

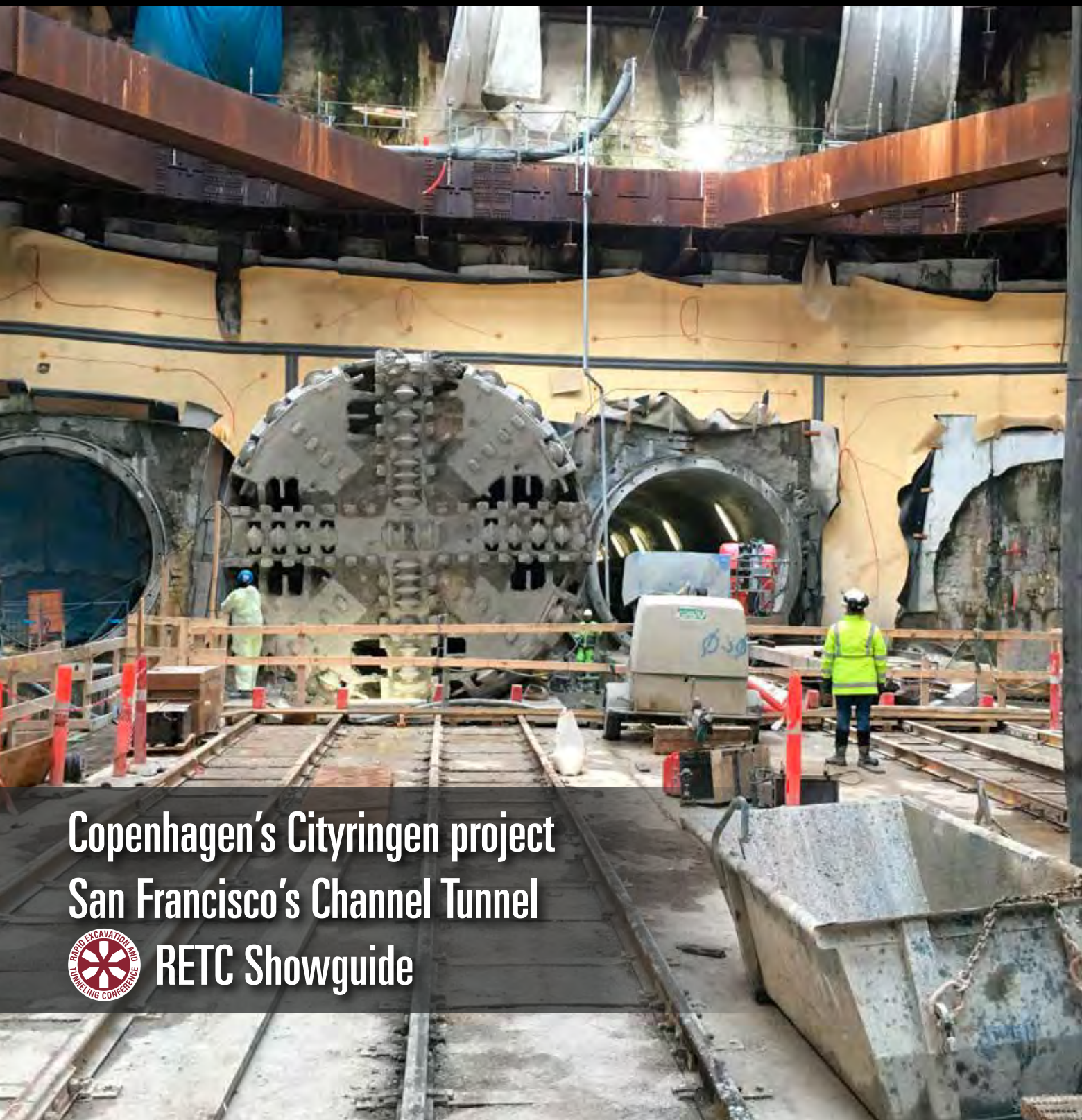
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Copenhagen's Cityringen project
San Francisco's Channel Tunnel
RETc Showguide



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COVER STORY



In this issue —
The Cityringen project in Copenhagen will form a new circular line in the city center. The new tunnels will pass under several buildings. A complex system of compensation and jet grouting was performed, page 11. San Francisco's Channel Tunnel that will upgrade the city's sewer system, page 19. Cover photo shows the Cityringen tunnels.

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CHAIRMAN'S COLUMN

Bertha's breakthrough proves US tunneling has no boundaries

Emerging from the depths of the northwestern coast along the edge of Puget Sound in Washington, Bertha has concluded its subterranean run of more than 2,800 m (9200 ft) on April 4, 2017, proving that the determination of the American tunneling industry has no boundaries. Agencies throughout the country can now rest assured that no complication affecting their infrastructure project will prevent project success. The UCA of SME salutes all of the Alaska Way team members for their resilience and accomplishments.

As I reported in the last Chairman's Column (March 2017, page 2), *The History of Tunneling in the United States* has been compiled, printed and distributed. Many thanks to all that contributed to this wonderful tabletop book, including its primary authors, Mike Roach, Colin Lawrence, Brian Fulcher and Dave Klug. My thanks go out as well to the UCA staff who participated in developing this amazing book. All WTC 2016 registrants have received their copy. Additional copies may be purchased through the UCA.

I am happy to report that again this year, attendance scholarships have been provided to allow more young members to attend the Rapid Excavation and Tunneling

Conference (RETC) in San Diego, CA. These young members are crucial to our efforts to expand our association and the tunneling industry as a whole to all corners of the nation. It is imperative that members both old and new come together in order to encourage continued participation in our events and industry.

This year's class of recent graduates has already begun to make an impact on our companies and agencies. Engineers and interns are being hired and tasked with meaningful work that will help them develop skills and experience that will allow them to lead the industry well into the future. I'm sure that our veterans will help them to grow into a new generation of industry leaders.

This year's RETC is sure to be a meaningful experience for all those who attend. The sessions are sure to be informative and provide us with highlights of the most innovative technological advances in modern tunneling. The weather and local attractions will be excellent as well.

I wish everyone a happy, safe and healthy summer season. ■

Artie Silber

UCA of SME Chairman



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Bertha breaks through at SR-99 Project

Bertha, the world's largest tunnel boring machine (TBM), broke through into a receiving pit after an arduous, 2.7 km (1.7 mile) journey beneath the city of Seattle, WA.

The 17.5-m (57.5-ft) diameter TBM was built by Hitachi Zosen and delivered to Seattle in 2013 to bore a tunnel as part of a multi-billion dollar project for the Washington Department of Transportation (WSDOT) to replace the aging Alaskan Way Viaduct in Seattle.

Boring operations began in April 2013 and the four-lane tunnel was estimated to open in 2015, however, about four months into its voyage the cutter head stalled on what was believed to be a long steel pipe and three days later Bertha overheated and stalled, about 314 m (1,030 ft) into its journey. The stall lasted about two years as crews had to excavate a 36-m (120-ft) repair pit and construct a crane to repair the TBM.

After an investigation, contractor Seattle Tunnel Partners (STP) discovered damage to the machine's main bearing. Crews completed repairs and resumed mining in December 2015. The cause of

damage to the tunneling machine is in dispute and is currently in litigation. Neither WSDOT nor STP is able to comment further on ongoing legal issues, WSDOT said in a statement.

Bertha returned to operation on Dec. 22, 2015 and reached its final breakthrough on April 4.

Led by WSDOT and designed and built by STP, the tunnel project will move a 3.2-km (2-mile) section of SR 99 underground when it wraps up in early 2019. Crews will then demolish the viaduct, clearing the way for the city's new waterfront.

"This is a historic moment in our state's transportation history," Gov. Jay Inslee said. "Innovation and perseverance are the engines that keep Washington in the forefront. There is still more work ahead but this moment is one worth celebrating."

"We were always confident that we would successfully complete the tunnel drive," STP project manager Chris Dixon said. "The dedication and commitment of everyone on the Seattle Tunnel Partners team has been exceptional, and we wouldn't be at this milestone without the hard work of our crews. We look forward

to continuing this outstanding progress through project completion."

STP still has significant work to complete before the tunnel opens. Crews must finish building the double-deck highway within the circular walls that were bored by crews inside the tunneling machine. Mechanical and electrical systems, plumbing and safety features also must be installed.

Even as crews are installing these systems, crews will begin the extensive task of testing and commissioning the tunnel to ensure it's ready for traffic. Inspectors will individually test more than 8,500 separate components before testing each of the tunnel's various systems as a whole.

"This truly is a remarkable feat of engineering," Transportation Secretary Roger Millar said. "We've had delays and there's still work to be done, but the folks working on this job should be justifiably proud of today's milestone."

Over the next several years, the City of Seattle's Waterfront Seattle project will build new public space and a surface boulevard in the place of the double-deck viaduct, which is scheduled for demolition in 2019. ■

Funding for Gateway Project at risk

President Trump introduced his 2018 budget that includes cuts to many programs, including one that would provide funding for the Gateway Tunnel linking New York and New Jersey.

The estimated cost of the tunnel project is \$20 billion, which would be split between the states of New York and New Jersey on one side and the federal government on the other. That plan is in jeopardy under the proposed budget that would slash funds from the Transportation Department program called New Starts. The New Starts program was

tapped to cover the \$10 billion from the federal government.

Additionally, \$400 million was slated to go to extending the Hudson Bergen Light Rail line into Englewood.

The Portal Bridge near Secaucus, a weak link in the system, is also slated for replacement.

"If you take a look at it, the Portal Bridge was based on designs from the 1840s and apparently has been called the Achilles heel of the entire Northeast Corridor," said Port Authority Commissioner Caren Turner.

Two Democratic state senators from Bergen County called the press conference to urge Congress to reverse the president and restore the funds.

"Govs. Chris Christie of New Jersey and Andrew Cuomo of New York have both come out publicly against the New Start budget cuts, and we are united on a bipartisan basis in urging Republicans and Democrats in our congressional delegation to come together," said Sen. Bob Gordon.

"We're getting late in the

(Continued on page 9)

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Repair work on Hudson River and Delaware Aqueduct requires special TBM

Robbins has completed the manufacture and testing of a unique tunnel boring machine that will be used to repair the longest continuous tunnel in the world. The tunnel boring machine (TBM) will be used to overhaul a section of New York City's Delaware Aqueduct, a 137-km (85-mile) long tunnel that delivers about 50 percent of the city's drinking water each day. Over the span of two days in February, representatives from the owner New York Department of Environmental Protection, consultant McMillen Jacobs, and JV contractor Kiewit-Shea Constructors (KSC) traveled to the Robbins facility in Solon, OH to witness the

factory acceptance testing of the custom TBM.

The Robbins single shield TBM will bore a tunnel to replace a 3.8 km (2.4 mile) stretch of the Delaware Aqueduct. The Delaware Aqueduct currently leaks about 75 million L/d (20 million gpd) of water per day into the Hudson River. Investigations of the Delaware Aqueduct dating back more than a decade revealed cracks in the tunnel lining. While several inspections with an automated underwater vehicle showed that these cracks were stable, it was determined they could not be fixed from within the existing tunnel. New York City then decided that a new tunnel would be built under the

river to bypass the leakage.

To build a bypass tunnel around the aqueduct's leaking section, Robbins manufactured the 6.8 m (21.6 ft) diameter single shield TBM to safely seal against pressures up to 30 bar, and to operate in variable hard rock conditions. The Delaware Aqueduct was completed in 1944. During its original construction, work crews documented groundwater inflows of 7.5 to 15 million L/d (2 to 4 million gpd). Because this particular section of the tunnel lies 183 m (600 ft) below the Hudson River, the inflows are under immense head pressure and

(Continued on page 10)

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Nigeria developing framework to expand underground and tunneling infrastructure

To meet its needs to support its growing population, the government of Nigeria has begun to develop the necessary legal framework for the adoption of tunneling and underground space technology in the country.

The Guardian reported that President Muhammadu Buhari has pledged his support to develop underground infrastructure by 2050 to meet the demands of the growing cities in Nigeria. Recently, the first international tunneling and underground space conference was held in Lagos where minister of transport, Rotimi Amaechi, said the Buhari administration understands the reality and the need to

encourage Nigerians to embrace the need to develop the underground space, broaden it to combat the challenges and mitigate the impacts of congestion in Nigeria's growing cities.

"I understand that underground space development will be a major inter-ministerial commitment to respond to our national needs. This informed our willingness and devotion to buy-in into this vision and I can assure you that this administration will do everything possible to provide an enabling environment for this vision to flower, mature and be embraced as a major factor in our quest for national planning in the areas of road, rail,

flood control, power and other areas."

Tarcisio Celestino, president, International Tunneling Association, expressed confidence in the potential of Nigeria to adopt the tunneling and under ground space technologies in order to remain relevant among global communities.

The National President of Nigerian Society of Engineers (NSE), Otis Anyaeji, stated that the Society has set up a Tunneling Engineering Study Group drawing members from various divisions of NSE with well-defined terms of reference to prepare an MOU between NSE and TAN adding that tunneling is one of those sectors developed countries are promoting and recording tremendous success.

Anyaeji, who was represented by the national president of the Nigerian Institution of Electrical and Electronics Engineers, Emmanuel Akinwola, emphasized that skills and expertise have to be developed between NSE and other professional bodies like surveyors and town planners, geologists, environmentalist, architecture to strengthen tunnel infrastructure.

"Developing tunnels or underground space, especially in our fast developing mega cities, will enable the country to maximize the use of square foot of space, thereby adding more value to the structure and our lifestyle. To further strengthen this manpower capacity, I have taken note of the 10-year plan by TAN to locally engage at least 50 percent of the delivery of major tunneling and underground activities. This is a commendable and ambitious plan which has to be complemented by evolving the young talents in our universities in relevant disciplines to sustain the sector," he stated. ■

Speaking on the TAN project,

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Norway announces plans for the world's first tunnel for ships

Norway announced plans to build the world's first tunnel for ships, a 1,700-m (5,610-ft) passageway burrowed through a piece of rocky peninsula that will bypass the Stadhavet Sea, the most exposed and dangerous part of the Norwegian coast.

The plans for the tunnel were included in the Norwegian National Transport Plan for 2018 to 2029. Construction is estimated to cost NOK 2.7 billion (\$314 million). Funding of NOK 1.5 billion (\$175 million) is included in the first six years of the plan.

The tunnel will be 36 m (118 ft) wide and 49 m (162 ft) high, large enough to accommodate cruise and

freight ships weighing up to 14.5 kt (16,000 st). Construction of the Stad Ship Tunnel is expected to begin in 2019.

"There are still many pieces of the puzzle that need to be put into place before construction can start, but we have previously stated that the actual construction could be at the earliest in 2019," said project manager, Terje Andreassen.

Vessels using the tunnel will be able to be up to 21.5 m (70.5 ft) wide, giving them a clearance of 2.5 m (8 ft) on each side. For safety purposes, the distance between passing vessels will probably be 400 m (1,300 ft). This means five ships will be able to sail through per hour.

The tunnel will be 36 m (118 ft) wide and 49 m (162 ft) high, large enough to accommodate cruise and freight ships weighing up to 14.5 kt (16,000 st).

Norwegian Transportation Minister Ketil Solvik-Olsen said that sea currents and underwater topography in this part of the country's southwestern coast "result in particularly complex wave conditions."

"We are pleased that the ship tunnel now becomes reality," Solvik-Olsen said, adding that travel time between Norwegian cities and towns in the area would be reduced. Over the years, plans for a ship tunnel in Stad had been floated, but now a project with a financing is ready, he said.

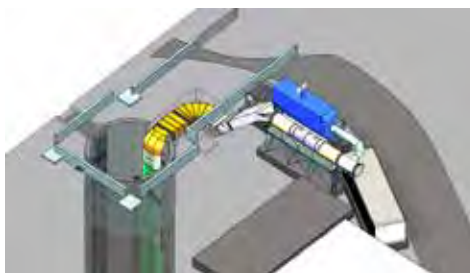
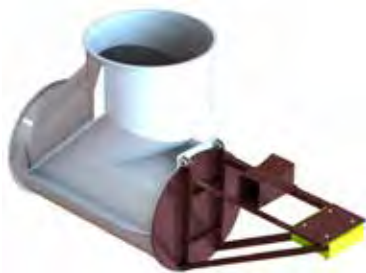
The tunnel is expected to be located at the narrowest point of the Stadlandet peninsula and the weather has for decades been considered an obstacle for shipping.

Andreassen said engineers will have to blast out an estimated 7.5 Mt (8 million st) of rock to build the tunnel. Construction is expected to start at the earliest in 2019.

Under the plan, passenger traffic will be given priority, but leisure boats and other vessels can also use the tunnel. It will be free of charge for vessels measuring less than 70 m (230 ft), and vessels longer than that would have to be led.

Vessels sailing through the tunnel likely will get slot times from a traffic center — like planes at an airport — to avoid congestion. ■

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Gateway: New budget could withdraw millions

(Continued from page 4)

game and we need a congressional delegation along with our two governors to stand up on this and make loud noises,” said Sen. Loretta Weinberg.

The replacement for the century-old Portal Bridge over the Hackensack River in northern New Jersey, a source of regular delays, also could be jeopardized.

Environmental permitting, engineering and design for a new bridge have been completed, and the project only awaits federal dollars to begin construction. Yet, like the tunnel, the Portal Bridge would be left out under the current budget proposal.

“For a president who wants to be known as the infrastructure president, it’s indeed unfortunate that the Trump administration budget includes scores of billions of dollars to the defense budget while transportation is forced to the back of the train, or the bus, to conduct bake sales to raise desperately needed funds,” said Len Resto, president of the New Jersey Association of Railroad Passengers.

Even just delaying the funding for a year would add to the ultimate cost and risk a system failure.

“If we were to close just one of those two train tunnels, train traffic between New Jersey and New York City would be reduced not by half, but by three quarters. Only six trains per hour rather than the customary 24 trains that we now have, because that one tunnel would be required to handle both incoming and outgoing traffic,” said Regional Plan Association New Jersey Director Mark Lohbauer.

“This is the most important infrastructure project in the country,” Gordon said. ■



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Repair: Single shield will bore a bypass tunnel

(Continued from page 6)

thus require the unique tunneling technology.

Due to the challenges presented by the aqueduct repair, such as difficult geology and considerable water inflows, the TBM had to be designed accordingly. Difficult ground solutions features, including powerful drilling, grouting and water inflow control systems, have been incorporated into the machine's design to overcome the expected challenges. "One unique feature of this TBM is the closeable bulkhead, which allows the excavation chamber to be sealed off," said KSC Tunnel Manager Niels Kofoed. "We expect this to be a key feature in the event that ground water flows (shunt flows) from the excavated portion of the tunnel cause washout of the annulus

The 6.8 m (21.6 ft) Robbins Single Shield TBM will bore a bypass to replace a section of the world's longest continuous tunnel, the Delaware Aqueduct.



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grout. Once the bulkhead is closed the groundwater flows are stopped and secondary grouting of the precast liner can be performed, effectively cutting off the flow path of the shunt flows."

Robbins project manager Martino Scialpi further noted that, "the TBM was designed with a 9,500 L/min (2,500 gpm) dewatering capacity. The machine is equipped with two drills in the shields for drilling through the head in 16 different positions and a third drill on the erector to drill through the shields in an additional 14 positions. Drilling and pre-excavation grouting will be a routine job to control and minimize water inflows." In addition, water-powered, high pressure down-the-hole-hammers will allow for drilling 60 to 100 m (200 to

330 ft) ahead of the machine at pressures up to 20 bar if necessary.

In order to provide access to launch and retrieve tunneling equipment, two deep shafts were constructed in the towns of Newburgh and Wappinger, New York, where the bypass will begin and end. The project site itself poses challenges to the assembly and launch of the TBM because of the limited space available.

Robbins worked closely with KSC to ensure that TBM components were designed and sized so all could be lifted with the contractor's hoist system and fit down the narrow, 270 m (885 ft) deep shaft. Once assembled, the machine is expected to begin boring in autumn 2017. ■

FEATURE ARTICLE

Compensation and jet grouting as mitigation measures for a TBM operation

The Cityringen project in Copenhagen, Denmark will form a new circular line in the city center and will consist of 21 new stations (17 + four transfer stations) and approximately 31 km (19 miles) of earth pressure balance (EPB) twin-bored tunnels.

The new tunnels passed under the historical building of Magasin du Nord, McDonald's and two pubs in the heart of the city with a minimum cover of about 4 m (13 ft).

To minimize the movements, a complex system of compensation grouting and jet grouting soil treatment was performed. A detailed action plan between the parties involved allowed coping with the critical tunnel boring machine's (TBM) successful passage.

The Cityringen is an extension of the existing metro line underground Copenhagen and will include the City Circle Line, 15 km (9.5 miles) of twin tunnels looping around the city. The City Circle Line will form a new circular track inside the city center and will intersect the existing M1 and M2 lines at Kongens Nytorv and Frederiksberg stations, as well as suburban train services at København H, Østerport and Nørrebro. It will extend the Metro network to the Nørrebro, Østerbro areas and the central station at København H (Fig.1). The two new lines M3 and M4 will run on the same tracks, but the M3 will be a circle route running around the entire line, whereas the M4 will drive from the station to the north side of the city.

The €1.5 billion design-build contract was awarded by Metroselskabet in January 2011 to the Copenhagen Metro Team (CMT), a joint venture (JV) between the Italian companies Salini, Tecnimont Civil construction and Seli SpA. Since the bankruptcy of Seli SpA and Tecnimont, Salini Impregilo now owns 100 percent of the JV shares. Seli Tunneling Denmark ApS, a subcontractor to CMT, was initially constituted as a Seli SpA subsidiary and, following the economic difficulties of Seli SpA, was acquired in 2015 by Salini Impregilo. Seli Denmark is in charge of the tunnels excavation and lining and owns the four 5.84-m (19-ft) diameter Seli/Kawasaki earth pressure balance machines.

FIG. 1
Copenhagen Metro network.



Ground conditions are at times challenging, most of the alignment runs through limestone with occasional inclusions of flint bands, but it occasionally dips in and out of a mixed face to include sand, clays and tills. Invert depth is up to 45 m (147 ft) under a high-water table and requires machines capable of withstanding the resulting 4.5 bar operational pressures. The north drives, from the station of Nørrebro to Vibenshus Runddel, are entirely in soft ground, sand and glacial deposits.

Track and TBMs main features

The tunnels are being excavated with four Seli-Kawasaki EPB TBMs (Fig. 2), two of which were manufactured in Denmark by Seli Tunneling Denmark ApS, which is also operating them. TBMs

Antonio Raschilla, Valerio Violo and George Kafantaris

Antonio Raschilla and Valerio Violo, member UCA of SME, are technical director and managing director, respectively, Seli Tunneling Denmark, and **George Kafantaris**, is technical manager, civil works, with Copenhagen Metro Team, Salini Impregilo Group, email a.raschilla@selidenmark.dk.

TABLE 1

TBM's main features.

Cutterhead diameter	5.84 m (19.1 ft)
Shield diameter	5.74 m (18.9 ft) un-tapered
Shield length	10.50 m (34.5 ft)
Ring configuration	Universal five + key
Lining diameter	Outer 5.5 m (18 ft) / Inner 4.9 m (16 ft)
Minimum radius	Horizontal 180 m (590 ft) / Vertical 625 m (2,050 ft)
Maximum gradient	6 percent
Maximum operative pressure	5 bars
Number of cutters	38 (17 in. – 18 in. peripheral)
Maximum load per cutter	267 kN

1 and 2 were launched in July and December 2013 from ørrebroparken shaft toward Sounder Boulevard. Here, the machines were disassembled and moved to Øster Søgade shaft to mine toward København Central Station (KH).

TBMs 3 and 4 were built and tested in Denmark in 2013 and launched from Tommergraven shaft to København Central Station in June and August 2014. Once in KH, machines were disassembled and moved back in Nørrebroparken shaft to complete the last stretch to ØSØ.

The four TBMs are identical. Table 1 summarizes the main technical features.

Passage under historical buildings

One of the main challenges of the Cityringen is the passage under the historical building of Magasin du Nord, McDonald's and two old pubs in the heart of the city, with a minimum cover of about 3.7 m (12 ft).

TBMs 1 and 2 were reassembled and launched

from Øster Søgade shaft, respectively, in October 2015 and January 2016 to complete the stretch Øster Søgade — KH by the beginning of 2017 (Fig. 3). At the time that this paper was written, 90 percent of the tunnels had been completed.

In July 2016, the first TBM arrived at Kongens Nytorv station ready to cope with the most critical passage of the entire project (Fig. 4) — the drive from the Kongens Nytorv station.

In the first 40 m (131 ft) of this drive the TBMs had to pass under the so-called transfer tunnel. This is the connection between the existing metro and the new one and, at the time of the passage, its roof slab and retaining walls were in place.

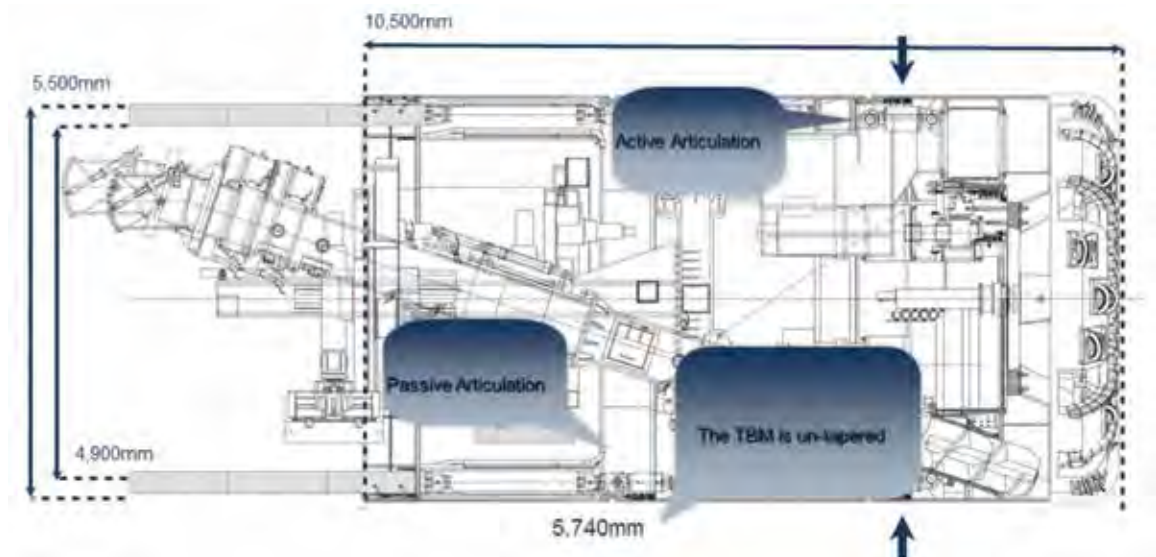
The tunnels of the existing, and operating, metro line are right below with a clearance of just 150 cm (60 in). The existing tunnels have been built in limestone.

Next, the TBM drives pass underneath the two old pubs then dive under the basements of Magasin du Nord and McDonalds with a minimum clearance of 3.7m (12 ft) from the deepest foundation.

The first 70 m (230 ft) after the exit from Kongens Nytorv station is in soft ground with a mix of sand, sand-till and clay before reaching the competent limestone. A complex system of compensation grouting and jet grouting soil treatment was put in place in order to mitigate the risks for the buildings and to minimize the settlements.

FIG. 2

Seli-Kawasaki TBMs shields configuration.



Design and monitoring

Pre-design phase and key risks. During the early days of the project, in 2011/2012, the review of the available information (Buildings Database) for this critical passage brought to light the first important risk to be assessed and addressed: presence of steel micropiles hammered to unregistered depths below the foundation pillars of Magasin du Nord as temporary underpinning for the lowering of its basement (Fig. 5). The potential consequences of clashing with a micropile or more, in soft ground and with such low overburden, with the associated risks of a hyperbaric intervention and/or a long stoppage under the building for their removal, made the pursuit of the definitive solution to the problem crucial to the project. Additional investigations failed to provide further input. In fact, even more uncertainty was added by unsuccessful attempts to locate the micropiles indicated by the available design drawings. In agreement with the client, Metroselskabet, the risk was addressed by a modification (lowering) of the track alignment, introducing a very aggressive slope of 6 percent, immediately after the exit of the station. The probability of encountering micropiles was in this way mitigated and made negligible. Additionally, lowering the TBM alignment shortened the distance to be bored in soft ground, prior to reaching the limestone bedrock.

Other important risks identified during the pre-design phase:

- The presence of large granite boulders in the quaternary deposits, which was recognized during the excavation of the existing metro station.
- Unregistered and/or potentially not decommissioned structures and services under the buildings' basements.
- The complex structural system of Magasin du Nord which is made of different blocks of different ages (from 1857 to early 20th century) and complex typologies inter-connected one with each other. Moreover, the available information about beams, columns and/or connections of the different elements was extremely sparse.
- The poor condition of the old pubs that had already required the underpinning of one of the corners to cope with the important displacement during the construction of the first metro line.

Preliminary design phase. The effects of the tunneling activities on the overlaying structures (Magasin du Nord and McDonald's) were studied by Lombardi Ingegneria S.r.l through an integrated 3D geotechnical and structural FEM analysis (Fig. 6). A fully coupled soil-structure interaction was considered, and the entire excavation process was reproduced in a 3D model where the buildings were adequately modeled. In this way, a risk assessment analysis was performed, evaluating directly the effects of the excavation in terms of settlements and variations of the

FIG. 3

Cityringen layout.



internal actions as far as the excavation process proceeds.

The input necessary to feed into the FE model with regard to the structures affected by the TBM was provided by a detailed buildings' condition review, performed by a specialized subcontractor and supervised by CMT and its consultants. Despite a reasonably good knowledge of the structure acquired in terms of geometric properties (position and dimensions of structural members), due to

FIG. 4

Kongens Nytorv station and compensation grouting shaft.



FIG. 5

Magasin du Nord foundation interference.



unavoidable limitations during the execution of the survey in the busiest mall of Copenhagen, some uncertainties remained regarding:

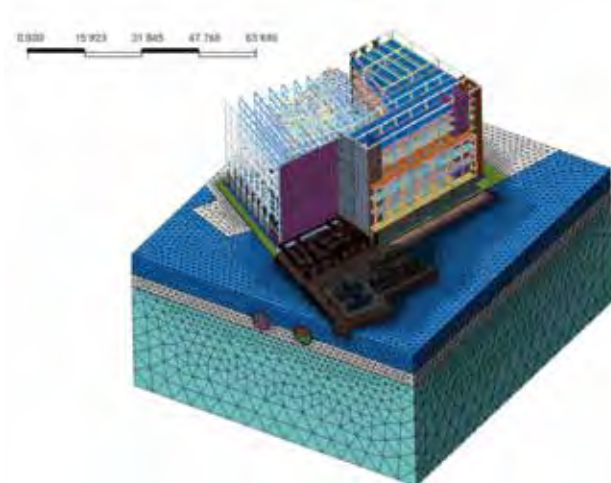
- Material properties.
- Properties of connections and structural joints.
- Geometry of many structural elements.

The evaluation of different scenarios within the FE model, in terms of volume loss (0.5 percent and 1 percent) and elasticity modulus for the sand, resulted in respective profiles of displacements, angular distortions and actions for the buildings overlaying the tunnels. On the basis of the results of the analyses for the different scenarios, the parts of the buildings where mitigation measures were required were thus defined (Fig. 7).

Two sets of threshold values (alert/alarm) were defined with regard to the initiation of mitigation activities/measures:

FIG. 6

Magasin du Nord 3D FEM analysis.



- Type A — For the cast-iron pillars of Magasin du Nord and the foundations for the McDonalds and the pubs: An alert distortion limit of 1/2000 and an alert displacement of 2 mm and alarm distortion limit of 1/1000 and an alarm displacement of 3.5 mm;
- Type B — For all other foundations: An alert distortion limit of 1/2000 and an alert displacement of 2.5 mm and alarm distortion limit of 1/1000 and an alarm displacement of 5 mm.

Considering that more than 80 percent of the buildings' foundations fall under Type A, the respective threshold values for mitigation measures application were applied to all foundations and Type B limits were eventually discarded. The previous values refer to the activation of mitigation measures and not the start of functional damage, which of course corresponded to much higher displacements.

The completion of the finite element method (FEM) analysis and definition of the predicted effects of the tunneling works was followed by a feasibility study of different mitigation measures, for the limitation of the buildings' displacements:

- Permeation grouting.
- Compensation grouting.
- Jet grouting.
- Ground freezing.
- Underpinning/structural interventions.

The following evaluation criteria were applied and an overview of pros and cons was produced for each technique to be finally assessed:

- Compatibility with the site geological and hydrogeological conditions.
- Effectiveness to counteract the impact of the tunneling activities on the buildings.
- Suitability to tackle pre-identified risks (micropiles, boulders, unknown underground structures, buildings' heterogeneity).
- Compatibility with risks associated with the TBM operation (face pressure loss/blow out, breakdown/stoppage, etc.).
- Compliance with the time schedules of the station and the TBM works.
- Eventual expropriation requirements (Magasin and McDonald's basements, realization of additional shafts, etc.).
- Implementation cost.

The feasibility study was concluded with the adoption of compensation grouting, executed from a shaft installed between Magasin du Nord and the pubs, addressing potential movements of all four buildings in combination

with jet grouting underpinning of the foundation pillars of McDonald's.

Detailed design phase. The development of the detailed design, for both jet grouting and compensation grouting, was undertaken with the full involvement of CMT's selected subcontractor for the ground improvement works, Keller Grundbau GmbH, and the contribution and supervision by the experienced geotechnical consultant RD Geotech.

With regard to jet grouting under McDonald's basement, the minimum performance requirements for the columns were defined by Lombardi Ingegneria S.r.l and confirmed by a site trial executed by Keller:

- $E = 800 \text{ MPa}$.
- $UCS = 2 \text{ MPa}$.
- Diameter = 1.50 m.

The detailed design comprised 86 columns, 6.5-m to 8.5-m (21-ft to 28-ft) long, reaching the limestone level (Fig. 8). The execution took place between September 2015 and January 2016 by Keller and the basement was refurbished and delivered back to its owner in accordance with the agreed expropriation window.

The detailed design of compensation grouting, on the basis of locating a 6.5-m (21-ft) internal diameter shaft between Magasin du Nord and the pubs, foresaw the installation of 43 steel TAMs (max length 42 m or 138 ft) for grouting during the TBM passage and 12 additional TAMs for ground improvement during the preconditioning phase (Fig. 9). A maximum horizontality error of 1 percent was defined for the drillings and a target heave of 1 mm-2 mm was specified with regard to the preconditioning phase injections.

Keller started with the drilling and TAM installation works in August 2015 and completed the preconditioning injections in April 2016, well before the first TBM transit. The high presence of granite boulders in the quaternary soil, as highlighted during the predesign phase, resulted in the need to redrill or even abandon the original location for an important number of TAMs. Staged checks of the drillings' horizontality led to backfilling and redrilling up to seven times for some holes.

In other cases, provided that the TAM could be installed and be operational and the geometrical impact (proximity to foundations or the tunnel) was tolerable, the 1 percent horizontality error was slightly compromised.

As a result of the foregoing, the preconditioning execution did not follow the completion of installation of the TAMs but instead, Keller were instructed to alternate between drilling and preconditioning in order to ensure compliance with the overall time schedule.

The design of the compensation grouting for the TBM transit was based on the following assumptions:

- 1 percent maximum volume loss.

FIG. 7

Compensation grouting area of influence.



- 10 m (33 ft) daily TBM advance rate.
- 50 percent of TBM shield in soft ground under MdN.
- 10 percent grouting efficiency.

For a flow rate of 10 L/min (2 gpm), an injection module with four packers operational at all times would provide sufficient capacity during the TBM transit.

Design injection plans (DIP) prepared prior to the TBM transit, as sets of provisional injections targeting to maintain any settlements within the threshold values in case a movement trend would be detected, complied with

FIG. 8

Jet grouting under McDonald's basement.

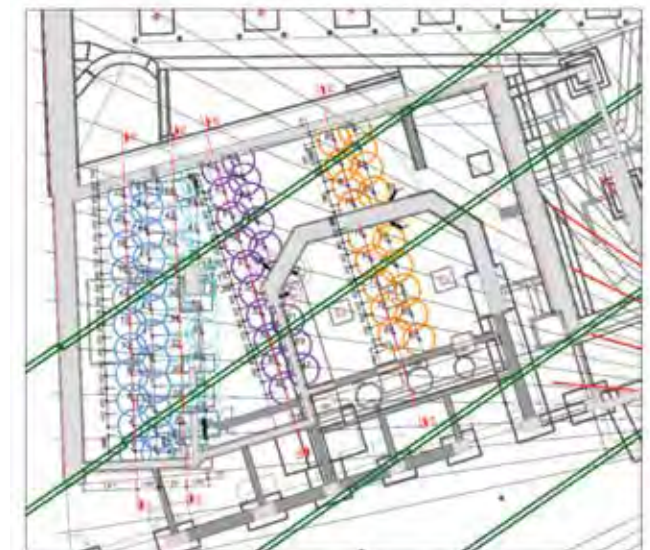
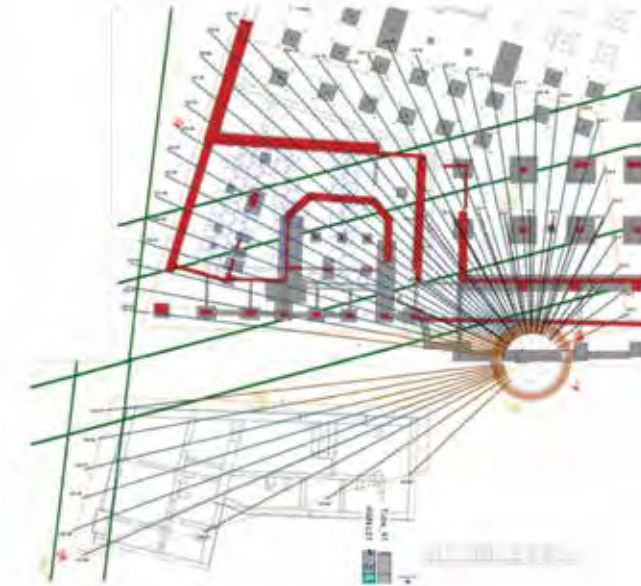


FIG. 9

Compensation grouting TAM installation.



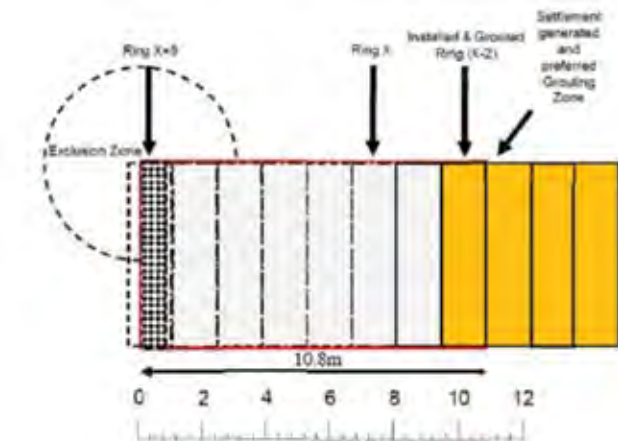
the assumptions above and with the restricted zones for injection agreed with SELI Denmark (Fig. 10).

Structural monitoring. The real-time control of displacements on the structural elements of the buildings affected by the TBM passage was primarily assigned to a liquid levelling (LL) sensor system provided by GeTec, acting as a subcontractor of Keller. All structural elements of the four buildings within the zone of influence were equipped with sensors and the respective measurements were transmitted to the Cityringen project database, KRONOS, visible to CMT, Seli Denmark and to the project owner Metroselskabet (Fig. 11).

Precise levelling performed by the monitoring crews of

FIG. 10

Grouting zone during TBM passage.



CMT, on the same structural elements, intended to confirm the validity of the LL system, quantify the contribution of external influences (e.g. temperature) but also provide backup in case of system malfunction.

Finally, CMT measured the facades of the buildings with automated systems.

TBMs passage

Actions taken before the passage. There were two important phases, before and during the tunnel excavation. And everything had to be carefully planned for both.

Before the start of excavation from Kongens Nytorv station, meetings with foremen and pilots were held to analyze the situation and the issues that could possibly arise from mining operations. During those meetings, which were called “awareness campaigns,” it was decided that it was important to share with the crews all the information about the passage that was about to be undertaken, including a detailed yet easy to understand risk assessment.

The expected geology, all risks related to it and to the adjacent structures and the possible different behavior of the TBM under the buildings; possibility of the screw and/or cutter head blockages due to boulders etc was discussed.

Plan and section drawings have been posted in the TBM control cabin showing the actual position of the machine, meter by meter for the whole 70 m (230 ft) critical stretch from launching from Kongens Nytorv to the safer geology, in limestone.

The main excavation parameters, such as pressure, extracted weight and backfilling, were connected to the tunneling process control (TPC) software and broadcast to Seli Denmark managers and supervisors, with relevant alert for sensitive data such as face pressure and muck weight. The alerts were also sent via mobile app and smartphone.

The TPC system is also normally connected to the Kronos system, the monitoring software used by CMT: in this way the client, designer and partners were able to monitor the advance of the TBM in real time.

For the excavated weight control, besides the two usual scales, double scales have been implemented and the filling degree of the wagons was compared to the TBM speed. To do this, sensors were installed on the backup gantry, next to the discharge point, in order to measure the level of the muck in the muck car box related to the actual TBM advance and an alarm sensor was set in the control cabin to alert the operator in case of excavation above the 10 percent compared to the theoretical value.

TBM mechanical enhancement

To mitigate some of the risk connected to the TBM operation, some mechanical improvements were done.

While mining in soft ground and, especially, at the contact between different geotechnical formation, the tendency of the TBM to slow down and to suffer increased thrust forces and, generally, friction was experienced. To mitigate this behavior, the tail shield towing system and the bentonite injection system were enhanced

Tail shield towing system. It was redesigned to work up to 36.000 kN by adding a mechanical towing system and by redesigning and rebuilding the hydraulic system in order to be able to operate up to 400 bars. In addition to this, the shield was reinforced with 50-mm, circular-shaped plates.

Bentonite system. Bentonite has proven positive in reducing the friction during the advance; to maintain face pressure during short- or long-term stoppages and to stabilize the steering gap around the shield, i.e the void created by the cutterhead overcut. In order to enhance the bentonite system, six additional injection points in the middle and tail shield were added to be able to inject in the over cut to achieve the best efficiency of the above-mentioned positive effect of bentonite injection. In particular the use of bentonite as a friction reducing measure, proved to be extremely useful.

Actions taken during the passage

The coordination between the TBM excavation performance, the execution of the compensation grouting and a real-time monitoring system for the control of the buildings response and application of prompt and adequate mitigation measures for any abnormal displacements, was paramount during the TBM passage. The clear definition of the roles and responsibility among the involved parties and the synergy among the organization, the processes and the communication during the tunneling operation was also essential.

In order to enhance collaboration and communication, it was decided to adopt the most traditional way.

A site office was set up near to the Kongens station where CMT, Seli Tunneling Denmark and Keller technicians were present during the passage of the two TBMs, 24 hours a day, seven days per week, to follow the smooth running of the operations. There was nothing better than sharing the same office to collaborate and to exchange information in a quick and effective way. Also the project owner was often on site, gathering information as the TBM proceeded and coordinating with the involved third parties, in particular the pub owners and the Magasin Du Nord management.

Each involved company set up two levels of support.

On site. An on-site technician/engineer was in constant contact with the operative personnel. For example, in the case of Seli Denmark the onsite engineer granted an immediate access to the TBM status beyond what the automated system and the mobile application is able to indicate. The onsite engineer was in contact with the mining crew through radio and was always able to determine what particular action was in progress at any given moment. This proved to be particularly valuable for monitoring personnel that could know in advance how long a stoppage was going to last, whether it was for normal ring build operation or for a mechanical problem, thus giving a longer time span for possible compensation injection.

FIG.11

Sensors for the building displacement control.



On call. For all those decisions that could not be made on site, each organization provided an on call senior engineer or manager. The person who was on call was constantly connected to the machines thanks to the mobile application and/or remote access software and, in case of call, could quickly understand the situation and make decisions accordingly.

Monitoring during the passage

According to the on-site/on-call presence, each company provided its own level of monitoring support.

CMT was in charge of the real time review and analysis of the monitoring system recordings. It was also in charge of the compensation grouting injections review and the compliance with the predefined action and emergency plan.

Seli Tunneling Denmark was responsible for the TBM excavation monitoring and the coordination of the communication flow between the tunneling crews and the monitoring crews.

Keller oversaw the compensation grouting and liquid level monitoring system and the design injection plan adaptation.

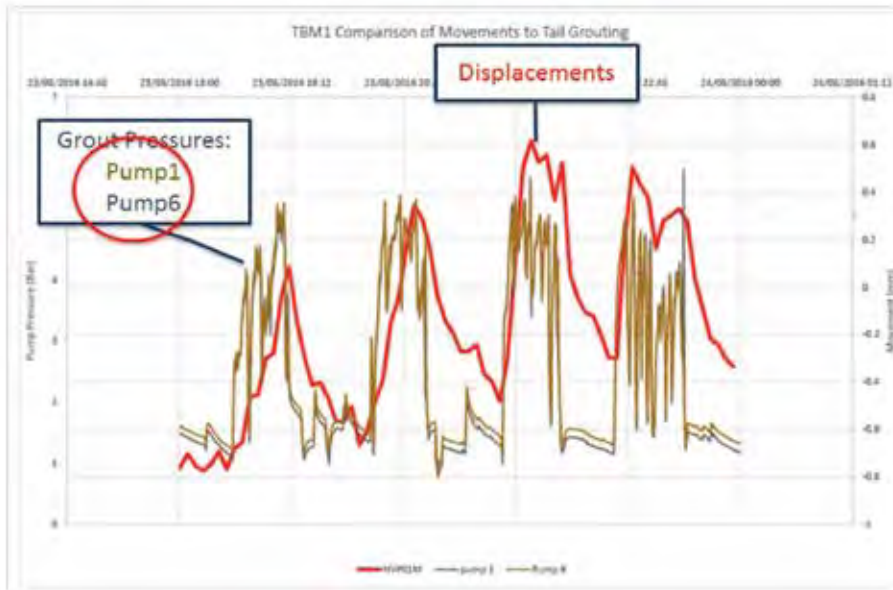
The monitoring personnel communicated and cooperated with Seli Tunneling DK during TBM critical strokes advance, giving a prompt feedback of how the adjacent building was reacting to TBM behavior and to consequently coordinate with the grouting operations.

The TBM passage for both machines was highly successful in terms of recorded settlements which did not exceed 0.8 mm, thus remaining within the predefined threshold values and not necessitating any compensation grouting injections. Limited post grouting, following the TBM passage, recovered the very low displacements incurred.

The following two examples show how the accuracy of the monitoring, both at TBM level and at displacement

FIG. 12

Grout pressure vs. ground displacements.



level, allowed us an extremely detailed follow-up of all operations and, consequently, an informed decision-making process.

Figure 12 compares the back-filling, two-component pressure with the movements of the ground, recorded under the corner of the first building encountered during the excavation.

It is clear and interesting how the influence of the backfilling injections is immediately visible on the building displacements. During each stroke, the grout injection pressures were directly influencing the ground

heaves. Once the pressures were reaching the peak, the displacements were increasing too. We could follow up on production just looking at the building behavior.

Monitoring the correlation between TBM parameters and building behavior provided the possibility to promptly react and change the TBM influence accordingly, if necessary.

Another interesting correlation is shown in Fig.13. Here, the thrust force on the tail shield, or better the pulling force on the tail shield articulation system, is correlated to the geology. The decrease of the pull force indicated that also the tail shield was, at the point, safely into the limestone bedrock.

Conclusions

The excavation of the critical 70 m (230 ft) stretch lasted three days per machine and it took place without any disruption. Both TBMs bored in the extremely unfavorable conditions with an average advance rate of 22.3 m/day (73.2 ft/d). Both TBMs raced to the next station, Gammel Strand, completing the 439 m (1,440 ft) stretch in only 25 days, keeping a good average daily production of 17.6 m (57.9 ft).

The maximum settlement recorded was less than 1 mm and compensation grouting injection during the TBM operations was eventually not necessary.

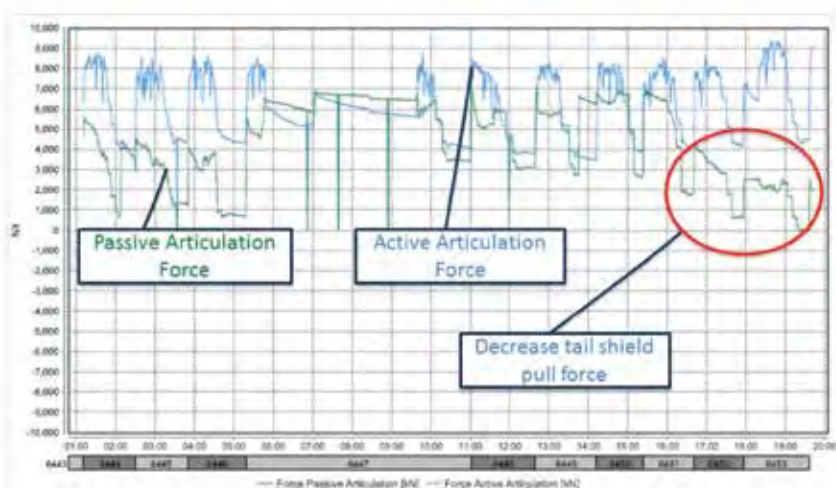
While the design set at a conservative 1 percent of volume loss, the recorded volume losses didn't exceed 0.1 percent.

The whole design process lasted three years. It has been complex and involved different disciplines, actors and negotiations with the project owner. It required delicate interfaces with third parties, both during the expropriation process and during the actual works and monitoring process.

This long undertaking culminated in the three uneventful days of the actual TBM passage. Overall, a good example of how accurate design study before and careful execution, with clear distribution of responsibilities after, allowed to complete in a very short time one of the most delicate and challenging passages of the project. ■

FIG. 13

Articulation force vs. geology.



FEATURE ARTICLE

Planning of the San Francisco Public Utilities Commission's Channel Tunnel

The proposed Channel Tunnel is a critical component of the San Francisco Public Utilities Commission's (SFPUC) Central Bayside System Improvements Project (CBSIP), which is a key element of a \$6.9-billion sewer system improvement program to upgrade its aging and seismically vulnerable wastewater facilities. The tunnel will provide gravity conveyance and storage of combined sewage flows from the northeast sector of San Francisco, CA to the Southeast Water Pollution Control Plant for treatment. The tunnel will be approximately 2.7 km (1.7 miles) long and 7.3 m (24 ft) in internal diameter. It will utilize a single-pass precast concrete segmental lining system. Tunneling challenges include excavating with pressurized face tunnel boring machine (TBM) technology through highly variable ground conditions including the Franciscan Complex (rock and mélangé), clayey/silty sands, stiff to hard clay (Old Bay Clay) and mixed-face conditions. The project will also require several deep shafts that will be technically challenging.

Project background

The SFPUC is a department of the City and County of San Francisco, CA that provides municipal power, drinking water and wastewater services to San Francisco.

San Francisco's combined sewer system collects both wastewater and stormwater in the same sewers, which is then pumped, treated to stringent state standards and discharged into the San Francisco Bay and Pacific Ocean. The sewer system includes tunnels, large storage/transport boxes, 1,600 km (1,000 miles) of collection sewers, 28 pump stations and three wastewater treatment plants. After decades of service, much of the system is nearing the end of its useful life.

The existing system is also vulnerable to seismic damage. During the 1989 Loma Prieta earthquake, damage to SFPUC wastewater infrastructure was extensive. This included the 3,415 m (11,200-ft) long, 1.7m (66-in.)

diameter Channel Force Main, built in 1976, and a critical component of the conveyance system. The Channel Force Main carries 70 percent of the bayside dry weather sewage flow from the northern and central part of the city to the Southeast Water Pollution Control Plant for treatment. It is antiquated, not pile-supported and not constructed to current seismic codes. There is also currently no conveyance redundancy for north/central bayside flows to the treatment plant. Figure 1 shows the SFPUC's wastewater collection system, the existing Channel Force Main and the

FIG. 1

Schematic diagram of the SFPUC's wastewater distribution system.



R. John Caulfield, Art Hamid and Manfred Wong

R. John Caulfield, member UCA of SME, is principal, Jacobs Engineering, **Art Hamid**, member UCA of SME, is Vice President Emeritus, Stantec/MWH Global and **Manfred Wong**, member UCA of SME, is senior project manager, San Francisco Public Utilities Commission, email john.caulfield@jacobs.com.

FIG. 2

Regional geological map. Source: Graymer et al., 2006.



these sediments consists of consolidated rocks of the Franciscan Complex. This Franciscan bedrock consists of highly deformed, weathered and intensely fractured sedimentary rocks of the Franciscan assemblage including mélange shales, sandstones, siltstones, mudstones, greywacke sandstone, serpentinite and greenstone. Sediments overlying the Franciscan Complex include Old Bay Clays, Young Bay Muds and Colma Sands with interbedded clays, and undifferentiated alluvium/colluvium. Historical development in the area resulted in placement of fill over substantial portions of modern estuaries, marshlands, and creek beds to reclaim land. A regional geologic map is shown in Fig. 2 (Graymer et al., 2006).

The preliminary geotechnical investigation included the installation of open standpipe piezometers along the alignment to monitor ground water levels. Piezometer readings indicate that the ground water levels are generally consistent at between 0.6 m and 6 m (2 ft to 20 ft) below the ground surface.

Seismic characterization

Characterizing the potential seismic impacts on the facility and developing seismic design parameters will be critical activities in the final design process. The proposed Channel Tunnel is located in central coastal California, which is a seismically active area. As shown in Fig. 3, the proposed alignment does not cross any identified active faults but is situated between the San Andreas (12 km or 7.4 mile to the southwest) and Hayward (17.8 km or 11.1 miles to the northeast) faults, which are capable of generating large earthquakes (USGS, 2016). There are also numerous smaller active faults within 48 km (30 miles) of the proposed alignment. A total of 15 earthquakes of M6.0 have occurred in the San Francisco Bay region between 1850 and the present. These include the 1906, M7.9 San Francisco earthquake and the 1989, M6.9 Loma Prieta earthquake.

The Channel Tunnel is expected to experience significant ground shaking during its specified design life of 100 years. As required by the SFPUC's general seismic design requirements, the project will be designed for ground motions that will have a 5-percent probability of exceedance in 50 years (975-year approximate return period). As part of the design studies, a probabilistic seismic hazard analysis for ground shaking along the alignment will be performed. The purpose of this evaluation will be to estimate the levels of ground motions at a specified exceedance probability. Deterministic scenario ground motions will also be calculated and compared to the probabilistic ground motions. An evaluation of liquefaction potential will also be performed as part of the design.

project location.

This article addresses the planning aspects of the proposed tunnel. Current planning is for a 7.3-m (24-ft) internal diameter, 2.7-km (1.7-mile) long gravity conveyance/storage tunnel with a 454 ML/d (120 million gal/day) capacity lift station at its downstream end located on the south side of Islais Creek. It will be constructed in a highly congested urban and industrial area of San Francisco under challenging geotechnical conditions.

This project has completed the conceptual engineering planning phase that provides the 10 percent design for the project. The 35 percent tunnel design effort is currently underway.

Geologic conditions

The project site is located on the San Francisco peninsula within the Coast Ranges Geomorphic Province, with northwesterly trending ridges and valleys. Rugged hills consisting of Jurassic- to Cretaceous-aged bedrock are juxtaposed with low, flat-lying areas underlain by Quaternary sedimentary deposits. Bedrock underlying

Tunnel alignment

Potential alignments for the Channel Tunnel were evaluated based on a number of different factors including anticipated geological conditions, tunnel and shaft construction methods, constructability and risk considerations, right-of-way acquisition, permitting requirements, operations considerations, hydraulic impacts, regulatory compliance and project cost.

The preferred alignment (also called the Eastern Alignment), as depicted in Fig. 4, was determined to provide the best overall value to the SFPUC. The tunnel alignment profile provides a gravity fed system to the downstream lift station that is approximately -39 m (-130 ft) deep to the tunnel invert at the upstream end and -45 m (-148 ft) at the downstream end. This 5.4 vertical m (18 vertical ft) difference provides an overall constant grade of 0.2 percent.

The preliminary alignment studies for the project identified some significant tunneling challenges that lead to the proposed depth. At shallower depths, the tunnel would pass through soft Young Bay Mud strata and multiple mixed-face zones that would be problematic to tunnel construction. The TBM steering and grade control, as well as control of face pressure were deemed to be significant issues. Potential settlement was also a consideration as the existing active Channel Force Main overlies the majority of the proposed tunnel alignment.

Additionally, building structures and infrastructure in the area were constructed on deep-pile foundations to penetrate the very soft Young Bay Mud deposits. Avoiding these foundations with the proposed tunnel required going through them (and tunneling through the surrounding extremely soft soils) or avoiding them altogether. Avoidance options included threading the tunnel through the piles and placing it within the extremely soft soils, removing the piles in the affected areas, or going deeper with the tunnel alignment. Based on an evaluation of these options and the current understanding of the project conditions, a deeper tunnel alignment was deemed to be the preferred alternative.

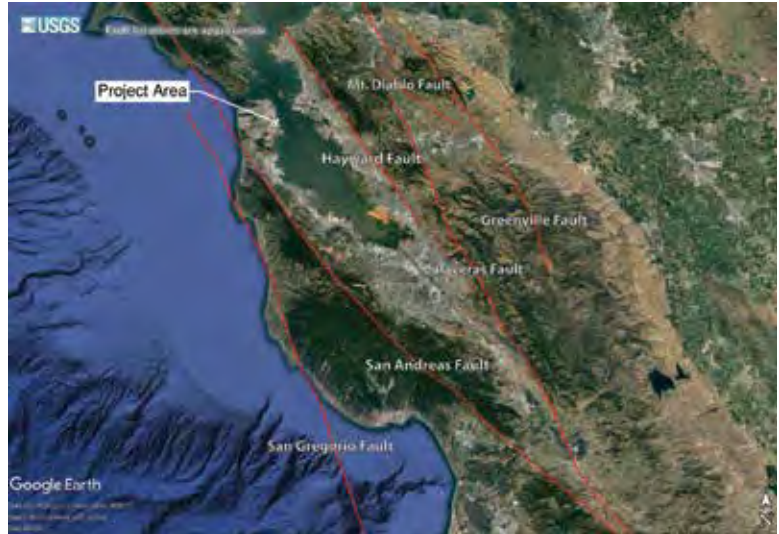
Tunneling conditions

Tunnel construction for the Eastern Alignment are anticipated to be within rock and highly weathered rock conditions; soil conditions and some mixed-face conditions (i.e., rock and/or highly weathered rock and soil). Figure 5 provides a generalized geologic profile along the tunnel alignment.

The initial 121 to 152 linear m (400 to 500 linear ft) of the tunnel drive from the launch shaft and under Islais Creek is anticipated to consist mostly of Old Bay Clays (sometimes referred to as Yerba Buena Mud). The Old Bay Clays consist of very stiff to hard, fat clay materials. They are over-consolidated and have typical undrained shear

FIG.3

Regional fault map. Source: USGS, 2016.



strengths in the range of 2,000 to 4,000 psf. They generally have good tunneling excavation characteristics and possess good standup time.

From the north shore of Islais Creek and for the next 2,400 to 2,470 linear m (8,000 to 8,100 linear ft) the tunnel drive is expected to encounter Franciscan Complex materials. The exception to this will be a section where a mixed face of Franciscan Complex and Old Bay Clays may be encountered. The rocks of the Franciscan Complex are highly variable in their degrees of fracturing, strength, hardness and weathering, ranging from soft to hard and from friable to moderately strong or massive. They have also been known to exhibit squeezing behavior. The rock types have been divided into the following categories:

- Mélange matrix.
- Greywacke sandstones.
- Serpentine (including greenstone).

The mélange is characterized by a pervasively sheared block-in-matrix fabric consisting of extremely weak to weak, dark gray to black clayey shale or blue green serpentinite matrix with abundant tectonic inclusions of greywacke. The block-in-matrix inclusions in the Franciscan Complex are known to range from gravel-size to more than 31 m (100 ft) in dimension. The greywacke is moderately strong to strong and typically occurs as smaller gravel to boulder-size pieces within the mélange matrix. The internal structure of the mélange is chaotic and depends on the degree and intensity of localized shearing and the size and distribution of the harder block inclusions. Bedrock strength is correspondingly variable, but is generally considered to be low in areas that display the greatest degree of shearing or a higher proportion of mélange matrix to block inclusions.

FIG.4

Proposed tunnel alignment.



Greywacke sandstones found within the Franciscan Complex typically have wide ranging unconfined compressive strengths, from approximately 50 psi to over 9,000 psi. Calculated unconfined compressive strengths obtained from point load index testing range from nearly 100 psi to over 15,000 psi.

The serpentinite of the Franciscan Complex is slightly to moderately weathered, with altered infilling of discontinuities. The initial project geotechnical investigations also encountered moderately weathered, moderately strong to strong greenstone (metamorphosed basalt) beneath the surficial soils. This unit was highly fractured with localized shear zones that were completely weathered/altered and soft.

The majority of unconfined compressive strength tests performed during preliminary investigations returned values of less than 5,000 psi and typically less than 3,000 psi. Point load index tests performed on the greenstone had results ranging from 11 psi to 294 psi. Brazilian Tensile Strength tests indicated a wide range of tensile strengths from 20 to 1,080 psi, with a skew in the data towards the lower strengths.

Laboratory tests on collected samples indicate that much of the serpentinite contains levels of naturally occurring chrysotile asbestos.

The ground classifications indicate that a high percentage of the Franciscan Complex ground is poor to extremely poor. Q classification indicates that more than 60 percent of the ground is “very poor” and rock mass rating (RMR) indicates that more than 55 percent of the ground is “poor,” showing good correlation between both methods. The GSI values typically ranged from 15 (“very poor” and “disintegrated”) to 60 (“blocky” and “good”), which suggests high variability in rock quality. It is anticipated that the excavation through the Franciscan Complex will present a number of challenges including potential squeezing behavior, highly variable ground conditions, abrasion of excavation tools.

The remaining approximately 152 m (500 ft) of the tunnel excavation is expected to encounter Old Bay Clays with some dense sand layers entrained within the lower part of the tunnel near the invert.

The entire tunnel alignment is located under the water table, potentially subject to approximately 3 to 4 bars (45 to 60 psi) of hydrostatic pressure. Further evaluation of the hydrogeologic characteristics of the subject formations will be part of the future project geotechnical investigations.

Tunnel excavation and lining methods

Bored tunneling methods using a shielded pressurized face machine were considered to be the most suitable method for excavating the main tunnel drive based upon the current understanding of the geologic conditions. The machine will need to accommodate the wide range of rock, soil and mixed-face ground along the alignments as well as the groundwater conditions. A pressurized-face shielded TBM will also facilitate the installation of the lining system anticipated.

The pressurized-face TBM will likely be an earth pressure balance machine (EPBM) given the recent tunneling success and contractor experience with these machines in the local geologic conditions. Recently completed EPBM excavated tunnels within the San Francisco Bay Area include the SFMTA Central Subway twin tunnels (ENR, 2015), the SFPUC Bay Tunnel (Caulfield et al., 2014), and the SFPUC Sunnydale Auxiliary Sewer Tunnel (Fippin et al., 2011).

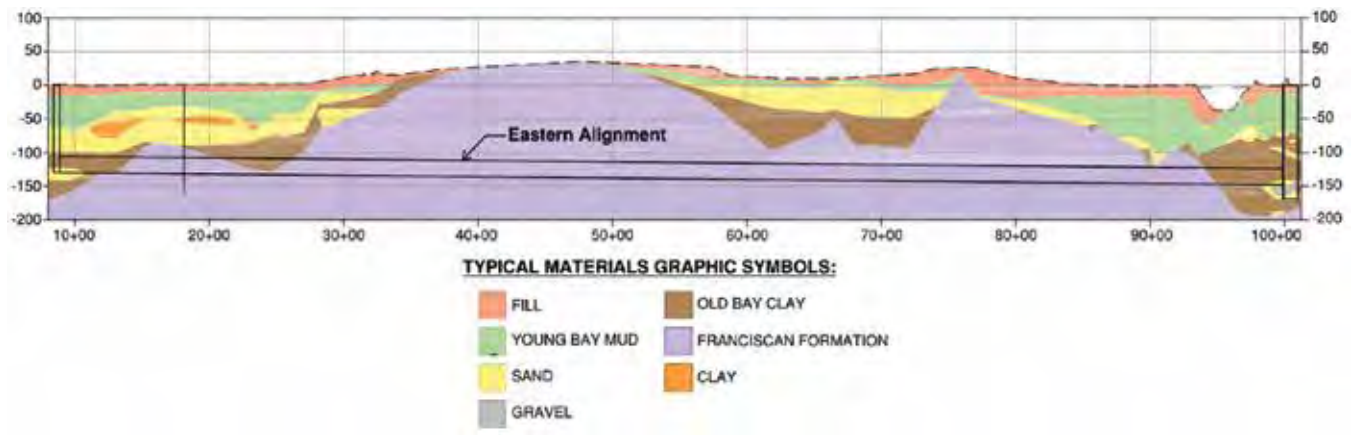
A slurry-shield TBM may also be viable, but space considerations for the extensive slurry surface plant involved may prove difficult at the TBM drive shaft site.

Based upon the current understanding of the ground conditions, some of the machine capabilities and features would include:

- The ability to excavate in low-strength mélange and serpentinite as well as blocks of hard sandstone.

FIG.5

Generalized geologic profile along the tunnel alignment.



- The ability to excavate in and restart after a stoppage in squeezing ground types.
- To handle the variable rock and soil conditions, it is anticipated that the cutterhead will be fitted with a combination of back-loaded disc cutters and drag picks as excavation tools.
- The ability to inject bentonite under pressure in the annular space between the shield and the excavated rock to help mitigate against squeezing ground conditions.
- The ability to grout ahead of the TBM face.
- Due to the ground conditions along the tunnel drive and an anticipated hydrostatic head of up to 3 to 4 bars (45 to 60 psi), hyperbaric interventions may be required for machine maintenance and/or repairs.

The excavated tunnel and shaft muck will be screened for hazardous materials to identify the appropriate disposal location. It will be dispositioned for beneficial reuse wherever possible. However, it is anticipated that the majority of the muck will contain elevated levels of naturally occurring chrysotile asbestos. This will dictate special handling requirements and potential disposal as a classified hazardous waste. This will also require enhanced personal protective equipment for underground personnel during excavation, as well as increased air quality monitoring.

The tunnel lining will consist of precast concrete segments that will act as the initial support as well as the final lining system (i.e. a one-pass lining). The segments will be bolted and gasketed to limit water intrusion and the potential outflow of any effluent. The annular gap between the segments and the surrounding ground will be backfilled with a two-part grout to limit potential settlement and provide good embedment for the lining system.

Project shafts

There are a number of proposed shafts for the project, including:

- An EPBM launch and main construction operations shaft that will also be used to house the permanent lift station at the south side of Islais Creek.
- An EPBM receiving shaft at the south side of Mission Creek, which will also be used as the permanent upstream drop shaft.
- A connection shaft near the downstream end of the tunnel to tie in an existing box sewer to provide wet weather operational flexibility.

There are currently no intermediate vent shaft locations associated with the current alignment but they may be added during the design phase depending upon the results of hydraulic modeling and air entrainment studies.

TBM launch and lift station shaft

As depicted in Fig. 6, the launch shaft for the EPBM will be constructed at a 1.72-acre site (2 Rankin Street) at the northwest corner of Rankin Street and Davidson Street. The site is located in an industrial area and is currently a vacant lot. Historically, it was occupied by a large fish packing plant that was developed sometime prior to 1938. That structure, which was supported on deep foundations, was demolished sometime around 2010. Some of the old foundation elements of the facility were left in-place and will need to be addressed during design and construction. With the large shaft size and amount of work activities centralized at 2 Rankin Street, the contractor's working space will also be very constrained, which will require efficient site planning and organization.

The internal diameter of the launching /lift station

FIG.6

EPBM launch and lift station shaft.



shaft is currently set at 33 m (110 ft), which is governed by the space needs of the permanent lift station structure. The shaft is anticipated to be excavated to a depth of approximately 55 m (183 ft).

The anticipated geological strata at the launching/lift station shaft site, based on preliminary site borings are as follows:

- 0 to 2.4 m (0 to 8 ft) depth: Fill.
- 2.4 to 28 m (8 to 93 ft) depth: Young Bay Mud (CH) — Very soft to stiff (increasing with depth).
- 28 to 30.3 m (93 to 99.5 ft) depth: medium sand with silt and gravel (SP) — Very dense.
- 30.3 to 44 m (99.5 to 145 ft) depth: Old Bay Clay (CH) — Stiff.
- 44 to 46 m (145 to 151 ft) depth: Fine to medium sand (SM) — very dense.
- 46 to 50 m (151 to 164 ft) depth: Well-graded gravel (GW) — Very dense.
- 50 to 51.5 m (164 to 169 ft) depth: Clayey sand with gravel (SC) — Medium dense.
- 51.5 to 56 m (169 to 184 ft) depth: Fat clay with silt (CH) — Very stiff.
- 56 to 58.2 m (184 to 191 ft) depth: Silty fine sand (SM) — Medium dense.
- 58.2 to 59 m (191 to 194 ft) depth: Well-graded gravel with sand (GW) — Very dense.
- Below 59 m (194 ft) depth: Franciscan Complex.

The ground-water table in the vicinity is generally around 1.5 to 3 m (5 to 10 ft) below the ground surface.

Receiving shaft

The receiving shaft of the Eastern Alignment is to be located on a 1.96 acre empty lot referred to as Parcel P7 on the west side of Owens Street, just north of the University of California, San Francisco Medical Center.

The internal diameter of the receiving shaft is currently planned to be 13 m (45 ft), which will accommodate retrieval of the EPBM as well as the construction of permanent access, connections to the existing upstream pump station and hydraulic drop structures. The shaft will be excavated to a depth of approximately 43 m (140 ft).

The anticipated geological strata at the receiving shaft site, based on preliminary site borings, are as follows:

- 0 to 6 m (0 to 19.5 ft) depth: Fill.
- 6 to 19.5 m (19.5 to 64 ft) depth: Young Bay Mud (CH) — Very soft to soft.
- 19.5 to 30.7 m (64 to 101 ft) depth: sand (SP with some SM) — Very dense.
- 30.7 to 38.2 m (101 to 125.5 ft) depth: Old Bay Clay (CH) — Very stiff.
- 38.2 to 40.8 m (125.5 to 134 ft) depth: sandy clay (CL) — Very stiff.
- 40.8 to 44 m (134 to 145 ft) depth: sand with silt (SP-SM) — Very dense.
- 44 to 52.7 m (145 to 173 ft) depth: Old Bay Clay (CL-CH) — Very stiff.
- Below 52.7 m (173 ft) depth: Franciscan Complex

The ground water table in this area is generally located about 2.4 m (8 ft) below the ground surface.

Shaft construction methods

A number of different shaft construction methods were considered, including slurry diaphragm walls, ground freezing, secant piles and caissons. Based upon the geologic information collected to date, as well as the size and depth of the shafts, slurry diaphragm walls are anticipated to be the preferred method of construction.

The slurry wall panels for the shafts would be keyed into the Franciscan Complex rock to provide a water cutoff system to allow them to be excavated in the dry with reduced dewatering efforts. Packer tests performed in the Franciscan Complex rock during the geotechnical investigations had very little water take, which indicates very low permeability. The slurry wall embedment depth and shaft bottom stability would be confirmed following the detailed future geotechnical investigations during design. Additional grouting may be required at the toe of the slurry wall panels to improve the ground water cutoff where zones of permeable features are encountered. Slurry wall trench stability may also be a concern for the construction of the panels, so deep soil mixing or other means of ground improvement may be utilized for strengthening the upper soft Young Bay Mud layers.

Ground improvement may also be specified outside of the shafts to create a seal to mitigate the inflow of water and soil upon breakout/breakin of the machine through fiberglass rebar “soft eyes” located in the shaft walls.

Project schedule

The final design of the Channel Tunnel is currently underway. The project environmental documentation is being performed in parallel with the design. Construction will follow once the project has secured the necessary funding and approvals.

Summary and conclusions

The SFPUC’s proposed 2.7-km (1.7-mile) long, 7.3-m (24 ft) diameter Channel Tunnel is a critical wastewater conveyance/storage facility for the City of San Francisco. Replacement of the existing antiquated force main

pipeline with the tunnel is required to adequately address the project service requirements, and upgrade the existing seismically vulnerable wastewater facilities.

The geologic conditions are well suited, for pressurized face TBM excavation methods, and recent local tunnels in the area have been successfully constructed using Earth Pressure Balance technology. Tunneling challenges include excavating through highly variable ground conditions including Franciscan Complex rock, stiff to hard clay (Old Bay Clay), sands and mixed-face conditions, all located under the ground water table.

Based upon the current project information, the tunnel alignment is located at depths up to 40 m to 45 m (130 ft to 148 ft) to avoid potential conflicts with existing pile foundation obstructions and soft soils that would present very difficult tunneling conditions. This would require several deep, large diameter shafts, which would be some of the deepest soft ground shafts ever constructed in North America. ■

Acknowledgments

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References

- Caulfield, R. John, Whitman E., Stevens J., Fleming K., and Wong J.I. 2014. Construction of the Bay Tunnel. In Proceedings of the North American Tunneling Conference, Los Angeles, California: SME.
- ENR. San Francisco’s \$1.6 Billion Central Subway Stays on Course. November 23, 2015. <http://www.enr.com/blogs/14-gold-rush/post/38027-san-franciscos-16-billion-central-subway-stays-on-course>
- Fippin R.L., R.J. Caulfield, M. Wong, W. Lee. 2011. Sunnydale CSO Tunnel – Dealing with Urban Infrastructure. In Proceedings of the Rapid Excavation and Tunneling Conference, San Francisco, California: SME.
- Graymer, R.W. et al. 2006. Geologic Map of the San Francisco Bay Region. U.S. Geological Survey, Scientific Investigations Map 2918.
- MWH/URS Joint Venture, April, 2015. Channel Tunnel Alignment Alternatives Analysis Technical Memorandum, Final Draft. Internal Report.
- MWH/URS Joint Venture, May 5, 2015. Central Bayside System Improvement Program, Revised Preliminary Geotechnical Interpretive Technical Memorandum. Internal Report.
- MWH, September 2016. Central Bayside System Improvement Program. Draft Interim Geotechnical Phase 2B Data Report (GDR) Addendum, Internal Report.
- U.S. Geological Survey, 2016. Bay Area Faults.

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Gateway Tunnel	Amtrak	Newark	NJ	Subway	14,600	24.5	2018	Design study
2nd Ave. Phase 2	NYC-MTA	New York	NY	Subway	16,000	20	2020	Under design
2nd Ave. Phase 2-4	NYC-MTA	New York	NY	Subway	105,600	20	2017-22	Under study
Water Tunnel #3 Stage 3 Kensico	NYC-DEP	New York	NY	Water	84,000	20	2020	Under study
Bergen Point Wastewater Outfall	Suffolk Co., DPW	Babalon	NY	Sewer	14,200	12	2017	Bid date June 8, 2017
Cross Harbor Freight Tunnel	NYC Reg. Develop. Authority	New York	NY	Rail	25,000	30	2022	Under study
Amtrak B&P Tunnel	Amtrak	Baltimore	MD	Rail	10,000	30	2018	Under design
Thimble Shoal Parallel Tunnel	Chesapeake Bay Bridge & Tunnel Dist.	Chesapeake	VA	Highway	5,700	45	2016	Dragados/ Schiavone awarded
Hampton Roads Bridge-Tunnel Project	Virginia DOT	Hampton Roads	VA	Highway	7,500	42	2018	Under design
Northeast Boundary Tunnel	DC Water and Sewer Authority	Washington	DC	CSO	17,500	23	2017	Bids submitted March 1, 2017
Potomac River CSO Tunnel	DC Water and Sewer Authority	Washington	DC	CSO	4,500	33	2022	Under design
Olentangy Relief Sewer Tunnel	City of Columbus	Columbus	OH	Sewer	58,000	14	2017	Under design
Alum Creek Relief Tunnel Phase 1 Phase 2	City of Columbus	Columbus	OH	Sewer	30,000 21,000	18 14	2018 2019	Bid date 03/07/17
Doan Valley Storage Tunnel	NEORS	Cleveland	OH	CSO	10,000/ 9,400	18/18.5	2017	Southland/ Johnson/Mole low bidder
Westerly Main Storage Tunnel	NEORS	Cleveland	OH	CSO	12,300	24	2020	Under design
Shoreline Storage Tunnel	NEORS	Cleveland	OH	CSO	16,100	21	2021	Under design
Shoreline Consolidation Tunnel	NEORS	Cleveland	OH	CSO	11,700	9.5	2022	Under design
ALCOSAN CSO Ohio River Allegheny River Monongahela River	Allegheny Co. Sanitary Authority	Pittsburgh	PA	CSO	10,000 41,700 53,900	30 30 30	2019 2020 2021	Under design Under design Under design
Three Rivers Protection/Overflow	City of Fort Wayne	Fort Wayne	IN	CSO	26,400	12	2016	Salini Impreglio/ Healey low bid
Louisville MSD Tunnel	Louisville MSD	Louisville	KY	CSO	13,200	22	2018	Under design
Deer Creek Sanitary Tunnel	St. Louis MSD	St. Louis	MO	CSO	21,000	19	2016	JayDee/Frontier Kemper low bid
Blacksnake Creek Tunnel Project	City of St. Joseph	St. Joseph	MO	CSO	6,650	10	2017	Bid date April 13, 2017
KCMO Overflow Control Program	City of Kansas City	Kansas City	MO	CSO	62,000	14	2018	Under design

FORECAST T&UC

TUNNEL NAME	OWNER	LOCATION	STATE	TUNNEL USE	LENGTH (FEET)	WIDTH (FEET)	BID YEAR	STATUS
Mill Creek Peaks Branch Tunnel	City of Dallas	Dallas	TX	CSO	5,500	26	2014	To be rebid 2017
Ballard to Wallingford Tunnel	Seattle Public Utilities	Seattle	WA	CSO	14,250	14	2018	Under design
L.A. Metro Westside Phase 2 Phase 3	Los Angeles MTA	Los Angeles	CA	Subway	26,500 26,500	20 20	2016 2017	Tutor Perini/O&G JV low awarded Under design
Speulvada Pass Corridor	Los Angeles MTA	Los Angeles	CA	High/Trans.	55,500	60	2018	Under study
Northeast Interceptor Sewer 2A	LA Dept. of Water and Power	Los Angeles	CA	Sewer	18,500	18	2014	Delayed indefinitely
River Supply Conduit - Unit 7	LA Dept. of Water and Power	Los Angeles	CA	Water	13,500	12	2015	Advertise 03/2017
JWPCP Effluent Outfall Tunnel project	Sanitation Districts of LA	Los Angeles	CA	Sewer	37,000	18	2015	Contractor RFQ submitted
Two Mile Bar Tunnel	Oakdale Irrigation	Oakdale	CA	Water	5,950	11.5x13	2017	SMCI low bidder
Freeway 710 Tunnel	CALTRANS	Long Beach	CA	Highway	26,400	38	2016	Under design
BDCP Tunnel #1 BDCP Tunnel #2	Bay Delta Conservation Plan	Sacramento	CA	Water	26,000 369,600	29 35	2018 2019	Under design Under design
SVRT BART	Santa Clara Valley Trans Authority	San Jose	CA	Subway	22,700	20	2016	Redesign activated
Silicon Valley Clean Water Tunnel	Silicon Valley Clean Water	Silicon Valley	CA	CSO	17,500	13	2017	Advertise June 2017
Coxwell Bypass Tunnel program	City of Toronto	Toronto	ON	CSO	35,000	12	2015	Advertise 3Q 2017
Highway 401 Rail Tunnel	Metrolinx	Toronto	ON	Subway	580	35x28	2017	Shortlisted teams announced
Keswick Effluent Outfall	City of Toronto	Toronto	ON	CSO	11,600	23	2018	Under design
Yonge St. Extension	Toronto Transit Commission	Toronto	ON	Subway	15,000	18	2016	Under study
Taylor Massey Tunnel	City of Toronto	Toronto	ON	CSO	20,000	18	2018	Under design
Inner Harbour West	City of Toronto	Toronto	ON	CSO	18,400	19	2021	Under design
Scarborough Rapid Transit Extension	Toronto Transit Commission	Toronto	ON	Subway	25,000	18	2017	Under design
REM Transit Tunnel	City of Montreal	Montreal	QC	Subway	27,000	22	2017	Bidders selected
Newfoundland-Labrador Fixed Link	Gov. of Newfoundland/Lab	Newfoundland	NL	Transit	56,000	40	2020	Under study
Green Line LRT	City of Calgary	Calgary	AB	Transit	26,250	20	2018	Under design
Second Narrows Tunnel	City of Vancouver	Vancouver	BC	CSO	3,600	14	2013	Under design
Annacis Island Outfall	City of Vancouver	Vancouver	BC	Water	8,000	10	2017	Under design
Burnaby Mountain	Kinder Morgan	Vancouver	BC	Oil	8,000	12	2017	Under design
Broadway Sky train extension	Trans Link	Vancouver	BC	Subway	25,000	18	18	Under design
Northern Gateway Houlst Tunnel	Enbridge Northern	Kitimat	BC	Oil	23,000	20	2014	Under design

PERSONAL NEWS

JOHN KAPLIN, CCM (SME), is the new California Regional Manager for McMillen Jacobs Associates. The region includes offices in San Francisco, Walnut Creek, Pasadena and San Diego. Kaplin has been with McMillen Jacobs for three years, most recently serving as



KAPLIN

the firm's construction management practice lead. Kaplin has 30 years of experience in geotechnical investigations, design management, and construction management of underground and heavy civil projects.

SARAH WILSON, PE, CCM (SME), will assume the construction management (CM) practice lead position. Most recently, she served as resident engineer on the Central Subway project in San Francisco. Wilson is a senior associate and has

been with McMillen Jacobs Associates for 17 years. She has focused on construction management roles for the last 12 years.



WILSON

In her new role, she will provide day-to-day support for CM staff and overall leadership to the CM Practice on operational matters for existing projects.

PRODUCTS

Direct pipe technology from Herrenknecht

In booth 1217 at the SME Annual Conference & Expo, Herrenknecht Tunneling Systems USA featured a full product range of innovative machines for tunneling and underground mining infrastructure.

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On Oct. 12, 2016, the AVN800 achieved the last of two breakthroughs in Czeszów, Poland using the direct pipe method.

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The sticky ground that typically tends to cause blockages is not a barrier for the direct pipe method. Even at very high levels of friction resistance, the 500 t (551 st) of thrust provided by the pipe thruster in the launch shaft is more than enough. ■

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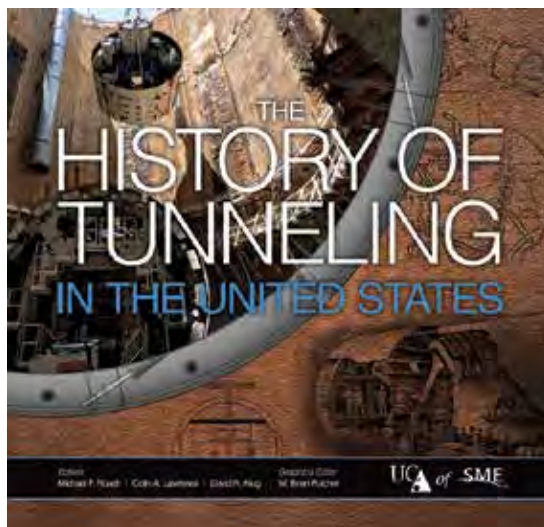
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NEW MEDIA

The History of Tunneling in the United States

2017, edited by Michael F. Roach, Colin A. Lawrence and David R. Klug, graphics editor W. Brian Fulcher, published by SME, 12999 E. Adam Aircraft Cir., Englewood, CO 80112, USA, www.smenet.org/store, email books@smenet.org, phone 303-948-4225, 800-763-3132 x225, 564 pp. hardcover, full color, ISBN 978-0-87335-430-1, \$129 member, \$109 student member, \$259 list.

Without its tunnels, this nation would be a quagmire of clogged streets, urban gridlock, massive sewage and water pipes along



the sidewalks, and train routes that would take hours go around a mountain instead of going straight through it. Tunnels have been built for 200 years to solve some of society's most pressing and dangerous problems. And yet the public rarely understands the complexity of boring through the earth under skyscrapers or the danger of burrowing under rivers, lakes and oceans. This beautifully illustrated book includes a collection of museum-worthy historical photos. And the story is told by the industry experts who created the tools and technology needed to do the job. ■

Rapid Excavation and Tunneling Conference 2017 Proceedings

Edited by Colin A. Lawrence and Anthony Del Vesco, published by SME, 12999 E. Adam Aircraft Cir., Englewood, CO 80112, USA, www.smenet.org/store, email books@smenet.org, phone 303-948-4225, 800-763-3132 x225, 1,068 pp. hardbound, ISBN 978-0-87335-451-6, \$149 member, \$129 student member, \$199 list.

Every two years, industry leaders and practitioners from around the world gather at the Rapid Excavation and Tunneling Conference (RETC) to learn about the most recent advances and breakthroughs in this unique field. Tunnels are getting larger, deeper, and excavated in more challenging conditions. The expectation for the industry is to successfully complete these projects while meeting the other



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Chapters titles include: Pressure Face TBMs, Instrumentation and Monitoring, Shafts, Grouting and Ground Modification, Hard Rock TBMs, Conventional Tunneling, Large-Span Tunnel Caverns, Future Tunneling, Risk Management, Major Projects, Innovation and Technology, Tunnel Linings, Stations and Cross Passages, Trenchless Tunneling, SEM/NATM, Difficult Ground and Tunnel Rehabilitation. ■

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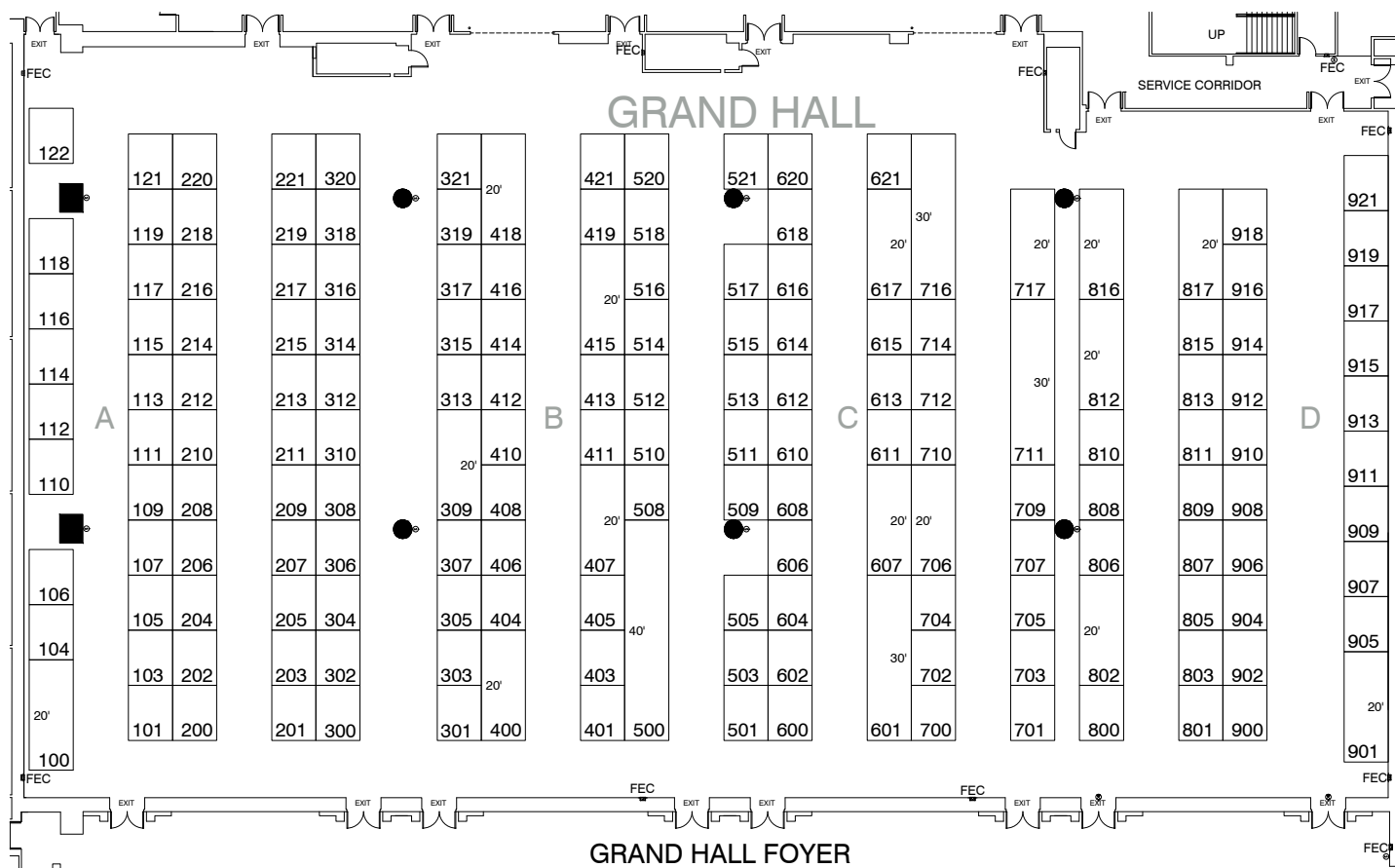


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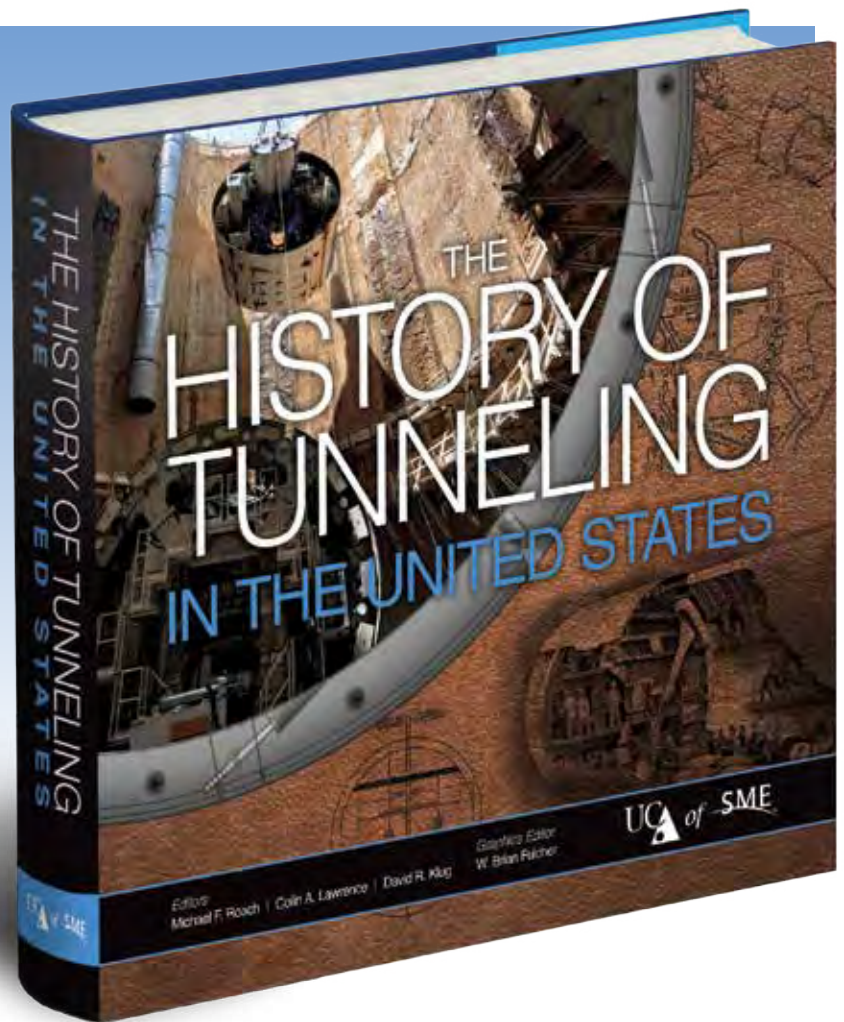


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Booth 106

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Booth 714

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Booth 313

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Since 1988, Georgetown, SC-based Agru America, Inc. has been the world's leading manufacturer of flat die extrusion geomembranes, geonets, geocomposites, geotextiles, geo clay liners, concrete protective liners and fittings. Agru America also supplies vertical barrier systems and piping systems for the U.S. and international markets. The company's state-of-the-art products include Sure-Grip® CPL, Hydroclick®, Agru Smooth Liner® / MicroSpike® (structured textured products), Super Gripnet®, and Drain Liner®. Agru America is part of Alois Gruber GmbH, an Austrian family-owned business since 1948 with production facilities in Austria, the U.S., Germany, China and India, and distribution in over 80 countries worldwide.

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Booth 606

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Booth 701

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Booth 217

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Booth 706

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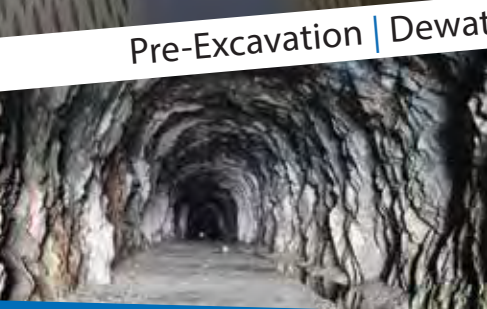
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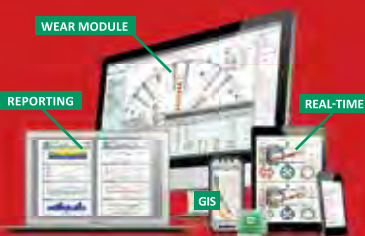
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Booth 203

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Booth 607

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BAUER-Pileco Inc

Booth 916

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Booth 503

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Brokk Inc

Booth 407

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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.

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www.brokkinc.com



Brookville Equipment Corp

Booth 201

See our ad on page 18

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 rerailing 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.

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Booth #
201

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Case Foundation - Bencor*Booth 508*

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Booth 302

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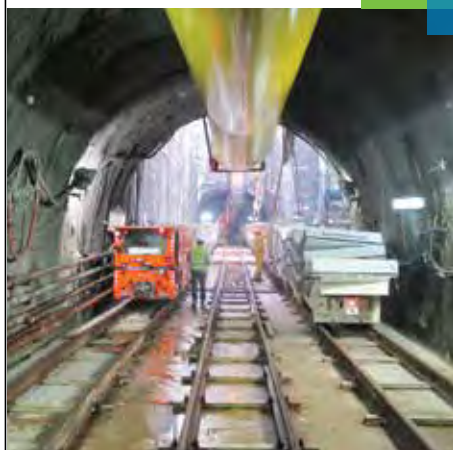
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Colorado School of Mines Center for Underground

Booth 907

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We are a collaborative, interdisciplinary group of faculty and students from the departments of civil and environmental engineering, geology and geological engineering, mining engineering and mechanical engineering, as well as geophysics and computer science, with a collective interest in education and research in innovative underground engineering.

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COWI North America

Booth 518

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Booth 406

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CTS Cordes tubes & seals GmbH & Co KG

Booth 513

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David R. Klug & Associates, Inc*Booth 501**See our ad on page 23*

David R. Klug & Associates, Inc. provides international and national manufacturer representative services to the underground heavy civil and mine construction industries. The company specializes in the coordination of products, equipment and services for NATM, soft ground, precast segmental and conventional tunnel construction. This includes initial support systems, GFRP bolts and soft-eye structures, flexible membrane waterproofing systems, prefabricated final lining reinforcement products, steel moulds, connectors and gasket sealing systems for one pass precast tunnel linings, tunnel profiling/scanning equipment and associated site services, design and supply of project specific material handling systems, and complex final lining forming systems.

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Booth 516

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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

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Booth 918

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Fibermesh*Booth 107*

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Concrete Reinforcement

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Gall Zeidler Consultants*Booth 103***See our ad on page 26**

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GCP Applied Technologies

Booth 909

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Booth 620

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Geo-Instruments, Inc

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Booth 317

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Geokon, Inc. is a specialist in the supply of instruments for the NATM method of tunnel support. In addition to almost all major cities in the USA, the company has instrumented subway systems in Seoul, Taipei, Guangzhou, Istanbul, Hong Kong, Singapore and London. Geokon also has instruments in the Channel Tunnel. Call Geokon for a quote or with questions on an application. The company is prompt and courteous in its replies.

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GEO-SLOPE International Ltd

Booth 111

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Gomez International, Inc

Booth 418

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Gomez International Incorporated's three divisions provide assistance with all of your project needs. CONSULTING ENGINEERING DIVISION assists from Project Concept to Completion. With over 80 years combined experience, our team specializes in all types of underground excavation, support, operation systems, TBM application, design and procurement. MANUFACTURING, REBUILD DIVISION manufactures and refurbishes custom designed equipment We offer for sale or lease a wide variety of equipment to fit your needs. EQUIPMENT SALES DIVISION is the OEM representative for Grout/Shotcrete Plants, Pumps, Battery Powered Locomotives, Tunnel Entrance Seals, Omega Seals; Starloy Cutter Bits, Scrapers and Tail Brushes.

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Grindex Pumps

Booth 221

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Hayward Baker Inc

Booth 510

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Heintzmann Corp

Booth 700

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Booth 500

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Booth 614

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HNTB Corp

Booth 401

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Booth 902

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Hughes Brothers Inc

Booth 213

Hughes Brothers Inc., manufacturer of Aslan® FRP materials supplies FRP products for soft-eye openings for TBM launch and reception, consumable FRP soil nails and tie-backs for slope and soil stabilization, FRP rebar for use in the sequential excavation method. FRP bars are high strength, lightweight, and non-corroding but are easily consumed by mining equipment or tunnel boring machines. Aslan 100 GFRP rebar has been used in over 300 TBM launch and break-outs in projects worldwide. Aslan FRP materials are also used in situations where encroachment or future use issues require consumable or removable anchors or methods.

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Jennmar Civil

Booth 812

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Klug Construction Systems LLC

Booth 900

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Korea Railroad Research Institute

Booth 114

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Booth 711

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Malcolm Drilling Co Inc

Booth 405

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Booth 901

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Booth 707

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McMillen Jacobs Associates

Booth 602

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McMillen Jacobs Associates is an employee-owned engineering and construction firm serving the heavy civil, underground, and water resource markets. We offer comprehensive design, design-build, self-performing construction and construction management capabilities. Our services include environmental studies, licensing, permitting, hydraulics, hydrology, and dam safety, as well as civil, structural, geotechnical, mechanical, and electrical engineering. We also provide claims and dispute resolution services. McMillen Jacobs Associates maintains offices covering North America and Australasia.

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Measurand Inc

Booth 308

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Booth 604

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Michels Corp

Booth 218

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 (TBM), hard rock TBMs, conventional drill blast tunneling, sequential excavation methods (SEM), remote-controlled tunneling systems and microtunneling.

Products & Services

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Shotcrete Equipment, Supplies, and Services
Slurry Services and Machines
Underground Excavation Services and Equipment

Main Office

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www.michels.us

Microtunneling Inc

Booth 505

Founded in 1992, we specialize in new microtunneling machines by RASA and ancillary equipment including custom fabrication. We also can assist in marketing your used equipment through our sister company Rhinotraders.com.

Products & Services

Tunnel Boring Equipment

Main Office

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www.microtunneling.com

Mighty Shield Industries Sdn Bhd

Booth 809

Mighty Shield Industries Sdn Bhd (522095-T) Mighty Shield Industries incorporated in 2002, is located in Shah Alam, Malaysia. As part of our range of products, we manufacture Dunamis™ FRC macro polypropylene (PP) fibers to support reinforcement in mining and concrete construction. Our PP fibres bridge cracks support, resist flexural deformation with added



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EXHIBITORS

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Products & Services

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Precast Concrete Linings
Tunnel Lining and Support Materials

Main Office

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Shah Alam, Selangor 42450 Malaysia
Phone: +601 2202 9606
Email: dunamisfiber@mightyshield.com.my
www.mightyshield.com.my



Mining Equipment Ltd

Booth 617

See our ad on page 37

Mining Equipment has been supplying the mining and tunneling industries with quality rebuilt underground equipment for more than 30 years. The business has grown to encompass new ventilation equipment, Jetair fans, and new rolling stock, C.S. Card and Moran Engineering. Mining Equipment, Jetair and Mine Hoists International are currently doing business in North and South America, Australia, Asia, Africa and Europe.

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Mining Equipment
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Moretrench

Booth 304

See our ad on page 39

Moretrench is a geotechnical contractor specializing in design/build and turnkey solutions for construction requirements and subsurface conditions. Credited with developing the first practical wellpoint system in 1924, Moretrench has dewatered sites for subway and underground construction across the country. With the development of other geotechnical methods, Moretrench moved beyond dewatering to utilize ground freezing for shaft construction and connector tunnels, various grouting methods, including jet, permeation, compaction and compensation grouting, for other tun-



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Water Treatment Plant and Materials

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Fax: (973) 627-3950
www.moretrench.com

M
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Mott MacDonald

Booth 400

See our ad on page 38

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

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www.mottmac.com

National Concrete Accessories

Booth 905

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Products & Services

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www.nca.ca

Naylor Pipe Co

Booth 801

See our ad on page 41

Naylor Pipe is manufactured in accordance with ASTM A-139 and ASTM A-211 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 Couplings to complete your pipe system.

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Nexans AmerCable

Booth 702

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Nicholson Construction Co**Booth 312**

Founded in 1955, Nicholson is a leader in geotechnical construction, providing a wide range of deep foundation, earth retention and ground treatments 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

Geological, Geotechnical Services and Equipment
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Jet Grouting Equipment and Services
Shaft Drilling and Raiseboring Equipment

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Nightstick by Bayco Products**Booth 521**

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Underground Excavation Services and Equipment
Underground Utility Materials and Operations
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www.mynightstick.com

Normet Americas, Inc**Booth 100**

See our ads on pages 40 and 42

Normet provides solutions for selected, demanding customer processes in underground mining and tunneling. For 50 years Normet has developed, manufactured and marketed equipment and vehicles for underground applications. In addition, it provides a comprehensive range of life time care services e.g. maintenance, service programs and spare parts. Normet offers solutions for the following underground customer processes: concrete spraying and transport, explosive charging, lifting and installation, underground logistics and scaling. For concrete spraying and transport, Normet provides equipment, comprehensive range of construction chemicals and support for the whole application.

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EXHIBITORS

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North American Drillers

Booth 115

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Grouting Services, Equipment and Materials
Shaft Drilling and Raiseboring Equipment

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North American Tunneling Journal/Tunnelling Journal

Booth 904

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Northern Light Technologies

Booth 319

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Fax: (416) 425 5960
Email: info@nltinc.com
www.nltinc.com

Northwest Laborers-Employers Training Trust

Booth 817

See our ad on page 43

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.

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Pacchiosi Drill

Booth 211

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Jet Grouting Equipment and Services

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Palmieri S.p.A.

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Parsons

Booth 310

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Parsons is a technology-driven engineering services firm with more than 70 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.

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Plaxis Americas LLC

Booth 306

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EXHIBITORS

in this user-friendly and intuitive software. A suite of constitutive models is available, ranging from soft soil to rock, and from linear elastic to fully nonlinear. Special modules are available for modeling dynamics and (complex) groundwater flow. Easy to use tools are available to define construction stages and to build complex geometries of tunnels and excavations.

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Computer Hardware and Software
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Poltinger Precision Systems GmbH

Booth 807

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Booth 717

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Pultrall Inc

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www.vrod.ca

Putzmeister

Booth 305

See our ad on page 47

Putzmeister is an international group based in Aichal, Germany, with over 50 years experience in the construction and public works sector, and worldwide leader in the development and manufacture of concrete pumping equipment. The Putzmeister Group is set in 5 different business divisions. Putzmeister Underground Technology Division develops, manufactures, and markets concrete spraying equipment for rock-support in tunnels and underground mining as well as low profile concrete mixing and transport equipment.

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Booth 300

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Booth 413

R.S.T. Instruments Ltd. has been in the engineering instrumentation industry since 1977. From conceptual designs of site-specific products to the exceptional post-sale calibration and repair service offered by the company's technical department, RST's commitment to client satisfaction is our ultimate organizational goal. RST takes much pride in providing custom engineered solutions to site-specific problems on a design-build basis. With ISO 9001 Certification, RST has a proven track record for quality, long-term stability, and product reliability. Our 26,000 sq.ft. modern facility incorporates CAD, CAM, and CNC manufacturing techniques. Such techniques assure high quality, at a reasonable cost, with timely delivery.

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www.rstinstruments.com

Resiplast US, Inc

Booth 204

Since its inception in 1963, RP Industries has developed resin systems for various industrial applications. Resiplast US, Inc. was established in 2013 to manage the United States and Caribbean operations of RP Industries. Brand names include Spetec, a line of high-quality polyurethane injection resins specially developed to stabilize soil, rock and seal water ingress. For over 25 years, Spetec injection resins have been used in structures such as tunnels, mining, metro systems, excavations, dams and ground barriers. Spetec - A Worldwide Standard in Chemical Grouting!

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Richard Goettle, Inc

Booth 318

Richard Goettle, Inc. is a geotechnical engineering and construction company serving the United States. With 60 years of experience, Goettle continues to be an industry leader specializing in design-build earth retention systems, deep foundations, ground modification and marine construction. Goettle services the tunneling industry by providing large diameter drilled shafts and earth retention systems, including secant pile, soldier piles and lagging, and sheet pile systems.

Products & Services

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Richway Industries

Booth 608

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Tunnel Lining and Support Materials
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www.cretefoamer.com

Robit Plc

Booth 118

See our ad on page 49

Robit is a strongly internationalized growth company selling and servicing global customers in drilling consumables for applications in mining, construction and

contracting, tunneling and well drilling. The company's offering is divided into three product and service range: Top Hammer and Down the Hole products as well as Digital Services. Robit has 20 own sales and stock points as well as active sales network in 115 countries. The manufacturing units are located in Finland, South Korea, Australia, UK and USA. Robit is listed in Nasdaq Helsinki Ltd's First North Finland marketplace with trading code ROBIT. For more information, see www.robitgroup.com

Products & Services

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ROBODRILL

Booth 913

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Underground Excavation Services and Equipment

Main Office

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Phone: +33 4 72 79 00 20
Fax: +33 4 72 79 00 29
www.robodril-sa.com/

Rocscience, Inc

Booth 206

Rocscience develops geotechnical software used worldwide by over 6,000 companies and universities in over 130 countries. The suite of programs includes slope stability, settlement and consolidation, stress analysis, support design, and underground modelling. 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

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Geological, Geotechnical Services and Equipment

Main Office

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Toronto, Ontario M5T1V1 Canada
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Ruen Drilling, Inc

Booth 303

Ruen Drilling provides drilling services including surface, underground, and horizontal directional core drilling for the geotechnical, exploration and geothermal 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

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Clark Fork, ID 83811 USA
Phone: (209) 988-4261
Fax: (209) 577-3157
www.ruendrilling.com

S.A. Healy Company

Booth 805

Heavy-civil contractor specializing in the construction of tunnels, shafts, highways, bridges, dams, and rail projects.

Products & Services

Construction - Contracting Services
Underground Excavation Services and Equipment

Main Office

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Henderson, NV 89074 USA
Phone: (702) 754-6400
Fax: (702) 754-6410
www.sahealy.com

Saminco Inc

Booth 811

For 25 years, Saminco International has been developing and manufacturing high power DC and AC drives and complete electrical systems. Utilizing the latest in technology with the expert capabilities of our engineering R&D team, we are able to design products that meet and exceed our customers' needs. We have expanded our product lines to now provide complete electrical systems for all types of mining, industrial and transportation equipment. Recent innovations include AC VFD Battery Systems for LHDs and 1000V systems for Feeder Breakers. We specialize in customizable solutions for your mining needs. How can we help you?

Products & Services

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F (970) 245-9402

info@schauenburg.us

Eastern Region
25 Rodeo Dr.
Fairmont, WV
26554
U.S.A.

T (304) 363-0868

F (304) 363-0875

www.schauenburg.us

Main Office

10030 Amberwood Rd

Ft Myers, FL 33913 USA

Phone: (239) 561-1561

Fax: (239) 561-1502

Email: sales@samincoinc.com

www.samincoinc.com

Sandvik Construction

Booth 415

Sandvik Construction is a business area within the Sandvik Group providing solutions for virtually any construction industry application encompassing such diverse businesses as surface rock quarrying, tunneling, excavation, demolition, road building, recycling and civil engineering. The range of products includes rock tools, drilling rigs, breakers, bulk-materials handling and crushing and screening machinery. Every product is preceded by extensive R&D and backed with application expertise supported by a worldwide service network offering on-site service, project simulation, training and round the clock support.

Products & Services

Drilling Services and Equipment
Dust and Fume Control Technology
Mining Equipment
Roadheaders
Rock Drills
Tunnel Boring Equipment

Main Office

300 Technology Ct
Smyrna, GA 30082 USA

Phone: (404) 589-2823

Fax: (404) 589-2923

www.construction.sandvik.com

Schauenburg Flexadux Corp

Booth 419

See our ad on page 48

Schauenburg offers a complete line of ventilation products and ventilation design assistance for the mining and tunneling industry. Its products include forced air ventilation ducting, cassette systems for tunneling, flexible wire reinforced suction ducting, high pressure couplings, phenolic fiberglass ducting, inflatable stoppings, fans and dust collectors (wet or dry) as well as all fittings and adapters required to complete your ventilation system. In addition, Schauenburg carries gas detection radio cap lamps, brattice line curtains, tarps, brattice cable hangers, powder bags and cushions. All of its ventilation products are MSHA approved for underground use.

Products & Services

Dust and Fume Control Technology
Safety Products
Ventilation Systems, Materials and Equipment

Main Office

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Grand Junction, CO 81505 USA

Phone: (970) 245-9400

Fax: (970) 245-9402

www.schauenburg-us.com

Schauenburg MAB GmbH

Booth 421

German manufacturer of slurry treatment plants for tunneling, micro tunneling and HDD. 50 years of experience. Numerous construction sites worldwide. Separation plants with capacities up to 4.000 m³/h for the regeneration of bentonite slurries.

Products & Services

Microtunneling Equipment, Tools, and Supplies
Slurry Services and Machines

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Mülheim-Ruhr, 45478 Germany

Phone: +49 208 99 91 - 0

Fax: +49 208 59 24 - 09

Email: sales@schauenburg-mab.com

www.schauenburg-mab.com



EXHIBITORS

Schnabel Foundation Co

Booth 414

Schnabel Foundation Company is a specialty geotechnical contractor that has been designing and constructing earth retention and deep foundation projects since 1959. Schnabel has a wide range of design and construction methods to provide the tunneling industry with the best possible circular access shaft or water cutoff retention system. These methods include secant piles, jet grouting and soil mixing, along with more conventional earth support systems and micropile foundations. Schnabel's numerous offices throughout the United States and in-house design capabilities allow a tailored fit system for project specific needs.

Products & Services

Construction - Contracting Services
Drilling Services and Equipment
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials
Jet Grouting Equipment and Services
Underground Excavation Services and Equipment

Main Office

45240 Business Ct, Ste 250
Sterling, VA 20166 USA
Phone: (703) 742-0020
Fax: (703) 742-3319
Email: info@schnabel.com
www.schnabel.com

SealBoss Corp

Booth 914

The SealBoss GeoTech Line offers a wide range of chemical and mineral injection technologies to address grouting applications such as consolidation, stabilization, contact, and leak-sealing. These systems include polyurethane foams for consolidation, water cut-off, and void filling, polyacrylate gels for permeation grouting and leak-sealing, and silicate grouts for EPBM tunnel face grouting, void filling, and water-control grouting. SealBoss offers a wide range of accessory items such as pumping equipment, soil needles, and ports. Please stop by our Booth to discuss any of your grouting needs.

Products & Services

Grouting Services, Equipment and Materials

Main Office

1669 E Wilshire Ave
Santa Ana, CA 92705 USA
Phone: (714) 662-4445
Fax: (714) 662-4446
www.sealboss.com

sensemetrics

Booth 214

Products & Services

Control Systems
Geological, Geotechnical Services and Equipment
Ground Improvement Equipment and Services
Instrumentation Equipment and Services
Survey Equipment and Lasers
Tunnel Communication Systems and Equipment

Main Office

406 9th Ave, Ste 209
San Diego, CA 92101 USA
Phone: (619) 485-0575
www.sensemetrics.com

Shannon & Wilson, Inc

Booth 403

Since 1954, Shannon & Wilson has been a pioneer in developing effective underground solutions to complex site development problems. This includes design, plans and specifications, and construction management and support on over 700 soft ground and hard rock tunnel projects, ranging from trenchless to the world's largest bore tunnels. Resources include over 300 staff from the corporate headquarters in Seattle, Washington, and branch offices in Oregon, California, Colorado, Alaska, Missouri, Wisconsin, and Florida. Shannon & Wilson offers services in geotechnical evaluations, tunnel assessments, groundwater and dewatering, instrumentation, environmental, and natural resource assessments.

Products & Services

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

Main Office

400 N 34th St, Ste 100
Seattle, WA 98103 USA
Phone: (206) 632-8020
Fax: (206) 695-6777
www.shannonwilson.com

Shotcrete Technologies, Inc

Booth 621

STI has been providing innovative Shotcrete products and services to the mining and tunneling industry for over 30 years with our Shot-Tech Robotic Arm which can be mounted on many types of carriers and our industry standards STI Alkali Free and Shotset 250 Liquid Accelerators. STI also has new shaft lining (vertical lining) technology. STI's knowledgeable team of professionals can provide everything from a Shotcrete System design, mix design, to testing and training based on your specific needs from mega projects to small mines.

Products & Services

Shaft Drilling and Raiseboring Equipment
Shotcrete Equipment, Supplies, and Services
Tunnel Lining and Support Materials

Main Office

PO Box 3274
Idaho Springs, CO 80452 USA
Phone: (303) 567-4871
Fax: (303) 567-4605
Email: info@shotcretetechnologies.com
www.shotcretetechnologies.com

Sika Corporation

Booth 615

Sika Corporation is a global specialty chemicals company. For tunneling, Sika offers a wide variety of products such as chemical admixtures for concrete, repair and protection products, waterproofing products and equipment for shotcrete. Sika's product line for chemical admixtures includes a full range of admixtures, useful for cast-in-place concrete, precast concrete and shotcrete. Sika's repair products include grouts, mortars, adhesives, sealants and structural strengthening systems, and Sika's waterproofing products include membranes, waterstops and drainage systems. For equipment, Sika has a global alliance with Putzmeister and offers a wide range of equipment for dry and wet shotcrete applications.

Products & Services

Concrete Reinforcement
Grouting Services, Equipment and Materials
Shotcrete Equipment, Supplies, and Services

Main Office

201 Polito Ave
Lyndhurst, NJ 07071 USA
Phone: (201) 933-8800
Fax: (201) 933-6225
www.usa.sika.com

SoilFreeze Inc

Booth 121

See our ad on page 51

SoilFreeze Inc. provides temporary frozen soil shoring systems to support excavations and provide groundwater 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

Main Office

5931 238th St SE, Ste 201
Woodinville, WA 98072 USA
Phone: (206) 261-0733
www.soilfreeze.com

SOLDATA Inc

Booth 314

Soldata is a leading provider of automated real time instrumentation monitoring for geotechnical, structural and environmental projects. With 20 years of experience, Soldata has demonstrated expertise in large urban tunnel instrumentation projects in cities including Seattle, Washington DC, Los Angeles, Amsterdam, London, Budapest, Barcelona, Toronto, etc. Soldata is currently monitoring the largest TBM project in the world, the Alaskan Way viaduct replacement project, as well as the light rail "Northlink Project, both in Seattle.



Applied Innovation. Proven Solutions.



Congratulations to JayDee, Collucio, and Michels on recently completing the tunneling for the Sound Transit light rail project in Seattle. SoilFreeze Inc.'s participation included freezing "canopies" for the entry/exit portals, and frozen soil ground improvements for five cross passages (the first in the United States) requiring freezing from ground surface as well as from inside the tunnel.

We design, fabricate, install and maintain customized freeze systems for each client's needs. The installation can be designed to be maintained for a few weeks, months, or even years. We serve both the private and public sectors and have a substantial list of successful projects and clients. SoilFreeze Inc. has advanced and refined freeze technology to create freeze systems that are **COST EFFECTIVE**, mobile, reusable and expandable to address the needs of small projects and urban locations.

The Industry Leader in Frozen Soil Technologies

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Environmental/Soil Remediation

New Office in: 5931 238th ST SE #201 • Woodinville WA 98072

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EXHIBITORS

Products & Services

Computer Hardware and Software
Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment
Instrumentation Equipment and Services

Main Office

1448 Elliott Ave W
Seattle, WA 98119 USA
Phone: (206) 200-8935
www.soldatainc.com

Spendrup Fan Co

Booth 320

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-T6 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

Main Office

PO Box 4308
Grand Junction, CO 81502 USA
Phone: (970) 243-3429
Fax: (970) 242-6724
www.spendrupfanco.com

Stantec-MWH

Booth 520

The Stantec community unites approximately 22,000 employees working in over 400 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.

Products & Services

Construction - Contracting Services
Consulting Engineers
Consulting Environmental

Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment

Main Office

1340 Treat Blvd, Ste 300
Walnut Creek, CA 94597 USA
Phone: (925) 941-1400
Fax: (925) 941-1401
www.stantec.com

Superior Gunitite

Booth 802

Superior Gunitite has been in business for over sixty-years as the industry leader in pneumatically placed structural concrete. We focus on turning around diversified wall construction to be quicker, cost-effective and more environmentally conscience when in comparison with the traditional form and pour method. Our company was instrumental in the development and continues to be the leading industry innovator on the improvement of the wet-mix process of Shotcrete. Our work focuses on the ability to utilize Shotcrete in specified cast-in-place concrete versus traditional form and pour concrete for greater value engineering. Shotcrete eliminates one and two sided form construction.

Products & Services

Tunnel Lining and Support Materials

Main Office

12306 Van Nuys Blvd
Lakeview Terrace, CA 91342 USA
Phone: (818) 391-3009
www.shotcrete.com

Surecrete Inc

Booth 301

See our ad on page 52

Surecrete Inc. is a supplier focusing on packaged cementitious materials, admixtures, placing equipment and related accessories to the heavy civil tunnel, geotechnical and mining markets. Product lines include Super Fine ultrafine cement and HNP nano-fine cement grouts as well as other specialized grouting materials. We also concentrate on supplying wet and dry shotcrete materials that are custom blended for specific applications by including fibers, accelerators, special cements, and additives. Our additives include rheology modifiers, waterproofing and repair materials. We also represent several major equipment manufacturers specializing in the mixing and placing of shotcrete, concrete, and grout.

Products & Services

Grouting Services, Equipment and Materials
Shotcrete Equipment, Supplies, and Services

Main Office

155 NE 100th St, Ste 300
Seattle, WA 98125 USA
Phone: (206) 523-1233
Fax: (206) 524-6972
Email: jeff@surecrete.com
www.surecrete.com

SURECRETE INC.

www.surecrete.com

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Every project has its own unique challenges, which is why every Robbins TBM is built with your specific needs in mind. Our relentless pursuit to innovate is driven by the needs our customers face every day. From machine design to tunnel completion, we are by your side working together to create new methods, and set new records in underground excavation.

We invite you to learn more about our latest products and projects in our 2017 presentation series at WTC and RETC.





SWS Engineering S.p.A.

Booth 104

SWS is an engineering company active in infrastructure construction, offering specialist engineering, project management and risk management services. For over thirty years, SWS has been helping clients build works which form the infrastructural backbone of local communities. We are committed to designing and building works with a sustainable economic, environmental and social footprint. As a leader in tunnelling, SWS prides itself for working on the world's most important projects where we were able to offer the same level of technical expertise and efficiency for projects constructed in geologically complex or congested urban areas.

Products & Services

Consulting Engineers
Consulting Environmental
Engineering Design and Services for Tunnels
Geological, Geotechnical Services and Equipment
Precast Concrete Linings
Underground Excavation Services and Equipment

Main Office

Via della Stazione, 27
Trento, 38123 Italy
Phone: +39 0461 979 000
Fax: +39 0461 979 250
www.swsglobal.com

TBM Supply

Booth 219

Supplier factory new, used and surplus, carbon, stainless and PVC: pipe, valves, fittings. Grooved, Threaded, Flanged, Welded. Domestic, DIN, JIS replacement including actuation.

Products & Services

Steel Pipe
Underground Utility Materials and Operations

Main Office

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Shafter, CA 93263 USA
Phone: (855) 535-1555
www.tbmsupply.com

Team Mixing Technologies, Inc

Booth 710

For over 40 years Team Mixing Technologies has provided fully automated material handling systems for TBM bi-component grouts, bentonite slurries and grout injection as well as for shotcrete, concrete and mining backfill. TMT manufactures colloidal mixers, pumping and delivery systems, as well as the automation and controls. Concepts are specifically tailored to the customer's needs and include complete engineering, design and fabrication of all mechanical, structural and electrical systems. Services range from preliminary engineering and case studies through to hands-on commissioning and field training with complete CAD documentation and follow-up.

Products & Services

Conveyor Equipment and Systems

Grouting Services, Equipment and Materials
Jet Grouting Equipment and Services
Pumps and Pumping Equipment
Soil Conditioning Equipment and Materials

Main Office

1A - 30528 Great Northern Ave
Abbotsford, BC V2T 6H4 Canada
Phone: (604) 556-7225
Fax: (604) 556-7215
www.teammixing.com

Technical Tunnelling Components LTD (TTC)

Booth 515

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
Tunnel Lining and Support Materials
Segment Accessories

Main Office

Unit K Radius Ct, Tungsten Pk
Hinckley, Leicester LE10 3BE United Kingdom
Phone: +44 0 1455 234401
Fax: +44 0 1455 250578
www.ttcld.org

Tenbusch, Inc

Booth 703

Tenbusch, Inc. designs and manufactures custom tunneling and pipe jacking systems. Products include: shields, excavators, conveyors, spoil carts and track, jacking frames, hydraulic power units, bentonite/polymer lubrication systems, and backstops. Tenbusch also manufactures sliplining systems and pipe carriers. In addition to the fabrication and manufacture of high quality heavy equipment, it offers reconditioning and refurbishment of used heavy equipment, support and training with design and problem solving services centered around over 40 years experience with hydraulics, and underground construction equipment. Over 15 years in mechanical design, mechanical engineering, and stress analysis, solid modeling and 3-D CAD design capabilities.

Products & Services

Air Locks and Bulkheads
Conveyor Equipment and Systems
Fabrication Materials
Mining Equipment
Soft Ground Shields
Tunnel Boring Equipment

Main Office

PO Box 417
Lewisville, TX 75067 USA
Phone: (972) 221-2304
Fax: (972) 221-2498
Email: info@tenbusch.com
www.tenbusch.com

Terratec

Booth 109

Incorporated in 1990, TERRATEC is the world renowned Australian designer and manufacturer of Tunnel Boring Machines, Raise Boring Machines, Conveyor Systems and other custom-made products for tunneling and mining applications. TERRATEC is ALWAYS ADVANCING.

Products & Services

Conveyor Equipment and Systems
Earth Pressure Balance Machines
Rock TBM's
Shaft Drilling and Raiseboring Equipment
Tunnel Boring Equipment

Main Office

4F, Empire Center, Mody Rd
Kowloon, Hong Kong (China)
Phone: +447 745992107
www.terratec.co

The PBE Group

Booth 815

The PBE Group, founded over 45 years ago, is a global heavy industries technology company, unique in the vertical integration of its engineered solutions. Serving multiple markets including, mining, tunneling and construction, PBE is unparalleled in its range of internally designed and manufactured safety, communications and productivity systems. Through one supplier of all equipment and software, the customer benefits from the reliability, functionality and cost benefits only a true single source solution provider can deliver. PBE offers a designed for purpose, robust, advanced solution enabling data-driven decisions through PBE's suite of management and control software.

Products & Services

Environmental Control Equipment and Supplies
Mining Equipment
Safety Products
Tunnel Communication Systems and Equipment
Ventilation Systems, Materials and Equipment

Main Office

9115 Harris Corners Pkwy, Ste 310
Charlotte, NC 28269 USA
Phone: (704) 509-6747
www.pbegrp.com

The Robbins Co

Booth 601

See our ad on page 53

The Robbins Company has led the tunneling industry for over 65 years with advanced, underground con-

struction equipment. Robbins machines are customized to meet each project's unique specifications, delivering optimal results in the most difficult conditions. Robbins is a total supply company with offerings that range from machines and conveyors that overcome tunneling challenges in hard rock and soft ground to knowledgeable field service personnel. For a complete solution and unparalleled support on your next tunneling project, look no further than Robbins.

Products & Services

Conveyor Equipment and Systems
Earth Pressure Balance Machines
Microtunneling Equipment, Tools, and Supplies
Rock TBM's
Slurry Services and Machines
Tunnel Boring Equipment

Main Office

29100 Hall St
Solon, OH 44139 USA
Phone: (440) 248-3303
Fax: (440) 248-1702
www.therobbinscompany.com

Thompson Pipe Group - Flowtite

Booth 709

Tough Flowtite® FRP pipe is made using the continuous filament-winding process, allowing for additional strength to meet your exact jacking, microtunneling, or sliplining needs. The pipe can be customized within a broad range of lengths, diameters, pressure grades and stiffness classes. Flow-Crete™ jacking pipe is also available, which combines the strength of reinforced concrete with the corrosion resistance and pressure capabilities of Flowtite® FRP. Flowtite® can be specified for both pressure and gravity applications, as well as for wastewater and hydroelectric penstock projects and more.

Products & Services

Underground Utility Materials and Operations

Main Office

18585 Samuels Rd
Zachary, LA 70791 USA
Phone: (225) 658-6166
www.thompsonpipegroup.com

Tioga HVAC Rentals & Sales

Booth 220

Tioga designs, manufactures, rents, and sells climate control and ventilation equipment to provide safe working environments for employees and allow for operations to continue. Our portable heating equipment is great for remote locations of areas where power and fuel are a challenge. Tioga's skid mounted equipment are built with powerful blowers to quickly heat large areas or push heated air greater distances to where it is required. Tioga's equipment is known for its reliability in harsh conditions and ease of use. Visit us to discuss your next application.

Products & Services

Ground Freezing
Ground Improvement Equipment and Services

Ventilation Systems, Materials and Equipment
4810 Lilac Drive N
Minneapolis, MN 55429 USA
Phone: (800) 218-4642
Fax: (763) 525-9796
www.tiogahvac.com

Tolsa Wyoming Bentonite Inc

Booth 917

Experts in Global solutions for the industrial sector. Our products are used in more than 250 different industrial applications, as civil engineering, oil & gas, construction and a long list of many others. Our raw materials extracted on three continents, the special processes in our plants, along with extensive research in our laboratories and our experts technical support, are key factors that help us to develop the broadest and most distinct line of industrial products and specialties in the clays sector.

Products & Services

Drilling Services and Equipment
Geological, Geotechnical Services and Equipment
Grouting Services, Equipment and Materials
Lubricants for TBM
Shotcrete Equipment, Supplies, and Services
Underground Excavation Services and Equipment

Main Office

Calle Campezo, 1, Bldg 4, Flr 2
Parque Empresarial Las Mercedes
Madrid, Madrid 28022 Spain
Phone: +34 63 654 70 50
Fax: +34 91 322 01 01
www.tolsa.com/industrial/en

TRE ALTAMIRA Inc

Booth 105

TRE ALTAMIRA is recognized as the global leader in ground monitoring using SAR (Synthetic Aperture Radar) satellite data providing detailed surface motion information for engineering activities during tunneling operations. Using our proprietary SqueeSAR™ algorithms the group analyses images, captured by radar satellites to measure ground deformation to millimeter accuracy: detecting and monitoring ground subsidence, uplift, landslides, surface expression of faults, and for verifying the stability of individual structures. TRE ALTAMIRA produces dynamic maps and a database of surface deformation that provides a quantitative understanding of ground response to natural and anthropogenic activities. We have offices in Vancouver, Milan and Barcelona.

Products & Services

Instrumentation Equipment and Services

Main Office

475 W Georgia St, Ste #410
Vancouver, BC V6B 4M9 Canada
Phone: (604) 331-2512
www.tre-altamira.com

Trelleborg Engineered Products

Booth 611

Products & Services

Tunnel Lining and Support Materials

Main Office

PO Box 4007
Ridderkerk, 2980 GA Netherlands
Phone: +31 180 495 555
www.trelleborg.com/infrastructure

TREVIICOS

Booth 215

TREVIICOS is a full service geotechnical and foundation contractor specializing in Dam Rehabilitation, Slurry Walls, Cutoff Walls, Secant Piles, Caissons, Jet Grouting, Deep & Shallow Mixing and Ground Improvement. Our vast experience in underground construction allows us to find innovative and cost effective solutions to even the most challenging construction projects. We serve our clients nationwide from our headquarters located in Charlestown, Massachusetts.

Products & Services

Construction - Contracting Services
Ground Improvement Equipment and Services
Grouting Services, Equipment and Materials
Jet Grouting Equipment and Services
Slurry Services and Machines
Underground Excavation Services and Equipment

Main Office

38 Third Ave, 3rd Fl
Charlestown, MA 02129 USA
Phone: (617) 241-4800
Fax: (617) 241-4801
Email: info@treviicos.com
www.treviicos.com

Tsurumi Pump

Booth 511

Products & Services

Pumps and Pumping Equipment

Main Office

1625 Fullerton Ct
Glendale Heights, IL 60139 USA
Phone: (630) 793-0127
Fax: (630) 793-0146
www.tsurumipump.com

Tunnel Business Magazine (TBM)

Booth 210

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, 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

10050 Brecksville Rd
Brecksville, OH 44141 USA
Phone: (330) 467-7588
Fax: (330) 468-2289
www.tunnelingonline.com

Tunnels & Tunnelling

Booth 810

With more than 40 years of service to the tunneling industry, and packed with information about the business its customers are in, Tunnels & Tunnelling International 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

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Fax: +44 (0) 20 7936 6813
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TunnelTalk

Booth 205

Welcome to www.TunnelTalk.com - your gateway to tunneling on the web. Designed specifically as a web publication, TunnelTalk brings industry news, views and video reports directly to your internet device. A comprehensive editorial Archive is complimented by our industry Directory, Diary Dates, Job Opportunities, Equipment Sales and Procurement notices. Free weekly e-Alerts drive traffic to the site and, for industry advertisers, our readers are your next customers!

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Main Office

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www.tunneltalk.com

VMT USA

Booth 321

See our ad on page 56

As a driving technological force for more than 20 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

Geological, Geotechnical Services and Equipment
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Precast Concrete Linings
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Tunnel Communication Systems and Equipment

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Fax: (253) 863-9376
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www.vmt-us.com

Williams Form Engineering Corp

Booth 912

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 90 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, micro piles. 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 tie backs, micro piles and post-tensioning.

Products & Services

Concrete Reinforcement
Geological, Geotechnical Services and Equipment
Ground Improvement Equipment and Services
Steel Pipe
Tunnel Lining and Support Materials

Main Office

8165 Graphic Dr
Belmont, MI 49313 USA
Phone: (616) 866-0815
Email: williams@williamsform.com
www.williamsform.com

Wisko America, Inc

Booth 309

Wisko America Inc. has been installing flexible membrane in tunnels and underground structures since 1988 because the system works. With millions of square feet of flexible membranes successfully installed all over North America, Hawaii and Puerto Rico on over 90 projects, Wisko has a proven track record of providing dry underground structures to many clients and contractors.

Products & Services

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Tunnel Lining and Support Materials

Main Office

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Phone: (703) 378-7858

Fax: (703) 378-7568
Email: pamela.moran@wiskoamerica.com
www.wiskoamerica.com

Worldsensing

Booth 113

We provide customers with the tools to make the right operational decisions based on real-time intelligence. Our insights enable operators to understand the performance of distributed infrastructure, make predictions, improve efficiency and prevent disasters. We use wireless sensor technology and real-time software solutions to provide operational intelligence to operators and decision makers. This is what we call Connected Operational Intelligence. We work with customers in more than 50 countries across 5 continents, reinventing the world we will live and work in tomorrow.

Products & Services

Instrumentation Equipment and Services
Mining Equipment
Tunnel Communication Systems and Equipment

Main Office

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Barcelona, Barcelona 8013 Spain
Phone: +34 93 418 05 85
www.worldsensing.com

WSP | Parsons Brinckerhoff

Booth 600

WSP | Parsons Brinckerhoff is a leader in tunneling and underground construction, from San Francisco to Stockholm. The firm has participated in the design and construction of some of the longest, largest, deepest, and most complicated tunnels in the world, including tunnels built in hard rock, soft ground or mixed-face conditions, and using mining, boring, jacking, cut-and-cover, and immersed tunnel technology. Projects include the Second Avenue Subway in New York City; the Stockholm City Line; the Eurasia tunnel in Istanbul; and San Francisco's Central Subway. WSP | Parsons Brinckerhoff employs 36,500 professionals in 500 offices across 40 countries.

Products & Services

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

Main Office

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Phone: (213) 362-9470
www.wsp-pb.com/usa

Zed Tunnel Guidance Ltd

Booth 416

ZED manufactures and develops TBM guidance/navigation systems. More recently, ZED offers a redesigned system for long/curved pipejacks and a configuration that places the total station on the TBM backup rather than the tunnel wall, intended for smaller diameter TBM's where space is at a premium, especially along the backup walkway. The company provides comprehensive R&D services for electro-optical instrumentation for a variety of uses, from applications in the

railway industry to vertical shaft alignment. Based in the UK, ZED has an enthusiastic team who provide a seasoned and prompt reaction to customer requirements and technological advances applicable to their products.

Products & Services

Instrumentation Equipment and Services
Laser Guidance Systems
Microtunneling Equipment, Tools, and Supplies

Main Office

Unit 1 Russell House, Molesey Rd
Walton on Thames, Surrey KT12 3PJ United Kingdom
Phone: +44 (0) 1932 251 440
Fax: +44 (0) 1932 244 971
www.zed-tg-co.uk



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Air Locks and Bulkheads

ASI Marine – Booth 217
Ballard Marine Construction – Booth 509
Tenbusch, Inc – Booth 703

Computer Hardware and Software

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Plaxis Americas LLC – Booth 306
Rocscience, Inc – Booth 206
SOLDATA Inc – Booth 314

Concrete Mixing and Transportation Equipment

Advanced Concrete Technologies – Booth 106
Amix Systems Ltd – Booth 701
Cell-Crete Corporation – Booth 803
Elasto Plastic Concrete – Booth 117
King Shotcrete Solutions – Booth 411
Mining Equipment Ltd – Booth 617
Normet Americas, Inc – Booth 100
Putzmeister – Booth 305

Concrete Reinforcement

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Fibermesh – Booth 107
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Helix Steel – Booth 618
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Hughes Brothers Inc – Booth 213
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Williams Form Engineering Corp – Booth 912

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TREVIICOS – Booth 215
Wisko America, Inc – Booth 309

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WSP | Parsons Brinckerhoff – Booth 600

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Spendrup Fan Co – Booth 320

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 Richway Industries – Booth 608
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 Spendrup Fan Co – Booth 320
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 Terratec – Booth 109
 The Robbins Co – Booth 601

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DSI Tunneling LLC – Booth 716
 Innovative Wireless Technologies – Booth 119
 LIOS Technology, Inc – Booth 910
 Northern Light Technologies – Booth 319
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 Irwin Car and Equipment – Booth 212
 McDowell Equipment Ltd – Booth 707
 Mining Equipment Ltd – Booth 617

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 BASF Corporation – Booth 607
 Bekaert Maccaferri Underground Solutions – Booth 503
 ConShield Technologies – Booth 915
 CTS Cordes tubes & seals GmbH & Co KG – Booth 513

Datwyler Sealing Technologies – Booth 200
 David R. Klug & Associates, Inc – Booth 501
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 Everest Equipment Co – Booth 705
 Heintzmann Corp – Booth 700
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 Hughes Brothers Inc – Booth 213
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 Korea Railroad Research Institute – Booth 114
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 Richway Industries – Booth 608
 Shotcrete Technologies, Inc – Booth 621
 Superior Gunite – Booth 802
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 Trelleborg Engineered Products – Booth 611
 Williams Form Engineering Corp – Booth 912
 Wisko America, Inc – Booth 309

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 Amberg Technologies Ltd – Booth 804
 Atlas Copco – Booth 706
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 Daigh Company, Inc – Booth 408
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 Gomez International, Inc – Booth 418
 Mapei Corp – Booth 901
 McDowell Equipment Ltd – Booth 707
 McMillen Jacobs Associates – Booth 602
 Michels Corp – Booth 218
 Nightstick by Bayco Products – Booth 521
 Richway Industries – Booth 608
 ROBODRILL – Booth 913
 S.A. Healy Company – Booth 805
 Schnabel Foundation Co – Booth 414
 SWS Engineering S.p.A. – Booth 104
 Tolsa Wyoming Bentonite Inc – Booth 917
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 Irwin Car and Equipment – Booth 212
 McDowell Equipment Ltd – Booth 707

Underground Utility Materials and Operations

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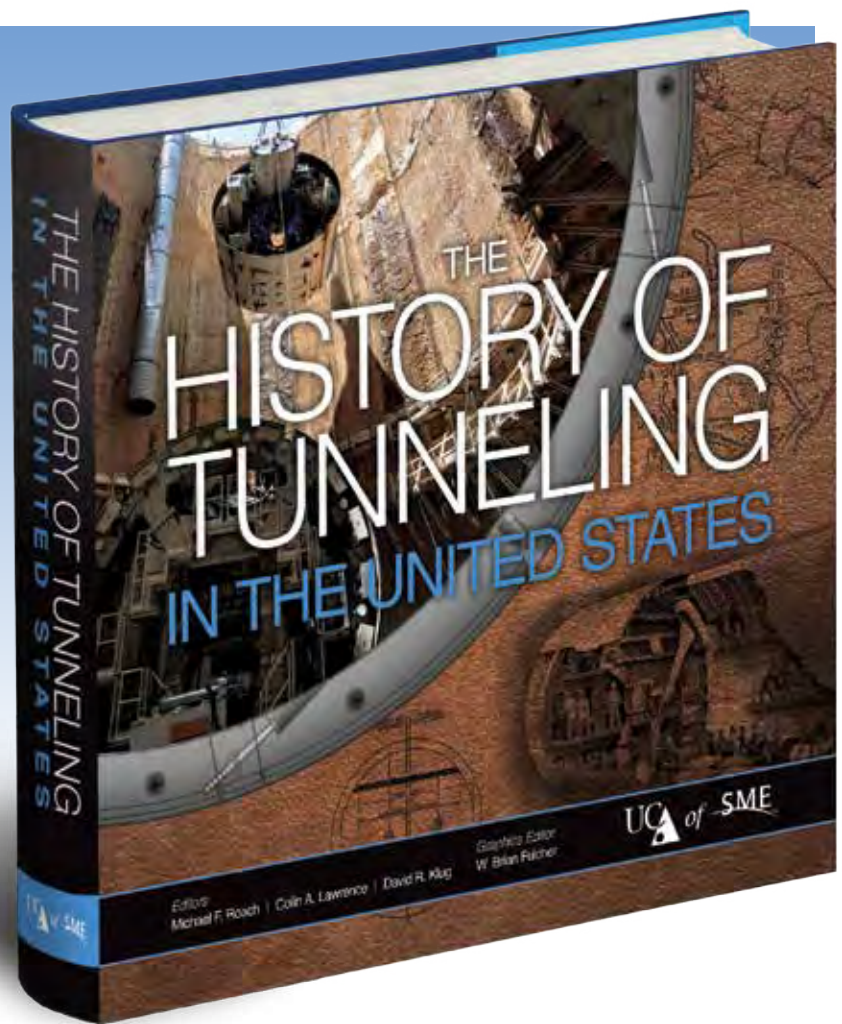
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 Hobas Pipe USA – Booth 902
 QSP Packers, LLC – Booth 300
 Saminco Inc – Booth 811

Water Treatment Plant and Materials

Agru America, Inc – Booth 313
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New Book Chronicles 200 Years of Tunneling in the United States



What has surprised most of us within the underground world is actually the success story that has unfolded as we unearthed surprises and unexpected achievements that were long forgotten by the tunneling industry.

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