

ITA  
AITES

September 2020

## ITA Member Nation Activity Reports 2019

**BRENNER BASE TUNNEL, AUSTRIA – ITALY**

# **PUSHING LIMITS WITH VIGOROUS ENGINEERING**

The new Brenner Base Tunnel represents a next level of trailblazing hard-rock-tunnelling. With a total length of 64 km and maximum overburden of 1,300 meters this high-impact project sets new records. Six project specific engineered Herrenknecht hard-rock-machines are involved in the hardest mission worldwide. Empowering our customers to push the limits.

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**Contractors:**

- › 1x Gripper TBM:  
Consortium H33 Tulfes-Pfons
- › 3x Double Shield TBM:  
Consortium Mules 2-3
- › 2x Single Shield TBM:  
Consortium H51 Pfons-Brenner

**PIONEERING  
UNDERGROUND  
TOGETHER**

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**Tunnelling Systems**

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## Jinxiu (Jenny) Yan ITA President



### ITA President's message for the ITA Member Nations Activity Report 2019

ITA is the leading international organization for tunnelling and underground space. This position is dependent not only on the intensive worldwide activities of the ITA itself, but also of its Member Nations with their leading positions in their respective countries. Over the past year, this has been further consolidated via stronger communication and closer cooperation between the ITA and its Member Nations, and also among the Member Nations themselves.

Issuing this print version of the yearly ITA Member Nations Activity report is one of the most effective ways to promote better communications within the ITA family. By reading this report, you get the chance to better understand our Member Nations, the tunnelling projects completed, under construction or in planning in their respective countries, as well as the activities and events held or currently being organized. I firmly believe that it will facilitate the furthering of cooperation among the Member Nations and subsequently promote a better use of tunnelling and underground space, which is the mission of ITA.

I would like to thank all of the Member Nations, the ITA secretariat and Tunnelling Journal for making it possible!

## Olivier Vion ITA Executive Director



For the 4th year, ITA in cooperation with Tunnelling Journal is happy to present to all of you the reports of its Member Nations. This year, despite all the inconvenience due to COVID-19, 38 Member Nations sent us their report. This magazine is the opportunity for everyone to better know what is happening in ITA Member Nations, as well to know more what are the main tunnelling works and projects. As there won't be any physical WTC, the magazine will be sent by post to all those who receive generally Tunnelling Journals and ITA Member Nations and all ITA members and affiliate will get an electronic version which will also be available on ITA website.



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# Albania



**Name:** ALB Tunnelling

**Type of Structure:** non profit, open association

**Number of Members:** 12 members for the year 2019.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Several activities, including lectures and presentations at engineering events.

## CURRENT TUNNELLING ACTIVITIES

### Construction of two NATM Tunnels on the Qukes-Qafe Plloce road as part of Tirana-Korca highway.

The tunnels have a length of 1000m and are bi-directional. The value of the works is €22M for the primary and final lining, with E&M works at €3M. The primary and final lining was completed in September 2019 and the E&M works are yet to start.

The project is financed by the Islamic Development Bank and Government of Albania. The Contractor is JV Combined Group Contracting – Alb Building. The Engineer is Sajdi (Jordan Supervision Company).

### Construction of five NATM bi-directional Tunnels on the Arbri road, with the longest at 3.2km.

Contractor is Gjoka Konstruksion (Albanian Contractor). The Supervision works are carried out by GR Albania. The total cost of the road is estimated €460M. The concessionary firm agreed to build the

road at its own expenses and maintain it for 8 years after works completion. The project is scheduled to finish by March 2021.

### Construction of 10.7km of tunnel on the Moglica HPP for Client, Statkraft, which was completed in October 2019, by the Turkish Contractor, Limak group.

Construction activities started in 2015. Moglicë HPP is planned to utilize a head of 300m between 650 - 350m asl. The approx. 167m high dam is an asphalt-core rock-filled structure and will be one the highest of its kind in the world. The reservoir is planned to have a storage capacity of approx. 400Mm<sup>3</sup>. The reservoir is planned to have a surface area of approx. 7.2km<sup>2</sup>. The Moglicë HPP will receive its water through the 10.7km long tunnel from the Moglicë reservoir and will use two Francis turbine units. The planned installed capacity is 184MW with an average generation of 450GWh/year.

## FUTURE TUNNELLING ACTIVITIES

### For 2020 the below projects are scheduled to start:

- The Milot-Balldren Tunnel: 1km
- The Llogara Tunnel: 5km
- The Kardhiq-Delvine Tunnel: 1km



Construction of two NATM Tunnels on the Qukes-Qafe Plloce road as part of Tirana-Korca highway

## STATISTICS

1. Length or volume excavated
  - 30% mechanized/70 % conventional during 2019
2. Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019
  - US\$80M
3. List of tunnels completed:
  - Moglica HPP Tunnels finished in 2019
4. List of tunnels under construction
  - Qukes-Qafe Plloce (E&M works)
  - Arbri Road Tunnels



Construction of five NATM bi-directional Tunnels on the Arbri road



Construction of 10.7km of tunnel on the Moglica

# Argentina



**Name:** Asociación Argentina de Túneles y Espacios Subterráneos (AATES)

**Type of Structure:** non profit, open association

**Number of Members:** 57 affiliate members, 7 corporate members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

In September, a 3 day Tunnelling Congress was held under the title "Technological innovation in Design, Construction and Operation of Tunnels", with the participation of the ITACET Foundation, developing a training session called "Tunnelling 4.0 : New technologies and automation".

An online webinar was developed for the Argentine Construction Chamber, dealing with "Safety Criteria and Design of Railway Stations" and a second for the Public Companies of the City of Buenos Aires, where Design and Construction Aspects of Mechanised Tunnelling and the Pipe Jacking method were addressed

## CURRENT TUNNELLING ACTIVITIES

### Extension of the Metro Buenos Aires - Line H

After opening the North section in 2018 to traffic, during 2109 the second workshop cavern at the South end of the Line was completed and put in operation. Station Saenz, further South, as well as the last section of running tunnel are still on hold.

### Sarmiento Railway Line – Buenos Aires

Replacement of the "Sarmiento" Railway Line, running from the Western Head Station in Buenos Aires (Station Once) to Station Castelar, located approx. 22km away, via a double track tunnel, mainly excavated with a 12m diameter EPBM, and a short NATM section, featuring section 9 station, 7 mined and 2 in cut & cover. By mid 2019 the first 7km of running tunnel excavated by EPBM was completed and the machine recovered in an open pit for maintenance. Due to financing problems the Owner (the Transport Ministry) decided to interrupt construction works. Only limited works for the mined stations had been done. Until the end of 2019 and also after the change of the National government, no decision has been taken about the future of this project.

### Sewer (Left Margin) Riachuelo River and Emissary – Buenos Aires

This project comprises the construction

of a main sewer located parallel to the Riachuelo River, on its left margin, composed of 2 sections: a 9.4km long upper section with a 3.2m i.d. excavated by EPBM, and a lower section of 5.1km with a 4.5m i.d. excavated using a slurry machine. The project features a treatment plant and an Emissary of 12km with 4.3m i.d. to be excavated into the La Plata River with an EPBM. Three contracts were awarded in 2015 (sewers, plant, emissary), which presently are all in construction. At the end of 2018 the construction of the treatment plant was stopped, due to the withdrawal of the contractor JV. This work was restarted at the end of 2019, after the appointment of a new contractor. Also, at the end of 2019 the excavation of the emissary tunnel was concluded successfully. The EPBM used on the upper sewer section bored 6,660m from a total of 9,400m, whereas the slurry machine advanced approx. 2,850m of the lower 5.1km long section. Secondary pipe jacking galleries of dia 800mm and 1,100mm also are fairly advanced, with a total excavated length of 12km, with just 1.75km remaining.

### Relief Tunnel of the Vega River – Buenos Aires

This project comprises the construction of a relief tunnel for the existing underground "Vega River", with a total length of 8.4km (6km of 5.3m i.d. using a 5.3m i.d. Herrenknecht EPBM, and the rest as a 2.4m i.d. pipe-jack using a Herrenknecht AVN 1600 slurry machine). Additionally, the project comprises other secondary galleries in NATM and various shafts. The project was awarded mid 2016 and was successfully completed in the second semester of 2019.

### Underground water main "Río Subterráneo Sur" – Buenos Aires

This project was designed to provide a new potable water distribution main, fed by the Grl. Belgrano water purification in Bernal, to the southern area of Buenos Aires, feeding a population of 2.5M people. It consists of a 23km long underground river and 2 large pumping

plants, tendered for construction by the water company AYSA in 2 contracts. The first, awarded in September 2017, comprises an initial 14km long section of the 3.9m i.d. main and the pumping station N°1. The second part is still to be awarded, but was tendered. Two Terratec EPBMs were purchased for the first contract, with excavation planned to begin in early 2020. Meanwhile the launching shaft is under construction and is pretty well advanced. Each machine is scheduled to excavate half of the total length, some 7km each. The first contract is scheduled to be completed in April 2022.

### 2 road tunnels on the National Highway 75 – Province of La Rioja

The project will bypass a road section aligned next to a creek, that features beautiful gardens and weekend houses, via the construction of 2 bidirectional road tunnels of 560m and 890m in length. The construction method is conventional tunnelling with a shotcrete primary lining and a prefabricated inner lining. The excavation of the top heading of the shorter tunnel was completed at the end of 2019, with the bench and invert excavation still in progress. The start of excavation of the second (longer) tunnel is scheduled for April 2020.

### Several sewer projects - Buenos Aires

Over the last few years, in the surrounding neighbourhoods of Buenos Aires, a large number of sewer projects were constructed for the Water Company AYSA. Some are still in progress using the pipe jacking method. Typical diameters range between 0.8 -1.5m, with jacking sections in the range of 200 – 300m.

### Highway "Paseo del Bajo" - Buenos Aires

This new highway runs alongside the coast and the La Plata River, northeast of Buenos Aires, closing the circle around the city. Its central 8km long section, between the "Puerto Madero" neighbourhood and the city downtown, is located within a trench which is covered at the points of frequent crossings, both for transversal roads and for the implementation of parks and pedestrian areas. The construction finished successfully at the end of 2019.

## FUTURE TUNNELLING ACTIVITIES

### Red de Expresos Regionales (RER)

In 2016, the present national government presented this very challenging project, featuring the underground inter-

connection of the 3 main railway stations in Buenos Aires: West Station "Once", South Station "Constitución" and North Station "Retiro".

The project comprises 20km of new railway lines, approx. 85% underground, and the rest on viaducts. Besides the underground enlargement of the head stations, 4 new underground stations of a 280m<sup>2</sup> cross section will be constructed using the NATM method. During 2018 and 2019 all three viaducts were completed. All other underground works, however, were not initiated due to financing restrictions. During 2019 the Transport Ministry modified the original underground works, optimizing and downsizing it, to make it more economical, but also scalable for construction. Presently, there is no official decision about future activities on this project. It is expected that it will be delayed for a couple of years, since financing is currently extremely difficult.

#### Bi-National Trans Andean Tunnels – Argentina - Chile

**Agua Negra Tunnel:** This 14km long twin-tube Road Tunnel is the project of highest priority for both countries. Its financing would be provided by the IDB for the Argentine part, whereas Chile will finance its part without the support of this bank. A new pre-qualification process for contractors was launched in 2017, with the short list of companies published in 2018. According to the latest developments, it seems that neither

country agrees on a final technical solution for the project. The bi-national Authority EBITAN did advance the preparation of the tender documents process which was supported by the IDB. However, due to recent criticism of the project by the Chilean authorities, the entire process is back under review.

**Corredor Bi-oceánico del Aconcagua:** This Private Initiative, featuring a railway connection between Mendoza (Argentina) and Los Andes (Chile) with a 52km long base tunnel, developed so far to Preliminary Design, was not further developed by the private initiator JV. This is basically related to the high level of geological investigation costs required.

**Las Leñas Tunnel:** This approx. 11km long twin-tube Road Tunnel is officially recognized by both countries as the second most important bi-national base tunnel. By the end of 2019 a new geological-engineering study for this project was awarded by the Chilean Public Works Ministry to a consulting JV. Its aim is to develop more detailed geological investigations to create a better geological model, to then define the final corridor for the tunnel, as well as its functional design. The awarded study is scheduled to end in approximately 22 months, including two field campaigns (in 2 summer periods).

**Tunnel Cristo Redentor – second tube:** With the support of the IDB the design of the second tube of the existing road tunnel Cristo Redentor of approx. 3.1km length was completed and the

tender for construction developed. This second tube will be constructed as an enlargement of the existing single track railway tunnel "Caracoles", which was part of the Transandean Railway from Buenos Aires to Valparaiso and has been out of operation since 1978. It is expected that at the beginning of 2020 a contractor will be selected and construction started.

#### Metro Buenos Aires and other underground projects in the city of Buenos Aires

For March 2020 the Buenos Aires city government is tendering the tender design of the new Metro Line "F", a circumferential line which crosses most of the existing lines. Additionally, two further projects would be tendered for design: The "Colector Baja Costanera", a sewer tunnel along the coast of the La Plata River; and a new relief tunnel for the existing rainwater drainage river "Medrano".

#### EDUCATION ON TUNNELLING IN THE COUNTRY

Postgraduate Course of Design and Construction of Tunnels and Underground Works at the Engineering Faculty of the University of Buenos Aires, held for the second year in 2019, with a duration of 32 hours. Both lecturers, the engineers Ezequiel Zielonka and Jorge Laiun, are members of AATES.

## Australia



**Name:** Australian Tunnelling Society (ATS)

**Type of Structure:** The ATS is an industry based Technical Society of Engineers Australia (EA) and is affiliated with the Australian Shotcrete Society, the NZ Tunnelling Society and the International Tunnelling and Underground Space Association (ITA).

**Number of Members:** 640 Members, 54 Gold and Silver Corporate Members and 6 Platinum Sponsors.

#### ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

During 2019 the ATS held its Tunnel Design and Construction Short Course in Perth which featured technical presentations by leading experts on topics relevant in Australia and with a knowledge of international practices. The 2019 David Sugden young tunneller's Award was presented to Senthilnath

Thangavelu. The top three 2018 David Sugden paper authors (including the winner) undertook a speaking tour of ATS Chapters in 2019.

The ATS Chapters hold monthly technical sessions and also ran a number of 1 day workshops throughout 2019. The ATS is involved with initiatives undertaken by the Australian Shotcrete Society (AusSS) including an industry

workshop to review and update the Shotcrete Guide – it is expected that the 3rd edition of the Shotcrete Guide will be published by June 2020. The ATS continues to be a contributor to the Austroads Tunnel Task Force which consists of jurisdictional representatives from around Australia and New Zealand.

The ATS is hosting its triennial conference "2020 Australasian Tunnelling Conference" in Melbourne 29 November to 2 December. Additionally, the 2020 ITA Awards are being held in conjunction with the Conference.

**Publications:** The ATS Journal was published twice in the last calendar year in conjunction with Tunnelling Journal.

**Working Groups:** During 2019, the ATS developed a Tunnel Design Guidelines which is expected to be published early 2020. The Tunnel Design Guidelines is targeted for use by less experienced practitioners. It is intended to hold

workshops/seminars during 2020 to introduce the guidelines. The ATS Air Quality Working Group (AQWG), published information on health strategies for managing silica dust exposure in tunnels which was launched early 2019. The ATS and the Working Group were recognised internationally for the quality of its work through winning the ITA-AITES Award for Safety Initiative of the Year 2019.

The ATS has 12 members active in ITA Working Groups which includes 1 Animateur and Vice Animateur.

**CURRENT TUNNELLING ACTIVITIES**

**Image 1:** LendLease/Bouygues JV is continuing with the design and construction of the \$A2.65B NorthConnex in Sydney, twin 9 km long road tunnels linking the M1 to the M2 and M7 motorways. The project is planned for completion March 2020. The project utilised 17 roadheaders during tunnel excavation.

**Image 2:** CPB/Samsung/John Holland JV completed the design and construction of the \$A2.7B M4 East project (WestConnex Stage 1B) in Sydney in July 2019. The project includes twin 3-lane road tunnels, each 5.5 km in length and utilised 18 roadheaders to mine the tunnels through Hawkesbury Sandstone and Ashfield Shale.

**Image 3:** CPB/Samsung/Dragados JV is continuing with the design and construction of the \$A4.3B New M5 project (WestConnex Stage 2) in Sydney. The project includes twin 3-lane road tunnels, each 9 km in length and has utilised 18 roadheaders to mine the tunnels through Hawkesbury Sandstone and Ashfield Shale. The project is due to open to traffic in 2020.

**Image 4:** In April 2016, the Salini Impregilo-NRW JV was awarded the \$A1.176B Forrestfield-Airport Link design, construct and maintenance contract for the Public Transport Authority in Perth, Western Australia. The project includes 8km of twin 7m diameter bored tunnels, two underground and one at-grade stations. Tunnelling commenced with TBM Grace in July 2017 and TBM Sandy started her journey in September 2017. Grace reached her final destination and broke through, into the dive structure at Bayswater, on 18/02/2020. Sandy is anticipated to follow in May 2020. Trains are expected to be operational in late 2021.

**Image 5:** Sydney Metro City and South West Tunnels and Station Excavation contract has been awarded to the John Holland/CPB/Ghella JV. The contract involves the design and construction of twin running tunnels, each 15 km long, between Chatswood and Sydenham and six new underground stations. Five TBMS were used to excavate the 30 km of tunnels. TBM excavation will finish in early 2020 with contract completion expected in 2021.

**Image 6:** In December 2017 the CPB/ John Holland JV was awarded the West Gate Tunnel Project which includes the design and construction of twin three lane road tunnels in Melbourne. Two 15.5 m diameter TBMs have been assembled and commissioned for the excavation of the 2.8 km long eastbound tunnel and the 4 km long westbound tunnel. The project is scheduled to be completed by the end of 2022 but may be delayed due to issues with contaminated spoil.

**Image 7:** In December 2017 the Melbourne Metro Tunnels and Stations PPP contract was awarded to the Cross Yarra Partnership comprising John Holland/Lendlease/ Bouygues and Capella Capital. The contract involves the design and construction of twin running tunnels, each 9 km long, and five new underground stations. Two TBMS commenced the excavation of the running tunnels during 2019 and two TBMs will commence excavation in

2020. The section between the two CBD stations is being mined by roadheaders.

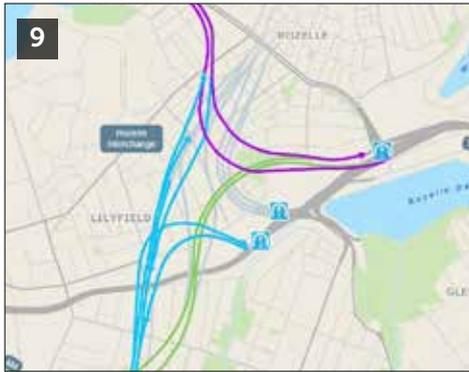
**Image 8:** In June 2018 the M4-M5 Link Main Tunnel Works Contract (WestConnex Stage 3A) was awarded to the Lendlease-Samsung-Bouygues JV for the design and construction of twin 3 and 4 lane road tunnels each 7.5 km in length. The project is planned to open in 2023.

**Image 9:** In December 2018 the Rozelle Interchange Contract (WestConnex Stage 3B) was awarded to the John Holland-CPB Contractors JV for the construction of a predominantly underground interchange to link the proposed M4-M5 Link Tunnels with the existing Anzac Bridge, Iron Cove Bridge and the future Western Harbour Tunnel. Twenty one roadheaders will be required to excavate the 22 km of tunnels. The project will be completed by 2023.

**Cross River Rail – Brisbane**

The State of Queensland reached contractual close during June 2019 with the Pulse consortium, which is comprised of CIMIC Group companies, Pacific Partnerships, CPB Contractors, and UGL with international partners DIF, BAM, and Ghella Investments & Partnerships. The Pulse consortium will deliver 5.9km twin tunnels, four new underground stations, and ongoing maintenance services for Cross River Rail, South East Queensland’s largest infrastructure project.





**FUTURE TUNNELLING ACTIVITIES**

**Kidston Pumped Storage Hydro – Queensland**

The 250 MW Power Station will include 1.5 km of tunnels, three 250 m deep shafts and an underground power house. Contract award is expected in mid 2020.

**Snowy 2.0 Hydro Project - New South Wales**

The preferred tenderer for the civil works which will include 27 km of TBM tunnels is Future Generation, a partnership between Australian construction and engineering company, Clough, and global hydropower and tunnelling specialists, Salini Impregilo. Voith Hydro is the preferred electrical and mechanical tenderer. Australian company Leed Engineering has also been awarded the contract for exploratory works pre-construction activities. Contracts are currently being finalised, with contract execution subject to Shareholder approval of the project.

**North East Link – Melbourne**

This road link between the existing M80 Ring Road and the Eastern Freeway will include twin tunnels each 5 km long. Tenders are scheduled to close in May 2020.

**Inland Rail Project – South East Queensland**

The 126 km long Gowrie to Kagaru section of the Inland Rail Project in south east Queensland will include three single track rail tunnels totalling 8.5 km in length. The Inland Rail Project is a 1700 km freight rail link from Melbourne to Brisbane. Tenders for this section of the project are expected to be called in the second half of 2020.

**M6 Stage 1 – Sydney**

Twin 3-lane road tunnels, each 4 km long, from the New M5 (WestConnex Stage 2) at Arncliffe to Kogarah. Tenders are expected to be called in Q2 2020.

**Sydney Metro West – Sydney**

This will be a new metro style underground rail line between Parramatta and the Sydney CBD which will include twin running tunnels, each 22 km long. Tenders are expected to be called in Q2 2020.

**Western Harbour Tunnel – Sydney**

Tenders for the second under harbour road tunnel in Sydney to connect the proposed Rozelle Interchange (WestConnex Stage 3b) with the existing

Warringah Freeway on Sydney’s North Shore are expected in late 2020.

**Sydney Metro Greater West – Sydney**

This will be a metro style rail line to link the proposed Western Sydney Airport with the existing train service at St Marys. Tenders for the tunnel section are expected to be called in 2021.

**Beaches Link – Sydney**

This road tunnel will connect the northern beaches area of Sydney with the Warringah Freeway and the proposed Western Harbour Tunnel.

**Suburban Rail Loop – Melbourne**

The Suburban Rail Loop is a 90 km long circle line to connect the outer suburbs with the existing radial rail network. The project is likely to be delivered in four stages with construction for the first stage planned to commence by 2022. The majority of the loop will be constructed as bored tunnels.

**STATISTICS**

1. **Length or volume excavated**
  - % mechanized/% conventional during 2019. Length of bored tunnels by TBM completed in 2019 (excluding pipejacking): 34,474m
  - Volume of mined tunnels completed in 2019: 830,000m<sup>3</sup>
2. **Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019**
  - USD5,040M or EUR4,632M
3. **List of tunnels completed:**
  - M4 East, July 2019.
4. **List of tunnels under construction (Excludes pipejacking works)**
  - NorthConnex, Sydney, NSW;
  - WestConnex Stage 1B (M4 East), Sydney, NSW;
  - WestConnex Stage 2 (New M5), Sydney NSW;
  - WestConnex stage 3A (M4-M5 Main Tunnel Works);
  - WestConnex Stage 3B (Rozelle Interchange);
  - Forrestfield Airport Link, Perth, WA;
  - Sydney Metro City and Southwest, Sydney, NSW;
  - WestGate Tunnel, Melbourne, Vic;
  - Melbourne Metro Rail Project Tunnel and Stations PPP, Melbourne, Vic;
  - Cross River Rail, Brisbane, Qld.

# Belarus



**Name:** Belarusian Tunnelling Association

**Type of Structure:** non profit, open association

**Number of Members:** Number of corporate members: 7 organisations

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

In 2019 the Minskmetrostroy UE celebrated its 40th anniversary. An international scientific and technical conference was held.

## CURRENT TUNNELLING ACTIVITIES

Minskmetrostroy UE continues the construction of section 1 of Minsk metro line 3. The length of the section is 8.42km with 7 stations. In 2019, TPMK CGM BESSAC (France) dug 1932 m of tunnels with a diameter of 6.0m with the use of reinforced concrete high-precision lining. The construction of 4 stations is near its completion (readiness - 90%). Currently installation of equipment and escalators is underway, finishing work is being carried out. Using TPMK A VND2400

AB and A VNI000 XC (manufactured by Herreknecht), 1272m of sewage collector with a diameter of 2.0m and 1058m of a collector with a diameter of 1.0 m were completed. Works were performed by Trest No. 15 Spetsstroy JSC in Minsk. In June 2019 under the design documentation developed by Minskmetroproject JSC in Moscow a section of the Kozhukhovskaya line was put in operation. The line length is



8.2km, 4 stations (Kosino, Dmitrievskf, Lukhmanovskaya, Nekrasovka stations).

## FUTURE TUNNELLING ACTIVITIES

Minskmetroproject JSC has been developing design documentation for the construction of section 1 of the Minsk Metro line 3, and also begun the development of the project "section 2 of the Minsk Metro line 3". The length of the line is 8km with 7 stations. Stage is "architectural project".

## STATISTICS

### 1. Length or volume excavated

- In 2019 were built: 1932m of metro tunnels. 100% mechanized digging and 2330m of tunnels for sewage, incl. 1272m with diameter 2m and 1058m with diameter 1m.

## EDUCATION ON TUNNELLING IN THE COUNTRY

Belarusian National Technical University, Department "Bridges and Tunnels". 275 students and 75 teachers, including 6 Do.Sc. in engineering.

## BUILDING ON THE LEGACY OF EXCELLENCE



Don River & Central Waterfront Coxwell Bypass Tunnel Project  
Toronto, Ontario, Canada  
RMP278SE – 7m Single Shield Rock / EPB Dual Mode TBM  
North Tunnel Constructors ULC  
Year of Manufacture: 2019

# Brazil



**Name:** Brazilian Tunnelling Committee (CBT)

**Type of Structure:** CBT is a committee of the Brazilian Society for Soil Mechanics and Geotechnical Engineering (ABMS). It is an open society based on membership

**Number of Members:** 287 Individual Affiliate Members and 17 Corporate Affiliate Members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

**January** - Beginning of the new board of directors e-form online survey: 'Tunnel Works in 2018' and contribute to the country's tunnel engineering

**February 02nd** - Lecture on the Geotechnical Baseline Report (GBR)- 70 participants - São Paulo.

**February 21 to 22nd** - FloripaTUN - International Tunnel Seminar - 150 participants - Florianópolis, Santa Catarina.

**February 23 to 24th** - ITA Executive Council meeting - Florianópolis, Santa Catarina.

**March 12th** - CBT participated in a round table at the São Paulo State University (FEI) addressing case studies and academia

**March 20th** - CBT Young Members organized a guided tour of the Sabesp (São Paulo Water Supply Department) tunnel - 20 participants.

**April 10th** - WTC2019 Pre-Congress Meeting - São Paulo.

**May 03 to 09th** - WTC 2019 and ITA General Assembly - Naples - Italy.

**May 21 to 23th** - CBT-YM promotes the course "Tunnels and Underground Works" during the Mauá University Week of Innovation, Leadership and Entrepreneurship - 50 participants.

**June 13th Talk** - "The insertion of tunnels as a planning element for major infrastructure works", Dnit planning week - Brasília

**June 11th** - Echoes of WTC 2019 - A local event to bring some impressions from WTC to the local community that did not join WTC - 120 participants - São Paulo.

**July 24th** - Lecture about the Tietê Project, by Geologist Bruno Rodrigues Leite - 50 participants - São Paulo.

**August 02 to 03rd** - Practical Aspects of the Construction of Conventional (NATM) and Mechanized Tunnels (TBM) - Auditorium Villa Lobos Office - 150 participants - São Paulo.

**August 15 to 16th** - Concrete Show participation - "Waterproofing Solutions for Underground Works" ABMS corporate

associates - CBT (Metro SP- Soprema- MC Bauchemie), invited geologist Bruno Leite, from Telar- 20 participants - São Paulo Expo

**October 15th** - Talk, Innovative solution for the construction of vertical wells, by Eng. Edson Peev from Herrenknecht AG - 50 participants - São Paulo.

**October 17th** - CBT participated in the Geotechnical Seminar from the Brazilian South Region. Talk: Trends in underground excavations influenced by industry 4.0, by Eng. Alex Nowak. - 450 participants - Joinville, Santa Catarina.

**November 17th** - CBT participated in a Geotechnical Seminar from the Brazilian Northeast Region. Talk: Rock Tunnels, by Eng. Felipe Gobbi - 500 participants - Recife, Pernambuco.

**December 04th** - Tunnel Day, Small Diameters, Big Solutions. One day conference in São Paulo. 152 participants.

## Publication

**Journal: Soils & Rocks** ([www.soilsandrocks.com.br](http://www.soilsandrocks.com.br)), in English, published by the Brazilian Society for Soil Mechanics and Geotechnical Engineering (ABMS), the Brazilian Association for Engineering Geology and the Environment (ABGE) and the Portuguese Geotechnical Society (SPG). Three issues are released per year. As a sample, the following papers were published in 2019:

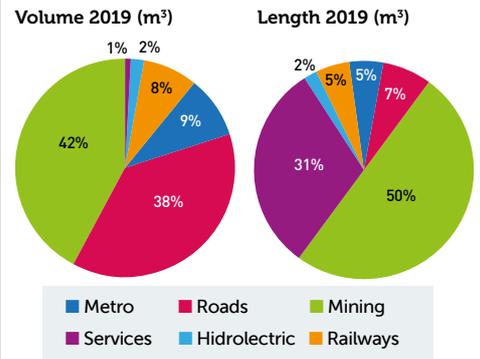
**Volume 42**, N. 1, January-April 2019 - [http://www.soilsandrocks.com.br/soils-androcks/SR42-1\\_Cover\\_Contents.pdf](http://www.soilsandrocks.com.br/soils-androcks/SR42-1_Cover_Contents.pdf)  
**Volume 42**, N. 2, May-August 2019 - [http://www.soilsandrocks.com.br/soils-androcks/SR42-2\\_Cover\\_Contents.pdf](http://www.soilsandrocks.com.br/soils-androcks/SR42-2_Cover_Contents.pdf)  
**Volume 42**, N. 3, September-December 2019 - [http://www.soilsandrocks.com.br/soils-androcks/SR42-3\\_Cover\\_Contents.pdf](http://www.soilsandrocks.com.br/soils-androcks/SR42-3_Cover_Contents.pdf)

## Press and social media

101 published articles on CBT website; 33 mailing on CBT@News; 02 podcasts and 216 posts on facebook, Instagram and LinkedIn.

## CURRENT TUNNELLING ACTIVITIES

The estimated total volume of tunnels excavated in Brazil is 1.1Mm<sup>3</sup> in 48km of tunnels. It includes roads, railways, hydroelectric facilities, mining and services. The mining and services tunnels length and volume are estimated based on previous data and an informal report about 2019 productivity, as we did not get the current table from the mines. The distribution, in percentage is:



## FUTURE TUNNELLING ACTIVITIES

Metro de Fortaleza is one of the projects expected for 2019. São Paulo Metrô, Lines 2 and 6. Ring-Road around Florianópolis (expected in 2019, postponed to 2020); New concessions around the country bring some provisions for new tunnels in SP, RJ, RS, but probably later than 2020.

## STATISTICS

### 1. Length or volume excavated

- Length: total 48.116km (32% mechanized and 68% conventional). Volume: total 1.021.000m<sup>3</sup> (1.1% mechanized and 98.9% conventional)

### 2. Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019

- Estimated US\$200M

## EDUCATION ON TUNNELLING IN THE COUNTRY

No undergraduate courses in Brazil that focus on tunnel yet. Some universities have one or two disciplines related to underground construction, like Makenzi, USP, UNB. On post graduate courses our references in Brazil are Brasilia Federal University and São Paulo Federal University, São Carlos school. Efforts are being made to spread knowledge in tunnelling, by CBT mainly.

# ALWAYS ADVANCING

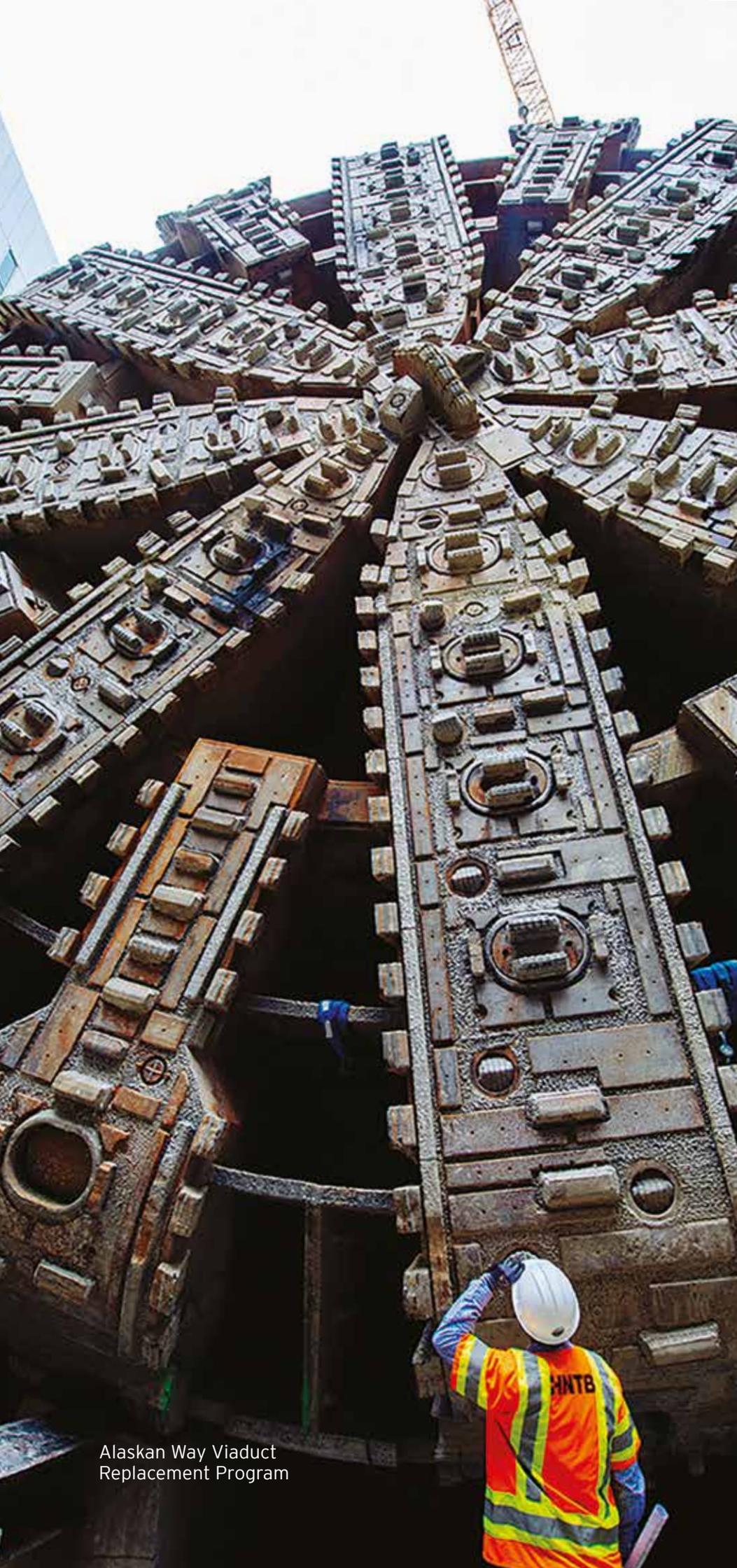
[www.terratec.co](http://www.terratec.co)



## ARGENTINA'S AGUA SUR

In recent years, TERRATEC's order book has demonstrated significant growth around the world. In Argentina, two 4.66m diameter TERRATEC Earth Pressure Balance Machines (EPBM) are currently being deployed by Italian contractor CMC di Ravenna on a 13.5km-long tunnel that will carry drinking water from the newly expanded General Belgrano Water Treatment Plant to the city of Lomas de Zamora.

The tunnel is a key component of the multi-billion-dollar Agua Sur system that is being built by Argentina's national water company AySA. It is the country's largest water infrastructure project in 40 years and will provide fresh water to 2.5 million inhabitants in the southern region of Buenos Aires.



Alaskan Way Viaduct  
Replacement Program

# SETTING THE STANDARD

HNTB has set the standard in state-of-the-art tunnel design.

- A standard based upon solutions that work.
- A standard that prioritizes safety and efficiency.
- A standard that reflects the technical excellence that HNTB continues to set for the most complex tunnels and underground projects in the nation.

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# Bulgaria



**Name:** Bulgarian Association for Geotechnical and Tunnel Construction - BAGTC

**Type of Structure:** non profit, open association

**Number of Members:** Unavailable

## CURRENT TUNNELLING ACTIVITIES

Extension of the Sofia Metro, III – metroline Botevgradsko shose blvd – Bul “Vladimir Vazov – Central city, private Ovcha kupel – I stage – Subway station 6 – Park Zaimov L = 105m. Tunnel underpass L = 23m, cross sectional area = 35m<sup>2</sup>; Subway station 8 “Orlov most” – two tunnels with a total length of 66m and cross sectional area of 220m<sup>2</sup>; Tunnel underpass L = 95m. Cross section 35m<sup>2</sup>, Tunnel before Subway station 6 length 190m. cross section: 75m<sup>2</sup>

III -5004 “Gabrovo bypass” from 0000km to 31,000km, drilling and construction of Tunnel No 1 from 12,420km to 12,960km with a length of 540m and cross section of 66m<sup>2</sup>

Highway “Hemus” - Rehabilitation of the Vitinya tunnel. Length = 1195m and cross section area of around 100m<sup>2</sup>

Highway “Struma” Tunnel “Zheleznicna” with a length of around 2000m

## FUTURE TUNNELLING ACTIVITIES

The Gabrobo bypass, 20,124.50km to 30,673.48km. In this future project there are 5 tunnels with a total length of 7231m. The tunnels have different cross sections from 80m<sup>2</sup> to 120m<sup>2</sup>

Highway Struma “Kruptnik-Kresna” - 7 tunnels with a total length of 7963m.

## STATISTICS

### 1. List of tunnels completed

The Gabrovo bypass Tunnel from 12,420km to 12,960km  
Extension to the Sofia Metro III

### 2. List of tunnels under construction

Rehabilitation of the Vitinya Tunnel on the “Hemus” Highway  
The Zheleznicna Tunnel on the “Struma” Highway

# Canada



**Name:** Tunnelling Association of Canada (TAC)

**Type of Structure:** Federally incorporated non-for-profit society

**Number of Members (2019):** 474 (326 full, 54 corporate, 14 retired, 80 student)

**Board of Directors (2019): Officers:** Erik Eberhardt - President, Rick Lovat - Immediate Past President, Bruce Downing - Vice President West, Steve Skelhorn - Vice President East, Michelle Richards - Treasurer, Derek Zoldy - Secretary

**Directors:** Stephanie Robillard - BC Region, Remco Kleinlugtenbelt - Alberta, Jason Mann - Manitoba and Prairies, Dan Ifrim - Ontario, Jean Habimana - Québec and Maritimes, Nichole Boulton, Andrew Caruana, Mark Diederichs, Connor Langford, Boro Lukajic, Andre Solecki, Seamus Tynan

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### 2019 TAC Technical Workshop

The 2019 TAC Technical Workshop was held October 21-22 in Winnipeg, Manitoba and featured 14 technical presentations from local, Canadian, American and International speakers under the theme The Use of Tunnelling Technologies and Underground Space for Stormwater and Flood Control. This was the first time TAC held an event in Winnipeg, and it attracted over 80 participants and was a tremendous success.

### TAC 2019 Awards Dinner

The Tunnelling Association of Canada

presented achievement awards in 2019 recognizing deserving individuals and projects in the Canadian tunnelling industry. The following awards were presented:

- Lifetime Achievement Award – Enrique Fernández Gonzáles (posthumous)
- Canadian Innovation Initiative Award – Dragados Canada, gGravity Engineering, Dr. Sauer & Partners, City of Ottawa, SNC Lavalin and Ellis Don for the “Ottawa LRT Construction Sequence and Tension Tie Support for Shallow Urban Caverns”
- Canadian Project of the Year (Up to \$100M CAD) – Ward & Burke Microtunnelling, Metro Vancouver, Stantec and the Langley Concrete Group for the “South Surrey

- Interceptor – Johnston Road Section”
- Dan Eisenstein Memorial Scholarship – Antoine Gagnon

Full 2019 details are posted on the TAC website at [http://www.tunnelcanada.ca/awards\\_2019.php](http://www.tunnelcanada.ca/awards_2019.php).

## Chapter Activities

TAC’s Ontario and British Columbia chapters continue to be very active running up to eight meetings (each) annually and featuring presentations on Canadian and international tunnelling projects. The Ontario Chapter closes the year with a December social, which was attended by over 100 members and non-members in 2019. The BC Chapter always opens the year in January with a combined meeting with the Vancouver Geotechnical Society. The Quebec Chapter is partnering with the local section of the Canadian Geotechnical Society to run events in Montreal.

## TAC Young Members

TAC had another successful year running numerous student and young member presentations and tours in Eastern and Western Canada. TAC’s student membership grew to 80 members in 2019, up from 48 in 2018, reflecting the success of our YM Group’s initiatives.

## CANADIAN TUNNELLING ACTIVITIES ONTARIO

The Ontario tunnelling market continues to be strong and is attracting both local and international competition. Currently

there are a number of tunnelling projects that have just started to break ground or are nearing construction completion. As well, there are a good number of upcoming projects that are in different stages of design and tendering. Below is a summary of most representative current, near term and future projects in Ontario:

**Current Projects**

- Ottawa Combined Sewage Storage Tunnel (CSST) - Anticipated completion: 2020
- Hwy # 401 Rail Tunnel Project, Toronto, Ontario - Anticipated completion: 2021
- Eglinton Crosstown (Stations Contract) - Anticipated completion: 2021
- Coxwell Bypass - Anticipated completion: 2024
- Ashbridges Bay Outfall - Anticipated completion: 2024

**Near-term Projects**

- East Brampton Watermain Contract 2, Peel Region – 4.5km of twinned watermain. Anticipated Tender: 2020
- Upper York Sewage Servicing (UYSS) – York Durham Sewage System Modifications, Newmarket – 5km of a combination of conventional tunnelling and micro tunnelling with internal diameters ranging from 1.8m to 3m. Anticipated Tender: 2020
- Fairbanks Silverthorn Storm Trunk Sewer System, City of Toronto – 2.5km of 3m to 4m diameter storm sewer tunnels and approximately 12km of new local storm sewers ranging from 250mm to 1800mm diameter. Anticipated Tender: 2021

**Future Projects**

- Massey Creek Tunnel, Toronto – Part 2 of the Don River and Central Waterfront Projects connects to the Coxwell Bypass. 6.0km of 4.4m diameter soft ground tunnelling, at depths ranging from 12m to 60m below grade. RFQ is anticipated to be in 2021 and construction in 2024.
- Scarborough Subway Extension, Toronto, Ontario – 6km of single bore tunnel 11m internal diameter and a terminus station. The project design is approaching 100% submission and is expected to go to tender after design approval by the Owners.
- Relief Line South / Ontario Line, Toronto, Ontario – The 7.5km twin tunnel Relief Line South is to relieve crowding on the existing Line 1 subway. Date: TBD

- Yonge Subway Extension, Toronto/ Richmond Hill, Ontario – A 7.4km extension on the existing Yonge Subway. Potentially utilizing a very large TBM. Date: TBD
- Inner Harbour Tunnel, Toronto, Ontario – Part 3 of the Don River and Central Waterfront Projects initiated by the City of Toronto, (The other being the Coxwell Bypass and Massey Creek). Date TBD
- West Vaughan Sewage System Project, York Region, Ontario – Approximately 14km of 3m id sewer tunnel. Date 2028

**Microtunnelling Projects**

Along with tunnelling, microtunnelling continues to contribute to the active underground work in Ontario. Many projects are being constructed all over the province, such as:

- Scarborough Watermain
- South Service Rd, Burlington
- Dixie Rd & QEW Crossing
- Seaton-Pickering - Rossland Rd
- Streetsville, and various MTO highway crossings

**QUEBEC**

**Current Projects**

- Réseau Électrique Métropolitain (REM) – The construction of the REM is well underway. The launch shaft for the approximately 3km long single tube tunnel is almost finished and TBM parts arrived on site and were assembled in the fall of 2019 to begin mining in winter in order to be driven underneath the Montreal Airport runways in spring next year. On the other hand, excavation for the 70m deep underground station at Edouard Montpetit is well underway on the

University of Montreal main campus as well as the McGill Station.

- Atwater – Two deep shafts and approximately 1km of tunnel by drill and blast. Work is almost complete, and it is expected to be commissioned in early 2020.
- Garage Cote Vertu – Approximately 2.5km by roadheader and deep shafts. Excavation completed and concrete work ongoing. Expected to finish end of 2020.

**Future Projects**

- Montreal’s Metro Blue Line Extension – Will add five underground stations to the east of the existing line for approximately 6km. Has secured federal and provincial funding. Preliminary design is ongoing. Project delivery method to be announced in fall 2019. Final design for this \$3.9G will start early 2020 and construction is expected to start in 2021.
- Quebec Tramway – The City of Quebec has secured federal and provincial funding to build 23km of new tramway that will include two sections of tunnels. Preliminary design is underway. Project delivery by design-build. Tender is expected in summer 2020.
- Louis H. Lafontaine Tunnel – Tender design for the major upgrades is nearing completion. The goal of the project is to prolong the lifespan the approximately 1.5km long double tube immersed tunnel. Bids are due end of the year; contract award is expected early next year, and construction work is expected to start in spring 2020.
- Quebec Levis Tunnel – The Quebec Provincial Government has decided on the tunnel option to link the Cities



SEM excavation of the Laird Station tunnel for the Eglinton Crosstown LRT project, Toronto

Successful completion of microtunnel through difficult clays in Winnipeg.



of Quebec and Levis underneath the Saint Lawrence River. Conceptual design is underway. The project delivery method as well as its budget are expected to be announced at the end of 2020

## PRAIRIES (SASKATCHEWAN AND MANITOBA)

### Current Projects

From a busy 2018 construction season, 2019 continued with several tunnelling projects planned for the City of Winnipeg as part of two overlapping City programs, the Basement Flood Relief program (BFR), and the Combined Sewer Overflow (CSO) Management program.

Four major projects are underway as part of the BFR & CSO programs. These projects include:

- Cockburn and Calrossie Sewer Relief Project
- Ferry Road Sewer Relief Project
- Jefferson Sewer Relief Project
- Transcona Sewer Relief Project

Together, these four projects have over 14km of pipe installations in excess of 1,200mm, and include pipe diameters up to 3,000mm.

### Near Term to Future Projects

Near-term City of Winnipeg tunnelling construction contracts (i.e. within approximately 6-8 months):

- City of Winnipeg Contract 12 and the Jefferson East Combined Sewer Relief (Phase 2) are projected to proceed in 2020.
- Investments in the Winnipeg CSO Program are planned to continue and continues to generate interest from tunnelling companies across North America.

Regina has also embarked on a significant infrastructure renewal project within the critical downtown portion of the City. Monitoring of the project design development continues.

## ALBERTA

### Current Projects

- Valley Line LRT, Edmonton, Alberta – Construction of two 500m long soft ground NATM tunnels as part of a \$1.8bn P3 project awarded to TransEd Partners.

### Future Projects

- Green Line LRT – Calgary has approved the \$4.5bn Green Line LRT, which includes over 3km of tunnel in the City's downtown area.
- Inglewood Sanitary Trunk Project – Microtunnelling of 4km of sanitary pipe.

## BRITISH COLUMBIA

The British Columbia tunnel market continues to be very busy with many of the large projects under procurement last year moving into construction, and many more advancing through procurement.

### Current Projects

- Second Narrows Water Supply Tunnel, Vancouver – 1.1km, 6m diameter tunnel connecting the Vancouver suburbs of North Vancouver and Burnaby below Burrard Inlet.
- Douglas Trunk Sewer – 1.85km alignment of HDPE-lined reinforced concrete pipe (1200mm ID). The project is on schedule for completion by March 2020.
- North Shore Conveyance – North Shore Wastewater Treatment Plant with the existing outfall below

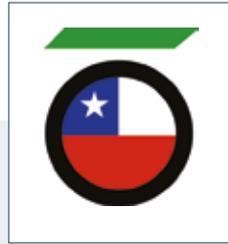
the Lions Gate Bridge. Tunnelling operations began in August of 2019 with a busy final 12 months scheduled to completion.

- BC Hydro Site C Diversion Tunnels, Fort St. John – Twin diversion tunnels to facilitate the construction of the main earth fill dam.
- Second Narrows Water Supply Tunnel – The project includes a 1.1km long, 6m diameter tunnel under the Burrard Inlet, parallel to the Second Narrows Bridge. The tunnel will house 3 welded steel water mains. Construction will take place 2019 through 2023.

### Future Projects

- Annacis Island Wastewater Treatment Plant Outfall – The project will showcase a challenging marine operation to complete the tunnel drive under the river and construct a riser structure and diffuser for the outfall.
- Broadway Subway Project - Millennium Line Extension – 6km extension to the existing Millennium Line Skytrain in downtown Vancouver. Construction is projected to take place 2020 to 2025.
- Eagle Mountain Gas Pipeline – A 9km long tunnel to house the 24" pipe as part of the 47km gas pipeline extension from Coquitlam to the new Woodfibre LNG facility, west of Squamish, BC. Construction is set to start in 2020.
- The Annacis Water Supply Tunnel – Another major Metro Vancouver marine crossing to provide reliable drinking water to the region. The project consists of a 2.3km long, 3.9m ID tunnel located between New Westminster and Surrey, BC RFP planned for mid-2020.
- Stanley Park Water Supply Tunnel – To meet the growing demand for drinking water in the region, Metro Vancouver is planning to construct a major water infrastructure project, called the Stanley Park Water Supply Tunnel, deep underground in Stanley Park. The project consists of a 1.4km long bedrock tunnel that will house a 2.6m diameter water main, which will replace the existing water main through the park that was built in the 1930s. The project involves the excavation of 3 shafts and 2 tunnel drives through weak sedimentary bedrock (primarily sandstone, siltstone and mudstone) as well as construction of two new valve chambers. The project entered Detailed Design in Q4 of 2019 and construction is scheduled to begin in 2021.

# Chile



**Name:** Committee of Tunnels and Underground Spaces (CTES)

**Type of Structure:** Non-profit, open association



**Number of Members:** 97 Members (81 are companies from the industry)  
Corporate Members: 25 Category Gold, 51 Category Associated and 21 Individual members.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### 1. Seminars and conferences

- Progress, challenges and future works to be carried out in NNM Andes Norte project, Codelco El Teniente
- Mechanical excavation TBM-TBS and underground mega-projects
- Vision of the use of underground spaces for infrastructure.

### 2. Training

- None

### 3. Technical Lectures

- International Symposium: Mechanical Excavation TBM-TBS and Underground Megaprojects
- Design and construction of tunnels with TBM; CTES –ARCADIS

### 4. Other

- Creation of a Young Members Technical Group
- Agreement of a partnership with Instituto del Cemento y el Hormigón (Cement and Concrete Institute Chile)
- Agreement of a partnership with the Architecture Offices Association to aid the development of underground spaces
- Photographic contest for underground spaces in Chile
- Technical Committee's formed for the revision and upgrading of the Highway Manual of Chile for tunnelling issues
- Technological mission to Poland and Czech Republic

## FUTURE TUNNELLING ACTIVITIES

**April 2020** – Challenges works preparation Quinquenio Mine, CODELCO

**May 26th** – 27th Seminar: International Standards in Road Tunnels

**July 2020** – Best Practices in Tunnel Components (fortification elements, waterproofing, mechanized equipment, cables, bolt-mesh)

**August 2020** – Technological mission to Finland and Sweden

**August 2020** – Training in fortification elements.

**September 2020** – Seminar: Tunnelling and Underground Spaces to students (University La Serena)

**September 2020** – Conference: Vertical Transportation of Mining and Tunnelling materials

**October 2020** – International Workshop on Underground Works

**November 2020** – Conference: Equipment and Explosives for Underground Uses.

**December 2020** – Seminar on Materials and Products for Tunnels

## EDUCATION ON TUNNELLING IN THE COUNTRY

1. Postgraduate Diploma in Tunnels and Underground Spaces; University of Chile
2. Diploma in Modern Tunnel Excavation Techniques; University of Santiago of Chile
3. Diploma in Applications of Soil Mechanics in Civil and Building Works, Pontifical Catholic University, Chile

# China



**Name:** China Civil Engineering Society (CCES)

**Type of Structure:** Non profit, open association

**Number of Members:** Total number 44521 people, number of corporate members 1123 group members.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

1. The 2019 world tunnel conference was held in Naples, Italy, from May 3 to 9. The Chinese society of civil engineering sent a delegation to attend the meeting. At this meeting, Ms. Yan Jinxiu was elected president of ITA.
2. The 2019 Metro Science and

Technology Forum and 40th anniversary meeting of tunnel and underground engineering branch of China Civil Engineering Society was held in Wuhan, September 27-28, 2019. More than 260 relevant academicians, experts, scholars, and leading figures attended.

3. The 5th construction management

and youth work Science and Technology Forum of tunnel and underground engineering branch of China Civil Engineering Society was held in Emei on October 12, 2019. Participants numbered more than 500, a new record over previous years.

4. The 18th cross strait tunnel and underground engineering academic and technical seminar was held in Chongqing on November 2-3. Participants numbered over 350, receiving more than 100 papers, 20 of which are recommended to be published in the Journal of Chongqing Jiaotong University (NATURAL SCIENCE EDITION).
5. The 19th academic exchange meeting of waterproof and Drainage Technology Forum of tunnel and

underground engineering branch of China Civil Engineering Society was held in Nanning. About 120 experts, engineering technicians and designers from all over the country attended.

- The 10th National tunnel and underground space science and Technology Forum on operation safety, energy conservation and environmental protection was successfully held in Jinniu Hotel, Chengdu, Sichuan Province from November 30 to December 1, 2019.

#### Publication: Modern Tunnelling Technology - Distribution: 2000 volumes/monthly

#### WGs, WG5:

- Responsible for the research on risk management and control of the super long tunnel on the Sichuan Tibet Railway
- Responsible for research on rock burst tendency and prediction control on the super long tunnel of the Sichuan Tibet Railway
- Responsible for the convening of the fifth Youth Committee
- Participating in the annual meeting of tunnels on both sides of the Taiwan Strait
- Participating in the technical consultation on risk assessment of the super large straight tunnel in Zhuhai
- Participating in the underwater project of super large cross section, super short span, super shallow buried and small spacing Technical consultation on design and construction of tunnel with mining method.

#### CURRENT TUNNELLING ACTIVITIES

- Railway tunnel works:** By the end of 2019, the total number of railway tunnels in operation in China's mainland is 16128, with a total length of 18150km. In 2019, 1011 new railway tunnels and 1819km new mileage were added.
- Highway tunnel works:** By the end of 2018, there are 17738 highway tunnels, 17236.1km, an increase of 1509 and 1951km, including 1058 extra-long tunnels, 4706.6km, 4315 long tunnels and 7421.8km.
- Metro tunnel works:** As of June 30, 2019, the total scale of lines approved by the state has reached 10706km, 5643km of lines have been operated, and 5063km of urban rail transit are under construction in the mainland. The new operating mileage is 339.5km and 238 stations are added.

#### FUTURE TUNNELLING ACTIVITIES

At present, the total length of railway tunnels listed in the construction plan in China is 16065km, including 843km on the Sichuan Tibet railway. At present, the longest railway tunnel in China is 32km, and there are 6 extra-long tunnels with a length of more than 30km. The annual growth of highway tunnels is about 8%, which should reach 2000km. According to the approved line, construction progress and the new round of line network approval, it is preliminarily predicted that 123 rail transit lines will be newly opened and operational in 2020-2021, with a total length of 2853.29km.

#### EDUCATION ON TUNNELLING IN THE COUNTRY

- Tongji University: Tunnel engineering
- Tsinghua University: Tunnel engineering
- Central South University: Tunnel engineering
- Southwest Jiaotong University: Tunnel engineering



#### STATISTICS

##### 1. Length or volume excavated

- Railway tunnel works: In 2019, 1011 new railway tunnels and 1819km were added.
- Highway tunnel works: An increase of 1509 and 1951km. According to incomplete statistics, the total number of TBMs in China is nearly 3000.

##### 2. List of tunnels completed

Tunnel name	length (m)	line type	speed target value	single and double tunnels (km/h)	completion time
Qingyang tunnel	10 100	Ji-Qing high speed railway	350	single tunnel double line	2018-12
Beitaizi tunnel	10 130	Jing-Shen Line	350	single tunnel double line	2018-12
Liao-Xi tunnel	13 205	Beijing Shenyang Line	350	single tunnel double line	2018-12
Tianmushan tunnel	12 013	Hang-Huang Line	250	single tunnel double line	2017-07

##### 3. List of tunnels under construction

Tunnel name	length (m)	line type	speed target value	single and double tunnels (km/h)	commencement time
Gaoligongshan tunnel	34 538	Da-Rui line	140	single tunnel single line	2014-12
Xiaoxiangling tunnel	28 426	Cheng-du-Kunming expansion	160	single tunnel double line double	2016-06
Ping'an tunnel	28 426	Cheng-du-Lanzhou line	200	tunnel single line	2013-03

# Colombia



**Name:** Colombian Tunnelling Committee

**Type of Structure:** Non-profit association

**Number of Members:** 7 members that represent more than 2000 engineers in the country

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- The Committee participated in the WTC 2019 held in Naples. The committee participated with members in Working Group 3 (Contractual practices in underground construction) and Working Group 2 (Research).
- Some members contributed to the joint Task Group (TG 10), between FIDIC and ITA, to develop the FIDIC Conditions of Contract for Underground Works, First Edition 2019.
- CCT representative joined the Executive Council
- The Committee worked hand in hand with the Colombian Society of Engineers as part of the review team of the Tunnelling Design Manual Developed by Invias (National Roads Institute).
- The committee carried out technical talks and activities with the following Working Groups:

WGs	Topic
WG3	Contractual practices in underground construction
WG6	Maintenance and repair of underground structures
WG12	Sprayed concrete use
WG15	Underground and environment
WG19	Conventional tunnelling
YM	ITA Young Members Group

## CURRENT TUNNELLING ACTIVITIES

During 2019, in Colombia, several works were carried out in terms of tunnels and the use of underground space, including the completion of La Línea Main Tunnel across the Andes through unprecedented, complex geological conditions.

### Completion of the La Línea Tunnel (2019)

La Línea tunnel (L = 8600m, d = 13.9m), along with 15 short tunnels (3225m total length), was part of a national roadway

project to cross the Andes' Central Mountains. Construction started in 2009 but was halted in 2016, as squeezing ground and creep phenomena occurred. The tunnel crossed graphite schist, mylonite and more than 7 geologic faults, including La Soledad, which induced severe squeezing (over 35% deformation). Completion works re-established and

stabilized the tunnel section, by changing the lining and support philosophy. La Línea was completed in 2019, becoming the largest roadway tunnel Colombia (in length and cross-section).

### Other Underground works in Colombia

Other ongoing tunnels and underground works and studies include:

- Road tunnels:
- Oriente Tunnel I (L= 786m) and Oriente Tunnel II (L= 8200m).
- El Toyo (L= 9,840m), under construction.
- Ruta 40 national road: 4 short tunnels (2,077m total length)
- Ruta del sol I, 3 short tunnels, (3,500m total length)
- Tesalia, 2 tunnels (L= 3,500m each), under construction.



- Mulatos (L= 2,500m), under construction
- Irrá (L= 450m)
- Amagá (L=3,600m), under construction
- Pamplona – Cúcuta road, 5 tunnels (5,200m total length).
- Buenavista (4,500m), under construction
- Hydropower projects with underground works:
  - Hydroelectric Project El Buey, 190MW
  - Hydroelectric Project Chapasia, 385 MW
  - Hydroelectric Project Upia- Chapasia, 400MW
  - Hydroelectric Project Talasa: 150MW, to be constructed

**FUTURE TUNNELLING ACTIVITIES**

- The committee will organize the 2020 Tunnelling Symposium, in which all Working Groups will participate with

- topics covered during the year.
- The committee will work on an academic article about tunnelling based on the local Working Groups research.
  - The committee will organize more short talks with invited experts, which will be open to all interested members of the community.

**EDUCATION ON TUNNELLING IN THE COUNTRY**

1. Application of geology and geotechnics in the design of tunnels - EAFIT University
2. Certificated in soil and rock tunnels - Escuela Colombiana de Ingenieros University
3. Andean seminar of tunnels and underground works - Colombian Society of Engineers

**STATISTICS**

**1. List of tunnels completed**

- Occidente Tunnel
- Renacer Tunnel
- Sumapaz Tunnel
- Oriente Tunnel I and Oriente Tunnel II
- Ruta 40 national road: 4 short tunnels
- Ruta del sol I, 3 short tunnels
- Irrá
- Pamplona – Cúcuta road, 5 tunnels

**2. List of tunnels under construction**

- El Toyo
- Tesalia, 2 tunnels
- Mulatos
- Amagá
- Buenavista

# Costa Rica



**Name:** ACROS – Asociación Costarricense de Obras Subterráneas  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 28 individual members, 3 corporate members

**ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE**

- II National Congress on Underground Works, 28-29 March 2019
- Strategic planning Workshop (Second Part)
- Working group for the drafting of a national technical regulation for the development of underground works 50% advance
- Short Course on Tunnel Design (in registration stage)

**CURRENT TUNNELLING ACTIVITIES**

- New underground pass of 700m at the Garantías Sociales roundabout (95% advance)
- Start of a new underground pass of 790m at the Guadalupe roundabout



- Two tunnels for the storm sewage in the Metropolitan Area of San Jose, 1300m length and 3m diameter each (at the tender stage)

**FUTURE TUNNELLING ACTIVITIES**

- Three tunnels for the Fifth stage of the potable water supply project for the Metropolitan Area of San José, with a total length of 11.8km and 3.9m diameter
- Two tunnels for the storm sewage of the Metropolitan Area of San Jose, 1300m length and 3m diameter each
- New underground pass of 900m at the La Bandera roundabout
- New underground pass of 60m under the national route No. 2 at the La Galera intersection
- New tunnel of 600m length and 12m diameter parallel to the Zurquí Tunnel on the national route 32

**STATISTICS**

- 1. Length or volume excavated - % mechanized/% conventional during 2019**
- % mechanized = 0%
  - % conventional = 100%

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Course on Underground Works, as part of the Master Science Program on Civil Engineering at the University of Costa Rica (UCR)

# Czech Republic



**Name:** Czech Tunnelling Association

**Type of Structure:** Non-profit, open association

**Number of Members:** Total number: 92, number of corporate members: 41

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- On June 3–5, 2019: 14th International Conference Underground Construction Prague.
- In 2019 the Czech Tunnelling Association (CzTA) continued organising the “Tunnelling afternoons” – public lectures. The lectures were on the themes:
  - Current Tunnel Construction Projects Abroad
  - Historic Underground Workings
- CzTA continued publishing the “Tunel” journal (four issues).
- CzTA organised a technical excursion to Innsbruck to the construction site of Brenner Basis Tunnel.
- Members of a CzTA WG have prepared a publication about conventional methods of tunnelling.

## CURRENT TUNNELLING ACTIVITIES

In 2020 the Czech Tunnelling Association (CzTA) will continue with these activities:

- We will start with the preparation of the 15th International Conference Underground Construction Prague, which will be held in 2022 in Prague.
- “Tunnelling afternoons” will be held on these topics:
  - Mezno and Deboreč tunnels
  - Foreign Tunnel Projects IV
  - Metro D – A New Line for Prague Metro
- CzTA will hold technical trips to tunnel construction sites in Europe.

## EDUCATION ON TUNNELLING IN THE COUNTRY

1. **Czech Technical University in Prague, Faculty of Civil Engineering.**  
Bachelor and Master and Doctoral Study Programmes – Structural and Transportation Engineering.  
Doctoral Study Programme – Building and Structural Engineering
2. **Brno University of Technology, Faculty of Civil Engineering.**  
Bachelor, Master and Doctoral studies – Civil Engineering, Structures and Traffic Constructions
3. **VSB-Technical University Ostrava, Faculty of Civil Engineering.**  
Bachelor, Master and Doctoral studies – Geotechnics

- The publishing of the “Tunel” journal will be continuing – four issue per year.

## FUTURE TUNNELLING ACTIVITIES

In 2022 will be organised 15th International Conference Underground Construction Prague.

## STATISTICS

1. **Length or volume excavated - % mechanized/% conventional during 2019**  
790m, 100% conventional
2. **List of tunnels completed**  
None
3. **List of tunnels under construction**  
Deboreč tunnel  
Mezno tunnel  
Metro D line of the Prague Metro – geological survey

# Finland



**Name:** Finnish Tunnelling Association – MTR - FTA

**Type of Structure:** non-profit, independent association

**Founded:** 1974

**Number of Members:** 111 Individual Associate Members, 27 Corporate Affiliate Members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- Get-together event and Annual Meeting on 30.4.2019
- Nordic Grouting Symposium 2019 on 2 – 3rd September in Finland.
  - 120 participants from 17 countries, 22 technical papers orally presented
- Nomination of Finnish Young Tunneller 2019 and piloting the Young Member activities in Finland
- ACUUS 2020 Conference in Finland: Scientific and Organization Committee

- work in co-operation with the Finnish Association of Civil Engineers RIL and Finnish Association of Architects SAFA
- Participating into work of FISE Qualification of Professionals in Building, HVAC and Real Estate Sector in Finland

## CURRENT TUNNELLING ACTIVITIES

### The Helsinki Olympic Stadium:

- Modernization and renewal project 2016 – 2020
- Total excavation volume 145,000m<sup>3</sup>

including underground tunnel

- More info: [www.stadion.fi](http://www.stadion.fi)

## Waste Water Treatment Plant Mikkeli:

- The Wastewater Treatment Plant in Mikkeli is responsible for producing drinking water and treating wastewater for about 55,000 inhabitants in the city and its surrounding areas.
- Expected to begin operating in 2020.

## Jokeri Light Rail:

- The Jokeri Light Rail line will be built between Itäkeskus in Helsinki and Keilaniemi in Espoo and it is one of the key projects for orbital cross-region public transport in capital area
- Construction works of the line started in 2019. Estimated to be ready in 2024.
- The length of the line is approximately 25km (15.5 miles), the line will have 33 stops. Has large open rock excavations and a 400m long tunnel.
- More info: <https://raidejokeri.info/in-english/>

### Sulkavuori Underground wastewater treatment plant (under construction)

- The treatment plant will process wastewater for up to 429,000 residents (2040)
- More info: <https://www.keskuspuhdistamo.fi/>

### Lahti Southern Ring Road

- Rerouting of main road No 12.
- Involves 2 tunnels with a total length of 1.4km
- Construction started in 2017 and will be finished in 2023
- More info: <https://vayla.fi/web/en/projects/all-projects/lahti-southern-ring-road>

### Underground Parking hall in Katajanokka

- Excavation volume of 90,000m<sup>3</sup>
- For 500 car slots with estimated cost of €25M
- Construction from 2020-2021

### Tampere Region Central Wastewater Treatment Plant

- Budget €300M, the largest single environmental investment in the Tampere region
- Started in 2018 and it will be come online in 2024.
- More info: <https://www.keskuspuhdistamo.fi/>

### Final Disposal Facility ONKALO

- The final disposal facility consists of two sections:
  - The above ground encapsulation plant where spent nuclear fuel is received, dried and packed into final disposal canisters
  - The repository located deep inside the bedrock, in which the most important section are the tunnels where the encapsulated spent nuclear fuel is disposed of.
- The volume of rock to be excavated for the facility, is approximately 1.3 M cubic metres.
- The number of final disposal tunnels required is 137. The total length of the tunnels is 42km, located within an area extending over 2 to 3 square kilometres.
- More info: [http://www.posiva.fi/en/final\\_disposal/final\\_disposal\\_facility](http://www.posiva.fi/en/final_disposal/final_disposal_facility)

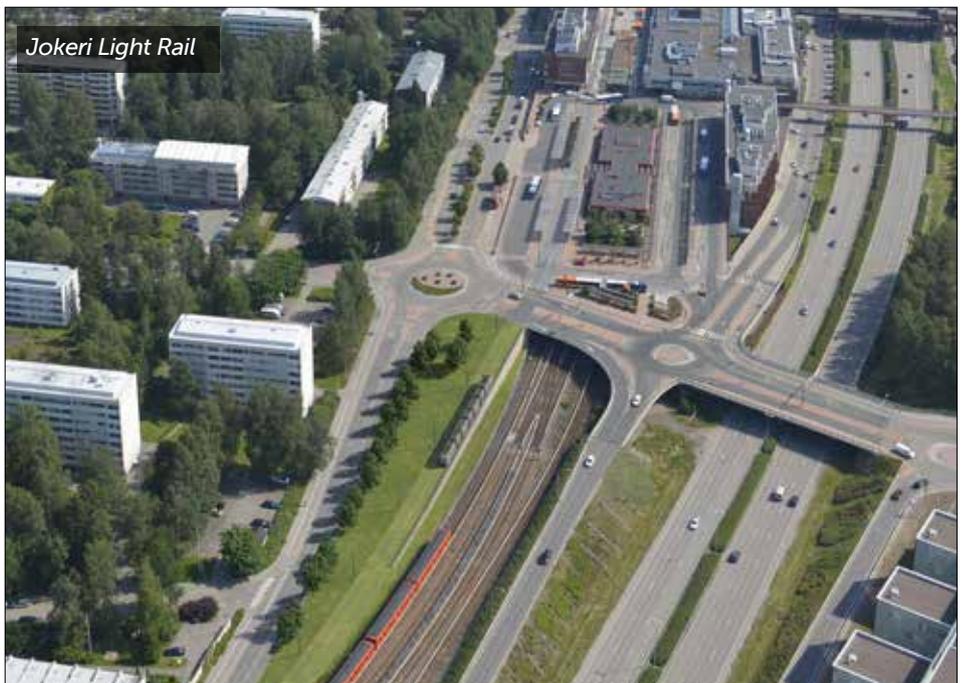
### FUTURE TUNNELLING ACTIVITIES

#### City Rail Loop Pissararata (Waiting for a decision)

- The City Rail Loop is a planned urban railway line for commuter trains under the Helsinki city centre.



Helsinki Metro Western



Jokeri Light Rail

- The city plan has been approved but the decision on the construction has not yet been verified.
- More info: <https://vayla.fi/pisara#.WgrnfU32SM8>

#### FinEst Link (Feasibility study):

- Information, statistics and research about the cities of Helsinki and Tallinn and the increasing mobility between them.
- A proposal to build an 85km under-sea railway tunnel linking Finland and Estonia
- Construction 2035-2045?
- More info: <http://www.finestlink.fi/en/>

#### Esplanadi waste water tunnel (Planning, waiting for a decision on construction)

- Improve wastewater service in the central city of Helsinki
- Length 1km

- Estimated cost of €5M

#### Garden Helsinki (Planning, waiting for a decision on construction)

- Event arena providing sports and culture events, shopping facilities, apartments
- Private funding
- Excavation volume of 800,000m<sup>3</sup>
- Construction 2020/2021
- More info: <http://www.gardenhelsinki.fi/en/>

#### Traffic tunnel in Sörnäinen (Planning, waiting for a decision on construction)

- Two parallel tunnels with length of 800m and excavation volume of 270,000m<sup>3</sup>
- Estimated cost of €160M
- Currently in the general planning phase
- Construction 2026-2030?

**Underground Distributor Street Project (Planning, waiting for a decision on construction)**

- Located in the central city
- Excavation volume of 2,000,000m<sup>3</sup>
- Length of 4,2km
- Construction: 2027 – 2032?

**Espoo – Salo -high-speed railway (planning)**

- 95km of new high-speed rail between Espoo and Salo
- Multiple tunnels with a total length of over 14km
- General planning phase was completed in 2020
- More info: <https://vayla.fi/kaikki-hankkeet/espoo-salo-oikorata>

**Underground Parking hall for hospitals in Laakso (Planning, waiting for a decision on construction)**

- Underground parking for 550 cars under a future hospital area

**STATISTICS**

**Underground (UG) Spaces in Helsinki with Rock Surface:**

1. Area 2,073,725m<sup>2</sup> = 2,074km<sup>2</sup>
2. Volume 12,657,457m<sup>3</sup> = 117\*
  - UG spaces altogether 336 pieces
  - Helsinki’s surface area 215,12km<sup>2</sup>
  - 1M<sup>2</sup> UG space for each 100m<sup>2</sup> surface area i.e. 1%
3. Tunnels altogether 293km
  - 194km of technical tunnels
  - 34km of traffic tunnels
  - 30km of tunnels with secondary purpose as emergency shelters
  - 14km of parking caverns
  - 22km of tunnels for other purposes.



**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Aalto University**
- GEO-E1010 Engineering Geology
  - GEO-E1040 Rock Excavation
  - GEO-E2030 Rock Mechanics
  - GEO-E2040 Rock Construction
  - GEO-E2060 Seminar in Geoen지니어ing
  - GEO-E2090 Project Course in Geoen지니어ing
- University of Oulu**
- Rock Mechanics
  - Mining Technology
  - Rock Blasting
  - Applied Rock Mechanics
  - Rock Dynamic and Applications

- Tampere University**
- RAK-22410 Rock Engineering
  - RAK-23410 Advanced Course in Bedrock Engineering
  - RAK-22411 Introduction to Rock Engineering
  - RAK-23420 Design of Rock Engineering Structures
  - RAK-23430 Construction of Rock Engineering Structures
- Lapland University of Applied Sciences + Kajaani University of Applied Sciences**
- Rock Excavation and Mining Technology
  - Rock Engineering

- Metropolia University of Applied Sciences**
- Soil and Rock Construction
- Saimaa University of Applied Sciences**
- Rock Excavation and Safety Regulations for Blasting Works
  - Underground Excavation and Rock Reinforcement Methods
  - Rock Mechanics
- Turku University of Applied Sciences**
- Rock Engineering

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# ITA moves to digital events

In the current context of the health crisis linked to Covid-19, it has become impossible to organize face-to-face events.

Based on this observation, the ITA had to rethink its strategy and decided to focus on the implementation of new event formats. ITA intends to maintain the social distancing measures recommended by the World Health Organization and the various governments impacted by the pandemic.

To continue to maintain the link with the Tunnelling family in these troubled times, ITA will develop physical gatherings into digital events. ITA will intensify the planning of webinars and develop distance learning courses. Scheduled for the end of the year, the 6th edition of the ITA Tunnelling awards will also be held in digital format.

Finally, we look forward to see you next year in Copenhagen, Denmark for the World Tunnel Congress 2021.

# France



**Name:** French Tunnelling and Underground Space Association (AFTES)

**Type of Structure:** Non-profit, open association

**Number of Members:** 1062 members (including 133 corporate members and 94 young members or students)

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### International Partnership

- May: ITA WTC in Naples
- June: BEFIPS and DACH meeting in Luzern during the Swiss Tunnel Congress
- October: European Underground & Tunnel Forum (EUTF) meeting in Lisbon, Portugal

### Technical Day Conferences

- March: The new metro projects in Paris, Marseille, Lyon and Toulouse
- May: Underground space and urban planning
- June: Very deep tunnels (organized with the French rock mechanics society)
- September: Construction machinery and equipment for conventional tunnelling

### Young Members Events:

- February and July: Worksite visits
- June and October: Technical events

### Evening Conferences and Visits

- February: The launch of the construction of Line 18 of Grand Paris Express
- March: Refurbishment of the Caluire Tunnel (visit)
- April: West extension of RER line E in Paris (visit)
- May: The underground law and presentation of line 16 du Grand Paris Express
- October: Cavern and tunnel on the CERN site in Meyrin in Switzerland (visit)
- December: Health and safety in urban tunnelling

### Education in Tunnelling

- Action 1: Initial training (Post graduate master's course « TUNNELS AND UNDERGROUND STRUCTURES from design to operation » Promotion 8 (9 students): 9 graduates - Pro Licence «Underground Works and Geotechnical Works» Promotion 3 (4 students): 4 graduates)

- Action 2: Lifelong learning
- Action 3: Public students
- Action 4: Research

### TES Review (Tunnels and Underground Space) Main topics:

- TES 267: Techniques of shafts
- TES 268: Deep shafts
- TES 269: Rock blasting
- TES 270: Explosive risk management

### Technical

- 2 recommendations:
- GT35: Management and use of excavated materials
  - GT16: Impact of tunnelling on surrounding constructions

## CURRENT TUNNELLING ACTIVITIES

### Grand Paris

- 16 active TBMs:
- 8 on line 15 South,
- 3 on line 14 South
- 4 on line 16
- By 2022, there should be up to 22 TBMs.

### Lyon Sytral

Extension of subway line B with a total length of 2.4km due for commissioning in June 2023. Construction of the shaft and the stations in 2019 - TBM assembly is underway for a late 2019 start up to the end of 2020.

## FUTURE TUNNELLING ACTIVITIES

### Grand Paris

- Metro line 15 South: 33km - 16 stations
- Metro line 16: 29km - 9 stations
- Metro line 17 North: 20km - 6 stations

### Toulouse

- 3rd metro line: 27km - 21 stations - Line between line A, line B and rail. Five railway stations and two metro lines will be served.
- CLB (Connection Line B): Project to extend line B to the south, which must allow a connection with the 3rd line.

### Lyon

Metro line E: From Alaï to Bellecour or from Alaï to Hôtel de Ville - 6.5km and 5 to 7 stations.

### Marseille

Extension of line 2 east of Marseille, from the current terminus Dromel/Sainte-Marguerite - Line would therefore cover a total of 15km, including an underground section with a length of 4.8km.

### TELT (France)

TELT - Tunnel Euralpin Lyon Turin: 2 x 50km in tunnel.



# Germany



**Name:** Deutscher Ausschuss für unterirdisches Bauen e. V. (DAUB, German Tunnelling Committee)

**Type of Structure:** Registered non-profit and restricted association (limited to 30 individual members)

**Number of Members:** 30 members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### Activities

- STUVA Conference '19, Separate Segments on "Tunnelling" and "Tunnel Operation", attended by more than 2000 participants and approx. 200 exhibitors, 26–28 November 2019, Frankfurt
- DACH-meeting (German, Austrian, Swiss Tunnelling Committees) in Switzerland (technical seminar and site visit)
- Meeting and inauguration of a European Underground and Tunnel Forum (EUTF, consisting of Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain and Switzerland)
- Regular Meetings of Tunnel Committee and Working Groups
- Several Meetings with workshops of Young Engineering Professionals "STUVA-YEP"

### Working Groups

- Recommendations for contracts with low potential for conflicts
- Life-cycle costs calculation
- Face Support Pressure Calculations for Shield Tunnelling in Soft Ground
- Design, production and installation of segmental rings
- External communication of DAUB
- Digitization and Building Information Modelling (BIM) in tunnelling
- Selection of tunnelling machines (TBM)
- Planning and implementation of occupational health and safety concept on underground worksites
- Standardization needs for the design of underground structures

### Publications (recently finished)

- Recommendations for the Life Cycle Costing of Road Tunnels
- Recommendation BIM in Tunnelling
- Recommendation for Gasket Frames in Segmental Linings

### Publications of DAUB can be found in/on

- Journal "tunnel" ([www.tunnel-online.info](http://www.tunnel-online.info))
- German Handbook of Tunnelling ("Taschenbuch Tunnelbau", published annually)
- Recommendations are available for download from website ([www.daub-ita.de](http://www.daub-ita.de), [www.stuva.de](http://www.stuva.de)); the majority is bi-lingual (German/English)

### Future Activities

- Regular meetings with Austrian, Swiss and EUTF colleagues
- Munich Tunnel Symposium, 8 May 2020
- InnoTrans, Tunnel Forum, 22–24 September 2020, Leading int. trade fair for transport technology
- Sealing of buildings by injections; Information on afterwards sealing of concrete structures, geotechnical sealing injections, 4–5 November 2020
- STUVA-Conference 2021, Separate Segments on "Tunnelling" and "Tunnel Operation", 24–26 November 2021, Karlsruhe

### CURRENT TUNNELLING ACTIVITIES

About 190km of traffic tunnels are under construction in Germany in 2019.

- This year, the main activities relating to inner-urban rail tunnelling are taking

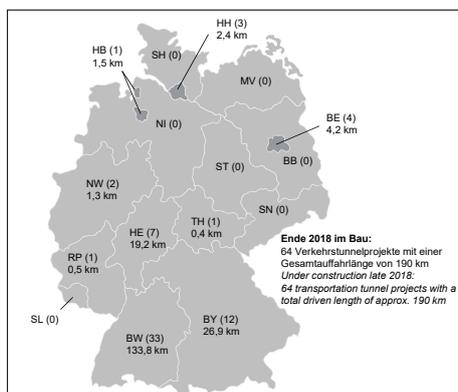


Fig 1. Length-related classification according to federal states for transportation tunnel projects under construction, with the number of tunnel projects given in brackets.

place in Munich, where some 13.8km of urban and underground tunnels are under construction at the turn of the year 2018/19. Due to the official start of construction for the second core S-Bahn route ('S-Bahn-Stammstrecke') the construction volume has more than doubled, although the excavation works haven't started yet. This is followed by Karlsruhe (4.7km), Frankfurt/Main (4km), Berlin (3.5km) and Stuttgart (2.9km). Further tunnel projects amounting to less than 2km are underway in Nuremberg, Hamburg and Dortmund.

- The main-line rail tunnels largely relate to DB Netz AG tunnelling works in and around Stuttgart. Of the tunnelling projects currently being implemented (a total of 119km), almost 51km are accounted for by the major project "Stuttgart 21 rail hub" and some 57km by the new Wendlingen–Ulm rail route. Further 9km of main-line tunnels are being constructed in conjunction with the upgraded/new Karlsruhe–Basle section. Currently, 32% of main-line tunnels are built by the classical shotcrete method, whereas TBMs are applied for 61% of the driven volume.
- The drive-up length in road tunnel construction in 2019 was approx. 39km throughout Germany. About 50% of the driven length was accounted for by the two southern federal states of Baden-Württemberg and Bavaria. About two thirds of all road tunnels are built by underground methods. The shotcrete method predominates in the majority of those tunnelling projects.

### FUTURE TUNNELLING ACTIVITIES

About 203km of traffic tunnels are projected but not yet started in 2019.

- Compared to last year's figures, there has been a significant decrease in the

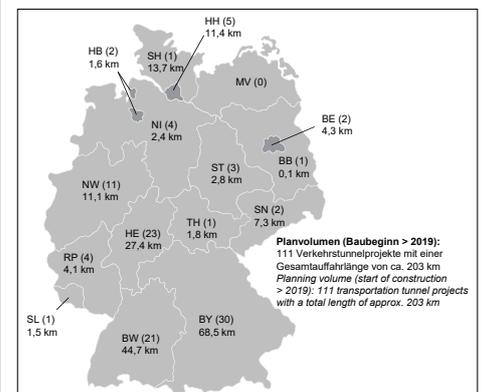
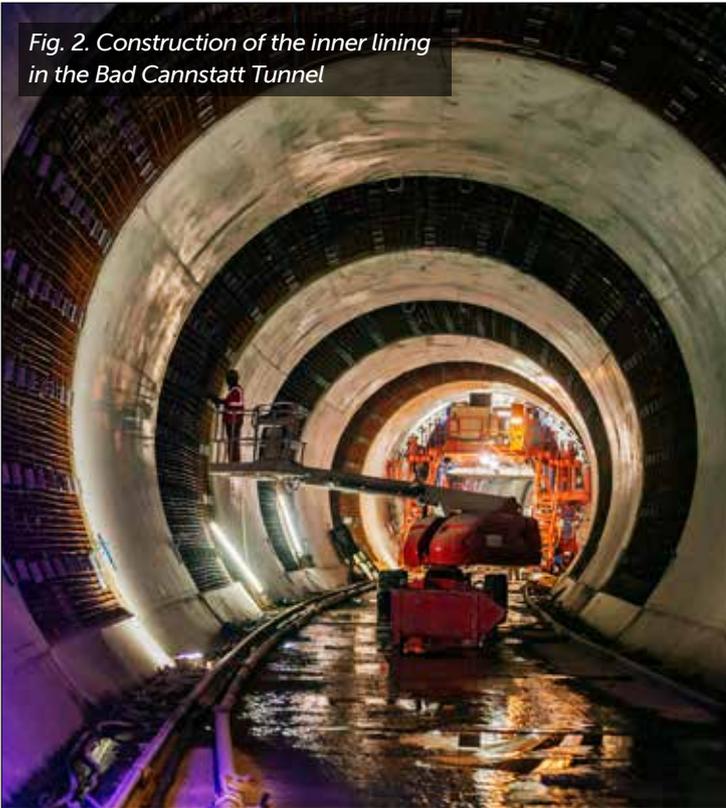


Fig 3. Length-related classification of planned transportation tunnels according to federal states, with the number of registered transportation tunnel projects given in brackets.

Fig. 2. Construction of the inner lining in the Bad Cannstatt Tunnel



planning volume of inner-urban rail tunnels, mainly due to fluctuation in the awarding process. In this context, the high planned volume for the city of Munich, comprising a good 24km, is still conspicuous among the listed projects. Almost 9km of tunnels are being planned for the Hamburg Metro (partly at the pre-planning stage). Leipzig is engaged in pre-planning 7km. Further tunnelling activities involving less than 3km are foreseen in the cities of Frankfurt/Main, Nuremberg, Berlin, Düsseldorf, Stuttgart and Dortmund.

- Regarding the planned volume of main-line rail tunnels, it should be noted that practically the half is accounted for by the tunnels approved for the new/upgraded Karlsruhe–Basle rail line (driven length: 19km). Further tunnels are planned in conjunction with the new/upgraded Rhine/Main–Rhine/Neckar route (9km), the Nuremberg–Fürth rail line (7km) and the new/upgraded line Nuremberg–Marktreditz (5km).
- The planned volume of projected road tunnels (106km) has again decreased slightly, due primarily to a lack of awards. On account of the German state's revamped planning requirements, the scheduled volume has dipped considerably in recent years.

## STATISTICS

See sections above, for detailed analysis, figures and tunnel lists visit: <https://www.stuva.de?statistik>

## EDUCATION ON TUNNELLING IN THE COUNTRY

Many Universities and Universities of Applied Sciences offer numerous courses on tunnel related topics and provide extensive possibilities for interested persons (see e.g. MSc "Geotechnics and Tunneling", 4 Semester Mastercourse in German language at the Ruhr University Bochum, BSc Civil Engineering required)

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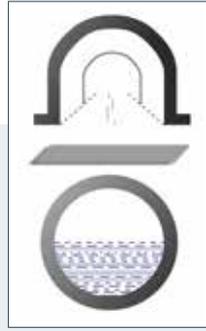
Go to [www.bekaert.com/underground](http://www.bekaert.com/underground) and get in touch with your local underground expert.

# Greece

**Name:** Greek Tunnelling Society

**Type of Structure:** non-profit association with membership

**Number of Members:** 250 members, 14 corporate members



## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

The Council Board executed monthly meetings for the organization of GTS activities. Currently GTS sponsors include "ATHENS METRO S.A.", TERNA S.A., PPC S.A., INTRAKAT S.A., NAM S.A., SIKA, MAPEI, AKTOR S.A., HILTI, GRECIAN MAGNESITE, ELTERGA, EDAFOS Engineering Consultants S.A, GR8 GEO.

A half-day conference was organized on the 16th-1-2019 titled "Licensing - Monitoring/Surveillance Methods - Experiences from the Operation of the Greek Tunnels Motorways". The lectures were delivered by representatives of the main motorway concessionaires as well as by a representative of EGNATIA ODOS S.A.

Between 6 – 8 November 2019 the Hellenic Conference on Geotechnical Engineering was held which included a special session on tunnelling.

On the 6th of December 2019 the GTS celebrated St Barbara's day with a technical visit to the new Piraeus METRO station. More than 60 members attended the site visit and the lectures for the presentation of the project at the construction site.

Three issues of the electronic magazine of the Greek Tunnelling Society were published. The Young Members Group promoted tunnelling news, research results, new projects etc, both in Greece and abroad via social networks (facebook page).

During 2019 the GTS created a scientific group of national and international tunnelling and underground space experts and submitted on 10-1-2020 a bid to host - for the first time in Greece - the World Tunnel Congress in 2023. The proposed host city for WTC2023 is Athens (<https://athenswtc2023.gr/>)

## CURRENT TUNNELLING ACTIVITIES

### ATTIKO METRO (Athens METRO)

Since March 2012, the METRO Line 3 extension to Piraeus has been under construction and approaches completion.

The 7.6km long new Metro line 3 will consist of 6 modern Metro Stations. 6.5km of the tunnels were constructed using TBM. The Metro Extension to Piraeus will serve approximately 132,000 passengers on a daily basis. Tunnelling excavation works are complete, and works are currently under way for the construction of the stations.

### Thessaloniki METRO

The first Metro Line of the second largest city of Greece, Thessaloniki, is under implementation. The project includes 18 underground stations, ~14.4km of tunnelling and a 50,000m<sup>2</sup> depot in Pylea area. Approximately 80% of the total tunnels' length were constructed using two EPBMs. The excavation and final lining installation of the twin single-track tunnels has been completed. State of the art construction methods, driverless trains and modern operation systems were specified and implemented. The Project focuses on minimizing the impact on the highly congested streets of the Thessaloniki City Centre and on providing safe transportation services to the densely populated urban areas. The Metro line alignment was designed at significant depths in order to minimize the possibility of interventions with

archaeological findings which were expected to be encountered within the historical centre of Thessaloniki.

### Central Athens railway Station – Three bridges area.

The €66M project, assigned to INTRAKAT – SIDIRODROMIKA ERGA JV, involves the construction of a 2.36km long four-track rail corridor, 60% of which will be fully underground.

### Xanthi – Echinus – Greek/Bulgarian borders road axis (Vertical axis 70 of Egnatia Highway)

The construction of two tunnels, approximately 120m long, along the new highway connecting Xanthi – Sminthi – Echinus - Greek-Bulgarian borders is near completion in the area of the Dimario-Greek/Boulgarian borders, while two others (475m and 170m) will be constructed to mitigate severe landslide areas.

### Athens – Patras railway: Psathopyrgos – Patras (Bozaitika area) section

The project involves the construction of the new 10.5km double-track railway line. It includes works Installation of the track bed of the new railway line, approx. 10.5km long, as well as construction of structures, the most important of which are 2 Cover & Cuts, one in Ag. Vassileios area, 625.97m long, and one in Rio area, 392.20m long; 9 Railway Bridges and approx. 33 Overpasses of the intersecting road network, and 3 Road Bridges for the side road network

### Athens – Patras railway: Rododafni – Psathopirgos section

The project involves the construction of the infrastructure for the new double



railway line, 21.5km long, between ch. 91+500 to ch.113+000. It includes the Panagopoula twin tunnels (each approximately 4.800m long).

### Central Greece Motorway (E65) – Lamia – Xyniada Section

The project concerns the construction of the south section of the Central Greece Motorway. It includes a twin tunnel with a total length of approximately 3km.

### Halkidiki mining project

The north-eastern side of Halkidiki, in northern Greece, has a long history of mining activity. Currently three exploitation areas exist namely Olympiada, Skouries and Straton. The overall development of Kassandra mines is considered as a mega-project with numerous challenging civil works (surface and underground) and earthworks. In underground infrastructure, the most notable works completed or currently under construction include the Kokkinolakkas stream diversion tunnel, 1,140m long, the Olympias main access tunnel, ~9km long, the Skouries spiral decline, ~5.5km long and the Skouries access shaft, ~700m deep.

### FUTURE TUNNELLING ACTIVITIES New Athens Metro Line 4 - Section A "ALSOS VEIKOY – GOUDI"

The €1.6bn budgeted Design and Built Contract concerns a new Metro Line in the city of Athens. The 13km long, fully automated new METRO line 4, will consist of 15 stations. The project includes tunnelling works, underground stations, station fit-out, mechanical and electrical systems, rail Infrastructure and rail systems.

The U-shaped Line 4 consists of two radial branches to Galatsi and Maroussi municipalities, as well as of one central section that runs through Athens City Centre. Tender award of the first phase of Line 4 is currently ongoing (from Alsos Veikou to Goudi). The scope of the project is to cover the foreseen ridership of 8,000 passengers at peak hours in the section with the highest passenger load per direction in 2030, as well as the ridership of 13,000 passengers/peak hour/direction in the longer run.

### Underwater road link connecting Salamina - Perama in Attica region – Estimated cost ~ €400M.

A competitive dialogue process is underway between the preferred three interested parties. The project concerns



the design, construction, financing, operation, maintenance and exploitation of an approximately 15km long highway which includes a 1.2km long immersed tunnel and three tunnels with a total length of 2km.

### Northern Road Axis of Crete island (NRAC)

A concession project concerning the design, construction, financing, operation, maintenance and exploitation of an approximately 200km long motorway which includes a significant number of tunnels (total length ~ 30km single tube). The project is split in 2 separate competitions: i) a concession agreement for the section between Chania and Hersonissos, and ii) a PPP project for the Hersonissos-Neapolis section. The cost has been estimated at around €1.1bn for the concession project and €359.6M for the PPP project. The tendering process involves a Competitive Dialogue. Currently the Contracting Authority (the Ministry of Infrastructure and Transport) is examining the technical skills of the interested parties.

### Immersed road tunnel connecting Lefkada island – Aetoloakarnania region

A project which is currently in the planning stage and concerns the design, construction, financing, operation, maintenance and exploitation of an approximately 4km long high-way that

will connect Lefkada island of the Ionian Sea with the Greek mainland. It will include a 0.8km long immersed tunnel as well as 0.5km long entrance and exit, partially Cut & Cover, works are in an environmentally sensitive and seismic active area.

### Motorway Tunnels along the new Elefsina – Thiva – Yliki Road Section

The new motorway, which is currently in the planning stage, includes the construction of three (3) new tunnels with a total length of 5km.

### Urban tunnels in the Metropolitan area of Athens

The implementation of the Athens Metropolitan area Master Plan requires some new road tunnels, which include: i) The 3km long Ilioupolis urban tunnel ii) The 2km long motorway tunnel that will connect Attiki Odos (highway) and Rafina port and iii) The 2.2km long double tube Kimis Urban tunnel that will connect Attiki Odos (highway) with Athens – Thessaloniki highway.

## STATISTICS

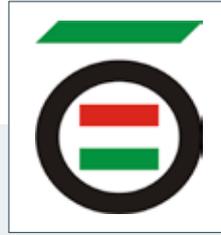
- 1. Length or volume excavated - % mechanized/% conventional during 2019**  
0%
- 2. Amount (USD or EUR) of tunnelling/ underground space facilities awarded in 2018**  
No available data
- 3. List of tunnels under construction**  
Athens METRO extension to Piraeus, Thessaloniki METRO, Othris mountain twin tunnels (E65 motorway), tunnels along the Dimario-Greek/Bulgarian borders road section, tunnels along the Rododafni - Patra (Bozaitika area) new railway section and some other hydraulic and railway tunnels in the Attika region.

## EDUCATION ON TUNNELLING IN THE COUNTRY

### National Technical university of Athens

Postgraduate Course  
Design and Construction of  
Underground Works  
Schools: Mining and Metallurgical  
Engineering Civil Engineering (more  
info: <http://tunnelling.ntua.gr/>)

# Hungary



**Name:** Hungarian Tunnelling Association

**Type of Structure:** non-profit, open association

**Number of Members:** 57 members, 21 corporate members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- In 2019 the Association held two General Assemblies: The annual General Assembly of the Association was held on 1st of March, and the other one was held on 10th of May.
- The XXVth Károly Széchy Memorial Lecture was held at the Hungarian Academy of Sciences in February 2019.
- Geotechnical Conference 2019 (7-9 October 2019)
- Saint Barbara Day, Annual Closing Ceremony of our Association (5th December).

Several activities, like Lectures and Presentations at engineering events were developed through 2019.

## CURRENT TUNNELLING ACTIVITIES

- Expressway M85 Sopron Bypass, features a tunnel under Bécsi hill: preparatory work is underway for the tunnel construction. Please see the pictures below.

- Reconstruction of the M3 metro line in Budapest – South section: Reconstruction between Nagyvárad square and Kőbánya-Kispest metro stations. Under construction.
- There are pending infrastructure investment plans with tunnels in different phases of planning:
  - a.) Expressway M100 between Esztergom and the motorway M1: planning in early stage.
  - b.) Budapest, reconstruction of the Váralagút tunnel: construction design is finished, no information about the construction date available as yet.
  - c.) Nuclear waste disposal at Bataapáti: I-N1 and I-N2 chambers → construction planning just started.

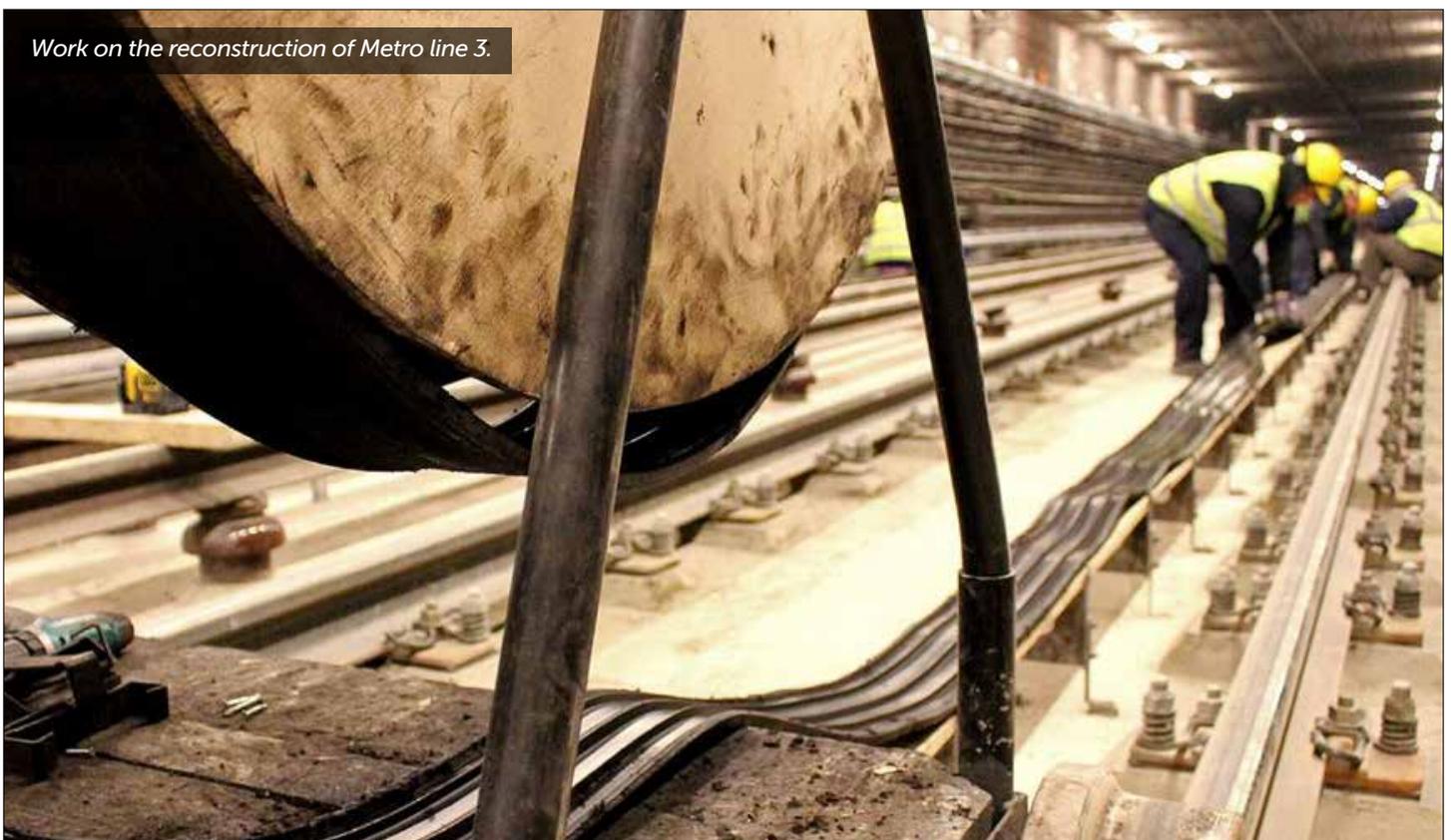
## FUTURE TUNNELLING ACTIVITIES

- Expressway M85, Sopron bypass, Tunnel under Bécsi hill: construction will continue.

- Reconstruction of M3 metro line in Budapest – South section: reconstruction between Nagyvárad square and Kőbánya-Kispest metro stations. Construction will be continued and hopefully it will be completed in 2020.
- There are pending infrastructure investments featuring tunnels in different phases of planning:
  - a.) Expressway M100
  - b.) M1: planning in the early stage will continue.
  - c.) Bataapáti: I-N1 and I-N2 underground chambers → construction planning will continue.

## STATISTICS

1. Length or volume excavated - % mechanized/% conventional during 2019  
0%
2. Amount (USD or EUR) of tunnelling/ underground space facilities awarded in 2019  
0
3. List of tunnels completed:  
No completed tunnels
3. List of tunnels under construction  
Expressway M85, Sopron bypass, Tunnel under Bécsi hill: preparatory work underway for tunnel construction



Work on the reconstruction of Metro line 3.

# Iceland



**Name:** Icelandic Tunnelling Society

**Type of Structure:** Independent Society of corporate and ordinary members, founded 1974

**Number of Members:** 55 members, 17 corporate members.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Three board meetings and an annual meeting with invited speakers. In addition, one lecture with invited speaker.

## CURRENT TUNNELLING ACTIVITIES

The Dyrafjordur tunnel, a 5.6km long, 50m<sup>2</sup>, road tunnel in the Westfjords in north west Iceland which lies between two fjords, Arnarfjörður and Dýrafjörður, and will, when opened for traffic, replace a difficult mountain road that is closed several days over winter due to heavy snow accumulation. It will shorten the travel distance along the main road linking the north and south

of the Westfjords by 26km. Excavation started in August 2017 and the opening is planned for September 2020.

## FUTURE TUNNELLING ACTIVITIES

Fjardarheidi road tunnel, a 13.5km long, 60m<sup>2</sup>, road tunnel in east Iceland. This road tunnel will replace a mountain road between Seydisfjord village at the fjord side to a larger inland community Egilsstadir. The present mountain road peaks over 600m a.s.l. and can be dangerous to pass for several days in winter due to icy road and sudden snowstorms. The tunnel will not only ease travel for locals but also for several tourists coming to Iceland by ferry from Europe (Denmark and Faroe

Island). Pre-design is ongoing. This will presumably follow with an environmental impact assessment and tender design in 2021. Possible start of tunnel excavation is assumed in 2022.

There are some underground hydroelectric projects planned but construction is not foreseen in the near future (next two years).

## STATISTICS

- 1. Length or volume excavated - % mechanized/% conventional during 2019**  
Approximately 1.2km, drill & blast
- 2. List of tunnels completed:**  
Dyrafjordur road tunnel, 5.6km

## EDUCATION ON TUNNELLING IN THE COUNTRY

No special education on tunnelling except for a traditional education in engineering and geological courses (University of Iceland and University of Reykjavik).

# Iran



**Name:** Iranian Tunnelling Association (IRTA)

**Type of Structure:** non-profit, open association

**Number of Members:** 800 (non-student) members, 519 student members, 190 corporate members.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- Publishing Quarterly "Tunnel" Magazine
- Publishing bi-annual "Tunnelling and Underground Space Engineering" Journal together with Shahrood Technical University
- Holding a total of 6 technical seminars
- Holding the 13th Iranian Tunnelling Conference (ITC 2019) on 19-20 November 2019 entitled "New Horizons in Tunnelling"
- Holding 4 workshops as a side program to ITC 2019

## CURRENT TUNNELLING ACTIVITIES

### Water transfer tunnels

- The Kerman water tunnel with a total length of 38km is under construction

using two DS-TBMs. This tunnel will transfer 700Mm<sup>3</sup> water from Safa dam to the city of Kerman.

- Azad Water tunnel transfers water from Azad dam to Ghorveh-Dehgan

in Kordestan Province. The total length of the tunnel is 10.8km and is being constructed with an EPBM.

- The Sabzkouh water tunnel is being constructed to transfer 75Mm<sup>3</sup> of water to Choghakour dam. The total length of the tunnel is 10.7km and is being constructed with an DS TBM.
- Gelass water tunnel is being constructed to transfer 650Mm<sup>3</sup> of water from Gelass River to Urmiah Lake. The total length of the tunnel is 35.7km and is being constructed with an DS TBM.
- Dez water tunnel transfers 24m<sup>3</sup>/sec from Dez Dam to Khuzestan



The portal of Konjan Cham tunnel Section KT2



Sar-e Pol-e Zahab tunnel (T4)



Compaction grouting in Sirvan River Water Transfer Tunnels T2

province. The length of the tunnel is 9.1km and being constructed using a DS TBM.

- Chamshir water tunnel transfers water from Chamshir dam to Liravy plain for agricultural purposes. The 7.1km long tunnel is being constructed using a hardrock TBM.
- Lar water tunnel in north of Tehran is being constructed in two sections to transfer 260m<sup>3</sup> of leaking water from Lar dam to Tehran's water treatment plant No. 5 and Latian dam. The first section is 20.3km long and the second 7.5km.

**Sewage tunnel**

- Tehran's western Sewage tunnel with a length of 10.8km is being constructed using and EPBM to transfer 17.22m<sup>3</sup>/sec of water to the water treatment plant in south of Tehran.

**Metro tunnels**

Construction of various metro lines in different cities in Iran is continuing. These include:

- Extension of Tehran metro line 6 –1840m were constructed in 2019

- Tabriz metro line 2 with a total length of 22.4km and 20 stations (being constructed by TBMs) 1500m were constructed in 2019
- Mashhad metro line 3 with a total length of 28.5km and 24 stations (being constructed by TBMs) – 3400m were constructed in 2019
- Shiraz Line 2 (double tube) with a total length of 26.2km (2\*13.1km) – 4120m were constructed in 2019
- Isfahan Line 2 with a total length of 24.7km is under construction – 4250m were constructed in 2019

**COMPLETED PROJECTS**

**Road tunnels**

- The Shoushtari tunnel is an 8km long tunnel forming part of the Shoushtari highway in Tehran which is currently under construction using conventional methods.

**Water tunnels**

- The construction of Zagros tunnel in the following sections has been completed in March 2019: Section T1-1A with a length of 13.7km; Section T1-1B with a length of 8.8km; and section T1-2 with a length of

- 25.7km (all constructed with DS TBM)
- Sirvan River Water Transfer Tunnels T2 with a length of 2.8km and T3 with a length of 1.5km constructed with conventional methods
- Sar-e Pol-e Zahab tunnel (T4) with a length of 4.3km constructed with an EPBM.
- Konjancham tunnel constructed with DS TBM was completed in the following sections: Section KT1 with a length of 4.9km and constructed with conventional method was completed in June 2019 Section KT2 with a length of 12km was constructed by a DS TBM and completed in March 2019
- Bazi-Deraz Tunnel (T5) with a length of 8.5km was constructed with an EPBM and completed in January 2019

**Road tunnels**

- First sector of Tehran-Shomal Freeway completed. This sector has a total length of 32km and consists of 40 tunnels (total length of 32km in two directions and also includes the longest service tunnel of the freeway namely Taloun tunnel with a length of 4900m)

**FUTURE TUNNELLING ACTIVITIES**

The following tunnel projects are planned (long term):

- Completing and expanding road and railway networks
- Completion and development of various metro lines in numerous cities (eg. Tehran, Tabriz, Karaj, Isfahan, Mashhad)
- Completion of water transfer tunnels

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Tunnelling as a specialized field of Study is being held at Postgraduate level (Master's Degree) in the following Universities:

- 1) Amirkabir University of Technology;
- 2) Shahrood University of Technology;
- 3) Tarbiat Modares University;
- 4) Urmia University of Technology.

Tunnelling is also taught at Bachelor level in form of study modules in Mining and Civil Engineering fields in numerous universities. Other related courses in Geotechnical Engineering (Soil mechanics, rock mechanics, Engineering Geology), Construction Management etc. are also offered in various universities.

# Italy



**Name:** Società Italiana Gallerie (Italian Tunnelling Society)

**Type of Structure:** Scientific, non-profit

**Number of Members:** About 800 members (inc. 80 corporate members)

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### Congress

**03-09/05/2019 World Tunnel Congress, Naples:** Tunnels and Underground Cities: Engineering and Innovation meet Archaeology, Architecture and Art, Naples

**03/12/2019 S. Barbara Congress & Adolfo Colombo Lecture:** L'ingegneria e l'imprenditoria italiana del secolo scorso: tra scienza, tecnica ed emozioni, Milan

### Technical Visits

The association also organized several technical site visits to relevant underground construction sites in Italy and abroad:

**22/02/2019** - Railway link Torino-Ceres

**12/04/2019** - Subway Line 1, Naples

**28/06/2019** - Subway Line 4, Milan

**12/07/2019** - High speed railway line Milano, Genova

**27/09/2019** - Brenner base Tunnel, Fortezza, Bolzano

**08/11/2019** - Fondo valle Sangro road SS652, Chieti

### Courses and Seminars

**04/04/2019** I reciproci apporti di scavi minerari e gallerie civili nel campo della geologia, geotecnica e delle tecniche costruttive, Politecnico di Torino

**03-04/05/2019 ITA-CET Course:**

Tunnelling 4.0 Information technology for the Design, Construction and Maintenance of Underground works, Naples

**04/05/2019 ITA-CET Course:**

Communication and stakeholders' engagements. Naples

**06/12/2019** 1st ITACET PhD Students conference, Politecnico di Torino

### Others

SIG is also a Sponsor of the Level II Masters in Tunnelling and Underground Constructions, at the Politecnico di Torino and at the Politecnico di

Milano and of the Level II Masters in Geotechnical engineering at the Sapienza University in Rome and at the Federico II University in Naples. These collaborations aim to bridge the gap between Universities and Industry and to support the growth of future industry leaders.

Since 1976, the Journal "Tunnels and Major Underground Works" is SIG's pride and glory. It is currently published once every three months and it reached issue 132 in December 2019.

The periodical presents technical and scientific articles, as well as Editor's letters, news about construction works and tenders around the world, bulletins from the Italian tunnelling market, reports on technical visits, scheduled training courses and international congresses.

The association members take part in the ITA-AITES working group (WGs) and in the SIG working groups. Members proactively collaborate with national and international colleagues to exchange expertise and experience, divulging technical, scientific and business know how in underground construction. SIG WG "Research" published in May 2019 the guideline on "Damages of segmental lining". A free copy can be downloaded from the SIG website.

The SIG YM Group, with 180 young tunnellers as of December 2019, actively supports SIG activities and connects young professionals from both University and Industry. The group has also established a fruitful collaboration with the other ITA Member Nation YM Groups.

SIG has also published, in May 2019, the booklet "The Italian Art of Tunnelling 2019" collecting statistics on existing Italian tunnels and technical sheets about construction technology in recent application.

In 2019 SIG organized the ITA-AITES World Tunnelling Congress in Naples, which was attended by nearly 2,700 participants, with 2000 of these delegates from 73 different nations. 230 exhibitors and sponsors, 730 scientific contributions, 180 podium presentations



and 400 e-poster presentations are some of the impressive figures of WTC. Additional special AAA (Archaeology, Architecture and Art) off-site events, including special sessions and keynotes, were arranged during the congress. Finally, a great social program was organized including a free concert at the San Carlo Theatre (one of the oldest opera houses in Europe) offered by the Association to all WTC attendees, on the 6th of May.

### CURRENT TUNNELLING ACTIVITIES RAILWAY PROJECTS

#### Milano – Genova High Speed Railway

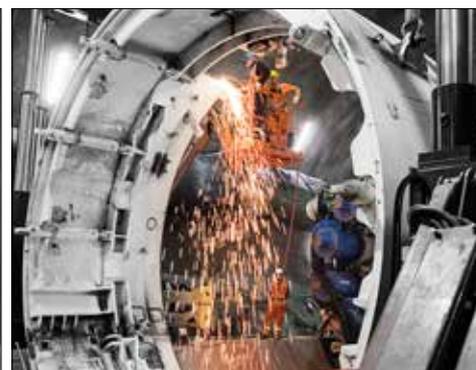
The project is part of the Rhine-Alpine Corridor on the trans-European transport network (TEN-T core network). The project involves the construction of two single-track tunnels, with a total length of 37km, connected by cross passages every 500m. The tunnels, which are excavated for 65% by conventional methods and 35% by TBM, are located in the complex Apennines range between Piedmont and Liguria.

#### Brenner Base Tunnel

The BBT runs for 55km between Tulfes/ Innsbruck and Fortezza and when considering the Innsbruck by-pass, it runs for a total 64km, making it the longest underground railway stretch in the world. The works include the construction of two single track tunnels (9m dia.) with underground safety areas every 20km and an exploratory/service tunnel (6m dia.). Two of the main sites are on the Italian side: Mules 2-3, which is the last stretch on Italian border; and the Section under passing the Isarco river, which is the southern segment of the tunnel before entering the station at Fortezza.

#### Turin – Lyon, Mont Cenis base tunnel

The new Lyon-Turin railway link is the main project of the whole Mediterranean corridor and is highly strategic as it is the missing link in the corridor which aims to connect southwestern Europe with Central and Eastern Europe. The Mont Cenis base tunnel includes two 57.5km long tubes, 45km on the French side and 12km on the Italian side, with about 170 communication bypasses located every 333m. Four intermediate accesses, five central ventilation systems and three underground security areas are also planned. Complementary works as the Maddalena survey gallery, in Chiomonte, Susa Valley, were completed in February 2017.



#### Napoli Bari High Speed Railway

It is included in the 'Scandinavia–Mediterranean' corridor of the Trans-European Railway Network (TEN-T) that, in Naples, sees the division of the Corridor in a southerly direction, with the stretch from Naples–Palermo, and to a south easterly direction with the Naples–Bari line. Seven functional and construction sections are foreseen for an overall cost of the investment of about €6bn: Napoli–Cancello, Cancello–Frasso, Frasso–Telese, Telese–Vitulano, Apice–Irpinia, Irpinia–Orsara and Orsara–Bovino with the first 2 sections currently under construction. The second two were awarded in summer 2019 and the last three close to the tender process. All sections have many kilometres in tunnels, under passing the Appennini mountain chain with difficult geological & geotechnical condition.

### CURRENT TUNNELLING ACTIVITIES HIGHWAY PROJECTS

#### Variante di Valico (A1 Bologna – Florence), Santa Lucia Tunnel

Extension of the Appennine section of the A1 motorway, between Bologna and Florence. The entire project consists of 66.6km with about 50% of the alignment excavated by TBM and conventional tunnelling. The Santa Lucia Tunnel length is about 7.6km and is excavated by an

EPB machine with a diameter of 15.87m, Europe's largest TBM.

### CURRENT TUNNELLING ACTIVITIES METRO PROJECTS

#### Naples Line 1 and 6

The Naples Metro Lines 1 and 6 are included in an integrated metro system serving the whole city that today embodies six underground railway lines and four funiculars. This is one of the largest infrastructure projects currently under construction in Italy and will see the service expanded with two rail lines, 93km of track and a further 30km of new light rail connecting 114 stations.

#### Rome Line C

Line C is the third Metro Line in Rome. It is one of the strategic infrastructure projects in Italy and is one of the biggest European construction projects. The overall investment is about €3.8bn. Line C is the first metro line in Italy to be fully automated. Line C crosses the entire city of Rome like a backbone, from the east to the north-west. It extends for about 25.5km (18km underground), with 30 new stations (20 underground).

#### Milan M4

The new Line 4, with a length of 15km is entirely underground from Linate to Lorenteggio. Currently the central stretch

passing through the historical city centre is under construction using 2 x 9.1m diameter EPBMs that allows one track plus a station platform in each tube to limit station works from the surface.

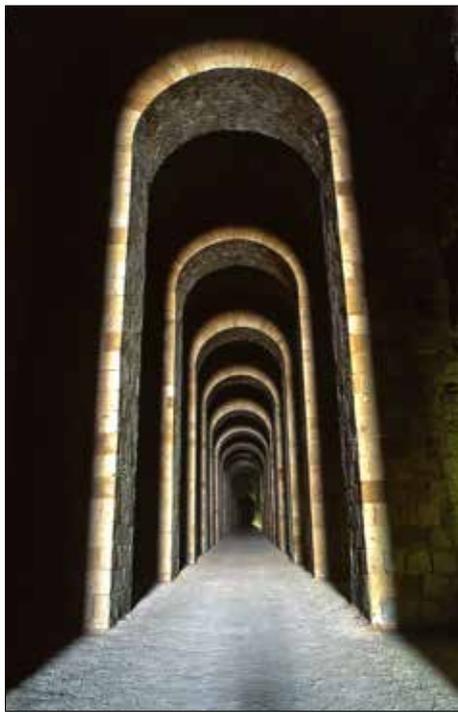
## FUTURE TUNNELLING ACTIVITIES RAILWAY PROJECTS

### Napoli Bari High Speed Railway

The alignment has an overall length of about 178km from Naples to Foggia and 121km of railway line must still be built for the completion of the line that will run mainly underground (about 68km in bored and cut and cover tunnels). As mentioned before the sections Irpinia-Orsara and Orsara-Bovino (40km) are close to the tender process with 37km out of 40km in tunnel. The most complex underground works are in these two sections, not just for the length of the longest tunnel (with 27km length Hirpinia Tunnel will be the longest railway tunnel in Italy), but mainly because of the geological and geotechnical context in which tunnels have to be constructed. The Hirpinia tunnel crosses reliefs in the Southern Apennines with structurally complex formations (scaly clay) featuring methane gas and a high level of tectonisation with particularly critical mechanical behaviour due to swelling and squeezing condition together with geomorphological conditions linked to a high level of surface erosion and slipping and complex landslides typical of Apennine reliefs and the high seismic condition. The completion of the work is scheduled for December 2026.

### Palermo-Catania-Messina new railway line

The Palermo-Catania-Messina line is part of the Scandinavian-Mediterranean Core Corridor no. 5 (Helsinki-La Valletta) of the Trans-European Networks-Transport (TEN-T). The alignment has an overall length of about 180km from Fiumetorto (close to Palermo) to Catania and a length of 42km between Fiumefreddo (close to Catania) and Giampilieri (toward Messina). Eight functional and construction sections are foreseen for an overall cost of the investment of about €8bn. Nearly 50% of the alignment will be built in tunnel and all the tunnel sections (7 out of 8) are currently in an advanced design phase. The tender process for the first tunnel sections (Fiumefreddo-Giampilieri with 37km of tunnels out of 42km of line and with the new underground railway station of Taormina), is scheduled in summer 2020.



### Verona-Fortezza new railway line

As part of the Southern Access to the Brenner Base Tunnel, four functional lots have been identified, giving priority on the sections that currently have limits of performance and speed. The section n. 1 from Forteza to Ponte Gardena has a length of about 23km. The final design has been completed and the tender (design and build) is scheduled in summer 2020. The section includes the Scaleres Tunnel (about 16km long), and the Gardena Tunnel (about 6km long), separated by a short stretch on a viaduct crossing the Isarco River. The overall development of all the underground works is approximately 62km, including the two twin-bore tunnels, connection tunnels, lateral adits and complementary works. The main tunnels will be bored with a maximum overburden of 800m, in the Bressanone Granite and Quartz Phyllites with good geotechnical properties, except for fault zones. Both conventional and TBM excavation is foreseen.

## FUTURE TUNNELLING ACTIVITIES HIGHWAY PROJECTS

### Gronda di Genova

The project, called "Gronda di Ponente", foresees the construction of a new carriageway, the widening of the existing A10 highway in the section which crosses the municipality of Genoa, as well as the strengthening of the A7 and A12 highways. The project consists of over 70km of road, of which 53km are in tunnels, 25 tunnels, of which 12 on the highways and 13 on the interchanges, 21 bridges and viaducts, of which 11 are new and 10 are existing.

## FUTURE TUNNELLING ACTIVITIES METRO PROJECTS

### Rome Line C

The T3 extension is currently in progress (3km of twin single-track tunnels, 2 new stations and 2 multi-functional shafts) in the historical centre of the city. In 2018 the two EPBMs started from San Giovanni Station toward the Fori Imperiali Area; in mid 2019 the TBMs passed near the Colosseo and the Basilica di Massenzio: important consolidation and protection interventions have been carried out to protect the archaeological and monumental heritage. Currently the TBMs are approaching to Piazza Venezia.

### Metro 2 Torino

The first phase of the preliminary design of line 2 of the Turin Metro (MTO2) was completed in November 2018. The final route of the MTO2 is about 27km long with 33 planned stations. The alignment will connect the south-west side of Turin city (Orbassano) with the north and north-east areas of San Mauro T.se and Rebaudengo, crossing the metro line 1 in the Porta Nuova railway station. The construction works of the line will start in 2022 and the completion is expected by 2038.

## STATISTICS

- 1. Length of tunnels excavated in 2019**  
TBM – 32.5km/Conventional – 13.6km
- 2. Amount (EUR) of tunnelling/ underground space facilities awarded in 2019:**  
€1bn

## EDUCATION ON TUNNELLING IN THE COUNTRY

- Politecnico di Torino, Turin – Master in "Tunnelling and Tunnel Boring Machines"
- Politecnico di Milano, Milan – Master in "Tunnel Engineering"
- Università di Roma "Sapienza" – Master in "Geotechnical Design"
- Università di Napoli "Federico II" – Master in "Geotechnical Engineering for Infrastructures"

### Master degree level

- Politecnico di Milano, Milan
- Politecnico di Torino, Turin
- Università di Roma "Sapienza"
- Università di Napoli Federico II
- Università di Bologna "Alma Mater Studiorum"
- Università Politecnica delle Marche

# Japan



**Name:** Japan Tunnelling Association

**Type of Structure:** Non-profit, Organization

**Number of Members:** Total number 1,236 (203 corporate members)

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

WGs: JTA consists of the following four committees and each committee has WGs and task forces. Technology/International Communication /Events/Public Relations. In each committee, the main activities are:

- Investigation, research and information interchanges on general techniques and on subjects of specific projects.
- Meetings such as lectures, symposiums, workshops, training and site visits
- "Two-days seminars", "Site Visits" and "Lectures on topics of the year" (organized by Events committee)
- Publication of reports and documents - monthly journal "Tunnels and Underground"
- International cooperation

## CURRENT TUNNELLING ACTIVITIES

### Tachiaigawa Rainwater Discharge Tunnel project

Tachiaigawa River is a small - medium-sized river of 8m width and 750m long. It has issues with flooding and water quality deterioration caused by rainwater. The Tachiaigawa Rainwater Discharge Tunnel project was put forward by Tokyo Metropolitan Government Bureau of Sewerage to handle these issues. The project consists of two segmentally lining tunnels, each with an i.d of 5m and a length of approximately 780m. A remarkable feature of this project is that the twin-bored tunnels were excavated simultaneously using a special slurry shield TBM, called an H&V (Horizontal variation & Vertical variation) shield tunnelling machine, which consisted of two circular machines jointed to each other. Due to constraints from existing underground structures and land boundaries, the project adopted the first spiral excavation in the world, which rotated one of the twin tunnels by 90 degrees around the other during 137m of drilling. This challenging operation required pin-point control to maintain the constant speed of the above rotation. Therefore, pre-analysis was executed with a simulator for an H&V

machine to optimize the attitude controls. As a result, the spiral excavation has been successfully completed within the control value of the tunnel alignment.

### Utilization of a Precast Concrete Lining (PCL) method in a Mountain Tunnel Project to Shorten Construction Time and Improve Productivity

In order to shorten the construction period, conventional methods such as cast in-situ concrete lining would have required several sets of formwork to operate simultaneously. However, in a relatively small tunnel dimension (less than 5m width), it is impossible for several sets of formwork to operate simultaneously since the flow of vehicles, concrete mixers and other machinery is restricted. The PCL method is considered to address this matter. PCL consists of arc-shaped precast concrete (PCa) plates divided into two installed on side walls that have been cast in-situ beforehand. After setting of PCa, concrete backfilling is carried out between PCa plates and the primary support. The positioning of the PCL is possible using mechanized construction without the need for highly skilled workers. Even though the material cost for PCL is higher than the conventional method, cost reduction can still be achieved by the reduction of the number of workers during the placing of the concrete. Moreover, since the PCa are factory-made, the risk of encountering problems such as filling failure of concrete can be reduced ensuring a high quality concrete lining.

## FUTURE TUNNELLING ACTIVITIES

### The Tokyo Ring Road (Kan-etsu Expressway – Tomei Expressway Section)

The Tokyo Ring Road, some 85km long, connects areas within an approximate 15km radius from the centre of Tokyo. By dispersing the inflow of traffic that passes through the centre of Tokyo, the Tokyo Ring Road will eliminate the chronic traffic congestion in the Greater Tokyo Area. By constructing the Kan-etsu Expressway – Tomei Expressway Section, it will not only alleviate traffic congestion, improve

environment, enhance international competitiveness, and revitalize of communities, but it will also allow Tokyo to continue to function as the capital in the event of a major disaster by facilitating smooth support and recovery operations. The Tokyo Ring Road (Kan-Etsu - Tomei) is the first expressway project in Japan to fully utilize its great underground area. For the section that runs between the Kan-etsu Expressway and Tomei Expressway, a 15.8m diameter deep-bore tunnel structure (up to 40m) has been adopted. The total length is approximately 16.2km, and the two main tunnels with three lanes each are to be constructed by shield machines of about 16m diameter, the largest cross section in Japan. The excavation started from both the north and south sides of the tunnels and 4 shield machines are now in operation. On the north side, the tunnel's starting shaft has been constructed, the machine assembly completed, and the initial excavation began from Jan. 2019. The drilling on the southern side started earlier on Feb. 2017 and as of Sept. 2019, the total excavated length is about 1.9km.

### Hokuriku Shinkansen

Hokuriku Shinkansen is a high-speed railway that covers 690km from Tokyo. The Shin-Hokuriku Tunnel, which is one of the tunnel sections under construction, is a 20km long large-scale mountain tunnel for multiple Shinkansen tracks. It is divided into six zones constructed

## STATISTICS

1. **Length or volume excavated**  
28% mechanized/59% conventional during 2019
2. **Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019**  
US\$38.6bn
3. **List of tunnels completed**  
-
4. **List of tunnels under construction.**

	No. of construction section	Total length (km)	Contract amount (US\$bn)
Road	234	354	20.7
Railway	74	213	6.2
Waterway	150	261	5.1
Overseas	22	93	4.8
Others	46	96	1.8
<b>Grand Total</b>	<b>526</b>	<b>1017</b>	<b>38.6</b>

by NATM. Construction works in these zones are under severe conditions due to its complex geological characteristics. Especially when excavating through a fault crush zone directly below an existing highway tunnel (about 40m below), increased safety consideration is necessary to not disrupt the highway,

which is an important trunk road. Finite Element Analysis has been conducted beforehand to assess the amount of settlement and pressure on the lining, along with plans to measure and compare during actual excavation. As of October 2019, 96% of the excavation of this tunnel is finished. The start of operation is

targeted at the end of the 2022 fiscal year for the section.

For the rest of the Hokuriku Shinkansen section, an Environmental Impact Assessment is now being carried out to specify the detailed route. It is planned to have several tunnel sections since it passes through urban districts.

# Kenya



**Name:** Tunnelling Association of Kenya  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 70 members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

TAK held its first training on Underground space use and tunnel project management on the 6th and 7th December, 2018 and attracted over 75 participants. The event was facilitated by the ITACET foundation with trainers Tarcisio Celestino (former ITA president), Olivier Vion and Han Admiraal. A second training on Introduction to Tunnelling – From Design to Construction was held on 5th and 6th December, 2019 also facilitated by the ITACET foundation by trainers Lars Babendererde, Gérard

Seingre and Maud Macary. This attracted over 90 enthusiastic participants.

## CURRENT TUNNELLING ACTIVITIES

There are a number of tunnels underway in Kenya and many more planned tunnels for road and rail transport. TAK intends to hold more training and networking events for its members comprising of professionals from various disciplines involved in the planning design and construction of tunnels. TAK further intends to engage in a rigorous outreach program to various

engineering institutions with a view of sharing knowledge and shaping the future Engineers in the field of underground space use.

## EDUCATION ON TUNNELLING IN THE COUNTRY

There are no courses in Kenya at the moment focused specifically on tunnelling but there are courses that offer relevant modules such as geotechnical engineering, soil mechanics, foundation engineering and so on. Universities in Kenya that offer such courses in Certificate, Diploma, Degree, Masters & PhD.

1. University of Nairobi
2. Kenyatta University
3. Moi University
4. Jomo Kenyatta University of Agriculture and Technology
5. Egerton University
6. Technical University of Kenya



# Korea (South)

**Name:** Korean Tunnelling and Underground Space Association

**Type of Structure:** Non profit, open association

**Number of Members:** 2,957 members (73 corporate members)



## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Established in 1992 as a non-profit incorporated association, KTA is the tunnel-oriented national organization to comply with the international aims of ITA. Most of the KTA members are tunnel engineers, but not limited to the civil engineering field and recent expansion into the field of fire, disaster prevention and ventilation within tunnels, among others, are noteworthy.

### In 2019, KTA hosted the ITA endorsed international conference on Jeju Island

The 2019 International Conference on Tunnels and Underground Spaces, ICTUS19

- 2019.09.18~19, Jeju Island (62 international participants)
- Two honourable keynote lectures:
  - Prof. Jamal Rostami: Underground Construction on the Moon
  - Prof. Thomas Marcher: Long infrastructure tunnels/future trends and challenges

### ITA Tunnelling Award 2019 Final List

The Seoul Metropolitan High-Speed Railway Construction Project (Yulhyeon Tunnel)

- Presented by Korea Rail Network Authority
- 2019.11.18, Miami, USA
- Entry Category, over €500M

### In addition, KTA hosted several domestic conferences and forums:

- 2019 KTA General Assembly & Annual Conference, 2019.04.25, Seoul (170 domestic participants)
- The 2019 Domestic Seminar on tunnel technology
  - 2019.07.04, Seoul (112 domestic participants)
  - Tunnel segment lining design practice based on international design standards
- The KTA Special Lecture delivered by Prof. Jamal Rostami
  - 2019.09.20, Seoul (55 domestic participants)



Kimpo-Paju 2nd Seoul Outer-ring-road Project (passing Han River section)

- The use of discrete event modelling and process simulation in estimating TBM utilization
- The 3th Joint-Forum on Tunnel Safety and Future Technology
  - 2019.09.29, Daejeon (360 domestic participants)
- KTA-Korea Land & Housing Cooperation(LH) MOU
  - 2019.10.21, Seoul
- The KTA Technical Forum on Tunnel and Underground Safety
  - 2019.10.22, KyunggiDo (333 domestic participants)

- 2019 KTA Tunnel Construction Policy Forum
  - 2019.11.14, Seoul (105 domestic participants)

### A total 11 Working Groups in KTA

- KTA-Annual WG Activity Reports: 2 WG activity reports

### Publications

- Domestic technical journal "Tunnelling Technology" (6 issues with 78 papers in 2018)
- Quarterly magazine "Nature, Human Being and Tunnel"

### CURRENT TUNNELLING ACTIVITIES

#### Daegok-Sosa Railway Tunnel Construction

- TBM + NATM hybrid construction
- Dia. 8.1m twin shield TBM tunnel crossing the Han River
- Total length of 18.36km (2.85km under the Han River)
- Corner stone of South-North Korea economic cooperation

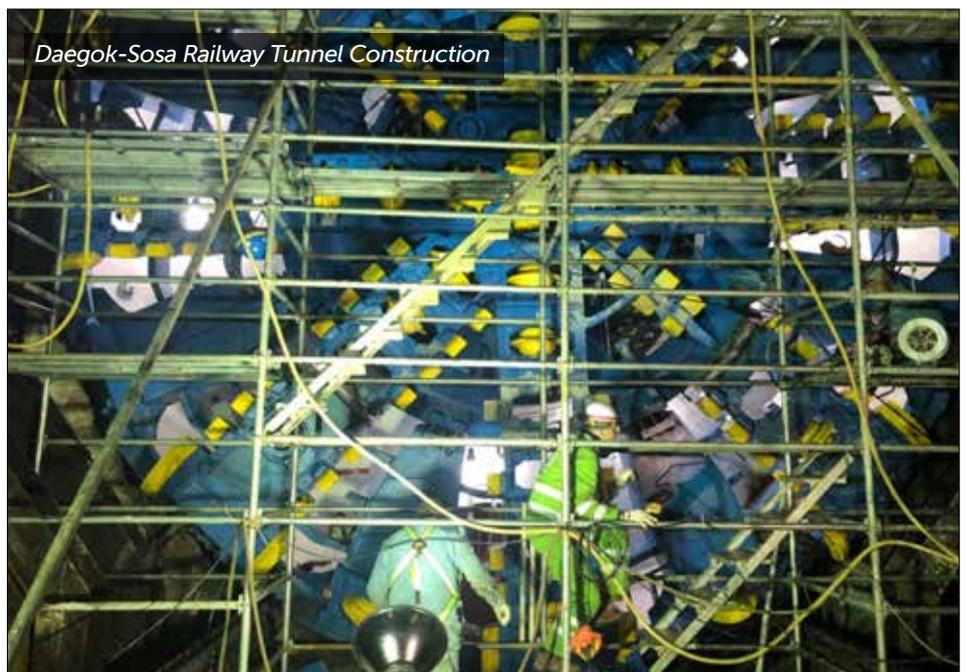
#### Kimpo-Paju 2nd Seoul Outer-Ring Road Project (passing the Han River section)

- Connecting the 2nd Seoul outer-ring-road
- Total length of 25.3km (Han River section of 4km)
- Project cost will be about \$1.3bn

### FUTURE TUNNELLING ACTIVITIES

#### Youngdong Main Street Underground Complex Development Project

- Mega-Underground Space in the Seoul Metropolitan area



Daegok-Sosa Railway Tunnel Construction

- Total underground space of 0.41Mm2
- Project cost will be about \$1.5bn

**Honam-Jeju Subsea Tunnel Project**

- Connecting the Korean Peninsula and Jeju Island
- Total length of 167km (Undersea section of 73km)

- Project cost will be about \$15bn

**Youngjong Island 3rd Connection Way Project**

- Connecting Incheon hub airport and the Seoul metropolitan area
- The 3rd connection after two long- span marine bridges



Youngdong Main Street Underground Complex Development Project

**STATISTICS**

- 1. List of tunnels completed**
  - Wonju-Gangneung High-speed Railway Tunnel
  - Inje-Yangyang road tunnel
  - Incheon (North Port) Subsea Road Tunnel
  - Boryung-Taeon Subsea Road Tunnel
- 2. List of tunnels under construction**
  - Jinhae-Guyjae Main Gas Pipe Line Tunnel
  - Yulchon Thermoelectric Power Plant Tunnel
  - Gunjang Energy GE-3 PJT Subsea Tunnel
  - Daegok-Sosa Railway Tunnel
  - Kimpo-Paju 2nd Seoul Outer-ring-road Project

**EDUCATION ON TUNNELLING IN THE COUNTRY**

**KTA Continuing Education and Training Course**

2019 KTA Training Course: Sustainable Development of Future Underground Space. 2019.02.14-15, Seoul (54 attendees)

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# Malaysia



**Name:** The Institution of Engineers, Malaysia

**Type of Structure:** Non-profit, learned society

**Number of Members:** Over 50,000 members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Through 2019, 8 technical presentations/talks and 2 short courses/seminars were organised for members and non-members, on different topics including BIM, finite element modelling in Tunnels and Tunnelling, Autonomous TBM, etc. as well as 10 technical visits to various interesting tunnelling and underground construction sites. The highlight was Two-Day Practical Short Course in Tunnels and Underground Space (PSCTUS2019) on 16-17 July 2019 by TUSTD as part of the publicity to promote WTC2020 to the participants. This event was endorsed by ITA and managed by IEM Academy.

IEM TUSTD is committed to grow the tunnelling and underground space technology, training and education as well as nurturing the young talents/tunnellers for sustainability of Malaysian tunnelling industry. TUSTD has in 2009 set up its own Young Members sub-committee to promote and connect the young tunnellers with opportunities, both locally and abroad via ITAym. The inaugural Symposium for Young Tunnellers of Asia (SYTA2020) is being planned to be organised in conjunction with WTC2020 next year.

## CURRENT TUNNELLING ACTIVITIES

2019 has been very challenging for Malaysia in light of the financial constraints and change of the political landscape in Malaysia since mid-2018. No significant new works are reported for 2019, only the continuation of works that were already ongoing and the revival of the East Coast Rail Link project, while some other infrastructure projects have remained in deferment.

### Klang Valley Mass Rapid Transit (Line 2), SSP Line

SSP Line is the second line (MRT2) of the Klang Valley Mass Rapid Transit which began construction in 2016. With a total length of 52.2km, consisting of 38.7km of elevated tracks and 13.5km underground tunnels the line connects 35 stations and

Klang Valley Mass Rapid Transit (Line 2), SSP Line



will serve a corridor with a population of 2 million people stretching from Sungai Buloh, to Serdang and ends in Putrajaya. The overall progress of the MRT2 has reached 70% completion rate as at the end of 2019 and on schedule to achieve the full opening by January 2023. The line will commence Phase 1 operation in July 2021 from Sungai Buloh Station to Kampung Batu Station while Phase 2 will see trains running all the way to Putrajaya Sentral Station.

Currently, there are six TBMs operating along the underground section between Sentul West and TRX, between Bandar Malaysia South and Chan Sow Lin had been completed, with a total tunnel excavation distance of 20km out of 23.6km or 85% completed.

The mined tunnel works of the Southern elevated alignment were completed in August 2019. This section, over high ground, is one of the three tunnel sections of the entire 38.7km of elevated tracks. The tunnel consisting of a mined tunnel and a cut and cover tunnel with a total length of 540m. The mined tunnel is a single twin track spanning about 182m. Meanwhile the cut and cover tunnel is a twin cell box structure covering on both sides of the concrete lined tunnel with length of about 197m on the upstream side and 161m on the downstream side. The mined tunnel was constructed using NATM with a permanent cast in-situ concrete lining. The completion of a pair of pipe-arched

tunnels undercrossing the KL-Seremban Highway marks another milestone in the progress of MRT2. Each tunnel measuring 60m in length, located about 5m below the road surface, were built using a combination of methods such as micro-tunnelling using mini TBM and pipe jacking, beginning March 2019.

### East Coast Rail Link (ECRL)

The relaunch of the ECRL project in July 2019 has kick-started the construction of the longest rail tunnel along the 223km main line between Dungun in Terengganu and Temerloh in Pahang, which is also known as Section B. The other sections of the 640km stretch include Kota Bharu to Dungun (Section A) and Temerloh to Port Klang (Section C). The 2.8km Kuantan Tunnel, located in Jabor, is the longest among the three tunnels of the ECRL in Section B, which includes the 1.1km Paka Tunnel and 871m Dungun Tunnel, both in Terengganu. While the excavation and earthwork begun in July, the drilling and blasting work for the 11.8m diameter tunnel project, which is scheduled to be completed in March 2022, was officially scheduled to start on Oct 7, 2020. In total, the 640km route will have approximately 40 tunnels with the longest tunnel measuring 7km, and will be built in the Jelebu-Semenyih area.

### The Langat 2 Water Supply Project

The Langat 2, which is part of the Pahang-Selangor Raw Water Transfer project, will be the largest water supply scheme in Malaysia supplying 2260MLD of treated water. It will be carried out through two phases with each phase

## STATISTICS

- 1. Length or volume excavated % mechanized/% conventional during 2019.**  
Briefly reported above.
- 2. List of tunnels completed**  
Interstate water transfer tunnel (2011), KVMRTSBK (2016)
- 3. List of tunnels under construction**
  - MRT2 (Expected completion 2020), East Coast Rail Link (ECRL), Bandar Malaysia Underground City.
- 3. List of tunnels under planning & Design**  
Singapore/KL High Speed Rail (HSR), Circle Line (MRT3), Penang Undersea Tunnel, Penang

capable of treating and distributing 1130MLD of water to the targeted demand centres. There are two drill & blast tunnels, the Sg. Besi tunnel (0.53km) and theHulu Langat tunnel (2km). Both the horseshoe shaped tunnels will be sized for housing the bulk distribution pipes with space allowance for pipe laying and maintenance purposes. The construction of the Sg. Besi tunnel commenced in 2019.

**FUTURE TUNNELLING ACTIVITIES**

The 350km Kuala Lumpur-Singapore High Speed Rail is expected to be resumed by the mid of 2020. The HSR express service is now expected to start operation by 1 January 2031, instead of the original commencement date of 31 December 2026.

In the coming years, as the financial status in the country getting healthier, it is expected that the

KVMRT Line 3 will be resumed, mostly for underground tunnels. Line 3, a circle line, is essentially aimed to interconnect all other transit system and serve the key major developments surrounding the Kuala Lumpur central business district.

The Penang Undersea Tunnel is a 6.5km tunnel which will connect Butterworth, Seberang Perai in the east to George Town, Penang Island in the west. If it materialises, it will become the first undersea tunnel in Malaysia and the second in the Southeast Asia. There will be a toll plaza at the undersea tunnel.

**EDUCATION ON TUNNELLING IN THE COUNTRY**

- MMC-GAMUDA Tunnel Training Academy in Kota Kumuning, Selangor
- MMC-GAMUDA TBM Refurbishing plant in Ipoh, Perak
- Talks, Courses, Seminar, Workshop and Conferences Organised by IEM
- Tunnelling and Underground Space, IEM TUSTD & IEM Academy.

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# Mexico



**Name:** Asociación Mexicana de Ingeniería de Túneles y Obras Subterráneas, A. C.

**Type of Structure:** Non profit, open association

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Between November 2018 and February 2019, the members of the 16th Executive Council have dedicated most of the work to important administrative, legal and accounting issues that were necessary to regulate. Some other activities in this period were:

- A complete restructuring and new design of our website.
- Scanning of the covers and indexes of all the books in our library, as well as the elaboration of a database with all the bibliographic records.
- Creation of the AMITOS Photo Archive.
- Sending to ITA the tender for the candidacy for the WTC 2022.
- Multiple academic meetings with the professors of the Master studies on tunneling and underground works and redesign of the academic programs.
- Advances in the book "Brief History of the Tunnels and their passage through Mexico"
- Announcement of the first tunneling photo contest AMITOS 2019.
- Preparation of the campaign for WTC 2022 to be presented in Naples in WTC 2019.
- Visit with the AMITOS young members group to the Compostela Tunnels in the state of Nayarit.
- Publication of magazine Obras Sbterráneas #23.

During the ITA general assembly 2019 in Naples, Mexico won the elections to host

the congress in Cancun.

Other activities during this period were:

- Participation in the Costa Rican Tunneling Congress 2019 (March 28th - 29th). Fermin Sánchez, president opened the ceremony on behalf of former ITA president Tarcisio Celestino.
- On March 12th, in the auditorium of the postgraduate division of the engineering faculty of the UNAM, AMITOS organized an informative session for students interested in our master's program.
- Held the Conference on sustainability and underground infrastructure during the oath taking of the new directive committee of the young member association of the Instituto Politécnico Nacional (IPN).
- Participation of AMITOS at the 45th General Assembly of ITA.
- Speech and presentation of the promotional video for WTC 2022 during the candidate's dinner in Naples.
- Participation of Mexico's representative during the ITA young member's meeting in Naples.
- Participation of AMITOS during the event of the 100 years of the Madrid metro with the lecture "Modern Design Techniques of sprayed concrete linings applied to Mexico City metro line 12".
- Creation of the AMITOS photographic archive.
- Participation during the Third Latin American Congress of Urban Railway Lines in Medellin Colombia (March 7th - 8th).

- Participation of AMITOS during the debates on the National Infrastructure Plan at the Chamber of Congressmen of Mexico's government.
- Publication of the magazine Obras Sbterráneas #24.

## May to August.

- Lecture on Advanced Techniques for the design of fiber reinforced shotcrete linings, by Fermin Sánchez during the "Shotcrete Underground Santiago de Chile" congress.
- Working sessions with the Chilean Underground Space Technical Committee.
- Course on Underground Support Systems organized by AMITOS and DSI International on June 20th, 120 participates and 7 lecturers.
- Interview with Jesús Esteva Medina, Secretary of the Public Works of Mexico City's Government. The objective was to promote underground infrastructure as a sustainable solution for urban problems.
- Interview with Rodrigo Díaz, Vice Secretary of Mobility of Mexico's City Government, with the same objective.
- First course on design and construction of tunnels in soft ground with EPB technology, organized by the young member's group of AMITOS with five expert lecturers.
- Publication of magazine Obras Sbterráneas #25.

## August to December.

- Participation of AMITOS in the Tunnel & Mining 2019 Congress in Lima Perú (October 22nd - 24th).
- Participation of Fermin Sánchez during the ExCo Meeting in Warsaw (September 14th and 15th).
- Presence at the XIV Seminar on Tunnels and Underground Works in Medellin, Colombia, where Fermin Sánchez presided over the opening ceremony and gave a lecture on geo-structural models for studying rock-shotcrete interaction.
- Conference on the Role and Relevance of underground projects in Santiago de Chile (September 23rd). The Lecturer was Francisco Schmith, Architect and Urban Planner from the Catholic University of Lovaina.
- AMITOS Workshop on Sustainable Underground Space Use, ITACUS-AMITOS (November 7th and 8th). This workshop aimed to analyze multiple environmental problems in the modern world and the way in which



underground works can contribute to improving the living conditions of the population as well as protecting and preserving the natural environment. The participants were Han Admiraal, Antonia Cornaro, Marilú Melo Zurita and others from Sweden, Colombia and Mexico.

- Prize ceremony of the first photography contest of AMITOS 2019 (November 8th).

### CURRENT TUNNELLING ACTIVITIES

- Six road tunnels are being constructed at the Tepic Puerto Vallarta with lengths between 200 – 1000m; three of them are for 4 lanes with a span of up to 22m, the others will have three lanes.
- Three road tunnels at the Oaxaca Puerto Escondido highway of about 250m each, advanced to about 45%.
- Three road tunnels on the de Mitla-Tehuantepec highway of about 250m each with an advance of 30%.
- 4.06km of Metro Line 12 tunnel with three underground stations. Works started in 2017, with a current advance of 75% of the tunnelling works and 50% of the total construction of the line.
- 5.3km of TBM tunnelling were finished in 2019 for Line 3 of the Guadalajara City Metro System with a diameter of 11.55m.
- 4.7km twin tunnels excavated with 8.57m diameter TBMs for the railway tunnel in Mexico City, where finished in 2019. The total completion of the works is about 90%.
- 13km of 5m diameter TBM tunnelling for the sewage system in Mexico City.
- 115m long road tunnel at the Atizapán-Atacomulco highway in Estado de México.
- Finishing of 62km of the Emisor Oriente Tunnel.

### FUTURE TUNNELLING ACTIVITIES

- Continuation of 134 road tunnel listed above; completion of the Line 12 Metro System; three 5m diameter tunnels with TBM.
- There is also a possibility of building a railway tunnel below the city of Merida y state of Yucatán.

### EDUCATION ON TUNNELLING IN THE COUNTRY

Master studies on tunnelling and underground works, Faculty of Engineering, National University of México (UNAM), organized and coordinated by AMITOS and the Faculty. This master program is endorsed by ITA.

Finishing of 62km of the Emisor Oriente Tunnel



### STATISTICS

#### 1. Length or volume excavated - % mechanized/% conventional during 2019 In 2019 (conventional):

Conventional Tunnels	Length (m)	Advance %	Advance (m)
Mitla-Tehuantepec 1	170	100.00%	170
Mitla-Tehuantepec 2	94	0.00%	0
Mitla-Tehuantepec 3	173	0.00%	0
San Antonio	145	60.00%	87
San Sebastián	130	0.00%	0
Santa Martha	170	100.00%	170
El Paso del Jaguar	240	100.00%	240
Las Truchas	235	10.00%	23.5
El Puma	200	10.00%	20
Guamuchil	1080	90.00%	972
Los Bueyes	267	10.00%	26.7
Las Varas-Puerto Vallarta (3)	120	0.00%	0
Línea 12 del Metro	4060	10.00%	406
Atizapán-Atacomulco	115	10.00%	11.5
<b>TOTAL</b>	<b>7199</b>		<b>2126.7</b>
Mechanized Tunnels	Length (m)	Advance %	Advance (m)
Túnel Emisor Oriente	62000	1.62%	1006.88
Churubusco-Xochiaca	13000	20.00%	2600
<b>TOTAL</b>	<b>6200</b>		<b>3606.88</b>

#### 2. List of tunnels completed:

Mitla-Tehuantepec 1, Santa Martha, El Paso del Jaguar, Túnel Emisor Oriente

# The Netherlands

**Name:** Department of Tunnelling and Underground Works (TTOW) of the Royal Institution of Engineers (KIVI) in the Netherlands



**Type of Structure:** Non-profit, The Royal Institution of Engineers in the Netherlands is an association with individual members who are also member of the various departments of the association. The Department of Tunnelling and Underground Works is one of the larger departments within the association.

**Number of Members:** 580

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

In 2019 the Department of Tunnelling and Underground Works performed several activities:

- TTOW Young Members: site visit to North South line Amsterdam
- Project marathon: Site visit to 3 projects in one day: Gaasperdammertunnel/ Schipholtunnels/Rijnlandroute
- Lecture day: Fire protection in tunnels
- TTOW Young Members: Site visit to the Gaasperdammertunnel
- ITA presentation evening and annual meeting of TTOW

## CURRENT TUNNELLING ACTIVITIES Rijnlandroute (TBM)

In the Rijnlandroute project, a connection between the A4 with the A44 motorways is being built near Leiden. The twin-tube TBM tunnel is 2.5km in length. Each tube provides two traffic lanes. 15 years of management and maintenance are also part of the contract. The first TBM-drive is finished and the 2nd TBM-drive will start early in 2020. In 2019 a fatal accident happened on the project. As with every such an accident in the Netherlands, an independent body is investigating the accident.

## Victory Boogie Woogie (Rotterdamsebaan) – (TBM)

In the Rotterdamsebaan project, an additional city entrance is created in The Hague via a TBM tunnel – the Victory Boogie Woogie tunnel. The 2 x TBM drives have been completed, the installation of the MEP is almost complete and testing of the software and systems is ongoing. Opening of the tunnel is planned for 2020. Durability and sustainability has played a large role in the design and preparation of this tunnel project. The project was nominated for the ITA-awards 2020.



*TTOW Young Members: site visit to North South line Amsterdam*

## Zuidasdok Amsterdam (in-situ)

The Zuidasdok project establishes an extension of the existing A10 Zuid motorway, the ring road of Amsterdam. In a combined approach, the existing public transport hub will be extended, and the motorway will be through a series of new tunnels. There will be two tunnels, each about 1km long. Each tunnel has two tubes; one four-lane tube for transit traffic and one two-lane tube for local traffic. On top of the tunnels, new public space will be developed, also providing space for the expansion of the public transport hub. The project

was awarded in 2017. The preliminary design was not completed according to schedule, and the contractor was not able to keep the estimates within the budget fixed during the tender. Currently the client is reconsidering the project and a remediation between Client and contractor is being undertaken, to find out if the project budget can be closed.

## Blankenburg connection: Maasdelta tunnel (immersed tube) & Hollandtunnel (in-situ)

The Blankenburg connection in the new A24 motorway consists of 2 tunnels: the Maasdelta tunnel, which is an immersed tube tunnel under the Scheur (Nieuwe Waterweg) waterway and the Holland tunnel, an in-situ tunnel through a natural habitat called the Krabbeplas. Also, 20 years of management and maintenance are incorporated in the project (DBFM contract).

The Maasdelatunnel will be about 945m in length and the Holland tunnel about 510m. The whole connection will be partly paid for by toll collection. In 2018, execution started for the Maasdelta tunnel with the construction of coffer dams for the building docks in which the two tunnel elements for the Maasdelatunnel will be constructed. The final design was completed in 2019. Foundation construction works for the ramps of the Maasdelta tunnel and the earthworks for the Hollandtunnel have started.

## A16 – Rottemerentunnel (in-situ)

The A16 motorway from the traffic junction Terbregseplein will be lengthened and connected to the A13 motorway near Rotterdam, The Hague airport. In this connecting road, a new tunnel is required; the Rottemerentunnel. The Rottemerentunnel is planned to be opened



*Maasdelatunnel - Courtesy Consortium BAAK*



Kiltunnel

in 2024 and will be around 2235m in length. There will be two tubes with two lanes per tube and an emergency lane. The project has an energy-neutral design with optimal integration of the new road in its environment. The design and construction activities are in progress.

#### A9-Gaasperdammertunnel

Construction works finished. Testing is in progress, near opening later in 2020.

#### The Maastunnel (1942) refurbishment

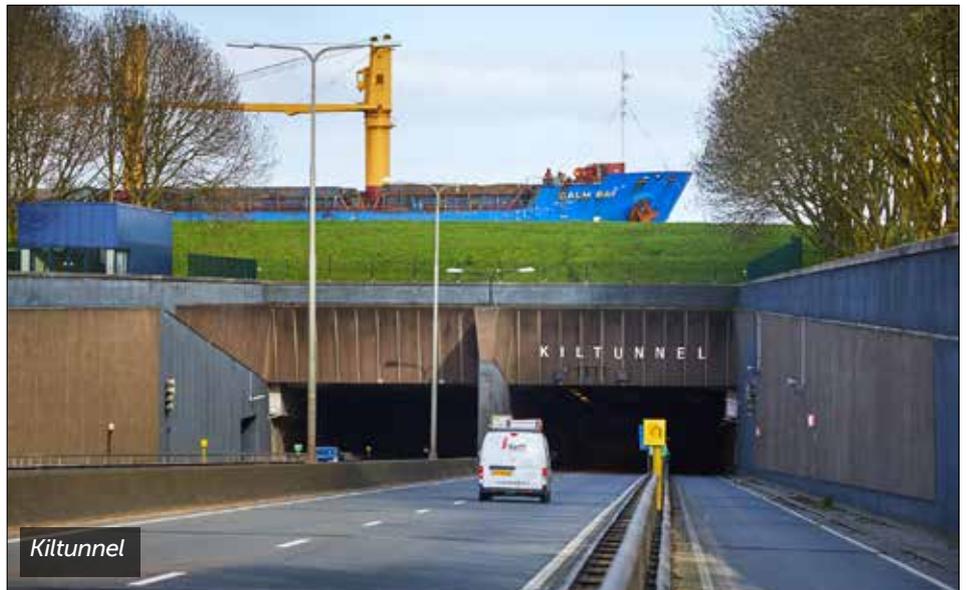
In 2019 the 2nd traffic tube was renovated according to schedule. The renovation of the oldest immersed tunnel in the Netherlands will be completed when the pedestrian and cyclists' tubes are renovated in 2020.

#### The Kiltunnel (1977) refurbishment

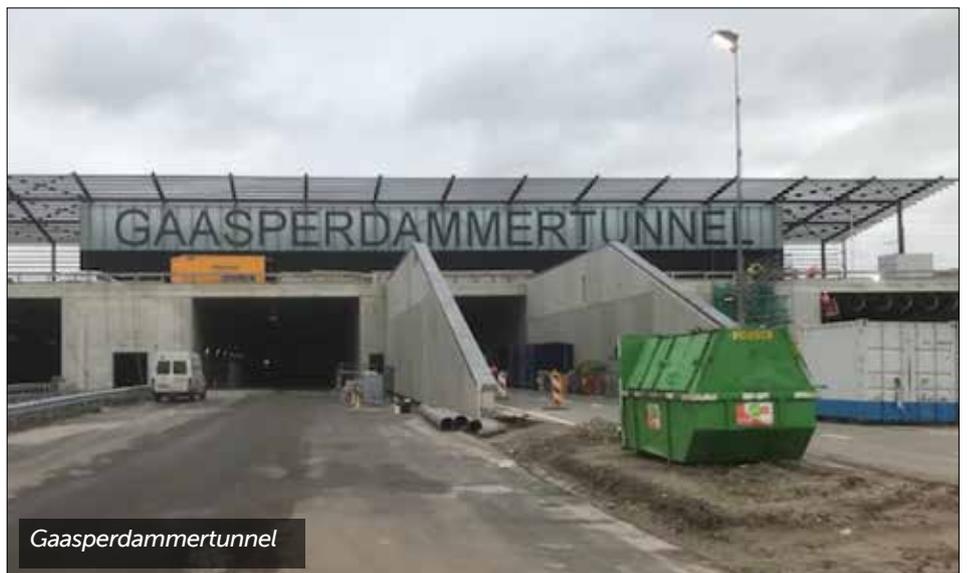
The E&C-contract for the renovation project has been awarded. A special alliance contract has been chosen to stimulate cooperation between contractor and client, and flexibility when unexpected conditions are found in this old tunnel. The engineering for the refurbishment has started.

#### The Heinenoordtunnel (1969) refurbishment

The tender for this refurbishment project started at the end of 2019. The municipality of Amsterdam is preparing a renovation scheme for the 5 tunnels



Kiltunnel



Gaasperdammertunnel

they own. (Piet Hein tunnel, Arena tunnel, Spaandammertunnel, Michiel de Ruijter tunnel, IJ-tunnel), Amsterdam is aiming to standardise the maintenance and operations procedures for this set of tunnels.

#### FUTURE TUNNELLING ACTIVITIES

##### Future renovation projects (renovation mainly to 2022)

- Eerste and Tweede Beneluxtunnel
- Buitenveldertunnel
- Noordtunnel
- Sijtwendetunnel
- Westerscheldetunnel
- Drechtunnel
- Piet Hein Tunnel

##### Future tunnel projects (Renovation - after 2022):

- Botlektunnel
- Hubertustunnel
- Thomassentunnel
- Wijkertunnel
- Zeeburgertunnel

## STATISTICS

1. Length or volume excavated  
x% mechanized/% conventional  
during 2019.  
Rijnlandroute: 2250m, 11m diameter  
mechanized (1st drive)
2. Amount (USD or EUR) of tunnelling  
/ underground space facilities  
awarded in 2019  
0
3. List of tunnels completed  
0
2. List of tunnels under construction
  - A9 Gaasperdammertunnel:  
Testing, near opening
  - Rijnlandroute
  - Zuidasdok
  - Victory Boogie Woogie tunnel
  - Maasdeltatunnel & Hollandtunnel  
(Blankenburgtracé)
  - Rottemerentunnel (A16  
Rotterdam)

# New Zealand



**Name:** New Zealand Tunnelling Society

**Type of Structure:** Incorporated non-profit

**Number of Members:** 77 individuals and Corporate Sponsors Two Platinum Three Gold and Two Silver Corporate Sponsors

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

The NZTS held a series of technical presentations from industry across 2019.

There were two tunnelling short courses, a three day course by Dr Donald Lamont on health and safety, and the NZTS Annual one day short course

The NZTS published a GBR Guide for New Zealand on its website. <https://nztunsoc.org.nz/wp-content/uploads/2020/03/A-Guide-for-GBRs-in-NZ-February-2020-FINAL.pdf> (free to download)

The New Zealand Tunnelling industry has commenced a worker competency training development programme sponsored by the major tunnelling

projects and supported by industry and the regulator Worksafe.

## CURRENT TUNNELLING ACTIVITIES

In Auckland the two major tunnelling projects, the City Rail Link (CRL, metro) <https://www.cityraillink.co.nz/> and the Central Interceptor Project (CIP, wastewater) <https://www.watercare.co.nz/About-us/Central-interceptor> are well underway with TBM's expected in 2020. These two flagship projects continue the growth in the New Zealand tunnelling industry.

Various pipejacking projects for water supply wastewater and stormwater are underway including Snells Beach, Algies Bay Hunua 4 (two 1200m. 2.5m dia

pipejacks through basalt), St Mary's Bay and Ports of Auckland Stormwater, 2500 id pipe jack, 300m long.

Tunnel re-purposing and rehabilitation projects continue and are becoming more widespread. Projects include, the Northland Rail Upgrade (13 tunnels) by KiwiRail over 276km of railway as part of regional investment. Genesis has commenced a new Intake Gate for the Tekapo A Power Station to provide the ability to stop flow through the intake under full load conditions in an emergency.

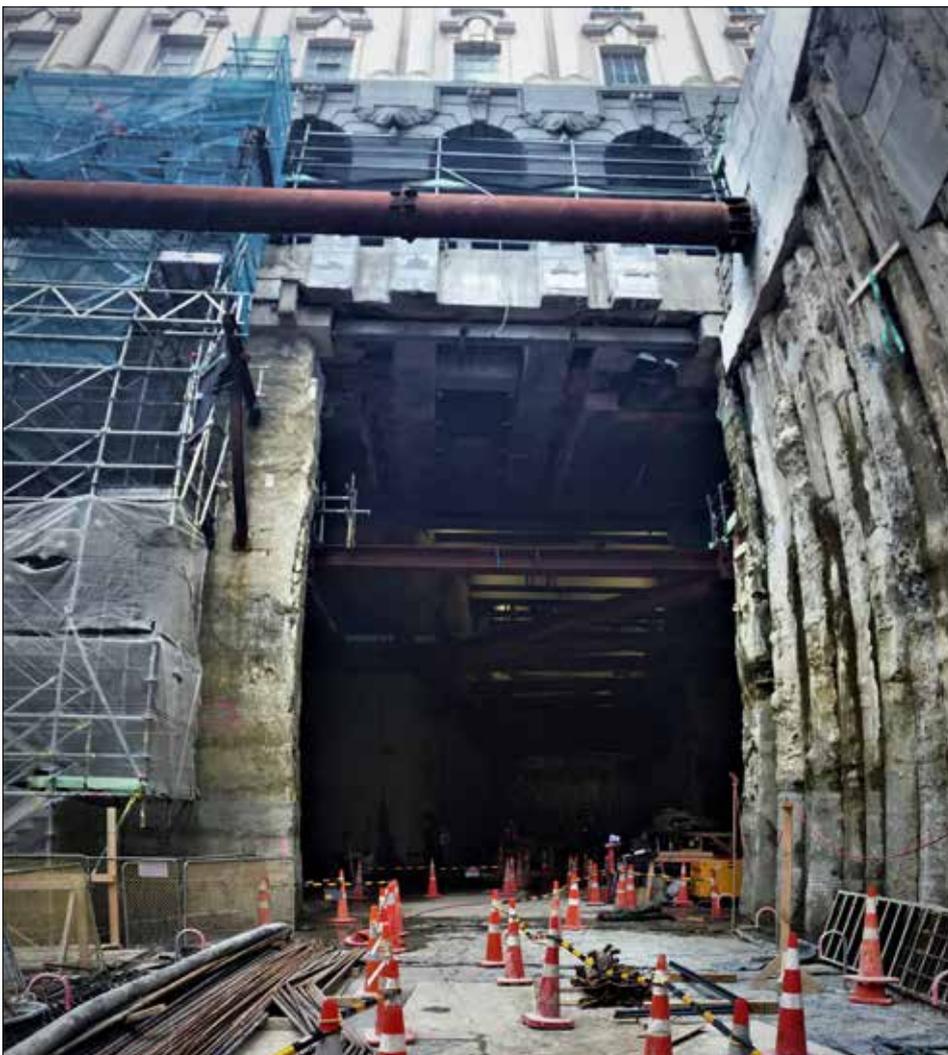
Re-entry to the Pike River Coal mine, where 29 miners died in 2011 an event that has re-shaped health and safety practice in New Zealand has occurred in 2019 to '...to give the Pike River families closure, to promote accountability for this tragedy and to help prevent future mining tragedies.' <https://www.pikeriverrecovery.govt.nz/>

## FUTURE TUNNELLING ACTIVITIES

Construction of the Mt Messenger Tunnels are likely to be accelerated in 2020 <https://www.nzta.govt.nz/projects/awakino-gorge-to-mt-messenger-programme/mt-messenger/>

The Lets Get Wellington Moving transportation initiative has been given significant momentum by the NZ government and may include a duplication of the existing Mt Wellington tunnel and a grade separation of the Basin Reserve <https://lgwm.nz/our-plan/our-projects/>

In Auckland, a new light rail system with a significant underground component through the central city is being evaluated by the Ministry of Transport for delivery <https://www.transport.govt.nz/land/auckland/atap/next-steps-on-auckland-light-rail/>



## STATISTICS

**Amount (USD or EUR) of tunnelling/ underground space facilities awarded in 2019**

Approximately US\$2.4bn – skewed by the major projects CRL and CIP

## EDUCATION ON TUNNELLING IN THE COUNTRY

The NZTS Committee continues to provide lectures at Auckland University and mentoring research projects including investigating the role of Erionite within the ECBF of Auckland.

# Norway



**NORWEGIAN  
TUNNELLING SOCIETY**

**Name:** The Norwegian Tunnelling Society

**Type of Structure:** Non-profit, open society with members from the whole value chain, both corporate and personal

**Number of Members:** 1000 personal members, 100 corporate members (incl. research institutes, academia, and public clients)

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

The Norwegian Tunnelling Society has a set of yearly events such as conferences, courses and evening meetings. Among these, the largest one is Fjellsprengningsdagen, which gathers more than 700 rock blasting and TBM enthusiasts to share knowledge and news.

2019 is the first year NFF participated at Arendalsuka – the most extensive political event for Norway. *(Image 1)*

Norway was among the finalist in two categories in the ITA Tunnelling Awards. The Follo Line in the “Major project of the year” category, and the Ulriken Tunnel in the “Project of the year between €50M and €500M” category. Neither won among strong finalists from other countries.

The Society publishes handbooks and technical reports in Norwegian and one English publication every year. In 2019, a Norwegian technical report regarding Electronic Detonators in Tunnel, in addition to the English Publication nr 28 “Digitalisation in Norwegian Tunnelling” was published.

## CURRENT TUNNELLING ACTIVITIES

Tunnelling activity in Norway has declined both in 2018 and in 2019. In 2019 we excavated 3.9Mm<sup>3</sup> of rock. The amount of excavated rock had been steadily growing, but 2018 was the first year with a decrease in volume since 2009 due to large projects being in their final phase of excavation, and new ones yet to start. Major activities are still concentrated around road and rail tunnels, with hydropower tunnels another significant contributor.

In 2019, the longest and deepest subsea road tunnel in the world, The Ryfylke tunnel, was opened to traffic. Of the two other tunnels on the same project, the Ryfast will be open for traffic, but the even deeper Rogfast is delayed, although some excavation to prepare the main project has started. *(Image 2)*

The project that excavated the most in 2019 is the E39 Kristiansand Vest- Mandal

Øst. This is a road tunnel project for Nye Veier, where AF-gruppen has excavated more than 500,000m<sup>3</sup> of rock. Digital solutions are developing in Norway, and here web-based access should contain and display all of the project’s BIM models.

*(Image 3)*

Skanska has excavated almost 400,000m<sup>3</sup> at the hydro powerplant in Tolga, and more than 300,000m<sup>3</sup> on Nordøyveien, a road tunnel for The Norwegian Public Road Administration just outside Ålesund. In addition to



1

digitalisation, zero emission construction is a main focus for many contractors in Norway, at Nordøyveien they have started using a brand-new electrical loader. *(Image 4)*

The largest infrastructure project in Norway so far, The Follo Line has started the installation of tracks and so on. The planned opening of the tunnel is now in December 2022. We recommend reading this year’s publication from NFF, which covers many aspects of this project.



2



3



4

**FUTURE TUNNELLING ACTIVITIES**

The high activity within infrastructure development will continue in the years to come. And we believe that we will see an increase in the activity again, at least from 2021.

Work has already started on a new railroad between Drammen and Kobbervikdalen. This project will complete the double track railroad from Oslo to Tønsberg and opens in 2024. The project will include 6km of hard rock tunnelling, almost 300m of soft ground tunnelling and about 700m of cut-and-cover.

The next large infrastructure project will be the joint rail and road project, the Ringerike Line and E16 Highway, it will include a 40km long tunnel for the railway and some shorter tunnels both for rail and

a new highway between Sandvika and Hønefoss.

Nye veier will continue the road building along the E18 from Porsgrunn to Stavanger. These projects will include both tunnels and rock blasting above ground. The same goes for new E6 between Hamar and Lillehammer, and the new E6, both south and north of Trondheim.

The Norwegian Public Road Administration has started the first contract for Rogfast. This project will include the longest and deepest subsea tunnel to date.

A new big project is under planning - a new water supply to Oslo. The water will go through a long tunnel from Holsfjord, west of the city into the existing water

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Norway has several universities offering both bachelor and master degrees with several aspects of tunnelling included; the major ones being NTNU in Trondheim and the University of Oslo. Norway also offers a set of schools preparing students via a four-year program for the certification for rock blasters.

pipe system. In addition, the Fornebu Line will be starting soon. This will be a metro tunnel that will connect Fornebu with the rest of the metro system in Oslo. Furthermore, both a new metro and railroad tunnel are under planning through the central part of Oslo City.

**STATISTICS**

1. **Length or volume excavated**
  - 74 598m in total, (included 4387m by TBM)
  - 3.9Mm<sup>3</sup> in total
2. **Amount (USD or EUR) of tunnelling/ underground space facilities awarded in 2019**  
Do not have a number
2. **List of tunnels completed – an example form a long list**
  - The excavation at the E39 Svevatjørn – Rådal, and the E6 Soknedal tunnel is completed
  - The Ryfylke tunnel is opened for traffic.
3. **List of tunnels under construction**
  - There are more than 50 tunnels under construction at any time in Norway.

# Poland



**Name:** Subcommittee of Underground Construction of Polish Committee on Geotechnics (Polish Tunnelling Committee)

**Type of Structure:** Non-profit, open association

**Number of Members:** 69 members, 4 corporate members

**ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE**

In 2019 the Polish Tunnelling Society (full name: Subcommittee of Underground Construction of Polish Committee on Geotechnics) organized a one day International Seminar endorsed by ITA "Challenges of modern tunnelling". The Seminar took place in the Sheraton, Warsaw on 13th September 2019 and was followed by the ITA Executive Council meeting. 250 participants took part in the Seminar. Honoured speakers were: Jinxiu (Jenny) YAN (Pic.1), Martin Knights, Tarcisio B. Celestino, Giuseppe Lunardi, Randall J. Essex, Andres Marulanda, Jamal Rostami.

The representatives of Poland were

present at ITA General Assembly and attended meetings of ITA Working Groups held during WTC 2019 in Naples: Monika Mitew-Czajewska (president) - WG20, Anna Siemińska-Lewandowska (secretary) - WG15, Dymitr Ganew – WG14.



Road Tunnel in Warsaw – the tunnel passing under the existing metro tunnel

**CURRENT TUNNELLING ACTIVITIES**

**Road Tunnel in Warsaw – as part of the south city ring**

2,700m long tunnel, 3 lanes in each direction; construction method - cut and cover. Construction works in progress. Due date end of 2020.

**Construction of the 2nd metro line in Warsaw, an extension of the existing central part:**

- In the east direction (3 stations, 6.3km) – completed
  - In the east-north direction (3 stations, 8km) - Due date 2023.
  - In the west direction (3 stations, 7km) – Due date April 2020.
  - In the west direction (5+1 stations, 12km) – Due date 2023
- Construction method: TBM + cut & cover.

**Road Tunnel under Luboń Mały – south Poland**

Over 2 x 2km tunnels on the S7 motorway from Kraków to Zakopane (a Polish skiing resort). Construction works in progress, 2200m executed, method of construction - ADECO RS. Due date 2020.

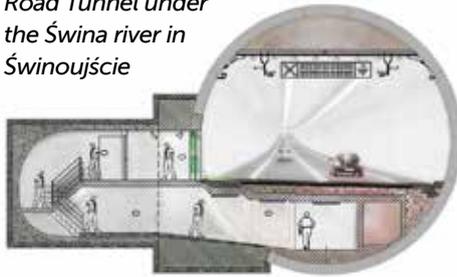


Road Tunnel under Luboń Mały,  
Construction site

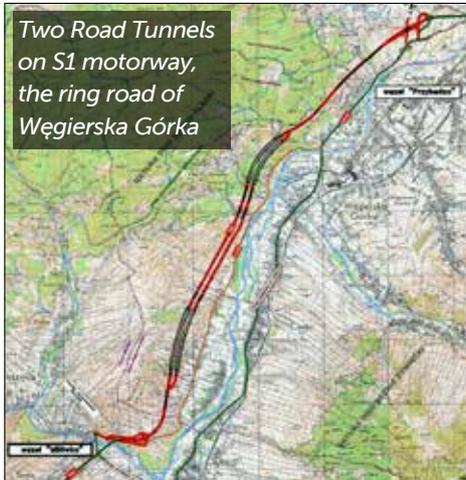


Road Tunnel on S3 motorway Bolków-  
Kamienna Góra, Portal visualisation

Road Tunnel under  
the Świna river in  
Świnoujście



Two Road Tunnels  
on S1 motorway,  
the ring road of  
Węgierska Góra



### Road Tunnel on S3 motorway Bolków-Kamienna Góra – south Poland

2,3km tunnel on the S3 motorway from Bolków to the state boarder. Design and build. Contract was signed in September 2018, design works begun. The method of construction – NATM. Due date end of 2023.

### Road Tunnel under the Świna river in Świnoujście – north Poland

The 1.44km long tunnel will connect the islands of Uznam and Wolin. Construction method TBM – 12m diameter. Due date end of 2022. Design works begun, TBM ordered.

### Rail Tunnel in Łódź – Tunnel connecting Łódź Fabryczna and Łódź Kaliska stations

Length of the tunnel – 3km of double track tunnel, 4.5km of single track/ tube tunnels; 2 underground stations; Construction method TBM + cut & cover. Due date 2022. Design works are completed. Two TBM's – diameter 13.04m and 8.76m were ordered. Construction of shafts begun in 2019, first TBM should start operation in summer 2020.

### Two Road Tunnels on S1 motorway, the ring road of Węgierska Góra – south Poland

Two road tunnels (830m and 980m) on the S1 motorway from Bolków to the state border as a design and build

contract. Tunnels will be constructed using Sequential excavation method or ADECO. Due date 2022.

### FUTURE TUNNELLING ACTIVITIES

#### Four Road Tunnels on the S19 motorway, Via Carpatia, section Rzeszów - Barwinek

Four road tunnels (1.35km, 1.75km, 1.6km, 1.2km) on the S19 from Rzeszów to the state border. The conceptual design is in progress. Construction time 2020-2025.

#### 2 Road Tunnels on the S7 motorway in Warsaw

2 road tunnels; 2 x 3 lanes in each direction, in preliminary design

#### Eleven Rail Tunnels – 12km length in total on the planned 58km long new rail route Podłęże-Piekietko in the south of Poland. Also two Rail Tunnels – 5.8km length in total on the rail route Chabówka – Nowy-Sącz will be modernized.

Environmental decision obtained. The design works are in progress. Preparatory works and the design are to be completed by 2021. The construction and modernization is planned for 2020-2026

#### Two short rail tunnels in Górki (0.22km) and Maksymilianowo (0.11km)

A lot of short tunnels, under rail tracks, are being built across Poland.

## STATISTICS

1. Length or volume excavated
  - 75% mechanized, 25% conventional during 2019
2. Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019
  - €500,000
3. List of tunnels completed:
  - 1, East extension of the 2nd metro line in Warsaw
4. List of tunnels under construction
  - 8 + 19 in the design stage

## EDUCATION ON TUNNELLING IN THE COUNTRY

### Basics of Underground Structures

(1st degree studies), Underground Structures I and II, Fire safety in tunnels – 2nd degree studies – Warsaw University of Technology, Faculty of Civil Engineering

**Underground Construction** (1st degree studies), Geotechnology of underground structures and tunnels, The impact of underground construction on surface and surrounding rock mass, Ventilation in selected underground facilities – 2nd degree studies – AGH University of Science and Technology, Faculty of Mining and Geoengineering

**Underground Structures** – 2nd degree studies – Wrocław University of Science and Technology, Faculty of Civil Engineering

**Tunnels and underground passages** – 2nd degree studies – Cracow University of Technology, Faculty of Civil Engineering

**Elements of rock mechanics and underground structures** – 2nd degree studies – Faculty of Civil and Environmental Engineering, Warsaw University of Life Sciences – SGGW

**Underground structures** – (1st degree studies) – Silesian University of Technology, Faculty of Civil Engineering

**Underground structures** (2nd degree studies) – Białystok University of Technology, Faculty of Civil and Environmental Engineering

# Russia



**Name:** Russian Tunnelling Association (RTA)

**Type of Structure:** Non profit

**Number of Members:** Total number - 60

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

### The following were created:

Working Group No. 1 "Assistance in designing and construction of the North Amur tunnel No. 2". Working Group No. 2 "Assistance in information modelling technology implementation, when executing underground development projects".

### The following were held:

Scientific and Technical Conference "Cities' underground space development and construction of traffic facilities", Moscow, 21 March 2019.

Scientific and Technical Forum "Trends, problems and growth prospects of underground development", Moscow, 3-5 October 2019.

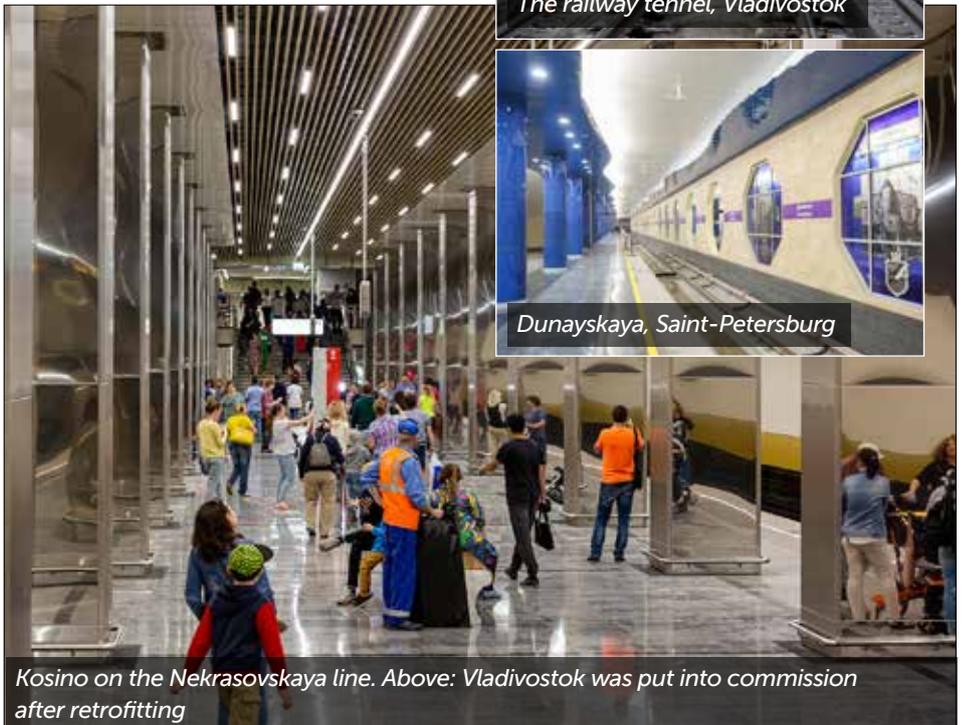
### The following professional skills competitions were organized and held:

- S.N. Vlasov Competition "Engineer of the Year of the Russian Tunnelling Association - 2019";
- Competition "For the best application of advanced technologies, when building tunnels and underground constructions";
- Competition of scientific (graduation) papers of students from higher educational institutions.

Trade journal "Metro i tonneli" [Underground and Tunnels] (4 issues of the journal have been published) and 1 news-bulletin of the Russian Tunnelling Association have been issued.

### CURRENT TUNNELLING ACTIVITIES

In 2019 according to Moscow's Metro Development Program, eight new Metro Stations were put into commission including Filatov Lug, Prokshino, Olkhovaya, Kommunarka on the Sokolnicheskaya line, and Nekrasovka, Lukhmanovskaya, Ulitsa Dmitrievskogo and Kosino on the Nekrasovskaya line. In Saint-Petersburg, the Prospekt Slavy - Dunayskaya - Shushary section of the Saint Petersburg Metro was put into commission. The main line tunnels in this



The railway tennel, Vladivostok

Dunayskaya, Saint-Petersburg

Kosino on the Nekrasovskaya line. Above: Vladivostok was put into commission after retrofitting

section were bored using with 10.6m diameter TBMs.

The railway tunnel in Vladivostok was put into commission after retrofitting. Members of the Russian Tunneling Association are involved in ambitious programs in increasing the capability of the Trans-Siberian Railway and the Baikal-Amur Mainline Railway. The second line of the Baikal tunnel at BAM has been completed and is being prepared for commission.

### FUTURE TUNNELLING ACTIVITIES

Works on Moscow's and Saint Petersburg's Metros development continue. The length of Metro lines in Moscow is expected to be 450km by 2022. According to the Saint Petersburg Metro development plan the length of its lines should be increased from 113.6km to 155.5km by 2027. The number of stations will grow from 67 to 85, and the number of metro depots - from 5 to 7. It is planned to resume the construction of Metro in Krasnoyarsk.

There are large-scale projects for the short-term on construction and reconstruction of railway tunnels on the

Trans-Siberian Railway and the Baikal-Amur Mainline Railway. Development of technical and economic assessments for the construction of the second line of the North Amur tunnel at Baikal-Amur Mainline Railway is being completed.

Construction of a tunnel for the railway from the mainland to Sakhalin Island may also be adopted.

### EDUCATION ON TUNNELLING IN THE COUNTRY

- Moscow State University of Communication Lines (MIIT);
- Moscow State University of Civil Engineering (MGSU);
- Moscow State Mining University (MGGU) of National University of Science and Technology "MISIS";
- National Mineral Resources University "Gorny" (SPGU);
- Saint Petersburg University of Communications (PGUPS);
- Tula State University;
- Ural State Mining University (UGGU);
- Siberian State University of Communications (SGUPS).

# Singapore



**Name:** Tunnelling and Underground Construction Society (Singapore) (TUCSS)

**Type of Structure:** non profit, open association

**Number of Members:** 1222 members, 115 corporate members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

In 2019, TUCSS continued to promote tunnelling and underground construction through organising monthly evening seminars, training courses, Conference & site visits for dissemination of tunnelling & underground related information and best practices, as well as conducting social networking events to bring together the practitioners from the different sectors of the industry. TUCSS continued to support the accreditation of tunnelling resident site supervisory staff during the year.

### Monthly Evening Seminars for members:

**17 Jan 19** - Construction of Road Tunnels in Iceland Hedinsfjardargong Project  
*Mr. Ermin Stehlik, MCC Singapore*

**20 Feb 19** - Management of Tunnel Construction within Europe using Innovative Solutions  
*Mr. Diwakar Velu, Land Transport Authority*

**20 Mar 19** - Design and Construction for Deep Shafts in Rock and Soil using Vertical Tunnel Boring Machines, from VSM to SBR  
*Mr. Hannes Lager, Arup London*

**18 Apr 19** - Rational and Efficient Design of Cement - Treated Soil Systems for

Underground Construction  
*Dr. Lee Fook Hou, National University of Singapore*

**16 May 19** - Tunnelling beneath Piled Foundations, A Study from the UK  
*Dr. Michael Williamson, Mott MacDonald Singapore*

**20 Jun 19** - Glass Fiber Reinforced Polymer (GFRP) Rock- Bolts used as Temporary and Permanent Reinforced in Mined Caverns  
*Mr. Pierre Hofmann, Dextra Group*

**18 Jul 19** - Challenges in Wuhan Sanyang Road Tunnel Project, Wuhan, China  
*Mr. Li Hong, STEC Singapore/Shanghai*

**15 Aug 19** - Tunnelling with Macro Synthetic Fibre Reinforced Concrete  
*Dr. Ing. Ralf Winterberg, Barchip Inc.*

**21 Nov 19** - Alternative Tunnel System for a 8.5km long Road Tunnel through the Himalayas  
*Mr. Florian Krenn, Geoconsult India*

### Annual Lecture

TUCSS Annual Lecture was held on Thursday, 17 October 2019 at NTUC Auditorium. The topic was "From Small Diameter Pipe Jacking to Super Large Diameters at High Pressure – Developments in Mechanised Tunnelling"

by Dipl. - Ing. Werner Burger. The Annual Lecture was attended by 310 TUCSS members.

### Hulme Prize

- TUCSS Hulme prize was held on 19th September 2019, at SMU Auditorium. 3 papers were shortlisted out of 6 submitted papers:
- Application of Ground Freezing for Mined Tunnel in T226 Marina Bay Station Ivan Sim Zhan Rui, Land Transport Authority
- Productivity Analysis of Diaphragm Wall Construction in Jurong Formation Mark Smith, Land Transport Authority
- Undercrossing Live Tunnels in Parallel below the Water Table in an Urban Environment Diwakar Velu, Land Transport Authority

### Training Courses

TUCSS held the "TUCSS Short Course on Design & Construction of Tunnels & Underground Structures" on 4 & 5 April 2019 at Orchard Hotel. It was well attended by 220 participants.

### SICAT 2019 Symposium

TUCSS held "Symposium on Innovations & Challenges in Asian Tunnelling 2019" on Thursday & Friday, 5 & 6 September 2019, at Raffles City Convention Centre. It was attended by a total of 300 participants with 16 prominent experts sharing their knowledge and experience.

### Annual Dinner

TUCSS Annual Dinner was held on 6 September 2019 at Raffles City Convention Centre. The Dinner was attended by 750 guests and members.

### Golf Challenge

TUCSS organised 2 golf tournaments in 2019:

- 26 April 2019 at Singapore Island Country Club
- 26 September 2019 at Sentosa Golf Club

### TUCSS Site Visit

- TUCSS held Technical Site Visit to T311 Bedok South Station Site & Tunnels on 4 May 2019. It was attended by a total of 20 TUCSS members.
- TUCSS held Technical Site Visit to DTSS2 Design and Construction of Sewer Tunnels for the Deep Tunnel Sewerage System Phase 2 – Contract T-11 on 21 September 2019. It was attended by 20 TUCSS members.



# Spain



**Name:** Asociación Española de Túneles y Obras Subterráneas (Spanish Association of Tunnels and Underground Works)

**Type of Structure:** Non-profit, open association.

**Number of Members:** 315 (incl. 57 corporate and 23 young members)

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

**February** - VII Symposium of Road Tunnels. ATC (Technical Road Association) celebrated on 12th to 14th February in Barcelona, the VII Symposium of Road Tunnels "Tunnels: shorting distances, joining people. Current overview and good practices".

**March** - AETOS active presence in the "Congreso costarricense de Obras subterráneas CCROS" S. José de Costa Rica. 28th -29th March.

**May** - ITA WTC in Naples (AETOS Represented by Miguel Fernández-Bollo).

**9th and 10th May.** In Collaboration with E.T.S. Engineers of Mines and Energy UPM on the occasion of 100 years of Metro de Madrid, the Conference "100 Years of Madrid Metro and its international translation"

**June** - BEFIPS and DACH meeting in Luzern during the Swiss Tunnel Congress. **27th June**, in the Betancourt Auditorium Madrid "Homage Act Miguel Fernandez-Bollo and Professor Carlos Oteo, Honor Members of AETOS; organized by AETOS and the CICCPC and with the collaboration and participation of different entities: DGC of the Ministry Fomento, ADIF, CEDEX, as well as different Universities and Associations.

**October** - European Underground & Tunnel Forum (EUTF) meeting in Lisbon, Portugal. Hosted by CPT & LNEC.

**November** - Seminar on "Construction and maintenance of road tunnels in Asturias". Organized by the AETOS in collaboration with Ministry of Fomento, ADIF, and Principado de Asturias. Oviedo **20th – 21st November.** Technical Visit to HS RL Pajares Tunnel

**December** - FAT Technical Forum to encourage the active participation of AETOS members and their incorporation into the working groups.

**During the year** - Regular Technical Meetings of working Groups.  
Constitution of Young Members Groups.

Focus on tunnels in the ROP (Journal of Public Works). A new special issue of the ROP on Tunnels and Underground Works was presented, as a continuation of the collaboration that the Spanish Association of Tunnels and Underground Works (AETOS) and the Journal of Public Works (ROP) has been developing since 2009 which disseminates the experiences related to performances in tunnels and underground works.

In 2019 AETOS suffered some painful losses in the Spanish Tunnel Association, with the passing of a number of well-known figures in underground works: Carlos Oteo Mazo (Director of the Master of Tunnels and Underground Works that this year celebrates its fourteenth year, Enrique Fernández González (Member of the Board of Directors of AETOS and Professor of our Master), Antonio Soriano Peña (Partner of AETOS and Professor of our Master), Miguel Fernández Bollo (Vice-President of AETOS and our Representative in ITA and BEFIPS), and Felipe Mendaña Saavedra (Professor of our Master, Honorary Partner of our Association and regular collaborator of these monographs until this issue of 2019).

This circumstance forces us to strive harder in our task, to continue their efforts and to recognize their many



Parking in Sevilla-Canalejas

merits. We serve this special number as a tribute to all of them, allowing us to also publicly express our appreciation for their work and dedication.

E.T.S. Engineers of Mines and Energy UPM on the occasion of 100 years of the Metro de Madrid, held the Conference "100 Years of Madrid Metro and its international translation" in which AETOS participated with the Presidency of the Event. Alfonso XIII inaugurated the Madrid Metro on October 17th, 1919, with the current line 1 between Sol and Cuatro Caminos. Now it is the sixth-longest underground railroad in the world with some 294km (about 183 miles) of track.

The Metro has come a long way during its first century of operation. On the opening day, the route covered a mere 3.48km (about 2.16 miles), taking 10 minutes to travel 8 stops from Cuatro Caminos to Sol. On that first day, just over 56,000 passengers rode what was then called the North-South Line. Now, close to 2.3M riders take the Metro every day. Serving over 300 stations, it remains one of the most efficient ways to move around Madrid. In honour of the Metro's 100th birthday, the Regional Government of Madrid installed an educational exhibition throughout the original route, now called the 'Centenary Line.' Period photographs will highlight the Metro's history, and a new vinyl-wrapped train evoking the first train will run along the rails.

Other cities in Spain with metros in expansion are Barcelona, Valencia, Bilbao, Sevilla, Málaga, Palma de Mallorca and Granada.

## CURRENT TUNNELLING ACTIVITIES

### Parking in Sevilla-Canalejas and parking in Alcalá, Madrid.

Refurbishment has been undertaken in both to adapt them to the new regulations. In the same refurbishment, Sevilla – Canalejas and Alcalá car parks have been linked by an underground tunnel, and the Sevilla-Alcalá car park's first floor will be part of the Canalejas complex that will be finish by July 2020

### Certification Course in Fire Management for Tunnel Control Room Operators.

On the 5th and 6th November, a training workshop for tunnel control room operators with practical exercises and simulations using real fire was organized in the TST testing tunnel. Operators can gain personal certification, which provides them with a record of their technical competence in fire



Requejo VI Tunnel

management. This certification involves practical exercises and drills with real fire carried out in the TST testing tunnel. The first edition took place on 9-10th April, 2019 in Siero (Asturias).

#### Road Tunnels In Glories Square In Barcelona.

Site supervision of 1,300m of road tunnel works under one of the most important street junctions in Barcelona. Due to its construction in a consolidated urban area, it is necessary to excavate the tunnels whilst taking into account the presence of multiple existing utilities and to reduce disruption due to a large number of traffic diversions. The tunnel passes under four old railway and metro tunnels, which requires the construction of extremely rigid provisional support methods to reduce possible movements (large diameter steel tubes filled with concrete).

#### Málaga metro L1-L2 works.

Works of the Málaga Metro are ongoing in the Renfe-Guadalmedina section, which runs 100% underground between el Perchel-María Zambrano Station. Lines 1 and 2 of the Malaga Metro, to El Perchel-María Zambrano, constitutes the network in commercial service since July 2014, and consist of 12km of track with 17 stations. Currently, the Ministry of Development, Infrastructure and Land Management is advancing the works of the Renfe-Guadalmedina and Guadalmedina-Atarazanas sections, which cross the centre of the capital and which include the two additional stations

at Guadalmedina and Atarazanas, in the Paseo de la Alameda, Malaga.

The section currently under construction is 713m in length and contains a station, called Guadalmedina. The route between the stations of El Perchel and Guadalmedina, is of about 481m, both Lines 1 and 2 converge, to enable, as in the El Perchel interchange, the meeting of the two lines on the same platforms at the Guadalmedina station, so that the tunnel in this route consists of three levels to house both lines, as is also the case with the Guadalmedina station.

#### Tunnel 2 of the Cortes de Pallás Hidropower Plant

Extensive repair and rehabilitation design works for Tunnel 2 on the Cortes de Pallás pumping plant, Valencia (España).

#### M-14 highway tunnel

Due to the flooding in the M-14 highway tunnel located in the general airport system of Adolfo Suarez Madrid Barajas Airport, Madrid, a structural analysis and replacement of the damaged electromechanical systems has been performed.

#### Eight new tunnels in La Aldea de San Nicolás (Gran Canaria)

In October 2019 work began on the El Risco - Agaete stretch, in the Gran Canarian municipality of La Aldea de San Nicolás. The El Risco-Agaete section will complete the route of the GC-2 to La Aldea and replace the old GC-200 road, a dangerous road due to constant landslides that have forced its closure

repeatedly, and left the inhabitants of La Aldea virtually isolated from the rest of the island.

The construction of eight new tunnels that, with a maximum length of 5.5km, will account for three quarters of the 8.5km of the total length of the work. The aim is to build and commission the first tunnels, those for El Risco, within 24 months of the start of the works. Mechanical means and controlled blasting will be used for the excavation. In this first phase two parallel tunnels of just over 2km each will be built with a radius of 6m and a gauge of 5m.

The Aldea Tunnel is a tunnel of 3,145m length that will be the longest in the Canary Islands and will be among the 20 largest in Spain. The tunnel has two tubes, each with an 11m platform for two lanes, two carriageway and two sidewalks. The project and involves an investment of €152M and its construction period is 65 months.

#### Calle 30 Urban, the Highest Highway Tunnel in Europe (Madrid)

The 48km of tunnel on the Madrid Calle30, executed by "cut and cover" and TBM, make up the longest network of urban tunnels in Europe. EMESA, as the contractor for the maintenance and operation of the M-30, carries out the inspection and maintenance of both the infrastructure and its facilities, and manages the operation of the road. One of the most relevant projects this year was the inspection of 7,500m of tunnel and a total of 60 enclosures between the emergency exits, technical rooms and ventilation wells, following an inspection procedure in-house developed specifically for these tunnels. The 21,500 support devices that support the slab in the TBM built section (total length of 8km) have also been inspected.

#### Recoletos railway tunnel renovated

The renovation of the rail track and catenary of the Recoletos tunnel is complete and will improve the reliability of the infrastructure and reduce incidents in this key section for the Commuter network of Madrid. Renfe Cercanías de Madrid will resume the usual service through the Recoletos tunnel, which reopens once the comprehensive improvement work has been completed.

The work carried out in the tunnel, which is one of the most important actions of the Madrid Plans of The Commuter Plan, has involved an investment of more than €45M (VAT

included). This infrastructure, 7km long, is the busiest on the entire Spanish railway network, with 470 trains and 200,000 commuters per day.

**New High speed railway tunnels - ongoing**

The Pajares New Line is part of the León–Asturias Line, belonging to the High-Speed North-Northwest Corridor. It is specifically located between La Robla (León) and Pola de Lena (Asturias), in the central hub of this line, between the León - La Robla and Pola de Lena - Oviedo sections. It is 49.7km long and, in addition to the construction of the two main Pajares tunnels, between Pola de Gordón (León) and Telleo (Asturias), it also includes the outer stretches in the direction of La Robla and Pola de Lena. The Pajares Tunnels, approximately 25km in length, will be the sixth longest in Europe and the seventh longest in the world. Another important tunnel on-going is the 6km long Pontones Tunnel. The final construction of these tunnels (expected in 2025) will allow the Puerto de Pajares mountainous massif to be crossed, while ensuring a high-speed connection between Madrid, Castile-León and Asturias. The distance between Asturias and Castile-León will be shortened by 33km compared to the current railway route, with a new route designed with high-speed parameters, where trains will be able to reach speeds of over 250km/h. The time taken to travel along the new line will be approximately 15 minutes.

**Improving safety of highway tunnels**

Detailed design of refurbishment works for several tunnels on the road network are ongoing to national tunnel regulation RD 635/2006.

Among the tunnels under study in 2019 to suit European regulations are:

- Tunnels at Lladó, Colladetes, Fogá and Juan Carlos I (Vielha)", in the provinces of Huesca and Lleida
- Tunnels de Santa Isabel, Bubierca; Ateca and Sant Just", in the provinces of Zaragoza and Teruel
- Tunnels at Jarrío and Rellón. Highway A-8. Tt. MM. Coaña y Navia", in the province of Asturias
- Tunnel at Somosierra, province of Madrid

**Metro San Sebastian (Basque country)**

The scope includes the construction of a 2,020m length tunnel (cross section of 60m<sup>2</sup>) plus one station cavern (110m



long and 190m<sup>2</sup> cross section) plus two access drifts 490m and 220m long and several galleries and service shafts. A Heavy-class 130 ton roadheader is carrying out mechanical excavation in Flysch

**Cabanasses ramp, ICL (Barcelona)**

Excavation in rock with a heavy roadheader at the new potash mine development at Cabanasses ramp within the Phoenix Project of ICL Group in Iberpotash mine (Suria, Barcelona, Spain), planned length of the drift = 4.5km.

**Section 9A, Peñaskal-Bolintxu, of phase I of the metropolitan south (Basque country, Spain)**

Lot 9-A Peñaskal-Bolintxu of the South Bilbao Bypass includes the Arnotegi twin road tunnel with a total length of 1,760m per tube, and an average excavated cross-section of 115m<sup>2</sup>. The project includes eight connection galleries (214m) of 33m<sup>2</sup> cross-section and 112m of technical rooms at 62m<sup>2</sup>. Excavation method is drill & blast through marl and limestone. It is the first underground project in the Basque country fully executed on a BIM platform

**FUTURE TUNNELLING ACTIVITIES**

- New emergency exits for the E.T.S. tunnels located on the route of the Vitoria – Bilbao – San Sebastián axis of the high-speed train network. The project consists of four different tunnel sections where, by the new regulations, it is necessary to fit new parallel emergency galleries so there are no more than 1,000m of tunnel without an emergency exit.
- AETOS to collaborate with the Road Ministry DGC at conferences regarding road tunnels in Colombia and Chile
- March 2020 AETOS Seminar Metro in Sevilla (Solución sostenible para el transporte en la ciudad)
- May 2020 AETOS Seminar in Bilbao, the "Lamiako tunnel", a 3km highway tunnel under the Nervión River
- Jun 2020 Annual Conference AETOS
- October 2020 XI Simposio Nacional de Ingeniería Geotécnica SEMSIG – AETOS in Mieres (Asturias)
- Under construction 12km length Hydraulic tunnel at the Mularroya Dam
- Finishing more than 20 (> 100km) of High-Speed Railway tunnels currently under construction
- Technical meetings and WG activities on going

**EDUCATION ON TUNNELLING IN THE COUNTRY**

**Tunnelling Master and Degree courses:**

UPM Polytechnic University in Madrid, UPC Cataluña, UPV Valencia, Univ. Cantabria, Univ. La Coruña, Univ. Castilla la Mancha, Univ. Granada and Univ. Sevilla.

All courses with a Discipline of Civil Eng ECTS (European Credit System, according to the European Higher Education Area).

XIV Edition "Master in Tunnels and Underground Works". The Master's degree is currently a degree from the National University of Distance Education (UNED), with an equivalence of 60 ECTS and is training recognized by the ITA (International Tunnelling Association). This Master Course has an important international projection through collaboration with the ITA Member Associations, especially those with development in Spanish-speaking countries, such as: ACTOS, AMITOS, APTOS, etc. with which AETOS maintains collaboration agreements.

# Sweden



**Name:** Swedish Rock Engineering Association

**Type of Structure:** non-profit, open association

**Number of Members:** 87 corporate members from public and private clients, contractors, suppliers, mining companies, consulting firms, institutions and research organizations

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

Four permanent working groups constitutes the backbone of the Swedish Rock Engineering Association (Svenska Bergteknikföreningen). These working groups are Yearly Congress, International, Competence Development and Young Members. The association works towards a sustainable use and development of Swedish underground space. The main activity has been the annual Swedish congress. 2019 the two-day congress gathered approximately 530 delegates. Young Members continued its second year with the successful mentor program that was launched in 2018. The International group work towards an increased Swedish participation in ITA activities. In December a national WG meeting was held where the representatives presented each group's ongoing work. Within ITACUS National Action Programs, Think Deep Sweden continued their work. The Competence Development group arranged a webinar on the Swedish publication Design of rock structures in May and in September an international advanced grouting design course was held. The first theoretical part was held in Finland and the second practical part was held in Sweden. The course was very well received by the 46 participants and we are looking into the possibilities of arranging this course again during 2020.

## CURRENT TUNNELLING ACTIVITIES E4 Förbifarten, Stockholm (Stockholm By-pass)

This project includes an 18km long road tunnel with an excavation volume of 6,500,000m<sup>3</sup>. During 2019 construction activities have been ongoing. The tunnel is now halfway complete (52%), with current excavation speeds of approximately 900m/month. (see image 1).

## Västlänken, Gothenburg (West Link)

This is a large railway project in the

centre of Gothenburg to convert the present terminus into a through station for commuter trains. The project is built in a dense urban environment with complex geotechnical conditions of a mix of loose clay and hard rock. Tunnel length will be 6km. During 2019 work is ongoing in all four major construction contracts.

## Extensions of the subway in Stockholm

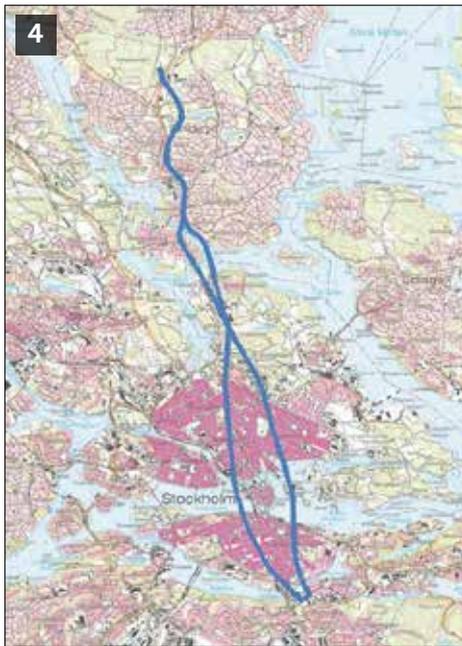
The extension of the Stockholm subway is a large tunnelling project (approx. 4Mm<sup>3</sup>) that will be ongoing in different parts of the city for some years. It will result in 11 new stations and 20km new tunnels by 2030.

The construction of the three work tunnels on the first stage, Akalla - Barkarby, started in April 2019. 160m of work tunnel has been drill and blasted by end of 2019. The construction of the 4.1km main tunnel and two underground stations has started. The first stage of this project will be ready 2026.

## Reconstruction of Slussen Stockholm incl new underground bus terminal

Slussen is a central area by the lock between lake Mälaren and the Baltic sea. This is an important hub in Stockholm and a very busy area which





is now being re-constructed with new bridges, water works etc. In addition, a large underground bus station is under construction in the same area. The tunnelling works were ongoing during 2019 and will be finished in 2023. (see image 2).

#### Varberg railroad tunnel

The West coast link is being upgraded with double tracks through the city of Varberg. 3km of rock tunnel and 300m concrete tunnel will be built. The project will create better opportunities for commuting and to be able to transfer freight transportation to the railway. Preparation for the tunnel mouth started in December 2019. The project is planned to be finished in 2024.

#### Sewage tunnel under Stockholm

Due to decommissioning of the Bromma treatment plant in the western part of Stockholm, wastewater will be conveyed to the extended Henriksdal plant in a new 14km tunnel blasted in the rock under Stockholm. Construction works started in September 2019.

#### Henriksdal sewage plant

In the Stockholm future wastewater project, an existing plant, Henriksdal, is extended to double the treatment capacity to serve 1.6M people to comply with more stringent treatment requirements. The expansion includes a new underground facility for pre-treatment under the Hammarbybacken ski slope and a complete upgrade of the Henriksdal plant. The project includes several complicated rock constructions, and blasting must be carefully controlled



to ensure continuous operation of the treatment process and minimize disturbance to surrounding infrastructure and housing. (see image 3).

#### FUTURE TUNNELLING ACTIVITIES

##### Extensions of the subway in Stockholm

Continued construction of tunnels for the subway extension in Stockholm. Four more stages including a depot will be started during 2020.

##### City Link tunnel

A tunnel with a length of 13.4km and a diameter of 5m will be built 50-100m below central parts of Stockholm. The purpose of the project is to connect northern and southern parts of Stockholm with a new electricity supply. The project will include 6 ventilation shafts, elevator systems and construction of technical buildings for electrical equipment. The work on a 100m deep shaft started in February 2020. From this shaft a 250m long tunnel will run under the Stockholms ström lake. After this work is done a TBM will arrive on site. Tunnelling will proceed for 4 years with a planned completion in 2024. (see image 4).

##### Oslänken, the East Link high speed rail

New high-speed rail south of Stockholm. Design and planning ongoing.

##### SKB Forsmark, a final repository for nuclear fuel

Planning is continuing regarding Sweden's final repository for spent nuclear fuel. Process of getting the necessary permits is on-going. (see image 5).

## STATISTICS

### 1. Length or volume excavated - % mechanized/% conventional during 2019

- Volume excavated 2019 is 1,530,000m<sup>3</sup> with 100% conventional.

### 2. List of tunnels under construction

- Stockholm By-pass; West link – Gothenburg; Extended Stockholm subway; New bus terminal at Slussen Stockholm; Varberg railroad tunnel; Sewage tunnel Bromma-Henriksdal; Henriksdal sewage plant.

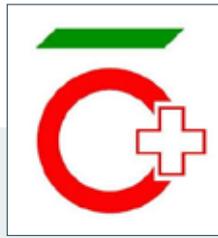
## EDUCATION ON TUNNELLING IN THE COUNTRY

**Bergsskolan** – Polytechnical education (3yrs) with Engineering Mining and construction technology/ Rock engineering Mining and construction industry Civil Engineering 3yrs (BSc) or 5yrs (MSc) as well as PhD studies is offered at several technical Universities. Courses are e.g. engineering geology, site investigation, rock mechanics, hydrogeology and risk analysis:

**Chalmers University of Technology** (Gothenburg), KTH (Stockholm), Luleå University of Technology (Luleå), and Lund University (Lund).

**Uppsala University (Uppsala)** courses are focused on geology, engineering geology and geophysical investigations.

# Switzerland



**Name:** Swiss Tunnelling Society (STS)

**Type of Structure:** Non-profit, open association

**Number of Members:** 535 members (thereof 87 young members), 96 corporate members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

**April** - General Assembly in Neuchatel, Switzerland

**June** - Swiss Tunnel Congress (STC) in Lucerne, Switzerland

**September** - DACH Meeting in Geneva, Switzerland

**October** - European Underground & Tunnel Forum (EUTF) Meeting in Lisbon, Portugal

Additionally, the STS young members (STSym) hosted the following events:

**March** - Field trip to Jörimann Stahl AG, Walenstadt, Switzerland

**June** - Reception as part of STC 2019 in Lucerne, Switzerland

**July** - Field trip to Project LEB Tunnel, Lausanne, Switzerland

**October** - BEFIPS ym meeting in Lisbon, Portugal

## CURRENT TUNNELLING ACTIVITIES

### LEB

The new 1.4km long railway tunnel in the centre of Lausanne is meant to replace the current above ground section. After completing the 42m deep access shaft in 2018, the main excavation works began in January 2019. More than 800m have already been completed, mainly by road header. Thanks to a nearby tunnel connected to the shaft by a temporary gallery, all excavated material is loaded on trains underground, reducing dramatically the number of trucks in the city centre.

Unexpected sulphurous gases released whilst excavating sandstone containing coal forced specific health and safety measures to be taken which significantly reduced the progress rate. The breakthrough is scheduled for summer 2020 and the tunnel will be put into service by the end of 2021.

## CERN

The Large Hadron Collider (LHC) is the most recent and powerful accelerator constructed on the CERN site. The LHC consists of a 27km circular tunnel, about 100m underground, with eight sites positioned around the tunnel's circumference. High-Luminosity LHC (HL-LHC) is a new project to upgrade the LHC, at Point 1 (ATLAS in Switzerland) & Point 5 (CMS in France) which consists at each the construction of an additional shaft and cavern, approximately 500m of tunnels connecting to the LHC tunnel, and additional technical buildings at the surface. The excavation of the shafts (at both Points) has been accomplished, the excavation of the cavern and of the tunnels/connections to the LHC tunnel is ongoing (70% done at Point 1 and 70% done at Point 5 as of 31.12.2019) and should be completed by the end of 2020, while lining works will continue and are scheduled to be finished by the end of 2021.

## Second Gotthard Tunnel Tube

Located on the north-south axis of the A2 motorway, the Gotthard Tunnel connects the cantons of Ticino and Uri between Airolo and Göschenen. The existing motorway tunnel was opened in 1980. As part of the 'Gotthard

conservation concept' study that began in 2009, efforts were made to identify and investigate different feasible options for conservation. These included constructing a second tunnel and subsequently renovating the first tunnel, as well as the possibility of enforcing complete closures lasting several years to enable the renovation of the existing tunnel. This latter option would have required the diversion of traffic via the pass and/or rail loading of the vehicles. On 27th June 2012, the Swiss Federal Council decided in favour of the construction of a second tunnel tube with renovation of the existing tube. The chosen solution significantly increases the level of safety in the Gotthard Tunnel and ensures that the most important north-south connection will remain open during the renovation of the existing tunnel tube. When the project is completed, both tubes will feature a single-lane operation with one standard lane and one service lane in each direction.

The planned second tunnel tube through the Gotthard has a total length of 16,866m. It runs at a standard clearance of 40m from the service and infrastructure tunnel located east of the existing Gotthard Tunnel. Construction work will start in 2021.

## Galgenbuckttunnel

After a construction period of over eight years, the Federal Roads Office (FEDRO/ASTRA) has completed the Galgenbuckttunnel in Schaffhausen on time and within budget. The new tunnel relieves the community of Neuhausen from through traffic and provides a long-term solution for the Schaffhausen South connection to the A4 motorway.





Galgenbucktunnel

Construction of the 1,138m long tunnel – with the Bahntal portal at one end and the Engi portal at the other – was a feat of precision planning that involved overcoming structural challenges and deploying modern technology. Inauguration of the tunnel marks the successful conclusion of this major project for Switzerland's national highway network.

### Taubenloch Nord

Taubenloch Nord is located near Biel in the Canton of Berne. The main part of the project is the deconstruction of the existing two 2-lane tunnels on the A16 motorway built in 1970. Other works are the refurbishment of a bridge in the north and the portal areas including a cut-and-cover tunnel in the south. In 2019 the works of tunnel 1 were completed in just 9 months while the traffic was directed through tunnel 2. 446m of the existing inner liner and excavation support have been demolished and widened by means of excavators equipped with hydraulic hammers and milling heads. The works on the second tube will be completed in 2020.

### CEVA

CEVA plays a crucial role in the mobility of Greater Geneva which encompasses nearly one million people. Since December 2019, this new trans-border line connects the stations of Geneva-Cornavin and Annemasse, linking the rail networks of Switzerland and France. Up to 80% of this connection is underground. It required the construction of two tunnels and several cut-and-cover sections.

The Pinchat tunnel is 2,024m long. Over the first 400m, the tunnel passes through clayey silts, then gradually penetrates the very compact gravels and locally cemented soil. It was excavated using the traditional method through loose ground with excavators. With an overall length of 1,600m, the Champel tunnel starts at its western end after the bridge over the river Arve, and leads, after a length of 502m, up to the Champel-Hôpital station.



Taubenloch Nord

The underground station will serve a very densely populated district with residential buildings and the university hospitals of Geneva. Over its entire length, the tunnel invert lies in the moraine gravels.

## FUTURE TUNNELLING ACTIVITIES

### Rail Tunnels

Lötschberg Basetunnel II (BLS, 35,000m), Stadelhofen Tunnel (SBB, 7,000m),

Brüttener Tunnel (SBB, 9,000m), Zimmerberg Tunnel II (SBB, 11,000m), Crossrail – Lake Crossing Luzern (SBB, 5,500m)

### Road Tunnels

Second Gotthard Tunnel Tube (ASTRA, 16,918m), Leissigentunnel (ASTRA, 2,200m), Tunnel Cholfirst (ASTRA, 1,250m), Safety Gallery Kerenzlerberg (ASTRA, 5,504m), Morschacher/Sisikoner Tunnel (Kt. SZ/UR, 7,680m), Vingeltunnel (Kt. BE, 2,300m), City Tunnel (Kt. BE, 900m), Portttunnel (Kt. BE, 1,700m), Tunnel Weidteile (Kt. BE, 1,300m), Tunnel Fäsenstaub (ASTRA, 1,460m), Bypass Luzern (ASTRA, 3,450m), Kaiserstuhl Tunnel (Kt. OW, 2,081m), Bypass Bern Ost (ASTRA, 4,000m), Rosenberg Tunnel 3. Röhre (ASTRA, 1,435m)

## STATISTICS

### 1. Length or volume excavated - % mechanized/% conventional during 2019

- 7,500m/30% TBM

### 2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2019:

- €460M.

### 3. List of tunnels completed:

- Ruckhaldetunnel (AB, 725m),
- Coldrerio (SBB, 96m),
- Dragonato (SBB, 30m),
- Galgenbuck (ASTRA, 1,138m)

### 2. List of tunnels under construction:

#### Rail Tunnels:

Ceneri-Basistunnel (ATG AG, 15,400m), 5 Tunnel of CEVA (SBB/Kt. GE, 8,200m), Bözberg II Tunnel (SBB, 2,500m), Eppenbergtunnel (SBB, 3,114m), Albulatunnel (RhB, 5,860m), RBS Bern Station Expansion (RBS, 1,200m), Ligerz Tunnel (SBB, 2,000m), LEB Tunnel Lausanne (LEB, 1,700m)

#### Road Tunnels:

Tunnel Eyholz Haupttunnel (Kt. VS, 4,200m), Safety Gallery Tunnel Ligerz (ASTRA, 2,483m), Safety Gallery Tunnel Sachseln (ASTRA, 5,084m), Tunnel Visp 2. Röhre (Kt. VS, 2,600m), Safety Gallery Tunnel Bärenburg (ASTRA, 1,028m), Rehabilitation Tunnel Belchen (ASTRA, 3,200m), Gubrist 3. Röhre (ASTRA, 3,230m), Safety Gallery Tunnel Crapteig (ASTRA, 2,171m), Tunnel Riedberg (Kt. VS, S: 555m, N: 483m), Südumfahrung Küssnacht (Kt. SZ, 500m), Safety Gallery Tunnel Rofla (ASTRA, 1,017m), Tunnel de déviation des Evouettes (Kt. VS, 770m), Tunnel des Nations (Kt. GE, 870m), Gallery Schwamendingen and Schöneich Tunnel (ASTRA, 1,680m)

#### Other Projects:

Nant de Drance Pumped Storage Power Plant, Hydro Power Plant Ritom, CERN HILUMI LHC Project

## EDUCATION ON TUNNELLING

ETH Zurich, Department of Civil, Environmental and Geomatic Engineering  
University of Applied Sciences, in various cities



# KRONOS

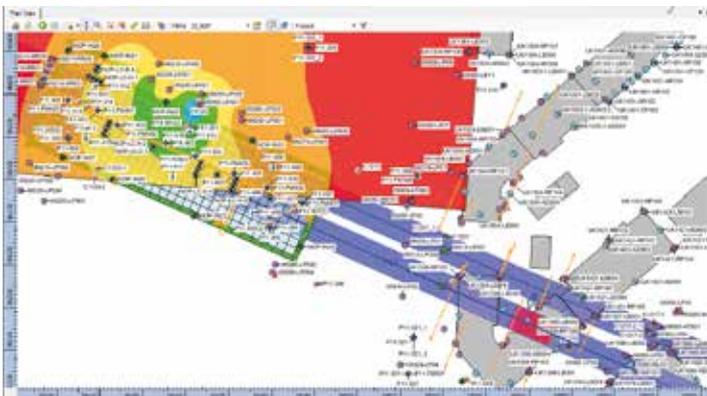
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# Thailand



**Name:** Thailand Underground and Tunnelling Group (TUTG), The Engineering Institute of Thailand under H.M. The King's Patronage

**Type of Structure:** non-profit organization

**Number of Members:** 60 members

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- Four 'Tea Talk' Seminars were held through 2019.
- Co-organizer of 14th International Conference on Shotcrete for Underground Support 2019 17th – 20th November 2019 at Nong Nooch Gardens, Pattaya, Thailand.
- Co-organizer of 6th Thai Geotechnical Conference 2019 (26th – 27th September 2019)
- Organize the 4th Training of - 'Tunnelling in Soft Ground' (24th – 26th July 2019) - 'Tunnelling in Rock' (6th – 8th November 2019)
- Continuing Activities from last year: Preparation of Shotcrete Guideline Publication

## CURRENT TUNNELLING ACTIVITIES

- Flood Diversion Tunnel – Khlong Nong Bon to Chao Pha Ya River – 5.7m diameter, 9.4km long tunnel (The Bangkok Metropolitan Administration)
- Orange Line - East Section – 20km tunnel length (Mass Rapid Transit Authority of Thailand)
- Mae Tang – Mae Ngud – Mae Kuang Water Diversion Tunnel – 48km long tunnel (Royal Irrigation Department)
- Track Doubling North-Eastern Line – Mab Kabao – Thanon Chira Junction – 7.9km long tunnel (State Railways of Thailand (SRT))
- Outgoing Cable Tunnel at Chidlom Terminal Station – 3.6m diameter, 1.8km long tunnel (Metropolitan Electricity Authority)
- Underground Khlong Phra Khanong Electric Tunnel Project – 3.6m diameter, 0.8km long tunnel (Metropolitan Electricity Authority)
- Conversion of Overhead Line to Underground System, Rama III Project : Thanontok Terminal Station – Rama IX Bridge – 4.7km tunnel length (Metropolitan Electricity Authority) – US\$60M (Approximately)

- Conversion of Overhead Line to an Underground System, Rama III Project : Rama IX Bridge – Chalm Mahanakorn Expressway Section – 6.2km tunnel length (Metropolitan Electricity Authority) – US\$47M (Approximately)

## FUTURE TUNNELLING ACTIVITIES

- Orange Line - West Section – 20.4km long tunnel (Mass Rapid Transit Authority of Thailand)
- Purple Line South – 25.4 km long tunnel (Mass Rapid Transit Authority of Thailand)
- Outgoing Cable Tunnel at Bang Phli Terminal Station – 2.6m diameter,

- 1.2km long tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Bang Sue Terminal Station – 2.6m diameter, 2.6km long tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Lad Phraw Terminal Station – 2.6m diameter, 1.6km long tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Erawan Terminal Station – 3.6m diameter, 5.5km long tunnel (Metropolitan Electricity Authority)
- Khlong Prem Prachakorn Flood Diversion Tunnel – from Khlong Bang Bua to Chao Pha Ya River – 5.7m diameter, 13.5km long tunnel (The Bangkok Metropolitan Administration)
- Khlong San Saeb Flood Diversion Tunnel – from Khlong Lad Praow to Soi Lad Praow 130 – 3.7m diameter, 3.8km long tunnel (The Bangkok Metropolitan Administration)
- Khlong Taweewattana Bottle Neck Flood Diversion Tunnel – 3.7m diameter, 2km long tunnel (The Bangkok Metropolitan Administration)



# Turkey



**Name:** Turkish Road Association

**Type of Structure:** TRA is an open association. Its function is to promote, coordinate and spread studies and research in the field of roads, highways, motorways, tunnelling and other underground works.

**Number of Members:** As of January 1st, 2020, TRA has 504 members of which 439 are individuals and 65 are corporate members which represent Universities, Consultants, Contractors, Manufacturers and some of the other Governmental Organizations.

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

The "2nd National Tunnelling and Underground Space Congress and Exhibition" was held on December 4th – 5th, 2019 at the Sheraton Ankara Hotel & Convention Center with the support of the Ministry of Transportation and Infrastructure and with the scientific and technical contribution from the General Directorate Highways, the Turkish Road Association (TRA – YTMK). The Deputy Minister of Transportation and Infrastructure Mr. Adil KARASMAILOGLU, General Director of Highways and chairman of the board of TRA, Mr. Abdulkadir URALOGLU gave their speeches in the opening ceremony. Representatives of several public and private organizations, NGOs, Universities and tunnel and underground sectors took part in the Congress. The total number of participants was more than 1000.

The exhibition, with 22 tunnel and underground sector companies, contributed in the sharing of knowledge and technology.

The Executive Director of ITA-AITES, Mr. Olivier VION and Member of the Board TRA and ITA Mr. Hamdi AYDIN, gave details of the ITA's activities and relations with TRA in their speeches.

Over the six sessions of the Congress, six invited speakers and 20 experts presented their works.

## CURRENT TUNNELLING ACTIVITIES

### New Zigana Tunnel

The 14.5km long New Zigana Tunnel project in Turkey is currently under construction. The two-lane tunnel will connect the Gumushane and Trabzon provinces in Turkey's north east, and will be located at an altitude of over 1,200m above sea level. The construction of the tunnel will replace the existing route over the Zigana Pass, which reaches an

altitude above sea level of 2,032m. The project consists of 2 x 14,500m long tunnels and 600m of connection roads. Upon completion of the tunnel, the existing road will be shortened by 8km.

### Egribel Tunnel

A total of 10,286m of excavation and support works were completed in the 5,905m long twin-tube Egribel Tunnel.

### Alacabel Tunnel

The Alacabel Tunnel connecting Konya and Antalya cities is a twin-tube, 7,360m in length.

### Kirik Tunnel

The Rize and Erzurum provinces are being connected by the twin-tube 7,105m long Kirik Tunnel Project.

### Kop Tunnel

When the 2 x 6,500m Kop Tunnel, on the Erzurum-Bayburt road, is completed access of the Gurbulak Border Gate to the Trabzon Port will be made easier. The economic and social structures of the Black Sea, Eastern Anatolia and Southeastern Anatolia will be greatly improved.

### Ilgar Tunnel

The Ilgar Tunnel is located on the (Ardahan-Cildir) Separation - Hanak-Damal Route. There are 2 x 4.9km long twin-tube tunnels within the project. With the completion of the Ilgar Tunnel, the route will be shortened by 5km.

### Sertavul Tunnel

Sertavul Tunnel is a twin-tube, 3,300m in length.

### Salarha Tunnel

A total of 4,231m of excavation and support works were completed in the 2,945m long twin-tube Salarha Tunnel in the Black Sea Region.

### Pirinkayalar Tunnel

The 2,246m long single-tube Pirinkayalar Tunnel will connect the cities of Erzurum and Artvin.

### Mediterranean Coastal Road Tunnels

The Mediterranean Coast Road between Mersin and Antalya is 446km long. This project includes 34 tunnels (39.8km). The construction of 16 tunnels (10,037m) has been completed to date.

### Dolmabahce-Levazim Tunnel

The Dolmabahce-Levazim Tunnel is the first tunnel of the Dolmabahce-Kilyos Tunnels Project. The excavation works of this 3,872m long twin-tube tunnel are continuing. The design works of the remaining tunnels of the route are completed.

### Dudullu-Bostanci Subway Line

The Dudullu-Bostanci Subway Line will be 14km long. The journey will take 21 minutes on the Dudullu-Bostanci Subway Line, which will have 13 stations. With a connection to be made at Kozyatagi Station, transfer to the Kadikoy-Pendik Subway Line will be provided.

### ISKI Europe 2nd Region 2nd Part Wastewater Tunnel

A wastewater tunnel is being constructed to transfer wastewater from the Kucukcekmece Wastewater Pretreatment Plant to the existing Ambarlı Advanced Biological Wastewater Treatment Plant in Beylikduzu. Within the scope of the project, a wastewater tunnel with an i.d. of 2.2m and a length of 6,438.28m, and a shaft of 91m depth with a diameter of 7.5m are being constructing.

### ISKI Kagithane-Sefakoy Drinking Water Tunnel

The ISKI Kagithane-Sefakoy Drinking Water Tunnel project consists of two lines. Line 1 which is 7.7km length between the Kagithane-Eyup (Munzevi) districts. Line 2 is 13.1km in length and is situated between the Islambey-Sefakoy districts. The 19.56km section of the 20.81km long water tunnel line will be excavated by TBM, the rest will be excavated using NATM or SEM.

### Babakaya and Silvan Irrigation Tunnels

Within the scope of the Southeastern Anatolia Project, the Babakaya and Silvan Tunnels are being built to bring water from the Silvan Dam (under construction). The Babakaya Tunnel is

5,320m long, 7m i.d. with twin-tubes. The Silvan Tunnel, which will carry 212m<sup>3</sup> of water per second, is being constructed as a single tube with a length of 13.4km and a diameter of 10m. The water in the dam will be transferred to the 97.6km long main canal through the Silvan and Babakaya Tunnels.

**Hadimi Irrigation Tunnel**

The Hadimi Tunnel is 18,136m long and will transfer the water stored in Afsar Dam to Bagbasi Dam. Hadimi Tunnel is one of the biggest projects in the region, and in Turkey. 11.5km of the tunnel is excavated by TBM and 6,631m by the drill and blast method.

**FUTURE TUNNELLING ACTIVITIES**

**3-Deck Great Istanbul Tunnel**

The new mega project in Istanbul, the “3-Deck Great Istanbul Tunnel,” will be first 3-deck tunnel in the world and will consist of both the metro line and dual motorway. The tunnel is estimated to cost \$3.5bn and will be 17.5m in diameter and 4.5km in length. There are 2x2 lane highways

and a dual line metro in the scope of the great tunnel. It will be integrated with rail systems and highway lines.

Within the project; there are 31km of metro lines with 14 stations, and 16.5km of highway. The station I at Golden Horn (Halic) will be constructed under sea using an immersed tube.

It is expected that 6.5M passengers a day will benefit from the line.

**Dolmabahce-Kilyos Tunnels**

The Dolmabahce-Kilyos Tunnels Project consists of three sections. In this sections there are six tunnels, which will be excavated by NATM. The total length of these four tunnels is approximately 20.4km. The excavation works of the Dolmabahce-Levazim tunnel has started.

**Kagithane-Buyukcekmece Tunnels**

In the Kagithane-Buyukcekmece Tunnels Project there are eight tunnels. Two different methods will be used for these tunnels. The first two tunnels will be excavated by NATM and the others will be excavated by TBM. The total length

of this eight tunnels are approximately 26.7km.

**Harem-Kucukusu Tunnels**

The Harem-Kucukusu Tunnels Project consists of 3 twin-tube tunnels. The total length of these three tunnels is approximately 9.2km.

**Yenisahra-Bostanci-Kucukyali Tunnels**

The Yenisahra-Bostanci-Kucukyali Tunnels Project consists of two sections. In this section there are 2 twin-tube tunnels with a total length of approximately 6km.

**STATISTICS**

**1. Length or volume excavated - % mechanized/% conventional during 2019**

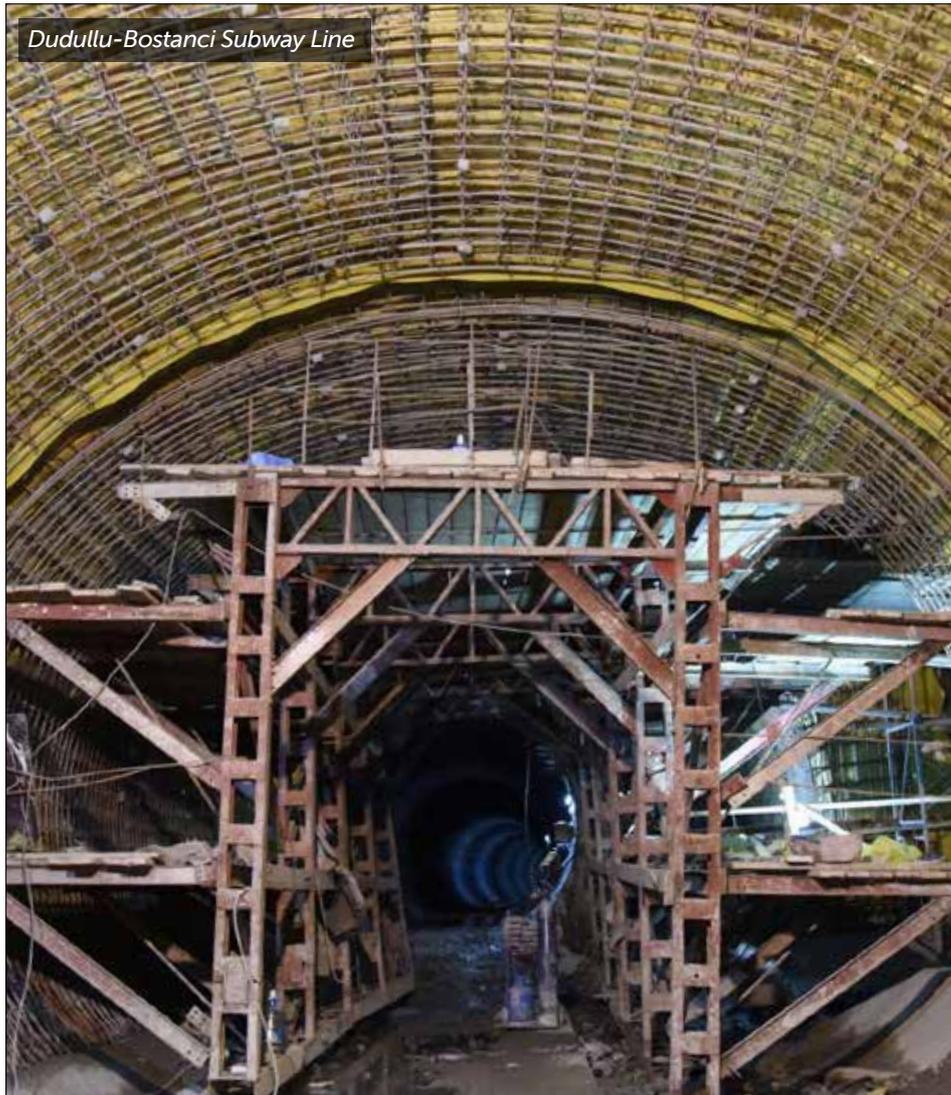
- Total Length (m) 232.496,76  
Mechanized (%) 80,40  
Conventional (%) 19,60
- Total Volume (m<sup>3</sup>) 15.496.937,40  
Mechanized (%) 70,90  
Conventional (%) 29,10

**2. Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019:**

Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019: US\$3.828.757.547,20

**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Afyon Kocatepe University
- Bilecik Seyh Edebali University
- Bingol University
- Cukurova University
- Dicle University
- Dokuz Eylul University
- Fatih Sultan Mehmet Vakif University
- Istanbul University - Cerrahpasa
- Istanbul Okan University
- Istanbul Technical University
- Konya Technical University
- Mugla Sitki Kocman University
- Nigde Omer Halisdemir University
- Ondokuz Mayis University
- Middle East Technical University
- Nisantasi University
- Pamukkale University
- Recep Tayyip Erdogan University
- Sivas Cumhuriyet University
- Suleyman Demirel University
- Toros University
- Yalova University
- Zonguldak Bulent Ecevit University



Dudullu-Bostanci Subway Line

# United Kingdom



**Name:** British Tunnelling Society

**Type of Structure:** non-profit, professional membership body, learned society and Associated Society of Institution of Civil Engineers (ICE)

**Number of Members:** 809 members, 90 corporate members at end 2019

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

In 2019 the British Tunnelling Society continued to offer its membership technical lectures; training and development and engage and inform on the development and use of underground space.

The BTS continues to work closely with University of Warwick in the delivery of an MSc in Tunnelling & Underground Space

We are a focal part of the Industry working group – Transforming Tunnel Safety comprising BTS, Clients, Consultants and Contractors with the initiative to drive improvement in the health and safety performance of the tunnelling industry.

- 10 informal evening discussions – monthly apart from July and August.
- Various technical and social meetings and events arranged by the BTS Young Members
- Award of James Clark Medal to Mike King for his tireless work in the tunnelling industry and for the BTS for its lifetime contribution to tunnelling.
- Lunch for James Clark Medal recipients
- Harding Prize competition for under 35's
- Annual dinner held each year in May.
- Holds the Biennial BTS Conference & Exhibition (next event to be held in March 2021, delayed from October 2020 due to the Covid-19 Pandemic)
- Co-badged events with numerous other organisations including ICE, IOM3, BGA, Concrete Society

The BTS jointly with the Institution of Civil Engineers supports an All Party Parliamentary Group to engage with parliamentarians and promote tunnelling and the use of underground space as a sustainable form of infrastructure development. The group was busy during 2019, despite other time pressures on parliamentarians, and held a number of briefing sessions at the ICE and hosted a summer reception in the Houses of Parliament. This group was also

recognised in the Government spending review for the role it plays in promoting infrastructure development.

The BTS continues to work with and support Tunnel Skills. TunnelSkills (the industry training development forum) has developed a number of tunnelling specific courses in conjunction with City & Guilds and CITB. Tunnel Entry, Loco Operators, Concrete Pump Operation and Tunnel Safety Training Scheme are some of the courses developed.

The BTS also continues to work with industry clients, contractors and consultants in an industry forum to review and improve health and safety cross the tunnelling industry. Transforming Tunnelling Safety aims to transform the health and safety performance of UK tunnelling works and has embarked on a major project to increase openness, and to share best practice. This information is available to all through the BTS website <https://www.britishtunnelling.org.uk>

An updated version of BS6164 – Health and safety in tunnelling in the construction industry – Code of practice was published late 2019 by BSi. The BTS and its members provided significant input to this document.

The BTS has begun a process for undertaking a further update of the Specification for tunnelling. Feedback on the current specification is being collated through our blog at <https://btsspec4.wordpress.com/>

2021 will see the 50th anniversary of the BTS. This is a hugely significant milestone for the society and there are many plans being developed to mark this occasion in 2021. The plans for this have commenced and are well advanced. The BTS intends to publish a book celebrating 50 years of the BTS which will be available for WTC 2021.

Think Deep UK has further developed its initiatives on the development of underground space in 2019, holding three further workshops on Design, Transport and 3D Planning, following on from the workshop on Social Value. The group has

published its first “blue paper” entitled Investing in urban underground space – Maximising the social benefits following the first workshop and is in the process of preparing the remaining three blue papers.

## BTS Young Members

The young members continued to offer a wide range of activities including lectures, workshops and socials. The BTSYM has close links with other ITA young member organisations and continue to develop relationships and co-host lectures and events. A key part of their work in 2019 was actively working on encouraging the younger generations to consider tunnelling as a career. The BTSYM continue with monthly workshops on specific tunnel issues for the development of young engineers in the tunnelling industry. They once again held their annual conference in March 2019 which proved yet again to be hugely successful.

## CURRENT TUNNELLING ACTIVITIES

### Thames Tideway Tunnel

During 2019, tunnelling on the Thames Tideway contracts comprising 25km of 7.2m diameter tunnel at depths up to 66m under the River Thames connecting the previously constructed Lee Tunnel continued. There will be a total of six TBMs completing the tunnelling works. In November 2019 the first TBM completed its journey. Tunnelling will continue throughout 2020 and into 2021 when the final TBMs will be launched.

### High Speed Two

2019 has seen the continuation of the ECI design phase for the main works civils contracts for the proposed high speed rail line between London and Birmingham. These contracts comprise 35km of twin bored tunnel. The ECI phase completed in later 2019/early 2020 and the construction contracts were awarded in early 2020. Works are currently in planning for the tunnelling works. Phase 2 for HS2 is currently under development and this currently comprises a further 21km of twin running tunnels giving a total of 56km, which is approximately 10% of the total 561km length.

### North Yorkshire Polyhalite Project

New project owner Anglo American, has commenced work on the 37km long tunnel to transport the high-grade potash (polyhalite) to the coast at Redcar. Tunnelling at depths of up to 300m, with

associated access shafts and mine shafts up to 1500m deep, commenced in 2019.

**Hinkley Point Nuclear Power Station**  
Work continues on the first new nuclear power station in the UK for many years. Part of the work on this will comprise 2 No. intake tunnels and 1 No. outtake tunnel comprising around 9km in total. The first TBM commenced its journey in September 2019 with completion due towards the end of 2020.

**Bank Station Capacity Upgrade**  
Construction work has continued on the upgrade to Bank Station, one of the largest underground railway complexes in the world. The works comprise a new entrance, three ticket halls, six lifts, 10 platforms, two 94m travellers, 570m tunnel and platforms for the Northern Line.

**Silvertown Tunnel**

Late 2019 saw the contract award for

the Silvertown project comprising twin bored tunnels under the River Thames approximately 1.4km long and 12m diameter. The project is a PPP delivery model. This project will create another road crossing in East London adjacent to the existing Blackwall tunnel.

**FUTURE TUNNELLING ACTIVITIES**

**Lower Thames Crossing**

A proposed new motorway on the M25 to include 14.5 miles of road. This will also comprise 4km of twin tunnel beneath the River Thames East of London each with a diameter of around 15m. The project is currently in the planning and development phase with the procurement process for construction due to commence in late 2020. The road is due to be operational in 2027.

**A303 Stonehenge Tunnel**

This is a proposed 11km dualling of the A303 in the vicinity of the ancient monument at Stonehenge. The works will comprise 2.9km of twin tunnels. The project is in planning and development and due for construction procurement in 2020.

**Bakerloo Line Extension**

TfL is proposing to extend the Bakerloo line beyond Elephant & Castle to Lewisham, serving Old Kent Road and New Cross Gate. This will comprise new stations and twin 8.5km tunnels from Elephant and Castle to Lewisham. The project was released for consultation in late 2019.

**Crossrail 2**

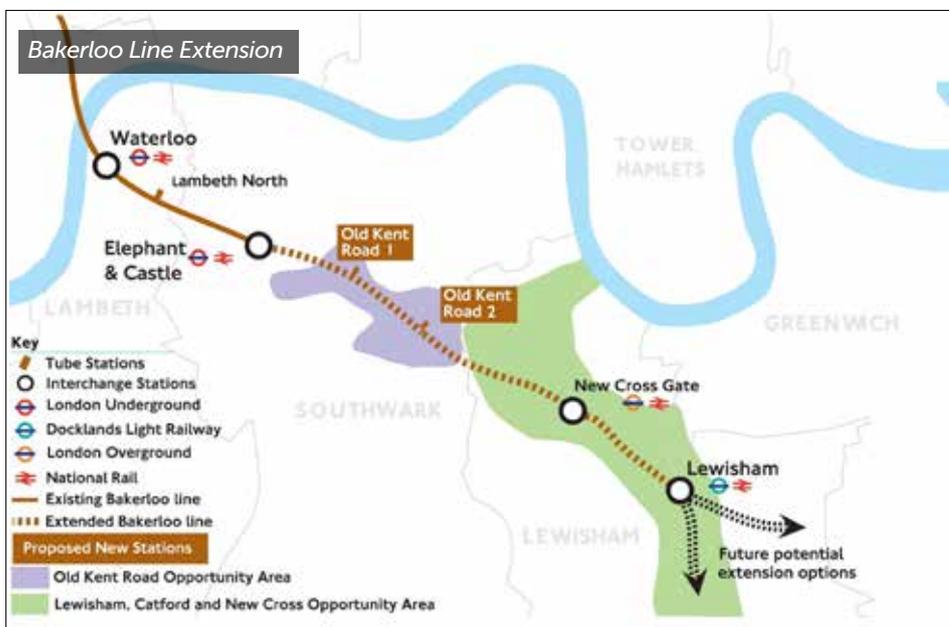
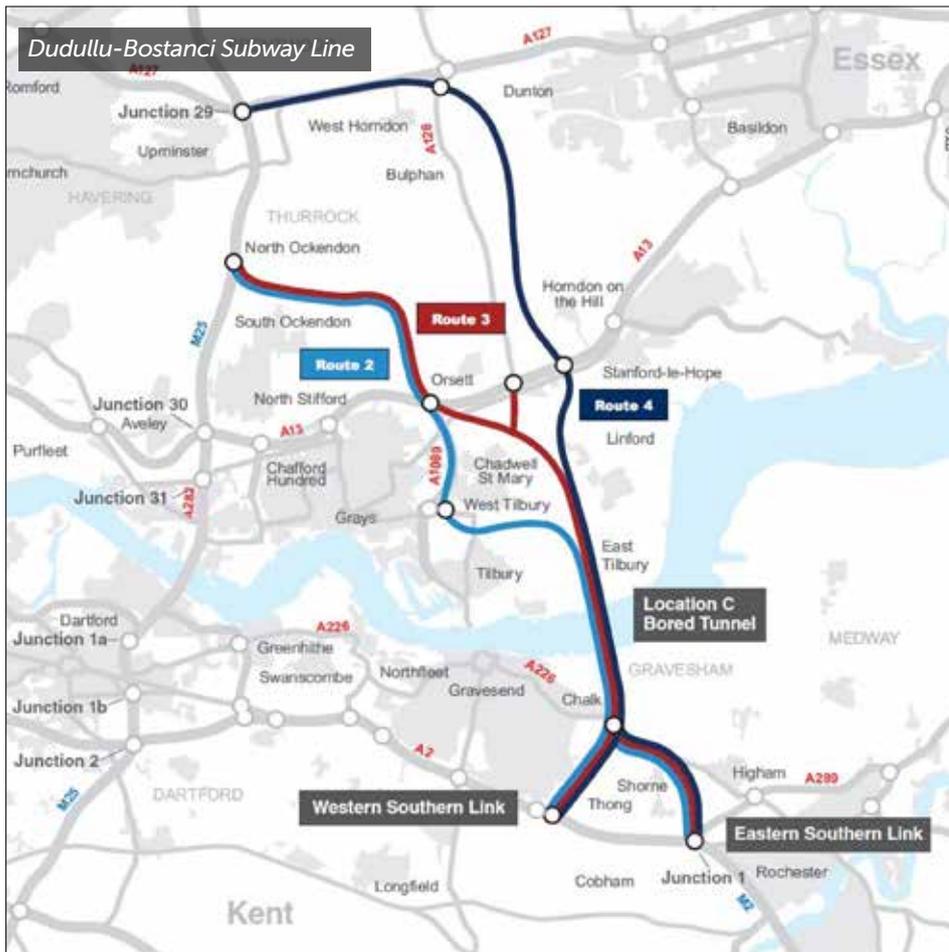
This project will comprise 72km of twin-bored tunnel and 11 underground stations. It is currently undergoing a review by Government prior to being taken forward to Hybrid Bill.

**Coire Glas hydroelectric scheme**

Scottish and Southern Energy continue with plans to develop a new hydroelectric scheme in Scotland. This projects is expected to included tunnelling and large span caverns.

**Haweswater Aqueduct Replacement Project**

United Utilities is planning to replace an existing aqueduct in the North West of England that provides drinking water for the city of Manchester. This replacement will comprise approximately 50km of 3m diameter tunnelling at depths of up to 300m.



# United States



**Name:** Underground Construction Association (UCA of SME)

**Type of Structure:** non-profit, open association

**Number of Members:** Total number: 1,472, number of corporate members: 67

## ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

- 2019 and 2020 George Fox Conferences. These one-day conferences provide concise information on the themes of water tunnels: past, present and future (2019) and design and construction of complex projects (2020).
- Provided numerous student scholarships for attendance of the Rapid Excavation and Tunnelling Conference (RETC) held in Chicago, Illinois.
- 2019 Cutting Edge Conference. Annual two-day conference to explore technical advancements and innovations in the industry. This year's event featured the ITA tunnelling awards in Miami, Florida, and included two days of discussion on advances in tunnelling technology.
- Our Young Members group continued their activities, including organization of monthly webinars on various topics of interest to our developing associates.
- Published four editions of our magazine, "Tunnelling & Underground Construction".
- Published a second edition of the Recommended Contract Practices for Underground Construction (2019), edited by Sarah Wilson.
- Completed the majority of planning for June's North American Tunnelling (NAT) Conference, UCA's biennial technical event to be held this year in Nashville, Tennessee.
- Realized a 6% growth in membership within the past 12 months.

## CURRENT TUNNELLING ACTIVITIES

There are dozens of notable tunnels currently under construction in the United States. These include:

### Highway Tunnels

- The Parallel Thimble Shoal Tunnel project in Virginia Beach, VA is advancing. This EPB TBM excavation

will twin the existing immersed tube tunnel under the Chesapeake Bay constructed between 1960–1964.

- Hampton Roads Bridge and Tunnel Project in Virginia Beach, VA is underway. This is another example of an EPBM tunnel paralleling two immersed tube tunnels.

### Transit Tunnels

- Ahead of the 2028 Olympics, Los Angeles continues to be the American hot bed for transit tunnels. Four major subway projects are currently underway; Crenshaw/LAX Corridor, Regional Connector, Purple Line Extension–Phase 1 and Purple Line Extension–Phase 2. Phase 3 of the Purple Line Extension is in design with mobilization to site expected during the spring of 2020. Combined, these projects will add 19 miles of new commuter lines and connect existing lines for shorter overall travel times.
- Las Vegas Convention Center is underway with a people mover tunnel that is partially completed.

### Water Supply

- TBM tunnelling is completed and lining operations are underway for a water supply tunnel beneath the Hudson River in upstate New York on the Rondout West Branch Bypass Tunnel. As the project name implies, this tunnel will bypass a deteriorating portion New York City's main water supply.
- The Deep pump station cavern and connection tunnels are nearing completion and commissioning in Las Vegas, NV.
- Mill Creek/Peaks Branch/State Thomas Drainage Relief Tunnel Project. This project includes 26,385 lf of 32.5-ft excavated diameter (30-ft ID) tunnel and 7 shafts (ranging in depth from 120 to 200 vf).

### Wastewater

- Sewer and drainage tunnels continue to be the most prevalent tunnels being constructed in the United States. Several municipalities continue with their programs, as others are just beginning.
- In Washington, D.C., The Northeast Boundary Tunnel CSO tunnel is underway.
  - St. Louis, MO currently has wastewater tunnelling underway, at Deer Creek tunnel (22,800 lf of tunnel, 19 ft diameter, with an average depth of 120 ft. There are 5 drop shafts). Jefferson Barracks Tunnel (17,800 lf of 11-ft excavated diameter tunnel, and the installation of a 7-ft diameter FRP carrier pipe and fiber optic conduits in the tunnel). Maline Creek CSO Storage Tunnel (now 90% complete).
  - The Ship Canal Water Quality Project



in Seattle is underway. This 18-foot diameter x 14,000-foot-long tunnel project includes the construction of five shafts.

- Cleveland, OH has the Shoreline CSO tunnel about to get started in construction. Westerley Storage Tunnel (CSO) is approximately 50% complete.
- Joint Water Pollution Control Plant Effluent Outfall Tunnel. This outfall tunnel for the Los Angeles County Sanitation Districts issued NTP on April 8, 2019. The tunnel will be approximately 7 miles long and 18 ft ID.
- Indianapolis, IN Fall Creek Tunnel began in 2019. This 17,850-ft, 18-ft finished concrete lined tunnel is approximately 250 ft deep and

features ten CSO connecting structures/deaeration chambers and tunnel connection adits.

- Ohio River Tunnel (ORT) for the Louisville and Jefferson County Metropolitan Sewer District (MSD) issued NTP on Nov. 8, 2017, and is scheduled to reach Substantial Completion by Dec. 31, 2020 (Final Completion: March 31, 2021). The tunnel length is 21,300 ft; Diameter: 22 ft excavated, 20 ft finished; Depth – 200 ft; Shafts – 6.
- Hartford, CT, Akron, OH, Ft. Wayne IN and Louisville, KY have the first of their wastewater tunnel projects underway.

**FUTURE TUNNELLING ACTIVITIES**

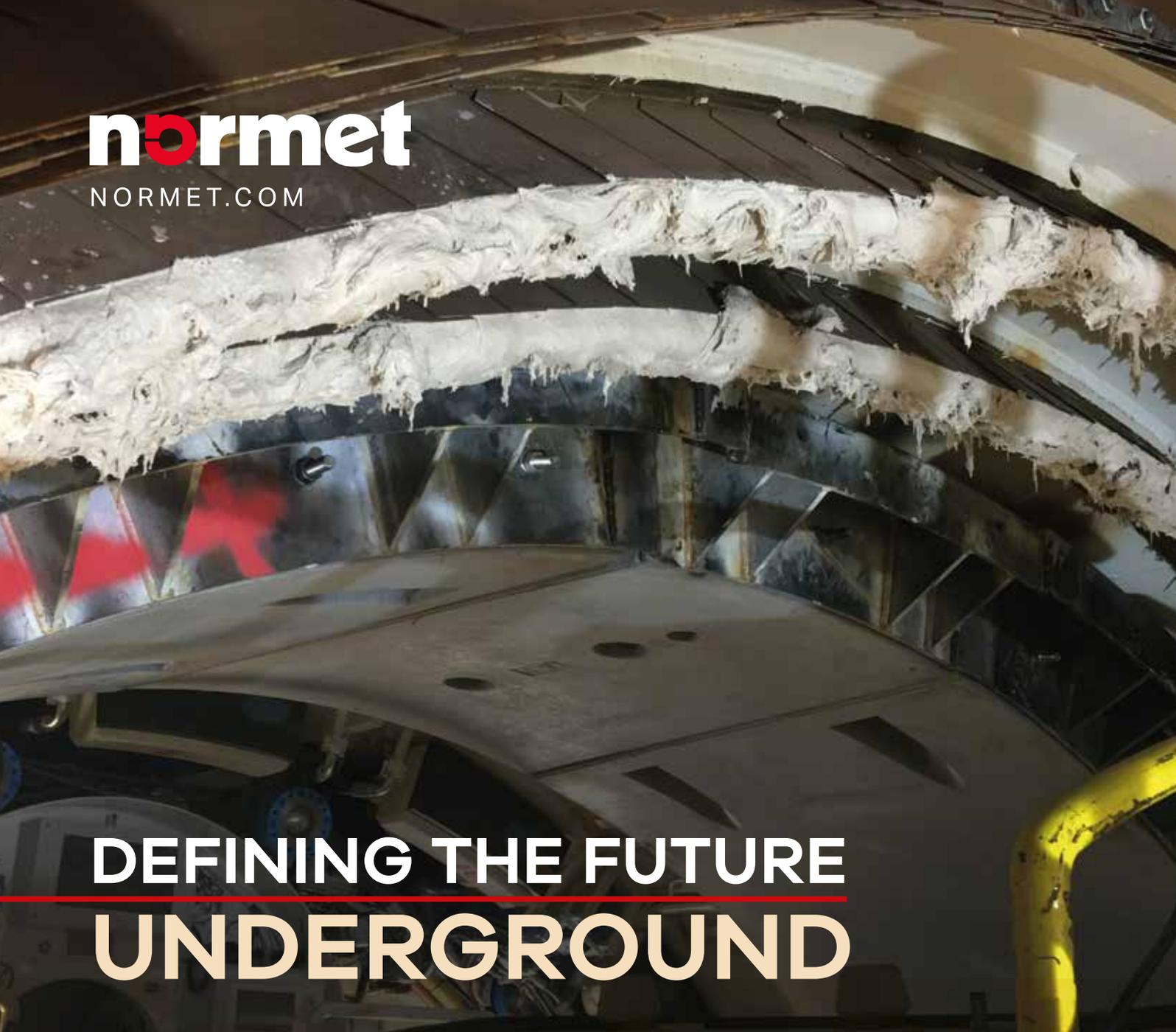
Several large tunnelling projects are on the horizon in the United States.

- Subject to available funding, the massive Bay Delta Water Conveyance Program may get started in 2019-2020, as several design and logistical contracts are scheduled for procurement. The entire project is planned to consist of over 36 miles of twin 40-foot diameter tunnels. Recent state government decisions may reduce the scope of this project to a single bore.
- We may see the Gateway Tunnels Project in procurement in 2021. These twin heavy rail tunnels will run under the Hudson River between New Jersey and New York to complement the existing and aging North River Tunnels. This project originally went into procurement in 2009 but was cancelled when the State of New Jersey withdrew funding. A follow-on project will rehabilitate the existing tunnels to effectively double current rail commuter rail capacity. The project continues to face major funding hurdles.
- Wastewater tunnels will continue to make up the majority of tunnelling projects in the United States throughout 2020. Cleveland, OH, Providence, RI, Columbus, OH, Los Angeles, CA, and the burgeoning tunnelling markets of Houston, San Antonio, and Dallas, (all in Texas) are just some of the U.S. cities that will continue to expand their facilities.



**STATISTICS**

- 1. Length or volume excavated - % mechanized/% conventional during 2019**  
UCA does not track this statistic.
- 2. Amount (USD or EUR) of tunnelling/underground space facilities awarded in 2019:**  
UCA does not track this statistic.
- 3. List of tunnels completed**  
Alaskan Way Viaduct Replacement Tunnel opened. Indianapolis, IN White River /Lower Pogues Run Tunnel completed tunnelling in 2019. Purple Line Light Rail Tunnel recently completed with Project completion in 2022. Doan Valley Tunnel in Cleveland, OH.
- 4. List of tunnels under construction**  
See Update list above for major tunnels under construction.



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- > **Adhesion to wet and dry surfaces**
- > **Low density**
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# DEFY EXPECTATIONS



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A 5.06 m diameter Robbins Double Shield TBM exceeded all expectations at Nepal's Bheri Babai Diversion Multipurpose Project (BBDMP). After excavating in excess of 1,000 meters per month through the notoriously difficult geology of the Himalayas, the country's first TBM holed through nearly a year ahead of schedule.

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