deployed in the extraction face of a roadheader or other similar sequential excavation method (SEM) tunnels, and is best suited for long road and rail tunnels.

An extract ventilation system, also known as exhausting or reverse ventilation, is where air is drawn through the tunnel from the outside atmosphere and exhausted via a single duct to a scrubber to deliver clean air to the atmosphere. Air inflow needs to balance with air exhaust volume. Scrubbers can be located within station boxes, where louvres balance airflow into the tunnel or within the shaft. These systems work well for short tunnels where they can be installed as permanent solutions for the duration of the project, reducing risks of contact with contaminants at the tunnel face and contaminated air mixing with the surrounding tunnel air.

While forced ventilation is the most common approach in tunnel construction, overlap ventilation and extract ventilation systems, when properly designed and used with the appropriate dust collector(s), provide more effective solutions to dust control during tunnel construction.

**Use of mobile dust collectors for dust control**

Grydale mobile dust collectors (Fig. 1) use a centrifugal fan to draw dirty air into the unit through one or multiple air intakes via ducting. Larger dust particles fall into the drop-out box and are separated from the air stream, which increases the life of the filters. Dust and fumes are trapped on the filters, forming a “cake” on the surface as air passes through the filter house. A reverse-pulse filter cleaning system cleans the filters using an onboard air compressor.

Dust particles are discharged from the machine via the augers and rotary valves, either onto the site floor, via incline augers to bulker bags, or as a wet slurry. An air-velocity probe monitors the air speed, and the variable-speed drive turns the centrifugal fan up and down to maintain the required air volume.

Different mobility options (Table 1) including skid-mounted, caster wheel, hydraulic stepper and track-mounted units allow mobile dust collectors to be used at every stage of shaft, tunnel, station and cross-passage construction. Depending on mobility type and project parameters, mobile dust collectors can deliver forced air from the surface or provide targeted dust extraction at source in the underground excavation area. To add further adaptability to the needs of each construction site, dust collectors can be built to use diesel, electric or hybrid power.

**Mobile dust control case studies**

**Metro Tunnel, Melbourne — Central Business District Stations**
The Metro Tunnel is a key rail infrastructure project underway in Melbourne, Australia that includes the construction of twin 9-km (5.59-mile) rail tunnels and five new underground stations. Site geology consists of interbedded siltstone and sandstone known as the Melbourne Formation, with a minerology of primarily quartz.

The Melbourne metro stations are being built as trinocular caverns, where three overlapping tunnels reach a platform width of about 19 m (62.34 ft) — one of the widest metro platforms in the world. The stations employed a cut-and-cover methodology using traditional top-down excavation and was mined by roadheaders. The Cross Yarra Partnership, a consortium consisting of John Holland Pty Ltd, Lendlease Engineering Pty Ltd and Bouygues Construction Pty Ltd, selected Grydale machines for at-source dust extraction during shotcreting and bolting of the walls as well as for general ventilation when the cover was installed. The station’s location in the heart of the central business district (CBD) presented several unique challenges, including space and noise constraints.

The system used nine skid-mounted electric mobile dust collectors each generating 60 m³/s (125,000 cfm) of air volume for general ventilation of the CBD North (four units) and south stations (five units). At both stations, dust collectors were mounted on the surface within acoustic sheds, leveraging a full extract system to deliver clean air to the underground working area, as seen in Fig. 2. Grydale designed the ventilation system around this revolutionary approach to minimize machine movements in a confined area with the main benefit being to the personnel underground working in a clean environment.

On the underground Parkville Station, directly north of the CBD Stations, one diesel 30-m³/s (60,000-cfm) mobile dust collector on tracks and three electric 10-m³/s (20,000-cfm) drag skid units are being used during shotcreting to provide short-term dust extraction at the source as well as serving as general ventilation for areas with dead zones.

For tunnel cross-passage excavation, two electric caster-wheeled units creating 10 m³/s (20,000 cfm) air volume provided dust control at the source. These units were designed with caster wheels, allowing the units to slide onto the tightly constrained cross-passage platforms for the duration of construction. Three diesel 30-m³/s (60,000-cfm) track units have been used

### TABLE 1
Comparison of mobility options.

<table>
<thead>
<tr>
<th>Skid</th>
<th>Caster wheel</th>
<th>Hydraulic stepper</th>
<th>Track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used for benching and ancillary works where a high level of mobility is required for a short duration to capture dust at source.</td>
<td>Used for cross passages in TBM rail tunnels where space is limited. More maneuverable than a skid. Can be mounted on utility platforms. Intermediate profile mobility option.</td>
<td>Designed to walk 6 m (19 ft) in 30 minutes, in line with typical roadheader advance rates. Predominantly used at the tunnel face. Works well when steady advancement is needed without having any downtime in production activities. Self-propelled mobility. Intermediate profile mobility option.</td>
<td>Moves up to 2–4 km/h (1.24 to 2.48 mph). Used for benching and ancillary works where a high level of mobility is required for a short duration to capture dust at source. Controlled with remote control. Largest profile mobility option.</td>
</tr>
</tbody>
</table>

### FIG. 2
Ducting extends from the dust collector mounted at the surface into an underground station in the heart of Melbourne, Australia.
for dust extraction within back-end works at various project work sites.

Using multiple sizes and styles of mobile dust collection units provided the required amount of airflow to manage dust by the most effective means during station development.

**City Rail Link (CRL) — Karangahape Station**

**Tunnel section:** Station  
**Excavation method:** Roadheader  
**Ventilation system:** Extract  
**Mobility type:** Skid  
**Air volume:** 60 m³/s

The City Rail Link (CRL) is Auckland’s first underground rail line and the largest transport infrastructure project in New Zealand. The 3.45-km (2.14-mile) twin tunnel includes the construction of two new inner-city stations, Karangahape (K-Road) Station and Aotea Station. The K-Road Station has a unique layout and dimensions and is being excavated by two Mitsui S200 and Mitsui S300 roadheaders. The Link Alliance Joint Venture (Vinci Construction Grand Projects S.A.S, Downer NZ Ltd, Soletanche Bachy International NZ Ltd, WSP Opus (NZ) Ltd, AECOM New Zealand Ltd, Tonkin+Taylor Ltd and CRL Ltd.) is managing construction of the tunnels and stations.

K-Road’s ventilation design was separated into 15 construction stages and designed around the last stage when maximum airflow was required. Each stage represents changes to the tunnel area as construction advances. Ventilation modeling confirmed that a 450-kW electric 60-m³/s (125,000-cfm) dust collector would meet the ventilation requirements for the entire station excavation.

Construction began in August 2020 with the Mercury Lane temporary shaft, which is 15 m (49.21 ft) wide and 27 m (88.58 ft) deep. The shaft serves as an access point to the mined tunnels for all excavation equipment. Ventilation requirements for the excavation of the temporary shaft were met by a 90-kW axial fan with an open-circuit capacity of 46 m³/s (97,468 cfm). The axial fan continued to be used throughout the construction of K-Road to increase airflow into the tunnel to balance the extraction rate.

The fan was mounted alongside the dust collector on a mezzanine within an acoustic shed on the surface and connected via 1,600-mm (63-in.) steel ducts to the excavation area through the shaft. The use of rigid steel ducting helps to reduce pressure loss within the ventilation design.

The Mitsui S200 roadheader was launched from the Mercury Lane shaft to excavate the first tunnel platform and two intermediate adits before breaking through at the Beresford shaft. The tunnel stub (where the passing TBM will pick up excavation within the station) was excavated using a twin header on a 14T excavator.

The Mitsui S300 was then used to overcut the tunnel and brattice was installed to block open sections of tunnel that would otherwise have resulted in air loss to create sections within the tunnel. Once brattice work was complete, the Mitsui S200 was launched in the second tunnel, following the same extraction method back toward Mercury Lane.

**Sydney Metro — Central Station, Central Walk**

**Tunnel section:** Station and underground pedestrian walkway  
**Excavation method:** Excavators — buckets and drum cutters  
**Ventilation system:** Extract  
**Mobility type:** Skid  
**Air volume:** 50 m³/s

Sydney Metro is Australia’s biggest public transport project, extending the existing rail network in the country’s most populous city. Construction is currently underway to expand the system under Sydney Harbor and the Central Business District, including 66 km (41 miles) of twin tracks and 31 stations by 2024.

Central Station is an existing underground station undergoing construction. New developments include expanding the station to include a new 19-m (29.53-ft)-wide underground pedestrian concourse that will provide access to existing and new platforms through an extensive elevator system. Central Station and its landmark Central Walk were awarded to Laing O’Rourke.

An electric skid-mounted dust collector with 50 m³/s (105,000 cfm) capacity was selected as the best solution based on footprint, cost and cleaner energy. The dust collector was mounted on the surface at the main access shaft, with ducting running down at a 90-degree angle before turning under to run along the tunnel drive. Locating the dust collector at the surface reduced the plant footprint within the excavation area. Small, portable axial fans were also used to direct air flow into corners and prevent dead zones.

There are eight escalators and eight shafts along Central Walk: four on the southern and four on the northern side. When construction of each section commenced on the southern side, the coinciding escalator shaft was opened to the surface, and dust extraction was provided to the area by the dust collector. Once excavation was completed, extraction ducting was returned to the furthest excavation face. Air was then drawn into the working area through the access and escalator shafts. This process was followed for the northern side of Central Walk.

Fiberglass-reinforced panel (FRP) works followed excavation. A brattice wall was installed to separate the fit-out area from the excavation area. To ensure sufficient airflow, the brattice wall required openings to provide air in both areas. The openings needed to have a cross-sectional area below 25 m² (269 sq ft);
otherwise, the FRP area would not receive ventilation from the surface-level dust collector.

WestConnex — 3A (M4-M5 Link) and 3B (Rozelle Interchange)

Tunnel section: Mined tunnels
Excavation method: Roadheader
Ventilation system: Overlap
Mobility type: Hydraulic steppers, tracks
Air volume: 10 m³/s, 20 m³/s, 30 m³/s, 40 m³/s, 50 m³/s, 60 m³/s

WestConnex is Australia’s largest infrastructure project connecting a link between the inner city, west Sydney, the Sydney Airport, and southwest Sydney in a continuous 33-km (21-mile) motorway. This will be Australia’s most extensive underground network of urban road tunnels and is expected to significantly reduce capacity constraints and traffic congestion. Construction will consist of four stages, with 3A and 3B being the final two stages of the project, scheduled for completion in 2023.

Stage 3A, managed by the Acciona/Samsung/Bouygues (ASB) joint venture, is the WestConnex M4-M5 link and consists of twin 7.5-km (4.66-mile) tunnels to accommodate up to four lanes of traffic in each direction. Stage 3A is being mined by 28 roadheaders.

Stage 3B, managed by John Holland/CPB (JHCPB), is the Rozelle interchange, consisting of a group of underground tunnels mined by 22 roadheaders. The geology consists of Hawksberry sandstone with dykes and fault zones present.

Both sections primarily used an overlap ventilation system. As 3A consists of twin tunnels with no stations, the ventilation design was relatively straightforward. However, the design of 3B was both intricate and complex. From an isometric view, the interchange basically resembles a plate of spaghetti, with sections of tunnels having less than 4 m (13 ft) of cover. In addition, mainline cavern spans were up to 28.49 m (93.5 ft) with ventilation facilities as high as 21.03 m (69 ft) in the tunnel.

Stage 3A has 41 Grydale dust collectors: 25 × 50 m³/s (105,000 cfm) hydraulic stepper units and 16 × 50 m³/s (105,000 cfm) tracked units, both using hybrid power. Stage 3B had 28 units: 22 × 40 m³/s (85,000 cfm) and six 60 m³/s (125,000 cfm) hydraulic stepper, hybrid-power units, plus rentals of 10 tracked units in varying sizes ranging from 10 m³/s (20,000 cfm) to 50 m³/s (105,000 cfm)( Fig. 3). On the Rozelle Interchange project, silica dust levels have been more than halved compared to other projects completed previously by JHCPB.

Summary

RCS dust has always been present in tunneling, but increased health and safety regulations now necessitate careful monitoring and removal to protect workers from disease-causing air. Tunnel owners and designers are expected to include dust-control measures in their concepts, while contractors are needing to increasingly implement and work with dust-control equipment and technologies. While PPE, administrative controls and water suppression provide varying levels of protection, dust collectors generally are the most effective at removing dust while simultaneously preserving the working environment. As RCS regulations increase and workplace exposure limits shrink, mobile dust collectors are positioned to help owners, designers and contractors of hard-rock and mixed-ground tunnels maintain compliance and protect tunnel workers during the excavation of stations, shafts, cross passages, TBM tunnel adits or for mined (non-TBM) tunnels where dust is a concern.

Acknowledgments

The authors thank Thomas Ioramo for his contributions to this article.

References

Wireless optical displacement sensor for convergence and divergence monitoring

The automation of monitoring in general appears undeniably tempting right up to the moment at which prices are discussed. That is when suddenly manual surveys seem not so outdated anymore. Obviously, this perspective is rather short-sighted if automation is applied where its advantages can be exploited, for example:

- In areas where access is limited, difficult or dangerous.
- In projects where frequent recording rates (that is, shorter than one day) are required.
- Where long-term observations (that is, longer than one year) are desired.
- Where it takes care of repetitive procedures to release human resources for decision-making tasks.
- Any combination of the above.

The nature of tunneling more or less represents all of the above. Monitoring work is not only repetitive, but can potentially disrupt and delay tunnel construction or operation because of constrained access conditions. Such delays can give rise to significant cost and schedule issues.

A common parameter in tunnel monitoring is convergence as observation of changes in the tunnel profile perpendicular to the alignment. This can be conducted as life-cycle monitoring of ageing masonry tunnels as well as temporary observation of deformation induced by adjacent construction measures, or even in advance and construction of the tunnel itself.

In all of the above cases, wireless condition monitoring (WCM) is an intelligent solution with regard to costs, ease of installation and efficiency. The optical displacement sensor (ODS) is a typical component of a modern WCM system, representing unrivalled simplicity in convergence monitoring.

Convergence

Tunnel deformation. Excavation of a tunnel, or close to an existing tunnel, will cause volume loss, and thus a disturbance of the surrounding medium. To re-establish the initially lost equilibrium, depending on the material, the ambient environment starts to settle with the tendency to fill the void represented by the tunnel or cavity.

The design of a tunnel profile and lining type is intended to deflect external loads to maintain stability and establish a new final equilibrium with the surrounding ground. Only if this precondition is reached can operation of the tunnel be safe and provide support of the overburden, for example, in bearing urban infrastructure.

Therefore, it is essential to observe tunnel deformation as a component of a project’s holistic monitoring concept.

Depending on factors such as the tunnel profile, surrounding regime and overburden, the tunnel can experience various types of deformation (Fig. 1). As convergence we consider the displacement of a point toward or away from the interior: that is, the center point of the profile area. For a circular profile this would be the direction perpendicular to the outside tangent. For efficient convergence observation it is crucial to estimate the pattern of deformation in advance to distribute sensors appropriately and yield representative results. Segmented lined tunnels will deform at the joints as the segments can be considered rigid, while masonry-lined tunnels might deform homogeneously and require more thorough consideration of placement of the sensors.

Common observation techniques. The strategy of continuous observation depends on a variety of criteria, not least those already mentioned in the introduction. Generally speaking, monitoring is the observation of change, and thus the comparison of an in situ current state with an initial state some time in the past, represented by a zero or baseline measurement. In addition, the parameters observed need to be identical and comparable in both epochs, which might require some information about the environmental conditions. In the case of geometric observations like convergence, the location of the observed spot must be identical or at least be restored with sufficient precision. The latter becomes increasingly significant if the tunnel undergoes renovation, or the initial survey is carried out when only the preliminary lining is installed.

The first and foremost consideration would be the observation frequency. If annual observation repetition is required and access is not an obstacle, automatization is hardly economical. Manual observations can be conducted using geodetic total stations, tape extensometers or in modern days, even terrestrial laser scanning:

1. For total station observations, the tunnel profile is equipped with reflectors, ideally prisms that are observed from the total station’s location by horizontal and vertical angle and slope distance...
WCM systems essentially consist of three components: (1) the sensor node, (2) the gateway and (3) the data-management platform.

Compact design and low power consumption of the node allow easy installation of the field equipment even by nonexperts with only minimal maintenance required for up to 15 years depending on the sensor. The nodes establish communication between an implemented sensor, such as a MEMS tilt sensor and/or a laser-based ODS, or a connected external sensor (such as a potentiometric crack meter, vibrating wire strain gauge or PT100 temperature sensor). The data is transmitted either via 868/915-MHz LoRaWAN-based signal or meshed 2.4-GHz Wi-Fi frequency to a gateway. It is temporarily stored at the gateway and transferred either via cellular network or ethernet landline to a remote central server.

Wireless communication minimizes installation effort and reduces the risk of accidental damage or vandalism causing loss of data that cabled systems can experience. The long battery life reduces the need for maintenance to almost zero and allows for redeployment on multiple short-term projects if not required for long-term lifecycle monitoring.

Intelligent systems enable remote system modification according to the stage of works, related expectations of the development of changes, or requirements of contingency measures.

Last but not least, WCM allows easy modification and expansion of the system by gradually adding more and even different sensors, all communicating within the same platform without the need for additional cables. It is relatively simple to relocate or replace elements of the system; for example, to focus resources close to the tunneling face as construction progresses. Even the subsequent extension by additional sensor types is reduced to the mere hardware installation.

The data-management platform provides access for multiple users with adequately defined user roles. The data...
are stored and further processed if required. In the event of predefined threshold values being breached, automated alarms can be sent to approved stakeholders.

Case studies

Costa Blanca — Martorell Tunnels — Spain. As part of the Mediterranean Corridor project, the Spanish rail infrastructure operator ADIF needed to upgrade three old tunnels in the Catalonia region for use by bigger, faster trains. Located on the line between the towns of Martorell and Castelbisbal, each tunnel was several hundred meters in length. Main contractor Dragados was tasked with strengthening the linings, lowering the track and installing overhead electrification.

By lowering the invert, the overall tunnel geometry was altered and there was a need to closely observe whether the redistribution of loads would jeopardize structural integrity. Continuous monitoring was instructed to compare predicted and actual movement. This was viewed as essential to protect the workforce and provide timely warning of any significant deformation that would require a response from the construction team.

The requirement for near real-time monitoring throughout the works made automated monitoring the obvious, and probably only, choice. Conditions for long-distance optical observations were expected to be highly dusty, with sight lines blocked by construction machinery and materials. The use of total stations was therefore rejected.

Dragados and its assigned monitoring consultant, INSTOP, opted for a Senceive WCM system using laser distance sensors (ODS) in a triangular arrangement with a node at each spring line and one at the crown (Fig. 3). Although also relying on optical observations, the distances observed in this configuration are much shorter and therefore more reliable than in any applicable total station arrangement.

The ODS nodes include a three-axes MEMS tilt sensor enabling observation of rotational movement at each location regardless of the node orientation, as well as measuring the distance to a reflective target. Arrays of ODS nodes were installed at 25-m intervals such that the Costa Blanca tunnel featured 30 ODS profiles, Martorell tunnel 27 profiles, and Castelbisbal tunnel 35 profiles.

Achieving the nominal submillimeter accuracy not only depends on the environmental conditions — for example, the medium the laser beam has to travel through — but also on the quality and orientation of the target. Aiming at rough and/or oblique surfaces decreases accuracy as the incidence point might shift inadequately. Therefore, specific targets were installed to provide a reflective, smooth surface at 90° incidence angle.

In addition to the distance measurements, the ODS’s three-axes MEMS tilt sensor allows the observation of rotational movements without the node being restricted to horizontal oriented installation.

Besides the challenging environment, one more reason for choosing WCM was the tight schedule, which provided a very short window for installation. Because the system is configured before installation, and because of its modular characteristics, a wireless system is easy to install, even by nonspecialists. At four sections per hour, an entire tunnel installation was completed within a single working day.

At the Costa Blanca and Martorell tunnels, the system included instruments to automatically observe longitudinal settlement. The system consisted of fixed-length beams daisy-chained in cardanic wall mounts with wireless tilt nodes fixed to the beams. Via trigonometric functions, any longitudinal tilt could be converted into vertical displacement by the known length of the beam. The accumulation of the incremental vertical displacements along the chain yielded longitudinal settlement or upheaval. As the components of the system were located relatively far apart, the long-range LoRaWAN system was the chosen communication platform. Each tunnel was equipped with its own gateway serving a system with the furthest node 1.2 km (0.8 mile) away. Gateways also received signals from the nodes located in the other tunnels — at distances of up to 8 km (5 miles). However, to maintain redundancy, the multigateway constellation was retained.

Specific diligence was required on the Martorell tunnel as the city of Martorell and its high-rise buildings were located directly above. A number of rod extensometers were therefore installed to observe vertical ground movement at three levels (3 m, 6 m and 9 m), each communicating its readings to the solar-powered gateway via multichannel vibrating wire nodes.

All of the systems were delivered preconfigured and with all sensors functioning. It was therefore possible to
check system performance within minutes of installation, avoiding the need for potentially disruptive repeat visits to the site.

The renovation of the three tunnels, including their intermediate galleries, was completed within three months with a monitoring system of more than 400 nodes in place for about four months. After demobilization, the components were redeployed on other INSTOP projects.

Chipping Sodbury Tunnel — UK. A comparable situation to the previous case was encountered in the Chipping Sodbury Tunnel near Bristol, UK. The structure, which was completed in 1902 and thus is more than 100 years old, is 4,000 m (13,100 ft) in length and features a brick-lined arch profile 8.4 m (28 ft) wide and 6.4 m (21 ft) high. To comply with modern requirements there was a need to lower the track by 150 mm in places to achieve the required clearances for a new alignment design including electrification.

Again, a tight schedule and challenging site conditions, plus the need to keep trains running, necessitated a solution using automated monitoring methods. The monitoring consultant, AECOM, had gained experience in similar renovation projects and could therefore use the proven technology of WCM. Tunnel geometry, obstructions by traffic, and construction activity as well as dusty, humid atmospheric conditions prohibited total station observations.

Unlike in the Spanish tunnels, it was possible to access cellular signal reception throughout the entire length of Chipping Sodbury Tunnel. Therefore, Senceive’s propriety communication platform FlatMesh could be employed. Due to the greater bandwidth of the 2.4 GHz signal, the platform provided optimized synchronization and short message pulses for high-frequency observations. The wireless mesh platform provided significant redundancy and therefore a high level of system reliability.

Hence, establishing communication proved to be relatively straightforward by simply installing gateways at regular intervals to gather the data from adjacent nodes.

As stated, three-axes tilt sensors can be installed in any orientation without the necessity of prior leveling. Therefore, the initial approach was to install daisy-chained tilt beams within the tunnel section representing deformation arrays. AECOM chose miniaturized Senceive NanoPlus MEMS tilt nodes for compactness and confidence in the IP68 performance under the expected wet and dusty ambient conditions. The use of shape arrays had been considered but rejected because each chain would have needed its own gateway, whereas data from numerous tilt sensors could be gathered at a single gateway, saving time and money.

As the work progressed it became impractical to install beam chains at some locations where tunnel curvature meant they would have projected into the tunnel and caused an obstruction. Hence, individual tilt beams were installed only at crucial locations, still employing more than 200 nodes throughout the tunnel. Where convergence observation was required, tilt nodes were substituted by ODS nodes positioned to measure the distance to the opposite wall.

Permanent online access to the data-management platform allowed remote temporary deactivation of the inherent alarming during blockage of the line of sight by construction works to avoid false alarms.

The tracks were lowered one after the other; the behavior of the remaining track was observed using rail-specific vibration resistant tilt node. A total of 843 of these high-G tilt nodes were installed at 3-m (9-ft) centers within and adjacent to the immediate area of impact. In addition, it was considered crucial to ensure proper operation of the tunnel drainage, realized by a subsurface culvert located in the center of the tunnel. It was expected that any significant impact on this structure would result in measurable deflection of the invert and thus the track, so additional tilt nodes were installed on sleepers to observe movement related to the invert.

Conclusion

The monitoring programs described here found that neither of the presented projects encountered significant deformation. However, because the works were conducted under the umbrella of risk mitigation by meticulous observation of structural changes and deformation, they could be progressed with confidence and efficiency.

The use of the optical displacement sensor in particular enabled analysis of convergence in situations that would not have been possible with other methods. The use of automated wireless systems in general demonstrated that their capability encompasses the entire workflow from data acquisition via transfer and processing toward multiuser data visualization and thus provision of the observed parameters to all involved disciplines without delay.

Looking forward, the obtained information can be fed into the “observational method,” the feedback loop suggested by Peck (1969), confirming or refuting the design assumption in a “learn-as-you-go” procedure. This allows timely modification of processes to optimize construction progress and reduce the hazard risks.

An additional advantage of the presented solutions is that the initial installation (“ab initio” system) can be expanded to multisensor, multipurpose systems by successively adding sensors in response to changing conditions and requirements (a “best-way-out” method).

The ease of use of the system promotes the common and efficient utilization of automated methods in physical and commercial risk mitigation, even at early stages, by making “deformation monitoring an integral part of decision making in the design-construction-supervision maintenance system” (Kavvadas, 2005). (References available from the author.)
One of the many benefits of being a member of the UCA is access to technical information. That access is now even better with the launching of OneTunnel.org, a collaborative effort among multiple professional societies to place the world’s most comprehensive collection of tunneling, underground construction and mining research at your fingertips.

A companion to OneMine.org, OneTunnel.org gives you access to the most relevant and reliable technical information including technical documents, conference papers, articles, preprints and presentations.

OneTunnel.org is an excellent resource for professionals, students and professors who need to have access to quality information that can be trusted.

“OneTunnel.org is an excellent resource for the professionals in the tunneling industry and facilitates sharing of the knowledge and technology related to the best practices in tunneling,” Jamal Rostami, Ph.D., PE, director of excavation engineering and Earth Mechanics Institute (EMI), professor of mining engineering and underground construction and tunneling, Colorado School of Mines. Editor-In-Chief, Tunneling and Underground Space Technology (TUST) and Vice President of International Tunneling Association (ITA). “As a practitioner, teacher, and researcher, I can appreciate the value of OneTunnel.org more than others since it allows me to find useful information about various projects and processes involved in tunneling and share that with my students, use the information in my research, and benefit from the precedents in the ongoing projects I am involved with.”

OneTunnel.org is a benefit that is included in your UCA membership.

“The database can be a useful, and sometimes a critical resource to the engineers as it allows them to look at the track records of various projects when they plan, design, and construct the underground spaces and tunnels,” said Rostami. “The available data can be reached by all on a worldwide basis and complements the available technical content that is available through World Tunneling Congress (WTC), technical journals such as and trade journals.”

Delve Underground appoints new leadership

Delve Underground announces two new appointments to expand the organization’s talented leadership team. John Kaplin will join the firm’s executive leadership as chief development officer and Rachel Martin has been appointed California regional manager. Both Kaplin and Martin bring a wide range of experiences and expertise that will be impactful to Delve Underground’s mission and strategic initiatives.

“I am incredibly excited to work alongside both John and Rachel in these leadership roles,” said Victor Romero, Delve Underground president. “They both have a deep knowledge of our company and clients and will be instrumental as we work toward the firm’s vision to provide fulfilling opportunities in a collaborative and inclusive workplace that inspires bold, responsive infrastructure solutions.”

Kaplin is a vice president and Principal and has been with the firm since 2013. He has 36 years of experience in design and construction management of heavy civil projects using a variety of project delivery methods. As chief development officer, he will be responsible for leading and aligning strategic, marketing, and project initiatives for Delve Underground across the firm’s geographic footprint. For the past six years he has served as Delve Underground’s California regional manager, and prior to that was the construction management practice lead.

Martin takes over the role of Delve Underground’s California regional manager. She is a principal engineer based out of the firm’s Walnut Creek office and has 21 years of experience in design and construction management of civil projects focused on the fields of water, wastewater, and hydropower. As a vice president and California regional manager, she will be responsible for operations in the San Francisco, Walnut Creek, San Diego and Pasadena offices.
The Cutting Edge: Innovation, new technology and moving the industry forward

Editor’s note: This column was first published in the March issue of T&UC without the included image. This is the full column.

There is an adage that goes: “If you do what you always did, you’ll get what you always got.” And while that may be a zone of comfort for some, history shows that it typically leads to stagnation, at best, and demise, at worst. Others might rally to the cry of “change and grow or die,” or “evolution is the natural progression.” Wherever you may stand in the spectrum, it’s hard to argue that innovation, in its many possible incarnations, has made the industry what it is today. Further, innovation has increased the competitiveness of tunneling with other alternatives such as those built on the surface or at elevation.

So, where do we go from here … and how quickly?

It seems clear that the element of risk, particularly in terms of cost, is the primary headwind against innovation. I don’t think anyone necessarily innovates for the sake of it but rather because, with different approaches or implementation of new technologies, they visualize a better future state. One should always measure the potential benefit against what could go wrong … but not be paralyzed by it. Fortune also reportedly favors the brave and, for some like the British Special Air Service, it becomes their motto (They who dare, win!). So, by all means, evaluate and mitigate risk but do not reject innovation. You will pay a price in the long term.

A decade ago, the UCA took the innovative step of partnering with Tunneling Journal and creating the annual Cutting Edge Conference, a forum conceived with the intent of showcasing novelty, innovation, current issues and future visions in the tunneling industry. I have had the privilege as Chair to be a part of the organizing committees of the last two conferences (2021 in Dallas, TX and 2022 in Long Beach, CA). The feedback received for this two-day, single-track forum has been overwhelmingly and effusively positive. If you have not yet attended, I encourage you to do so in 2023 and beyond. It feels like real momentum is building behind this event.

In 2021, it was my honor to moderate a panel, comprised of one owner, engineer, contractor supplier and academic, to discuss the state of innovation in our industry. We discussed how good or bad we thought we were, what obstacles needed to be removed to foster innovation, and how did we measure innovation and its effects. The discussion was brisk, with great input and perspective from the audience. While celebrating that the industry has moved forward, there was also acknowledgment that our industry tends to be a technology adoption laggard, that cut-and-paste specifications are completely counter to innovation and adoption of new technologies, and that owner bodies tend to be against things that have not been proven somewhere else.

Hey, somebody’s got to be first; and then there is the rush to lead the way to be second. In the 2022 conference, there was an engaging panel of owners, with four representatives willing to sit and comment on tunneling from their perspectives, and to entertain questions from the audience. It was asked whether owners would be supportive of first-time innovation on one of their projects. One respondent stated confidently that if it was in respect to means, materials and methods, they would, provided a requisite risk analysis had been completed. A second panel member had a different take with the response being along the lines of “we can only do so much,” elaborating that there would be reluctance to try things that were not already applied elsewhere.

Contractors tell me that they want to innovate more, particularly where efficiency, cost and/or safety benefits can be realized on their projects at-hand, but that their hands get tied if it’s something “new.” Engineers may be open to evaluating new tech but, somewhere between avid interest and convincing their client that it is the way to go, enthusiasm gets lost. Suppliers, while happy to provide the tried-and-true, also keenly understand the need to innovate or their business will suffer when the next best mousetrap comes along from a competitor. But there also must be a receptive audience. Does this illustration strike a chord for anyone?

All industry participants have a part to play. Coming full circle, where do we go from here? It seems that in terms of stakeholder awareness (infrastructure owners, society-at-large), our industry is in the public eye more now than ever. We have the opportunity to show how the industry has innovated and got us to where we are now. We also have a burden to continue innovating, enabling the building of safer, bigger and better underground infrastructure, in lieu of alternatives at the surface.

Tunnel on!
Advertisers Index

AECOM ............................................. 11
Antraquip ......................................... 13
BabEng GmbH .................................... 14
Bekaert ............................................. 15
Brookville ......................................... 16
CAB ................................................ 17
CDM Smith ........................................ 18
Crux Subsurface ............................... 19
David R. Klug .................................... 20
Delve Underground ............................ 21
Drill Tech .......................................... 22
DSI Tunneling .................................... 23
Equipment Corp of America .............. 24
Gall Zeidler ....................................... 25
GeoForm ........................................... 27
Hager-Richter .................................... 28
Herrenknecht ................................... 29
HNTB ................................................ 29
IPI Packers ........................................ 31
J.H. Fletcher ...................................... 33
Jennmar ............................................. 35
Keller ............................................... 36
Kelley Engineered ............................. 38
Kiewit Infrastructure ......................... 37
MAPEI ............................................. 41
Michels Construction ....................... 39
Mining Equipment ......................... 40
Naylor Pipe ....................................... 42
NW Laborers-Employers ................... 43
Putzmeister Shotcrete ...................... 45
Senceive ......................................... 47
Sentinel Solutions ............................. 49
Soil Freeze ....................................... 48
Strata Products .................................. 51
Terratec ........................................... 53
Tunnel Radio ..................................... 53

ShowGuide

SME

Rapid Excavation and Tunneling Conference

June 11–14, 2023
Boston, MA
With the enormous economic boom, the demand for efficient traffic and utility infrastructures has increased dramatically. Here in North America, state-of-the-art tunnel systems for metro, road, water, sewage, gas and power supply are being built with proven and innovative Herrenknecht technology in a variety of different ground conditions. Herrenknecht guarantees the local support with their offices in Sumner, WA and Toronto, ON.

herrenknecht.com
DOWNLOAD THE RETC CONFERENCE APP

The most current conference information at your fingertips!

1. Scan the RETC QR Code

2. After downloading the App, click on the RETC app icon within

3. Choose your username (this is a one-time login)
   Password: retc23

App sponsored by Jacobs
Explore the RETC Exhibit Hall

Find your next industry partner at RETC. The Exhibit is packed with trusted companies ready to provide creative solutions and innovative products to meet your most challenging problems.

HYNES CONVENTION CENTER
Veteran’s Auditorium and Hall C, Level 2
Whether you are looking for something new to solve a problem or want to connect with current vendor partners, RETC brings it all together on the Exhibit Hall Floor. Meet with over 180 exhibitors, enjoy food and beverages, and take advantage of extended learning opportunities at the NEW IdeaXchange stage. Badges are required for admittance.

Monday, June 12
- Exhibit Hall Open 5:00 pm – 7:00 pm
- Exhibit Hall Opening Reception 5:00 pm – 7:00 pm
  Sponsored by JENNMAID Civil and Turnstone Industrial Solutions
- IdeaXchange Sessions 5:15 pm – 6:45 pm

Tuesday, June 13
- Exhibit Hall Open 11:00 am – 2:00 pm
- Exhibit Hall Lunch 11:30 am – 1:00 pm
- IdeaXchange Sessions 11:30 am – 1:50 pm
- Exhibit Hall Open 4:00 pm – 7:00 pm
- Exhibit Hall Reception 4:00 pm – 7:00 pm
  Sponsored by DSI Tunneling
- IdeaXchange Sessions 4:30 pm – 6:25 pm

Wednesday, June 14
- Exhibit Hall Open 9:00 am – 12:00 pm
- IdeaXchange Sessions 9:30 am – 11:25 am

IDEAXCHANGE AT RETC
The IdeaXchange stage located on the Exhibit Floor will host micro sessions focused on current hot topics in a new format. These 15-minute dynamic discussions will allow you the opportunity to engage with topics and exhibitors and sponsors in a new way. Find additional session details in the RETC mobile app.
MUMBAI: MITHI RIVER PROJECT

Previously used on the Mumbai Sewer Disposal Project (MSDP) Stage-II Priority Works in Mumbai, India, TERRATEC 3.14m diameter Earth Pressure Balance Machine (EPBM) is currently making excellent progress in the soft rock of the Mithi River Water Quality Improvement Project.

In recent years, TERRATEC’s order book has demonstrated significant growth & diversity globally including projects in South America, Europe and Asia which have been the result of robust custom made TBM designs, a readily available stock of TBM spares and consumables, and a highly skilled team offering specialised TBM support and prompt onsite assistance throughout tunnelling operations.
JENNMAR Civil
Monday Opening Exhibit Hall Reception Co-Sponsor
We have integrated JENNMAR products used in the coal industry into our civil engineering offerings. Our Civil product roster includes materials used for large diameter shaft and tunnel ground support systems, steel rail and pipe support products.
• Steel Tunnel Ribs and Shaft Rings • Steel Sets • Lattice Girders • Bolts: HR and CR Threadbar, M3® expandable rock bolts, FRICCTION-LOK® stabilizer systems, Fast Anchors™ DCP Bolts • Liner Plate (2-flange) with our Alliance Partners, Con-tech Engineered Solutions LLC • Resins • Rail, Rail Ties, Rail Hardware

DSI Underground
Tuesday Exhibit Hall Reception Sponsor
DSI has provided ground support products to the underground construction industry for over 100 years. With our signature 4 flange liner plate and superior beam bending capabilities we are the premier supplier of steel supports to tunnels and mines. We also offer engineering services from design through bidding to stamped submittals. Our range of products include DSI and Alwag rock bolts and Sequential Excavation Method (SEM); pipe umbrellas, lattice girders, forepoling. DSI also has a full line of TBM support products including drill consumables, large batch plants for back filling segment tunnels, Condcat TBM Lubricants.

Mott MacDonald
Digital Convention Center Branding Sponsor
Mott MacDonald provides tunnel design and engineering solutions for rail and transit, road, water/wastewater conveyance, CSO storage, and cable and communications. With a reputation for technical excellence, Mott MacDonald identifies practical approaches to tunneling, equipment selection and contracting approaches. Expertise includes soft ground and rock tunneling, cut and cover, underground caverns, immersed tube tunnels, jacked tunnels, and microtunneling. Complementary skills in technical areas include tunnel rehabilitation, ground stabilization and treatment, tunnel systems, ventilation, and life safety and security. With 16,000 employees worldwide, Mott MacDonald is one of the world's largest employee-owned companies.

Jacobs
Mobile App Sponsor
At Jacobs, we’re challenging today to reinvent tomorrow by solving the world’s most critical problems. Jacobs brings extensive design and construction management experience to all types of tunnel projects and has successfully delivered on the most complex and challenging design-build/P3 tunnel projects in the U.S. With a talent force of more than 60,000, Jacobs provides a full spectrum of professional services including consulting, technical, scientific and project delivery for the government and private sector.

Herrenknecht
Hotel Keycards Sponsor
Herrenknecht is a technology and market leader in the area of mechanized tunnelling systems. As the only company worldwide, Herrenknecht delivers cutting-edge tunnel boring machines for all ground conditions and in all diameters – ranging from 0.10 to 19 meters. The Herrenknecht product range includes tailor-made machines for all sorts of tunnels. Furthermore, Herrenknecht supplies an entire range of innovative machines for the mechanized construction of underground mining infrastructures. The company also produces state-of-the-art deep drilling rigs that drill down to depths of 8,000m and plants for the exploration of shallow geothermal energy. Company: www.herrenknecht.com LinkedIn: www.linkedin.com/company/herrenknecht-ag/
Traylor Bros
Lanyards Sponsor
Traylor Bros., Inc. (Traylor) is a family-owned corporation founded in 1946. For more than 75 years, Traylor has provided single-source, comprehensive, cutting-edge construction and design-build services to public works agencies throughout North America. The tremendous depth of experience in our engineering and management staff, together with our highly experienced field personnel, has allowed Traylor to develop some of the most innovative construction solutions in the industry. Our array of services includes tunnels and other underground structures, bridges, locks and dams, ports and wharfs, and mine development, as well as equipment support.

Hatch
Water Bottle Sponsor
Hatch is an international consulting engineering firm offering multi-disciplinary, design and construction management in the transportation, water, energy, mining and metals sectors. Our global presence of 65 offices and 10,000 staff worldwide, includes 21 offices and 1,000 staff in the USA. Hatch has deep roots in the North American tunneling industry for over 65 years. Hatch has participated in the design & delivery of some of the most complex tunnels and underground infrastructure projects in the world. We are passionately committed to the pursuit of a better world through POSITIVE CHANGE. Please join us at RETC 2023 booth #107.

Skanska
USB Proceedings Drives Sponsor
Skanska is nationally ranked as the third largest contractor in the United States for mass transit, with tunneling and rail being two of our core competencies. Skanska is one of the largest, most financially sound construction and development companies in the United States with a proven history of successfully delivering major tunnel projects throughout North America and the world. From such iconic tunneling and deep foundation projects as Second Avenue Subway & 7 Line Subway in NYC, First Street and Blue Plains tunnels in Washington DC to Regional Connector & Purple Line subway tunnels in Los Angeles, our portfolio of large-scale public infrastructure projects continues to expand. Skanska’s expertise in deep foundations and support of excavation, including slurry wall, secant wall and ground freezing techniques, have been invaluable to the success of our underground projects.

Turnstone Industrial Solutions
Monday Opening Exhibit Hall Reception Co-Sponsor
Turnstone Industrial Solutions, LLC., is a U.S.A. manufacturer of world-class ventilation systems, vertically integrated, with a goal to ensure customer satisfaction through the timely delivery of durable and reliable equipment that ensure a safe and efficient working environment in the harshest conditions.

Turnstone provides ventilation equipment, specifically to mining, tunneling, and industrial temperature control markets, that promote industry-leading safety and efficiency. The systems include negative and positive pressure flexible and semi-rigid offerings, with worldwide approvals, to ensure compatibility with a wide range of applications.
Master Builders Solutions
RETC IdeaXchange Innovation Stage Sponsor, UCA Young Members Reception Sponsor
Master Builders Solutions is a leading supplier of underground construction solutions to support tunneling success, even in highly challenging ground conditions. Master Builders Solutions has the largest range of products and services available to meet needs and solve problems in TBM and conventional tunneling, whether in soft ground or hard rock conditions. We offer a full range of MasterRoc® tunneling products such as soil conditioning foams and polymers, anti-clay agents, tail sealants, anti-abrasion agents, dust suppressants, bearing seal greases, EP2 greases and annulus grouts, plus product for sprayed concrete and injection for ground consolidation.

J.F. Shea Construction, Inc.
RETC exclusive Welcome Luncheon Sponsor
J.F. Shea Construction, Inc. has been involved in development of American Infrastructure since 1881. Shea’s storied past includes immense projects such as Hoover Dam, Golden Gate Bridge and the Interstate Highway system. Today, Shea’s experience spans 142 years in American Tunnel Construction, Water Treatment and Conveyance and Bridge Construction. As a fourth-generation family-owned tunnel and heavy civil construction firm our team has the requisite personnel, financial strength, bonding capacity, insurability, and safety experience to successfully complete each Project to demanding requirements.

The Walsh Group
Technical Sessions Sponsor
Founded in 1898, The Walsh Group is a fourth generation family-owned company providing design, build, finance, operation and activation services throughout the building, transportation and water markets. The Walsh Group operates as Walsh Construction, Archer Western and Walsh Canada across 18 regional offices and is consistently listed among the top U.S. contractors per Engineering News-Record. A leader in underground construction, The Walsh Group is experienced in delivering tunneling solutions for a variety of roadway, transit and environmental projects. Connect with The Walsh Group at www.walshgroup.com and across social media @thebiggreenw.

HNTB
Technical Sessions Sponsor
With 3800 professionals, HNTB is a leader in providing solutions to infrastructure problems nationwide. The firm has a long history in design and engineering services for tunnels and underground construction. HNTB has completed award-winning projects on some of the country’s most complex projects, including highway, transit, rail, aviation and water resources. HNTB’s experts have the insight and knowledge to provide state of the art innovative solutions to tunneling challenges, from small diameter excavations to designing the largest bored tunnel in the world (Alaskan Way Tunnel)-- utilizing both conventional tunneling methods (sequential excavation) or mechanized tunneling for variety of ground conditions.

Stantec
Technical Sessions Sponsor
The Stantec community unites approximately 22,000 employees working in over 350 locations across six continents. We have successfully delivered more than 1,200 underground projects in the past five years. Our portfolio includes tunnels up to 33 feet in diameter and shafts up to 110 feet in diameter. Our recent experience includes the City of Atlanta’s Raw Water Delivery System with 5 miles of 10-foot diameter tunnels, City of Ottawa’s CSST project with 3.7 miles of 9.8-foot diameter tunnels, and Metro Crenshaw/LAX Transit Corridor with three underground stations connected by four reaches of twin-bored, 21-foot diameter tunnels totaling 2 miles.

Barnard Construction
Tuesday Coffee Breaks Sponsor
People building for People. That’s what we do at Barnard. Whether we’re tunneling through the mountains of northern British Columbia or below the streets of downtown San Francisco, our people arrive at projects determined to do the best for their communities and be the best in the industry. We self-perform heavy civil and underground construction including TBM tunneling, drill and blast, and sequential excavation methods. Our work also encompasses power transmission, dams and reservoirs, pipelines, and environmental construction. We have built our reputation on skill, innovation, reliability, and safety. We live where we work and know our projects personally. We build for People.

Dyno Nobel
Attendee Giveaways
Dyno Nobel provides customer solutions through our people, our products, and our services. Our blasters are among the most highly trained in the industry. We offer a full range of reliable explosives products from manufacturing plants throughout the US and blasting services from a distribution network unmatched in the industry. Our R&D focuses on practical ways to use new technologies to benefit our customers. Renowned for our excellent safety performance and innovative explosive products and services, Dyno Nobel continuously delivers trusted technology, unmatched expertise, and explosive results.

SAK Construction
UCA Young Members Reception Sponsor & Women in Tunneling Breakfast Sponsor
AFFHOLDER, formerly the tunneling division of SAK Construction, is an industry leader in large-diameter tunneling, shaft excavation, shotcrete, and slippiping services. Our contribution to expanding, rebuilding, and maintaining America’s water infrastructure is unmatched, and we continue to deliver outstanding underground solutions with our unwavering commitment to safety and world-class services. Since 1968, our founder, Robert “Bob” Affholder’s principles have guided our operations, emphasizing customer satisfaction, hiring top talent, and fostering a valued work environment. Our innovative approach and 65+ years of expertise have earned us the trust of customers across the United States, with a legacy of successful projects that span decades.
The application of innovative design solutions and high quality field supervision has led to the successful construction of tunnels and underground structures.

Dr. Sauer & Partners Corporation
Bronze+ Sponsor
Dr. Sauer & Partners has been in practice in the United States for over 30 years, and employs tunnel engineers at main offices located in Washington D.C., London and Salzburg. The firm provides cost effective and innovative tunneling solutions using conventional mining approaches to owners and contractors. Dr. Sauer & Partners is recognized worldwide as one of the leading consultants for design and construction supervision of tunnels and underground structures. The application of innovative design solutions and high quality field supervision has led to the successful completion of numerous transportation and utility tunnels.

Schnabel Geotechnical Design Construction
Bronze+ Sponsor
Schnabel is a leading nationwide design-build contractor that provides customized earth retention and specialty foundation solutions for clients throughout the construction industry. They are well known for their unique blend of family pride, technological innovation, specialized equipment, extensive field experience, and engineering excellence that enables them to provide economical solutions and quality construction services to their clients.

Black & Veatch
Women in Tunneling Breakfast Sponsor
For more than a century, Black & Veatch has been developing the water conveyance and storage infrastructure that has built communities across the nation and around the world. As your needs evolve and grow, our experienced team is at the cutting edge of innovation, helping clients address the challenges of today, while planning for a more sustainable tomorrow. With a focus on sustainability and resilience that starts with you, we deliver long-term value to water, sanitation and stormwater clients at every stage of the project lifecycle. Learn more at www.bv.com/water.

Brierley Associates
Women in Tunneling Breakfast Sponsor
Brierley Associates is a nationwide tunnel, trenchless, geotechnical, and geo-structural design firm that specializes exclusively in the planning, design, and construction of subsurface projects. “Creating Space Underground” is our mission and our passion. Founded in 1999, the firm has grown to more than 85 geotechnical and geo-structural engineers and geologists specializing in underground construction. Working across the U.S. in various ground conditions gives us the ability to effectively interpret geotechnical conditions, understand the strengths and limitations of existing construction technologies, and methods that enable owners and contractors to successfully mitigate risk.

Delve Underground
Women in Tunneling Breakfast Sponsor
Delve Underground is a leader in heavy civil engineering, serving the transportation, water, wastewater, and energy industries. Specializing in tunnel design, we provide innovative solutions to the most challenging underground problems. We offer comprehensive design, construction management, and dispute resolution capabilities. Our expertise includes civil, structural, and geotechnical engineering. Founded in 1954, as Jacobs Associates, Delve Underground is an employee-owned firm with 21 offices and 350 team members throughout the United States, Canada, Australia, and New Zealand. www.delveunderground.com

Jay Dee Contractors
Mobile App Banner Ad Sponsor
We’ve never been ones to back down from a challenge. It is this mentality that has guided our company for nearly 60 years, giving us the experience necessary to tackle even the most complex projects. Recognized as the pioneer of the pipe jacking tunneling method, there is no challenge too great for our team to overcome.

Our team of skilled employees, paired with an extensive inventory of equipment, has allowed us to build a project portfolio that varies in size, scope and level of complexity. To date, Jay Dee has constructed and rehabilitated over 200 miles of underground spaces and tunnels in a variety of soil conditions, including soft ground and hard rock.

AZTEC/TYPSA Engineering
Bronze+ Sponsor
AZTEC/TYPSA is a multi-discipline engineering and environmental firm assisting public and private clients to plan, develop, design, construct, and maintain critical infrastructure projects around the world with permanent offices in 43 countries and 3,300+ staff worldwide. We provide our clients a one-stop shop covering all disciplines, including Geotechnics, Structural Engineering, MEP, IT, Architecture, Ventilation and FLS, and BIM throughout the whole lifecycle of major underground projects. Over the last 15 years alone, we have been involved in over 1,100 miles of tunnels with experience in a wide range of construction methods, challenging ground conditions and dense urban environments.
<table>
<thead>
<tr>
<th>EXHIBITOR LISTING</th>
<th>&amp; BOOTH NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC Industries, Inc</td>
<td>415</td>
</tr>
<tr>
<td>ABC Ventilation Systems</td>
<td>120</td>
</tr>
<tr>
<td>Acciona Infrastructure Canada Inc.</td>
<td>113</td>
</tr>
<tr>
<td>Ackcio</td>
<td>1072</td>
</tr>
<tr>
<td>Advanced Concrete Technologies, Inc</td>
<td>825</td>
</tr>
<tr>
<td>Advanced Infrastructure Design</td>
<td>908</td>
</tr>
<tr>
<td>AECOM</td>
<td>223</td>
</tr>
<tr>
<td>Aerix Industries</td>
<td>319</td>
</tr>
<tr>
<td>AGRU America, Inc</td>
<td>214</td>
</tr>
<tr>
<td>Algager S.A.</td>
<td>927</td>
</tr>
<tr>
<td>Alpine Equipment</td>
<td>615</td>
</tr>
<tr>
<td>Almagoured Mining &amp; Tunneling</td>
<td>426</td>
</tr>
<tr>
<td>Amberg Technologies Ltd</td>
<td>430</td>
</tr>
<tr>
<td>AMIX Systems Ltd</td>
<td>1023</td>
</tr>
<tr>
<td>AMR PEMCO, Inc</td>
<td>1011</td>
</tr>
<tr>
<td>Antraquip Corp</td>
<td>523</td>
</tr>
<tr>
<td>Arup</td>
<td>126</td>
</tr>
<tr>
<td>ASI Marine</td>
<td>831</td>
</tr>
<tr>
<td>Avanti International</td>
<td>618</td>
</tr>
<tr>
<td>BabEng, LLC</td>
<td>219</td>
</tr>
<tr>
<td>Ballard Marine Construction</td>
<td>312</td>
</tr>
<tr>
<td>BarChip Inc</td>
<td>424</td>
</tr>
<tr>
<td>Bauer Foundation Corporation</td>
<td>524</td>
</tr>
<tr>
<td>Bekkaert</td>
<td>411</td>
</tr>
<tr>
<td>Bessac</td>
<td>514</td>
</tr>
<tr>
<td>Brokk Inc</td>
<td>514</td>
</tr>
<tr>
<td>Brookville Equipment Corp</td>
<td>518</td>
</tr>
<tr>
<td>CAB</td>
<td>818</td>
</tr>
<tr>
<td>Carroll Technologies Group</td>
<td>808</td>
</tr>
<tr>
<td>CBE GROUP</td>
<td>627</td>
</tr>
<tr>
<td>CDM Smith</td>
<td>608</td>
</tr>
<tr>
<td>ChemGrou, Inc</td>
<td>422</td>
</tr>
<tr>
<td>Chengdu Foresight</td>
<td>932</td>
</tr>
<tr>
<td>CI&amp;Geo</td>
<td>809</td>
</tr>
<tr>
<td>Collier Geophysics</td>
<td>1008</td>
</tr>
<tr>
<td>Colorado School of Mines</td>
<td>725</td>
</tr>
<tr>
<td>Control International</td>
<td>625</td>
</tr>
<tr>
<td>Continental Building Materials</td>
<td>112</td>
</tr>
<tr>
<td>CREG TBM Germany GmbH</td>
<td>830</td>
</tr>
<tr>
<td>Crux Subsurface, Inc</td>
<td>519</td>
</tr>
<tr>
<td>Daigh Company, Inc</td>
<td>733</td>
</tr>
<tr>
<td>David R. Klug &amp; Associates, Inc</td>
<td>213</td>
</tr>
<tr>
<td>Deep Foundations Institute</td>
<td>900</td>
</tr>
<tr>
<td>Delve Underground</td>
<td>522</td>
</tr>
<tr>
<td>Derrick Corporation</td>
<td>427</td>
</tr>
<tr>
<td>Dibit Measuring Technique USA, Inc.</td>
<td>716</td>
</tr>
<tr>
<td>Dr. Sauer &amp; Partners Corp</td>
<td>317</td>
</tr>
<tr>
<td>DSI Tunneling LLC</td>
<td>408</td>
</tr>
<tr>
<td>Duham Geo Slope Indicator</td>
<td>702</td>
</tr>
<tr>
<td>E-BERK</td>
<td>118</td>
</tr>
<tr>
<td>EC Applications - Tunnel Lining</td>
<td>115</td>
</tr>
<tr>
<td>Ecoresources</td>
<td>517</td>
</tr>
<tr>
<td>ENVECO ENVIRONMENTAL SOLUTIONS, LLC</td>
<td>530</td>
</tr>
<tr>
<td>Epiroc</td>
<td>508</td>
</tr>
<tr>
<td>Equipment Corporation of America</td>
<td>709</td>
</tr>
<tr>
<td>Everest Equipment Co</td>
<td>516</td>
</tr>
<tr>
<td>FAMA Srl</td>
<td>836</td>
</tr>
<tr>
<td>Fiori Group S.p.A</td>
<td>614</td>
</tr>
<tr>
<td>FPT Infrastructure</td>
<td>431</td>
</tr>
<tr>
<td>Fugro</td>
<td>730</td>
</tr>
<tr>
<td>Gail Zeidler Consultants</td>
<td>711</td>
</tr>
<tr>
<td>GCP Applied Technologies</td>
<td>324</td>
</tr>
<tr>
<td>Geocomp Corp/GeoTesting Express, Inc</td>
<td>611</td>
</tr>
<tr>
<td>Geo-Instruments</td>
<td>909</td>
</tr>
<tr>
<td>GEOKON</td>
<td>423</td>
</tr>
<tr>
<td>Geosense Ltd</td>
<td>626</td>
</tr>
<tr>
<td>GeoSonics/Vibra-Tech</td>
<td>925</td>
</tr>
<tr>
<td>Gomez International, Inc</td>
<td>617</td>
</tr>
<tr>
<td>Grydale USA</td>
<td>910</td>
</tr>
<tr>
<td>Hatch</td>
<td>114</td>
</tr>
<tr>
<td>Herrenknecht Tunneling Systems USA, Inc</td>
<td>610</td>
</tr>
<tr>
<td>HTNB Corp</td>
<td>107</td>
</tr>
<tr>
<td>HOBAS Pipe USA</td>
<td>708</td>
</tr>
<tr>
<td>HYTORC</td>
<td>311</td>
</tr>
<tr>
<td>IIF Consultants, Inc.</td>
<td>123</td>
</tr>
<tr>
<td>Inflatable Packers Internacional LLC</td>
<td>109</td>
</tr>
<tr>
<td>Innovative Wireless Technologies</td>
<td>907</td>
</tr>
<tr>
<td>Inzwa Technologies</td>
<td>128</td>
</tr>
<tr>
<td>IoT Automation</td>
<td>622</td>
</tr>
<tr>
<td>J.H. Fletcher &amp; Co</td>
<td>425</td>
</tr>
<tr>
<td>JADCO Manufacturing Inc</td>
<td>106</td>
</tr>
<tr>
<td>JOK Underground, Inc</td>
<td>607</td>
</tr>
<tr>
<td>JENNIAR Civil</td>
<td>1022</td>
</tr>
<tr>
<td>Kayden Environmental Services</td>
<td>718</td>
</tr>
<tr>
<td>Keller</td>
<td>834</td>
</tr>
<tr>
<td>Messinger Bearings</td>
<td>416</td>
</tr>
<tr>
<td>Michels Corp</td>
<td>708</td>
</tr>
<tr>
<td>MILLER</td>
<td>814</td>
</tr>
<tr>
<td>Miller Sales and Engineering</td>
<td>824</td>
</tr>
<tr>
<td>MineARC Systems</td>
<td>916</td>
</tr>
<tr>
<td>Mining Equipment Ltd</td>
<td>417</td>
</tr>
<tr>
<td>Minova</td>
<td>714</td>
</tr>
<tr>
<td>MoxOnSite USA, Inc</td>
<td>837</td>
</tr>
<tr>
<td>Moldequipo Internacional</td>
<td>378</td>
</tr>
<tr>
<td>Mott MacDonald</td>
<td>509</td>
</tr>
<tr>
<td>MSP Structures Inc</td>
<td>926</td>
</tr>
<tr>
<td>Naylor Pipe Co</td>
<td>1007</td>
</tr>
<tr>
<td>Nexans AmerCable</td>
<td>707</td>
</tr>
<tr>
<td>Nicholson Construction Co</td>
<td>911</td>
</tr>
<tr>
<td>North American Drillers LLC, a Shaft Drillers International Company</td>
<td>311</td>
</tr>
<tr>
<td>Northwest Laborers-Employers Training Trust</td>
<td>724</td>
</tr>
<tr>
<td>Palmeiri S.p.A.</td>
<td>817</td>
</tr>
<tr>
<td>Parsons</td>
<td>314</td>
</tr>
<tr>
<td>Pini Group USA Inc</td>
<td>918</td>
</tr>
<tr>
<td>Polytcrest Systems GmbH</td>
<td>832</td>
</tr>
<tr>
<td>Promat</td>
<td>116</td>
</tr>
<tr>
<td>Promat International NV</td>
<td>117</td>
</tr>
<tr>
<td>Promat</td>
<td>116</td>
</tr>
<tr>
<td>PSC Crane and Rigging</td>
<td>826</td>
</tr>
<tr>
<td>Pulzmeister America, Inc</td>
<td>529</td>
</tr>
<tr>
<td>QSP Packers, LLC</td>
<td>728</td>
</tr>
<tr>
<td>Renesco Inc</td>
<td>327</td>
</tr>
<tr>
<td>Richard Goettle, Inc</td>
<td>936</td>
</tr>
<tr>
<td>Richway Industries</td>
<td>823</td>
</tr>
<tr>
<td>Robbins</td>
<td>409</td>
</tr>
<tr>
<td>ROBOODRILL S.A.</td>
<td>527</td>
</tr>
<tr>
<td>Roccscience, Inc</td>
<td>923</td>
</tr>
<tr>
<td>Rocvent Inc</td>
<td>815</td>
</tr>
<tr>
<td>Roxard Industries</td>
<td>528</td>
</tr>
<tr>
<td>Ruen Drilling, Inc</td>
<td>322</td>
</tr>
<tr>
<td>Sandvik Mining and Rock Solutions</td>
<td>412</td>
</tr>
<tr>
<td>Schauenburg Flexadux Corp.</td>
<td>835</td>
</tr>
<tr>
<td>Schauenburg Maschinen- und Anlagen-Bau GmbH</td>
<td>833</td>
</tr>
<tr>
<td>Schnabel Engineering</td>
<td>806</td>
</tr>
<tr>
<td>SEALABLE Solutions GmbH (formerly Datwyler Sealing Technology)</td>
<td>323</td>
</tr>
<tr>
<td>Seequent</td>
<td>308</td>
</tr>
<tr>
<td>Sencorse Corp</td>
<td>811</td>
</tr>
<tr>
<td>Sentinel Solutions LLC</td>
<td>525</td>
</tr>
<tr>
<td>Shannon &amp; Wilson, Inc</td>
<td>612</td>
</tr>
<tr>
<td>Shotcrete Technologies, Inc</td>
<td>722</td>
</tr>
<tr>
<td>Sigcom Inc</td>
<td>906</td>
</tr>
<tr>
<td>Sika Corporation</td>
<td>316</td>
</tr>
<tr>
<td>Simen Undergroounds, Inc</td>
<td>723</td>
</tr>
<tr>
<td>SIXENSE</td>
<td>315</td>
</tr>
<tr>
<td>SoilFreeze Inc</td>
<td>727</td>
</tr>
<tr>
<td>Southern Nevada Water Authority</td>
<td>429</td>
</tr>
<tr>
<td>Spendrueh Fan Co/OFT</td>
<td>715</td>
</tr>
<tr>
<td>Stage 3 Separation</td>
<td>630</td>
</tr>
<tr>
<td>Stanitec</td>
<td>212</td>
</tr>
<tr>
<td>STM Industreale SpA</td>
<td>802</td>
</tr>
<tr>
<td>Straas Worldwide I Tunelinel</td>
<td>827</td>
</tr>
<tr>
<td>STV Inc</td>
<td>1010</td>
</tr>
<tr>
<td>TBM Supply</td>
<td>616</td>
</tr>
<tr>
<td>Technical Tunneling Components LTD (TTC)</td>
<td>309</td>
</tr>
<tr>
<td>Technogenia Lasercah Okhoma Inc</td>
<td>735</td>
</tr>
<tr>
<td>Terra Insights</td>
<td>719</td>
</tr>
<tr>
<td>Terratec / Kelly Engineered Equipment</td>
<td>526</td>
</tr>
<tr>
<td>TLT-Turbo</td>
<td>428</td>
</tr>
<tr>
<td>TNL18</td>
<td>1026</td>
</tr>
<tr>
<td>Tovill, Inc.</td>
<td>217</td>
</tr>
<tr>
<td>TPH &amp; GEOFORM North America</td>
<td>629</td>
</tr>
<tr>
<td>TRE ALTAMIRA Inc</td>
<td>731</td>
</tr>
<tr>
<td>Trevicos</td>
<td>111</td>
</tr>
<tr>
<td>Trimble Inc</td>
<td>624</td>
</tr>
<tr>
<td>Tsurumi Pump</td>
<td>822</td>
</tr>
<tr>
<td>Tunnel Business Magazine (TBM)</td>
<td>513</td>
</tr>
<tr>
<td>Tunnel Radio of America, Inc</td>
<td>531</td>
</tr>
<tr>
<td>Tunnel24 GmbH</td>
<td>122</td>
</tr>
<tr>
<td>Tunneling Journal</td>
<td>413</td>
</tr>
<tr>
<td>Tunnels &amp; Tunneling</td>
<td>1006</td>
</tr>
<tr>
<td>TunnelTalk</td>
<td>325</td>
</tr>
<tr>
<td>United Rentals Trench Safety</td>
<td>110</td>
</tr>
<tr>
<td>VMU USA</td>
<td>209</td>
</tr>
<tr>
<td>VRod</td>
<td>515</td>
</tr>
<tr>
<td>Watson Bowman Acme</td>
<td>124</td>
</tr>
<tr>
<td>Williams Form Engineering Corp</td>
<td>418</td>
</tr>
<tr>
<td>Worldbusing SL</td>
<td>623</td>
</tr>
<tr>
<td>WSP</td>
<td>807</td>
</tr>
<tr>
<td>x-Glo North America Inc</td>
<td>310</td>
</tr>
<tr>
<td>Yamamoto Rock Splitter</td>
<td>628</td>
</tr>
<tr>
<td>Zeiron USA</td>
<td>329</td>
</tr>
</tbody>
</table>
ABC Industries, Inc
Booth 415
For over 90 years, ABC Industries continues to be a leading supplier of high quality, customized ducting solutions in mine, tunnel and underground construction operations worldwide. As these operations continue to evolve, ABC proactively collaborates with industry professionals to engineer unique, premium ventilation products. A new innovative addition to ABC's arsenal, RigiVent™ is a flexible, interlocking ducting solution for positive pressure applications requiring minimal storage and ease of handling. Similar to RigiDuct®, RigiVent™ is constructed from filament wound fiberglass rovings and reinforced with polyester fibers for added strength and resiliency. Visit our website to see more innovative solutions.

Products & Services
Dust and Fume Control Technology
Mining Equipment
Tunnel Lining and Support Materials
Ventilation Systems, Materials and Equipment

Main Office
301 Kings Hwy
Winona Lake, IN 46590 United States of America
Phone: (574) 267-5166
www.abc-industries.net

ABC Ventilation Systems
Booth 120
ABC Ventilation Systems is a world leader in mine and tunnel auxiliary ventilation solutions. Our commitment to always remaining the benchmark for quality, innovation and customer service ensures our end users receive unmatched products and support. Presently, our manufactured product offerings include: ToughVent High Efficiency Fans, HardLine Performance Ducting, HardLine Silencers, FlexLine Performance Ducting, Engineered Inflatables and Quality Accessories to complement all product lines.

Products & Services
Ventilation Systems, Materials and Equipment

Main Office
1802 Quebec Ave
Saskatoon, SK S7K 1W2 Canada
Phone: (306) 653-4303
abcventilation.com/

Acciona Infrastructure Canada Inc.
Booth 113
Products & Services
Construction - Contracting Services
Consulting Engineers

Main Office
900 W Hastings St, Ste 600
Vancouver, British Columbia V6C 1E5 Canada
Phone: (604) 458-6190
www.acciona.ca

Acciona Infrastructure Canada Inc.
Booth 1027
Acciona builds reliable wireless data acquisition systems for industrial monitoring applications. Accio's flagship solution, Accio Beam, is an industrial data acquisition platform that uses a patented long-range wireless mesh network to monitor sensors accurately and reliably in both above-ground and underground environments.

Products & Services
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services
Mining Equipment
Tunnel Communication Systems and Equipment

Main Office
4000, 421 – 7 Ave SW
Calgary T2P 4K9 Canada
Phone: (403) 891-8699
Email: sales@ackcio.com
www.ackcio.com

Advanced Concrete Technologies, Inc
Booth 825
Advanced Concrete Technologies, Inc. is the North America division of German based Wiggert & Co manufacturer of comprehensive concrete batching plants, mixers, automation/control systems, batching equipment, concrete distribution systems. Amongst the well-known brands are the high shear HPGM planetary countercurrent mixer, High output DWM twin shaft mixer, WicoMix concrete plants, CentroMix concrete plants, HydroMat microwave moisture measuring technology and the WCS PC based control system. ACT delivers highly efficient, fully integrated equipment solutions to the concrete industries and fulfills the demands for today’s highest quality and environmental standards.

Products & Services
Concrete Mixing and Transportation Equipment

Main Office
300 Portsmouth Ave
Greenland, NH 03840 United States of America
Phone: (603) 431-5661
Email: sales@concretebiz.com
www.concretebiz.com

Advanced Infrastructure Design
Booth 908
Digital tunnel inspection

Products & Services
Consulting Engineers

Main Office
1 Crossroads Dr
Greenland, NH 03840 United States of America
Phone: (603) 431-5661
Email: sales@ackcio.com
www.ackcio.com

AEM
See our ad on p. 11
Booth 223
With more than 2,000 miles of transit, roadway, water and energy tunnel projects worldwide, AECOM is at the forefront of the industry. Our 500 tunneling experts and 2,000 geotechnical engineers develop innovative, award-winning solutions for our clients’ toughest challenges worldwide. AECOM understands that specialized services are vital to a successful project. We bring extensive expertise in ESG and digital design, including alternative delivery and construction management. We provide fully integrated services to each aspect of large-scale tunnel design, management, inspection, rehabilitation, ventilation and FLS, and construction. We are driven by a common purpose to deliver a better world.

Products & Services
Consulting Engineers
Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment

Main Office
1111 3rd Ave, Ste 1600
Seattle, WA 98101 United States of America
Phone: (206) 743-8355
Email: BusinessInquiry.Americas@aecom.com
www.aecom.com/tunneling

Aerix Industries
Booth 319
Aerix Industries, manufactures and supplies a dynamic product line of integrated engineered foam liquid concentrates, enabling its customers to produce and install high quality lightweight backfill, ideal for annular grouting, tunnel arch backfill and flowable fill. The company's foams also allow its customers to transport tailings, sand, or other construction materials using minimal amounts of water. Aerix Industries dedication to research and technical support has allowed it to provide advanced engineered foam solutions to the construction and mining industries for more than 80 years.

Products & Services
Grouting Services, Equipment and Materials

Main Office
7020 Snowdrift
Allentown, PA 18106 United States of America
Phone: (610) 398-7833
Email: info@aerixindustries.com
www.aerixindustries.com

AGRU America, Inc
Booth 214
AGRU America, Inc. is the world's leading manufacturer of flat die extrusion geomembranes, concrete protective liners and tunnel liners. The company also supplies vertical barrier systems and large diameter piping systems for the U.S. and international civil/environmental markets. AGRU America is part of the worldwide AGRU Group, an Austrian family-owned business since 1948.

Main Office
1 Crossroads Dr
Hamilton, NJ 08691 United States of America
Phone: (609) 838-2216
Email: sales@adipe.com
www.adipe.com
with production facilities in Austria, the U.S., Germany
and China, and distribution in over 80 countries world-
wide.

Products & Services
Microtunneling Equipment, Tools, and Supplies
Precast Concrete Linings
Tunnel Lining and Support Materials
Underground Utility Materials and Operations
Wastewater Management Products
Water Treatment Plant and Materials

Main Office
500 Garrison Rd
Georgetown, SC 29440 United States of America
Phone: (843) 546-0600
Email: salesmkg@agruamerica.com
www.agruamerica.com

Algaher S.A.
Booth 927
ALGAHER is specialized in the design and production of
tunnel segment gaskets. ALGAHER has a wide range of
geometries focused on satisfying every project needs.
R&D is one of the most important feature for this com-
pany whose technical staff has developed recently a
new integration system for cast-in gaskets model, giv-
ing solution to real challenges of the current market.
ALGAHER is involved in many overseas projects where
currently is the only gasket supplier for all sectors of
HS2 in the UK. ALGAHER is also supplying gaskets in
the USA for PAWTUCKET tunnel.

Products & Services
Segment Accessories

Main Office
CTRA. CORELLA Km1
Alfaro, La Rioja 26540 Spain
Phone: +34 941 182 153
www.tunnelsegmentgaskets.com

Alpine Equipment
Booth 615
For 50 years Alpine/Rockwheel Americas has been a
trusted supplier of equipment for the underground,
construction, and mining sectors. Our Rockwheel line
of hydraulic drum cutter attachments allow for rapid
and precise removal of rock and concrete. Rockwheels
are available for excavators in any size class. We also
supply innovative hydraulic rotary soil mixing attach-
ments for use in remediation, stabilization, and solidi-
fication projects. All products are available on a rental
basis with purchase option. Alpine’s experienced team
can help with job-specific customization and is always
available for technical support, service and parts.

Products & Services
Ground Improvement Equipment and Services
Mining Equipment

Main Office
801 Pleasant View Blvd
Bellefonte, PA 16823 United States of America
Phone: (814) 466-7134
Email: info@rockwheelamericas.com
www.rockwheelamericas.com

Amalgamated Mining &
Tunneling
Booth 426
Main Office
6932 Roper Rd. NW
Edmonton, AB T6B 3H9 Canada
Phone: (801) 243-2065
www.amt-inc.ca

Amberg Technologies Ltd
Booth 430
Whether it’s a subway tunnel in London, a hydroelectric
plant on the Amazon river, the Gotthard Base Tunnel in
Switzerland or a high-speed rail route in China: Con-
struction projects of this magnitude are nothing unusu-
al for Amberg Technologies AG. The Swiss company is
one of the global leaders specializing in user-friendly
Delivering complex tunnel projects globally

Pictured:
Grand Central Madison, New York City

Contact:
Paul Nicholas
Vice President, AECOM Tunneling Practice
paul.nicholas2@aecom.com

#AECOMTunneling
aecom.com/tunneling

Delivering a better world
surveying solutions. Geophysicists and surveyors as well as software and hardware engineers at the head- quarters in Regensdorf design customized solutions for georeferenced data capture and processing in infra-structure installations. The company offers its custom- ers field-proven products as well as customer-specific services for railway surveying, tunnel surveying and tunnel seismic.

Products & Services
- Geological, Geotechnical Services and Equipment
- Laser Guidance Systems
- Survey Equipment and Lasers

Main Office
- Trockenlostrasse 21
- Regensdorf-Watt, Zurich 8105 Switzerland
- Phone: +41 44 870 92 22
- Email: info@amberg.ch
- ambergtechnologies.com/

AMIX Systems Ltd

Booth 1023

AMIX Systems Ltd. is a design, engineering and fabri- cation team that solves problems for today’s most chal- lenging grout mixing & backfill projects. We take com- plex project needs and build automated, self-cleaning products and systems that simplify the grout mixing process. If you are retrofitting existing plants, we’re your solution. Our team has a deep expertise in systems design and control automation. It’s not about selling systems, we’re on a mission to help companies reduce their overall equipment costs and make sig- nificant advances in productivity. We now have rents equipment available for all your grouting applications! Contact us for more information.

Products & Services
- Grouting Services, Equipment and Materials

Main Office
- Unit 460 - 688 Hastings St W
- Vancouver, BC V6B 1P1 Canada
- Phone: (604) 746 0555
- Email: Info@amixsystems.com
- www.amixsystems.com

AMR PEMCO, Inc

Booth 1011

Collectively, AMR PEMCO now offers: ground check/ fault monitors, electronic circuit breakers, speed sen- sors and tip switches, atmospheric (gas) monitoring, wireless communications, personnel/equipment track- ing, and collision avoidance systems, power centers, substations, dry-type transformers, industrial control buildings, and power distribution/PLC panels. The com- bined strength of AMR PEMCO’s management, engi- neering, and sales teams provide our customers with an unparalleled experience by leveraging AMR’s global sales network and electronics expertise with PEMCO’s extensive electrical knowledge and high quality crafts- manship.

Products & Services
- Environmental Control Equipment and Supplies
- Instrumentation Equipment and Services
- Mining Equipment
- Safety Products

Tunnel Communication Systems and Equipment
- Ventilation Systems, Materials and Equipment

Main Office
- PO Box 234
- 12187 N Scenic Highway
- Rocky Gap, VA 24366 United States of America
- Phone: (276) 326-2611
- Email: sales@amrpemco.com
- www.amrpemco.com

Antraquip Corp

See our ad on p. 13

Booth 523

USA based Antraquip is a leading manufacturer of drum cutter attachments for excavators (roadheader attach- ments), electrically driven roadheaders, and various tunnel support products. While AQ roadheaders are consistently used for tunnel excavation projects in soft rock, Antraquip drum cutters are frequently being used in the tunnel industry for various applications including tunnel excavation (even in hard rock where blasting is not possible), shaft sinking, tunnel enlargement, and refurbishment projects. Products within Antraquip’s expanding tunnel support division include lattice gird- ers, steel sets, arch canopy systems, and more. Rely on Antraquip, North America’s mechanized rock excava- tion experts for your next tunnel project.

Products & Services
- Roadheaders
- Rotary Drum Cutters
- Scaling
- Tunnel Boring Equipment
- Tunnel Lining and Support Materials
- Underground Excavation Services and Equipment

Main Office
- 758 Bowman Ave
- Hagerstown, MD 21740 United States of America
- Phone: (301) 665-1165
- Email: info@antraquip.net
- www.antraquip.net

Arup

Booth 126

Arup employs a multidisciplinary Total Tunnel Design approach to tackle some of the world’s most complex underground challenges. Beyond the core tunnel dis- ciplines of civil architecture, geotechnics, machinery and soil mechanics, our global team includes experts in ventilation, lighting, MEP, acoustics, fire, drainage, safety and public health. By integrating these skills, our tunnel designs are lower-risk and more efficient, effective and affordable. The designs our Total Tunnel Design approach makes possible are also sustainable, reducing excavation and materials by effective space proofing and lining system optimization and introducing innovations such as extracting heat from tunnel linings.

Products & Services
- Consulting Engineers
- Engineering Design and Services for Tunnels

Main Office
- 77 Water St
- New York, NY 10005 United States of America
- Phone: (212) 896-3000
- Email: tunnel-design@arup.com
- www.arup.com

ASI Marine

Booth 831

ASI specializes in providing hyperbaric intervention planning and management services for soft ground tunnel construction projects, and remote tunnel in- spection for flooded tunnels. Our Hyperbaric services include consultation for all hyperbaric needs includ- ing: planning, risk assessment, safety and adherence to local regulatory requirements. We also provide full hyperbaric intervention support; hyperbaric workers and worker training, specialized equipment with main- tenance program and servicing of the air-lock and sup- porting systems. ASI has been a global leader in remote inspections for more than 30 years, providing accurate and repeatable data for maintenance planning while delivering safe solutions for industry.

Products & Services
- Air Locks and Bulkheads
- Construction - Contracting Services
- Earth Pressure Balance Machines
- Microtunneling Equipment, Tools, and Supplies
- Survey Equipment and Lasers
- Tunnel Boring Equipment

Main Office
- 566 Arvin Ave
- Stoney Creek, ON L8E 5P1 Canada
- Phone: (905) 643-3283
- Email: info@asi-group.com
- asi-group.com

Avanti International

Booth 618

Avanti International a full-service producer of high-quality injection grouts in the United States. Since 1978, Avanti’s comprehensive line of injection grouts - including acrylic, polyurethane, epoxies and cements - have been used world-wide in municipal, industri- al, commercial and geotechnical applications to stop leaks, stabilize soils and rock, and control groundwater – permanently.

Products & Services
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Pumps and Pumping Equipment
- Underground Utility Materials and Operations

Main Office
- 822 Bay Star Blvd
- Webster, TX 77598 United States of America
- Phone: (281) 486-5600
- Email: info@avantigrout.com
- www.avantigrout.com
BabEng, LLC
See our ad on p. 14
Booth 219

Energy, enthusiasm, and knowledge – these are some of the qualities that drive our passion for understanding the world of underground works and making the most out of any TBM tunneling project. BabEng, is a worldwide engineering and consulting company specializing in underground works. Detailed knowledge about TBMs makes us a highly qualified project partner, able to complete critical tasks and solve problems from feasibility study to design and construction to contract closure. Tunnelsoft, a division of BabEng, offers software that is specifically tailored to the needs of TBM tunneling. It’s everything you need for in-depth tunneling analysis and documentation.

Products & Services
Computer Hardware and Software
Consulting Engineers
Engineering Design and Services for Tunnels

Main Office
28205 203rd Ave SE
Kent, WA 98042 United States of America
Phone: (253) 630-2221
Email: contact@babeng.com
www.babeng.com

Ballard Marine Construction
Booth 312

A leader in tunnel, shaft, caisson and pipeline construction support services for premier tunneling and mining contractors, as well as joint ventures. Ballard has a reputation for managing highly complex tasks in a cost effective and efficient manner. We have experienced supervisory personnel and a full complement of experienced and qualified compressed air workers, dive medical technicians, hyperbaric nurses, hyperbaric physician assistants, and other specialty personnel. Ballard owns and maintains related equipment from shuttles to tunnel specific saturation systems (SAT).

Products & Services
Construction - Contracting Services
Tunnel Boring Equipment

Main Office
727 S 27th St
Washougal, WA 98671 United States of America
Phone: (360) 695-5163
Email: liam.obrien@ballardmc.com
www.ballardmc.com/projects/tunnel-support/

Bauer Foundation Corporation
Booth 524

BAUER Foundation Corp. (BFC) is a Florida corporation and the U.S. subsidiary of the world-wide operating BAUER Group based in Schrobenhausen, Germany. The BAUER Group is a world-renowned foundation contractor, designer and builder of the world’s finest foundation equipment. BAUER Foundation Corp. as part of the BAUER construction division, is a nation-wide leader in the execution of complex excavation pits, ground improvement, deep foundations and vertical seals, utilizing the most up to date equipment and installation techniques. BAUER Foundation Corp. provides all types of foundation solutions and services for industrial, commercial, residential and governmental construction projects.

Products & Services
Ground Freezing
Grouting Services, Equipment and Materials

Main Office
13203 Byrd Legg Dr
Odessa, Fl 33556 United States of America
Phone: (727) 992-1769
Email: estimating@bauerfoundations.com
bauerfoundations.com

Bekaert
See our ad on p. 15
Booth 411

Bekaert, your global partner for smart reinforcement of your tunneling and mining project. We optimize your project by providing innovative, cost-effective and safe solutions. We offer a range of Dramix® steel fibers directly produced in the US to meet all Made In USA / Buy America requirements. Dramix® steel fiber reinforcement offers you sustainable and durable solutions which saves steel, concrete, and time while reducing the CO2 footprint of underground projects worldwide. We have a team of technical experts available, specifically dedicated to the underground construction world.

Products & Services
Concrete Reinforcement
Engineering Design and Services for Tunnels
Shotcrete Equipment, Supplies, and Services
The future of reinforced low carbon linings

A new frontier for tunnel linings, Dramix® high performance fibres achieve high performance requirements at lower dosage rates per cubic metre of concrete than ever before.

- Sustainable
- Durable
- EPD certified

Save concrete, steel, and time while significantly reducing CO₂ emissions

bekaert.com/underground
Bessac
Booth 313
Tunneling equipment and TBM manufacturer, special trenchless equipment. Tunnel and Micro Tunnel contractor.

Products & Services
Tunnel Boring Equipment
Tunnel Lining and Support Materials

Main Office
5161 Arapahoe Rd, Ste 420
Centennial, CO 80112 United States of America
Phone: (786) 570-0532
www.bessac.com/

Brokk Inc
Booth 514
BROKK is the world leader in electrically powered remote controlled demolition machines, which are used extensively in tunneling, cross-passages, shaft sinking, micro-tunneling, scaling, and other underground construction applications. BROKK machines can be equipped with a variety of attachments, such as hydraulic breakers, rock drills, rotary drum cutters, digging buckets, beam manipulators, and shotcrete nozzles. Boasting an impressive power-to-weight ratio, these compact machines can operate effectively in limited access, confined spaces, with zero-emissions. Operators can remain at a safe distance while they maneuver BROKK machines in challenging areas underground.

Products & Services
Underground Excavation Services and Equipment

Main Office
17321 Tye St SE, Ste B
Monroe, WA 98272 United States of America
Phone: (360) 794-1277
www.brokk.com

Brookville Equipment Corp
See our ad on p. 16
Booth 518
BROOKVILLE is a leading manufacturer of rail-mounted diesel and battery-powered tunneling locomotives and personnel carriers. Featuring planetary final drive gear reducers at each wheel end to divide driveline torque, shock loading for reduced stress and longer service life, and liquid-cooled internal wet disc brakes to extend brake life and provide maximum braking capacity for long, continuous grades, BROOKVILLE units are designed for dependability. Optional equipment features include explosion proofing and patented on-board relaying systems to enhance safety in all work environments. BROOKVILLE also manufactures rubber-tired equipment, ideal for steep tunnel grades, inspections, and maintenance for non-tracked projects.

Products & Services
Mining Equipment
Rail Products
Underground Locomotives and Rail Haulage Equipment

Main Office
175 Evans St
Brookville, PA 15825 United States of America
Phone: (814) 472-5077
www.cabproducts.com

CAB
See our ad on p. 17
Booth 818
For over 45 years CAB has been supplying the tunneling and mining industry with high quality hangers and safety products. CAB hangers are widely recognized for their high strength, quality and important safety features. They are designed to safely support all types of sensor, data, control, communication and electrical cables in above and below ground operations. With the growing importance of Safety in the Industries, CAB has greatly expanded its line of Safety Products in recent years. This includes products such as high-visibility streamers, markers, tubes, bags, and apparel.

Products & Services
Electrical - Generator-Motor, Wire-Cable
Mining Equipment
Safety Products
Tunnel Lining and Support Materials
Underground Utility Materials and Operations
Ventilation Systems, Materials and Equipment

Main Office
175 Industrial Park Rd
Ebensburg, PA 15931 United States of America
Phone: (814) 472-5077
www.cabproducts.com
Carroll Technologies Group

Booth 808

Carroll Technologies Group is a leading provider of Communications, Electronics, and Safety Equipment for the tunneling and mining sectors. We distribute products for over 80 manufacturers, repair/calibrate over 75% of those products, and have a service team on hand to help facilitate those needs. Our company is dedicated to giving you a service model 24/7 and we focus on the individual needs of our customers by providing a robust stock of the products they need at all times. Our number one goal is taking care of our customers and building a strong relationship.

Products & Services
- Electrical - Generator-Motor, Wire-Cable
- Hoists and Headframes
- Instrumentation Equipment and Services
- Lighting Systems
- Safety Products
- Tunnel Communication Systems and Equipment

Main Office
6822 Barger Pond Way
Knoxville, TN 37912 United States of America
Phone: (865) 771-4074
Email: jj@carrollengineeringco.com
www.carrolltechnologiesgroup.com

CBE Group

Booth 627

CBE Group designs and manufactures segment moulds, automated plants for segment production and segment handling equipment for tunnel projects all over the world. The company ensures assembly of precast plants, staff training and maintenance worldwide. Its offices are located in France, with two production sites in France and China. Since its creation in 1987, the company has achieved 620 projects and produced more than 29 500 moulds. Recent achievements include: High Speed 2 (UK), HRBT (USA), Snowy Hydro (Australia), Grand Paris (France), Sao Paulo L2 (Brazil), Sydney Metro West (Australia), Shanghai Metro (China), Chennai Metro (India), CR105 (Singapore), and more.

Products & Services
- Engineering Design and Services for Tunnels
- Precast Concrete Linings
- Segment Accessories
- Tunnel Lining and Support Materials

Main Office
17 rue Frederic Joliot-Curie
Saint-Avertin 37550 France
Phone: +33247375364
Email: cbe@cbegroup.fr
www.cbe-tunnels.com

CDM Smith

See our ad on p. 18
Booth 608

CDM Smith provides lasting and integrated solutions in water, environment, transportation, energy and facilities to public/private clients worldwide. As a full-service engineering and construction firm, we deliver exceptional client service, quality results and enduring value across the entire project life-cycle. CDM Smith’s underground construction staff includes geotechnical, structural, and civil engineers and geologists located across the globe. With a full range of tunnel-related services, we

Visit us at Booth #818
2023 Rapid Excavation & Tunneling Conference
June 11th - 14th, Boston, MA
www.cabproducts.com

Cambria County Association for the Blind and Handicapped

Serving the mining industry for over 45 years.

CAB Products are proudly Manufactured in the USA by Persons with Disabilities.
EXHIBITORS

provide planning, feasibility and design - both 2D and 3D FEM analyses, construction services, program management, inspection and geotechnical instrumentation monitoring and data interpretation.

Products & Services
Ground Freezing

Main Office
75 State St, Ste 701
Boston, MA 02109 United States of America
Phone: (617) 452-6000

ChemGrout, Inc
Booth 422
With more than 60 years of experience, ChemGrout continues to manufacture the world’s largest selection of grouting equipment. ChemGrout’s underground equipment offers exceptional productivity for contact grouting, water cut-offs, cable stays and rock bolts. Its patented pumps are industry standards offering reliability and durability, along with unique features simplifying clean up and maintenance. Offering many unique and innovative features, ChemGrout has remained the industry leader in underground grouting since 1963.

Products & Services
Grouting Services, Equipment and Materials
Pumps and Pumping Equipment

Main Office
805 E 31st St
LaGrange Park, IL 60526 United States of America
Phone: (708) 354-7112
Email: cginfo@chemgrout.com
www.chemgrout.com

Chengdu Foresight
Booth 932
Established in 2006, Chengdu Foresight Composite Co., Ltd. is an integrated manufacturer of flexible and semi-rigid PVC ventilation ducts for underground mines and tunnels with over 15 years of service to customers worldwide. We have a complete industrial chain from base fabric, PVC calendered membrane, lamination, semi-coating, and finished products. Product sales outlets are all over the country and exported to Europe, America, the Middle East, Southeast Asia, Africa, and other countries and regions. The company has obtained SGS, ISO9001 quality system certification, MSHA certification and D & B certification, and multiple product certifications.

Products & Services
Mining Equipment
Tunnel Boring Equipment
Tunnel Lining and Support Materials
Underground Utility Materials and Operations
Ventilation Systems, Materials and Equipment

Main Office
No.88 Longshi Rd
Chenghua District
Chengdu, Sichuan 610123 China
Phone: 13628049515
Email: yuanshuyu@cdfhcl.com
www.pvctextile.com

CJGeo
Booth 809
CJGeo specializes in annular space and abandonment grouting using cellular concrete, and water stop grouting. From neutral carrier buoyancy grouting to managing 23MGD leaks, CJGeo is a trusted partner throughout the Eastern United States for tunneling, utility and mining customers.

Products & Services
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials

Main Office
3402 Acorn St, #202
Williamsburg, VA 23188 United States of America
Phone: (800) 428-5690
Email: James@cjgeo.com
www.cjgeo.com

Leading the tunneling industry
- Engineering design
- Program/construction management
- Inspection/rehabilitation of underground structures
- Resident engineering
- Geotechnical engineering
- Risk management
- Cost estimating & life cycle cost analysis
- Value engineering & peer review

CDM Smith
cdmsmith.com
**Collier Geophysics**  
*Booth 1008*

Geophysical Survey & Investigations using the following methods: Electrical, Seismic, Electromagnetic, Potential Fields, Borehole Logging, Potential Field, Electrical Logs, Porosity Logs, Flow Meter, and Water Quality Logs. We also provide services in water, wastewater and environmental investigation including (but not limited to) hydrology, groundwater modeling, subsurface mapping, aquifer testing, water resources engineering, and construction management.

**Products & Services**  
Geological, Geotechnical Services and Equipment

**Main Office**  
596 Main St  
Woburn, MA 01801 United States of America  
Phone: (781) 935-8111  
Email: info@colliergeophysics.com  
colliergeophysics.com/

**Colorado School of Mines**  
*Booth 725*

Underground Construction and Tunnel Engineering Graduate Degree Program. The only program of its kind in the United States. Offering Masters Non-Thesis, traditional Masters, and PhD programs. We are also planning to offer a unique, 10-credit hour Graduate Certificate program, pending final approval and accreditation.

**Products & Services**  
Educational

**Main Office**  
1812 Illinois St  
Golden, CO 80401 United States of America  
Phone: (303) 273-3640  
Email: jengagne@mines.edu  
www.mines.edu

**Comtrol International**  
*Booth 625*

Control International is recognized as a major designer and Manufacturer of industrial communication and control systems for more than a half century. Our products are used in power generation plants, steel mills, chemical plants, paper mills and the Tunneling industry where rugged and reliable control and communication systems are necessary.

**Products & Services**  
Control Systems  
Safety Products  
Tunnel Communication Systems and Equipment

**Main Office**  
500 Pennsylvania Ave  
Irwin, PA 15642 United States of America  
Phone: (724) 864-3800  
www.comtrol-corp.com

**Continental Building Materials**  
*Booth 112*

Fiber reinforcement products for concrete and shotcrete

**Products & Services**  
Concrete Reinforcement  
Shotcrete Equipment, Supplies, and Services  
Tunnel Lining and Support Materials

**Main Office**  
1217 W Artesia Blvd  
Compton, CA 90220 United States of America  
Phone: (562) 432-1900  
Email: contact@continental-bm.com  
www.continental-bm.com

**CREG TBM Germany GmbH**  
*Booth 830*

CREG - China Railway Engineering Equipment Group Co., Ltd. - is a leading TBM supplier for mechanized tunnelling construction all around the world. CREG provides full-range TBM hard- and soft rock solutions together with its up-to-date technical solutions highly oriented towards project challenges and customer expectations.

**Products & Services**  
Engineering Design and Services for Tunnels  
Roadheaders

---

**Crux**

Crux specializes in difficult-access locations and is committed to solving our clients’ most challenging problems. The integration of in-house engineering with unique and experienced construction services allows us to seamlessly provide a more complete project package.

**Geotechnical Drilling Services**

- High-Efficiency Core Recovery  
- Specialty Grouting and Dewatering  
- Downhole Geophysics  
- Instrument Installation

**Experience. Innovation. Results.**

[www.cruxsub.com](http://www.cruxsub.com)
It is expected to be able to provide the Inland Feeder’s 72-km (45-mile) alignment of large-diameter tunnels for Jacobs Associates is in San Ber.

Indy is one of the most successful contractors in America. The successful contract bid for the Snowy Mountain hydro electric tunnel project was Walsh-Perini-Raymond on a successful basis.

The project is comprised of the mountain hydro electric tunnel project crosses an active splay of the San Andreas Fault and San Manwel Indian Reservation range from massive, hard, strong and seamy rock and crushed ground. Additional ground conditions in the tunnels were used along the alignment, were used along the alignment, and many of the tunnels pass beneath occupied historical buildings.

This job consists of a 1,500-m (4,921-ft) long underground rapid transit guideway with two underground rapid transit guideways.

While much of the work Jacobs Associates does is in California, the work Jacobs Associates does is in California, which was established the business as a one-person partnership in almost all levels of underground construction and tunneling.

David R. Klug & Associates, Inc.

David R. Klug & Associates, Inc. provides manufacturer representatives services to the underground civil and mine construction industries. The company specializes in products and services for soft ground, conventional, and NATM/SEM tunnels. Expertise is offered in the supply of componentry used in precast tunnel linings inclusive of EPDM gaskets, plastic and steel connectors, grout lifting assemblies and steel segment moulds plus final lining forming systems for C-I-P applications. Through their distribution company, Klug Construction Systems, LLC offers Nittetsu ultrafine cement, GFRP rock bolts and soft-eyes, steel and synthetic fiber reinforcement, prefabricated mesh and rebar reinforcement plus specialty grout systems for tunnel backfill requirements.

David R. Klug - Vice President

www.drklug.com

Show Guide - The leading monthly publication of the tunnel and mining industry.

EXHIBITORS

David R. Klug & Associates, Inc.

DAVID R. KLUG & ASSOCIATES, INC.

Specialty Products and Services for the North American Tunneling and Mining Industries

Jonathan D. Klug - Vice President

www.drklug.com

Tel (304) 905-8932
Fax (304) 905-0154
Cell (304) 281-4239

Main Office
4308 N Barker Rd
Spokane Valley, WA 99027 United States of America
Phone: (509) 892-9409
www.crusub.com

Daigh Company, Inc
Booth 733
Products: DA-MITE Rock Splitting Mortar & Hirado Powerful Hydraulic Rock Splitter: www.rocksplittingtech.com. Da-mite Rock Splitting Mortar, a non-explosive product used to fracture rock and concrete in no-blast conditions. Da-mite is an ideal and effective tool for boulders, tunnels, presplitting, mass rock, trench rock, dimensional stone & reinforced concrete. Easy to use. Mix with water & pour into properly drilled holes. Da-mite sets & expands with enough strength to fracture most any rock. No license required. 4 grades of Da-mite provide enough versatility to be utilized in drilled hole diameters from 1” to 3”.

Products & Services
Explosive Materials and Services

Main Office
84 Buford Dam Rd
Cumming, GA 30040 United States of America
Phone: (770) 886-4711
Email: sales@daighcompany.com
www.da-mite.com

David R. Klug & Associates, Inc.
Booth 213
See our ad on p. 20

David R. Klug & Associates, Inc. provides manufacturer representatives services to the underground civil and mine construction industries. The company specializes in products and services for soft ground, conventional, and NATM/SEM tunnels. Expertise is offered in the supply of componentry used in precast tunnel linings inclusive of EPDM gaskets, plastic and steel connectors, grout lifting assemblies and steel segment moulds plus final lining forming systems for C-I-P applications. Through their distribution company, Klug Construction Systems, LLC offers Nittetsu ultrafine cement, GFRP rock bolts and soft-eyes, steel and synthetic fiber reinforcement, prefabricated mesh and rebar reinforcement plus specialty grout systems for tunnel backfill requirements.

Products & Services
Tunnel Lining and Support Materials

Main Office
1994 Lumber Ave
Wheeling, WV 26003 United States of America
Phone: (304) 905-8932
Email: jklug@drklug.com
www.drklug.com

Deep Foundations Institute
Booth 900
DFI (www.dfi.org) is an international association of contractors, engineers, manufacturers, suppliers, academicians and owners in the deep foundations industry. Our multidisciplinary membership creates a consensus voice and a common vision for continual improvement in the planning, design and construction of deep foundations and excavations. We bring together members for networking, education, communication and collaboration. With our members, we promote the advancement of the deep foundations industry through technical committees, educational programs and conferences, publications, research, government relations and outreach. DFI has more than 4,000 members worldwide.

Products & Services
Educational Publishers

Crux Subsurface, Inc
See our ad on p. 19
Booth 519

Crux is a leader in geotechnical construction and exploration, combining innovative equipment and technologies with experienced team members to provide engineering and drilling services on some of the most logistically challenging projects in North America. With significant experience on a wide range of tunnel projects, we offer a broad understanding of challenging data acquisition and ground improvement techniques for tunnel upgrades and new tunnel construction. Expertise extends to high core recovery, borehole surveying and instrumentation, as well as pre-excavation stabilization including dewatering, permeation and compaction grouting, tube arch canopies, and cased horizontal boreholes.

Products & Services
Construction - Contracting Services
Drilling Services and Equipment
Geological, Geotechnical Services and Equipment
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials
Instrumentation Equipment and Services

Main Office
Willstätterstraße 15
Düsseldorf, Nordrhein-Westfalen 40549 Germany
Phone: 0049-211 522 889 00
Email: info@creg-germany.com
www.creg-germany.com

Rock TBM’s
Tunnel Boring Equipment
Underground Excavation Services and Equipment
Underground Locomotives and Rail Haulage Equipment

Main Office
Willsstätterstraße 15
Düsseldorf, Nordrhein-Westfalen 40549 Germany
Phone: 0049-211 522 889 00
Email: info@creg-germany.com
www.creg-germany.com

EXHIBITORS

David R. Klug & Associates, Inc.

DAVID R. KLUG & ASSOCIATES, INC.

Specialty Products and Services for the North American Tunneling and Mining Industries

Jonathan D. Klug - Vice President

www.drklug.com

1994 Lumber Ave.
Wheeling, WV 26003
Email: jklug@drklug.com
Derrick Corporation
Booth 427
Derrick is a family-owned and operated company with a global presence focused on pioneering fine-separation technology. Since 1951, Derrick has manufactured fine separation and dewatering equipment for the Mining and Aggregates industries. In 1988, Derrick branched out into the Civil Construction industry. From ruggedly dependable dewatering to slurry separation, Derrick’s innovative technologies are applicable to a global customer base and many worldwide markets. Derrick has remained dedicated to complete in-house manufacturing of every machine, screen panel, and tank system. Each unit is created and assembled at Derrick’s Buffalo, New York headquarters facility. To discover more, visit Derrick’s website.

Products & Services
Drilling Services and Equipment
Microtunneling Equipment, Tools, and Supplies
Slurry Services and Machines
Wastewater Management Products
Water Treatment Plant and Materials

Main Office
15630 Export Plaza Dr
Houston, TX 77032 United States of America
Phone: (281) 590-3003
Email: info@derrick.com
www.derrick.com

Dibit Measuring Technique USA, Inc.
Booth 716
Tunnel scanning

Products & Services
Construction - Contracting Services
Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services
Survey Equipment and Lasers

Main Office
15241 NE 90th Street, Suite 160
Redmond, WA 98052 United States of America
Phone: (425) 647-6502
Email: jerome.steinkuehler@dibit-scanner.com
www.dibit-scanner.com

Dr. Sauer & Partners Corp
Booth 317
Dr. Sauer & Partners has been in practice in the United States for over 30 years, and employs tunnel engineers at main offices located in Washington D.C., London and Salzburg. The firm provides cost effective and innovative tunneling solutions using conventional mining approaches to owners and contractors. Dr. Sauer & Partners is recognized worldwide as one of the leading consultants for design and construction supervision of tunnels and underground structures. The application of...
in innovative design solutions and high quality field supervision has led to the successful completion of numerous transportation and utility tunnels.

Products & Services
Consulting Engineers
Engineering Design and Services for Tunnels

Main Office
560 Herndon Pkwy, Ste 310
Herndon, VA 20170 United States of America
Phone: (703) 707-0700
Email: washington@dr-sauer.com
www.dr-sauer.com

DSI Tunneling LLC
See our ad on p. 23
Booth 408

DSI has provided ground support products to the underground construction industry for over 100 years. With our signature 4 flange liner plate and superior beam bending capabilities we are the premier supplier of steel supports to tunnels and mines. We also offer engineering services from design through bidding to stamped submittals. Our range of products include DSI and Alwag rock bolts and Sequential Excavation Method (SEM): pipe umbrellas, lattice girders, forepoling. DSI also has a full line of TBM support products including drill consumables, large batch plants for back filling segment tunnels, Condat TBM Lubricants.

Products & Services
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials
Tunnel Lining and Support Materials

Main Office
1032 E Chestnut St
Louisville, KY 40204 United States of America
Phone: (502) 473-1010
www.dsiunderground.com

Duham Geo Slope Indicator
Booth 702
Geotechnical and structural instrumentation

Products & Services
Instrumentation Equipment and Services

Main Office
4561 Greer Circle, Suite 100
Tucker, GA 30083 United States of America
Phone: (770) 465-7557
Email: mtibbutt@dgeslope.com
www.durhamgeo.com

E-BERK
Booth 118
E-BERK has launched its first TBM (Tunnel Boring Machine), E-3301 on May 2017. E-BERK has reached 12 TBM production capacity per year. E-BERK has been manufacturing spare parts for TBMs since 2002. E-BERK configures and manufactures Cutterhead in demanded diameters and sizes for all types of Tunnel Boring Machines (TBM) suitable for various geological conditions. The Multi-Purpose Tunnel Service Vehicle (MSV) is produced in only four countries in the world and is produced now by E-BERK Tunneling & Foundation Technologies as well. E-BERK company has actively participated as a solution partner for more than 100 projects.

Products & Services
Abrasion and Impact Resistant Materials
Conveyor Equipment and Systems
Microtunneling Equipment, Tools, and Supplies
Tunnel Boring Equipment
Tunnel Haulage Systems
Underground Locomotives and Rail Haulage Equipment

Main Office
Mal?köy Anadolu Osb Mah. 12. Cad. No:24, 06909 ANKARA, SINCAN Turkey
Phone: +90 (0312) 267 48 48
Email: sales@e-berk.com
e-berk.com/
We have the ability to solve every application challenge, whatever the ground conditions.

www.dsitunneling.com
EC Applications - Tunnel Lining
Booth 115
EC Applications supplies and installs protective tunnel liner systems combining the advantages of thermoplastics (HDPE, LLDPE & PVC) with associated materials (geotextile, waterbar, injectable grout hose and components) required for a turnkey tunnel lining system. ECA's qualified installation technicians, project experience and Los Angeles based fabrication facility provide a cost effective solution for geomembrane tunnel lining on any project.

Products & Services
Construction - Contracting Services
Tunnel Lining and Support Materials

Main Office
901 E Orangethorpe Ave
Anaheim, CA 92801 United States of America
Phone: (714) 921-9848
www.tunnellining.com

Ecoequipment Rentals
Booth 517

Main Office
75 Stedman St
Boston, MA 02130 United States of America
Phone: (617) 955-5630
Email: niall.osullivan@ecoquipment.com
www.ecoquipment.com

ENVECO ENVIRONMENTAL SOLUTIONS, LLC
Booth 530
Environmental Remediation, Dewatering, Muck and Spoils Processing and Disposal Solutions,

Products & Services
Consulting Environmental Drilling Services and Equipment
Environmental Control Equipment and Supplies
Slurry Services and Machines
Wastewater Management Products
Water Treatment Plant and Materials

Main Office
103 Manor Lake Estates Dr
Spring, TX 77379 United States of America
Phone: (713) 818-2930
Email: rgarland@envecoenvironmental.com
www.envecoenvironmental.com

Epiroc
Booth 508
Epiroc is a leading global productivity partner for the mining and infrastructure industries. With cutting-edge technology, Epiroc develops and produces innovative, safe and sustainable drill rigs, rock excavation and construction equipment and tools. The company also provides world-class service and solutions for automation and interoperability. The company is headquartered in the US near Denver, Colorado. Employing approximately 450 people, it extends its reach through a nationwide network of service centers and drilling distributors.

Products & Services
Hydraulic Hammers and Drills
Mining Equipment
Rock Drills
Rotary Drum Cutters
Tunnel Boring Equipment

Main Office
8001 Arista Pl, Ste 400
Broomfield, CO 80021 United States of America
Phone: (844) 437-4762
Email: inquiries@epirocmarketing.com
www.epiroc.us

Equipment Corporation of America
See our ad on p. 24

Main Office
PO Box 306
Coraopolis, PA 15108 United States of America
Phone: (336) 854-1220
Email: info@ecanet.com
www.ecanet.com

Everest Equipment Co
Booth 516
Since 1975, Everest Equipment Co. has been a designer and manufacturer of underground construction forms in North America. Everest is your formwork source should your project require shaft formwork, blast-proof shaft formwork, types of tunnel formwork, California switches, underground gantries and equipment. Everest is proud to encompass sales support, engineering, fabrication and onsite servicing of formwork designed to meet the requirements of underground forming. The formwork expertise has assisted contractors in underground tunnels, vehicular tunnels, hydro development projects and pre-cast primary liner segments. Its Canadian operation supports the products through many core employees that have built their careers with Everest.

Products & Services
Tunnel Lining and Support Materials

Main Office
1077 Westmount St
Ayer’s Cliff, QC J0B 1C0 Canada
Phone: (819) 838-4257
www.everestconstructionforms.com
FAMA Srl
Booth 836
Gasket and accessories for tunnel lining and precast plant

Products & Services
Segment Accessories

Main Office
via della Fossa 6
Zoppola, Pordenone 33080 Italy
Phone: +390434977783
Email: info@famaspa.it
www.famaspa.it

Fiori Group S.p.A
Booth 614
Concrete Self Loading Mixers, Site Dumpers

Products & Services
Concrete Mixing and Transportation Equipment
Grouting Services, Equipment and Materials
Underground Excavation Services and Equipment

Main Office
8333 NW 53 Rd St, Ste 450
Doral, FL 33166 United States of America
Phone: (240) 893-6580
Email: info@fiorigroup.com
www.fiorigroup.com

FPT Infrastructure
Booth 431
FPT Infrastructure repairs, protects and enhances the vital infrastructure that moves and connects us. With systems for structure waterproofing, ground stabilization, foundation and wall protection, and movement joint sealing, FPT can supply customized solutions for tunnel, trench and underground construction projects. Visit booth 431 to meet our team and learn more about our global experience in infrastructure preservation and protection.

Products & Services
Abrasion and Impact Resistant Materials
Geological, Geotechnical Services and Equipment
Grouting Services, Equipment and Materials
Microtunneling Equipment, Tools, and Supplies
Soil Conditioning Equipment and Materials
Tunnel Lining and Support Materials

Main Office
401 Old US 52 South
Mt Airy, NC 27030 United States of America
Phone: (336) 789-7259
Email: info@fptinfrastructure.com
www.fptinfrastructure.com

Fugro
Booth 730
Site screening; integrated digital site characterization; analytics, design and advice; design calibration and verification; geo-monitoring; structural health monitoring

Products & Services
Consulting Engineers

Main Office
6100 Hillcroft St
Houston, Texas 77081 United States of America
Phone: (713) 369-5600
Email: sewald@fugro.com
www.fugro.com

Gall Zeidler Consultants
See our ad on p. 25
Booth 711
Gall Zeidler Consultants is an international engineering consultancy firm specialized in innovative solutions for tunnel and underground projects. For over 20 years, we use our broad expertise in transportation, infrastructure, water conveyance, energy and mining projects to help our clients overcome challenging conditions and providing innovative solutions from conceptual and planning phases through construction and operation. Our engineering services cover all stages of a project: Conceptual to Final Design, Program & Construction Management, Construction Site Support, Tunnel Inspection & Rehabilitation, Mine Access Tunnels & Shafts, Independent Design Verification Services, Building Information Modeling (BIM)

For over 20 years, Gall Zeidler Consultants has been delivering innovative and sustainable underground solutions for massive infrastructure and environmental projects. We strive to produce environmentally conscious solutions for our projects, such as the Pawtucket Combined Sewer Overflow Tunnel in Providence, Rhode Island, for which we are providing designs for the SEM tunnels, adits and large diameter shafts up to 150 feet deep. Our elevated thinking for underground projects provides sustainable solutions for a greener future.

Visit us during the RETC 2023 at booth 711.

Gall Zeidler Consultants
Geotechnics | Tunnel Design | Engineering
www.gzconsultants.com

The Pawtucket Combined Sewer Overflow Tunnel in Providence, Rhode Island.
GCP Applied Technologies

Booth 324

GCP, a Saint-Gobain company, is a leading provider of construction materials that includes TYTRO™ solutions for tunnels and DE NEEF® injection materials, along with high-performance waterproofing products for buildings and infrastructure. The GCP portfolio offers solutions for different environments and uses, so builders have the best options available for specific applications. With products that last longer and make construction more energy efficient and less wasteful, GCP makes a tangible difference on the carbon footprint of our planet. GCP is focused on continuous improvement for its customers, end-users, and the environment.

Products & Services

Concrete Reinforcement
Grouting Services, Equipment and Materials
Shotcrete Equipment, Supplies, and Services
Tunnel Lining and Support Materials

Main Office
2325 Lakeview Pkwy
Alpharetta, GA 30009 United States of America
Phone: (617) 876-1400
Email: info@geocomp.com
www.geocomp.com

Geo-Instruments

Booth 909

Geo-Instruments provides automated solutions for monitoring the safety and stability of buildings, excavations, bridges, railways, roads, tunnels, dams, embankments, and slopes. We help clients manage risk by installing advanced monitoring systems and automating the collection, processing, and delivery of alarms, data, and reports. Established in 2003, Geo-Instruments has acquired a reputation for getting results and providing excellent customer service. Our team has extensive experience in instrumentation, information technology, civil engineering, and construction. Geo-Instruments also maintains a large inventory of rental equipment and specializes in sales, rentals, calibrations, and repair of instantal vibration monitors and seismographs.

Products & Services

Dust and Fume Control Technology
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office
24 B Celestial Dr
Narragansett, RI 02882 United States of America
Phone: (401) 782-1045
www.geo-instruments.com

GEOKON

Booth 423

GEOKON is a recognized world leader in the manufacture of structural and geotechnical instrumentation. Founded in 1979, GEOKON offers a full complement of instrumentation for industries including tunnels, dams, mines, piles, bridges, pipelines, landfills, embankments, transportation and wind turbines. GEOKON incorporates state-of-the-art manufacturing processes and equipment to produce the highest quality and performing products on the market. GEOKON has been awarded ISO 9001:2015 registration from both ANSI•ANAB, USA and UKAS of Great Britain. GEOKON products are supported by an experienced team of factory-trained associates ready to assist with instrument design, selection and installation. All products include a full, 13-month warranty.

Products & Services

Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office
48 Spencer St
Lebanon, NH 03766 United States of America
Phone: (603) 448-1562
Email: info@geokon.com
www.geokon.com

GeoSonics/Vibra-Tech

Booth 925

If you are managing a construction project that uses heavy equipment or blasting, your project will create off-site vibrations that can put your organization and reputation at risk. Since 1949, GeoSonics/Vibra-Tech has been providing vibration and blast consulting services. We have the tools and experience to help you manage your construction risk. Our Re:mote Monitoring Technology continuously collects and posts data to a customized website, keeping project personnel notified through email/text alarms. Re:mote monitoring capabilities bring the field to you whether you need vibration, noise, dust, geotechnical or environmental monitoring.

Products & Services

Blasting Services and Supplies
Engineering Design and Services for Tunnels
Explosive Materials and Services
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office
109 East First Street
Hazleton, PA 18201 United States of America
Phone: (570) 455-5861
Email: info@geosonicsvibratech.com
www.geosonicsvibratech.com

GeoSonics/Vibra-Tech

Booth 925

If you are managing a construction project that uses heavy equipment or blasting, your project will create off-site vibrations that can put your organization and reputation at risk. Since 1949, GeoSonics/Vibra-Tech has been providing vibration and blast consulting services. We have the tools and experience to help you manage your construction risk. Our Re:mote Monitoring Technology continuously collects and posts data to a customized website, keeping project personnel notified through email/text alarms. Re:mote monitoring capabilities bring the field to you whether you need vibration, noise, dust, geotechnical or environmental monitoring.

Products & Services

Blasting Services and Supplies
Engineering Design and Services for Tunnels
Explosive Materials and Services
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office
109 East First Street
Hazleton, PA 18201 United States of America
Phone: (570) 455-5861
Email: info@geosonicsvibratech.com
www.geosonicsvibratech.com

GeoSense Ltd

Booth 626

GeoSense is a leading UK manufacturer and global supplier of geotechnical instrumentation. Our history includes the support of iconic international projects across tunnels, metros, deep foundations, dams, and others. We specialize in Vibrating Wire and MEMS technologies, alongside data logging options, and other sensor types. For RETC, GeoSense will showcase recent product innovations. These include our redeveloped in-place-inclinometer (slimmer, lighter, proven performance) and IPI-X (combining both tilt and settlement monitoring via a single borehole).

In support of our North American customers, GeoSense has recently opened a US office located in New York.

Products & Services

Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office
15 West 38th Street
Suite 632
New York NY 10018 United States of America
Phone: 518-920-3483
Email: sales@geosense.com
www.geosense.com
PSGi®
Polymer Stabilizing Geoinjection

Eco Friendly
Human Friendly
Worker Safety Friendly

Consolidated ground zone created by grouting

Ground Consolidation & Leakage Stopping Solutions

Geoform Systems
2165 Buckingham Rd.
Oakville, ON L6H 0W7
CANADA
Phone: 1-833-GEOFORM
E-mail: info@geoforming.com
www.geoforming.com

Innovative Engineering

Proven Technology
EXHIBITORS

Grydale USA

**Booth 910**

Grydale manufacture a patented range of fixed, mobile and onboard industrial dust collectors, being used to solve dust and fume problems within major tunnelling, mining, quarrying, abrasive blasting and construction projects. Major tunnel contracts include, Melbourne Metro, VIC, WestConnex (Sydney, NSW), Sydney Metro (NSW), CRL (Auckland, NZ), HS2 (UK), Neom (Saudi Arabia) and more. We have mobilized source extraction and hold the patent for manufacturing self-propelled dust extractors, making the JMS M Series unique in the market. RDO Equipment Co are the North American Dealer for the Grydale product range and able to provide local sales, rental, service and support.

**Products & Services**
- Dust and Fume Control Technology
- Ventilation Systems, Materials and Equipment

**Main Office**
20 Iowa Avenue
Riverside, CA 92507 United States of America
Phone: (888) 479-3253
Email: info@grydaleusa.com
www.grydaleusa.com

GZA GeoEnvironmental, Inc

**Booth 114**

Focused on construction, GZA’s Contractor Services is intimately familiar with the fast-paced complexities of tunneling, heavy-civil, highway, and marine construction projects. Empowered by a team of dedicated engineers and decades of experience on small to mega-large construction projects, we are prepared to assist contractors with a variety of high-quality services including: Geotechnical Instrumentation, Automated Air Quality, Vibration, Noise, Dust & Weather Monitoring and Analysis, Excavation Support Design, Deep Foundation Testing, Pre-Bid Value Engineering, Pre- and Post- Construction Structural Condition Survey, Structural Construction and Demolition Engineering, Environmental Services, Construction Management

**Products & Services**
- Construction - Contracting Services
- Consulting Engineers
- Consulting Environmental
- Geological, Geotechnical Services and Equipment
- Instrumentation Equipment and Services
- Survey Equipment and Lasers

**Main Office**
249 Vanderbilt Ave
Norwood, MA 02062 United States of America
Phone: (781) 278-3700
Email: rayan.shamas@gza.com
www.GZA.com

H+E Logistics USA, Inc

**Booth 211**

Conveyor belt systems

**Products & Services**
- Conveyor Equipment and Systems
- Mining Equipment

**Main Office**
1613 132nd Ave E, Ste 200
Sumner, WA 98390 United States of America
Phone: (253) 447-2300
Email: info@helogistik.de
www.helogistik.de

Hager-Richter Geoscience, Inc

**See our ad on p. 28**

**Booth 610**

HAGER-RICHTER GEOSCIENCE, INC. is a well-established small business that specializes in Surface and Borehole Geophysics for Engineering applications (NAICS 541360). The firm has been in business since 1984, has earned a national reputation, and has a nationwide practice. Hager-Richter is headquartered in Atkinson, New Hampshire and has had a fully staffed and equipped New York/New Jersey Regional Office in New Jersey since 2001. Hager-Richter has extensive experience in providing high resolution surface and borehole geophysical services to support tunneling infrastructure projects throughout the U.S.

**Products & Services**
- Consulting Engineers
- Consulting Environmental
- Geological, Geotechnical Services and Equipment

**HRGS**

Hager-Richter Geoscience, Inc.

**Hager-Richter Geoscience, Inc.**

Geophysics for the Engineering Community


**www.hager-richter.com**

8 Industrial Way – D10
Salem, New Hampshire 03079
T: 603.893.9944

846 Main Street
Fords, New Jersey 08863
T: 732.661.0555
Delivering the Extraordinary

Delivering context sensitive, innovative and inclusive solutions on the country’s most complex tunneling projects to help connect communities.

The HNTB Companies
Infrastructure Solutions
hntb.com

Sanja Zlatanic
Chair, National Tunnel Practice
szlatanic@hntb.com | (646) 652-9440

Presidio Parkway
San Francisco, California
Heronknecht is a technology and market leader in the area of mechanized tunneling systems. As the only company worldwide, Herrenknecht delivers cutting-edge tunnel boring machines for all ground conditions and in all diameters — ranging from 0.10 to 19 meters. The Herrenknecht product range includes tailor-made machines for all sorts of tunnels. Furthermore, Herrenknecht supplies an entire range of innovative machines for the mechanized construction of underground mining infrastructures. The company also produces state-of-the-art deep drilling rigs that drill down to depths of 8,000m and plants for the exploration of shallow geothermal energy. Company: www.herrenknecht.com, LinkedIn: www.linkedin.com/company/herrenknecht-ag/

Products & Services
Earth Pressure Balance Machines
Microtunneling Equipment, Tools, and Supplies

Rock TBM’s
Shaft Drilling and Raiseboring Equipment
Soft Ground Shields
Tunnel Boring Equipment

Main Office
1613 132nd Ave E, Ste 200
Sumner, WA 98390 United States of America
Phone: (253) 447-2200
www.herrenknecht.com

HOBAS Pipe USA
Booth 225

Hobas pipes are centrifugally cast, fiberglass-reinforced, polymer mortar (CCFRPM) pipe, they are inherently corrosion resistant and last 100 years or more. Engineers and contractors regularly select Hobas pipe for all its performance features: light weight, high strength, ease of installation, leak-free push together joints and adaptability to most installation methods including open cut, sliplining, jacking, microtunneling, two-pass tunnel, casing carrier and above ground. Non-pressure and pressure classes are manufactured in diameters from 18 to 126 inches.

Products & Services
Underground Utility Materials and Operations
Wastewater Management Products
Water Treatment Plant and Materials

Main Office
1413 E Richey Rd
Houston, TX 77073 United States of America
Phone: (281) 821-2200
www.hobaspipe.com

HYTORC
Booth 706
HYTORC makes the world’s most trusted industrial bolting systems. With over 50 years of experience, our team specializes in providing the most efficient solutions for your toughest bolting jobs. For custom projects, our highly-experienced engineering team will design a solution tailored to your needs with guaranteed improvements in safety, speed and accuracy. On-site service and preventative maintenance ensures your equipment is always ready when you need it. Visit hytorc.com/world for your nearest HYTORC bolting specialist.

Products & Services
Construction - Contracting Services
Pumps and Pumping Equipment
Safety Products

Main Office
333 NJ-17 N
Mahwah, NJ 07430 United States of America
Phone: (201) 512-9500
Email: stewart@hytorc.com
www.hytorc.com

ILF Consultants, Inc.
Booth 934
Fire-life-safety engineering

Main Office
502 2nd Ave, Ste 1400
Seattle, WA 98101 United States of America
Phone: (206) 960-6948
www.ilf.com

Inflatable Packers International LLC
See our ad on p. 31
Booth 914
Grout-free Standpipes and Grouting Packers

Main Office
PO Box 2446
PO Box 2446
18 Pepsi Drive
Red Lodge, MT 59068 United States of America
Phone: (406) 446-9940
www.ipipackers.com

Illinois Tool Works, Inc.
Main Office
2 Industrial Way S/2
Atkinson, NH 03811 United States of America
Phone: (603) 370-7518
Email: jeff.reid@hager-richter.com
www.hager-richter.net

Hatch
Booth 107
Hatch is an international consulting engineering firm offering multi-disciplinary, design and construction management in the transportation, water, energy, mining and metals sectors. Our global presence of 65 offices and 10,000 staff worldwide, includes 21 offices and 1,000 staff in the USA. Hatch has deep roots in the North American tunneling industry for over 65 years. Hatch has participated in the design & delivery of some of the most complex tunnels and underground infrastructure projects in the world. We are passionately committed to the pursuit of a better world through POSITIVE CHANGE. Please join us at RETC 2023 booth #107.

Products & Services
Construction - Contracting Services
Consulting Engineers
Consulting Environmental
Engineering Design and Services for Tunnels

Main Office
2800 Speakman Dr
Mississauga, ON L5K 2R7 Canada
Phone: (647) 448-5832
www.hatch.com

HOBAS Pipe USA
www.hobaspipe.com

Hytorc
See our ad on p. 29
Booth 216
With 3800 professionals, HNTB is a leader in providing solutions to infrastructure problems nationwide. The firm has a long history in design and engineering services for tunnels and underground construction. HNTB has completed award-winning projects on some of the country’s most complex projects, including highway, transit, rail, aviation and water resources. HNTB’s experts have the insight and knowledge to provide state of the art innovative solutions to tunneling challenges, from small diameter excavations to designing the largest bored tunnel in the world (Alaskan Way Tunnel) — utilizing both conventional tunneling methods (sequential excavation) or mechanized tunneling for variety of ground conditions.

Products & Services
Engineering Design and Services for Tunnels
Tunnel Boring Equipment
Tunnel Communication Systems and Equipment
Tunnel Haulage Systems
Tunnel Lining and Support Materials
Ventilation Systems, Materials and Equipment

Main Office
350th 5th Ave, 57th Flr
Empire State Building
New York, NY 10118 United States of America
Phone: (212) 294-7567
Email: szlatanic@hntb.com
www.hntb.com

ILF Consultants, Inc.
See our ad on p. 31
Booth 934
Fire-life-safety engineering

Main Office
502 2nd Ave, Ste 1400
Seattle, WA 98101 United States of America
Phone: (206) 960-6948
www.ilf.com

Inflatable Packers International LLC
See our ad on p. 31
Booth 914
Grout-free Standpipes and Grouting Packers

Main Office
PO Box 2446
18 Pepsi Drive
Red Lodge, MT 59068 United States of America
Phone: (406) 446-9940
www.ipipackers.com

Inflatable Packers International LLC
See our ad on p. 31
Booth 914
Grout-free Standpipes and Grouting Packers

Main Office
PO Box 2446
18 Pepsi Drive
Red Lodge, MT 59068 United States of America
Phone: (406) 446-9940
www.ipipackers.com
Grout-Free Expandable Standpipe

Groundwater control in pre-excavation grouting and probe holes

- High pressure rating
- 15-minute installation time
- No down time waiting for grout to cure
- Pressure test immediately after installation
- Minimize progress delays - reduce construction cost

IPI Packers manufacture a full range of inflatable packer equipment

- High pressure grouting
- Permeability & aquifer testing
- Well completion and rehabilitation
- Rock stress testing
- Rock stress mitigation (hydraulic fracturing)
- Custom design and manufacturing

www.ipipackers.com/StandPipes
standpipes@ipipackers.com
Phone: 406.446.9940
Innovative Wireless Technologies

**Booth 922**

Innovative Wireless Technologies, Inc. (IWT) is the leading supplier of wireless communication, tracking and data systems for underground applications. IWT's SENTINEL™ system is easy to install and maintain and provides crystal clear voice communications for maximum productivity and low cost of ownership. Continuous tracking is also supported – all in one system. IWT offers line-powered, battery backed-up, networking infrastructure for long term construction projects, or battery-powered infrastructure for shorter term inspections. In either case, IWT equipment is 100% recoverable and reusable once the project is completed.

**Products & Services**
- Environmental Control Equipment and Supplies
- Tunnel Communication Systems and Equipment
- Safety Products

**Main Office**
1100 Main St
Lynchburg, VA 24504 United States of America
Phone: (434) 316-5230
www.iwtwireless.com

---

J.H. Fletcher & Co

**See our ad on p. 39**

**Booth 930**

**Products & Services**
- Drilling Services and Equipment
- Mining Equipment
- Rock Drills
- Scaling

**Main Office**
402 High St
Huntington, WV 25705 United States of America
Phone: (304) 525-7811
Email: sales@jhfletcher.com
www.jhfletcher.com

---

JADCO Manufacturing Inc

**Booth 726**

**Products & Services**
- Abrasion and Impact Resistant Materials
- Fabrication Materials
- Mining Equipment

**Main Office**
PO Box 465
Zelienople, PA 16063 United States of America
Phone: (724) 452-5252
Email: info@jadcomfg.com
www.jadcomfg.com

---

JCK Underground, Inc

**Booth 331**

**JCK Underground provides Owner Advisor, Engineering and Construction Management services for tunnel and underground projects. We provide public and private project owners and other consultants with specialized underground expertise and support throughout the entire project life-cycle, including early planning, design, procurement, construction and asset management. Our experts have spent entire careers in the underground and tunneling business as planners, designers, construction managers, and contractors. This breadth of varied experience and resources help our clients properly manage the risks associated with implementing their programs.**

**Products & Services**
- Consulting Engineers
- Engineering Design and Services for Tunnels

**Main Office**
33 Centre St
Lexington, MA 02421 United States of America
Phone: (781) 454-9858
Email: jordan@jckunderground.com
www.jckunderground.com

---

Keller

**See our ad on the Outside Back Cover**

**Booth 907**

Facing challenging subsurface conditions is a familiar scenario for tunneling contractors, and as the leading experts have spent entire careers in the underground and tunneling business as planners, designers, construction managers, and contractors. This breadth of varied experience and resources help our clients properly manage the risks associated with implementing their programs.**

**Products & Services**
- Drilling Services and Equipment
- Microtunneling Equipment, Tools, and Supplies
- Slurry Services and Machines
- Undergraduate Excavation Services and Equipment
- Wastewater Management Products

**Main Office**
734 Conroe Park North Dr
Conroe, TX 77303 United States of America
Phone: (281) 907-1488
Email: Sales@kaydenindustries.com
www.kaydenindustries.com

---

Kayden Environmental Services

**Booth 109**

**Products & Services**
- Drilling Services and Equipment
- Microtunneling Equipment, Tools, and Supplies
- Slurry Services and Machines
- Undergraduate Excavation Services and Equipment
- Wastewater Management Products

**Main Office**
734 Conroe Park North Dr
Conroe, TX 77303 United States of America
Phone: (281) 907-1488
Email: Sales@kaydenindustries.com
www.kaydenindustries.com

---

IoT Automation

**Booth 512**

**Real Time Situational Awareness, IoT connected Smart Lighting solutions.**

**Products & Services**
- Control Systems
- Environmental Control Equipment and Supplies
- Geological, Geotechnical Services and Equipment
- Lighting Systems
- Safety Products
- Tunnel Communication Systems and Equipment

**Main Office**
1624 Market St, Ste 202
Denver, CO 80202 United States of America
Phone: (720) 446-6603
Email: m.brown@iotautomation.com.au
www.iotautomation.com.au

---

Inzwa Technologies

**Booth 1009**

Inzwa Technologies is committed to taking the headaches out of your geotechnical monitoring. How? By providing vibration, tilt, and sound monitoring equipment that is easy to install and activate right out of the box, and a plug-and-play geotechnical data platform that can host a plethora of third-party devices for centralized, 24/7 visibility of all sensor data on a job site.

**Products & Services**
- Computer Hardware and Software
- Instrumentation Equipment and Services

**Main Office**
200 W Butler Ave, Unit 3111
Philadelphia, PA 19002 United States of America
Phone: (844) 444-4992
Email: info@inzwatech.com
www.inzwa.io

---

JENNMAR Civil

**See our ad on p. 35**

**Booth 123**

We have integrated JENNMAR products used in the coal industry into our civil engineering offerings. Our Civil product roster includes materials used for large diameter shaft and tunnel ground support systems, steel rail and pipe support products. Steel Tunnel Ribs and Shaft Rings, Steel Sets, Lattice Girders, Bolts: HR and CR Threadbar, M3® expandable rock bolts, FRIC-TION-LOK® stabilizer systems, Fast Anchors™ DCP Bolts, Liner Plate (2-flange) with our Alliance Partners, Contech Engineered Solutions LLC, Resins, Rail, Rail Ties, Rail Hardware

**Products & Services**
- Geological, Geotechnical Services and Equipment
- Rail Products
- Shaft Drilling and Raiseboring Equipment
- Steel Pipe
- Tunnel Lining and Support Materials
- Ventilation Systems, Materials and Equipment

**Main Office**
258 Kappa Dr
Pittsburgh, PA 15238 United States of America
Phone: (412) 629-9578
www.jennmar.com

---

JENNMAR Civil

**See our ad on p. 35**

**Booth 123**

We have integrated JENNMAR products used in the coal industry into our civil engineering offerings. Our Civil product roster includes materials used for large diameter shaft and tunnel ground support systems, steel rail and pipe support products. Steel Tunnel Ribs and Shaft Rings, Steel Sets, Lattice Girders, Bolts: HR and CR Threadbar, M3® expandable rock bolts, FRIC-TION-LOK® stabilizer systems, Fast Anchors™ DCP Bolts, Liner Plate (2-flange) with our Alliance Partners, Contech Engineered Solutions LLC, Resins, Rail, Rail Ties, Rail Hardware

**Products & Services**
- Geological, Geotechnical Services and Equipment
- Rail Products
- Shaft Drilling and Raiseboring Equipment
- Steel Pipe
- Tunnel Lining and Support Materials
- Ventilation Systems, Materials and Equipment

**Main Office**
258 Kappa Dr
Pittsburgh, PA 15238 United States of America
Phone: (412) 629-9578
www.jennmar.com

---

Jennmar Industries

**See our ad on the Outside Back Cover**

**Booth 907**

Facing challenging subsurface conditions is a familiar scenario for tunneling contractors, and as the leading

**Products & Services**
- Drilling Services and Equipment
- Microtunneling Equipment, Tools, and Supplies
- Slurry Services and Machines
- Undergraduate Excavation Services and Equipment
- Wastewater Management Products

**Main Office**
734 Conroe Park North Dr
Conroe, TX 77303 United States of America
Phone: (281) 907-1488
Email: Sales@kaydenindustries.com
www.kaydenindustries.com

---

KELLER

**See our ad on the Outside Back Cover**

**Booth 907**

Facing challenging subsurface conditions is a familiar scenario for tunneling contractors, and as the leading

**Products & Services**
- Drilling Services and Equipment
- Microtunneling Equipment, Tools, and Supplies
- Slurry Services and Machines
- Undergraduate Excavation Services and Equipment
- Wastewater Management Products

**Main Office**
734 Conroe Park North Dr
Conroe, TX 77303 United States of America
Phone: (281) 907-1488
Email: Sales@kaydenindustries.com
www.kaydenindustries.com

---
85 YEARS OF SOLUTIONS.

Since 1937, Fletcher has been answering some of underground mining’s toughest questions. At Fletcher we provide more than solutions, we provide an atmosphere for an open dialogue with customers to ensure their operations are reaching maximum efficiency. Fletcher provides lifetime support through an experienced, knowledgeable team of sales staff, engineers and field service technicians. Is your operation facing obstacles that mass produced equipment isn’t addressing? Get your custom solution started today. Learn more at www.jhfletcher.com

Built on Answers.
geotechnical specialty contractor, Keller has provided solutions to these challenges for almost 100 years. Our solutions for tunneling include diaphragm walls, ground freezing, secant piles, dewatering, jet, permeation and compensation grouting, and instrumentation and monitoring. By connecting global resources and expertise with local knowledge and focus, Keller develops innovative, practical, and cost-effective solutions to geotechnical challenges. Keller builds projects designed by others and offers full design-build services for any geotechnical construction application.

Products & Services
- Ground Freezing
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Jet Grouting Equipment and Services
- Shaft Drilling and Raiseboring Equipment
- Slurry Services and Machines

Main Office
7550 Teague Rd, Ste 300
Hanover, MD 21076 United States of America
Phone: (410) 551-8200
www.keller-na.com

Kiewit Infrastructure Co
See our ad on p. 37
 Booth 128

Products & Services
- Construction - Contracting Services

Main Office
1550 Mike Fahey St, 3rd Fl
Omaha, NE 68102 United States of America
Phone: (503) 710-7504
Email: nicholas.joens@kiewit.com
www.kiewit.com

Line Power
Booth 622

Custom electrical power distribution and control products for mining, tunneling and dredging applications including portable substations, power centers, vacuum circuit breaker switch houses, longwall controls, belt and pump starters, transformers. Custom electrical controls for TBM.

Products & Services
- Electrical - Generator-Motor, Wire-Cable
- Mining Equipment

Main Office
115 Norfolk Ave
Bristol, VA 24201 United States of America
Phone: (276) 466-8200
Email: adver@linepower.com
www.linepower.com

Malcolm Drilling Co Inc
Booth 425

Malcolm Drilling is a renowned geotechnical and foundation contractor that has been serving the construction industry since 1962. Malcolm specializes in providing innovative solutions for complex and challenging ground engineering projects across the US. With a team of experienced engineers and construction professionals, Malcolm offers a comprehensive range of services, including drilled shafts, slurry and secant pile walls, soil mixing, jet grouting, dewatering, and more. Malcolm’s state-of-the-art equipment and technology, coupled with its commitment to safety and quality, enable it to deliver cost-effective and timely solutions to clients in a variety of sectors, including healthcare, transportation, energy, and commercial construction.

Products & Services
- Drilling Services and Equipment
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Jet Grouting Equipment and Services
- Shotcrete Equipment, Supplies, and Services
- Slurry Services and Machines

Main Office
92 Natoma St
San Francisco, CA 94105 United States of America
Phone: (415) 901-4400
www.malcolmdrilling.com

Master Builders Solutions
Booth 607

Master Builders Solutions is a leading supplier of underground construction solutions to support tunneling success, even in highly challenging ground conditions. Master Builders Solutions has the largest range of products and services available to meet needs and solve problems in TBM and conventional tunneling, whether in soft ground or hard rock conditions. We offer a full range of MasterRoc® tunneling products such as soil conditioning foams and polymers, anti-clay agents, sealants, anti-abrasion agents, dust suppressants, bearing seal greases, EP2 greases and annulus grouts, plus product for sprayed concrete and injection for ground consolidation.

Products & Services
- Earth Pressure Balance Machines
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Lubricants for TBM
- Precast Concrete Linings
- Shotcrete Equipment, Supplies, and Services

Main Office
23700 Chagrin Blvd
Beachwood, OH 44122 United States of America
Phone: (216) 839-7500
Email: admixtures@mbcc-group.com
www.master-builders-solutions.com/EN-US

Matrix Design Group
Booth 1022

Matrix designs, manufactures and sells innovative technological products that help keep people safe. Originally focused on the underground coal mining industry, Matrix has expanded into new industrial markets in the United States and globally.

Products & Services
- Engineering Design and Services for Tunnels
- Mining Equipment
- Safety Products
- Tunnel Haulage Systems
- Underground Excavation Services and Equipment

Main Office
3299 Tower Dr
Newburgh, IN 47630 United States of America
Phone: (812) 490-1525
www.matrixteam.com

McDowell Equipment Ltd
Booth 718

McDowell can supply brand NEW and LATE model tunneling equipment for Rental or Sale. Our rental fleet consists of Underground Loaders(LHD) 1/2 yd to 10 yd, Underground Haul Trucks from 7 ton to 40 ton, low profile Motor Graders, Jumbo Drills with one, two or three booms, Underground Removers, Locomotives, Muck cars. We manufacture Shotcrete machines, Scissor lifts, Anti loaders, Personnel carriers. We can also offer fully re-manufactured or reconditioned equipment at significant savings from new with Fast delivery times.
DEMANDING CONDITIONS

DEMAND JENNMAR.

JENNMAR Civil and TURNSTONE Industrial Solutions, LLC offer a wide range of products used in supporting, building, and rebuilding our infrastructure from above and below ground. Our strength lies in our ability to offer our customers solutions in every phase of their projects. We manufacture arch systems, girders, liner plates and Impact Resistant Laggings® and much more. Whether mining, rehabbing, ventilating or re-supporting transportation, water, wastewater or infrastructure tunnels, our team of experienced engineers and technicians are with you every step of the way, from initial consultation to qualified instruction and on-going technical support to make your project a success!

For more information on our portfolio of diverse and complementary brands visit us at www.jennmar.com.
EXHIBITORS

Products & Services
Concrete Mixing and Transportation Equipment
Drilling Services and Equipment
Microtunneling Equipment, Tools, and Supplies
Mining Equipment
Pumps and Pumping Equipment
Rock Drills
Shotcrete Equipment, Supplies, and Services
Tunnel Haulage Systems
Underground Excavation Services and Equipment
Underground Locomotives and Rail Haulage Equipment

Main Office
2018 Kingsway
Sudbury, ON P3B 4J8 Canada
Phone: (705) 566-8190
Email: sales@bmc dowell.com
www.bmc dowell.com

MCT Group Inc
Booth 834
Concrete batching plants/plant solutions for tunneling and underground structures

Products & Services
Concrete Mixing and Transportation Equipment
Conveyor Equipment and Systems

Main Office
9190 Double Diamond Pkwy, Ste #120
Reno, NV 89521 United States of America
Phone: (775) 313-0708
Email: info@mct-usa.com
www.mct-usa.com/en/

Messinger Bearings
Booth 416
Surpassing 100 years, Messinger Bearings is one of an elite few companies in the world capable of producing large (up to 25 feet in diameter), custom-designed bearings in limited quantities for tunnel boring machines (TBMs). In fact, Messinger focuses on manufacturing new and expert repairing of large custom bearings in low volumes for special applications. Messinger goes above and beyond supplying just the bearing, offering complete solutions (field inspection, bearing storage tanks, etc.). With Messingers expanding core of expertise and experience, its customers can expect a quick response, unparalleled application support and timely delivery to better support the tunnel market.

Products & Services
Tunnel Boring Equipment

Main Office
10385 Drummond Rd
Philadelphia, PA 19154 United States of America
Phone: (215) 824-4987
www.messingerbearings.com

Michels Corp
See our ad on p. 39

Booth 708
Michels is an industry-leading utility contractor. A sampling of our deep foundation services for tunneling consist of design/build of a multitude of ERS systems, soil nails, secant piles, soldier piles, tiebacks, grouting, and steel sheeting. Michels has the experience in a variety of tunneling techniques, including Earth Pressure Balance Tunnel Boring Machines (TBMs), hard rock TBMs, conventional drill blast tunneling, sequential excavation methods (SEM), remote-controlled tunneling systems and microtunneling.

Products & Services
Construction - Contracting Services
Underground Excavation Services and Equipment

Main Office
817 Main St.
Brownsville, WI 53006 United States of America
Phone: (920) 583-3132
www.michels.us

MILLER

Booth 814
At Miller, we strive to bring our customers the best valued projects with safe practices, fair pricing, superb service, and outstanding quality. Our projects are delivered on time and within budget by an honest and hard-working team of professionals. We are committed to long term relationships with new and existing customers. Our expertise ranges from design-build portal facilities, raise bore shaft excavation, conventional shaft excavation, concrete shaft lining, steel shaft lining, hoisting systems, ventilation fans, bath house facilities, and heavy civil concrete foundations.

Products & Services
Construction - Contracting Services
Hoists and Headframes
Shaft Drilling and Raiseboring Equipment

Main Office
9580 IL 13
Carrier Mills, IL 62917 United States of America
Phone: (618) 994-4616
Email: miller@millercontracting.us
millercontracting.us

Miller Sales and Engineering
Booth 824
Pumps and Dewatering Packages

Products & Services
Pumps and Pumping Equipment

Main Office
1641 W Commerce Ct
Tucson, AZ 85746 United States of America
Phone: (520) 888-2605
Email: ttryon@mseinc.net
www.mseinc.net

MineARC Systems
Booth 916
MineARC Systems is the global leader in controlled environments and safety technologies for the underground mining, tunnelling, chemical processing, disas-
A PROVEN LEADER.

Kiewit has built some of the most complex tunneling and underground projects for more than 60 years. We self-perform soft ground and hard rock TBM tunneling, along with conventional tunneling techniques such as SEM and Drill and Blast. As one of North America’s largest and most respected construction and engineering organizations, Kiewit’s underground capabilities offer clients unique advantages to navigating complex, challenging projects from engineering and design, through construction.

Kiewit Infrastructure Co.
1550 Mike Fahey Street, Omaha, NE 68102
(402) 346–8535
EXHIBITORS

MixOnSite USA, Inc
Booth 837
GeoFill low density cellular concrete installation

Products & Services
Grouting Services, Equipment and Materials

Main Office
1501 Abbott Ct
Buffalo Grove, IL 60089 United States of America
Phone: (847) 815-7836
Email: msalvatore@mixonsite.com
www.mixonsite.com

Moldequipo Internacional
Booth 737
Custom Forms for Tunneling lining, Engineering and steel structures for tunneling equipment, TBM, back ups structures, Conveyors Systems, different type of steel structures and equipment. Precast Forms for all infrastructure projects.

Products & Services
Conveyor Equipment and Systems
Tunnel Lining and Support Materials
Underground Utility Materials and Operations

Main Office
Jose Rosas Moreno 56
Col. San Rafael
Mexico City, CDMX 06470 Mexico
Phone: 5525600924
Email: moldeint@moldequipo.com
www.moldequipo.com

Mott MacDonald
Booth 509
Mott MacDonald provides tunnel design and engineering solutions for rail and transit, road, water/wastewater conveyance, CSO storage, and cable and communications. With a reputation for technical excellence, Mott MacDonald identifies practical approaches to tunneling, equipment selection and contracting approaches. Expertise includes soft ground and rock tunneling, cut and cover, underground caverns, immersed tube tunnels, jacked tunnels, and microtunneling. Complementary skills in technical areas include tunnel rehabilitation, ground stabilization and treatment, tunnel systems, ventilation, and life safety and security. With 16,000 employees worldwide, Mott MacDonald is one of the world’s largest employee-owned companies.

Products & Services
Consulting Engineers
Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment

Main Office
111 Wood Ave S
Iselin, NJ 08830 United States of America
Phone: (800) 832-3272
Email: americas@motmac.com
www.mottmac.com

MSP Structures Inc
Booth 926
Our mission is to offer innovative solutions for construction projects that require custom formwork, structures and products. Cast In Place tunnel forms and carriers, Aluminum or steel bulkheads, Fishmouth forms, Lifting Frames, Man Cages, Muck Boxes, Pipe Carriers, Work Decks. We stand out with our engineering expertise, responsiveness, quality of design and fabrication.

Products & Services
Consulting Engineers
Engineering Design and Services for Tunnels
Precast Concrete Linings
Segment Accessories
Tunnel Lining and Support Materials

Main Office
162 Cowie St, Ste 100
Granby, QC J2G 3V3 Canada
Phone: (450) 558-7141
Email: smaltais@mspstructures.com
www.mspstructures.com

MTS /Polaris Underground Solutions
Booth 1007
Tunnel Boring Machines - Microtunneling - System2 - Smart Combination

Products & Services
Earth Pressure Balance Machines
Engineering Design and Services for Tunnels
Microtunneling Equipment, Tools, and Supplies
Rock TBM’s
Slurry Services and Machines
Tunnel Boring Equipment

Main Office
826 N Dianthus St
Manhattan Beach, CA 90266 United States of America
Phone: (424) 212-9303
Email: info@mts-tunneling.com
mts-tunneling.com/en/

Naylor Pipe Co
See our ad on p. 42
Booth 707
Naylor Pipe is manufactured in accordance with ASTM A-139, A-211 & A-252 specifications. Diameters from 4" to 96", and thicknesses from 1/16” to 1/2”. Also available are the necessary fittings and connections including the exclusive Naylor Heavy Duty Wedgelock Coupling to complete your pipe system.

Products & Services
Steel Pipe

Main Office
1230 E 92nd St
Chicago, IL 60619 United States of America
Phone: (773) 721-5402
Email: sales@naylorpipe.com
www.naylorpipe.com

Kelley Engineered Equipment LLC
provides custom equipment solutions and engineering for your most challenging underground projects

PROFESSIONAL ENGINEERING SERVICES
CONCEPTUAL DESIGN TO FIELD SERVICE
SPECIALIZED FABRICATION, ASSEMBLY & SHOP TESTING
SITE SPECIFIC ENGINEERING SUPPORT

www.keellc.com
tyler.sandell@keellc.com
+1 206 412 4234

PROUD PARTNERS OF
Nexans AmerCable
Booth 911
Nexans AmerCable is the leading manufacturer of TBM power cables in the United States. Some of the largest TBMs in the world are powered by our Tiger® Brand cables, which are designed to provide safer, longer service life. Our flexible, high-quality power, control and instrumentation cables provide reliable operation in the harshest tunneling environments. Nexans AmerCable is the industry leader in engineering support and product innovation.

Products & Services
Consulting Engineers
Electrical - Generator-Motor, Wire-Cable

Main Office
350 Bailey Rd
Nexans AmerCable
El Dorado, AR 71730 United States of America
Phone: (800) 643-1516
Email: mining.sales@nexans.com
americable.nexans.com

Nicholson Construction Co
Booth 311
Founded in 1955, Nicholson is a leader in geotechnical construction, providing a wide range of deep foundation, earth retention and ground treatment services on projects throughout the United States. For tunnels, Nicholson constructs access shafts with diaphragm walls and jet grout columns and the company supports operations with a wide variety of grouting and earth retention techniques. Nicholson has offices around the country to address each region’s unique geotechnical construction needs.

Products & Services
Grouting Services, Equipment and Materials

Main Office
2400 Ansys Dr, Ste 303
Canonsburg, PA 15317 United States of America
Phone: (412) 221-4500
www.nicholsonconstruction.com

North American Drillers LLC, a Shaft Drillers International Company
Booth 724
North American Drillers LLC (NAD), a Shaft Drillers International Company, owns and operates a comprehensive fleet of sophisticated large diameter and small diameter drilling rigs which offers our domestic and international clients an unprecedented combination of services and turnkey ground construction solutions in both rural and urban conditions. Domestic & International Solutions, Access / Egress, Ventilation – Intake / Exhaust, Drop / Surge, Utilities, Foundation Elements, Exploration / Bulk Sample. Learn more online at: https://nadrillers.com

Products & Services
Construction - Contracting Services
Geological, Geotechnical Services and Equipment
Ground Improvement Equipment and Services

Northwest Laborers-Employers Training Trust
See our ad on p. 43
Booth 817
The Safety and Hazard Awareness for Tunnels (SHAFT) courses are designed to teach skills for working safely in tunnels constructed using a tunnel boring machine (TBM). The program was developed by the Northwest Laborers-Employers Training Trust with input and consultation from several organizations. In addition to classroom lecture and discussion, participants have the experience of training in a simulated, lifelike tunneling environment.

Products & Services
Educational

Main Office
27055 Ohio Ave NE
Kingston, WA 98346 United States of America
Phone: (360) 287-3035
www.nwlett.edu

Palmieri S.p.A.
Booth 314
With over 40 years of experience in the manufacturing of Tunneling and Drilling parts and consumables, Palmieri is nowadays one of the most experienced and specialized group of companies worldwide. Design and production of either rolling and fixed tools for any type of excavation; from horizontal boring (Tunnels for roads, railways and water) to vertical boring and drilling, Engineering development, manufacturing, refurbishment and rental of underground equipment such as TBMs, Raise Boring Machines, Microtunneling/ Pipejacking equipment, Cutterheads, Back-Up systems, Rolling Stock, as well as innovative and non-conventional solutions for all the above mentioned business sectors.

Products & Services
Drilling Services and Equipment

Michels Construction provides safe, reliable and cost-effective solutions for foundations, earth retention and ground improvement projects. We design and build shafts and bracing systems to connect underground work areas and the surface while keeping crews and equipment separated from water, groundwater, rock and soil. WE DO THAT ... & MORE

www.Michels.us

Solutions Built with Trust

Michels Construction Inc.

2023 RETC ShowGuide 39

SHOWGUIDE exhibitor listings as of May 05, 2023
SHOWGUIDE exhibitor listings as of May 05, 2023

**Microtunneling Equipment, Tools, and Supplies**
- Rock Drills
- Rock TBM’s
- Shaft Drilling and Raiseboring Equipment
- Tunnel Boring Equipment

Main Office
Via dell’Industria n.58
Gaggio Montano, BO 40041 Italy
Phone: +39 053432511
Email: info@palmierigroup.com
www.palmierigroup.com

**Parsons**
*Booth 918*
Parsons is a technology-driven engineering services firm with 75 years of experience in the engineering, construction, technical, and professional services industries. We have successfully delivered some of the largest and most complex tunneling and underground construction projects in the world. From planning and design through construction management and operations, Parsons provides a complete range of services for water, wastewater, and transportation tunnels. Whether your project involves soft ground, rock, or mixed-faced conditions, our dedicated staff of more than 100 tunnel professionals have the experience and skills to manage the risks and deliver safe, economical, and innovative solutions.

**Pini Group USA Inc.**
*Booth 832*
Pini Group is a Swiss leading engineering services provider with more than 70 years of experience and a leading role in several major European projects. The Group offers high-end engineering and consulting services in the domain of underground works, in a digital way. Today the Group operates worldwide, with particular focus on the US market, supporting Contractors & Owners in the design, tender and execution phase. The unique strength of the Group concerns tunnels located underneath moderate to extremely high-water table in soft ground/rock mass (Lake Mead intake No. 3 tunnel, Nevada; 3RPORT tunnel, Indiana; Outfall tunnel, LA).

**Poltinger Precision Systems GmbH**
*Booth 116*
Manufacturer of Underground Navigation Solutions for TBM’s, Roadheaders, Pipejacking/Microtunneling and other types of tunnelling machines. Additional products for conventional mining as well as surveying related services are offered as well.

**Products & Services**
- Instrumentation Equipment and Services
- Laser Guidance Systems
- Microtunneling Equipment, Tools, and Supplies
- Roadheaders
- Survey Equipment and Lasers
- Tunnel Boring Equipment

Main Office
Mondstr. 2-4
Feldkirchen 85622 Germany
Phone: +49 89 12766 1440
Email: info@pps-muc.de
www.pps-muc.de

**One track mind.**

Locomotives · Rolling Stock · Jetair Ventilation Systems
Mine Hoists & Stage Winches · Metalliance MSVs

**Proven Technology for Underground Construction**

Our commitment is the detail that makes the difference.
Reliable technology and expertise for underground construction
- Alkali-free set accelerators and admixtures for shotcrete
- Products for mechanized tunneling: foaming agents for soil conditioning, polymers, sealants and lubricants
- Products for grouting and consolidation
- Products for concrete repairing, protection and coating
- Products for waterproofing: synthetic waterproofing membranes and waterproofing accessories

Discover the world of MAPEI: Visit www.utt-mapei.com or email us at hq.utt@utt.mapei.com

> **Industry leading supply, support and engineering**

We’ve built our reputation on the foundation of providing robust equipment and exceptional service, and for generations have supported our clients and their projects around the world.

**MINING EQUIPMENT**

USA +1(970) 259.0412
CANADA +1(705) 495.8587
GERMANY +49.6061.97969.29
MININGEQUIPMENTLTD.COM
Proven Technology for Underground Construction

Our commitment is the detail that makes the difference.

Reliable technology and expertise for underground construction
- Alkali-free set accelerators and admixtures for shotcrete
- Products for mechanized tunneling: foaming agents for soil conditioning, polymers, sealants and lubricants
- Products for grouting and consolidation
- Products for concrete repairing, protection and coating
- Products for waterproofing: synthetic waterproofing membranes and waterproofing accessories

Discover the world of MAPEI: Visit www.utt-mapei.com or email us at hq.utt@utt.mapei.com
Promat International NV

Exhibitor: Promat International NV
Booth 117

Promat International NV is the world’s largest dedicated manufacturer of passive fire protection materials and global leader in the Fire Protection of Tunnels, providing fire protection solutions to many of the world’s largest tunnel projects. Promat supplies technical and design assistance pertaining to tunnel fire protection for transportation tunnels, bridges, limited access highways, ventilation corridors, cable trays, immersion and expansion joints, utility access corridors and architectural decorative tunnel linings. All fire protection products have undergone full scale fire and durability testing and meets NFPA-502 as well as all international standards, regulations and recommendations. PROMATECT®-H, PROMATECT®-T, PROMATECT®-TF-X, PROMASPRAY®-F5, PROMASEAL®--WF, PROMASEAL®--AG.

Products & Services
- Engineering Design and Services for Tunnels
- Tunnel Lining and Support Materials

Main Office
1731 Fred Lawson Dr
Maryville, TN 37801 United States of America
Phone: (423) 646-1071
Email: larry.degraff@etexgroup.com
www.promat.com/en-us/tunnels/

PSC Crane and Rigging

Exhibitor: PSC Crane and Rigging
Booth 826

Products & Services
- Construction - Contracting Services
- Engineering Design and Services for Tunnels
- Hoists and Headframes
- Underground Locomotives and Rail Haulage Equipment

Main Office
4243 W US Route 36
Piqua, OH 45356 United States of America
Phone: (888) 778-3632
Email: Sales@pscind.com
www.pscind.com

Putzmeister America, Inc

Exhibitor: Putzmeister America, Inc
Booth 529

Products & Services
- Concrete Mixing and Transportation Equipment
- Shotcrete Equipment, Supplies, and Services

Main Office
1733 90th St
Sturtevant, WI 53177 United States of America
Phone: (262) 884-6374
Email: beth.tepley@putzmeister.com
www.putzmeister.com

QSP Packers, LLC

Exhibitor: QSP Packers, LLC
Booth 728

QSP Packers is a Manufacturer of a complete range of Inflatable and Mechanical Packers used in North America and Worldwide. They have many uses for, Pressure Grouting, Single or Straddle Set-up, Tube-a-Manchette, Wireline/Core Drilling, Permeability Testing, and Water Wells. Also available are Environmental Well Packers. All Packers are Field Repairable, if something goes wrong, just call QSP Packers, and the parts, customers need, can be received the Next Day. Parts are Interchangeable with Packers using Bimbar, Geopro, and Petrometalic Glands. QSP Packers offers Design and Technical Support.

Products & Services
- Grouting Services, Equipment and Materials
- Mining Equipment
- Tunnel Lining and Support Materials

Main Office
13701 24th St. E. Unit A-9
Sumner, WA 98390 United States of America
Phone: (253) 770-6312
www.qsppackers.com

NAYLOR PIPE

NAYLOR PIPE

**Vent** • **Compressed Air** • **Water Discharge** • **Shaft Pipe**

- Diameters from 4” to 96”
- Thicknesses from .074” to .500”
- ASTM A-139, ASTM A-211
- Lightweight, Accurate Diameter
- High Salvage and Re-Use Value
- Exclusive Naylor Heavy Duty Wedgelock Coupling Reduces Connection Time
- Fittings, Connections, Coatings and Linings to Complete Your Pipe System

For more info on our complete line of Pipe Systems, check our new website

www.naylorpipe.com

NAYLOR
Spiralweld PIPE SYSTEMS

**CHICAGO**

1230 East 92nd St • Chicago, IL 60619
773/721-9400 • Fax: 773/721-9494
E-Mail: sales@naylorpipe.com
SHAFT was developed by the Northwest Laborers-Employers Training Trust with input from a team of industry experts and stakeholders. The SHAFT program provides quality, comprehensive safety training for both new and experienced tunnel professionals.

The curriculum is comprised of a blend of classroom discussion and use of materials and mockups in classes focusing on all aspects of tunnel safety.

Our facility, located in Elma, Washington, features a TBM mockup, loci, and access to 1,400’ of 12’ diameter tunnel, providing students with a unique, interactive educational experience.
ROBODRILL S.A.
Booth 527
ROBODRILL specializes in underground drilling; ROBODRILL designs, sells and hires manual or automated tunneling drill rigs including special-purpose drilling machines for the worldwide tunneling and mining market.

Products & Services
Rock Drills

Main Office
RUE JEAN PERRIN
GENAS F69740 France
Phone: +33472790020
www.robodrill-sa.com

Rocscience, Inc
Booth 923
Rocscience develops geotechnical software used worldwide by over 8,000 companies and 450 universities in over 130 countries. The suite of programs includes slope stability, settlement and consolidation, stress analysis, support design, and underground modeling. Created by experienced engineer-developers, Rocscience’s high-quality programs enable users to save time and money when designing solutions in both soil and rock.

Products & Services
Computer Hardware and Software

Main Office
54 St Patrick St
Rocscience
Toronto, ON M5T1V1 Canada
Phone: (416) 698-8217
www.rocscience.com

Rocvent Inc
Booth 815
We are a major manufacturer of Mine & Tunnelling Ventilation Ducting Systems

Products & Services
Dust and Fume Control Technology Ventilation Systems, Materials and Equipment

Sandvik Mining and Rock Solutions
Booth 412
Sandvik Mining and Rock Solutions is a business area within the Sandvik Group and a global leading supplier of equipment and tools, parts, service, digital solutions and sustainability-driving technologies for the mining and construction industries. Application areas include rock drilling, rock cutting, loading and hauling, tunneling and quarrying.

Products & Services
Drilling Services and Equipment Mining Equipment Roadheaders Rock Drills

Main Office
3696 Industrial Rd
Chelmsford, ON P0M-1L0 Canada
Phone: (705) 692-5854
Email: dson.turgeon@rocvent.com
www.rocvent.com

Roxard Industries
Booth 528
TBM Cutting Tools, Disc Cutters, Tools with Tungsten Carbide, Soft Ground Tools, Wear Parts, Steel Fabrications

Products & Services
Abrasives and Impact Resistant Materials
Tunnel Boring Equipment

Main Office
Malkiyov Baskent OSB
Unal Kocaman Cad. No:12 Sincan
Ankara 06909 Turkey
Phone: +905465464748
Email: orkunc@roxard.com
www.roxard.com

Roxadun, Inc
Booth 322
Roxadun provides drilling services including surface, underground, and horizontal directional core drilling for the geotechnical, exploration and geochemical industries throughout the U.S., South America and Asia. Drilling equipment includes truck, track, skid, and helicopter supported core drills. Rig capacities are to 10,000 ft. vertical or angle and 3,000 ft. horizontal. Crews are all trained in achieving a high degree of core recovery for the client. Recent projects include: Devils Slide Tunnel, Irvington Tunnel, Caldecott Tunnel 4th bore, Route 9 Tunnel in Hong Kong, Highway 53 Tunnel in Puerto Rico, White Sands Missile Range and Mt. Olympus Pipeline No. 6.

Products & Services
Drilling Services and Equipment

Main Office
2320 River Rd
Clark Fork, ID 83811 United States of America
Phone: (209) 988-4261
www.ruendrilling.com

Sandvik Flexadux Corp
Booth 835
Products & Services
Ventilation Systems, Materials and Equipment

Main Office
25 Rodeo Dr
Fairmont, WV 26554 United States of America
Phone: (304) 363-0868
schauenburg-us.com/

Schauenburg Maschinen- und Anlagen-Bau GmbH
Booth 833
Slurry treatment plants, individual processing plants, Soil washing plants, Plants for the processing of ores and minerals

Products & Services
Consulting Engineers
Consulting Environmental Microtunneling Equipment, Tools, and Supplies
Slurry Services and Machines
Water Treatment Plant and Materials

Main Office
Weseler Straße 35
Mülheim-Ruhr, Nordrhein-Westfalen 45478 Germany
Phone: +49 208 99 91-0
Email: sales@schauenburg-mab.com
www.schauenburg-mab.com

Schnabel Engineering
Booth 806
We help develop the structures and systems that are crucial parts of modern life by engineering quality solutions, managing risk, and providing specialized expertise.

Products & Services
Consulting Engineers
Consulting Environmental Engineering Design and Services for Tunnels Geological, Geotechnical Services and Equipment Instrumentation Equipment and Services

Main Office
12720 Hilcrest Road, Ste 585
Dallas, TX 75230 United States of America
Phone: (972) 250-3322
www.schnabel-eng.com/services/tunnel-underground/
ONLY THE BEST SHOULD BE IN A GALLERY

Tackle the toughest subterranean projects – from small tunnels to large galleries – with power, precision, and safety with Putzmeister.

Don’t settle for subpar equipment. Set a new standard for your expectations.
SEALABLE Solutions GmbH (formerly Datwyler Sealing Technology)
Booth 323
SEALABLE Solutions GmbH formerly known as DATWYLER Sealing Technologies, continues to be the world leading provider for high quality tunneling gaskets. SEALABLE with > 800 projects worldwide, offers full range tunnel gaskets: Mono EPDM, Hydrophilic, Co-Ex Swell/Composite Quick Swell and anchored gaskets. SEALABLE is providing safe gasket solutions avoiding spalling with fiber anchoring, patented round corner and performance corners. Just soft corners/gasket wont seal. SEALABLE gaskets will be more sustainable and reduce the carbon footprint of your project. SEALABLE will continue exceptional service and offer quality products to customer in this ever changing market! Looking forward to your questions.

Products & Services
- Precast Concrete Linings
- Rail Products
- Segment Accessories
- Tunnel Lining and Support Materials

Main Office
Eisenacher Landstrasse 70
Walterhausen, Thuringia D-99880 Germany
Phone: (732) 763-6203
Email: peter.tiedemann@seal-able.com
www.seal-able.com

Seequent
Booth 308
Seequent is the subsurface software company within Bentley Systems, the infrastructure engineering software company. Together, we are helping build a more resilient future by connecting the built world above ground with the hidden world below it. We share a vision that connecting software, teams, and data leads to better understanding and ultimately better decisions for people and the planet.

Products & Services
- Computer Hardware and Software
- Geological, Geotechnical Services and Equipment

Main Office
860 Homer St, Ste 300
Vancouver, BC V6B 2W5 Canada
Phone: (604) 209-0134
Email: claudia.williams@seequent.com
www.seequent.com

Senceive Corp
See our ad on p. 47
Booth 811
monitoring technology, sensor, nodes mesh networks

Products & Services
- Geological, Geotechnical Services and Equipment
- Instrumentation Equipment and Services
- Survey Equipment and Lasers

Main Office
812 W 13th St
Brooklyn
Deer Park, TX 77536 United States of America
Phone: (281) 881-9570
www.senceive.com

Sentinel Solutions LLC
See our ad on p. 49
Booth 525
Drilling Fluids/Slurry Treatment Equipment/Centrifuges/ Polymer Injection

Products & Services
- Microtunneling Equipment, Tools, and Supplies
- Pumps and Pumping Equipment
- Slurry Services and Machines
- Tunnel Boring Equipment
- Water Treatment Plant and Materials

Main Office
555 Furrows Rd
Holtsville, NY 11742 United States of America
Phone: (832) 434-4559
Email: chuck.skillman@sentinel-solutions.com
www.sentinel-solutions.com

Shannon & Wilson, Inc
Booth 612
Since 1954, Shannon & Wilson has been a pioneer in developing effective underground solutions to complex site development problems. This includes exploration, design, plans and specifications, and construction management and support on over 800 soft ground and hard rock tunnel projects, ranging from trenchless to the world’s largest diameter tunnels. Resources include over 300 staff from the corporate headquarters in Seattle, Washington, and branch offices in Alaska, California, Colorado, Florida, Missouri, Oregon, Utah and Wisconsin. Shannon & Wilson offers services in geotechnical site evaluations, and assessments of tunnels and related structures, groundwater and dewatering, seismicity, instrumentation, environmental, and natural resources.

Products & Services
- Consulting Engineers
- Consulting Environmental Engineering Design and Services for Tunnels
- Geological, Geotechnical Services and Equipment
- Ground Improvement Equipment and Services
- Instrumentation Equipment and Services

Main Office
400 N 34th St, Ste 100
Seattle, WA 98103 United States of America
Phone: (206) 632-8020
www.shannonwilson.com

Shotcrete Technologies, Inc
Booth 722
STI continues to be on the forefront of innovative Shotcrete products and services—NOW INTRODUCING—the new Cementitious sprayable fireproofing! Stop by our booth to discover the advantages of this innovative Fireproofing material. Providing our services to the tunneling and mining industry for over 35 years including our: Modular Shot-Tech Robotic Arm; ST Alkali Free and Shotset 250 liquid accelerators; Shaftlining (Vertical lining) technology and auxiliary equipment, hoses, nozzles, and etc. STI’s knowledgeable team of professionals provides everything from Shotcrete System design, mix design, to testing and training based on your specific needs from mega projects to small mines.

Products & Services
- Tunnel Lining and Support Materials

Main Office
PO Box 3274, 1431 Miner St
Idaho Springs, CO 80452 United States of America
Phone: (303) 567-4871
Email: info@shotcretechtechnologies.com
www.shotcretechtechnologies.com

Sigicom Inc
Booth 906
Sigicom is the leading supplier and manufacture for autonomous and innovative measuring instrumentation for vibration, noise and Geotech, with accompanying cloud software for presentation and reporting.

Products & Services
- Instrumentation Equipment and Services

Main Office
2636 Midpoint Dr ste b,
Fort Collins, CO 80525 United States of America
Phone: (970) 412-1108
Email: andrew.graba@sigicom.com
www.sigicom.com

Sika Corporation
Booth 316
Sika Corporation is a global specialty chemicals company with over 100 years of experience. For tunneling, Sika offers a wide variety of products such as chemical admixtures and fibers for concrete, repair and protection products, waterproofing products and equipment for shotcrete. Sika is at the forefront when it comes to efficiency improvements in tunneling and mining, reducing excavation times with faster shotcrete solutions and optimizing the cost performance of concrete in all underground operations. With a fully integrated and smart, high quality product portfolio, we are your ideal business partner to continue forging ahead in underground construction.

Products & Services
- Concrete Reinforcement
- Grouting Services, Equipment and Materials
- Lubricants for TBM
- Precast Concrete Linings
- Shotcrete Equipment, Supplies, and Services
- Soil Conditioning Equipment and Materials
Remote Condition Monitoring
For Safer, More Efficient Tunneling and Underground Construction

Use Senceive technology to monitor tunneling activity, ground behavior and impact on third-party assets. Get virtually real-time data and automated alerts:

- tunnel lining convergence/ divergence
- longitudinal deformation
- crack and joint movement
- lateral or vertical ground movement
- groundwater pore pressure
- strain/load
- building, utility and other above ground structure deformation

Easy to use | Precise | Proven

Get in touch
USA_info@senceive.com
(346) 200-6477
Senceive.com

Visit us at RETC Booth 811
Simem Underground Solutions, Inc
Booth 723
Simem Underground Solutions (SUG), with 30+ years of experience provides fully automated material handling and production systems for TBM bi-component grout, hydrated bentonite, lightweight cellular grout, shotcrete, concrete, mining backfill, and water filtration. SUG designs, engineers, and manufactures colloidal mixer plants, pumping and delivery systems, and integrated automation and controls packages for tailored turn-key solutions to meet the toughest project demands. Our in-house design, mechanical, structural, electrical, and automation engineering team delivers solution continuity for seamless on-site installation, commissioning, and field training. 24-7 technical support, CAD documentation, and spare parts inventories are in place to ensure optimal solution up-time.

Products & Services
Concrete Mixing and Transportation Equipment
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials
Precast Concrete Linings
Pumps and Pumping Equipment
Shotcrete Equipment, Supplies, and Services

SIXENSE
Booth 315
Sixense is a leading provider and integrator of automated real-time instrumentation and monitoring services (geotechnical, structural, and environmental). With over 25 years of global experience, Sixense has built a reputation for safety, environmental awareness, client care, technical excellence, and cutting-edge innovation. Sixense has been involved in many iconic, large urban tunnel programs in Northern America like the Alaskan Way (Seattle), West Side Extension (Los Angeles), Purple Line (Baltimore), Hampton Roads Bridge Tunnels (Norfolk), Ontario Line South (Toronto), Hwy 401/409 undercrossing (Mississauga), etc. Are you looking for peace of mind on your projects? At Sixense, we have you covered!

Products & Services
Computer Hardware and Software
Consulting Environmental Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment Instrumentation Equipment and Services

SoilFreeze Inc
Booth 727
SoilFreeze Inc. provides temporary frozen soil shoring systems to support excavations and provide ground-water cut-off. Our technology can be used for; ground water cut-off, in situ-isolation barriers, foundation excavation shoring, cross passages, adits, ground stabilization and more. We design, fabricate, install and maintain customized freeze systems for each client’s needs. We serve both the private and public sectors and have a substantial list of successful projects and satisfied clients. SoilFreeze Inc. has advanced and refined freeze technology to create freeze systems that are mobile, reusable, and expandable to address the needs of any sized project and urban locations.

Products & Services
Ground Freezing

Southern Nevada Water Authority
Booth 429
Water Utility Services - Owner

Spendrup Fan Co/CFT
Booth 715
Since 1968, Spendrup Fan Co. has designed and manufactured quality vane axial fans and accessories for all types of mining and industrial applications. Spendrup fans are designed to withstand the harshest environments. Fan casings are made of 5/16” steel. Impeller hubs are fabricated from mild steel. Impeller blades are 356-76 hardness, to resist highly abrasive conditions. Spendrup Fan Co. designs fans to meet client specifications. Spendrup Fan can meet client needs, from MSHA Sch. 2-G, U/L approved explosion proof, marine duty, to fans that provide trouble-free service in high-temperature or corrosive environments.

Products & Services
Dust and Fume Control Technology
Tunnel Boring Equipment
Ventilation Systems, Materials and Equipment
EXHIBITORS

Stage 3 Separation
Booth 630
- Slurry Management, Liquid and Solids Separation, spoils mitigation, environmental services

Products & Services
- Geological, Geotechnical Services and Equipment
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Slurry Services and Machines
- Wastewater Management Products
- Water Treatment Plant and Materials

Main Office
PO Box 4308
Grand Junction, CO 81502 United States of America
Phone: (970) 243-3429
www.spendrupfanco.com

STM Industriale SpA
Booth 802
- Belt Conveyors Systems, TBM Continuous Conveyor, Vertical Conveyor, Stackers Conveyors

Main Office
Zona Industriale
Tito Scalo 85050 Italy
Phone: +39349869869
Email: info@stm.group
www.stm.group

Strata Worldwide | Tunneling
See our ad on p. 51
Booth 827
Strata Worldwide is a global leader in advanced underground safety products and technologies. A suite of technologies that support a safer, more productive working environment and that are backed by a company with 30 years of underground and customer support experience. Product offerings include: underground networking for communications, tracking and real-time monitoring; emergency refuge chambers; proximity detection and collision avoidance; artificial intelligence sensors for accident prevention; and a collection of specialty resins, polymers and waterproof liners. Polymer Rubber Gel for leak repair and restoration, and the Boraid® line of TBM ground conditioners and shield sealant

Products & Services
- Safety Products
- Shotcrete Equipment, Supplies, and Services
- Tunnel Communication Systems and Equipment

Main Office
800 Roswell Rd, Ste 145
Sandy Springs, GA 30350 United States of America
Phone: (770) 321-2500

YOUR TURN-KEY AUTHORITY FOR EQUIPMENT, SOLIDS CONTROL, AND DRILL FLUIDS
Tunnel Lining and Support Materials

Segment Accessories

Grouting Services, Equipment and Materials

Products & Services

Consulting Engineers

Engineering Design and Services for Tunnels

Geological, Geotechnical Services and Equipment

Main Office
225 Park Ave W
New York, NY 10003 United States of America
Phone: (212) 614-3406
Email: Harshad.Pandit@stvinc.com
www.stvinc.com

TBM Supply

Booth 616


Products & Services

Steel Pipe

Underground Utility Materials and Operations

Main Office
3301 Zachary Ave
Shafter, CA 93263 United States of America
Phone: (855) 535-1555
Email: jones@tbsupply.com
www.tbsupply.com

Technical Tunnelling Components LTD (TTC)

Booth 309

Technical Tunnelling Components has over 40 years of experience manufacturing and supplying segment accessories such as connection bolts, grout/lifting sockets, segment packers and grommets along with the award winning Dowelock connection and alignment system, now with high shear options. TTC truly is the one stop shop for all precast segmental fixing and grouting systems. The in-house design and manufacturing capabilities that Tunnelling Accessories and Bosworth Plastics have can also offer bespoke products for challenging situations as well as the standard segment accessories. TTC are Supplying components worldwide with an impressive product portfolio along with an excellent service record.

Products & Services

Grouting Services, Equipment and Materials

Precast Concrete Linings

Segment Accessories

Tunnel Lining and Support Materials

Main Office
Unit K Radius Ct, Tungsten Pk
Hinckley, Leiceste LE10 3BE United Kingdom
Phone: +44 0 1455 234401
www.tcltd.org

Technogenia

Lasercarb

Oklahoma Inc

Booth 735

hardfacing services (lasercladding) / welding consumables

Products & Services

Abrasion and Impact Resistant Materials

Main Office
41 South Cooley Dr
Oklahoma City, OK 73127 United States of America
Phone: (405) 496-7702
Email: natalia.fulton@technogenia.com
www.technogeniausa.com/

Terra Insights

Booth 719

Powered by the trusted and experienced brands RST Instruments, Measurand, 3vGeomatics, Syscom Instruments, and NavStar, Terra Insights is a comprehensive platform of geotechnical, structural, and geospatial monitoring technology, along with purpose-built data delivery solutions. Terra Insights is the industry’s first, end-to-end sensor to data delivery platform that supports proactive, risk-informed decision making and monitoring. Terra Insights provides custom engineered solutions to site-specific problems.

Products & Services

Engineering Design and Services for Tunnels

Geological, Geotechnical Services and Equipment

Instrumentation Equipment and Services

Mining Equipment

Tunnel Communication Systems and Equipment

Main Office
11545 Kingston St
Maple Ridge, BC V2X 0Z5 Canada
Phone: (604) 540-1100
Email: sales@measurand.com
www.terrainsights.com

Terratec / Kelley Engineered Equipment

Booth 526

TBM’s and custom engineered tunneling equipment

Products & Services

Conveyor Equipment and Systems

Earth Pressure Balance Machines

Engineering Design and Services for Tunnels

Microtunneling Equipment, Tools, and Supplies

Mining Equipment

Tunnel Boring Equipment

Main Office
22010 Fowler Dr
Gretna, NE 68028 United States of America
Phone: (206) 412-4234

email: tyler.sandell@keellc.com
www.keellc.com

TLM-Turbo

Booth 428

TLT-Turbo Inc. is an industrial ventilation fan manufacturer, including engineering, development, manufacturing, repair, and service. Experience and specialization is in Tunnel & Metro, Mining, Wind tunnel, Industrial, MVR Fans, Power station, and Aftermarket service.

Products & Services

Ventilation Systems, Materials and Equipment

Main Office
2693 Wingate Ave
Akron, OH 44314 United States of America
Phone: (330) 776-5115
Email: Sales@tlffan.com
www.tlt-turbo.com

TGL18

Booth 1026

Soil conditioning, TBM lubricants. Slurry additives.

Products & Services

Soil Conditioning Equipment and Materials

Main Office
351 Route De Givors
Chasse Sur Rhone 38670 France
Phone: +34666779140
Email: carlos.bermudez@tln18.com
www.tln18.com

Towill, Inc.

Booth 217

Building on a successful business established in 1955, Towill, Inc. has become a trusted advisor and industry leader focused on providing geomatics solutions to complex issues. Towill delivers high-quality, innovative, and advanced surveying and mapping solutions to our clients throughout the US. Towill offers a wide array of services to the tunneling and underground construction community, including owners, designers, construction managers, and contractors. As a full-service company, we address all project surveying and mapping needs, from large-scale digital mapping prior to design to final as-built surveys at project completion.

Products & Services

Consulting Engineers

Engineering Design and Services for Tunnels

Main Office
2300 Clayton Rd., Ste 1200
Concord, CA 94520 United States of America
Phone: (925) 682-6976
www.towill.com

Tunitec

Booth 520

Tunitec is a Canadian company that develops innovative products and services for the tunneling industry, focusing on technology and process improvements. Their offerings include grouting systems, concrete lining solutions, and other products designed to enhance tunneling projects. Tunitec’s expertise is aimed at optimizing safety, efficiency, and sustainability in tunneling operations.

Products & Services

Concrete Lining Systems

Grouting Systems

Main Office
2185 Westwood Blvd, Suite 200
Richmond, BC V6W 1L9 Canada
Phone: (604) 875-0550
Email: info@tunitec.com
www.tunitec.com

Tunnel Boring Machine (TBM)

Booth 520

Tunnel Boring Equipment for a wide range of tunneling projects. The TBM is a key component in underground construction, enabling the creation of new transport routes, waterways, or other underground spaces. The equipment is designed to handle various tunneling conditions, ensuring efficient and safe construction.

Products & Services

Tunnel Boring Machine (TBM)

Main Office
2185 Westwood Blvd, Suite 200
Richmond, BC V6W 1L9 Canada
Phone: (604) 875-0550
Email: info@tunitec.com
www.tunitec.com

Tunnel Communication Systems and Equipment

Mining Equipment

Instrumentation Equipment and Services

Geological, Geotechnical Services and Equipment

Engineering Design and Services for Tunnels

Consulting Engineers

Main Office
351 Route De Givors
Chasse Sur Rhone 38670 France
Phone: +34666779140
Email: carlos.bermudez@tln18.com
www.tln18.com

Towill, Inc.

Booth 217

Building on a successful business established in 1955, Towill, Inc. has become a trusted advisor and industry leader focused on providing geomatics solutions to complex issues. Towill delivers high-quality, innovative, and advanced surveying and mapping solutions to our clients throughout the US. Towill offers a wide array of services to the tunneling and underground construction community, including owners, designers, construction managers, and contractors. As a full-service company, we address all project surveying and mapping needs, from large-scale digital mapping prior to design to final as-built surveys at project completion.

Products & Services

Consulting Engineers

Engineering Design and Services for Tunnels

Main Office
2300 Clayton Rd., Ste 1200
Concord, CA 94520 United States of America
Phone: (925) 682-6976
www.towill.com

Tunitec
/strata tunneling

Communication  Tracking  Automation  IoT Networking  Machine Digitalization
Proximity Detection  Collision Avoidance  Artificial Intelligence Sensors  Emergency Refuge Chambers  Gas Detection  Emergency Breathing Aparatus
Ground Conditioners and TBM Tail Sealant  Shotcrete  Resins & Grouts  Leak Repair and Restoration  Waterproofing  Water Removal/Muck Management  Sludge and Slurry Pumps

AMERICAS | EUROPE | AUSTRALIA | SOUTH AFRICA
info@strataworldwide.com  •  www.strataworldwide.com/tunneling
Geoform Systems is the leading, most innovative solutions provider, effectively solving water/flowing ground leaks and ground stabilization/consolidation challenges in major heavy construction, infrastructure and public transport projects. We combine the most efficient German technology materials, tools, machinery and the application know-how with the North American construction experience. TPH BAUSYSTEME is one of the world’s leading developers and manufacturers of innovative construction solutions for waterproofing, tunneling, injection technology, joint sealing, concrete redevelopement and surface protection. Besides its vast range of products, TPH BAUSYSTEME specializes in creating individualized solutions for sealing and redevelopement challenges in tunneling and civil engineering, and structural/foundation engineering.

**Products & Services**
- Ground Freezing
- Ground Improvement Equipment and Services
- Grouting Services, Equipment and Materials
- Jet Grouting Equipment and Services
- Soft Ground Shields
- Soil Conditioning Equipment and Materials

**Main Office**
1 · 2165 Buckingham Rd
Oakville, ON L6H 0W7 Canada
Phone: +1 833 GEOFORM
Email: info@geoforming.com
www.geoforming.com

---

**TRE ALTAMIRA Inc**

**Booth 731**

Satellite-based InSAR (Synthetic Aperture Radar) ground monitoring has been our focus for over 20 years, providing detailed surface motion information for engineering activities during tunneling operations. Using our proprietary SqueeSAR® algorithms we analyze images captured by radar satellites to measure ground deformation to millimeter accuracy, detecting and monitoring ground settlement, heave, landslides, surface expression of faults, and to track the stability of individual structures. TRE ALTAMIRA produces dynamic maps and a database of surface deformation measurements that provide a quantitative understanding of ground response to natural and anthropogenic activities. Offices in Vancouver, Milan, Barcelona, Australia and Chile.

**Products & Services**
- Consulting Engineers
- Consulting Environmental Engineering Design and Services for Tunnels
- Geological, Geotechnical Services and Equipment

**Main Office**
475 W Georgia St, Ste #410
Vancouver, BC V6B 4M9 Canada
Phone: (604) 331-2512

---

**Tunnel Business Magazine (TBM)**

**Booth 513**

TBM: Tunnel Business Magazine provides the North American tunneling industry with a trade magazine focusing on North American topics, projects and news. From large diameter tunneling to microtunneling, TBM: Tunnel Business Magazine, published by Benjamin Media, Inc., reports on the issues and topics important to the North American tunneling contractor, engineer and owner. Free subscriptions are available.

**Products & Services**
- Educational Publishers

**Main Office**
1625 Fullerton Ct
Glendale Heights, IL 60139 United States of America
Phone: (630) 793-0127
Email: info@tsurumipump.com
www.tsurumipump.com

---

**Tunnel24 GmbH**

**Booth 122**

Tunnel24 GmbH is the microtunneling industry’s premier provider of the world’s most advanced, innovative and reliable equipment. We are specialized in the purchase and sale of used microtunneling machines and ancillary equipment from the leading manufacturers. Tunnel24 GmbH does also sell new tools, equipment

**Products & Services**
- Consulting Engineers
- Consulting Environmental Engineering Design and Services for Tunnels
- Geological, Geotechnical Services and Equipment

**Main Office**
475 W Georgia St, Ste #410
Vancouver, BC V6B 4M9 Canada
Phone: (604) 331-2512
COMMUNICATION IS NEVER OPTIONAL

Tunnel Radio delivers.

INFRASSTRUCTURE
Jay Murray
541-760-5735
jay.murray@tunnelradio.com

MINING
JJ Craig
541-760-2995
jj.craig@tunnelradio.com

tunnelradio.com
and spare parts, such as cutting discs, cutter heads, upsize kits, hydraulic cylinders, navigation systems and components (laser target, gyro compass), slurry pumps, separation plants, centrifuges, pipes and fittings, cables, bentonite mixing and lubrication systems, and much more.

Products & Services
Laser Guidance Systems
Microtunneling Equipment, Tools, and Supplies
Pumps and Pumping Equipment
Slurry Services and Machines

Main Office
Bruener Landstrasse 27
Wesel, NRW 46485 Germany
Phone: +4928194868636
Email: retc2023@tunnel24.com
www.tunnel24.com

Tunneling Journal
Booth 413
Tunneling Journal delivers unrivalled editorial quality that features contemporary, lively, cutting edge articles with specific and unparalleled relevance to the tunnelling contractor, consultant, client and machine manufacturer. Published six times a year, the print copy is partnered with a constantly updated website and a fortnightly newsletter. We also publish Breakthrough magazine for the ITA YM, Canadian Tunnelling for Tunnelling Association of Canada, ITA Activity Report, A&NZ Journal for the Australian and New Zealand tunnelling societies, and organisers of the British Tunnelling Society Conference, and the Cutting Edge Conference in partnership with SME. Visit our booth to pick up your complimentary copies and meet the team.

Products & Services
Educational
Publishers

Main Office
The Old Library, Dudley Rd
Tunbridge Wells, Kent TN1 1LE United Kingdom
Phone: +44 (0) 1892 522 585
Email: gary@tunnelingjournal.com
www.tunnelingjournal.com

Tunnels & Tunnelling
Booth 1006
Celebrating 50 years of service to the tunnelling industry, and packed with information about the business its customers are in, Tunnels & Tunnelling remains the leading underground construction magazine worldwide. Since 1999 T&T offers T&T North America, a bi-monthly magazine dedicated to its customers’ regional market, and the official publication of the Tunnelling Association of Canada (TAC). Each edition of T&T informs tunnelling professionals on every aspect of underground construction in five continents. Readers include consulting engineers, clients, contractors and manufacturers in 90 countries. Stay abreast of all developments in the tunnelling industry by subscribing to T&T.

Products & Services
Educational
Publishers

Main Office
John Carpenter House
London EC4Y 0BS United Kingdom
Phone: +44 (0) 20 7406 6584
www.tunnelsonline.info

TunnelTalk
Booth 325
TunnelTalk.com is the most comprehensive record of archive information on tunnelling news, videos, project planning and project progress on the web. Despite a technical and website service hiatus at the moment, TunnelTalk is now in its 15th year and is publishing on the web in its associated digital magazine format and we are staying in touch with readers and industry followers via our Social Media accounts and YouTube channels. For industry suppliers, our readers are your next customers! Let’s meet in Boston in June!

Products & Services
Educational
Publishers

Main Office
21001 N Tatum Blvd, Ste 1630-274
Phoenix, AZ 85050 United States of America
Phone: (602) 399-7184
Email: tunneltalk@tunneltalk.com
www.tunnel24.com

United Rentals Trench Safety
Booth 110
Support of excavation, trench safety, engineering and safety training services available throughout the United States and Canada.

Products & Services
Engineering Design and Services for Tunnels
Safety Products
Underground Excavation Services and Equipment
Ventilation Systems, Materials and Equipment

Main Office
3505 Manchester Trafficway
Kansas City, MO 64129 United States of America
Phone: (800) 890-7129
Email: trenchsafety@ur.com
www.unitedrentals.com

VMT USA
Booth 209
As a driving technological force for more than 25 years, VMT has the experience, the capacities and the know-how to develop innovative system and product solutions that support construction companies all over the world to build tunnels and shafts of every size for ever more complex infrastructure projects: VMT’s navigation systems for driving equipment, its production and logistics management system for segment production and further innovative system solutions for safety, monitoring and data management play key roles here. VMT products can be combined into efficient, modern, networked solutions that ensure streamlined processes and seamless quality assurance for every tunnel project.

Products & Services
Instrumentation Equipment and Services
Laser Guidance Systems
Microtunneling Equipment, Tools, and Supplies
Roadheaders
Survey Equipment and Lasers
Tunnel Boring Equipment

Main Office
1613 132nd Ave E, Ste 200
Sumner, WA 98390 United States of America
Phone: (253) 447-2399
Email: info@vmt-us.com
www.vmt-us.com

VROD
Booth 515
V+ROD composite rebar has been manufactured by Pultrall since 1987. Pultrall manufactures V+ROD re-bars by combining the pultrusion process and an in-line coating process for the outside, sanded surface. The company’s manufacturing processes meet ISO 9001 and ISO 14001 standards. In addition, in-house quality control tests are routinely performed along with tests performed by independent laboratories.

Products & Services
Tunnel Lining and Support Materials

Main Office
700 E Rue Nord
Thetford Mines, QC G6G 6Z5 Canada
Phone: (418) 335-3202
Email: service@pultrall.com
www.fiberglassrebar.com

Watson Bowman Acme
Booth 124
WBA offers expertise in sealing and protecting for all industries including bridge, highway, and tunnel. Solutions are designed with our customers in mind, using high quality materials that are easy to install and even easier to maintain. Our capabilities extend beyond any other manufacturer in the industry, with our ability to create custom designs, and fabricate in-house. WBA is a proud supplier of the complete Omega-shaped Tunnel Seal system. We proudly design and fabricate our clamping system in the United States, reducing lead times on your project.

Products & Services
Control Systems

Main Office
95 Pineview Drive
Buffalo, NY 14228 United States of America
Phone: (716) 341-3238
Email: laura.zakrzewski@watsonbowmanacme.com
www.watsonbowmanacme.com
Williams Form Engineering Corp
Booth 418
Williams Form Engineering Corporation has been providing threaded steel bars and accessories for rock, soil and concrete anchors, post-tensioning systems, and concrete forming hardware systems in the construction industry for over 100 years. Our rock and soil anchor product line includes our Spin-Lock mechanical rock anchors, polyester resin anchors, multiple corrosion protection anchors, soil nails, strand anchors, Manta Ray soil anchors, Geo-Drill Hollow-Bar anchors, and micropiles. For concrete anchoring we offer Spin-Lock anchors, undercut anchors, reusable anchors and cast-in-place anchors. We also have a full line of All-Thread Rebar for tiebacks, micropiles and post-tensioning.

Products & Services
Concrete Reinforcement
Geological, Geotechnical Services and Equipment
Ground Improvement Equipment and Services
Soil Conditioning Equipment and Materials

Main Office
8165 Graphic Dr
Belmont, MI 49306 United States of America
Phone: (616) 866-0815
Email: williams@williamsform.com
www.williamsform.com

Worldsensing SL
Booth 623
Worldsensing is a global IoT pioneer. Founded in 2008, the infrastructure monitoring expert serves customers in more than 70 countries, with a network of global partners to jointly drive safety in mining, construction, rail and structural health. Worldsensing is headquartered in Barcelona and has a local presence in the UK, North and South America, Singapore, Australia and Poland. Investors include Cisco Systems, Mitsui & Co, McCrock Capital, EFG, Kibo Ventures, JME Ventures and Bentley Systems.

Products & Services
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services
Survey Equipment and Lasers

Main Office
Vintat, 47 10th Floor
Barcelona, Barcelona 08014 Spain
Phone: +34934180585
Email: connect@worldsensing.com
www.worldsensing.com

Yamamoto Rock Splitter
Booth 628
Yamamoto hydraulic Rock Splitters offers non-explosive excavation of hard rock without noise, vibrations or flyrock. The excavator-mounted splitters are based on the wedge principle and are the largest of its kind on the market. Applications include open pit excavation, highway widening, building foundations, shaft-sinking and tunnelling. The first unit of Yamamoto Rock Splitter was supplied in 1981. The method has become a standard for excavation in sensitive areas. We offer two models, HRB-1000 for 4" holes and HRB-1700 for 5" holes. Yamamoto is the ideal choice if you don’t want to blast!

Products & Services
Hydraulic Hammers and Drills
Shaft Drilling and Raiseboring Equipment
Tunnel Boring Equipment
Underground Excavation Services and Equipment

Main Office
3 Germay Dr, Unit 4 #2882
Wilmington, DE 19804 United States of America
Phone: (646) 543-8940
Email: info@yamamotorocksplitter.com
www.yamamotorocksplitter.com

Zitron USA
Booth 329
Ventilation, Fans, Ducting and Dust Control

Products & Services
Control Systems
Dust and Fume Control Technology
Ventilation Systems, Materials and Equipment

Main Office
PO Box 2668
Beckley, WV 25802 United States of America
Phone: (304) 253-0777
Email: Caleb@ziton.com
www.Zitron.com/us
<table>
<thead>
<tr>
<th>PRODUCTS &amp; SERVICES</th>
<th>Exhibitor</th>
<th>Booth Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abrasion and Impact Resistant Materials</td>
<td>E-BERK</td>
<td>118</td>
</tr>
<tr>
<td>FPT Infrastructure</td>
<td>Booth 431</td>
<td></td>
</tr>
<tr>
<td>JADCO Manufacturing Inc</td>
<td>Booth 726</td>
<td></td>
</tr>
<tr>
<td>Roxard Industries</td>
<td>Booth 528</td>
<td></td>
</tr>
<tr>
<td>Technogenia Lasercarb Oklahoma Inc</td>
<td>Booth 735</td>
<td></td>
</tr>
<tr>
<td>Air Locks and Bulkheads</td>
<td>ASI Marine</td>
<td>831</td>
</tr>
<tr>
<td>Blasting Services and Supplies</td>
<td>GeoSonics/Vibra-Tech</td>
<td>925</td>
</tr>
<tr>
<td>Computer Hardware and Software</td>
<td>BabEng, LLC</td>
<td>219</td>
</tr>
<tr>
<td>Inzwa Technologies</td>
<td>Booth 1009</td>
<td></td>
</tr>
<tr>
<td>Rocsience, Inc</td>
<td>Booth 923</td>
<td></td>
</tr>
<tr>
<td>Seequent</td>
<td>Booth 308</td>
<td></td>
</tr>
<tr>
<td>SIXENSE</td>
<td>Booth 315</td>
<td></td>
</tr>
<tr>
<td>Concrete Mixing and Transportation Equipment</td>
<td>Advanced Concrete Technologies, Inc</td>
<td>Booth 825</td>
</tr>
<tr>
<td>Fiori Group S.p.A</td>
<td>Booth 614</td>
<td></td>
</tr>
<tr>
<td>McDowell Equipment Ltd</td>
<td>Booth 718</td>
<td></td>
</tr>
<tr>
<td>MCT Group Inc</td>
<td>Booth 834</td>
<td></td>
</tr>
<tr>
<td>Putzmeister America, Inc</td>
<td>Booth 529</td>
<td></td>
</tr>
<tr>
<td>Simem Underground Solutions, Inc</td>
<td>Booth 723</td>
<td></td>
</tr>
<tr>
<td>Trevicos</td>
<td>Booth 111</td>
<td></td>
</tr>
<tr>
<td>Concrete Reinforcement</td>
<td>BarChip Inc</td>
<td>424</td>
</tr>
<tr>
<td>Bekaert</td>
<td>Booth 411</td>
<td></td>
</tr>
<tr>
<td>Continental Building Materials</td>
<td>Booth 112</td>
<td></td>
</tr>
<tr>
<td>GCP Applied Technologies</td>
<td>Booth 324</td>
<td></td>
</tr>
<tr>
<td>MAPEI Corp</td>
<td>Booth 106</td>
<td></td>
</tr>
<tr>
<td>Sika Corporation</td>
<td>Booth 316</td>
<td></td>
</tr>
<tr>
<td>Williams Form Engineering Corp</td>
<td>Booth 418</td>
<td></td>
</tr>
<tr>
<td>Construction - Contracting Services</td>
<td>Acciona Infrastructure Canada Inc</td>
<td>Booth 113</td>
</tr>
<tr>
<td>ASI Marine</td>
<td>Booth 831</td>
<td></td>
</tr>
<tr>
<td>Ballard Marine Construction</td>
<td>Booth 312</td>
<td></td>
</tr>
<tr>
<td>Crux Subsurface, Inc</td>
<td>Booth 519</td>
<td></td>
</tr>
<tr>
<td>Dibit Measuring Technique USA, Inc</td>
<td>Booth 716</td>
<td></td>
</tr>
<tr>
<td>EC Applications - Tunnel Lining</td>
<td>Booth 115</td>
<td></td>
</tr>
<tr>
<td>GZA GeoEnvironmental, Inc</td>
<td>Booth 114</td>
<td></td>
</tr>
<tr>
<td>Hatch</td>
<td>Booth 107</td>
<td></td>
</tr>
<tr>
<td>HYTORC</td>
<td>Booth 706</td>
<td></td>
</tr>
<tr>
<td>Kiewit Infrastructure Co</td>
<td>Booth 128</td>
<td></td>
</tr>
<tr>
<td>Michels Corp</td>
<td>Booth 708</td>
<td></td>
</tr>
<tr>
<td>MILLER</td>
<td>Booth 814</td>
<td></td>
</tr>
<tr>
<td>North American Drillers LLC, a</td>
<td>Shaft Drillers International Company</td>
<td>Booth 724</td>
</tr>
<tr>
<td>Parsons</td>
<td>Booth 918</td>
<td></td>
</tr>
<tr>
<td>Pini Group USA Inc</td>
<td>Booth 832</td>
<td></td>
</tr>
<tr>
<td>PSC Crane and Rigging</td>
<td>Booth 826</td>
<td></td>
</tr>
<tr>
<td>Richard Goettle</td>
<td>Inc-Booth 936</td>
<td></td>
</tr>
<tr>
<td>Consulting Engineers</td>
<td>Acciona Infrastructure Canada Inc</td>
<td>Booth 113</td>
</tr>
<tr>
<td>Advanced Infrastructure Design</td>
<td>Booth 908</td>
<td></td>
</tr>
<tr>
<td>AECOM</td>
<td>Booth 223</td>
<td></td>
</tr>
<tr>
<td>Arup</td>
<td>Booth 126</td>
<td></td>
</tr>
<tr>
<td>BabEng, LLC</td>
<td>Booth 219</td>
<td></td>
</tr>
<tr>
<td>Delve Underground</td>
<td>Booth 522</td>
<td></td>
</tr>
<tr>
<td>Dr. Sauer &amp; Partners Corp</td>
<td>Booth 317</td>
<td></td>
</tr>
<tr>
<td>Fugro</td>
<td>Booth 730</td>
<td></td>
</tr>
<tr>
<td>Gall Zeidler Consultants</td>
<td>Booth 711</td>
<td></td>
</tr>
<tr>
<td>Geocomp Corp/GeoTesting Express</td>
<td>Inc-Booth 611</td>
<td></td>
</tr>
<tr>
<td>Gomez International, Inc</td>
<td>Booth 617</td>
<td></td>
</tr>
<tr>
<td>GZA GeoEnvironmental, Inc</td>
<td>Booth 114</td>
<td></td>
</tr>
<tr>
<td>Hager-Richter Geoscience</td>
<td>Inc-Booth 610</td>
<td></td>
</tr>
<tr>
<td>Hatch</td>
<td>Booth 107</td>
<td></td>
</tr>
<tr>
<td>IFL Consultants, Inc</td>
<td>Booth 934</td>
<td></td>
</tr>
<tr>
<td>JCK Underground</td>
<td>Inc-Booth 331</td>
<td></td>
</tr>
<tr>
<td>Mott MacDonald</td>
<td>Booth 509</td>
<td></td>
</tr>
<tr>
<td>MSP Structures Inc</td>
<td>Booth 926</td>
<td></td>
</tr>
<tr>
<td>Nexans AmerCable</td>
<td>Booth 911</td>
<td></td>
</tr>
<tr>
<td>Parsons</td>
<td>Booth 918</td>
<td></td>
</tr>
<tr>
<td>Pini Group USA Inc</td>
<td>Booth 832</td>
<td></td>
</tr>
<tr>
<td>Schauenburg Maschinen- und Anla-</td>
<td>Booth 833</td>
<td></td>
</tr>
<tr>
<td>gnen-Bau GmbH</td>
<td>Booth 833</td>
<td></td>
</tr>
<tr>
<td>Schnabel Engineering</td>
<td>Booth 806</td>
<td></td>
</tr>
<tr>
<td>Shannon &amp; Wilson</td>
<td>Inc-Booth 612</td>
<td></td>
</tr>
<tr>
<td>Stantec</td>
<td>Booth 212</td>
<td></td>
</tr>
<tr>
<td>TRE ALTAMIRA Inc</td>
<td>Booth 731</td>
<td></td>
</tr>
<tr>
<td>Consulting Environmental</td>
<td>ENVECO ENVIRONMENTAL SOLUTIONS, LLC</td>
<td>Booth 530</td>
</tr>
<tr>
<td>GZA GeoEnvironmental, Inc</td>
<td>Booth 114</td>
<td></td>
</tr>
<tr>
<td>Hager-Richter Geoscience</td>
<td>Inc-Booth 610</td>
<td></td>
</tr>
<tr>
<td>Hatch</td>
<td>Booth 107</td>
<td></td>
</tr>
<tr>
<td>Pini Group USA Inc</td>
<td>Booth 832</td>
<td></td>
</tr>
<tr>
<td>Schauenburg Maschinen- und Anla-</td>
<td>Booth 833</td>
<td></td>
</tr>
<tr>
<td>gnen-Bau GmbH</td>
<td>Booth 833</td>
<td></td>
</tr>
<tr>
<td>Schnabel Engineering</td>
<td>Booth 806</td>
<td></td>
</tr>
<tr>
<td>Shannon &amp; Wilson</td>
<td>Inc-Booth 612</td>
<td></td>
</tr>
<tr>
<td>Stantec</td>
<td>Booth 212</td>
<td></td>
</tr>
<tr>
<td>TRE ALTAMIRA Inc</td>
<td>Booth 731</td>
<td></td>
</tr>
<tr>
<td>Conveyor Equipment and Systems</td>
<td>E-BERK</td>
<td>Booth 118</td>
</tr>
<tr>
<td>H+E Logistics USA</td>
<td>Inc-Booth 211</td>
<td></td>
</tr>
<tr>
<td>MCT Group Inc</td>
<td>Booth 834</td>
<td></td>
</tr>
<tr>
<td>Moldequipo Internacional</td>
<td>Booth 737</td>
<td></td>
</tr>
<tr>
<td>Robbins</td>
<td>Booth 409</td>
<td></td>
</tr>
<tr>
<td>Terratec / Kelley Engineered Equipament</td>
<td>Booth 526</td>
<td></td>
</tr>
<tr>
<td>Drilling Services and Equipment</td>
<td>Crux Subsurface, Inc</td>
<td>Booth 519</td>
</tr>
<tr>
<td>Derrick Corporation</td>
<td>Booth 427</td>
<td></td>
</tr>
<tr>
<td>ENVECO ENVIRONMENTAL SOLUTIONS, LLC</td>
<td>Booth 530</td>
<td></td>
</tr>
<tr>
<td>J.H. Fletcher &amp; Co</td>
<td>Booth 930</td>
<td></td>
</tr>
<tr>
<td>Kayden Environmental Services</td>
<td>Booth 109</td>
<td></td>
</tr>
<tr>
<td>Malcolm Drilling Co</td>
<td>Inc-Booth 425</td>
<td></td>
</tr>
<tr>
<td>McDowell Equipment Ltd</td>
<td>Booth 718</td>
<td></td>
</tr>
<tr>
<td>Palmieri S.p.A.</td>
<td>Booth 314</td>
<td></td>
</tr>
<tr>
<td>Ruen Drilling, Inc</td>
<td>Booth 322</td>
<td></td>
</tr>
<tr>
<td>Sandvik Mining and Rock Solutions</td>
<td>Booth 412</td>
<td></td>
</tr>
<tr>
<td>Trevicos</td>
<td>Booth 111</td>
<td></td>
</tr>
<tr>
<td>Dust and Fume Control Technology</td>
<td>ABC Industries, Inc</td>
<td>Booth 415</td>
</tr>
<tr>
<td>Geo-Instruments</td>
<td>Booth 909</td>
<td></td>
</tr>
<tr>
<td>Grydale USA</td>
<td>Booth 910</td>
<td></td>
</tr>
<tr>
<td>Rocvent Inc</td>
<td>Booth 815</td>
<td></td>
</tr>
<tr>
<td>Spendrup Fan Co/CFT</td>
<td>Booth 715</td>
<td></td>
</tr>
<tr>
<td>Zitron USA</td>
<td>Booth 329</td>
<td></td>
</tr>
<tr>
<td>Earth Pressure Balance Machines</td>
<td>ASI Marine</td>
<td>Booth 831</td>
</tr>
<tr>
<td>Herrenknecht Tunnelling Systems</td>
<td>USA, Inc-Booth 206</td>
<td></td>
</tr>
<tr>
<td>Master Builders Solutions</td>
<td>Booth 607</td>
<td></td>
</tr>
<tr>
<td>MTS / Polaris Underground Solutions</td>
<td>Booth 1007</td>
<td></td>
</tr>
</tbody>
</table>
Robbins–Booth 409
Terratec / Kelley Engineered Equipment–Booth 526

**Educational**
Colorado School of Mines–Booth 725
Deep Foundations Institute–Booth 900
Northwest Laborers-Employers Training Trust–Booth 817
Tunnel Business Magazine (TBM)– Booth 513
Tunneling Journal–Booth 413
Tunnels & Tunnelling–Booth 1006
TunnelTalk–Booth 325

**Electrical - Generator-Motor, Wire-Cable**
CAB–Booth 818
Carroll Technologies Group–Booth 808
Gomez International, Inc–Booth 617
Line Power–Booth 622
Nexans AmerCable–Booth 911

**Engineering Design and Services for Tunnels**
AECOM–Booth 223
Arup–Booth 126
BabEng, LLC–Booth 219
Bekaert–Booth 411
CBE GROUP–Booth 627
CREG TBM Germany GmbH–Booth 830
Delve Underground–Booth 522
Dibit Measuring Technique USA, Inc.– Booth 716
Dr. Sauer & Partners Corp–Booth 317
Gall Zeidler Consultants–Booth 711
Geocomp Corp/GeoTesting Express, Inc.–Booth 611
GeoSonics/Vibra-Tech–Booth 925
Gomez International, Inc–Booth 617
Hatch–Booth 107
HNTB Corp–Booth 216
JCK Underground, Inc–Booth 331
Matrix Design Group–Booth 1022
Mott MacDonald–Booth 509
MSP Structures Inc–Booth 926
MTS /Polaris Underground Solutions–Booth 1007
Parsons–Booth 918
Promat International NV–Booth 117
PSC Crane and Rigging–Booth 826
Schnabel Engineering–Booth 806
Shannon & Wilson, Inc–Booth 612
SIXENSE–Booth 315
Stantec–Booth 212
STV Inc–Booth 1010
Terra Insights–Booth 719

**Terratec / Kelley Engineered Equipment–Booth 526**
Towill, Inc.–Booth 217
TRE ALTAMIRA Inc–Booth 731
United Rentals Trench Safety–Booth 110
WSP–Booth 807

**Environmental Control Equipment and Supplies**
AMR PEMCO, Inc–Booth 1011
ENVECO ENVIRONMENTAL SOLUTIONS, LLC–Booth 530
Innovative Wireless Technologies–Booth 922
Iot Automation–Booth 512

**Explosive Materials and Services**
Daigh Company, Inc–Booth 733
GeoSonics/Vibra-Tech–Booth 925

**Fabrication Materials**
Gomez International, Inc–Booth 617
JADCO Manufacturing Inc–Booth 726

**Geological, Geotechnical Services and Equipment**
Ackcio–Booth 1027
AECOM–Booth 223
Amberg Technologies Ltd–Booth 430
Collier Geophysics–Booth 1008
Crux Subsurface, Inc–Booth 519
Delve Underground–Booth 522
Dibit Measuring Technique USA, Inc.– Booth 716
FPT Infrastructure–Booth 431
Geocomp Corp/GeoTesting Express, Inc–Booth 611
Geo-Instruments–Booth 909
GEOKON–Booth 423
Geosense Ltd–Booth 626
GeoSonics/Vibra-Tech–Booth 925
GZA GeoEnvironmental, Inc–Booth 114
Hager-Richter Geoscience, Inc–Booth 610
IOT Automation–Booth 512
JENNMAR Civil–Booth 123
Mott MacDonald–Booth 509
North American Drillers LLC, a Shaft Drillers International Company–Booth 724
Shannon & Wilson, Inc–Booth 612
Simem Underground Solutions, Inc–Booth 723
Stage 3 Separation–Booth 630
TPH & GEOFORM North America–Booth 629
Williams Form Engineering Corp–Booth 418

**Grouting Services, Equipment and Materials**
Aerix Industries–Booth 319
AMIX Systems Ltd–Booth 1023
Avanti International–Booth 618
Bauer Foundation Corporation–Booth 524
ChemGrout, Inc–Booth 422
CJ Geo–Booth 809
Crux Subsurface, Inc–Booth 519
DSI Tunneling LLC–Booth 408
Fiori Group S.p.A–Booth 614
FPT Infrastructure–Booth 431
GCP Applied Technologies–Booth 324
SIXENSE–Booth 315
Stage 3 Separation–Booth 630
STV Inc–Booth 1010
Terra Insights–Booth 719
TRE ALTAMIRA Inc–Booth 731
Williams Form Engineering Corp–Booth 418
Worldsensing SL–Booth 623
WSP–Booth 807

**Ground Freezing**
Bauer Foundation Corporation–Booth 524
CDM Smith–Booth 608
Keller–Booth 907
SoilFreeze Inc–Booth 727
TPH & GEOFORM North America–Booth 629

**Ground Improvement Equipment and Services**
Alpine Equipment–Booth 615
Avanti International–Booth 618
CJ Geo–Booth 809
Crux Subsurface, Inc–Booth 519
DSI Tunneling LLC–Booth 408
Inflatable Packers Intlformaional LLC–Booth 914
Keller–Booth 907
Malcolm Drilling Co Inc–Booth 425
Master Builders Solutions–Booth 607
North American Drillers LLC, a Shaft Drillers International Company–Booth 724
Shannon & Wilson, Inc–Booth 612
Simem Underground Solutions, Inc–Booth 723
<table>
<thead>
<tr>
<th>PRODUCTS &amp; SERVICES</th>
<th>Exhibitor Listings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflatable Packers Internaional LLC</strong>-Booth 914</td>
<td>SIXENSE–Booth 315</td>
</tr>
<tr>
<td>Keller–Booth 907</td>
<td>Terra Insights–Booth 719</td>
</tr>
<tr>
<td>Malcolm Drilling Co Inc–Booth 425</td>
<td>Trimble Inc–Booth 624</td>
</tr>
<tr>
<td>MAPEI Corp–Booth 106</td>
<td>VMT USA–Booth 209</td>
</tr>
<tr>
<td>Master Builders Solutions–Booth 607</td>
<td>Worldsensing SL–Booth 623</td>
</tr>
<tr>
<td>Minova–Booth 714</td>
<td><strong>Jet Grouting Equipment and Services</strong></td>
</tr>
<tr>
<td>MixOnSite USA, Inc–Booth 837</td>
<td>Keller–Booth 907</td>
</tr>
<tr>
<td>Nicholson Construction Co–Booth 311</td>
<td>Malcolm Drilling Co Inc–Booth 425</td>
</tr>
<tr>
<td>QSP Packers, LLC–Booth 728</td>
<td>TPH &amp; GEOFORM North America–Booth 629</td>
</tr>
<tr>
<td>Renesco Inc–Booth 327</td>
<td><strong>Laser Guidance Systems</strong></td>
</tr>
<tr>
<td>Richard Goettle, Inc–Booth 936</td>
<td>Amberg Technologies Ltd–Booth 430</td>
</tr>
<tr>
<td>Richway Industries–Booth 823</td>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
</tr>
<tr>
<td>Sika Corporation–Booth 826</td>
<td>Tunnel24 GmbH–Booth 122</td>
</tr>
<tr>
<td>Simem Underground Solutions, Inc–Booth 723</td>
<td>VMT USA–Booth 209</td>
</tr>
<tr>
<td>Stage 3 Separation–Booth 630</td>
<td><strong>Lighting Systems</strong></td>
</tr>
<tr>
<td>Technical Tunnelling Components LTD (TTC)–Booth 309</td>
<td>Carroll Technologies Group–Booth 808</td>
</tr>
<tr>
<td>TPH &amp; GEOFORM North America–Booth 629</td>
<td>IoT Automation–Booth 512</td>
</tr>
<tr>
<td>Treviocos–Booth 111</td>
<td>x-Glo North America Inc–Booth 310</td>
</tr>
<tr>
<td><strong>Hoists and Headframes</strong></td>
<td><strong>Lubricants for TBM</strong></td>
</tr>
<tr>
<td>Carroll Technologies Group–Booth 808</td>
<td>AMR PEMCO, Inc–Booth 1011</td>
</tr>
<tr>
<td>MILLER–Booth 814</td>
<td>H+E Logistics USA, Inc–Booth 211</td>
</tr>
<tr>
<td>PSC Crane and Rigging–Booth 826</td>
<td>J.H. Fletcher &amp; Co–Booth 930</td>
</tr>
<tr>
<td>Trevicos–Booth 111</td>
<td>JADCO Manufacturing Inc–Booth 726</td>
</tr>
<tr>
<td>Yamamoto Rock Splitter–Booth 628</td>
<td>Line Power–Booth 622</td>
</tr>
<tr>
<td><strong>Hydraulic Hammers and Drills</strong></td>
<td><strong>Matrix Design Group–Booth 1022</strong></td>
</tr>
<tr>
<td>Epiroc–Booth 508</td>
<td>McDowell Equipment Ltd–Booth 718</td>
</tr>
<tr>
<td>Trevicos–Booth 111</td>
<td>MineARC Systems–Booth 916</td>
</tr>
<tr>
<td>Yamamoto Rock Splitter–Booth 628</td>
<td>Minova–Booth 714</td>
</tr>
<tr>
<td><strong>Instrumentation Equipment and Services</strong></td>
<td>QSP Packers, LLC–Booth 728</td>
</tr>
<tr>
<td>Ackcio–Booth 1027</td>
<td>Robbins–Booth 409</td>
</tr>
<tr>
<td>AMR PEMCO, Inc–Booth 1011</td>
<td>Sandvik Mining and Rock Solutions–Booth 412</td>
</tr>
<tr>
<td>Carroll Technologies Group–Booth 808</td>
<td>Epiroc–Booth 508</td>
</tr>
<tr>
<td>Crux Subsurface, Inc–Booth 519</td>
<td>Carraro Technologies Group–Booth 808</td>
</tr>
<tr>
<td>Dibit Measuring Technique USA, Inc.–Booth 716</td>
<td>Terra Insights–Booth 719</td>
</tr>
<tr>
<td>DUHAM Geo Slope Indicator–Booth 702</td>
<td>Terratec / Kelley Engineered Equipment–Booth 526</td>
</tr>
<tr>
<td>Geocomp Corp/GeoTesting Express, Inc–Booth 611</td>
<td>Terra Insights–Booth 719</td>
</tr>
<tr>
<td>Geo–Instruments–Booth 909</td>
<td><strong>Precast Concrete Linings</strong></td>
</tr>
<tr>
<td>GEOKON–Booth 423</td>
<td>AGRU America, Inc–Booth 214</td>
</tr>
<tr>
<td>Geosense Ltd–Booth 626</td>
<td>ASI Marine–Booth 831</td>
</tr>
<tr>
<td>Geosonics/Vibra-Tech–Booth 925</td>
<td>Derrick Corporation–Booth 427</td>
</tr>
<tr>
<td>GZA GeoEnvironmental, Inc–Booth 114</td>
<td>E-BERK–Booth 118</td>
</tr>
<tr>
<td>Inzwa Technologies–Booth 1009</td>
<td>FPT Infrastructure–Booth 431</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Herrenknecht Tunnelling Systems USA, Inc–Booth 206</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Kayden Environmental Services–Booth 109</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>McDowell Equipment Ltd–Booth 718</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>MTS /Polaris Underground Solutions–Booth 1007</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Schauenburg Maschinen- und Anlagen-Bau GmbH–Booth 833</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Sentinel Solutions LLC–Booth 525</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Terratec / Kelley Engineered Equipment–Booth 526</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Tunnel24 GmbH–Booth 122</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>VMT USA–Booth 209</td>
</tr>
<tr>
<td><strong>Microtunneling Equipment, Tools, and Supplies</strong></td>
<td><strong>Mining Equipment</strong></td>
</tr>
<tr>
<td>AGRU America, Inc–Booth 214</td>
<td>ABC Industries, Inc–Booth 415</td>
</tr>
<tr>
<td>ASI Marine–Booth 831</td>
<td>Ackcio–Booth 1027</td>
</tr>
<tr>
<td>Derrick Corporation–Booth 427</td>
<td>Alpine Equipment–Booth 615</td>
</tr>
<tr>
<td>E-BERK–Booth 118</td>
<td><strong>Pumps and Pumping Equipment</strong></td>
</tr>
<tr>
<td>FPT Infrastructure–Booth 431</td>
<td>Avanti International–Booth 618</td>
</tr>
<tr>
<td>Herrenknecht Tunnelling Systems USA, Inc–Booth 206</td>
<td>ChemGrout, Inc–Booth 422</td>
</tr>
<tr>
<td>Kayden Environmental Services–Booth 109</td>
<td>Gomez International, Inc–Booth 617</td>
</tr>
<tr>
<td>McDowell Equipment Ltd–Booth 718</td>
<td>HYTORC–Booth 706</td>
</tr>
<tr>
<td>MTS /Polaris Underground Solutions–Booth 1007</td>
<td>McDowell Equipment Ltd–Booth 718</td>
</tr>
<tr>
<td>Palmieri S.p.A.–Booth 314</td>
<td>Miller Sales and Engineering–Booth 824</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Minova–Booth 714</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Sentinel Solutions LLC–Booth 525</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Simem Underground Solutions, Inc–Booth 723</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Tsurumi Pump–Booth 822</td>
</tr>
<tr>
<td>Poltinger Precision Systems GmbH–Booth 116</td>
<td>Tunnel24 GmbH–Booth 122</td>
</tr>
</tbody>
</table>
### Rail Products
- Brookville Equipment Corp–Booth 518
- JENNMR Civil–Booth 123
- SEALABLE Solutions GmbH (formerly Datwyler Sealing Technology)–Booth 323

### Roadheaders
- Antraquip Corp–Booth 523
- CREG TBM Germany GmbH–Booth 830
- Poltinger Precision Systems GmbH–Booth 116
- Sandvik Mining and Rock Solutions–Booth 412
- VMT USA–Booth 209

### Rock Drills
- Epiroc–Booth 508
- J.H. Fletcher & Co–Booth 930
- McDowell Equipment Ltd–Booth 718
- Palmieri S.p.A.–Booth 314
- ROBODRILL S.A.–Booth 527
- Sandvik Mining and Rock Solutions–Booth 412

### Soft Ground Shields
- Herrenknecht Tunnelling Systems USA, Inc–Booth 206
- Robbins–Booth 409
- TPH & GEOFORM North America–Booth 629

### Soil Conditioning Equipment and Materials
- FPT Infrastructure–Booth 431
- Geocomp Corp/GeoTesting Express, Inc–Booth 611
- MAPEI Corp–Booth 106
- Minova–Booth 714
- Sika Corporation–Booth 316
- TNL18–Booth 1026
- TPH & GEOFORM North America–Booth 629
- Williams Form Engineering Corp–Booth 418

### Survey Equipment and Lasers
- Amberg Technologies Ltd–Booth 430
- ASI Marine–Booth 831
- Dibit Measuring Technique USA, Inc–Booth 716
- GZA GeoEnvironmental, Inc–Booth 114
- MAPEI Corp–Booth 106
- Poltinger Precision Systems GmbH–Booth 116
- Sentinel Solutions LLC–Booth 525
- Stage 3 Separation–Booth 630
- Trevicos–Booth 111
- Tunnel24 GmbH–Booth 122

### Steel Pipe
- JENNMR Civil–Booth 123
- Naylor Pipe Co–Booth 707
- TBM Supply–Booth 616

### Survey Equipment and Lasers
- Amberg Technologies Ltd–Booth 430
- ASI Marine–Booth 831
- Dibit Measuring Technique USA, Inc–Booth 716
- GZA GeoEnvironmental, Inc–Booth 114
- MAPEI Corp–Booth 106
- Poltinger Precision Systems GmbH–Booth 116
- Sentinel Solutions LLC–Booth 525
- Stage 3 Separation–Booth 630
- Trevicos–Booth 111
- Tunnel24 GmbH–Booth 122

### Steel Pipe
- JENNMR Civil–Booth 123
- Naylor Pipe Co–Booth 707
- TBM Supply–Booth 616

### Survey Equipment and Lasers
- Amberg Technologies Ltd–Booth 430
- ASI Marine–Booth 831
- Dibit Measuring Technique USA, Inc–Booth 716
- GZA GeoEnvironmental, Inc–Booth 114
- MAPEI Corp–Booth 106
- Poltinger Precision Systems GmbH–Booth 116
- Sentinel Solutions LLC–Booth 525
- Stage 3 Separation–Booth 630
- Trevicos–Booth 111
- Tunnel24 GmbH–Booth 122

### Survey Equipment and Lasers
- Amberg Technologies Ltd–Booth 430
- ASI Marine–Booth 831
- Dibit Measuring Technique USA, Inc–Booth 716
- GZA GeoEnvironmental, Inc–Booth 114
- MAPEI Corp–Booth 106
- Poltinger Precision Systems GmbH–Booth 116
- Sentinel Solutions LLC–Booth 525
- Stage 3 Separation–Booth 630
- Trevicos–Booth 111
- Tunnel24 GmbH–Booth 122

### Tunnel Boring Equipment
- Antraquip Corp–Booth 523
- ASI Marine–Booth 831
- Ballard Marine Construction–Booth 312
- Bessac–Booth 313
- Chengdu Foresight–Booth 932

---

**Table:**

<table>
<thead>
<tr>
<th>Products &amp; Services</th>
<th>Booth Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rail Products</strong></td>
<td></td>
</tr>
<tr>
<td>Brookville Equipment Corp</td>
<td>518</td>
</tr>
<tr>
<td>JENNMR Civil</td>
<td>123</td>
</tr>
<tr>
<td>SEALABLE Solutions GmbH</td>
<td>323</td>
</tr>
<tr>
<td><strong>Roadheaders</strong></td>
<td></td>
</tr>
<tr>
<td>Antraquip Corp</td>
<td>523</td>
</tr>
<tr>
<td>CREG TBM Germany GmbH</td>
<td>830</td>
</tr>
<tr>
<td>Poltinger Precision Systems</td>
<td>116</td>
</tr>
<tr>
<td>Sandvik Mining and Rock</td>
<td>412</td>
</tr>
<tr>
<td>Solutions</td>
<td>209</td>
</tr>
<tr>
<td><strong>Rock Drills</strong></td>
<td></td>
</tr>
<tr>
<td>Epiroc</td>
<td>508</td>
</tr>
<tr>
<td>J.H. Fletcher &amp; Co</td>
<td>930</td>
</tr>
<tr>
<td>McDowell Equipment Ltd</td>
<td>718</td>
</tr>
<tr>
<td>Palmieri S.p.A.</td>
<td>314</td>
</tr>
<tr>
<td>ROBODRILL S.A.</td>
<td>527</td>
</tr>
<tr>
<td>Sandvik Mining and Rock</td>
<td>412</td>
</tr>
<tr>
<td>Solutions</td>
<td></td>
</tr>
<tr>
<td><strong>Soft Ground Shields</strong></td>
<td></td>
</tr>
<tr>
<td>Herrenknecht Tunnelling</td>
<td>206</td>
</tr>
<tr>
<td>Systems USA Inc</td>
<td>123</td>
</tr>
<tr>
<td>Keller</td>
<td>907</td>
</tr>
<tr>
<td>MILLER</td>
<td>814</td>
</tr>
<tr>
<td>North American Drillers</td>
<td>724</td>
</tr>
<tr>
<td>LLC, a Shaft Drills</td>
<td></td>
</tr>
<tr>
<td>International Company</td>
<td></td>
</tr>
<tr>
<td>Booth</td>
<td>724</td>
</tr>
<tr>
<td>Palmieri S.p.A.</td>
<td>314</td>
</tr>
<tr>
<td>Yamamoto Rock Splitter</td>
<td>628</td>
</tr>
<tr>
<td><strong>Shotcrete Equipment,</strong></td>
<td></td>
</tr>
<tr>
<td>Supplies, and Services</td>
<td></td>
</tr>
<tr>
<td>Bekaert</td>
<td>411</td>
</tr>
<tr>
<td>Continental Building Materials</td>
<td>112</td>
</tr>
<tr>
<td>GCP Applied Technologies</td>
<td>324</td>
</tr>
<tr>
<td>Malcolm Drilling Co Inc</td>
<td>425</td>
</tr>
<tr>
<td>MAPEI Corp</td>
<td>106</td>
</tr>
<tr>
<td>Master Builders Solutions</td>
<td>607</td>
</tr>
<tr>
<td>McDowell Equipment Ltd</td>
<td>718</td>
</tr>
<tr>
<td>Minova</td>
<td>714</td>
</tr>
<tr>
<td>North American Drillers</td>
<td>724</td>
</tr>
<tr>
<td>LLC, a Shaft Drills</td>
<td></td>
</tr>
<tr>
<td>International Company</td>
<td></td>
</tr>
<tr>
<td>Booth</td>
<td>724</td>
</tr>
<tr>
<td>Putzmeister America, Inc</td>
<td>529</td>
</tr>
<tr>
<td>Sika Corporation</td>
<td>316</td>
</tr>
<tr>
<td>Simem Underground Solutions</td>
<td>723</td>
</tr>
<tr>
<td>Strata Worldwide</td>
<td>827</td>
</tr>
<tr>
<td>Tunneling</td>
<td></td>
</tr>
<tr>
<td><strong>Slurry Services and</strong></td>
<td></td>
</tr>
<tr>
<td>Machines</td>
<td></td>
</tr>
<tr>
<td>Derrick Corporation</td>
<td>427</td>
</tr>
<tr>
<td>ENVESCO ENVIRONMENTAL SOLUTIONS, LLC</td>
<td>530</td>
</tr>
<tr>
<td>Kayden Environmental Services</td>
<td>109</td>
</tr>
<tr>
<td>Keller</td>
<td>907</td>
</tr>
<tr>
<td>Malcolm Drilling Co Inc</td>
<td>425</td>
</tr>
<tr>
<td>MAPEI Corp</td>
<td>106</td>
</tr>
<tr>
<td>MTS / Polaris Underground Solutions</td>
<td>1007</td>
</tr>
<tr>
<td>Schauenburg Maschinen- und Anlagen-Bau GmbH</td>
<td>833</td>
</tr>
<tr>
<td>Sentinel Solutions LLC</td>
<td>525</td>
</tr>
<tr>
<td>Stage 3 Separation</td>
<td>630</td>
</tr>
<tr>
<td>Trevicos</td>
<td>111</td>
</tr>
<tr>
<td>Tunnel24 GmbH</td>
<td>122</td>
</tr>
<tr>
<td><strong>Steel Pipe</strong></td>
<td></td>
</tr>
<tr>
<td>JENNMR Civil</td>
<td>123</td>
</tr>
<tr>
<td>Naylor Pipe Co</td>
<td>707</td>
</tr>
<tr>
<td>TBM Supply</td>
<td>616</td>
</tr>
<tr>
<td><strong>Survey Equipment and</strong></td>
<td></td>
</tr>
<tr>
<td>Lasers</td>
<td></td>
</tr>
<tr>
<td>Amberg Technologies Ltd</td>
<td>430</td>
</tr>
<tr>
<td>ASI Marine</td>
<td>831</td>
</tr>
<tr>
<td>Dibit Measuring Technique</td>
<td>716</td>
</tr>
<tr>
<td>USA, Inc–Booth</td>
<td></td>
</tr>
<tr>
<td>GZA GeoEnvironmental</td>
<td>114</td>
</tr>
<tr>
<td>MAPEI Corp</td>
<td>106</td>
</tr>
<tr>
<td>Poltinger Precision Systems</td>
<td>116</td>
</tr>
<tr>
<td>Sentinel Solutions LLC</td>
<td>525</td>
</tr>
<tr>
<td>Stage 3 Separation</td>
<td>630</td>
</tr>
<tr>
<td>Trevicos</td>
<td>111</td>
</tr>
<tr>
<td>Tunnel24 GmbH</td>
<td>122</td>
</tr>
<tr>
<td><strong>Tunnel Boring Equipment</strong></td>
<td></td>
</tr>
<tr>
<td>Antraquip Corp</td>
<td>523</td>
</tr>
<tr>
<td>ASI Marine</td>
<td>831</td>
</tr>
<tr>
<td>Ballard Marine Construction</td>
<td>312</td>
</tr>
<tr>
<td>Bessac</td>
<td>313</td>
</tr>
<tr>
<td>Chengdu Foresight</td>
<td>932</td>
</tr>
</tbody>
</table>
## PRODUCTS & SERVICES

<table>
<thead>
<tr>
<th>Products &amp; Services</th>
<th>Exhibitors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRODUCTS &amp; SERVICES</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CREG TBM Germany GmbH</strong>–Booth 830</td>
<td></td>
</tr>
<tr>
<td><strong>E-BERK</strong>–Booth 118</td>
<td></td>
</tr>
<tr>
<td><strong>Epircoc</strong>–Booth 508</td>
<td></td>
</tr>
<tr>
<td><strong>Gomez International, Inc</strong>–Booth 617</td>
<td></td>
</tr>
<tr>
<td><strong>Herrenknecht Tunnelling Systems USA, Inc</strong>–Booth 206</td>
<td></td>
</tr>
<tr>
<td><strong>HNTB Corp</strong>–Booth 216</td>
<td></td>
</tr>
<tr>
<td><strong>Messinger Bearings</strong>–Booth 416</td>
<td></td>
</tr>
<tr>
<td><strong>MTS /Polaris Underground Solutions</strong>–Booth 1007</td>
<td></td>
</tr>
<tr>
<td><strong>Palmieri S.p.A.</strong>–Booth 314</td>
<td></td>
</tr>
<tr>
<td><strong>Poltinger Precision Systems GmbH</strong>–Booth 116</td>
<td></td>
</tr>
<tr>
<td><strong>Richway Industries</strong>–Booth 823</td>
<td></td>
</tr>
<tr>
<td><strong>Robbins</strong>–Booth 409</td>
<td></td>
</tr>
<tr>
<td><strong>Roxard Industries</strong>–Booth 528</td>
<td></td>
</tr>
<tr>
<td><strong>Sentinel Solutions LLC</strong>–Booth 617</td>
<td></td>
</tr>
<tr>
<td><strong>Herrenknecht Tunnelling Systems USA, Inc</strong>–Booth 206</td>
<td></td>
</tr>
<tr>
<td><strong>HNTB Corp</strong>–Booth 216</td>
<td></td>
</tr>
<tr>
<td><strong>Messinger Bearings</strong>–Booth 416</td>
<td></td>
</tr>
<tr>
<td><strong>MTS /Polaris Underground Solutions</strong>–Booth 1007</td>
<td></td>
</tr>
<tr>
<td><strong>Palmieri S.p.A.</strong>–Booth 314</td>
<td></td>
</tr>
<tr>
<td><strong>Poltinger Precision Systems GmbH</strong>–Booth 116</td>
<td></td>
</tr>
<tr>
<td><strong>Richway Industries</strong>–Booth 823</td>
<td></td>
</tr>
<tr>
<td><strong>Robbins</strong>–Booth 409</td>
<td></td>
</tr>
<tr>
<td><strong>Roxard Industries</strong>–Booth 528</td>
<td></td>
</tr>
<tr>
<td><strong>Sentinel Solutions LLC</strong>–Booth 617</td>
<td></td>
</tr>
</tbody>
</table>

**Tunnel Communication Systems and Equipment**

| Ackcio–Booth 1027 | |
| AMR PEMCO, Inc–Booth 1011 | |
| Carroll Technologies Group–Booth 808 | |
| Controll International–Booth 625 | |
| HNTB Corp–Booth 216 | |
| Innovative Wireless Technologies–Booth 922 | |
| IoT Automation–Booth 512 | |
| MineARC Systems–Booth 916 | |
| Strata Worldwide | Tunneling–Booth 827 | |
| Terra Insights–Booth 719 | |
| Tunnel Radio of America, Inc–Booth 531 | |
| x-Glo North America Inc–Booth 310 | |

**Tunnel Haulage Systems**

| E-BERK–Booth 118 | |
| HNTB Corp–Booth 216 | |
| Matrix Design Group–Booth 1022 | |
| McDowell Equipment Ltd–Booth 718 | |

**Tunnel Lining and Support Materials**

| ABC Industries, Inc–Booth 415 | |
| AGRU America, Inc–Booth 214 | |
| Antraquip Corp–Booth 523 | |
| Bekaat–Booth 411 | |
| Bessac–Booth 313 | |
| CAB–Booth 818 | |
| CBE GROUP–Booth 627 | |
| Chengdu E-Berk–Booth 932 | |
| Continental Building Materials–Booth 112 | |
| David R. Klug & Associates, Inc–Booth 213 | |
| DSI Tunneling LLC–Booth 408 | |
| EC Applications - Tunnel Lining–Booth 115 | |
| Everest Equipment Co–Booth 516 | |
| FPT Infrastructure–Booth 431 | |
| GCP Applied Technologies–Booth 324 | |
| HNTB Corp–Booth 216 | |
| JENNMAR Civil–Booth 123 | |
| Minova–Booth 714 | |
| Moldequipo Internacional–Booth 737 | |
| MSP Structures Inc–Booth 926 | |
| Promat International NV–Booth 117 | |
| QSP Packers, LLC–Booth 728 | |
| Renesco Inc–Booth 327 | |
| Richway Industries–Booth 823 | |
| SEALABLE Solutions GmbH (formerly Datwyler Sealing Technology)–Booth 323 | |
| Shotcrete Technologies, Inc–Booth 722 | |
| Technical Tunnelling Components LTD (TTC)–Booth 309 | |
| VROD–Booth 515 | |

**Underground Excavation Services and Equipment**

| Alpine Equipment–Booth 615 | |
| Antraquip Corp–Booth 523 | |
| Bekaat–Booth 411 | |
| Brokk Inc–Booth 514 | |
| CREG TBM Germany GmbH–Booth 830 | |
| Fiori Group S.p.A–Booth 614 | |
| Kayden Environmental Services–Booth 109 | |
| Matrix Design Group–Booth 1022 | |
| McDowell Equipment Ltd–Booth 718 | |
| Michels Corp–Booth 708 | |
| Parsons–Booth 918 | |
| Richway Industries–Booth 823 | |
| United Rentals Trench Safety–Booth 110 | |
| Yamamoto Rock Splitter–Booth 628 | |

**Underground Locomotives and Rail Haulage Equipment**

| Brookville Equipment Corp–Booth 518 | |
| CREG TBM Germany GmbH–Booth 830 | |
| E-BERK–Booth 118 | |
| McDowell Equipment Ltd–Booth 718 | |
| PSC Crane and Rigging–Booth 826 | |

**Underground Utility Materials and Equipment**

| AGRU America, Inc–Booth 214 | |
| Avanti International–Booth 618 | |
| CAB–Booth 818 | |
| Chengdu E-Berk–Booth 932 | |
| HOBAS Pipe USA–Booth 225 | |
| MineARC Systems–Booth 916 | |

**Ventilation Systems, Materials and Equipment**

| ABC Industries, Inc–Booth 415 | |
| ABC Ventilation Systems–Booth 120 | |
| AMR PEMCO, Inc–Booth 1011 | |
| CAB–Booth 818 | |
| Chengdu E-Berk–Booth 932 | |
| Grydale USA–Booth 910 | |
| HNTB Corp–Booth 216 | |
| JENNMAR Civil–Booth 123 | |
| MineARC Systems–Booth 916 | |
| Mining Equipment Ltd–Booth 417 | |
| Rocvent Inc–Booth 815 | |
| Schauenburg Flexadux Corp–Booth 835 | |
| Spendrup Fan Co/CFT–Booth 715 | |
| TLT-Turbo–Booth 428 | |
| United Rentals Trench Safety–Booth 110 | |
| Zitron USA–Booth 329 | |

**Wastewater Management Products**

| AGRU America, Inc–Booth 214 | |
| Derrick Corporation–Booth 427 | |
| ENVECO ENVIRONMENTAL SOLUTIONS, LLC–Booth 530 | |
| HOBAS Pipe USA–Booth 225 | |
| Kayden Environmental Services–Booth 109 | |
| Stage 3 Separation–Booth 630 | |
| Tsurumi Pump–Booth 822 | |

**Water Treatment Plant and Materials**

| AGRU America, Inc–Booth 214 | |
| Derrick Corporation–Booth 427 | |
| ENVECO ENVIRONMENTAL SOLUTIONS, LLC–Booth 530 | |
| HOBAS Pipe USA–Booth 225 | |
| Schauenburg Maschinen- und Anlagen-Bau GmbH–Booth 833 | |
| Sentinel Solutions LLC–Booth 525 | |
| Stage 3 Separation–Booth 630 | |
| Tsurumi Pump–Booth 822 | |
Make an Exciting Career Move with the UCA Career Center

Search a dedicated career resource specific to the underground construction industry.

The UCA Career Center connects you with employers actively looking for professionals in the tunneling and underground construction industry.

Interested in posting a job or internship opportunity and connecting with the talented UCA membership?

Learn more at uca.careerwebsite.com or contact Laura Nelson at nelson@smenet.org.

Visit tunnelingjobs.org to:

- Create a job seeker profile
- Post a resume
- Apply for jobs
- Get job flash emails
At Keller, sustainability is at the heart of our strategy

As the leading geotechnical specialty contractor, we are committed to better understanding our contribution to sustainable development and are working to improve sustainability through innovative design and products.

KELLER

The leading geotechnical specialty contractor

Deep foundations
Environmental remediation
Ground improvement
Groundwater control
Instrumentation & monitoring
Liquefaction mitigation
Releveling structures
Slope stabilization
Support of excavation
Underpinning
Design-build

keller-na.com
Breakthrough at RETC2023

BUILD | CONNECT | GROW

21 sessions | 100+ speakers | 200+ exhibit booths

Build your knowledge and strengthen the growing underground construction and tunneling industry.

Register today at retc.org

MARK YOUR CALENDAR

Cutting Edge Conference
Advances in Tunneling Technology
November 13-15, 2023
Austin, TX

George A. Fox Conference
New York, NY
February 7, 2024

NAT2024
North American Tunneling Conference
JUNE 23-26, 2024
NASHVILLE, TN

UCA
Underground Construction
Association

CALL for PAPERS
QSP Packers, LLC
Quality - Service - Price
Serving Your Complete Packer Needs

- MECHANICAL PACKERS - Freeze Plugs, Custom Applications.

Prompt Shipping in US & International Usually in just One or Two Days!

Contact QSP with all your Packer questions!!
253-770-0315 or 888-572-2537
Fax #: 253-770-0327
Email: info@QSPPackers.com
Web: www.QSPPackers.com

GROUND SUPPORT SYSTEMS
YOU CAN BUILD ON
SUPPLYING MINING OPERATIONS WORLD WIDE FOR 55 YEARS

- GROUT SYSTEMS
- MIXERS
- SHOT-CREUTERS
- CONCRETE PUMPS

www.conmico.com TEL: 1(905) 660-7262

Hooper Jones
CENTRAL, NW U.S.
+1.847.486.1021
Cell: +1.847.903.1853
hooperhja@aol.com

Laura Lemos
EAST, SOUTH, WEST U.S.
Cell: +1.973.668.2449
laura@boja.com

Dave Bayard
CANADA AND INTERNATIONAL
Cell: +1.973.727.2020
dave@boja.com

Ad Index

Barnard Construction ................................... 06
Bradshaw ............................................... 09
David R. Klug ......................................... 08
Dr. Mole ............................................... 11
EarthGrid ............................................... 03
Frontier Kemper.............. Outside back cover
Gallovich Consulting ......................... 10
Kilduff Underground Engineering .......... 07
Superior Glove............... Inside front cover
Reliable Automatic Sprinkler ............... 05
UCA - Corp/Sustaining Member........... 12-13
UCA/NAT Call for Papers... Inside back cover
UCA - RETC Upcoming .................. 99
The 2024 NAT Organizing Committee has issued a Call for Papers.

Prospective authors should submit the following by June 30, 2023:
- Abstract of 100 words or less
- The topic to which it applies
- Complete author contact information
- Project name

Key dates:
- June 30, 2023 - Abstracts Due for Consideration
- September 2023 - Notice of Acceptance
- October 31, 2023 - Draft Manuscripts Due
- November 15, 2023 - Comments Returned to Authors
- December 15, 2023 - Final Manuscripts Due

MANUSCRIPTS ARE MANDATORY.

Topics for consideration include:

- Tunnel Boring Machines
- Ground Conditioning & Modification
- Equipment Automation
- NATM/SEM – Conventional Tunneling
- Caverns
- Small Diameter Tunneling
- Shaft Construction
- Emerging Technologies
- Risk Management
- Lining Design Advances
- Fire & Life Safety
- Rehabilitation
- Design
- Contracting Methods
- Alternative Delivery Methods
- Financing
- Labor Training
- Case Histories
- Future Projects
- Futuristic Tunneling

Please submit online to NAT: sme-nat.secure-platform.com

For additional information on exhibiting, sponsorship or general inquiries, contact
UCA Programs Department | 303.948.4200 | authors@smenet.org | smenet.org

Visit natconference.org for more details about NAT2024.
FKC-Lake Shore serves the underground heavy civil and mining industries throughout North and South America. We offer design-build-install services for innovative hoisting, elevator, and vertical conveyance systems used to transport personnel and material. Our Field Services Division provides routine maintenance, inspections, wire rope NDT, and 24/7 emergency repair of electrical and mechanical systems.

1.877.554.8600  |  information@frontierkemper.com
For more information, visit us at: www.frontierkemper.com