

# ITA Member Nation Activity Reports 2020

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## Jinxiu (Jenny) Yan ITA President

### ITA President's message for the ITA Member Nations Activity Report 2020

The true strength of the ITA, as the leading international organization, does not come from each of us working separately but comes from all our Member Nations working together as an integrated association. This report illustrates perfectly what can be accomplished, even in very difficult times, when the ITA MNs work together.

We can clearly see from the report that our global tunnelling activities have been consistently serving and supporting economies and sustainable development during the pandemic. This report serves as not only an effective channel of communication for MNs but also as a good way to present the global tunnelling activities in general. I am sure that it will also facilitate further cooperation among ITA MNs and promote the better use of tunnelling and underground space worldwide, which is the mission of ITA.

I would like to thank all the ITA MNs, ITA secretariat and Tunnelling Journal for their great joint effort in making this report possible!



## Olivier Vion ITA Executive Director

It is now the 5th year that ITA in cooperation with Tunnelling Journal is happy to present to all of you the reports of its Member Nations. With the COVID-19 pandemic preventing us from meeting face to face as we usually do during the WTC, it is even more important to share all the activities of the ITA Member Nations. It includes their activities as an Association - and we can see that despite the pandemic most of our Member Nations remain very active - and also overviews the main tunnelling works achieved or in progress in the different countries. This magazine is available to all those who regularly receive Tunnelling Journal and an electronic version will be sent to ITA Member Nations and all ITA members and affiliate as well as being posted on ITA website.



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# 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 2020 AND TO DATE

October 28th – 29th saw the Tunnelling Congress held named “Progress of the Construction of Tunnels in the Region”, with experts taking part from different countries in Latin America, and Mr. Nasri Munfah, as a representative of the ITACET Foundation. A training lecture called “Innovation in Conventional Tunnel Construction” was developed.

Two online training courses, each consisting of four classes, were developed for the Argentine Construction Chamber, dealing with the subjects “Construction Methodologies employed for the construction of tunnels and shafts in the metropolitan area of Buenos Aires” and “Tunnels in urban environment”.

## CURRENT TUNNELLING ACTIVITIES 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 nine stations, seven mined and two 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 (Transport Ministry) decided to interrupt all construction works. Only limited works for the mined stations have been done. After the change of the National government at the end of 2019 and to the end of 2020, also marked by the quarantine, and without any new public infrastructure projects starting, due diligence on the project is now underway by the national government to allow a decision to be made on the resumption of the construction and its extent, functionality and scope.

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

This project comprises the construction of a main sewer located parallel to the Riachuelo River, composed of two

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 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. At the end of 2019 the excavation of the emissary tunnel was concluded successfully, with construction of the raisers towards the riverbed carried out in 2020. The EPB shield machine used to excavate the upper sewer section completed its 9,400m, whilst the slurry machine finished the lower 5.1km long section. Secondary pipe jacking galleries of dia 800mm and 1,100mm are also fairly advanced, with a total excavated length of 12km, with only 0.5km remaining.

## 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 system 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. A contractor has been selected for the first section (Lot 1) of 13.5 km, 3,9 m inner dia and pumping plant No.1. The project has two EPBM machines,  $\varnothing$  4.66m, with a universal segment ring 6+0, 1.4m wide, and 0.25m thick. The first TBM is currently in operation, launched from the shaft in the General Belgrano plant and has excavated 1,175m to date. The second TBM will leave from an intermediate quad-lobed launch shaft to complete the tunnel to pumping plant No. 1 in Lomas de Zamora. The first contract is scheduled to be completed in August 2024. The second part of the project, (Lot 2) is still not awarded, but has been tendered.

## Two 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 shorter of both tunnels was completed at the of 2020. Meanwhile, the excavation of the second (longer) tunnel was initiated early 2021 and is scheduled to complete by end of 2022.

## 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, with pipes made in concrete and GFRP. Typical diameters used range between 0.8 and 2.4m, with jacking sections in the range of 200 – 300m.

## 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 three 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, four 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 started 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. Since then, no action regarding the implementation of this projects has been taken, basically due to a lack of financing.

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

Agua Negra Tunnel: This 14km long twin-tube road tunnel is a project of priority for both countries. Its financing

was guaranteed by the IDB for the Argentine part, whereas Chile would finance its part without the support of the bank. After a pre-qualification process for contractors, launched in 2017, with a short list of companies published in 2018, no further action for the tender of the construction has been implemented. According to the latest developments, it seems that both countries still do not agree on a final technical solution for this project. The bi-national Authority EBITAN did advance the preparation of the tender documents, supported by the IDB. However, due to recent criticism of the project by the Chilean authorities, the entire process is now under review. At the end of 2020, no official decision from either side has been taken to advance the infrastructure project.

**Las Leñas Tunnel:** This approx. 11km long twin-tube road tunnel is officially recognized by both countries as the other relevant bi-national base tunnel. By the end of 2019 a new geological-engineering study 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, defining the final corridor for the tunnel, as well as its functional design. The study is well advanced and scheduled to finalize mid-2021.

**Tunnel Cristo Redentor – second tube (Widening of Tunnel Caracoles):** With the support of the IDB during 2019 the design of the second tube of the existing Cristo Redentor road tunnel 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 “Caracoles” railway tunnel, which was part of the Transandean Railway from Buenos Aires to Valparaiso and which has been out of operation since 1978. The offers of contractor JVs were delivered in 2019 for the construction of the Argentine part of the tunnel, with an award to the winning contractor JV in early 2021. It is expected that works will be initiated in the first half of this year. As far as the Chilean part of this tunnel is concerned, the tender process has still not started.

### Metro Buenos Aires and other underground projects in Buenos Aires

A tender for the basic design of the new Metro Line “F”, a circumferential line which crosses most of the existing lines, was launched in 2019 and repeatedly delayed. To early 2021, this process has been neither cancelled nor confirmed. During 2020, the so called “Colector Baja Costanera”, a sewer tunnel along the coast of the La Plata River, was tendered and awarded.

The third and last “rainwater relief tunnel” for Buenos Aires, called “Medrano River”, is scheduled for design, although it is yet to be tendered.

### 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).

**Number of Members:** 693 Members, 64 Gold and Silver Corporate Members and 6 Platinum Sponsors

### ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Like many around the globe in 2020, the Australian Tunnelling Society (ATS) has had to move many of its events and activities to an online format as workplaces and people were largely working from home.

**Activities and Events:** Prior to the COVID 19 pandemic the ATS held face to face technical presentations including a well attended site visit to the Mr Coot the Quarry in Queensland with exhibits by leading organisations in the field. After this time events were moved to an online platform as webinars and delivered to members across the nation. The ATS collaborated with other societies, including the Australian Geomechanics Society, British Tunnelling Society and NZ Tunnelling Society to produce

webinars with presentations by leading experts. Webinar attendance exceeded expectations and moving forward future technical presentations will a hybrid model. The 2020 David Sugden young tunneller’s Award was presented to Daniel O’Kelly.

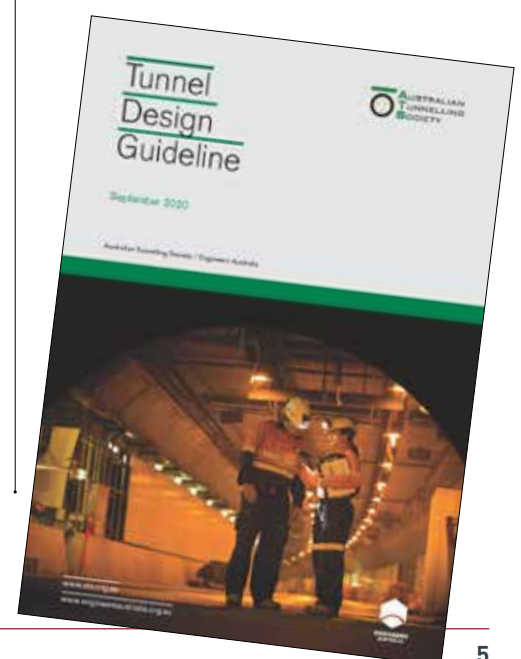
The ATS triennial conference ‘2020 Australasian Tunnelling Conference’ scheduled for 29 December to 2 November had to be postponed and will now be held in 2021, 10 to 13 May in Melbourne. The ATS will announce the winners of its inaugural Women In Tunnelling Award and the Allen Neyland Award at the conference. The next conference will be held in New Zealand with the NZ Tunnelling Society in 2023.

Toward the end of 2020 restrictions had begun easing around the country which allowed for a few face to face networking and hybrid (in person and online) events.

The ATS Chapters are beginning to return to holding monthly technical sessions using a hybrid approach for 2021.

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

The ATS Young Members developed a Tunnel Design Guidelines that was published online for members at the end of 2020. Webinars and workshops are planned for 2021 to introduce the guidelines.



**Working Groups:** During 2020, the ATS developed a Tunnel Operators focus group to draw attention to the systems and operations of tunnels after construction and provide a broader viewpoint to the ATS.

Following the launch of information on health strategies for managing silica dust exposure in tunnels in 2019, the ATS regularly participates in the Silica Working Party, established by the Australian Government.

The ATS has 8 members active in ITA Working Groups which includes shotcrete, shafts, and BIM.

**CURRENT TUNNELLING ACTIVITIES NSW**

**WestConnex:** Stage 3A. M4-M5 Link under construction and planned to be open for traffic 2023. Stage 3B. Rozelle Interchange: Underground interchange linking the M4 M5 Link to Anzac Bridge, Iron Cove Link and the future Western Harbour Tunnel. The project is under construction and due for completion in 2023.

**Sydney Metro City & Southwest Tunnel and Stations Excavation:** Underground rail Link from Chatswood to Sydenham via Central Station which includes twin 15km long tunnels excavated by TBM. Due to be completed in 2021.

**Queensland**

**Cross River Rail:** New north-south tunnel(s) with connections running from Dutton Park in the south to Victoria Park in the north and new underground stations. Under construction and due for completion 2024

**Brisbane Metro:** a 21km service connecting 18 stations along dedicated busways with easy links between Metro, bus and train services. This project includes a new underground bus station. Early utility diversions commenced. Due to be completed in 2023

**Kidston:** Renewable and pumped hydropower developer Genex Power has appointed engineering procurement and construction contractors McConnell Dowell and John Holland for the pumped storage hydro plant and dam construction, underground and waterway civil works, plus full powerhouse fitout.

**Victoria**

**Melbourne Metro Tunnel and Stations PPP:** Twin 9km long rail tunnels with five underground stations. Due to be completed 2025

**West Gate Tunnel:** Twin road tunnels (2 - 4km long) and elevated road



Sydney Metro City and South West Tunnels and Station excavation



Melbourne Metro

structures linking the Westgate Freeway at Williamstown Road with City Link. Construction work has been delayed now due to be completed 2024

**Western Australia**

**Forrestfield - Airport Link Project:** A 7.1km twin-bored, concrete lined and 6.2m internal diameter tunnels extending from Guildford Road to Dundas Road in Forrestfield. Three stations will be located underground close to the current Domestic Airport precinct. Due to be completed 2021.

**FUTURE TUNNELLING ACTIVITIES**

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

Civil works which will include 27km of TBM tunnels. TBM excavation has commenced.

**M6 Stage 1 (formerly known as F6 Stage1) – New South Wales**

4km of motorway tunnel from new M5 to Presidents Ave Kogarah. Tenders have been submitted.

**Sydney Metro West (Tunnels and Station Excavation Works) – New South Wales**

22km underground metro rail link from CBD to Westmead. Tenders have been submitted for Central package. Contract award expected in July 2021.

**Western Harbour Tunnel – New South Wales**

Road tunnel linking WestConnex with North Sydney. Expressions of Interest for project being sought in 2021.

**Sydney Metro Western Sydney Airport (Station boxes and tunnels) – New South Wales**

A Metro rail link from St Marys to the new Western Sydney Airport that is currently under construction. Expressions of interest submitted in 2020 and tenders are expected in April 2021 for award by December 2021.

**Beaches Link – New South Wales**

Road tunnel connecting Warringah Freeway with the Northern Beaches. Still in planning phase.



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**Coffs Harbour Bypass – New South Wales**

A road project including three tunnels with a combined length of 1km. Procurement is expected to commence in 2021.

**Inland Rail Project – Kagaru to Gowrie PPP package – Queensland**

A 126km rail link which includes three tunnels totalling 8.5km in length. Tenders are in preparation for submission in 2021.

**North East Link – Victoria**

A road link from Greensborough to Bullen linking the Western Ring Road to the Eastern Freeway which includes TBM bored tunnels and mined tunnels by roadheader. Tenders have been submitted. Award expected mid 2021

**Hawthorn Main Sewer Syphon – Victoria**

DN2000 pipejack under the Yarra River at Hawthorn. Tender has been awarded to John Holland/KBR.

**Maribyrnong River Main Sewer Augmentation – Victoria**

Augmentation of the existing sewer with

a 1.3km pipeline which includes 800m of DN1400 pipejacking. Tenders have been submitted.

**Hobson Bay May Sewer – Victoria**

Upgrade of existing Hobson Bay Main Sewer crossing of the Yarra River. Tenders have been submitted.

**Suburban Rail Loop – Victoria**

A 90km long rail loop to connect the outer suburbs of Melbourne. To be delivered in four stages. Expressions of Interest are expected in 2021.

**North South Corridor (Torrens River to Darlington) – South Australia**

Southern Project includes twin road tunnels, each 4km long. Northern Project includes twin road tunnels each 2km long. Procurement likely to commence late 2021.

**STATISTICS**

**1. List of tunnels completed:**

- NorthConnex, opened October 2020
- WestConnex Stage 2 (New M5), opened July 2020
- Gold Coast Seaway
- Forrestfield Airport Link (WA), TBM tunnelling completed April 2020

**2. List of tunnels under construction**

- Sydney Metro City & South West Tunnels and Station Excavation
- WestConnex 3A – M4 M5 Link
- WestConnex Stage 3B – Rozelle Interchange
- Melbourne Metro Tunnel & Stations PPP
- WestGate Tunnel Project
- Cross River Rail Tunnel Stations Development PPP

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Post-graduate (Master of Engineering) subject courses were held at the University of NSW, The University of Queensland, Royal Melbourne Institute of Technology and the University of Wollongong.

# Belarus



**Name:** Belarusian Tunneling Association  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 7 organisations

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

On November 6th, 2020, the first section of the 3rd Minsk Metro Line from Kovalskaya Sloboda to Yubileinaya Station was commissioned. The Line is 4.82km long, with four stations. The running tunnels were constructed by the mechanised method using a waterproof high precision reinforced concrete lining. For the station construction up to 25m deep, the 'Wall in the Ground' method was used, with PVC Membrane for waterproofing.

**CURRENT TUNNELLING ACTIVITIES**

Construction of the first section of the 3rd Minsk Metro Line continued in 2020. The second start of construction occurred from Korzhenevsky Station to Zhukovsky Station, the section is 4.2km long with three stations. In 2020, 1,382m of 6m diameter tunnel were bored and lined. The stations are being built by the

open cut method, using sheet piles and I-beams. This year, 24,100 square meters of monolithic, and 1,400 square meters of prefabricated reinforced concrete was placed, with 24,000 square meters of waterproofing completed. Utility tunnels in Minsk are also under construction, 74m of 2.4m diameter tunnel, and 375m of 1.2m diameter tunnel were constructed.

**FUTURE TUNNELLING ACTIVITIES**

The development of the 'Architectural Project' of the second section of the 3rd Line of the Minsk Metro from Yubileynaya to Logoiskaya Station continues. The line is 8.2km long with seven stations.

**STATISTICS**

**Built in 2020:**  
 1,382m of 6m diameter metro tunnels  
 449m of sewage tunnels





# Belgium



**Name:** ABTUS-BVOTS (Association Belge des Techniques et de l'Urbanisme Souterrains - Belgische Vereniging voor Ondergrondse Technieken en Stedebouw)

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

**Number of Members:** 19 individual members, 50 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020 unfortunately, no site visits could be organized due to the Covid pandemic. Nevertheless, digital activities were organized instead. The Belgian seminar on Mechanized Tunnelling in Urban Context was a successful event on the 30th June. In corporation with the Dutch Member Nation KIVI-TTOW, the COB and the Flemish engineering association ie-net and several European partners, we organised the European Conference Beyond a Tunnel Vision 2.0 with 700 attendees (<https://beyondatunnelvision.eu>).

We strengthened our close cooperation within the EUTF regarding the interests of the European Tunnel Community in general, with knowledge sharing the objective. Finally, our scientific 2020 prize was organised. We continued our close cooperation with the French Tunneling Society AFTES, with whom we share the magazine T&ES. Our activities are visible on <https://www.abtus-bvots.com/>

## CURRENT TUNNELLING ACTIVITIES

In 2020, the following activities were ongoing:

- The renovation of the metrostation Lemonnier and the start of a new metrostation Toots Thielemans (MIVB/STIB)
- Several mechanized tunnels:
  1. Storm basin Avenue Grandchamp (Vivaqua), tunnel i.d. 5.2m, length 370m
  2. Stormwater drainage networks from the airport to the Meuse (Sowaer), carried out by microtunnelling with mud pressure: total length 3,600m in DN1800 and DN1600mm
  3. Wastewater networks Vliegtuiglaan (Farys), carried out by microtunnelling, AVN2500 at mud pressure with a length of 350m
  4. Luxemburg Airport, technical gallery, carried out by microtunnelling AVN1800 with mud pressure at a length of 260m under the landing strip.

- In Brussels the rehabilitation of the road tunnels of the city's inner ring has started. These old tunnels are completely refurbished and will get an up-to-date control system. The most important is the Leopold II Tunnel.
- Renovation of the Kennedy railway tunnel with new control and safety systems.
- Start of the construction dock in Zeebruges for the tunnel elements for the Scheldt tunnel of the Oosterweel connection (this 1.8km long immersed tunnel will have two tubes for motorway traffic and a separate tube for cyclists and pedestrians).

## FUTURE TUNNELLING ACTIVITIES

- On the 30th March 2021, our annual seminar will be held with this year's topic 'Webinar on European Research in Underground Techniques and Urbanism'.
- On the 4th May 2021, a webinar on "le Grand Paris Express" will be organized
- In Brussels, the existing metro line will be adapted at the south station, so that the whole line can be changed into a fully automated subway system. The works have started. The tender for the extension of the metro from the north station towards the new NATO-building will begin.

- In Antwerp the works for the Oosterweel Connection (closing the northern motorway ring) have started with the adaptation of the interchange at the left bank of the Scheldt river. The preparation works for the immersed tunnel under the Scheldt river have started (works 2020-2027). The tender for the cut-and-cover tunnels under the Straatsburg dock will start.
- The road tunnels on the Brussels inner ring will be further rehabilitated and will become safer.
- In the future, the second railway track from Antwerp's main shunting station towards the hinterland will become needed. This will be done via two single track, 16km long, tunnels to underpass the Albert canal and several motorways and to avoid interference with the dense urban area on the surface.
- In Brussels the existing north-south railway link with its six tracks has reached saturation point. The link needs to be extended by four extra tracks (each in a separate tunnel of some 10km length) that will be bored by TBM under the existing ones. The need is there but the funding will determine the start of this project.

## STATISTICS

1. **Length:** Roughly 350,000m<sup>3</sup> were excavated with 35% mechanized and 65% conventional
3. **Amount (US\$ or EUR) of tunnelling/ underground space facilities awarded in 2020:** About €500M (50% of the investments is situated in tunnel renovation)



*The Scheldt tunnel - this 1.8km long immersed tunnel will have two tubes for motorway traffic and a separate tube for cyclists and pedestrians).*

# 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:** 217 Individual Affiliate Members and 103 Corporate Affiliate Members.

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

### Events

**16/07** - Aplicações do Tirantes em Contenção e Tratamentos de Emboques. Case: Cortina em Auto injetável, com Tirantes e Micro estacas. Retaining structures on tunnel portals. Case: self drilling use on tie back and micropiles.

**07/05** - "Recalques nas Obras do Porto Maravilha" – Werner Bilfinger – Case: Maravilha Harbor settlement due to tunnelling.

**14/05** - Tendências nas escavações subterrâneas influenciadas pela indústria 4.0 – Alex Nowak – Underground excavation tendencies due 4.0 Industrie.

**19/05** - "Benefícios ambientais, sociais e econômicos de obras subterrâneas" – Tarcisio B. Celestino – Environmental, social and economics benefits due to underground excavation.

**26/05** - "Jet Grouting em Obras Civis" – Akira Koshima – Jet Grouting in civil works.

**04/06** - "Especificando cimentos sustentáveis para concretos duráveis" – Sílvia Vieira – Votorantim – Sustainable cement specifications for durable concrete

**16/06** - "Concreto projetado reforçado com macro e micro fibras sintéticas" – Manfredo Belohuby – Sika S/A – Reinforced shotcrete with micro and macro synthetic fibers

**25/06** - "Projetos de Túneis – Diferentes soluções adotadas para problemas similares" – Luiz Guilherme Isfer Maciel – Pedra Branca escavações – Tunnel design – different solutions for similar problems.

**02/07** - "Etapas essenciais para um projeto de túneis por NATM: Técnicas Europeias" – Jose Adelmar Mello Franco – NATM essential steps in design: European techniques.

**09/07** - "Previsão sísmica em túneis: cases da Amberg Technologies" – Enrique Vegas Leon, Jozsef Hecht Mendez – Tauri Engenharia – Seismic forecast for tunnels: Amberg Technologies.

**16/07** - "Automação da instrumentação

de um túnel com vistas a avaliação da estabilidade da frente e da seção- interpretação dos deslocamentos" – Jose Adelmar Mello Franco – Case: automatic tunnel instrumentation for front stability evaluation and section support – displacement interpretation.

**23/07** - Membranas projetadas para impermeabilização de túneis" – Maurício Garcia – Master Builders Solutions (Basf) – Membranes designed for waterproofing tunnels

**30/07** - "Painel de Práticas Contratuais – Lei 8.666, Lei do RDC, Lei das Estatais" – advogado Arthur Luis Pinho de Lima, da Empresa de Planejamento e Logística (EPL); o engenheiro Flávio Henrique Cunha Lobato, da Galvão Engenharia; o engenheiro Tiago Ern, da AIG Seguros Brasil, e o advogado Júlio César Bueno, da Pinheiro Neto Advogados, moderador Eloi Angelo Palma Filho. – Contractual practice panel.

**05/08** - "Túneis da Ferrovia do Aço" – Carlos Serman – Case: Ferrovia do Aço railway tunnels.

**13/08** - "Aprendendo com Casos de Obras de Túneis – Teoria e Prática". Roberto Kochen – Learning from tunnel construction cases.

**20/08** - "Túneis para saneamento do Consórcio ITI-7 – Despoluindo o Rio Tietê" – Bruno Rodrigues Leite – Case: tunnels for sanitation – cleaning Tietê River.

**27/08** - "Concreto Projetado para túneis: aspectos práticos de um processo para o século 21". – Cassio Moura – Shotcrete for tunnels: process practical aspects for 21st century.

**03/09** - "Enfilagens Metálicas Tubulares como Pré Suporte de Túneis: Conceitos técnicos e casos de obra". Alaor Coelho – incotep – Steel pipe umbrella as tunnel preliminary support

**13/09** - "Estruturas subterrâneas em rocha para mineração". – Lineu Azuaga Ayres da Silva, CBMR – Underground estruturas on rock for mining.

**24/09** - "Prática recomendada – Concreto projetado reforçado com fibras" – Antonio

Figueiredo, Fernando Stucchi, Tarciso B. Celestino, Cassio Moura, Werner Bilfinger – Fiber reinforced shotcrete – recommended practice..

**01/10** - "Aspectos construtivos, desafios e soluções encontradas na construção de túneis de pequeno diâmetro" – George Teles – Solotrat – Construction, challenges and solutions on small diameter tunnelling. **08/10** - "TBM em Túneis em rocha no Brasil – Caso do Túnel Gastau" – Roberto Kochen – Rock tunnels excavated

### Publication

**Journal:** Soils & Rocks (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 each year. The following volumes were published in 2020:

#### Volume 43, N. 1, January - March 2020

[http://www.abms.com.br/links/soilsandrocks/Soils-43-1-2020v2\\_red.pdf](http://www.abms.com.br/links/soilsandrocks/Soils-43-1-2020v2_red.pdf)

#### Volume 43, N. 2, April - June 2020

<http://www.soilsandrocks.com.br/wp-content/uploads/2020/07/Soils-43-2-web.pdf>

#### Volume 43, N. 3, July - September 2020

[http://www.abms.com.br/links/soilsandrocks/SR-43-3\\_web.pdf](http://www.abms.com.br/links/soilsandrocks/SR-43-3_web.pdf)

#### Volume 44, N. 4, October - December 2020

[http://www.abms.com.br/links/soilsandrocks/Soils\\_43-4-web.pdf](http://www.abms.com.br/links/soilsandrocks/Soils_43-4-web.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.

LinkedIn 150 posts

Site 140 reports

Instagram 133 posts

Facebook 155 posts

Sending 54 issues of CBT@news.

### Launch of Technical Publication

On September 24, 2020, CBT launched its first technical publication. The publication "Recommended practice - Fiber reinforced shotcrete" has been downloaded 82 times by the CBT website since its launch.

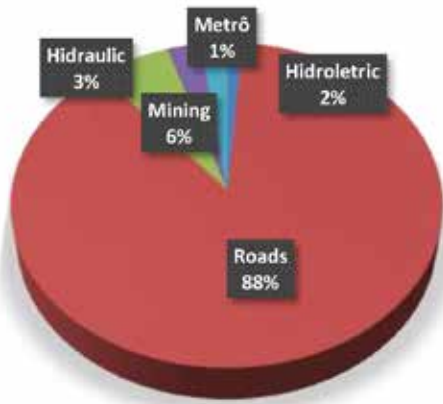


**CURRENT TUNNELLING ACTIVITIES**

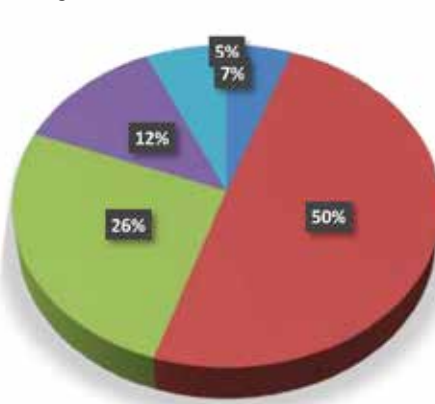
The estimated total volume of tunnels excavated in Brazil is 3.9 million m<sup>3</sup> in 46km of tunnels. It includes roads, railways, hydroelectric facilities, mining and hydraulic.

The distribution, in percentage is:

Volume 2020



Length 2020



■ Metrô ■ Roads ■ Mining ■ Hidraulic ■ Hidroletric

**STATISTICS**

**1. Length**

Total 46,2km (5.4% mechanized and 94.6% conventional)

**2. Volume**

Total 3,991,000m<sup>3</sup> (1.2% mechanized and 98.8% conventional)

**3. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020:**

Estimated US\$1.1bn

**4. Finalized tunnels**

PCH Salto do Guassupi, PCH Sede II, CGH Igrejinha and PCH Morro Grande.

**5. Tunnels under construction**

PCH Dois Saltos, PCH Alto Farias, Ipojuca I and II, Tigre, Cacareco, Fortaleza metro, Tamoios road.

**FUTURE TUNNELLING ACTIVITIES**

- Metro de Fortaleza is one of the projects expected for 2021.
- São Paulo Metrô, Lines 2 and 6.
- Ring road around Florianópolis (was expected in 2019, postponed to 2021);
- New concessions around the country bring some provisions for new tunnels in SP, RJ, RS, but probably later than 2020.

**EDUCATION ON TUNNELLING IN THE COUNTRY**

There are no courses in Brazil yet that focus on tunnelling. Some universities have one or two disciplines related to underground construction, like Mackenzie (São Paulo-SP), USP (São Paulo-SP), UnB (Brasília-DF), Iesplan (Brasília-DF). On post-graduate courses our references in Brazil are Brasília Federal University (UnB) and São Paulo University (USP), São Carlos school.

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# Canada



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

**Type of Structure:** Federally incorporated not-for-profit society

**Number of Members (2020):** 404 (288 full, 59 corporate, 11 retired, 46 student)

**Board of Directors (2020):**

Officers: Erik Eberhardt - President, Rick Lovat - Immediate Past President, Bruce Downing - Vice President West, Steve Skelhorn - Vice President East, Michelle Richards - Treasurer, Andre Solecki - Secretary

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

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

After starting 2020 with a number of in-person events and talks organized by our local chapters and TAC Young Members Group (TACym), TAC transitioned to organizing online events with the confirmation of the worldwide COVID-19 pandemic. TACym helped lead this transition by initiating a webinar series in May of 2020. Subsequently, TACym and the TAC Ontario and BC Chapters have offered 13 online webinars, some jointly with other national groups and tunnelling organizations. Presentations included:

- **04/28/2020** – Tunnel Face Pre-conditioning Using Destress Blasting
- **06/25/2020** – Theoretical Gardiner Expressway Replacement Tunnel Project
- **07/16/2020** – Time-dependent Deformation of Shafts and Tunnels in the Greater Toronto Area
- **08/13/2020** – 6th Century BC Eupalinos Tunnel Excavated Simultaneously from Both Ends
- **09/03/2020** – Excavation Damage Zone Prediction for Deep Repository Engineering
- **09/24/2020** – Applying UAV and LIDAR Scanning Technologies to an Underground Gold Mine
- **09/28/2020** – Lessons Learned as a Trenchless Litigation Expert and Designer
- **10/29/2020** – Cost Analysis on Greater Toronto Area Tunnelling Projects
- **11/17/2020** – Use of a P3 D-B-F-M Contract and a Large Diameter Tunnel to Address Interstate Flooding Problems
- **12/10/2020** – EPB Pipejacking Through Challenging Ground Conditions



Ashbridges Bay

- **01/28/2021** – Risk and Risk Management in Underground Projects
- **02/25/2021** – Current and Future Tunnel Projects in Ontario
- **03/04/2021** – 2020 TAC Undergraduate & Dan Eisenstein Memorial Scholarship Presentations.

COVID-19 limitations on meetings in 2020 also resulted in the postponement of TAC's 2020 Conference and Awards Banquet. However, TAC organized a virtual Annual General Meeting for our membership, which also included the announcement and highlight videos for our 2020 TAC Achievement Award winners. The following

awards were presented:

- Lifetime Achievement Award – Richard Staples
  - Young Tunneller of the Year Award (new in 2020) – Connor Langford and Andre Solecki
  - Canadian Innovation Initiative Award – Harbour Resource Partners, an AECOM, Graham Construction and Michels Canada joint venture in partnership with the Capital Regional District (CRD), for the "McLoughlin Point Wastewater Treatment Plant Cross Harbour Force Main and Outfall"
  - Canadian Project of the Year (Up to \$100M CAD) – Ward & Burke Microtunnelling, Les Entreprises Michaudville, CIMA+, Golder, Hatch, ABS and la Ville de Saint-Lambert for the "Riverside Stormwater Interceptor"
  - Canadian Project of the Year (Over \$100M CAD) – Crosslinx Transit Solutions, an ACS-Dragados, AECOM, EllisDon and SNC Lavalin joint venture, along with Dr. Sauer and Partners, gGravity, MetroInx, Thurber Engineering, IBI Group and Dufferin Concrete for the "Eglinton Crosstown LRT Mined Stations (Laird, Avenue and Oakwood)"
  - Photo of the Year Award – Hatch for "Ashbridges Bay Treatment Plant Outfall Shaft & Starter Tunnel"
  - Dan Eisenstein Memorial Scholarship – Madison Kennedy
  - TAC Undergraduate Scholarship (new in 2020) – Graham Swarbick
- Full 2020 TAC Achievement Award details and videos are posted on the TAC website at [https://www.tunnelcanada.ca/awards\\_2020.php](https://www.tunnelcanada.ca/awards_2020.php).

## CANADIAN TUNNELLING ACTIVITIES Eastern Canada Snapshot

The 2020 market was strong with numerous projects keeping local contractors busy as well as attracting more international competition from the US and from around the world. Examples of key projects currently in progress include:

- Hwy 401 Rail Tunnel (Greater Toronto and Hamilton Area, Ontario): Design-Build-Finance project with a contract value of \$116.9M involving two tunnels being excavated less than 3m underneath two busy highways. Anticipated to be completed in 2021.
- Coxwell Bypass (Toronto, Ontario): 6.3m diameter and 10.5km long TBM-excavated tunnel, is the first project of Toronto's \$3bn Wet Weather Flow Master Plan that will prevent combined





Riverside Interceptor

Eglinton Crosstown LRT

sewer overflows from entering Lake Ontario and the Don River. Anticipated completion in 2024.

- Ashbridges Bay Outfall (Toronto, Ontario): \$300M project involving a 7m diameter, 3.5km long TBM-excavated outfall tunnel underneath Lake Ontario. Anticipated completion in 2024.
- Bassin Lavigne (Montréal, Québec): \$38M project involving 1.9km of tunnelling to provide supply and connecting tunnels to a 42m diameter, 25m deep retention basin for reducing wastewater overflow.
- Lafontaine Tunnel (Montréal, Québec): Design-Build-Finance project with a contract value of \$1.14bn to renovate the 53-year-old, 1.5km long, double tube immersed, Louis-Hippolyte-Lafontaine tunnel.
- Réseau Électrique Métropolitain, REM (Montréal, Québec): \$6.5bn light rail network project with 26 stations, 67km of track, and two major tunnels including a 3km long TBM excavated tunnel to be driven underneath the Montreal Airport runways. The project is made up of five segments with the first expected to be commissioned in 2022 and the last in 2024.

Upcoming Eastern Canada projects include the Montreal Blue Line in Québec, the East Brampton Watermain in Ontario, as well as much awaited subway work on the Scarborough extension (6km), Eglinton Crosstown West extension (9.2km), Yonge Street extension (7.4km) and Ontario line (16km with 9km underground); procurement activity is currently underway for each of these subway projects.

In addition to these large diameter

tunnelling projects, numerous microtunnelling projects are being constructed throughout Eastern Canada.

#### Western Canada Snapshot

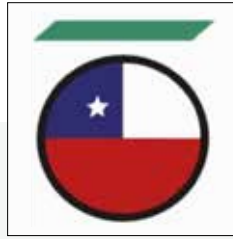
The 2020 market was equally strong across the western Canadian provinces, with numerous projects by local contractors and international joint ventures. Examples of key projects currently in progress include:

- Combined Sewer Overflow Relief Project (Winnipeg, Manitoba): Three current projects with contract values of \$43M total, involving significant tunnelling components to help reduce flooding and protect water quality in rivers and Lake Winnipeg by reducing the frequency of combined sewer overflows.
- Valley Line LRT (Edmonton, Alberta): P3 project valued at \$1.95bn, that will add 27km to the current LRT and includes construction of two 500m long soft ground NATM tunnels. Expected to be completed by the end of 2021.
- Green Line LRT (Calgary, Alberta): \$4.9bn project to add 29 stations and 46km to the existing LRT and includes over 3km of tunnel in the City's downtown area. Construction has just begun and is expected to be completed in 2027.
- Inglewood Sanitary Trunk Project (Calgary, Alberta): \$76M project involving 4km of microtunnelling with 2400mm diameter. Project completion expected in 2021.
- North Shore Wastewater Conveyance (North Vancouver, BC): \$1bn project that includes 520m intake tunnel to move wastewater from the existing

Lions Gate Wastewater Treatment Plant to the new North Shore Wastewater Treatment Plant, and to move the treated wastewater from the new plant to the existing outfall. Construction is expected to be completed in fall 2021.

- Second Narrows Water Supply Tunnel (Vancouver, BC): \$430M project involving a 6.5m diameter, 1.1km long TBM excavated water conveyance tunnel under the Burrard Inlet, as part of Metro Vancouver's efforts to improve water security in the event of a large earthquake. Construction is expected to be completed in 2023.
- Annacis Island Wastewater Treatment Plant Outfall (Vancouver, BC): \$184M project involving an 800m long TBM excavated tunnel between two 40m deep shafts. The project showcases 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 (Vancouver, BC): \$2.8bn project to add a 6km TBM bored subway extension to the existing Millennium Line Skytrain with 6 new stations. Construction is expected to be completed in 2025. Preliminary planning is also underway to further extend the line an additional 7km to the University of British Columbia.
- Trans Mountain Pipeline Burnaby Mountain Tunnel (Burnaby, BC): \$12.6bn pipeline project that includes a 4m diameter, 2.6km long TBM tunnel to relocate an existing 24-inch delivery pipeline and replace with three 30-inch pipelines. Tunnelling is expected to be completed in 2022.

# Chile



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

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

**Number of Members:** 60 Members (48 are companies from the industry)  
Corporate Members: 14 Category Gold, 34 Category Associated and 12 Individual members.

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

### 1. Seminars and conferences

- (Jan.2020): Closing Activity - Revision of Highway Manual of Chile in tunneling issues. Ministry of Public Works – CTES Chile - Upgrading and results
- (May.2020): Webinar – Communication and Remote operation in underground spaces – Lecture 1
- (May.2020): Webinar “Cases and Experiences of use of BIM methodology in underground works”
- (Jul.2020): Webinar: “TBM Tunneling - Design, construction, services and engineering projects” – Lecture 1
- (Jul.2020): Webinar: “Challenges and opportunities related to the development of Underground spaces” - Lecture 1
- (Aug.2020): Webinar – Communication and Remote operation in underground spaces – Lecture 2”
- (Aug.2020): Webinar: “TBM Tunneling - Design, construction, services and engineering projects” – Lecture 2
- (Sept.2020): Webinar: Implementation of the Geotechnical baseline report (GBR) for contracts based on Emerald Book FIDIC
- (Sept.2020): TBM Tunneling- Experiences on International Projects” – Lecture 3
- (Nov.2020): Webinar: “Uses and

opportunities related to the development of Underground spaces” - Lecture

### 2. Training

None

### 3. Technical Lectures

- International Seminar: Experiences on Road tunnels Standards (Visions from Austria, Spain, Switzerland and Norway)
- Webinar: Dramix Steel Fibers for Concrete Reinforcement

### 4. Other

- Launch of Young Members Group (85 pre-registered)
- Agreement of Partnership with Asociación de Oficinas de Arquitectos (AOA), Consejo de Políticas de Infraestructuras (CPI) and Comité de Infraestructura Públicas – Cámara Chilena de la Construcción (CChC)
- Working group for Underground Space Development (on framework of Agreement above).
- Georeferenced survey of national Underground Spaces (on framework of working group above).

## FUTURE TUNNELLING ACTIVITIES

- BIM technologies and innovations in

- underground works projects (Mining / Infrastructure /Road Works)
- Lecture Series - Underground Megaprojects Progress in Chile (Mining / Infrastructure / Road Works)
- Uses and opportunities related to the development of Underground spaces – 2 lectures along year
- Evolution in equipment, accessories and explosives for underground use
- Mining automatization
- TBM and D&B Experiences
- Design and Construction Underground Works with RAISE BORE
- Design of Projected Concrete Support in Underground Excavations
- Evolution of Mining Tunnel Equipment
- Design and Construction of Caverns
- Congress Tunnels and Underground Spaces - Congress
- Drillstring and bolts umbrella; Innovations and their importance in tunnel development.
- Innovations in Mechanized Fortification; with bolts, cables and shotcrete
- Mechanical Excavation (Mobil Mine and Road Headers)

## EDUCATION ON TUNNELLING IN THE COUNTRY

1. Postgraduate Diploma in Tunnels and Underground Spaces; Universidad de Chile
2. Diploma in Modern Tunnel Excavation Techniques; Universidad de Santiago de Chile
3. Undergraduate Programs in Civil Engineering Mining (University of Chile, University of La Serena, University of Santiago of Chile, Universidad Adolfo Ibañez and others)

# China



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

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

**Number of Members:** Total number 44,923 people, 1,236 corporate members.

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

### 1. Academic Activities

Hosting the “High-End Forum on Construction Technology of Super Large Section Shield Tunnels Across River and

Sea” - On August 22, 2020, the High-End Forum on Construction Technology of Super Large Section Shield Tunnels Across River and Sea was held in Shantou City, Guangdong Province on the occasion of completing the tunnelling work of the

Shantou Gulf Tunnel Project. Online virtual parallel sessions were also held during the forum, with more than 700 experts participating in the forum in total, 300 people were in the main venue and more than 400 people in 13 other online parallel sessions.

Hosting the “China Tunnel and Underground Engineering Conference (CTUC) in 2020 and the 21st Annual Conference of Tunnel and Underground Works Branch of Chinese Civil Engineering Society (CCES-TUWB)” - The CTUC 2020 & 21st CCES-TUWB Annual Conference was successfully held on November 27 to 29 in Shenzhen co-



organized by CCES-TUWB and Shenzhen University. The theme of the conference is "Challenges and Opportunities of Modern Tunnels and Underground Engineering - Green, Smart, Safe and Efficient". More than 200 experts and scholars delivered brilliant academic presentations. At the same time, the innovative mode of "online + offline conferences" was adopted to realize the simultaneous online webcast of the main forum and sub-forums, with more than 1,600 participants attending the conference, 6.1 million people participating in the online main forum and 2 million people participating in the online sub-forums.

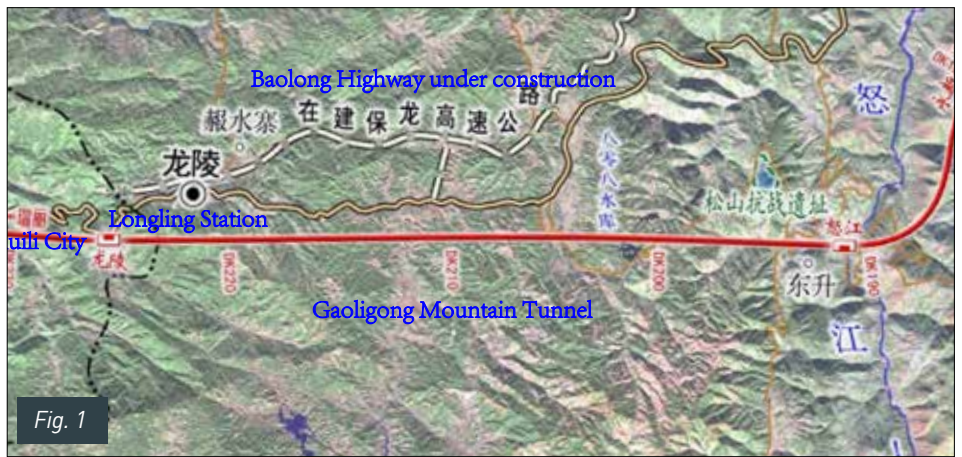
**2. Publication**

Since the first issue in 1964, Modern Tunnelling Technology is committed to academic exchange and technical progress in tunnelling. As the leading technical journal in the Chinese tunnelling industry and the official journal of the Tunnel and Underground Works Branch of the Chinese Civil Engineering Society, it is published bi-monthly with a focus on review & discussion, theoretical research, analysis & numerical simulation, planning & design, construction technology, construction equipment and materials, and so on. The proceedings of the "2020 China Tunnel and Underground Engineering Conference (CTUC) and the 21st Annual Conference of Tunnel and Underground Works Branch of Chinese Civil Engineering Society" was published as a supplement of the periodical Modern Tunnelling Technology.

**CURRENT TUNNELLING ACTIVITIES**

**Gaoligongshan Railway Tunnel (see fig. 1)**

The Gaoligongshan Railway Tunnel, 34,538m long, adopts an auxiliary gallery arranged in "through parallel adit + 1 inclined shaft + 2 vertical shafts". The main shaft of the Inclined Shaft 1# is 3,850m long, and the auxiliary shaft is 3870m; the main shaft of Vertical Shaft 1# is 762.59m deep, and the auxiliary shaft, 764.74m; the main shaft of Vertical shaft 2# is 640.22m deep, and the auxiliary shaft, 640.36m. Two TBMs are applied for excavation (the large TBM of 9.03m in diameter for the main tunnel, and the small TBM of 6.39m in diameter for the parallel adit). The geological structure of the tunnelling area is extremely complex, with characteristics of "three Highs (High geotherm, high in-situ stress, high seismic intensity)" and "four Actives (active neotectonics movement, active geo-hydrothermal environment, active



exogenetic force, and active epigenetic and superficial transformation of slope)". Unfavourable geological phenomena such as strong seismic activity, large (giant) landslides are concentrated in the area. The high geothermal temperature is a big challenge - the cross-ridge section is located at a high geothermal zone of Tibet and Yunnan Province, the water temperature up to 102 . It is extremely difficult to build the shafts as they are located in the migmatitic granite, with irregular groundwater distribution, the connected vertical fissures and the large amount of groundwater.

13,122m of the tunnel has been excavated to now, accounting for 38%. The main tunnel is expected to be fully completed on January 8, 2024.

**Su'ai Immersed Tunnel Project (see fig. 2)**

Su'ai Immersed Tunnel Project is a

complex line on the longitudinal national highway G324 in Shantou City's arterial highway network planning. The project is located between Shantou Bay Bridge and Shantou Queshi Bridge, starting from the intersection of Tianshan South Road and Jinsha East Road in Longhu District, ending at the foot of Hutou Mountain in Nanbin area of CITIC Coastal New Town, connecting to the planned Anhai Road, with a total length of 6.68km. The connection section on the north shore is 0.5km long, the connection section on the south shore is 1.35km long, and the single tunnel is 4.95km long. The tunnel is designed for two-way six-lane traffic, its seismic fortification standard is in conformity with seismic basic intensity of and first safety class (highest).

The tunnel will be completed in August 2020 and is scheduled to open to traffic in September 2021.



**Shenzhen-Zhongshan Channel (see fig. 3)**

Shenzhen-Zhongshan Channel Project is a cross-sea cluster project that integrates bridge, island, tunnel and underwater interchange. The project is 24km in length, including a 6.8m subsea immersed tunnel, a 17.2m bridge and two artificial islands in the east and west. The project is designed and constructed in accordance with the technical standard of a two-way eight-lane highway with a design speed of 100km/h.

The East Artificial Island is located on the Shenzhen's shore, i.e., on the south to Shenzhen Bao'an Airport, close to Shenzhen Airport Ferry Terminal. The island is 930m long, with a north-south axis length of 1136m, a land elevation of 4.9m, and a land area of about 335,100 square meters, which is equivalent to 47 international standard football fields. It will be open to traffic in June 2024.



Fig. 3

**FUTURE TUNNELLING ACTIVITIES**

By the end of 2020, there were 3,566 planned tunnel projects under the program in China, with a combined length of 8,036km, 136 of which are extra-long tunnels, totalling 1,891km in length.

Name of tunnel	Length (m)	Design Speed (km/h)	Construction Plan	Name of tunnel	Length (m)	Design Speed (km/h)	Construction Plan
Qinling-Mabaishan Tunnel	22,922	350	Single tube, two lanes	Daling Tunnel	12,960	350	Single tube, two lanes
Qinling-Taixingshan Tunnel	18,844	350	Single tube, two lanes	Gandeershan Tunnel	12,095	250	Single tube, two lanes
Lucaoliang Tunnel	18,040	350	Single tube, two lanes	Changqing Tunnel	11,310.69	350	Single tube, two lanes
Fuxian Tunnel	16,292.65	350	Single tube, two lanes	Wutaishan Tunnel	14,755	350	Single tube, two lanes
Taibantian Tunnel	16,090	350	Single tube, two lanes	Congtai-Yangtze Tunnel	14,220	350	Single tube, two lanes
Meizishan Tunnel	11,720	350	Single tube, two lanes	Zhongtianshan Tunnel	13,371	250	Single tube, two lanes
Zhengjia Tunnel	12,965	200 <i>250 as reserved</i>	Single tube, two lanes	Gushan Tunnel	11,430	350	Single tube, two lanes
Lunanshan Tunnel	17,475	350	Single tube, two lanes	Nanaoshan Tunnel	22,110	350	Double tube, single lane
Pengdong Tunnel	13,000	350	Single tube, two lanes	Yangshan Tunnel	14,835	350	Single tube, two lanes
Dabashan Tunnel	14,128	350	Single tube, two lanes	Daxing'anling Tunnel	17,750	250	Single tube, two lanes
Shijialiang Tunnel	12,090	350	Single tube, two lanes	Gonggua Tunnel	11,255	350	Single tube, two lanes
Guanmianshan Tunnel	18,181	350	Single tube, two lanes	Tianjieshan Tunnel	14,612	350	Single tube, two lanes
Jinzhuba Tunnel	10,320	350	Single tube, two lanes	Aoling Tunnel	16,130	350	Single tube, two lanes
Yongsheng Tunnel	18,085	350	Single tube, two lanes	Mayandun Tunnel	11,086	350	Single tube, two lanes
Yunwushan Tunnel	10,925	350	Single tube, two lanes	Jintang Subsea Tunnel	16,200	250	Single tube, two lanes
Gongling Tunnel	10,974	350	Single tube, two lanes	Jinggangshan Tunnel	14,407	350	Single tube, two lanes
Xindi Tunnel	14,250	250	Single tube, two lanes	Dabie Shan Tunnel <i>(within Hubei Province)</i>	11,917	350	Single tube, two lanes
Baotian Tunnel	11,203.728	250	Single tube, two lanes	Pingshan East Tunnel	27,762	350	Single tube, two lanes
Xinmeilin Tunnel	11,205	350	Single tube, two lanes	Suzhou East Tunnel	14,520	350	Single tube, two lanes
Yiliang Tunnel	24,792	350	Single tube, two lanes	Dingnaoping Tunnel	10,251	350	Single tube, two lanes
Changling Gang Tunnel	12,740	350	Single tube, two lanes	Wufeng Tunnel	13,032	350	Single tube, two lanes
Jiuliwan Tunnel	19,540	350	Single tube, two lanes	Qingtianling Tunnel	13,190	250	Single tube, two lanes
Baimashan Tunnel	13,407	350	Single tube, two lanes	Pingtoushan Tunnel	13,000.75	250	Single tube, two lanes

There are 1811 railway tunnels under construction, with a total length of 2,750km, 50 of which are extra-long tunnels, totalling 645km in length.

**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Tongji University: Tunnel Engineering
- Tsinghua University: Tunnel Engineering
- Central South University: Tunnel Engineering
- Southwest Jiaotong University: Tunnel Engineering, etc



# Reinforcing Progress



Tunnels help maximise space and improve communications – all key to helping drive human progress. And we supply key solutions that reinforce progress underground. Our products keep workers safe. Our reliability helps engineers plan ahead. And our expertise keeps tunnels advancing efficiently to bring benefits to everyone.

**We reinforce progress – for our customers, and for the world.**

# Colombia



**Name:** The Colombian Tunnelling Committee

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

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

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

- The members of the working group (TG 10) have contributed to the work carried out between FIDIC and ITA in 2019 'Conditions of Contract for Underground Works'.
- The Committee worked 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:  
 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

In 2020, the Colombian Tunnel Committee prepared three technical publications to be published at the next congress in 2021, called:

- Design and Construction Considerations for Two Shallow Highway Tunnels in Soft Ground - C. Marulanda and R. Gutierrez, Ingetec, Bogotá. Colombia
- Analysis of the Squeezing Phenomenon and Rehabilitation of La Línea Roadway Tunnel - C. Marulanda (1) and R. Gutiérrez (2) - (1) Technical Manager, (2) Head of Tunnelling Department - Geotechnical Division, Ingetec SA, Bogotá, Colombia
- Final Document on in-situ stress

measurement – ITA working group Bulletin No. 12 - Camilo Marulanda, with historical cases.

## CURRENT TUNNELLING ACTIVITIES

Until 2015, the hydroelectric sector was developing large projects that required, as an integral part of the designs, the construction of tunnels and deep caverns of all kinds, including some roadway tunnels to connect neighboring towns to the projects. The hydroelectric projects have represented a significant growth in the knowledge of the design and construction of tunnels in Colombia.

To mitigate long trips from ports to production centres and vice versa, the design and construction of highway tunnels has increased in recent years, the main objective of which is to improve specifications and reduce longitudinal slopes on the roads.

In recent years, the Colombian government has made large investments through the fourth generation 4G concession plan, which projects the construction of tunnels of different characteristics.

The construction of tunnels has become a fundamental pillar to the national road network with more than

**DATWYLER**

**2020 TODAY WE ARE**

**1968 STARTING WITH**

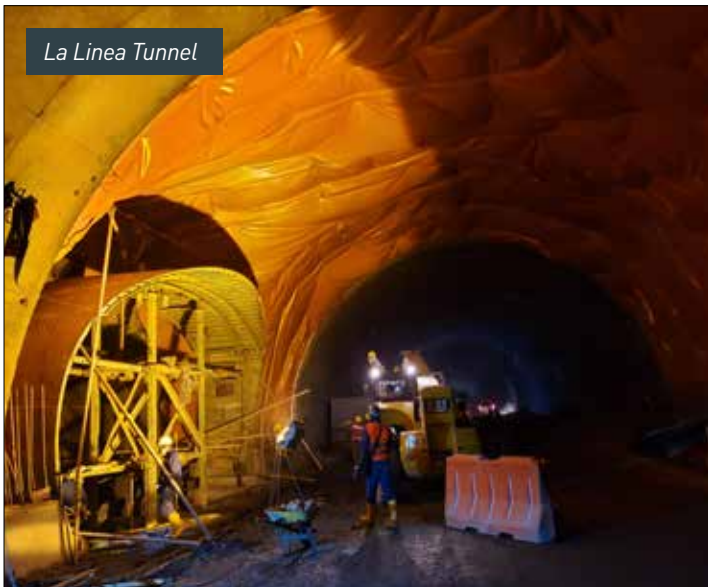
**2012 IT CONTINUES WITH**

**PHOENIX**

The expertise remains, only the name has changed:

**SEALABLE**  
pioneers in profiles





La Linea Tunnel



Balconcitos Tunnel

45km of tunnels currently being built. In the last two decades, the 4.5km long Buenavista tunnels, the 4.6km San Jerónimo tunnel in Antioquia and the Piloto tunnel on the 8.6km line, and the 4.6km long Sumapaz tunnel have been built on the Bogotá- Girardot highway, among others.

At present, several roadway tunnel projects are being developed, where the following stand out:

- Four tunnels on the Ruta del Sol
- Twenty two tunnels on the Buenaventura - Buga road, for a total of 8.8km of tunnel.
- Nineteen tunnels on the Bogotá Villavicencio road.
- The completion of six tunnels totalling 15km on the Highways on the Mountain Range.
- The 8.6km Line tunnel located on the Ibagué and Armenia road, being one of the most challenging due to its geological and geotechnical complexity and making it the longest in the country for at least two years in South America.
- Similarly, in 2020 and 2021, the construction of 25 short tunnels attached to the Linea tunnel will be completed, crossing the central mountain range in Colombia.

### FUTURE ASSOCIATION ACTIVITIES

The committee will organize the 2021 Virtual 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.

## STATISTICS

### 1. Length or volume excavated - % mechanized / % conventional during 2020

100% of the tunnels that are being built in Colombia are excavated with conventional system. Up to date there are no mechanized tunnels.

### 2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020

The amount in 2020 - 2021 is of the order of US\$2,500,000,000

Additionally, there are about 84km of tunnels under construction which are expected to be completed by the year 2025.

In terms of hydroelectric plants, the Colombian Energy Mining Planning agency (Upme) has planned three initiatives for hydraulic projects in the country that are in phase three, and already have their final designs and construction schedule settled. These projects are the San Andrés de Cuerquita hydroelectric plant, the Porvenir II project, and the Hidronare hydroelectric plant. The Talasa Microcentral projects are also being carried out.

In addition are projects to generate a greater amount of electrical energy that are in feasibility, they are: The Miel II hydroelectric plant, which would be carried out in the municipality of Caldas and which would have a capacity of 120 megawatts, and the Río San Juan hydroelectric system, which would have a capacity of 117.5 megawatts.

All these projects have a high component of underground works.

## EDUCATION ON TUNNELLING IN THE COUNTRY

Postgraduate course on the construction of soft ground and hard rock tunnels/  
University: Escuela Colombiana de Ingeniería Julio Garavito/Bogotá, Colombia.

Postgraduate course in Application of the geology and geotechnics in tunnel design/  
University: Educación Continua EAFIT

Postgraduate course in design and construction of roadway tunnels/University:  
Santo Tomas/Bogotá, Colombia.

Workshop of hard rock slopes and tunnels design/University: Los Andes/Bogotá,  
Colombia.

Course in underground construction/University: Los Andes/Bogotá, Colombia.

Course of engineering applied to mining/University: Pontificia Universidad Javeriana/  
Bogotá, Colombia.

Course in the project management of roadway engineering, bridges and tunnels/  
University: Universidad Nacional de Colombia/Bogotá, Colombia.

Course in tunnels: Design, construction, supervision and technology innovation/  
University: Universidad Nacional de Colombia/Bogotá, Colombia.

# Costa Rica



**Name:** ACROS - Asociación Costarricense de Obras Subterráneas  
**Type of Structure:** Non profit, open association  
**Number of Members:** 29 individual members, 4 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

- Working group for the drafting of a national technical regulation for the development of underground works (75% advanced)
- Short Course on Tunnel Design and Construction (Third edition completed)
- Webinar: Costa Rica´s San Jose Metro building and tunnelling project (Engineers Australia)
- Webinar: Underground Metro as a part of an intermodal transportation system for San Jose (Civil Engineers Costa Rica)

## CURRENT TUNNELLING ACTIVITIES

- New underground pass of 790m under the Guadalupe roundabout (100% completion)
- New underground pass of 900m under

the La Bandera roundabout (10% advanced)

- New underground pass of 60m under the national route No. 2 at the La Galera intersection (in design 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 (in the design stage)
- Two tunnels for the storm sewage of the Metropolitan Area of San Jose, 1300m length and 3m diameter each
- New parallel tunnel to the Zurquí Tunnel at the national route 32 of 600m length and 12m diameter (in the proposal stage from the concession company interested)



Underground Pass Guadalupe

## STATISTICS

### 1. Length or volume excavated - % mechanized / % conventional during 2020

- % mechanized = 0%
- % conventional = 100%

### 2. List of tunnels completed: 0

### 3. List of tunnels under construction: 0

## EDUCATION ON TUNNELLING IN THE COUNTRY

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



## TECHNOLOGY FOR UNDERGROUND CONSTRUCTION

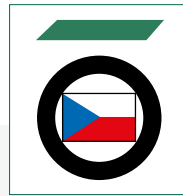
- Alkali-free set accelerators for shotcrete
- Products for mechanized tunneling: foaming agents for soil conditioning, polymers, sealants, lubricants
- Products for grouting and consolidating
- Products for concrete repairing, protection and coating
- Products for waterproofing: synthetic waterproofing membranes, waterproofing accessories



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# Czech Republic



**Name:** Czech Tunnelling Association

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

**Number of Members:** total number: 94, number of corporate members 45

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

CzTA continued with publishing of "Tunel" journal (four issues).

## CURRENT ASSOCIATION ACTIVITIES

In 2021 the Czech Tunnelling Association

(CzTA) will continue with these activities:

- 1) The publishing of the "Tunel" journal will continue – four issues per year.
- 2) In 2021 the Czech Tunnelling Association (CzTA) will continue with organising "Tunnelling afternoons" – public lectures

for those involved in the underground. The lectures will be held on these topics:

- Mezno and Deboreč tunnels
- Metro D – New Line of Prague Metro
- Foreign Tunnel Projects IV
- Prepared Underground Structures in Czech Republic

- 3) We will start with preparation for the 15th International Conference Underground Construction Prague, which will be held in 2023 in Prague.

## FUTURE ASSOCIATION ACTIVITIES

2023 will see the 15th International Conference Underground Construction Prague.

## STATISTICS

### 1. Length or volume excavated - % mechanized / % conventional during 2020

- 145,294m<sup>2</sup> conventional/0m<sup>2</sup>mechanized

### 2. List of tunnels under construction

- Metro line D geological survey
- Mezno and Deboreč tunnels
- Zvěrotice tunnel
- Free access to the metro station - Karlovo náměstí.

## 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 and Underground Engineering

# Denmark



**Name:** Danish Tunnelling Society

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

**Number of Members:** 35 corporate members, 230 individual participants

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

During 2020 all activities related to organising events for members were put on hold due to covid-19.

## CURRENT TUNNELLING ACTIVITIES

**The Fehmarnbelt Fixed Link** is an 18km long immersed tunnel connecting the island of Fehmarn in Germany with the island of Lolland in Denmark. The tunnel will comprise a four lane motorway and dual track railway.

The fixed link will close a gap in the rail network between Scandinavia and central Europe and will be supported by the EU as one of the Community's prioritised railway corridors in Europe.

The immersed tunnel consists of 89



Nordhavns tunnel

tunnel elements, that are cast in concrete and steel on land. The elements will then be transported out to the Fehmarnbelt and immersed in an excavated trench in the seabed, where they will be joined together one by one and covered.

When constructed, it will be the longest

immersed tunnel in the world.

Construction is ongoing with preparatory work reclamation works for the work site harbour and casting facilities for the immersed segments in ongoing on the Danish coast. The MEP contract will be tendered in 2021.

**The Nordhavn Tunnel** is a 1.4km road tunnel connecting the existing Nordhavnsvej tunnel with the urban development area of Nordhavn (Northern Harbour) in Copenhagen. Once finished the road will form a 3km tunnel connection with the Elsinore motorway and the road network North of Copenhagen. The project will connect with a new Ring Road to the East of Copenhagen. The Nordhavn Tunnel will be constructed as a cut & cover structure through an existing leisure boat harbour. The harbour area will be backfilled to construct a temporary dam, from which the tunnel will be excavated and cast. After construction of the tunnel the harbour will be re-established

**Copenhagen Metro Extension Northern Harbour** – In the Northern Harbour area the metro extension work was completed in

2020 and the line opened for passengers during the close down due to Covid-19. The line is the northern part of the M4 and consist of 2.5km of twin-tunnel, one underground station and two surface stations.

**Copenhagen Metro Extension Southern Harbour** – Extension of the Copenhagen Metro line M4 by 8km of TBM tunnels and five underground stations to join the southern harbour residential area into the network of the Copenhagen metro. The construction works started in 2018 and the line is due to open in 2024. Two EBPMs are engaged and will complete tunnelling in spring 2021.

**Strandboulevarden Storm Water Tunnel** – In Northern Copenhagen the Strandboulevarden Storm Water Tunnel consisting of 900m of 2m diameter TBM tunnel and 220m of 2.5m diameter TBM tunnel including four shafts is under construction.

**Kalvebod Brygge Storm Water Tunnel** is a 1.5km pipe jacked tunnel with ID: 2-3m and three shafts. The construction will start in mid 2021 and includes a huge pumping station. The tunnels will cross under existing railway tracks and in very close proximity to the Metro Circle line.

**FUTURE TUNNELLING ACTIVITIES**

The tunnelling activities in the coming years will increase with many new projects coming up. Some of the major projects that will start construction in the next 5 years are:

**Svanemøllen Storm Water Tunnel** consisting of 9km of bored tunnels, of which 2.5km is segmentally lined with an i.d. of 4.9m. The remaining 6.5km is pipe jacked tunnels with 2.2 – 3.2m i.d. The nine circular shafts vary in diameter from 15m to 20m and from 15m to 30m depth. The Environmental Impact Assessment and preliminary design is under preparation and the project is planned to be tendered for construction in 2023.

A study for a new **eastern bypass in Copenhagen** that will reduce traffic in the city centre has been completed in 2020. Two corridors have been investigated covering nine different alignments comprising both cut and cover tunnels, TBM bored tunnels and immersed tunnels have been investigated. The recommended alignment will run through tunnel from Nordhavn via Lynetteholmen and Refshaleøen



*The Fehmarnbelt Fixed Link*

along the east coast of Amager Island before joining the motorway network by the airport. The road will be designed for four lanes and a design speed of 80km/hour. The construction cost is estimated to be between €2.6bn and €4.1bn (2019) depending on which alignment is selected.

**A 3rd connection over Limfjord** in Northern Denmark with a 23km new road including an immersed tunnel to the island of Egholm has been added to the government’s infrastructure investment plan. Construction cost is estimated at €1bn (2019).

Further studies into a road tunnel and a rail tunnel between the Danish city Helsingør and the Swedish city Helsingborg have been undertaken. Separate alignments are being investigated for the road and rail connection. Both connections include a subsea tunnel under the Øresund Sea, connecting Helsingborg in Sweden and Helsingør in Denmark

**The Copenhagen-Malmö Metrolink** is an 18km subsea metro line connecting Malmö

in Sweden with Copenhagen in Denmark. The connection will provide a second link between the two cities and reduce travel time from 40 minutes to 20 minutes with departure every two minutes. This will free capacity on the Øresund Railway connection which will be required when the Femern Belt link is put into operation. The fourth phase of the feasibility study was completed in spring 2021.

**The Copenhagen Metro extension line M5** - a study for new metrolines connecting to Lynetteholm Island (which is a proposed new development area for new housing) was issued in 2020. Three different alignments are being proposed comprising between nine and 11 stations. Construction costs are estimated at €3bn (2019).

**The Kattegat Fixed Link** connecting Zealand with Jutland passes the island of Samsø and will carry rail and road. Several alignments combining bridges, bored and immersed tunnels are being considered.



# Finland



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

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

**Founded:** 1974

**Number of Members:** 182 Individual Associate Members, 26 Corporate Affiliate Members

**Incomes:** Annual fees and conferences as a main source of income

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

- Annual Meeting on 23rd April 2020
- BoD meetings 8 times during 2020
- 3 Scholarships for students active in studies, working life as well as position of trust
- ACUUS 2020 Virtual Conference on 3-4th February 2021: 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

## NEWLY COMPLETED PROJECTS

### The Helsinki Olympic Stadium:

- Modernization and renewal project 2016 – 2020
- Total excavation volume 145,000m<sup>3</sup> including tunnels
- More info: [www.stadion.fi](http://www.stadion.fi)

### Waste Water Treatment Plant in 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.

- Volume: 160,000m<sup>3</sup>
- Construction period 2017-2020
- More info: <https://www.yit.fi/en/projects/mikkeli-underground-wastewater-treatment-plant>

### Lahti Southern Ring Road:

- Rerouting of main road No 12.
- Involves two tunnels with a total length of 1.4km
- Construction started in 2017
- Opened for traffic in 2020
- More info: <https://vayla.fi/web/en/projects/all-projects/lahti-southern-ring-road>

## CURRENT TUNNELLING ACTIVITIES

### Blominmäki Underground Wastewater Treatment Plant (under construction):

- The treatment plant will process the wastewater of 400,000 residents (2020)
- By 2040: 150,000m<sup>3</sup> of wastewater will flow through the new treatment plant daily
- More info: <https://www.youtube.com/watch?v=D9PwTxA4rQ0>

### Helsinki Metro Western Extension to Espoo (under construction):

- Helsinki metro will be extended to the west in two phases: 8 + 5 new stations.

- The first phase was ready in autumn 2017.
- The metro will operate on a rail line of 21km underground in twin tunnels.
- In addition to the stations, a total of 23 shafts will be built for pressure equalization, ventilation and smoke extraction. The shafts will also be used as emergency exits. An underground metro depot will be located in Sammalvuori with a total excavation volume of 240,000m<sup>3</sup>.
- More info: <https://www.lansimetro.fi/en/home/>

### Jokeri Light Rail (under construction):

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

### Tampere Region Central Wastewater Treatment Plant "Sulkavuori" (under construction):

- The treatment plant will process wastewater for up to 429,000 residents (2040)
- Budget €300M, the largest single environmental investment in the Tampere region
- Started in 2018 and it will begin operation in 2024
- More info: <https://www.keskuspuhdistamo.fi/>

### Final Disposal Facility ONKALO (under construction):

- The final disposal facility consists of two sections:
  - The aboveground encapsulation plant** where spent nuclear fuel is received, dried and packed into final disposal canisters
  - The repository** is located deep inside the bedrock. The most important sections are the tunnels where the encapsulated spent nuclear fuel is disposed of.
- The volume of rock to be excavated for the repository is approximately 1.5M cubic metres.
- The number of final disposal tunnels required is 137. The total length of the tunnels is 50km, located within an area extending over 2 to 3 square kilometres.



Lahti Southern Motorway Tunnel

- final disposal starts in the mid 2020's.
- More info: [http://www.posiva.fi/en/final\\_disposal/final\\_disposal\\_facility](http://www.posiva.fi/en/final_disposal/final_disposal_facility)

**Havern Heat Storage Facility (under construction):**

- The caverns located underground in Mustikkamaa have previously been used for storing heavy fuel oil. The oil stores were emptied and decommissioned in 1999. Two of the connected caverns will now be converted into a heat storage facility.
- It will no longer be necessary to use and produce all heat at the same time. With the facility, it will be possible, for example, to avoid starting up separate oil or gas-fired heating plants in the winter season
- The volume of the heat storage facility is 260,000 cubic metres. The amount of energy stored is 11.6GWh. Its charging and discharging capacity is 120 megawatts, which enables discharge or charge for about four days when the accumulator is full or empty.
- Budget €15M, construction works 2019-2021
- More info: <https://www.helen.fi/en/news/2018/gigantic-cavern-heat-storage-facility-to-be-implemented-in-mustikkamaa>

**Art Cave Saimaa Retretti (under construction):**

- Reconstruction and additional spaces
- The new Centre of Art and Culture will be built during 2021-25.
- More info: <https://www.saimaantaideluola.fi/about-3-2>

**FUTURE TUNNELLING ACTIVITIES**

**Savilahti Underground Sport and Event Center, Kuopio**

- Re-use of an old underground military depot built 80 years ago
- New, modern facility to serve as an event center for 4,000 people and as an air-raided shelter for 7,500 people
- Construction in 2021-2023

**Underground Parking Hall in Katajanokka, Helsinki**

- Excavation volume of 90,000m3
- For 500 cars with an estimated cost of €25M
- Construction in 2021

**Underground Parking Hall in Keilaniemi, Espoo**

- Excavation volume of 250,000 m3
- Underground parking for 1,600 cars
- Construction in 2021



*Blominmaki Waste Water Plant*

**Teollisuuskatu Waste Water Tunnel, Helsinki**

- Improve wastewater service in Helsinki
- Length 0.2km
- Construction in 2021

**Underground Parking Hall in Hakaniemi, Helsinki**

- Construction in 2021

**Underground Parking Hall for Laakso hospital, Helsinki**

- Construction in 2022

**Garden Helsinki**

- Event arena providing sports and culture events, shopping facilities, apartments
- Private funding
- Excavation volume of 800,000m3
- Construction in 2022
- More info: <http://www.gardenhelsinki.fi/en/>

**Underground Parking Hall, Maria 01, Helsinki**

- Excavation volume of 60,000m3
- Underground parking for 350 cars
- Construction in 2022

**Seasonal Heat Storage, Vantaa**

- VECTES (Vantaa Energy Cavern Thermal Energy Storage) is a seasonal energy storage project, which harnesses the warmth of summer for the cold winter days. The facility will be the world's largest cavern thermal energy storage with 1,000,000m3 in size. It will have a storage capacity of 90GWh of energy – the annual heat consumption of a medium-sized town.

- VECTES answers the challenge posed by the increasing share of variable renewable energy sources. Seasonal fluctuation of energy demand and generation is significant and the supply of renewable energy cannot meet peak demand. Seasonal storage makes it possible for excess heat to be stored in the summertime and used to cut the demand peaks during high-demand days in the winter. The seasonal storage will be charged with energy in the summer that is either renewable or would otherwise be wasted, such as waste heat from air conditioners, solar and geothermal.
- Excavation volume of 1,000,000m3
- Completion expected 2026
- More info: <https://www.vantaanenergia.fi/en/fossil-free-2026/worlds-largest-cavern-thermal-energy-storage-to-be-built-in-vantaa/>

**Jätkäsaari harbour railway tunnel, Helsinki**

- Estimated cost of €180M
- The city council of Helsinki made a positive in-principal decision in Feb 2021
- Construction schedule remains open

**FinEst Link & Finest Bay Area (feasibility study):**

- An 85km-100km subsea railway tunnel linking Helsinki (Finland) and Tallin (Estonia)
- FinEst Link is an initiative established by Finnish and Estonian authorities
- Finest Bay Area is an initiative established by private organization
- More info: FinEst Link: <http://www.finestlink.fi/en/>





Helsinki Metro Western

- More info: Finest Bay Area: <https://finestbayarea.online/>

#### City Rail Loop Pissararata, Helsinki (waiting for the decision):

- The City Rail Loop is a planned urban railway line for commuter trains under the Helsinki city centre.
- The city plan has been approved but the decision on the construction has not yet been verified.
- More info: <https://vayla.fi/pisara#WgrnfU32SM8>

#### Esplanadi Waste Water Tunnel, Helsinki (planning, waiting for decision of construction):

- Improve wastewater service in the central city of Helsinki
- Length 1km
- Estimated cost of €5M

#### Traffic Tunnel in Sörnäinen, Helsinki (planning)

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

#### Espoo – Salo -High-speed Railway (planning):

- 95km of new high-speed railway between Espoo and Salo

- Multiple tunnels with a total length of over 14km
- General planning phase was completed in 2020, next planning phase on-going
- More info: <https://vayla.fi/kaikki-hankkeet/espoo-salo-oikorata>

#### Salo – Hajala -High-speed Railway (planning):

- 55km of new high-speed railway between Salo and Hajala
- Two new railway tunnels for parallel track, total length about 700m
- More info: <https://vayla.fi/helsinki-turku-nopea-ratayhteys>

#### Lahdenperä – Jämsä - railway (planning):

- 18km of new railway between Lahdenperä and Jämsä
- 5km length railway tunnel
- Environmental Impact Assessment and General planning started in 2021
- More info: <https://vayla.fi/kaikki-hankkeet/tampere-jyvaskyla>

#### Subsea Tunnel in Åland (feasibility study):

- Subsea road tunnel to link the island of Föglö and the Åland main island where city of Mariehamn is located
- Tunnel length 10.5km
- Requires further works on investigations, studies and design

## STATISTICS

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

- Area 2,145,081m<sup>2</sup> = 2,145km<sup>2</sup>
- Volume 13,100,000m<sup>3</sup>
  - 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%
- Tunnels - 294km
  - 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:

- Engineering Geology
- Rock Excavation
- Rock Mechanics
- Rock Construction
- Seminar in Geoengineering
- Project Course in Geoengineering

### Tampere University:

- Introduction to Rock Engineering
- Design of Rock Engineering Structures
- Construction of Rock Engineering Structures

### University of Oulu:

- Rock Mechanics
- Mining Technology
- Rock Blasting
- Applied Rock Mechanics
- Rock Dynamic and Applications

### 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

# France



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

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

**Number of Members:** 1045 members (including 124 corporate members and 138 young members and students)

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

### Tunnels and Underground Space Magazine

4 quarterly issues:

- TES 271: Special dossier "Ventilation during construction works"
- TES 272: Special dossier "Underground spaces"
- TES 273: Special dossier "Grouting and foundation"
- TES 274: Special dossier "Tribute to Pierre Duffaut"
- In the 4 publications: Specific information sheets about TBMs

### Technical

Seventeen active Working Groups and five recommendations published:

- WG3: Vibrations with use of explosives
- WG4: State of the art in TBM
- WG12: Organisation of emergency services during underground works
- WG24: Geological, hydrogeological and geotechnical investigations for tunnel design

- WG30: Bolting: Design and dimensioning

### Education on Tunnelling

4 main actions:

- Support of the INSA-ENTPE post-graduate master's course "Tunnels and underground structures from design to operation" and to the University Le Havre - Pro Licence "Underground Works and Geotechnical Works"
- Open several continuing education sessions for all professionals
- Promote know-how and trades in the underground to students
- Reinforce the bridge between the professionals and the academic research community

### Underground Space

Coordination of several activities:

- Organisation of a competition in the field of architecture: "Underground space and innovations"
- Finalisation of the national research project - Ville10D

- Preparation of publications and papers to promote underground use

### Young Members

- Consolidation of the YM Committee
- Development of the YM network
- Organisation of technical events (visits and technical sessions)
- Involvement in the EUTF Young members activities

### Materials, Equipment And Products

- Actions for the promotion of manufacturers and innovative products:
- Gather innovative solutions and feedback from worksites
- Preparation of the AFTES exhibition in the 2020 WTC (finally cancelled for Covid reason)

### Technical Events and Visits

Conferences (25th February 2020):

- The guide to testing and acceptance for tunnel equipment
- What's new in formwork?
- An innovative solution for the traceability of excavated material
- Webinars
- Information on the new AFTES recommendations (22 et 23 September 2020):
- New recommendations on grouting
- BIM: IFC for tunnel construction works
- New recommendation on vibration thresholds and impacts management
- New recommendation on geotechnical investigation for tunnel design
- New recommendation on rescue organisation in tunnel construction worksite
- New recommendation on bolting: design and dimensioning
- State of the art in TBM
- Consequences of the Covid epidemic on underground construction sites (17th November 2020)
- The durability of concrete in tunnels (8 and 9 September) – contribution to the technical event organized by PoCES

### International Partnership

#### AFTES International Congress

The AFTES International congress initially planned for September 2020 has been postponed to the 6-8th September 2021 in Paris, Porte Maillot

#### EUTF – European Underground and Tunnel Forum

Main actions:

- Consolidation of the EUTF priorities for action
- Discussion with ITA regarding the ITA





strategy and organisation

- Coordinated contribution to conferences and webinars

#### Conferences and webinars

- 26th November: Webinar on the major road projects in Norway
- 27th November: Webinar "Beyond a tunnel vision – the 2nd European conference on tunnel renovation" organized by
- COB – Netherlands with the contribution of EUTF

#### ITA-AITES

- Participation to the 16th September General Assembly
- Active contribution to the animation and production of several ITA working Groups and committees
- Specific involvement in ITA-CET: committee for training and knowledge sharing

### CURRENT AND FUTURE TUNNELLING ACTIVITIES

#### Grand Paris Area: 21 TBM running in 2020

##### Metro Line 11: 1 TBM in course

- TBM Sofia (3km) between Mairie des Lilas and Rosny Bois-Perrier

##### Metro Line 14 South: 3 TBM in the final rush

- TBM Claire (4km), TBM Koumba (4km) and TBM Allison (4.8km) for the link to Orly Airport.

##### Metro line 15 South: 8 TBM in course in 2020

- TBM Laurence (4.2km) between Pont de Sèvres and Fort d'Issy/Vanves/Clamart.
- TBM Ellen (4km) and TBM Amandine (3.4km) between Fort d'Issy/Vanves/Clamart and Villejuif.
- TBM Aby (4.3m) and TBM Marina (2.6km) between Villejuif and Créteil-Lachat
- TBM Camille (4.2km) and TBM Aïcha (3.1km) between Créteil-Lachat and Bry/Villiers/Champigny.
- TBM Malala (4.7km) between Bry/Villiers/Champigny and Noisy-Champs.

##### Metro Lines 16 – 17 Common stretch: 4 TBM in course

- TBM Valérie (1.7km), TBM Sarah (2.6km), TBM Dorine (1.3km) and TBM Bantan (3.8km) between le Bourget
- RER and Saint Ouen

##### Metro line 16: 3 TBM

- TBM Inès (3.1km) and TBM Armelle (3.3km) between Le Bourget RER and Le Blanc Mesnil.

- TBM Houda (5.8km) between Le Blanc Mesnil and Clichy-Montfermeil

##### Metro line 17: 1 TBM

- TBM Florence (3.4km) between Bonneuil and Le Bourget.

##### RER Line EOLE: 1 TBM

- TBM Virginie (8km) between la Défense and Gare Saint-Lazare

#### In 2021, 3 additional TBM will be launched

##### Lyon – Travaux 2020 – 2021

Metro line B: TBM Céline (2.5 km) between Saint-Genis Laval et Oullins. The TBM will complete its task in 1st semester of 2021

##### Toulouse – Project

3rd metro line: 27km - 21 stations – Design process underway

##### TELT – Tunnel Euralpin Lyon Turin

By March 2020, more than 30km of tunnel are already excavated (meaning 18.5% of the 162km), including a 9km long stretch for investigation purpose.

In 2021, the tender phase for the construction of the main international tunnel (57km, 2 tubes)

# 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 2020 AND TO DATE

#### Activities

- Due to the Covid-19-pandemics, the meetings were partly held via video conferences.
- Meetings of the European Underground and Tunnel Forum (EUTF, consisting of Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain and Switzerland)
- Regular Meetings of the Tunnel Committee and Working Groups
- Several Meetings with workshops by the Young Engineering Professionals "STUVA-YEP"
- Meeting of the DACH presidents (German, Austrian, Swiss Tunnelling Committees)

- Due to the Covid-19-pandemic, the following events (planned in 2020) were cancelled:
  - Sealing of buildings by injections
  - Munich Tunnel Symposium
  - InnoTrans, Tunnel Forum
- WG12 : Organisation of emergency services during underground works
- WG24 : Geological, hydrogeological and geotechnical investigations for tunnel design

#### Working Groups

- 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 Tunnel Boring Machines (TBM)
- Planning and implementation of occupational health and safety concept on underground worksites
- Standardization needs for the design of underground structures
- Risk Management in tunnelling
- Recycling/disposal of excavated material

#### Publications (recently finished)

- Recommendations for contracts with low potential for conflicts
- Recommendation BIM in Tunnelling, Model requirements (Part 1)
- Recommendation for the Selection of Tunnel Boring Machines (TBM)

#### 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 bilingual (German/English)

**Future Activities**

- Regular meetings with Austrian, Swiss and EUTF colleagues
- STUVA-Conference 2021, Separate Segments on “Tunnelling” and “Tunnel Operation”, 24–26 November 2021, Karlsruhe

**CURRENT TUNNELLING ACTIVITIES**

About 191km of traffic tunnels were in construction in Germany in 2020.

- This year, the main activities relating to inner-urban rail tunnelling are once again taking place in Munich, where some 13.8km of light rail and metro tunnels are under construction at the turn of the year 2019/20. It should be noted that preparatory construction work is still in progress on the Munich Second Trunk Light Rail Line and that the tunnelling work was yet to begin at the time of the survey. This is followed by Stuttgart (5.4km), Karlsruhe (4.7km) and Berlin with 3.5km of tunnelling. Further tunnelling projects, each less than 2km long, are under construction in Frankfurt am Main (1.9km) and Dortmund (0.8km).
- The main-line rail tunnels largely relate to the DB Netz AG (German Rail) tunnelling works in and around Stuttgart. Of the tunnelling projects currently being implemented (a total of 116km), almost 51km are accounted for by the “Stuttgart 21 rail hub” and some 5km by the new Wendlingen–Ulm rail route. A further 8km of main-line tunnels are being constructed in conjunction with the upgraded/new Karlsruhe–Basle section. Currently, 32% of the main-line tunnels are being built by the conventional method, whereas tunnel boring machines (TBMs) account for 61% of the driven volume.
- The drive-up length in road tunnel construction in 2020 was approx. 45km 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 298km of traffic tunnels are projected but were yet to start in 2020.

- A doubling of the volume can be observed for light rail and metro tunnels. Among the projects listed, the high volume planned for the city of Munich, at just under 44km, continues to stand out. A good 39km of tunnels are being

planned for the Hamburg Metro (partly at the pre-planning stage). Leipzig is engaged in pre-planning 7km, and Frankfurt am Main is planning around 6km of tunnel for regional transport. Further tunnelling activities involving less than 3km are foreseen in the cities of Nuremberg, Berlin, Dortmund, Stuttgart and Düsseldorf.

- The planned volume of main-line rail tunnels (8km) has also almost doubled compared to the previous year. Approx. 32% of the volume is accounted for by the newly included new/upgraded Leipzig–Prague rail line (approx. 27km).

A further 23km is accounted for by tunnels already approved as part of the new/upgraded Karlsruhe–Basel rail line. Further tunnels are planned in the course of the new Rhine/Main–Rhine/Neckar line (18km), the Nuremberg–Fürth rail line (8km) and the new/upgraded line Nuremberg–Marktreditz (6km).

- The planned volume of projected road tunnels (111km) has increased moderately – on account of the German state’s revamped planning requirements, the scheduled volume had dipped considerably in previous years.

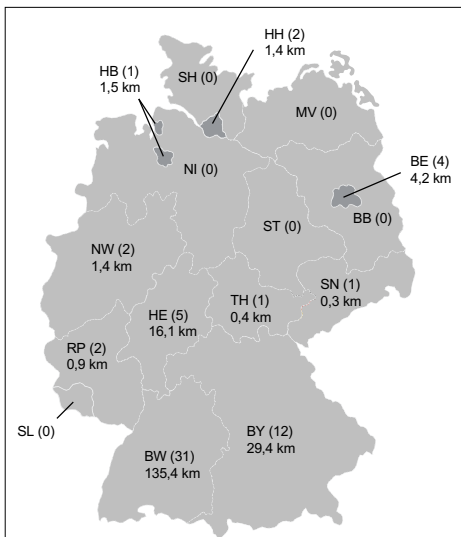


Fig. 1: Length-related classification according to federal states for transportation tunnel projects under construction, with the number of tunnel projects given in brackets

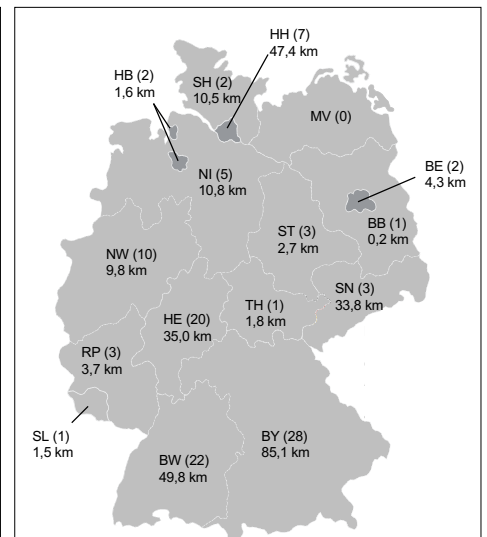


Fig. 2: Length-related classification of planned transportation tunnels according to federal states, with the number of registered transportation tunnel projects given in brackets



Fig. 3: Visualisation of the planned Fehmarnsund tunnel as a connection to the Fehmarnbelt crossing [Source: DB Netz AG]

**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)

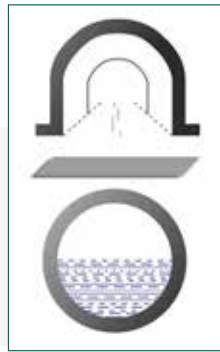


# Greece

**Name:** Greek Tunnelling Society

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

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



## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020 the Greek Tunnelling Society (GTS), during the pandemic, continued working to promote the environmental, social, technical and economic advantages of the construction and operation of tunnels and underground space. The Council Board executed monthly - mainly virtual - meetings for the organization of GTS activities, apart for the numerous meetings that were carried out for the various issues raised as part of the Athens Candidacy to host WTC2023.

Last year was a milestone for the GTS's activities as it involved numerous hours of hard work in supporting the Athens Candidacy to host WTC 2023 (<https://athenswtc2023.gr/>). At last, GTS's members hard work paid off as Athens was the preferred city for the WTC2023 by the MNs of ITA.

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).

Four Workshops / On-line webinars were organized / co-organized by GTS:

- em. Prof. K. Pitilakis "Seismic Response, Design & Risk Assessment of Tunnels" 7/10/2020 joint organization GTSym and TALym (India)
- Prof. N. Vlachopoulos "Eupalinos Tunnel - An Engineering Feat" 13/8/2020 joint organization GTSym and TALym (India)
- On-line Workshop with ITACUS "Expanding Underground / Knowledge & Passion to Make a Positive Impact on the world" 1/7/20
- Prof. V. Marinos & Prof. A. Benardos "Tackling Uncertainty in Tunnelling" 21/5/20 joint organization GTSym and BTSym (UK)

The webinars are available on the website of GTS. The Greek Tunnelling Society participated in the virtual WTC2020 Congress in Kuala Lumpur, Malaysia.



## CURRENT TUNNELLING ACTIVITIES

### ATTIKO METRO (Athens METRO)

On 6-7-2020, half of the 7.6km long METRO line 3 extension towards Piraeus, became operational including AGIA VARVARA, KORYDALLOS and NIKEA stations. The MANIATIKA - PIRAEUS - DIMOTIKO THEATRO section remained under construction. It was decided that the MUNICIPAL THEATER station was to become an open museum. 6.5km of the tunnels were constructed using TBM. The Metro Extension to Piraeus will serve approximately 132,000 passengers on a daily basis.

### Thessaloniki METRO

The first Metro Line for the second largest city in Greece, Thessaloniki, is under im-plementation. The project includes 18 underground stations, ~14.4km of tunnelling and a 50,000m<sup>2</sup> depot in the Pylea area. Approximately 80% of the total tunnels' length were constructed by 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 im-plemented. The Metro alignment was designed at significant depths to minimize the possibility of interventions with archaeological findings which were expected to be encountered within the historical centre of Thessaloniki. The Venizelos station will become an open museum that will display the ancient history of the city.

## Central Athens railway Station – Three bridges area.

The €66M project involves the construction of a 2.36km long four-track rail corridor, 60% of which will be a fully underground alignment. It is expected to become fully operational in 2024, while at the end of 2023, the new quadruple railway corridor from Athens to the area of 3 Gefyres will be completed.

## 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. Less than 400m remains to be excavated.

## Halkidiki mining project

The northeastern side of Halkidiki, in northern Greece, has a long history of mining activity. Currently three exploitation areas exist namely Olympiada, Skouries and Stratoni areas. The overall development of Kassandra mines is considered 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 Kokkinolakkas stream diversion tunnel, 1,140m long, Olympias main access tunnel, ~9km long, Skouries spiral decline, ~5.5km long and Skouries access shaft, ~700m deep.



## FUTURE TUNNELLING ACTIVITIES

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

The winning consortium offered €1.32bn tender for the Design and Built contract for the 13km long, fully automated new METRO line 4 that will include 15 new stations in Athens. 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 part that runs through Athens City Centre. Tender award of the first phase of Line 4 is

currently ongoing, for the implementation of the first section (from Alsos Veikou to Goudi). The scope of the project covers ridership of 8,000 passengers at peak hours in the section with the highest passenger load in year 2030, as well as the ridership of 13,000 passengers/peak hour/direction foreseen in the long run.

**New Athens Metro Line 2 extension to Glyfada**

A 4.5km long Extension METRO line including three stations has recently gone into design.

**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 two tunnels 1.7km long and 600m respectively. The Environmental Impact Assessment study of the project was recently completed.

**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 i.e. i) Souda-Kalyves section: an 1.22km long tunnel, ii) Kalyves - Agioi

Pantes: an 230m long tunnel, iii) Vrises-Petres-Atsipopoulos: five tunnels of 4.59km total length, iv) Exantis-Fodele-Linoperamata: Five 5 tunnels of a total length of 3.19km, v) Hersonissos - Malia: a 375m long tunnel, vi) Malia - Neapoli: two tunnels of 4km total long. The project is split in two 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 (Ministry of Infra-structure and Transport) is examining the technical skills of the interested parties.

**Urban tunnels in Metropolitan area of Athens**

The implementation of 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 shall connect Attiki Odos (highway) and Rafina port and iii) The 1.26km long double tube Kimis Urban tunnel and the 1.16km long Cut & Cover that will connect Attiki Odos (highway) with Athens - Thessaloniki highway.

**Thessaloniki METRO line extension**

The Thessaloniki METRO line extension to the north-west of the city that will serve six municipalities including nine new underground stations.

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:**

~ 3500m - 100% / 0%

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020:**

No available data

**3. List of tunnels completed:**

METRO line 3 extension AGIA VARVARA, KORYDALLOS and NIKEA section

**4. List of tunnels under construction:**

Athens METRO extension to Piraeus, Thessaloniki METRO, Othris mountain twin tunnels (E65 motorway), tunnels along the Rododafni - Patra (Bozaitika area) new railway section and some other hydraulic and railway tunnels in 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:** 63 members, 21 corporate members

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

In 2020 the Association held just one General Assembly because of the pandemic. The annual General Assembly was held on 27th of February, where a new Presidency was elected. The President of the Hungarian Tunnelling Association remained dr. Tibor Horváth. The Presidency has started the organization of the Tunnelling and Civil Engineering Day Conference to be held in November 2021.

The invited keynote lecturer is Prof. Robert Galler from Austria.

**CURRENT TUNNELLING ACTIVITIES**  
**Tunnelling activities in progress:**

- Expressway M85 Sopron bypass, 100m long twin-tunnels under Bécsi hill, started in 2020.
- M4 metro line, a 20m long ventilation cross-passage was excavated in 2020
- Reconstruction of seven stations on the M3 metro line.



M85 motorway bypass at Sopron

**Tunnels in different phases of planning:**

- Budapest, Galvani boulevard, cut and cover twin tunnel with 2 x 2 lanes is in the preliminary design phase. The planned length of the road tunnel is about 760m.
- M0 motorway, the west sector project is in the preliminary design phase: 7,980 - 9,800m long twin road tunnel for 2 x 2 lanes (cross-section area 98-106m²).
- National Radioactive Waste Repository at Bataapáti, 2 x 131-144m long



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underground disposal chambers (cross-section area 126m<sup>2</sup>) are in the construction plan phase.

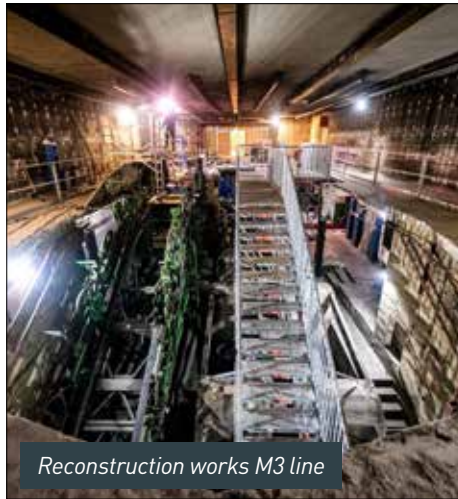
- M100 highway, three twin tunnels are in the construction plan phase - one separate tunnel of 230m length and the two others of 330m and 400m length, with a bridge between.
- H5 (Csepel island – Calvin square M4 connection) metro line preliminary planning, site investigation started.

**FUTURE TUNNELLING ACTIVITIES**

- Expressway M85, Sopron bypass, tunnel under Bécsi hill, construction continues.
- Reconstruction of Várhegy hill tunnel, Budapest. The 160 years-old tunnel with a brick vault is going to have a new sealing and reinforced concrete lining. The length of the tunnel is around 350m, with a cross-section area of 75.5m – 93.7m<sup>2</sup>.
- M0 motorway, north section, twin road tunnel with 2 x 2 lanes is to be excavated. The cross-sectional area of each tunnel is around 98-106m<sup>2</sup>. The length of tunnels are 2,030m and 3,345m. It has an approved construction plan.

**STATISTICS**

- 1. Length or volume excavated - % mechanized / % conventional during 2020:**  
Conventional tunnel 220m no mechanized section at Expressway M85 motorway Sopron bypass, Twin-tunnel under Bécsi hill. Budapest Metro 4 ventilation tunnel and shaft 20m length, conventional
- 2. List of tunnels completed:**  
Ventilation cross-passage for the M4 metro line 20m long, conventional
- 3. List of tunnels under construction:**  
Expressway M85 Sopron bypass, twin-tunnel under Bécsi hill



**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Budapest University of Technology and Economics**  
Faculty of Civil Engineering
- University of Győr**  
Faculty of Civil Engineering, short course
- University of Miskolc**  
Faculty of Earth Science and Engineering, short course

# Iceland



**Name:** Icelandic Tunnelling Society  
**Type of Structure:** Independent Society of corporate and ordinary members, founded 1974  
**Number of Members:** 56 members, 16 corporate members

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

Three board meetings and an annual meeting with invited speakers. Meetings via Teams due to Covid 19 pandemic.

**CURRENT TUNNELLING ACTIVITIES**

There is no current tunnelling activity. The latest tunnel activity was the Dyrafjordur road tunnel that opened for traffic in October 2020. The tunnel is a 5.6km long, 50m<sup>2</sup>, road tunnel in the Westfjords in north west Iceland. The tunnel lies between two fjords, Arnarfjord and Dyrafjord, and replaces a difficult mountain road that is closed for several days over winter due to heavy snow accumulation and shortens the travel distance along the main road linking north and south of the Westfjords by 26km.



**FUTURE TUNNELLING ACTIVITIES**

**Fjardarheidi road tunnel** (Point 1 on map), 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 during winter

due to icy road and sudden snowstorms. The tunnel will not only ease travel for locals but also for tourists coming to Iceland by ferry from Europe (Denmark and Faroe Island). Pre-design is finished, and the Environmental Impact Assessment is ongoing. Tender design in planned for winter 2021 - 2022 with a possible start of tunnel excavation in late fall 2022.

**Reynisfjall road tunnel** (Point 4 on map), a 1.3km long road tunnel in south Iceland. The tunnel will shorten the main road (highway 1) in south Iceland by about 3km and replace a road through a steep and snowy hill pass. An Environmental Impact Assessment is ongoing. Possible start of tunnelling in 2022.

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

**EDUCATION ON TUNNELLING IN THE COUNTRY**

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



# India



**Name:** Tunnelling Association of India

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

**Number of Members:** 600

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

### Main activities

- Organization of Conferences, Seminars, Workshops and Training Programmes;

### TAI Awards Biennial

- Life Time Achievement Award; Tunnelling project of the year
- Technical innovation of the year; Environmental initiative of the year
- Young Tunneller of the year

### TAI Young Member Group - Launched

### Publications

Préparation of Manual and Guidelines

**TAI journal** - 2 Nos. (Half yearly)

## CURRENT ASSOCIATION ACTIVITIES

### Virtual training sessions

In the present COVID-19 situation where skill enhancement and training of professionals has emerged as an important aspect and a challenge, the

Tunnelling Association of India organized the Virtual Training Sessions on Tunnelling and underground space development to update the knowledge of tunnel professionals and young engineers who are in the early stage of their career development. The list of the virtual training sessions/webinars organized by TAI and TAIYM is given in the hyper link.

1. Tunnel & Underground Work Activity.
2. List of Virtual Training Session organised by TAI.
3. List of webinars organised by TAIYM.
4. TAI Publication
  - Guidelines for Design of Steel Fibre Reinforced Concrete Precast Segments in Tunnels.
  - Guidelines for Geo-physical investigation for tunnels.
  - Directory of Tunnels: Under Preparation.
5. TAI Journals
  - January 2020 Issue
  - July 2020 Issue

## FUTURE ASSOCIATION ACTIVITIES

Life Cycle Cost Assessment May 2021

Webinar will be held in near future (Offline/Online/Hybrid)

S.No	Event Name	Date
1.	Workshop on Tunnel Design	June, 2021 in New Delhi
2.	International Conference on Construction of Road Tunnel in Himalayas: Issues and Challenges	July 2021 in New Delhi
3.	Workshop on Analysis of Design of Concrete Gravity Dams	August 2021
4.	BRO - Fire Safety Hazard in Tunnels - 3 days	Delhi
5.	Workshop on Best Practices in Cross Passages Construction	9 & 10 September 2021 in New Delhi
6.	Workshop on Dam Safety	October 2021
7.	Workshop on Observational Approach in Tunnelling: Evolvement, Issues and Challenges	9 November 2021
8.	Tunnelling Asia 2021- Underground Space - The Need of the Day TAI Awards 2021	10-13 November 2021
9.	ITA Award Function	12th November, 2021 in Mumbai
10.	International Conference on Challenges and Issues in Tunnelling for Infrastructure Projects	December 2021 in Chennai
11.	Workshop on Tunnelling in North East Area	February 2022 in Guwahati

## STATISTICS

**1.** Tunnelling Association of India has analysed 1,641 tunnels spanning a length of over 3,445km. These tunnels are spread across three stages of development – awarded, under construction and completed.

**In terms of no. of tunnels:** Of the total no. of tunnels analysed, 77.76% have been completed, 19.44% are under construction and the remaining 2.80% have been recently awarded.

**In terms of length of tunnels:** Of the analysed tunnel length, 60.02% has been completed, construction work is going on 33.45% tunnel length and the remaining 6.43% has been recently awarded. According to the data analysed by Tunnelling Association of India, drill and blast method (DBM) is the most commonly used method of tunnelling. DBM is closely followed by the deployment of mechanised/advanced tunnelling techniques such as tunnel boring machines (TBMs) which has a share of 31.58%. Other than TBMs, the New Austrian Tunnelling Method (NATM) has also gained prominence over the years. A significant amount of tunnel length in the railways and roads sectors has deployed more advanced NATM technique, in sharp contrast to DBM.

Another advanced method of tunnelling which is deployed in the construction of sewerage tunnels is micro-tunnelling.

**2.** Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020: India Infrastructure Research has estimated that tunnels covering around 2,600km are planned to be developed in the next 3-4 years. Typically, about 25-30% of the tunnel construction cost is invested in purchasing material. Over the next 3-4 years, about Rs 1.02 trillion will be spent on procuring equipment and machinery for upcoming tunnel projects.

## EDUCATION ON TUNNELLING IN THE COUNTRY

Include graduate courses, post graduate courses, technical courses / name of University, School...

1. M. Tech Tunnelling and Underground Space Technology in Indian Institute of Technology Indian School of Mines Dhanbad (Also known as: IIT DHANBAD)
2. M. Tech. in Tunnel Engineering at MIT WPU, Pune, Kothrud

**TUNNELS UNDER CONSTRUCTION**

Sector	Sector	Sector	Total project length (km)	Tunnel length (km)	Project cost (Rs million)	Expected date of completion
Metro	Ahmedabad-Gandhinagar Phase I	North-South Corridor (APMC to Motera Stadium)	18.87	-	125.00	NA
Metro	Ahmedabad-Gandhinagar Phase I	East-West Corridor (Thaltej Gam to Vastral Gam) (remaining stretch)	14.66	6.50	-	2021
Metro	Bhopal Phase I	Corridor 1 (Karond-AIIMS)	14.99	1.79	69.41	2023
Metro	Bhopal Phase I	Corridor 2 (Bhadbhada Square-Ratnagiri Trisection)	12.88	-	-	2023
Metro	Kanpur Phase I	Corridor 1 (IIT Kanpur-Naubasta)	23.78	8.62	110.76	2024
Metro	Chennai Phase-I Extension	Washermenpet to Wimco Nagar	9.00	2.40	37.70	June 2020
Metro	Indore (Phase I)	Ring line from Palasia to Bangali Chouraha	31.55	3.22	75.01	August 2023
Metro	Bengaluru Phase II	Baiyappanahalli-ITPL Whitefield (Extension of Eastern Line)	15.50	-	48.45	August 2021
Metro	Bengaluru Phase II	Mysore Road Terminal-Kengeri (Extension of Western Line)	6.47	-	18.68	October 2020
Metro	Bengaluru - Phase II	Hesaraghatta Cross-Bengaluru International Exhibition Centre (BIEC) (Extension of Northern Line)	3.77	-	11.68	January 2022
Metro	Bengaluru Phase II	Puttenahalli Cross-Anjanapura Township (Extension of Southern Line)	6.29	-	17.66	August 2020
Metro	Bengaluru Phase II	R.V. Road-Bommasandra (Reach 5)	18.82	-	57.44	November 2021
Metro	Bengaluru Phase II	Gottigere - IIM B - Nagawara (Reach 6)	21.25	13.79	110.14	June 2024
Metro	Kochi Phase IA	Petta to SN Junction	1.50	-	3.59	December 2021
Metro	Delhi Phase III	Remaining stretch (Mayur Vihar Pocket 1 - Trilokpuri) of Majilis Park - Shiv Vihar (Pink Line)	1.39	-	NA	September 2020
Metro	Delhi Phase III	Najafgarh - Dhansa Bus Stand	1.18	1.18	NA	December 2020
Metro	Delhi Airport Express Line Extension	Dwarka Sector 21-Dwarka Sector 25	1.70	1.70	3.10	2021
Metro	Kolkata East-West Project	Phase I (Salt lake stadium to Sealdah)	3.60	3.60	-	2021-22
Metro	Kolkata East-West Project	Phase II (Sealdah to Howrah Maidan)	7.20	7.20	-	2021-22
Metro	Kolkata Expansion Project	Joka to BBD Bagh via Majerhat	15.07	6.32	26.19	2021 (partly)
Metro	Kolkata Expansion Project	Noapara to Barasat via Bimanbandar	17.02	NA	48.29	2024
Metro	Kolkata Expansion Project	New Garia (Kavi Subhas)-Biman Bandar	29.10	NA	31.62	March 2021
Metro	Kolkata Expansion Project	Baranagar to Barrackpore	12.40	-	16.56	June 2021
Metro	Kolkata Expansion Project	Noapara-Baranagar-Dakshineswar	4.14	-	2.29	June 2020
Metro	Mumbai Project	Thane to Bhiwandi stretch of Line-5 (Thane-Bhiwandi-Kalyan)	12.81	-	-	2024
Metro	Mumbai Project	Line 6 (Swami Samarth Nagar to Vikhroli)	14.47	-	66.72	2022
Metro	Mumbai Project	Line 2A (Dahisar-DN Nagar)	18.59	-	64.10	December 2020
Metro	Mumbai Project	Line 2B (DN Nagar-Mandale)	23.64	-	109.86	2022
Metro	Mumbai Project	Line 3 (Colaba-Bandra-SEEPZ)	33.50	33.50	231.36	December 2021
Metro	Mumbai Project	Line 4 (Wadala-Kasarvadavali)	32.32	-	145.49	2022
Metro	Mumbai Project	Line 4A (Kasarvadavali-Gaimukh)	2.68	-	9.49	2022
Metro	Mumbai Project	Line 7 (Andheri East-Dahisar East)	16.48	-	62.08	December 2020
Metro	Mumbai Project	Line 9 (Dahisar East-Mira Bhayander)	10.48	-	65.18	2024



**TUNNELS UNDER CONSTRUCTION (CONTINUED)**

Sector	Sector	Sector	Total project length (km)	Tunnel length (km)	Project cost (Rs million)	Expected date of completion
Metro	Nagpur Phase I	North-South Corridor (Remaining stretch of Automative Square to MIHAN)	6.16	-	86.80	December 2020
Metro	Nagpur Phase I	East-West Corridor (Prajapati Nagar to Lokmanya Nagar)	7.56	-	-	December 2020
Metro	Navi Mumbai Phase I	Belapur-Pendhar	11.10	-	30.63	December 2020
Metro	Pune Project	Corridor 1 (PCMC to Swargate)	16.59	5.02	114.20	2021
Metro	Pune Project	Corridor 2 (Vanaz to Ramwadi)	14.66	-	-	2021
Metro	Delhi - Phase IV	R. K. Ashram-Janakpuri West (Corridor II)	28.92	7.74	-	2024
Metro	Delhi-Ghaziabad-Meerut Regional Rapid Transit System	Delhi-Ghaziabad-Meerut Corridor	82.15	14.12	302.74	2023 (priority stretch); 2025 (entire corridor)

# Iran



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

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

**Number of Members:** 834 (non-student) members, 561 student members, 197 corporate members

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

- Publishing the Quarterly "Tunnel" Magazine
- Publishing the bi-annual "Tunnelling and Underground Space Engineering" Journal together with Shahrood Technical University
- Holding a total of seven technical seminars (online webinars)

**CURRENT TUNNELLING ACTIVITIES**

**Water transfer tunnels**

3km of the Gelass water tunnel was constructed during 2020. This tunnel, once completed, will transfer 650Mm<sup>3</sup> of water from the Gelass River to the Urmiah Lake. The total length of the tunnel is 35.7km, being constructed with a DSTBM.

3km of the Azad tunnel was constructed during 2020. The tunnel transfers water from Azad Dam in Iran's Kurdistan to the Dehgolan plains. The total length of this tunnel is 10.8km being constructed by EPB machine.

**Wastewater Transmission tunnel**

2.5km of Tehran's western surface water drainage tunnel has been constructed (District 21 and 22). The total length of this tunnel is approx. 10.5km with a final

diameter of 3.7m constructed with an EPBM, to transfer 17.22m<sup>3</sup>/sec of waste water to the water treatment plant in south of Tehran.

**Metro tunnels**

Construction of various metro lines in different cities in Iran is continuing. Total constructed Metro tunnels during 2020 was about 20km. These include:

The Eslam-shar to Tehran metro line with a total length of 15km started in February 2020 with 2,700m constructed during 2020.

The southern Extension of the Tehran Metro Line 6 had 3070m constructed in 2020 with a total constructed length of 4910m

The Tabriz Metro Line 2 has a total length of 22.4 km with 20 stations (being

constructed by TBM), 1800m were constructed in 2020 with a total constructed length of 9,800m.

Mashhad Metro Line 3 has a total length of 28.5km and 24 stations (being constructed by two TBMs), 2,450m were constructed in 2020 with total constructed length of 16,500m.

Shiraz Line 2 (double tube) has a total length of 26.8km (2 x 13.4km) – 4,800m (2 x 2400m) were constructed in 2020 on a total constructed length of 23 km.

The Isfahan Line 2, with a total length of 24.7km, is under construction – 1st phase double tube tunnel of 15km (2 x 7.5km) started in March 2019, and 2,800m were constructed in 2020 from a total constructed length of 11,000m.

**Road tunnels**

The second sector of the Tehran-Shomal Freeway is in progress. This sector consists of 59 tunnels (in two directions) with a total length of tunnel of 37km (Approx. 16km northbound, 15km southbound, and 6.4km of service tunnels). Northbound, 9.1km were constructed during 2020

**Urban tunnels**

The Galoobandak Underpass in a central



Tehran Western Wastewater Transmission Tunnel

part of Tehran (District 12) is being constructed for pedestrians in an area with heavy traffic. The length of the project is 350m on two levels with 4,500m<sup>3</sup> earth works for the tunnel.

**FUTURE TUNNELLING ACTIVITIES**

The following tunnel projects are planned (long term):

- Expansion of road and railway networks
- Completion and development of metro lines in numerous cities (such as Tehran, Tabriz, Karaj, Isfahan, Mashhad)
- Completion of water transfer tunnels

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Tunnelling as a specialized field 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, cultural association founded in 1974.

SIG mainly promotes and coordinates studies and research in the field of tunnelling and underground construction works. SIG is a founding nation of the ITA and EUTF (European Underground & Tunnel Forum).

**Number of Members:** About 800 members (80 corporate and 250 young members).

The SIG YM Group, in December 2020 having 250 young tunnellers, actively support SIG activities and connect young professionals from both University and Industry. The group appointed, in 2020, a board expanding the number of YM actively involved in the organization of events and activities. The group has also established a fruitful collaboration with the others ITA’s Member Nations YM Groups.

SIG is engaged in the drafting of a “Handbook on Tunnels and Underground Works” an important and complete work, which will be published in 3 volumes, including the theoretical and construction aspects of the design, construction, monitoring and maintenance of tunnels and underground works.

Professors from the most important and influential Universities in Italy, professionals, specialists and technicians from large engineering companies and corporate infrastructure managers are actively participating in the drafting of the publication.

The first Volume “Concept-base principles of Design” will be published within December 2021.

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

**Congress:**

**15-16th/10/2020:** II SIG-YM Congress on Tunnelling 4.0: New Technologies and Future Perspectives for Maintenance, Upgrading and Refurbishment of Tunnels

**4th/12/2020:** S. Barbara Conference (on-line event), World Tunnelling Day, Adolfo Colombo Lecture (held by prof. Pelizza) and Master’s degree Award

**4th/12/2020:** ITA Young Members World Tunnelling Day 24h on-line event.

**Technical Visits:**

**25th/09/2020:** Rome - Metro C line Project - visit to the Piazza Celimontana and Fori Imperiali station sites

**Courses and Seminars:**

**27th/11/2020:** Beyond a Tunnel Vision conference – SIG Plenary Broadcast parallel Section “Inspection, investigation and monitoring during service life”

**15th/12/2020:** CIFI - IFR e SIG Webinar - The mechanized excavation for the construction of urban railway tunnels (online event)

**25th/03/2021:** SIG Webinar – Safety in the tunnelling sector - data analysis and use of digital tools for prevention.

**Others:**

SIG is a sponsor of the Level II Masters in Tunnelling and Underground Constructions, in Italy at the Politecnico di Torino and at the Politecnico di Milano; 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 to support the growth of future industry leaders.

Since 1976, the Journal “Tunnels and Major Underground Works” has been SIG’s pride and glory. It is currently published once every three months reaching issue 137 in March 2021.

The periodical presents technical and scientific articles, as well as Editor’s letters, news and tenders from around the world, bulletins from the Italian tunnelling market, reports on technical visits, and 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, hence divulging technical, scientific and business know-how in underground construction.

**CURRENT TUNNELLING ACTIVITIES**

**Railway Projects**

**Third Giovi Pass, Genoa - Tortona Railway:**

37km of twin tunnels along the 53km section between Genoa and Tortona, part of the Rhine-Alpine TEN-T Corridor. The tunnels, excavated for 65% using conventional methods and for 35% by TBM, are located in the complex Apennines range between Piedmont and Liguria. The Valico tunnel (27km) is going to be the longest in Italy.

**Brenner Base Tunnel:** When complete in 2028, it will be 55km long between Tulfes/ Innsbruck and Fortezza and, when including the junction in the Innsbruck tunnel, will



have a max. underground length of 64km, being the longest in the world. The works include the construction of two single track tunnels (9m dia.) with underground safety areas every 20km and a pilot/service tunnel (6m dia.). Two major sites are on the Italian side, Section Mules 2-3, and the Section under passing the Isarco river.

**Mont Cenis base tunnel, Turin – Lyon:** The project consists of two 57.5km long twin-tubes (45m on the French side and 12km on the Italian side), with 170 cross-passages (every 333m), four intermediate adits for construction and emergency, five ventilation plants and three underground safety areas.

**Brescia-Verona high speed railway:** 6.6km of bored tunnels, together with 10.2km of cut & cover tunnels to twice underpass the A4 highway (Lonato and Sona) and an urban centre near the Mincio river. This section is crucial for the completion of the high-speed railway line from Turin-Venice.

**Napoli Bari high Speed Railway:** The Napoli-Cancello section is under construction with the first cut & cover tunnel excavated in a hyperbaric chamber to sustain the water table. The Cancello-Frasso Telesino section includes a 4km tunnel (Monte Aglio). Excavation is almost completed. The Frasso Telesino – Telese and Telese-Vitulano sections include two tunnels, for a total length of 2km.

Furthermore, works are beginning on the Apice-Hirpinia section, with the Rocchetta tunnel (6.5km), Melito tunnel (4.4km), Monte Aglio tunnel (4.1km) and Grottaminarda tunnel (2km).

**Florence high speed railway junction:** The 8km long twin-tunnels underpass one of the most important art cities in the world, on the high-speed services along the Rome-Milan route.

**Messina-Palermo railway:** On the Fiumetorto-Castelbuono section, the excavation by conventional method of the 4.1km, S. Ambrogio tunnel (single tube, double track) is ongoing. In addition, a 10m diameter TBM will excavate the 6.7km long Cefalù tunnel (twin tubes) with a max. depth of 300m and a max. hydraulic pressure of 5 bar. Also, an underground station will be built in Cefalù. The 13km project will increase capacity and cut travel times between Messina and Palermo.

**Genoa urban railway junction:** Sextuplication of tracks along the Brignole-Principe section and quadrupling



of the Voltri-Sanpierdarena sections which are the busiest on the Genoa urban railway junction. The project will include with the extension of the existing Colombo tunnel and S. Tommaso tunnel.

#### Metro Projects

**Naples Metro - Line 1 and 6:** Two new metro lines excavated using technologies such as ground freezing and vertical shaft boring machines (SBM). Two twin TBM tunnels are currently under construction between Capodichino Airport station and Poggioreale station, on a 1km length, to close the Line 1 ring. A mini-TBM ventilation tunnel was completed in 2020 for the completion of Line 6.

**Rome Metro - Line C:** The overall investment is about €3.8bn for a project extending from south-east to north-west,

for about 25.5km (18km underground), with 30 new stations (20 underground).

**Milan Metro - M4:** 15km of twin-tunnels from Linate to Lorenteggio and several interchanges with the three existing lines. Currently the central stretch passing under the city centre is under construction using two EPBMs of 9.1m diameter.

#### FUTURE TUNNELLING ACTIVITIES Railway Projects

**Napoli Bari High Speed Railway:** The sections Hirpinia-Orsara (29km) and Orsara-Bovino (11km) will be awarded in 2021. The Hirpinia Tunnel will be 27km twin-bored with just 500m dividing it from the Orsara tunnel (10km twin-bore). The completion of works is scheduled for 2026.

**Palermo-Catania railway:** The project will link the two main cities in Sicily and involves the construction of several tunnels through central Sicily, such as: Alia (20km), S. Catana (7.8km), Marianopoli (6.6km), Salso (3.9km), Trinacria (13.4km), Montestretto (2.3km), Sicani (5.3km), Dittaino (2.3km).

**Messina-Catania railway:** 37km underground over a 42km alignment between Fiumefreddo (nearby Catania) and Giampileri (nearby Messina), including an underground station in Taormina. The project is divided into two lots, one of which was awarded in March 2021. The project will link the two main cities of Sicily and will help link Catania with Bari, Naples and Rome.

**Verona-Fortezza new railway line:** As part of the Southern Access to the Brenner Base Tunnel, four lots will be built. The Fortezza - Ponte Gardena section (23km) was awarded in 2020 and includes the tunnels "Scaleres" (16km), and "Gardena" (6km). The underground works will be approximately 62km, including the 2 twin-bored tunnels, connection tunnels, lateral adits and ancillary work, with a maximum overburden of 800m. Both conventional and TBM excavation will be used.

**Salerno - Reggio Calabria high speed railway:** After the Covid-19 pandemic, the Italian government decided to include this massive project in the country's strategic infrastructure plan to revitalize the economy and modernise southern Italy. Crossing complex ground, it would have 180km of twin-tunnels over a 400km total length, with an estimated cost of €20bn.

**Catania urban railway junction:** Will consist of an upgrading of the existing urban railway line, doubling the tracks and moving them under the city, with the addition of new underground stations. This will allow a new metropolitan railway service through the urban area, which will integrate with the existing metro line.

**Palermo urban railway ring:** The line will be integrated with the Messina-Palermo-Trapani railway and allow a metropolitan railway service within the city, interconnected with suburban services. The last section to be built will involve the construction of a new 1km long TBM tunnel which will connect Politeama to Notabartolo.

### Highway Projects

**Gronda di Genova:** The project "Gronda di Ponente", will involve the construction of a new highway, the widening of the existing

## STATISTICS

### 1. Length of tunnels excavated during 2020

Railway: TBM - 18.9km, Conventional - 16.8km

Highway: TBM - 1.8km, Conventional - 1km

Metro: TBM - 5.1km, Conventional 0.5km

### 2. Amount (Eur) of tunnelling / underground space facilities awarded in 2020:

€3.3bn, including €2bn (Rail), €0.8bn (Highway), and €0.5bn (Metro)

## EDUCATION ON TUNNELLING IN THE COUNTRY

### Politecnico di Torino, Turin - Master in "Tunnelling and Tunnel Boring Machines"

[https://didattica.polito.it/master/tunnelling/2020/at\\_a\\_glance](https://didattica.polito.it/master/tunnelling/2020/at_a_glance)

### Politecnico di Milano, Milan - Master in "Tunnel Engineering"

[http://www.mastertunnelling.polimi.it/?page\\_id=77](http://www.mastertunnelling.polimi.it/?page_id=77)

### Università di Roma "Sapienza" - Master in "Geotechnical Design"

<https://web.uniroma1.it/masterprogeo/en>

### Università di Napoli "Federico II" - Master in "Geotechnical Engineering for Infrastructures"

<https://www.unina.it/-/20290075-geotecnica-per-le-infrastrutture->

### Politecnico di Torino, Politecnico di Milano, Politecnico di Milano School of Management and Autostrade Group Master in "Integrated engineering and management of motorway networks"

<https://www.masterinfrastruttureautostrade.it/>

The II level Postgraduate Master in Tunnelling and Tunnel Boring Machines, held at Politecnico di Torino, has now reached its 13th edition. University lectures are merged with lectures/presentations by experts from construction companies, machines producers, design companies and professional to provide the multidisciplinary knowledge that is necessary to work in this sector. During 2020, despite of the Covid-19 pandemic, the course was regularly held through an online lecturing system without influencing the original schedule of the lecturers.

### Master Degree Level

All the major Italian Universities, among the others in:

- 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

A10 highway in the section which crosses the municipality of Genoa, and will include more than 70km of new road, 54km of which will be underground, with 23 tunnels.

### Metro Projects

**Turin Metro - Line 2:** The route will be 27km long with 33 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, intersecting the metro line 1 at Porta Nuova railway station. The construction works of the line will start in 2022 and the completion is expected by 2038.

**Catania Metro:** An extension of the existing metro is planned for both ends of the

current line, to reach the towns north-west of Catania (Misterbianco and Paternò) as well as the international airport of Catania Fontanarossa, including an interchange with the railway suburban services. The project will include more than 6km of new twin tunnels.

**Naples Metro - Line 10:** In 2020 the authorities of the Campania region presented the feasibility study of a new metro line linking the city centre (Cavour) and the existing metro network to the north-east area of the city. It would link the new high-speed railway hub of Napoli Afragola and the international airport of Capodichino. The alignment would be 12km long and run entirely underground.





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# Japan



**Name:** Japan Tunnelling Association  
**Type of Structure:** Non profit organization  
**Number of Members:** Total number 1431, number of corporate members 2015

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

WGs: JTA consists of the following four committees and each committee has WGs and task forces.

Technology/International Communication / Events/Public Relation

In each committee, main activities are:

- Investigation, research and information interchanges on general techniques and on subjects of specific projects.
- Meetings such as online lectures, online symposiums and online workshops and online training :
- “Two-days online seminars” and “Online lectures on topics of the year” (organized by Events committee)
- Publication of reports and documents: Monthly journal “Tunnels and Underground” and the Bi-yearly journal “Tunnelling Activities in Japan 2020”
- International cooperation
- Publicity activities

## CURRENT TUNNELLING ACTIVITIES

Building a crossing under a railway using the HEP & JES method at a Terminal Station

To build an underground crossing under one of the major terminal stations in Tokyo, High-speed Element Pull and Jointed Element Structure (HEP & JES) construction methods were adopted. Busy train schedules and confined work spaces as well as existing structures are some of the challenges in this underground construction. Excavation was done manually by hand drill to negate track displacement while drilling, with any

underground obstacles removed from inside the cutting edge. The available time for construction is limited to between train operations (1am to 4am). However the second level side wall and lower floor elements were constructed throughout the day and night regardless of the train operations as there would be minimal impacts on track displacement due to excavation. Additionally, friction cut sheets were used during the drilling of the upper floor element to repress horizontal displacement and reduce friction with the ground. Estimated tractive forces by drilling area, which was calculated from the ground and other conditions, were set against real time tractive forces and forces as high as 70% were monitored during actual excavation and no construction suspensions were needed. A measurement system – a Digital camera rail watcher - was used to measure and monitor the track displacement and even though settlement of 8mm was recorded, no malfunctions of the signal system were encountered.

Baba Ramps is situated in the middle of the Metropolitan Expressway North Line, which opened in March 2017. It is a ramp tunnel that has four ramps connecting the main tunnel to the streets at ground level. The area near Baba Ramps is a heavily populated residential area, with the main tunnel connecting at a great depth with overburden of 31-51m. Shield tunnelling method was used. The four shields were constructed from two launch shafts build within the business site and connected to the main tunnels’ underground enlargement, which was constructed using

the piperroof method when the Expressway was built, thus making it a ramp tunnel.

The four ramp tunnels’ diameters were set at the minimum with consideration to construction gauge, evacuation routes, inner section conditions and curve widenings. Large section shield boring machines with outer diameters of 10.13m - 11.13m used. The B ramp tunnel had a sharp curve (minimum curve 50m) and steep slope (maximum grade 7.6%), measures were taken to control the position of the shield while boring. The shield excavated through an overburden of minimum 1.3m, so measures were taken to prevent segment rising.

Ramp tunnel constructions feature small overburden, running below streets and residential areas. The ground under the residential areas here consisted of an alluvial cohesive soil layer with humus soil. A pilot excavation was carried out within the business site after the shield launch to pre-set the excavation management values.

There was a transmission tower 15m ahead of the start of the D ramp tunnel, with the minimum separation to the tower base being 4.7m (0.48D). Effects of excavation to the tower were assessed, and the tower base was reinforced to restrain impacts on the tower. Measurement control and excavation management values of the tower base were set along with measures to prevent looseness of the natural ground during construction.

The A Ramp Tunnel was constructed near to the main tunnel, with the minimum distance of 1.2m. Construction had to be finished without affecting the main tunnel, which was in use at the time. Construction data obtained from the three ramp tunnels excavated before the A Ramp Tunnel was used to pre-set excavation management values, and the main tunnel’s real time measurements and inspections were conducted. The shield machine was dismantled after taking safety measures to protect the vehicles going through the main tunnel with a temporary wall built beforehand. The temporary wall was taken out after the A Ramp Tunnel’s excavation





was finished.

With adequate measures taken, any influence of the construction to houses on the ground and important structures such as the transmission tower and main tunnel (which was in service) nearby were reduced, and the four-ramp tunnel was completed safely.

**FUTURE TUNNELLING ACTIVITIES**

SENJUSEKIYA Pumping Station, located in north-east Tokyo, is a pumping station designed to cope with the increased water runoff due to the recent increase in heavy rain. This was the first project in the world to simultaneously install two large pneumatic caissons for more than 50m underground. The two caissons, namely the west caisson (2,614m<sup>2</sup>) and the east caisson (2,289m<sup>2</sup>) were only 2m apart.

As this was an urban project, there were restrictions on the usage of land, which required the caissons to be installed to such great depths. Also, the construction period had to be as short as possible, considering the inconvenience caused to those living nearby. The Pneumatic Caisson method was the solution to these challenges. The DruckerPrager fracture criterion (a nonlinear dynamics model considering the dilatancy of the ground) was adopted to conduct a reproductive analysis of the ground pressure. Resistance to installation becomes larger as the surface friction increases. The project reached the yellow warning sign during the last phase of instalment (at deeper than GL-45m) as 669,300kN more was necessary to complete the sinking. As a result, the surface friction was reduced by 242,800kN, making the power to install larger than the resistance.

Various measurements and figures from the GPS automatic displacement measurement system showed that the final inclination was 1/2,000 (34mm). The simultaneous instalment of the two caissons was highly accurate.

The fifth phase of the SENJUSEKIYA Pumping Station construction is currently ongoing. This is to connect the two caissons by drilling the 2m distance between them.

The 1,045m long, 4.7m i.d. discharge channel tunnel on the Ishikari Bay Shinko Power Station constructed by slurry shield method is an undersea tunnel that connects the facility to the discharge outlet installed under the seabed. In this project, the protective work for the shield arrival area by the new freezing method using liquefied CO<sub>2</sub> as a secondary refrigerant was adopted.

Conventionally, sensible heat generated by the thermal difference between antifreeze (brine) and the ground was utilized, and CFCs, the subject of regulation, were used for the primary refrigerant. In the new CO<sub>2</sub> freezing method, heat is taken from the ground (not only by normal heat but also latent heat due to the evaporation of the liquefied CO<sub>2</sub>). The vaporized CO<sub>2</sub> is re-liquefied through heat exchange with NH<sub>3</sub>, a primary and natural refrigerant.

Latent heat from CO<sub>2</sub> is larger than normal heat of the antifreeze solution, so it can form a frozen soil of the same size at a flow rate of about 1/10 of the conventional method. Also, the viscosity of CO<sub>2</sub> is about 1/90 of that of the antifreeze solution, so the pipe diameter and the pump power can be reduced, and long-distance pumping is possible. Thus, the CO<sub>2</sub> freezing method is extremely advantageous in terms of

workability, work period and cost. It is a promising method with highly reduced environmental impacts.

Installation of the freezing plant was completed about a week after the shield machine arrived. The main pipe for the CO<sub>2</sub> was installed under railroad sleepers to secure the flow line of the disassembled materials. The connecting work was carried out under constant monitoring of the freezing temperature. No flooding occurred at the time of connection and completion of construction.

The freezing operation was carried out smoothly without interfering with the machine dismantling operation and the process was shortened by about one month compared to that of the conventional method. Power consumption was reduced by about 40%, contributing significantly to cost reduction and environmental impact reduction.

**STATISTICS**

**1. Length of tunnels excavated during 2020**

27.8 % mechanized / 55.8% conventional during 2020

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020**

US\$37bn

**3. List of tunnels under construction**

	Road	Railway	Waterway	Overseas	Others	Grand Total
Number under construction	196	71	139	20	39	465
Total length (km)	278	226	239	105	92	940
Contract amount (US\$bn)	18	7.6	5.7	4.4	1.3	37

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Hokkaido University, Muroran Institute of Technology, Kitami Institute of Technology Iwate University, Tohoku University, Akita University, Ibaraki University, Nagaoka University of Technology, Tokyo Institute of Technology, Yokohama National University, Niigata University, Kanazawa University, University of Yamanashi, Gifu University, Nagoya University, Nagoya Institute of Technology, Toyohashi University of Technology, School/Graduate School of Engineering, Osaka University, Tottory University, Ehime University Faculty of Engineering, Kumamoto University, Kagoshima University, University of The Ryukyus, Maebashi Institute of Technology, Osaka City University, Hokkai-Gakuen University, Tohoku Gakuin University, Tokyo University of Science, Nihon University, Hosei University, Tokyo City University, Ritsumeikan University, Setsunan University, Fukuoka University, Ashikaga University, Kinday University, Okayama University, Kyushu Institute of Technology, Nagasaki University, University of Miyazaki, Kanazawa Institute of Technology, Meijo University, Aichi Institute of Technology, Osaka Institute of Technology, Osaka Sangyo University, Kanazawa University, Kansaiuniversity, Gunma University, Saitama University, Kyushu Sangyo University, Shibaura Institute of Technology, Chubu University, Tokyo Denki University, Tohoku Institute of Technology, Nagaoka University of Technology, Hachinohe Institute of Technology, Hiroshima University, University of Fukui, Yamaguchi University, National Institute of Technology, Kagawa College, National Institute of Technology, Kochi College, National Intstitute of Technology, Toyota College, National Institute Of Technology(Kosen), Kure College, The University of Tokyo, Tokyo Metropolitan University, Waseda University, Kokushikan University, Yokohama National University, Chiba Institute of Technology, Ustunomiya University, Osaka Institute of Technology, Kyoto University, Kobe University, Yamaguchi University

# Korea (South)



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

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

**Number of Members:** 3055 members, 73 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 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 2020, KTA held a president election at 9. April - Prof. Seokwon Lee was inaugurated as a 14th president.

In addition, KTA hosted several domestic conferences and forums. The short list is as follows:

- 2020 KTA General Assembly  
2020.04.09, Seoul (117 domestic participants)
- 2020 KTA Tunnel Construction Policy Forum & Annual Conference  
2020.11.06, Seoul (180 domestic participants)
- The KTA Technical Forum on TBM Tunnel  
2020.02.25~02.26, Seoul (70 domestic participants)

KTA hosted 5 continuing education and training courses during the last year - The list follows in the section 'Education on Tunnelling in the Country'

A total 11 Working Groups in KTA - KTA-Annual WG Activity Reports: 11 WG activity reports, 3 WG technical reports

### Publications

- Domestic technical journal "Journal of Korean Tunnelling and Underground Space Association" (6 issues with 44 papers in 2020)
- Quarterly magazine "Nature, Tunnel and Underground Space"

## CURRENT TUNNELLING ACTIVITIES

### Daegok-Sosa Railway Tunnel Construction

- TBM + NATM hybrid construction
- Dia. 8.1m twin shield TBM tunnel crossing through Han River
- Total length of 18.36km (2.85km in section of Han River)



- Corner stone of South-North Korea economic cooperation
- Photo\_1.doc

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

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

## FUTURE TUNNELLING ACTIVITIES

### Youngdong Main Street Underground Complex Development Project

- Maga-Underground Space in Seoul Metropolitan
- Total underground space of 0.41Mm<sup>2</sup>
- 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 Seoul metropolitan area
- The 3rd connection way after previous two long-span marine bridges
- Consideration of transport security and weather accident

### Gangneung~Jejin Single Line Railway Construction Project

- Railway along the east coast in Korea
- Total length of 111.7km (Undersea section of 50.9km)
- Project cost will be about \$2.5bn

## STATISTICS

### List of tunnels completed

- Wonju-Gangneung High-speed Railway Tunnel
- Jinhae-Guyjae Main Gas Pipe Line Tunnel
- Gunjang Energy GE-3 PJT Subsea Tunnel

### List of tunnels under construction

- Yulchon Thermoelectric Power Plant Tunnel
- Boryung-Taeon Subsea Road 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

2020.09.03, Seoul (71 educatees/trainees)

- Tunnel blasting technology
- New technology in tunnel rock determination field

2020.10.08, Seoul (88 educatees/trainees)

- TBM design basics
- TBM construction basics

2020.11.12, Seoul (88 educatees/trainees)

- Mechanical excavation for urban tunnel
- Eco-friendly blasting and excavation in urban areas

2020.12.03, Seoul (online courses)

- Latest trends in road tunnel ventilation technology
- Latest trends in road tunnel disaster prevention guidelines

2021.01.21, Seoul (online courses)

- Latest Trends in Underground Safety Management System
- Review of standard manual for preparation of underground safety impact assessment report



# Malaysia



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

**Type of Structure:** A non-profit, learned society with its primary function is to promote and advance the science and profession of engineering in any or all of its disciplines and to facilitate the exchange of information and ideas related to engineering.

**Number of Members:** Over 50,000 members inclusive of corporate members, graduates, associates and students. IEM is the Secretariat of ASEAN Engineers, APEC Engineers and International Engineers

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Tunnelling and Underground Space Technical Division (TUSTD) of The Institution of Engineers, Malaysia (IEM) has remained active and continued to undertake activities related to the promotion and advancement of the science and engineering of tunnels and underground space technologies both locally and internationally. In 2020, three successful global digital events were organised for ITA and IEM members as well as non-members.

Amidst the Covid 19 pandemic, WTC2020 was launched on 14th – 17th September 2020 for the first time in the 46 years history of ITA on a digital platform with the theme “Innovation and Sustainable Underground Serving Global Connectivity”. Digital WTC2020 successfully gathered 655 participants, 169 exhibitors and sponsors as well as 272 technical presentation authors. This added up to a total of 1,196 delegates over the 3-day congress. The ITA General Assembly was held via Zoom on 17th September 2020. There were 80 international Exhibitors and Sponsors with 8,000 visitors and 263 technical presentations with 16,000 visitors globally. E-Proceedings for free download and three volumes of perfect bound Proceedings were published. The support for the digital event was beyond expectation.

Prior to Digital WTC2020, the first ever Digital Symposium for Young Tunnellers of Asia (SYTA) was held on 12th September 2020 with 10 presentations via Webinar and about 100 participants. The ITAYm held its AGM on 15th September 2020 via Zoom. ITACET conducted a one-day Webinar on 11th September 2020.

With the success of Digital WTC2020, another grand event was organized on the occasion of the 20th Anniversary of IEM Tunnelling and Underground Space Technical Division (IEM TUSTD) and World Tunnel Day. The celebration was organised by TUSTD and managed by the IEM



A TBM in Malaysia MRT 2

Academy Sdn. Bhd. The 2-day event was held on GoTo Webinar platform on 3rd – 4th December 2020 with the main objective of bringing to attention the advanced technology in tunnelling works carried out by Malaysia in the global arena with a total of 80 participants despite the Covid 19 pandemic. Six Webinar presentations were organized and well attended by some 100 participants each.

## CURRENT TUNNELLING ACTIVITIES

The current and future development and construction works look less promising as the world is hit by the devastating effects of the Covid-19 pandemic. Malaysia is affected with a slowdown in business and tunnelling project development. Apart from some urban road/subway tunnels and underground construction works in the city areas, major tunnelling projects still ongoing in Malaysia for the year 2020 are:

### 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 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 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 to Putrajaya Central Station. Currently, there are six TBMs operating along the underground section between Sentul West and TRX, between Bandar Malaysia South and Chan Sow Lin, 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, which is over high ground, is one of the three tunnel sections of the entire 38.7km of elevated tracks. The tunnel consisting of mined and cut and cover sections 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 either side of the concrete lined tunnel with a length about 197m on the upstream side and 161m on the downstream side. The mined tunnel was constructed using New Austrian Tunnelling Method (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 and 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 in March 2019.

### East Coast Rail Link (ECRL)

As part of its overall transport development plan for the East Coast Economic Region, the Malaysian Government has proposed connecting the East Coast to Kuala Lumpur and later to Port Klang, with a new electrified standard gauge railway. The railway line would cater to both passenger and freight trains. The ERCL alignment is situated on the east coast and the central mountain area and the terminal is situated at the transitional region between the central mountain belt and the western coastal zone. The relaunch of the ECRL project in July 2019 has kick-started the

**STATISTICS**

**1. List of tunnels completed**

SMART (2007), Interstate water transfer tunnel (2011), KVMRTSBK (2016)

**2. List of tunnels under construction:**

MRT2 (Expected completion 2020), East Coast Rail Link (ECRL), Bandar Malaysia Underground City, LRT 3

**3. Lists of tunnels under planning & Design:**

Circle Line (MRT3), Penang Undersea Tunnel, Penang & DUKE 2A road tunnel. The soon to be iconic Merdeka 118 Tower in Kuala Lumpur when completed in 2022 will be the second tallest building in the world. The ingress and egress approach tunnels are currently under construction to the numerous levels of underground parking facilities at the tower.

**EDUCATION ON TUNNELLING IN THE COUNTRY**

MMC-GAMUDA Tunnel Training Academy in Kota Kemuning, Selangor & MMC-GAMUDA TBM Refurbishing plant in Ipoh, Perak.

Talks, Courses, Seminar, Workshop and Conferences Organised by IEM Tunnelling and Underground Space (TUSTD), IEM Academy.

**The Penang Undersea Tunnel**

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

**DUKE 2A Lingkaran Kampung Bar**

A new RM250 million road project to link Kampung Baru and the Duta-Ulu Kelang Expressway (DUKE) as well as the Ampang-Kuala Lumpur Elevated Highway (AKLEH). DUKE 2A Lingkaran Kampung Baru or LINK would commence in stages beginning this year and is expected to be completed by 2024. This (redevelopment plan) / alignment will make Kampung Baru more open to an efficient traffic network system as it is relatively isolated and connected by small roads only. This project would allow direct access to Kampung Baru from AKLEH and also to create a smoother traffic flow with a road tunnel construction.



ECRL Kuantan Tunnel

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 while the other sections of the improved 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. In total, the 640km route will have approximately 40 tunnels with the longest tunnel measuring 7km to be built in the Jelebu-Semenyih area. In 2021, The East Coast Rail Link (ECRL) was further enhanced by extending the original alignment of 640km to 665km as a more efficient rail alignment system. The additional alignment will encompass the original 30km which is 24km from Jalan Kastam (Port Klang) to West Port and 6km from Jalan Kastam to the North Port. The project, which is expected to be ready in 2026, has reached 20.37% completion in January 2021 compared to the original schedule of 19.39%.

**The LRT 3**

The Light Rail Transit Line 3 (LRT3) envisages the connection of two million people between Bandar Utama and Klang by 2024. Developed in line with the Greater Kuala Lumpur/Klang Valley (GKL/KV) Land Public Transport Masterplan, LRT3 will be a key feature in extending rail connectivity to the Western Corridor of GKL/KV with 2km of tunnelling works.



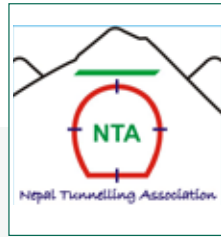
Merdeka 118 Tower

**Line 3 (MRT 3)**

Under the Budget 2021 MRT 3 will be a boon for construction companies. It is expected that the KVMRT Line 3 will be resumed, mostly in 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 centre business district.



# Nepal



**Name:** Nepal Tunnelling Association

**Type of Structure:** Non-profitable organization

## CURRENT TUNNELLING ACTIVITIES

	Project	Tunnel length (km)	Diameter (m)
1	Upper Tamakoshi	16	5.8
2	Khani Khola HEP	2.28	2
3	Khani Khola Sasha HEP	2.28	5.7
4	Middle Bhotekoshi HEP	7.12	2
5	Upper Sanjen	2.00	
6	Sanjen HEP	4.00	3.5
7	Rahuganga HEP Adits, tunnel	6.15	4
8	Khani khola HEP, Lalitpur tunnel	2.30	3
9	Dordi Khola HEP NRN	2.662	2.6
10	Super Dordi HEP	4.864	3
11	Upper Dordi A (Liberty	2.623	3
12	Dordi A HEP	3	2.2
13	Dordi -1 HEP	2515	
14	Mristi HEP	2.2	4
15	Middle Modi, HH	2.69	4
16	Bheri Babai Diversion Multipurpose Project	12	4.2
17	Solu Dudhkoshi HEP	7.68	4.5
18	Kabeli A HEP	4.32	6
19	Upper Trishuli 3 B HEP	3.9	6
20	Lower Solu HP	4.26	3.6
21	Maya khola HP	2.2	
22	Khimti -II HEP	6.2	4
23	Trishuli-Galchhi	8	9.3
24	Tanahu Storage HEP	1.32	7.4

	Project	Tunnel length (km)	Diameter (m)
25	Ghar Khola HP	3	3.5
26	Singati HP	5.6	3.5
27	Upper Kalanga HP	8.7	3.2
28	Kalanga HP	3.48	3.5
29	Arun III HEP	11.8	9.5
30	Likhu 1 HEP	7	3.8
31	Likhu 2 HEP	5	4
32	Likhu A HEP	2.3	4.6
33	Likhu 4 HEP	3.2	3.8
34	Lower Likhu HEP	4.9	5
35	Nagdhunga tunnel(12+2) w 4m Emerg Tun	2.68	14
36	Lower Irkhuwa HP 10MW	2.4	3.1
37	Irkhuwa HP		
38	Middle Tamor HP	4	6.5
39	Mai Beni HP	4	
40	Middle Mewa HP	5	3.5
41	Nilgiri-1 HP	3	
42	Nilgiri-2 HP	6	
43	Upper Trishuli 3A HEP	5	7
44	Mathillo Mailung Khola JA	3.18	2.8
45	Upper Trishuli-1	9.82	6.5
46	Rasuwagadi HEP	8.00	7.5
47	Super Madi HEP	6.57	4.2
48	Rahughat Mangale HEP	5.10	

## PLANNED PROJECTS

Project	Type	Tunnel length (km)	Diameter (m)
Upper Karnali HEP (900 MW)	Hydro	2.4	9.5
Khare Khola HEP (14 MW)	Hydro	4.8	3
Kathmandu Hetauda Road tunnel	Road	7	12
Kaligandaki Koban HEP (150MW)	Hydro	6.2	5
Tamakoshi 3 (650 MW)	Hydro	17	9
Upper Marsyangdi HEP (600 MW)	Hydro	9.2	6
Nalsinggad storage (390MW)	Hydro	9.2	6.5
Upper Modi-A (42MW)	Hydro	4.8	4
Upper Modi (18.2MW)	Hydro	3	4
Budhi Gandaki Storage (1200 MW)	Hydro	2	12
West Seti Multipurpose (750MW)	Hydro	6.7	10
Upper Marsyandi-2 (570MW)	Hydro	10	6
Lower Arun (400 MW)	Hydro	15	10
Upper Tamor (415MW)	Hydro	8.7	7.8
Kali Gandaki Gorge (275 MW)	Hydro	6.1	4.5
Solu Khola Small (40 MW)	Hydro	4.1	3.45
Madi I (26.5 MW)	Hydro	4.44	4
Upper Marsyangdi (14 MW)	Hydro	5.15	3.5

Project	Type	Tunnel length (km)	Diameter (m)
Upper Arun (1061MW)	Hydro	7.1	5.4
Dudh Koshi storage (650MW)	Hydro	5.6	5.2
Tamor Storage (762MW)	Hydro	2.5	7.2
Budhigandaki Ka HEP (130 MW)	Hydro	3.447	7.3
Budhigandaki Kha HEP (260 MW)	Hydro	6.925	7.2
Super Madi HEP (44 MW)	Hydro	5.905	4.4
East West Railway Project	Rail	45	8
Karnali chisapani Multi purpose (10050MW)	Hydro		
Karnali Betan HEP (450MW)	Hydro	2	9.8
Karnali Phukot HEP (450MW)	Hydro	4	
Arun Kimanthanka HEP (600MW)	Hydro	4	
Jagadulla HEP (110MW)	Hydro	7	
Bajhang Upper Seti (140MW)	Hydro	8.5	4
Uttar Ganga Storage (828MW)	Hydro	6	
Tamakoshi V (95 MW)	Hydro	8.1	5.6
Andhi khola storage (180MW)	Hydro	2	
Chainpur Seti (210MW)	Hydro	7	
Begnas Rupa Pump Storage(150MW)	Hydro	2	

# 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:** 558

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Due to Covid very limited activities have been organized in 2020.

- ITA presentation evening and annual meeting – online event

## CURRENT TUNNELLING ACTIVITIES Rijnlandroute (TBM)

In the Rijnlandroute project, a connection between the A4 with the A44 motorways has been established near Leiden. The twin-tube TBM tunnel is 2.5km in length. Each tunnel tube provides two traffic lanes. Fifteen years of management and maintenance are also part of the contract. The 2nd TBM-drive was finalized in 2020. The reception procedure was problematic, which resulted in deformation of the tunnel

lining and difficult demobilization of the TBM

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

Construction works on the Victory Boogie Woogie tunnel finished in 2020. After a testing period the tunnel was opened for traffic in February 2021.

## Zuidasdok Amsterdam (in-situ)

The Zuidasdok project establishes an extension to the existing A10 Zuid motorway, the ring road for Amsterdam. In a combined approach, the existing public transport hub will be extended, and the motorway will run 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. The contract was closed in 2019. In 2020 the client reconsidered the project. The tunnel project will be cut into 3 independent projects, in which the client is responsible for the integral design of the total project. Procurement of the 3 individual projects will start in 2021.

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

The Blankenburg connection, the new A24 motorway, contains two tunnels: the Maasdelatunnel, which is an immersed tube tunnel under the Scheur (Nieuwe Waterweg) waterway, the primary access towards the harbour of Rotterdam; And the Hollandtunnel, an in-situ tunnel through a natural habitat. Also, 20 years of maintenance is incorporated in the DBFM project.

The Maasdelatunnel will be about 945m in length and is characterised by its very deep ramps. The Holland tunnel is 510m long and is situated just below surface. In 2018, execution started for the Maasdelatunnel with the construction of coffer dams, within which the deep ramps are constructed. The construction of the deep ramps will continue throughout 2021. Immersion of the 2 tunnel elements in the Scheur waterway is planned for 2023. The foundation works on the Hollandtunnel started in 2020. The Blankenburg connection is scheduled for completion in 2024.

## A16 – Rottemerentunnel (in-situ)

The A16 motorway from 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 Rottemeren tunnel. The Rottemeren tunnel is planned to be opened in 2024 and will be 2,235m 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 into its environment. The project is currently in the construction stage, the first-floor sections of the tunnel (reinforced underwater concrete) were poured in May 2021.



Rotterdamse Baan



Blankenburgverbinding



#### 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 to be flexible when unexpected conditions are found in this old tunnel.

The project was awarded in 2020 and

renovation works started in 2021. The renovation works should be finished mid 2022.

#### The Heinenoordtunnel (1969) refurbishment

The project has been awarded in October 2020 and the final contract close took place

in April 2021. The renovation works will commence in 2023.

The municipality of Amsterdam is preparing a renovation scheme for the 5 tunnels it owns. (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
- Buitenvelderttunnel
- Noordtunnel
- Sijtwendetunnel
- Westerscheldetunnel
- Drechttunnel
- Piet Hein Tunnel
- Roertunnel and Tunnel Swalmen

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

- Botlektunnel
- Hubertustunnel
- Thomassentunnel
- Wijkertunnel
- Zeeburgertunnel

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# New Zealand

**Name:** New Zealand Tunnelling Society  
**Type of Structure:** Incorporated non-profit  
**Number of Members:** 130 individuals and Corporate Sponsors Two Platinum Three Gold and Two Silver Corporate Sponsors



## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Due to COVID disruption the NZTS held only two technical presentations including a year-end wrap-up of tunnelling activities in the year with a bi-monthly programme of technical presentations from industry across 2021.

The rollout of worker competency training

development programme sponsored by the major tunnelling projects and supported by industry, NZTS and the regulator Worksafe has commenced.

The NZTS is supporting the regional tunnelling conference to be held in Melbourne by having a virtual HUB in Auckland on the 11th and 12th of May 2021.

## CURRENT TUNNELLING ACTIVITIES

In Auckland the two major tunnelling projects, the City Rail Link (metro) <https://www.cityrailink.co.nz/> and the Central Interceptor Project (wastewater) <https://www.watercare.co.nz/About-us/Central-interceptor> are well underway with TBM's being prepared for launch at the time of writing. These two flagship projects continue the growth in the New Zealand tunnelling industry and the focus is now on what will follow.

In Southland work is underway on the Homer Tunnel upgrade aimed in part at resolving safety issues highlighted when a car caught fire inside the tunnel in 2020. Southland's iconic 1.2km-long Homer Tunnel is undergoing a \$25M safety upgrade which is expected to take several years to complete. The first work to get under way is \$3M worth of safety improvements, recommended after an investigation into a car fire in the tunnel recommended it in January 2020.

## FUTURE TUNNELLING ACTIVITIES

### Auckland Light Rail

In July 2020, the New Zealand Cabinet terminated the process of procuring a delivery partner for the light rail despite receiving two 'credible' offers from proponents, the New Zealand Transport Agency (NZTA) and a consortium (NZ Infra) of the New Zealand Super Fund and the Canadian pension fund CDPQ Infrastructure. The NZ Govt has set up an establishment unit to consider the next steps. <https://www.beehive.govt.nz/release/next-steps-auckland-light-rail-0>

### Auckland Additional Waitemata Harbour Crossing

Planning is underway to develop a rail-based rapid transit connection for the North Shore (including across the Waitematā Harbour to the city centre), that supplements and integrates with the upgraded Northern Busway and the wider public transport network to provide more public transport travel options. Construction is not anticipated to start until at least the 2030s.

Auckland Council has allocated about 10% of a \$500M 6-year work programme to tunnelling and HDD works as part of ongoing investment in improvements in water quality in Auckland.

Wellington The bi-directional Mt Victoria tunnel is a critical route between Wellington Central and the airport, Construction may commence in 5-10 years. <https://lgwm.nz/our-plan/our-projects/the-basin-reserve-and-an-extra-mt-victoria-tunnel/>.



CRL TBM March 2021 being moved into launch position



Central Interceptor – Mangere Shaft



**AECOM**



# Delivering complex tunnelling projects worldwide

**Pictured:** HMJV's TBM Caroline – National Grid London Power Tunnels 2

**Contact:** [tunnel@aecom.com](mailto:tunnel@aecom.com)

[aecom.com/tunneling](https://aecom.com/tunneling)



# North Macedonia

**Name:** Republic of North Macedonia

**Name of Association:** North Macedonian Tunneling Association (ITA North Macedonia)

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

**Number of Members:** 55



## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020 members of the Macedonian Tunneling Association are mainly active in reviewing the main design of tunnels in the Republic of North Macedonia as follow:

- Road Tunnel on the Expressway Gradsko – Prilep;
- Road Tunnel on the Expressway Bukojcani - Kicevo

Also some members of ITA Macedonia were consultants on the Macedonian Enterprise for State Roads concerning tunnelling activities.

## CURRENT TUNNELLING ACTIVITIES

Construction of the longest road tunnel in Rep of North Macedonia - the tunnel Preseka on the Motorway A2, section

Kicevo-Ohrid which has two tunnel tubes, with a length of 2.2km each excavated in graphite phyllites in category V after Bieinawski. The primary support system features a pipe roof in combination with heavy steel arches IPB 200 and 30cm of shotcrete. The final lining is completely finished. At present, works on the tunnel ventilation system, lightening system and other safety systems are under construction.

- Tendering procedure for Road Tunnel on the Expressway Gradsko – Prilep;
- Tendering procedure for railway tunnels on the Section Kriva Palanka – Border with Rep. of Bulgaria (22 tunnels).

## FUTURE TUNNELLING ACTIVITIES

- Tendering procedures for 13 tunnels on Railway line Beljakovce – Kriva Pakanka

## STATISTICS

**1. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020:** €75M

**2. List of tunnels completed:** none

**3. List of tunnels under construction:** Tunnel Preseka on the Motorway A2, section Kicevo - Ohrid

## EDUCATION ON TUNNELLING IN THE COUNTRY

Subject - “Tunnels” on graduate studies, Faculty of Civil Engineering – Skopje  
 “Selected chapters of tunnels”, post graduate studies, Faculty of Civil Engineering – Skopje

- Organizing seminars for tunnel construction methods for the engineers who will be involved in realization of future tunnels in Macedonia.
- Members of ITA Macedonia will take an active role in the construction of future tunnels through consultancy of Macedonian public enterprises for State roads and railways.



Waterproofing



# Norway



**Name:** Norwegian Tunnelling Society

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

**Number of Members:** 1,000 personal members and 100 corporate members (Including research institutes, academia, and public clients)



Organising digital conference

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

The Norwegian Tunnelling Society has a set of yearly events such as conferences, courses and evening meetings. Among these, the largest is the Fjellsprengningsdagen, which gathers more than 700 rock blasting and TBM enthusiasts to share knowledge and the latest news. 2020 became a very different year to most. We still managed to arrange an array of different courses and evening meetings. The yearly conference went ahead as a digital event with approx. 200 participants.

Norway was among the finalist in three categories in the ITA Tunnelling Awards: The Ryfast project in the category “Major project of the year”, “Spiralen” in the category “Oddities of the underground” and the Lower Otta hydropower in the category “Project of the year incl. renovation (up to €50M) – the last one winning this category!

The Society publishes handbooks and technical reports in Norwegian and one English publication every year. In 2020 we published a Norwegian handbook about bolting, and another one for Rockblasters.

## CURRENT TUNNELLING ACTIVITIES

The tunnelling activity in Norway has increased again in 2020 after two years of

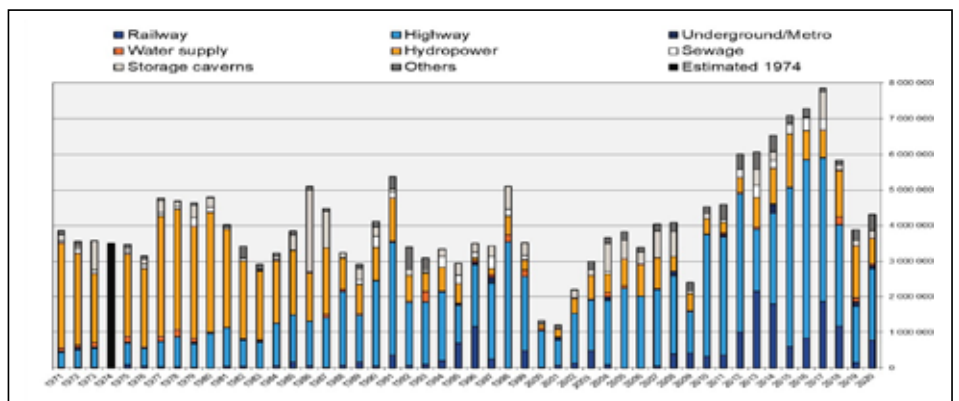
decline in both 2018 and in 2019. In 2020 we excavated 4.3Mm<sup>3</sup> rock underground. The amount of excavated rock has been steadily growing, but 2018 ended up being

the first year with a decrease in volume since 2009. The major part of the activity is still concentrated around road and rail tunnels, with hydropower tunnels as a significant amount of the activity.

The project that excavated the most in 2020, was the E39 Kristiansand Vest-Mandal Øst. This is a road tunnel project for Nye Veier, where more than 600,000m<sup>3</sup> has been excavated. Digital solutions are developing apace in Norway, and at this project a web-based access solution will contain and display all of the project’s BIM models. This includes documents and work basis, health, environmental and safety matters, progress information, quality and FDV documentation.

The company that excavated the most totalled more than 1Mm<sup>3</sup>. The largest project being built by it being Nordøyveien, where the company excavated almost 600,000m<sup>3</sup>. Nordøyveien is a project with several road tunnels for The Norwegian Public Road Administration just outside Ålesund. In addition to digitalisation, zero emission construction is a main focus for many contractors in Norway, at Nordøyveien they have started using a brand-new electrical loader.

Three important tunnel projects opened up for traffic in 2020. Two being in the middle of Norway; E6 Soknedal, and Fv714 Salomon road. Both projects eliminate large distances with narrow and winding roads and many fatal accidents. The third is E134



Tunnel statistics



The team grouting at Nordøyveien



E6 Soknedal

Damåsen – Saggrenda, improving the traffic flow around the city of Kongsberg.

**FUTURE TUNNELLING ACTIVITIES**

The high activity within infrastructure development will continue in the years to come. And we believe that we will see a further increase in the activity.

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 soft ground tunnelling and about 700m of cut-and-cover.

Another large project we are waiting for is a large infrastructure project that will be a joint rail and road project, the Ringerike Line and E16 Highway, it will include a 40km long tunnel for the railway in addition to some shorter tunnels both for rail and new highway between Sandvika and Hønefoss.

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

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

A new big project is in planning, a new water supply for Oslo. The water will go through a long tunnel from the Holsfjord west of the city into the existing net of water pipes. In addition, The Fornebu Line is

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 a railroad tunnel is under planning through the central part of Oslo City.

As a curiosity we also have to mention the Stad tunnel – the world’s first tunnel for ships! The construction of this 1.7km long tunnel starts in 2021.

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:**

72,266m in total, (included 5,175m by TBM) - 4.3Mm<sup>3</sup> in total

**2. An example of tunnels completed:**

The excavation for the Søgne tunnel is complete (4040m)

**3. List of tunnels under construction:**

More than 50 tunnels under construction at all times in Norway

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Norway has several universities giving both bachelor and master’s degrees with several aspects of tunnelling, the major ones being NTNU in Trondheim and University of Oslo. In addition to the higher degrees of education, Norway can offer a set of schools preparing the students through a four-year program for the certification for rock blasters. In addition to these educational institutes, you have a set of courses and classes with different level of classifications and certifications.

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# Poland



**Name:** Subcommittee of Underground Construction of Polish Committee on Geotechnics

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

**Number of Members:** 58 members, 5 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Because of the Covid pandemic all activities of the association were stopped.

The representatives of Poland were present online at the ITA General Assembly during WTC 2020 in Kuala Lumpur (digital) and at a special (digital) General Assembly on February 10th 2021. Monika Mitew-Czajewska (treasurer) is the member of WG20, Anna Siemińska-Lewandowska (president) - WG15, Bartłomiej Dziuban and Dymitr Petrow-Ganew - WG14, Maciej Ochmański - WG2 and WG22, Jerzy Lejk - WG3, and Bartłomiej Dziuban - ITAym.

## CURRENT TUNNELLING ACTIVITIES

### Construction of the 2nd metro line in Warsaw, extensions of the existing central part:

- In an east-northerly direction (three stations, 8km) - Gülermak Ağır Sanayi İnşaat ve Taahhüt A.Ş. Due date 2023.
- In a westerly direction (five + one stations, 12km) - Gülermak Ağır Sanayi İnşaat ve Taahhüt A.Ş. Building permit, due date 2024.

### Construction of the 3rd metro line in Warsaw

- Design works begun, feasibility study
- Construction method: EPBM + cut & cover.

### Road Tunnel in Warsaw – part of the south city ring

- A 2,700m long tunnel, 3 lanes in each direction, construction method - cut and cover.
- Construction works in progress. Due date June 2021.

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

The 1.44km long tunnel will connect the islands Uznam and Wolin. Construction method TBM – 13.46m diameter. Due date end of 2022. Design works are completed, a slurry TBM started on 5th March 2021.

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



Road Tunnel in Warsaw – part of the south city ring

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 are assembled. Starting shaft is completed. First TBM (8.76m in diameter) should start in April 2021.

### Road Tunnel under Luboń Mały – south Poland

- Over 2 x 2km tunnels on the S7 motorway from Kraków to Zakopane (polish skiing resort)
- Construction works in progress, 2200m executed, the method of construction is ADECO RS. Due date 2021.



Road Tunnel under the Świna river in Świnoujście – north Poland

**Road Tunnel on the S3 motorway Bolków-Kamienna Góra – south Poland**  
2.3km tunnel on the S3 motorway from Bolków to the state boarder. Design and build. Construction in progress. The method of construction – NATM. Due date end of 2023.

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

Two road tunnels (830m and 980m) on the S1 motorway from Bolków to the state boarder. The contractor will construct the tunnel under a design and build contract. The tunnels will be constructed using the sequential excavation method or ADECO. Due date 2022.

### Road Tunnels on the S19 motorway, Via Carpatia, Rzeszów - Babica

2,180m twin-tube TBM road tunnel on the S19 from Rzeszów to the state boarder. The feasibility study is completed, and tender awarded. Construction works will start at the end of 2021.

### FUTURE TUNNELLING ACTIVITIES Three road Tunnels on the S19 motorway, Via Carpatia, section Rzeszów - Barwinek:

Three road tunnels (1.75km, 1.6km, 1.2km) on the S19 from Rzeszów to the state boarder. The conceptual design is in progress. Construction time 2021-2025.

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

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

### Road Tunnel on the S6 motorway,

Road tunnel on the west city ring of Szczecin, under Odra river, 5km, preliminary design.



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

**Eleven (11) Rail Tunnels – 12km length in total on the planned 58km long new rail route Podłęże-Piekietko in the south part of Poland. In addition, two Rail Tunnels – 5.8km length in total on the rail route Chabówka – Nowy-Sącz, will be modernized.**

Environmental approval was 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 2021-2026.

**2.5km long railway tunnel in Łódź** on the railway line 85; a high-speed train tunnel will connect the Central National Airport (under design) with Warsaw and Wrocław.

**Two short rail tunnels in Górkki (0.22km) and Maksymilianowo (0.11km)**

## STATISTICS

**1. Length or volume excavated - % mechanized / % conventional during 2020:**  
70% mechanized / 30% conventional

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020:**  
€200M

**3. List of tunnels completed**  
(2): Metro tunnels in Warsaw

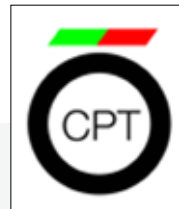
**4. List of tunnels under construction**  
(9) + 18 design stage

## 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

# Portugal



**Name:** Comissão Portuguesa de Túneis e do Espaço Subterrâneo (CPT) – Portuguese Tunnelling Association and Underground Space

**Type of Structure:** A Committee of Portuguese Geotechnical Society (SPG), non-profit, open association

**Number of Members:** 70 individual members, 8 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020 a new CPT Board was appointed. The current president is Dr. Raul Pistone, former vice president. The former president Ing. João Bilé Serra integrates into the board as past president.

There are seven working groups in operation: GT1 - Registry of Tunnels; GT2 - Contractual Practises; GT3 - Health and Safety; GT4 - BIM and Information Management; GT5 - Innovation and Life cycle Management; GT6 - Construction Methodologies: Conventional and Mechanized Methods; YM: Young Members.

In 2020, CPT worked to organize online events on the Public Works Contract Code (CCP) and its use on Complex Underground Works. CPT published a new Guide of Best Contractual Practices for Public and Complex Geotechnical Works, together with two important organizations: Portuguese Engineers Association and Portuguese Association of Engineering and Management Consultants.

GT2 worked with ITA WG3 and published the ITA Report #25: ITA Contractual



Framework Checklist for Subsurface Construction Contracts (2nd Edition / 2020) that is the revision of the 2011 Checklist.

The GT3 worked in the Preparation and Editing of the Technical Guide "Safety and Health in the phases of Project and Construction of Underground Works".

CPT participated in the ITA's WG actively, through meetings and paper contributions.

During 2020 the CPT secured participation in the WTC in Kuala Lumpur and in the 2020 ITA General Assembly as well as the 2021 Extraordinary General Assembly.

CPT participated actively in the board of the European Forum EUTF and in the Iberoamerican Group on Underground Works.

## CURRENT TUNNELLING ACTIVITIES Lisbon Drainage Tunnels-Municipality of Lisbon

New tender in December 2019. EPC contract for two drainage tunnels (4.5km and 1.3km long) with an internal diameter of 5.5m; three shafts in urban areas with approx. 20m depth and 15m diameter.

## Reinforcement of the sewage and water system in Basin Q with Microtunnelling

Works date from January 2019 to March 2020. Lump Sum contract of one microtunnelling pipeline with 1.6m diameter and 320m long, between two shafts (launch and reception) and several sewage box culverts.

## Lisbon Metro Extension (subway)

The new Metro extension (construction length over 2000m), which will connect the Yellow Line with the Green Line and is expected to open in 2024, was launched in 2020 and is divided in four Design/Construction EPC tenders: Lots 1 to 4. The expansion works contain two new stations at Estrela and Santos and two new ventilation shafts. Campo Grande and Cais do Sodré stations will also be reconstructed/adapted as part of the project, corresponding to the new circular line "closing points". Once the extension is placed into service, the Green and Yellow lines will be reorganised. The Green Line will run as a circular route and will take over the section of the Yellow Line



between Campo Grande and Rato, while the Yellow Line will run between Odivelas and Telheiras.

The Estrela station will feature an access shaft, a connection cavern, a 110m long main cavern and two lateral galleries for accessing the mezzanine floor from the subway platform. The Pharmacy building from the old Military Hospital will serve as the main access and be completely refurbished by demolishing its inside, while maintaining and reinforcing the façade. The Santos station will be built in an archaeologically sensitive environment, where a fire station currently operates. It consists of a huge central shaft, two symmetrical caverns and lateral access galleries to each one, as well as a tunnel access from Av. Carlos I.

**Oporto Metro System- Pink Line**

The construction contract was awarded in 2020 and notice to proceed issued in March 2021. The new Pink Line is 3.1km of tunnel, using the conventional method, between Praça da Liberdade and Casa da Música, including 4 Stations (Liberdade, Hospital de Santo António, Galiza and Boavista/Casa da Música) and three ventilation shafts in urban areas.

**Oporto Metro System-Yellow Line**

The construction contract was awarded in 2020 and notice to proceed issued in March 2021. The new Yellow Line is about 3km long, between Santo Ovídeo and Vila D’Este stations, including three Stations (Manuel Leão, Hospital Santos Silva and Vila d’Este), a ventilation shaft, about 0.9km of tunnel, by the conventional method, between Manuel Leão and Hospital Santos Silva stations, a viaduct and rollingstock maintenance and parking installations.

The new line starts at the Santo Ovídeo station through the construction of a viaduct, extends in an open trench

and continues in a tunnel excavated by conventional methods to the Manuel Leão station. The alignment continues in tunnel to the Hospital Santos Silva, where it emerges in a cut & cover tunnel to the Hospital Santos Silva station. Here, an open trench takes the line to Vila D’Este station.

Considering the space available at the surface, the results of the preliminary geological study and the depth at which the Manuel Leão Station will be located, the tunnel work will be carried out using 3 different construction methods, which will be:

**Cut & cover excavation:** The method with which the Manuel Leão station will be built, and the ventilation and evacuation shaft.

**Excavation with an “umbrella”:** The method with which the portals and sections of the tunnels will be built in conditions of very weathered to decomposed or very fractured rock, and in areas with low cover. This methodology is expected to be adopted in most sections of the tunnel

**Excavation by the Sequential Method** will be used in the sections of the tunnels and caves in medium or slightly altered rock conditions.

**Electrification and refurbishment of the Minho line ancient railway tunnels. IP – Portugal Infrastructures**

The electrification of the tunnels will be carried out using the catenary support of the elastic suspension type. The maximum speed allowed by this type of support is 110km/h.

The three tunnels in this section total 1471m in length:

- São Miguel da Carreira, built in 1876, about 260m long.
- Tamel, built in 1878, about 980m in length.
- Santa Lucrecia, built in 1878, about 230m long.

All tunnels were subjected to rehabilitation works and waterproofing of the vault over the catenary

**Rehabilitation of several others ancient rail tunnels**

Works dated from 2018 until 2020: Albergaria, Pragal, Seixas, Outeiro Grande, Portas de Rodão, Eirol, Caíde

**Alto Tâmega Hydroelectric System – IBERDROLA.** Under construction.

The system comprises the following hydroelectric complexes:

**Gouvães**

Dam height: 30m  
 Installed power: 880MW  
 Hydraulic circuit length: 7.6km  
 Reservoir area and volume: 176ha - 13.7hm<sup>3</sup>

**Daivões**

Dam height: 77.5m  
 Installed power: 118MW  
 Hydraulic circuit length: 0.25km  
 Reservoir area and volume: 340ha - 56.2hm<sup>3</sup>

**Alto Tâmega**

Dam height: 106.5m  
 Installed power: 160MW  
 Hydraulic circuit length: Powerhouse at the dam foot  
 Reservoir area and volume: 468ha - 132hm<sup>3</sup>


**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:** 3,000m, 100% Conventional

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020:** €400M



68 Tunnels  
621 Km

<p><b>Sealing</b></p> 	<p><b>Connection systems and accessories</b></p> 
<p><b>Precast plant</b></p> 	<p><b>Technical cogeneration</b></p> 

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# Russia



## EDUCATION ON TUNNELLING IN THE COUNTRY

Include graduate courses, post graduate courses, technical courses / name of University, School...

Main higher educational institutions, training and retraining specialists to work in the area of underground development:

- 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 "Gornyy" (SPGU)
- Saint Petersburg University of Communications (PGUPS)
- Tula State University
- Ural State Mining University (UGGU)
- Siberian State University of Communications (SGUPS)

Construction of Dusse-Alin and Kerak railway tunnels has begun in the Siberian region.

Work has begun on the Eastern test site to lay the railway bypassing the Shkotovo-Smolyaninovo site, where railway tunnels will also be built.

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

**Type of Structure:** Non profit

**Number of Members:** Total number - 63

### ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

An event on the occasion of the 30th anniversary of the creation of the Tunnel Association of Russia which was attended by the head of the ITA/AITES Executive Director O. Vion (Moscow, 02.28.2020).

- Round table "Innovative solutions for the construction of the Moscow Metro" (Moscow, February 27th 2020).
- International Scientific and Technical Forum "Use of Progressive Tunneling Technologies in the Development of Underground Space of Megapolises" (Moscow, October 15-16th 2020).

Professional competitions have also been organized and conducted:

- Contest S.N. Vlasov "Engineer of the Year of the Tunnel Association of Russia 2020";
- Contest "Best use of advanced technologies in tunnel construction and underground structures";
- Scientific (diploma) works contest for higher education university students.
- The professional magazine Metro and Tunnels (four editions of the magazine were issued) and the newsletter of the Tunnel Association of Russia were published (one issue was published).

### CURRENT TUNNELLING ACTIVITIES

In 2020, under the Moscow Metro development program, 17.9km of running tunnels were built, seven new stations were put into operation, including Lefortovo, Aviamotornaya, Nizhny Novgorodskaya, Stakhanovskaya, Okskaya, Yugo-Vostochnaya, Elektrozavodskaya.

The second line of the Baikal tunnel on the Baikal-Amur railway has been prepared for commissioning.

The member companies of the Tunnel Association of Russia are involved in the implementation of large-scale programs to increase the capacity of the Trans-Siberian Railway and the Baikal-Amur Railway.

### FUTURE TUNNELLING ACTIVITIES

Development works continue on the Moscow subway. In 2021-2023, it is planned to build and commission more than 58km of lines and 24 stations, as well as to build

and reconstruct four large electric depots. It is planned to complete the extension of the Lublin-Dmitrov branch from Seligerskaya to the village of Severny. Three stations are being built on the new section: 800th Anniversary of Moscow Street, Lianozovo and Phystech. The construction of a new section of the Solntsevsky radius from Rasskazovka station to Vnukovo Airport with an intermediate station of Pykhtino should also be completed. Another branch which is being extended in the southwesterly direction is Sokolnicheskaya: from Kommunarka it will reach Potapovo, where Novomoskovskaya station will open.

Development works continue on St. Petersburg subway. According to the plan for the development of the St. Petersburg subway, the length of its lines should increase from 113.6km to 155.5m. The number of stations will increase from 67 to 85, and the number of metro stations will increase from five to seven by 2027.

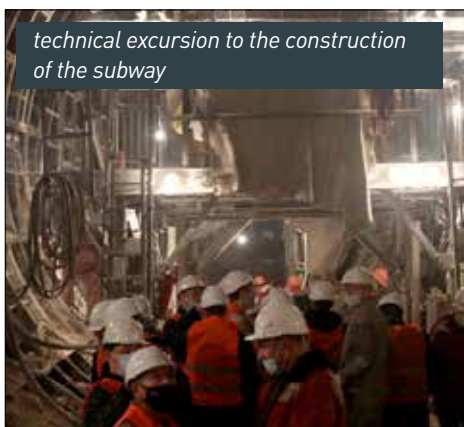
Work continues on the design of the metro in Krasnoyarsk.



The 30th anniversary of the creation RTA



Elektrozavodskaya metro station-1



technical excursion to the construction of the subway



Work in the running tunnel of the BCL



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# Singapore



**Name:** Tunnelling & Underground Construction Society (Singapore)

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

**Number of Members:** 1160 members, 113 corporate members

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020, 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.

### TUCSS Annual Lecture

- TUCSS Annual Lecture was held on Thursday, 15th October 2020 virtually. The topic was “Tunnelling with Slurry TBM: Challenges in Soil, Mixed Ground and Rock” by Mr. Francois Dudouit, Vinci Construction Grand Projects. The Annual Lecture was attended by 340 TUCSS members.

### TUCSS Corporate Members’ CNY Lo-Hei Dinner 2020

- TUCSS organised its annual Chinese New Year Lo-Hei Dinner with its corporate members and guests on 7 February 2020 at Chui Huay Lim Club, to thank the corporate members for their continuous support and creating a space for them to network. It was attended by 109 corporate members and 20 guests.

## CURRENT TUNNELLING ACTIVITIES

The construction of subway, road and utility infrastructures form the bulk of current tunnelling activities in Singapore. In addition, with the limited land space available, Singapore has seen an increase in the adoption of pipe jacking as a method for the construction of underground linkways and pipelines. Some of the ongoing major tunnelling activities are as shown below:

### Thomson East Coast Line (TEL)

TEL is the sixth Mass Rapid Transit (MRT) line to be built in Singapore, consisting of a total of 32 stations, inclusive of 7 interchange stations and spanning a

### Monthly Evening Seminars for members:

16 January 2020	BS / EN 16191 TBM Safety Standard	Dr Ruben Duhme, Herrenknecht Singapore
18 June 2020	Rock Mass Classification and its Application in Singapore for Underground Structures	Dr Lee Young Zoo, Geoconsult Asia, Singapore Pte Ltd
16 July 2020	Large Diameter EPB Operation to Control Settlement	Dr Harry Asche, Aurecon NZ
19 August 2020	Hydrogeology in Underground Design and Construction	Mr Tom Ireland, Aurecon NZ
19 November 2020	Changing Safety Standard Tunnelling	Dr Donald Lamont, Chairman BS 6164 revision panel

total of 43km in length. Bored tunnelling works using the 27 EPBMs and 24 Slurry TBMs have completed and the line will be progressively opened in stages, with the first three stations currently operational.

### North East Line Extension (NELe)

NELe adds an additional station, Punggol Coast, to the existing North East Line, bringing the total number of stations to 17. Two x EPBMs has been used to construct the 2km length of tunnels and tunnel breakthrough for both drives have completed successfully. The station is expected to be completed in 2023.

### Circle Line 6 (CCL6)

Commenced in 2018, CCL6 comprises of a total of three stations and an extension to the existing Kim Chuan Depot and serves to connect the Central Business District with the rest of the Circle Line. Once completed, the 4km CCL6 will close the loop between the existing HarbourFront Station and Marina Bay Station and will bring the total number of Circle Line stations to 33, inclusive of 12 interchange stations. Three EPBMs are used in CCL6 to support the bored tunnelling works. In addition, CCL6 comprises of five underground linkways that will be constructed via pipe jacking,





with 1.2m diameter slurry TBMs supporting the works.

**North-South Corridor (NSC)**

Commenced in 2018, NSC comprises of 21.5km of expressway, with a large portion underground and serves as Singapore’s 11th expressway, connecting the northern towns in Singapore from Woodlands down to the city centre. Envisaged to be Singapore’s first Integrated Transport Corridor, NSC comprises of dedicated, continuous bus lanes as well as cycling trunk routes and pedestrian paths, connected with the existing Park Connector Network. Construction of the road tunnels will be predominantly carried out via the cut and cover method and features extensive at-grade road and utility diversion works.

**Deep Tunnel Sewerage System (DTSS) Phase 2**

To meet Singapore’s long-term clean water needs, a used water conveyance system, the DTSS, is currently under construction. Some of the shafts were constructed using a vertical shaft boring machine which is a first in Singapore. The constructed link sewers will connect existing sewer lines with the deep tunnels via drop shafts, conveying used water via gravity to centralised water



reclamation plants for further processing and treatment. With Phase 1 completed in 2008, DTSS Phase 2 comprises of 60km of link sewers (50km of which to be constructed via pipe jacking) and 40km of deep tunnels at depths between 35m to 55m, both underground and undercrossing the sea. A total of 19 TBMs, comprising of both EPBMs and Slurry TBMs, will be used to construct the deep tunnels.

**Changi East Airport Development**

To support the future airport infrastructure with the planned Terminal 5 (T5), Changi Airport Group (CAG) has awarded contracts for the construction of underground bored tunnels to support services such as baggage transfer and underground people mover system for travellers as well as for cut and cover tunnels for airside roadway.

**FUTURE TUNNELLING ACTIVITIES**

**Cross Island Line (CRL)**

The CRL comprises of more than 50km of underground lines and is envisaged to increase connectivity between the western, eastern and north-eastern parts of Singapore. Construction of the CRL will be divided into three phases, with the first phase (CRL1) comprising of a total of 12 stations, inclusive of four interchange stations and spanning a total of 29km in length. In addition to the conventional EPBMs and slurry TBMs, CRL1 features the use of a large-diameter EPBM for the construction of a 3.2km length single tunnel to house both tracks. Passenger service for CRL1 is slated for 2030 and studies on the subsequent CRL phases are currently ongoing.

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020**  
 Approximately 15,600m/416,042m<sup>3</sup> (Mechanized), 9.2m/170m<sup>3</sup> (Conventional) (Bored tunnelling and cross passage works)

# Spain



**Name:** Asociación Española De Túneles Y Obras Subterráneas (Spanish Association Of Tunnels And Underground Works)

**Type of Structure:** Non profit, open association, founded in 1975

**Number of Members:** Total 321; (234 individual members, 59 corporate members, and 28 young members)

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

Due to the COVID-19 pandemic, many of the activities initially planned have been postponed and others have been held by teleconference. Among others, the following are worth mentioning:

- New Board Appointment AETOS, Current President: Juan Pablo Villanueva Beltramini, from 25th Nov 2020
- AETOS General Assembly, 25th Nov 2020 Jornada Técnica y Acto Homenaje: “Túnel de Valls -Montblanc” and a tribute to Miguel Fernández-Bollo”, Past-Vice President
- International Seminar CTES-MOP Estándares en túneles viales - Santiago



de Chile, Chile, 1st -28th Oct 2020. Participation with presentations and stands at a virtual exhibition

- 9º congreso Lationamericano de túneles - Tunnel Mining. Participation with the paper: “Criterios de diseño de túneles en España”, 1st - 4th Dec 2020, Lima. Perú

- XV Seminario Andino de Túneles y Obras Subterráneas. Participation with the paper: “Estándares internacionales en túneles viales y aplicación en proyectos”, Bogotá, Colombia, 26th - 28th Nov 2020
- 4th Expert Network meeting on the design of underground structures, 12th – 13th Nov. 2020
- Meeting of AETOS and CPT with the Grupo Lationamericano de túneles, 26th Jan 2021
- Regular meetings in the European Underground and Tunnel Forum EUFT
- Regular Technical Meetings of FAT (AETOS Technical Forum) with national working Groups
- Organization of the XVI Master Universitario en Túneles y Obras Subterráneas AETOS (Endorsed by ITA-AITES)
- Collaboration with DAUB in translating German-BIM in Tunnelling to Spanish (Feb 2020 draft version)
- Monography issue of tunnels in the ROP (Journal of Public Works). A new special issue of the ROP on Tunnels and Underground Works is presented, as a continuation of the collaboration that the Spanish Association of Tunnels and Underground Works (AETOS) and



Martorell tunnel

the Journal of Public Works (ROP) has been developing since 2009, to publish monographs disseminating the experiences related to tunnels and underground works.

## CURRENT TUNNELLING ACTIVITIES

### High speed network tunnels

The tunnel network on the high-speed railway lines currently includes a total of 1,229 tunnels, with a total length of 497km. In 2020 and 2021, work will continue on the following tunnels:

#### Mediterranean corridor:

##### Castellbilbal-Martorell:

- Castellbilbal 872m
- Costablanca: 810m
- Martorell: 1,025m

##### Murcia-Almería

- Chinchilla
- Alcantarilla
- Viator

##### Sant Feliu Burying 1,565m

##### Emergency exits for the Sant-Sagrera

##### Barcelona

#### Extremadura corridor:

##### Malpartida de Plasencia tunnel: 1,500m

#### Galicia corridor:

##### Rante tunnel: 3,410m

##### Montealegre tunnel: 3,495m

#### León-Asturias corridor:

##### Pajares tunnel (Emergency exits):

##### 88+204+295m

##### León burying: 1,790m

The Pajares New Line is part of the León-Asturias Line, on the High-Speed North-Northwest Corridor. It is located between La Robla (León) and Pola de Lena (Asturias), on 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 includes the outer stretches towards La Robla and Pola de Lena.

The Pajares Tunnels, approximately 25km in length, will be the sixth longest in Europe and the seventh in the world. Another important tunnel on-going is the Pontones, at 6km long.

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.

#### “Y” Vasca and Navarra

- Udalaitz West tunnel: 7023m
- Udalaitz East tunnel: 6910m
- Kortazar tunnel: 3684m
- Karraskain tunnels, twin single track 543m Western/448m Eastern.

The tunnels initially run through a zone of alternations of limestones, marlstones, carbonate siltstones and limestone breccias and a second zone of dark siltstones. The main characteristic of the limestone section is the karstification which is the main geological risk for the excavation of the tunnels.

Minimizing the impact on the aquifer and the control of possible water inflows into the tunnels will be two of the determining factors during their execution.

The method of excavation is the NATM (New Austrian Method) by drilling and blasting as a full section in the limestone and dividing the section into top heading and bench in the siltstones. Excavation will be carried out occasionally using mechanical methods.

The types of design supports are based on shotcrete, bolts and steel ribs. A 0.60cm thick invert of HA-30 concrete will be built along the entire length of the tunnels.

To avoid affecting “the Udalaitz karst system”, a waterproofing and secondary lining system has been designed.

### Hydraulic Tunnels

#### Mularroya tunnel

The tunnel will transfer water from the Jalon River to the new Mularroya reservoir. The underground tunnel of 12.6km has an i.d. of 2.9m and an o.d. of 3.35m, and will cross the municipalities of Calatayud, Paracuellos de la Ribera, El Frasno and Morata de Jalón, with a capacity to transfer 8 cubic metres of water per second.

### Road Tunnels

#### N-260 Roadway. Section Cogosto-Campo (Huesca)

##### Tunnel 1,265m

Tunnel 2,540m - it includes the construction of an emergency gallery parallel to the tunnel with a length of 263m.

The tunnels have a free section of 68m<sup>2</sup>. Both tunnels will be excavated in calcareous lithologies of limestones, breccias and shales. The method of excavation is NATM (New Austrian Method) by drilling and blasting the full section. The primary support consists of shotcrete, bolts and steel ribs. In addition, the tunnels will be waterproofed with a PVC sheet membrane protected by a geotextile and a final lining of 30cm of cast-in-place concrete.

#### Las Glorias Square lot 3 - (Barcelona)

This complex works consist of constructing a tunnel between two shafts, previously built, built under an existing railway tunnel. The reinforcement of the upper railway tunnel was carried out before the excavation of the tunnel. The construction procedure consisted of driving pipes both on top and laterally to create a protective enclosure for the tunnel. The top pipes are 24-30m long and 1100mm diameter, and the side pipes are 508mm diameter. All steel pipes were backfilled and connected by a tie beam.

#### M30 - Urban Roadway (Madrid)

Operations have been carried out throughout the year to maintain the M-30 tunnel's conditions for the thousands of users who travel through them every day. These include everything from cleaning and repainting to sealing, injections and treatment of metal structures, among others. One of the most extraordinary



operations is cleaning the vitrified steel panels that cover the walls. These get rid of the so-called “black hole” effect, act as a visual guide for users and increase the luminosity inside the tunnel.

This year, the corresponding Tunnel Condition Inspections have also been carried out, covering 6,500m of roadways and 50 enclosures, including emergency exits, technical rooms and ventilation shafts. The condition of the 21,500 support systems that bear the weight of the by-pass roadway slab and surfacing was also checked.

Furthermore, Special Spot Inspections, accompanied by auscultation campaigns, have been carried out, using unique methods, such as geophysical ground reconnaissance using the Continuous Surface Wave Recorder (CSW) method, to verify the ground stiffness.

**Seberetxe tunnel**

South Metropolitan Bypass in Bilbao, Stretch: 9B and 9B-2. Tunnel alignment 1 has a length of 520.6m (excavated) and 67.1m of artificial tunnel. Tunnel alignment 2 has a length of 528.5m (excavated) and 68.3m (artificial tunnel).

**Plaza de España Tunnel (Madrid)**

The Plaza de España Tunnel (1km) is being built adjacent to the Royal Palace of Madrid, one of the largest palaces in the world, which dates back to the 18th century. The tunnel will allow traffic (two lanes in each direction) to run underground, leaving the entire surface for pedestrians and landscaped areas. One of the main characteristics of this tunnel is that its construction has been adapted to the numerous archaeological remains of XVIII Century buildings and “palace exterior works” found in the area. The longitudinal profile of the tunnel, and the construction method have been modified to suit the position of the archaeological remains in different parts of the route. In areas where the remains were found in the middle of the tunnel cross section, they have been dismantled and reconstructed on the surface, in landscaped areas adjacent to the tunnel.

**Subway Tunnels**

**Metro de Málaga: Lines 1 and 2**

Section: Guadalmedina- Atarazanas

Length: 300m

Section: RENFE – Guadalmedina. Length:

713m.

Works of the Málaga Metro are ongoing in the Renfe-Guadalmedina section, which runs 100% underground between el



Málaga Metro Lines 1-2



Metro Madrid refurbishment

Perchel-María Zambrano Station. Lines 1 and 2 of the Malaga Metro to El Perchel-María Zambrano, in commercial service since July 2014, consist of 12km and 17 stops and stations. Currently, the Ministry of Development, Infrastructure and Land Management is advancing the execution of the works of the Renfe-Guadalmedina and Guadalmedina-Atarazanas sections, which cross the center of the capital and which include the two additional stations of Guadalmedina and Atarazanas, in the Paseo de la Alameda of Malaga.

**Tribunal station-Madrid subway**

Refurbishment of shafts and galleries for the modernization of the Tribunal Subway station

- Main Shaft 36m depth
- 150m of connecting galleries.

The geology of this area is made up of a succession of sand, silty sand, sandy silt and clayey silt.

**Bilbao Station, Madrid Subway**

Work includes 50m of galleries and 32m of Shafts. The objective is the installation of seven elevators to improve the station accessibility. The station is very shallow,

being a century-old station, and the works were carried out when the station was open to public transport.

The works were carried out from the level 3 distributor corridor and consist of a 55m gallery using the traditional Madrid method, 400m<sup>3</sup> of earth excavation, and a modernization of the station, which has allowed for waterproofing such a shallow station.

Other works carried out included the restoration of two murals, as well as a new layout of the main concourse level, which has facilitated passenger traffic.

**FUTURE TUNNELLING ACTIVITIES**

**Sub-river twin tunnels for the Multimodal riverbank connection in the Bilbao estuary**

The study phase for the project (“the Lamiako tunnel”), currently underway, began at the end of 2020. It encompasses the design of a road connection between riverbanks to solve the lack of capacity, congestion and vulnerability challenges on the road network of the Bilbao metropolitan area. The feasibility analysis of the addition of a railway connection, and its design, if viable, are also comprised in the project study, with the aim of providing a multimodal solution. The road connection consists of two 3.2km long twin tunnels under Bilbao estuary with two 3.5m wide lanes, plus shoulders in each tube. Connection galleries are planned with a spacing of 225m. The tunnels will be bored mainly through limestone, marl, siltstone and igneous rocks, crossing a complex stretch lying under saturated soils. The addition of the railway connection, if viable, will condition the design. Apart from the tunnelling works, challenging road junctions at both ends are included in the Project, resulting in a total length

of 4km between ends. The study phase is scheduled to finish in 2023. Presently geological investigations, construction method choice, traffic analysis, and layout design tasks, among others are being undertaken. Currently there is only one road connection between the riverbanks in the metropolitan area along the 10km of the estuary.

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

- La Canda and Padornelo tunnels (N-525) (Zamora)
- El Carmen, LLovio, Tezangos, El Fabar, Arena De Morís y Duesos. (Asturias)
- Somosierra. A-1 (Madrid)
- Jarrio and Rellón A-8 (Asturias)
- San Juan (Alicante)
- San Simón (Huesca)
- Lladó, Colladetes, Fogá and Juan Carlos I (Vielha). N-230 (Lleida)

**Erjos Tunnel:**

The project consists of the construction of the road section to close the Tenerife Island Ring Road (Canary Islands). The total length is 5,100m of twin-tube tunnel with two lanes of traffic running under the Teno Massif.



San Simón tunnel

- 2021 AETOS Seminar Metro in Sevilla ("Solución sostenible para el transporte en la ciudad" (pending on schedule due to COVID conditions)
- 2021 AETOS Seminar in Bilbao "Lamiako tunnel" 3km highway tunnel under the Nervión River (pending on scheduling due to COVID conditions)
- Jun 2021 Annual Conference AETOS
- European & Underground tunnel forum (EUFT) Board Meeting and Technical seminar, Madrid 4th-5th Nov 2021
- 2nd International Conference on Road Tunnel Operations and Safety & VIII Spanish Symposium PIARC 25th - 28th October 2022 (Granada)
- Technical meetings and WG activities are on-going

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Tunnelling Master and Degree course available in several Universities, the most relevant being: 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).

XVI 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 ITACET (International Tunnelling Association). This Master Course has an important international projection through collaboration with the ITA Member Associations, especially those with a development in Spanish-speaking countries, such as: ACTOS, AMITOS, APTOS, etc. with which AETOS maintains collaboration agreements. In the last edition of this Master, 10 of 22 students graduated.



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# Sweden



**Name:** Swedish Rock Engineering Association

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

**Number of Members:** 91 corporate members from public and private clients, contractors, suppliers, mining companies, consulting firms, institutions and research organizations

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Four permanent working groups constitutes the backbone of the Swedish Rock Engineering Association (Svenska Bergteknikföreningen). These working groups are Yearly Congress, Young Members, International, and Competence Development. The association works towards the sustainable use and development of Swedish underground space. The main activity of the association is the annual Swedish congress where a significant part of the Swedish industry gathers. Due to the pandemic the physical event had to be cancelled and the presentations were instead held online. Young Member's mentor program DevelopYM, that was launched in 2018 continues with great success. International

have been working towards an increased Swedish participation in ITA activities. Competence Development is since November the group within the Swedish Rock Engineering Association that is responsible for accreditations of educators and certification of grout-, bolt- and shotcrete workers.

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

This project includes an 18 km long road tunnel with an excavation volume of 6 500 000m<sup>3</sup>. The tunnel is now 72% completed, current excavation speed is approximately 900 m/month. When ready this tunnel will be one of the longest highway tunnels in the world. (fig.1).

## Västlänken, Gothenburg (West Link)

This is a large railway project in the center of Gothenburg in order to convert the present terminus into a through station for commuter trains. The project is built in a condense urban environment with complex geotechnical conditions with a mix of loose clay and hard rock. Tunnel length will be 6 km. During 2020 construction of service tunnels and main tunnel has been ongoing. (fig.2)

## Extensions of the subway in Stockholm

The extension of the Stockholm subway is a large tunnelling project (approx. 4 million

m<sup>3</sup>), that will be ongoing in different parts of the city for the following 8-10 years. It will result in 18 new stations and 20 km new tunnels by 2030. During 2020 three service tunnels have been finished and four have started.

## Reconstruction of Slussen Stockholm incl new underground bus terminal

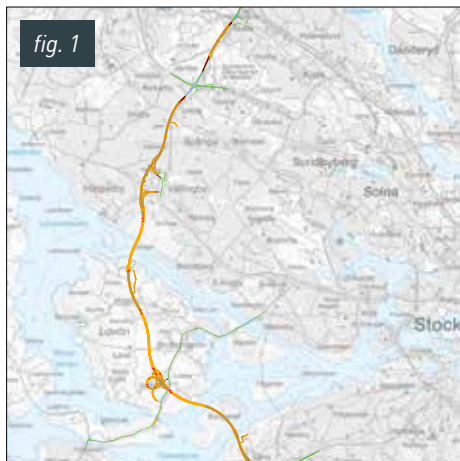
Slussen is a central area by the lock between lake Mälaren and the Baltic Sea. This is an important hub in Stockholm and a large underground bus station is under construction in the area. The construction works were ongoing during 2020. (fig.3)

## Varberg railroad tunnel

The West coast link is getting upgraded with double tracks through the city of Varberg. 3 km of rock tunnel and 300 m concrete tunnel will be built. The tunneling started during 2020. (fig.4)

## Sewage tunnel under Stockholm

Due to decommissioning of a treatment plant in the western part of Stockholm, wastewater will be conveyed to the extended Henriksdal plant in a new 14 km tunnel blasted in the rock under Stockholm. Construction works were ongoing during 2020.



**Henriksdal sewage plant**

This is a wastewater project in Stockholm were an existing plant, Henriksdal, is extended to double the treatment capacity to serve 1.6 million people. The expansion includes a new underground facility for pre-treatment and a complete upgrade of the existing 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.

**City Link tunnel**

A tunnel project with a length of 13.4 km and a diameter of 5 m approximately 50-100 meters below central parts of Stockholm started during 2020. The purpose of the project is to connect northern and southern parts of Stockholm with a new electricity supply. The project includes 6 ventilation shafts, elevator systems and construction of technical buildings for electrical equipment. A 100 m sunk shaft was finished during 2020. From this shaft a 250 m long tunnel will run under the Stockholms ström lake, the TBM tunnelling works started in 2020.

**FUTURE TUNNELLING ACTIVITIES**

**Ostlänken, the East Link high speed rail**  
New high-speed rail south of Stockholm. Design and planning ongoing. The project

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:**

Volume excavated 2020 is approximately 1,500,000m<sup>3</sup> with 100% conventional.

**2. List of tunnels completed**

Marieholmstunneln, Gothenburg – 500m long immersed beton tunnel under the river Göta Älv

**3. List of tunnels under construction**

Stockholm By-pass; West link – Gothenburg; Extended Stockholm subway; New bus terminal at Slussen Stockholm; Varberg railro

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Bergsskolan – Polytechnical education (3 yrs) with Engineering Mining and construction technology / Rock engineering Mining and construction industry Civil Engineering 3 yrs (BSc) or 5 yrs (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). At Uppsala University (Uppsala) courses are focused on geology, engineering geology and geophysical investigations.

includes 12 single rail tunnels and 15 double rail tunnels. The longest tunnel will be 6 km and the shortest will be 100 m long. Construction is planned to start in 2024

**SKB Forsmark, final repository nuclear fuel**

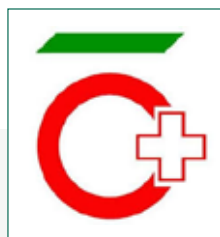
Planning is continuing regarding Sweden’s final repository for spent nuclear fuel. Getting the necessary

permits is ongoing. The construction is ready to start as soon as permission is granted.

**Hydrogen storage in Gällivare**

Large lined rock cavern project in northern Sweden. Pilot plant for testing underground storage of hydrogen. Cavern construction 30 m underground, 10m high and width 5m. Construction will start during 2021.

# Switzerland



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

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

**Number of Members:** 530 members, 92 corporate members

**ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE**

- **August:** General Assembly in Aarau, Switzerland
- June: Swiss Tunnel Congress (STC) in Lucerne, Switzerland (digital)
- **2020:** European Underground & Tunnel Forum (EUTF) – 3 Board Meetings (digital)

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

- **February:** Regional Event @CERN Geneva, Switzerland
- **July:** Field trip to the hydropower project Ritom, Ambri, Switzerland

- **September:** Field trip to the tunnel Gubrist, Autumn workshop, Zurich, Switzerland
- **December:** Took part in the young member digital celebrations of World Tunnel Day

**CURRENT TUNNELLING ACTIVITIES**

**Ceneri Base Tunnel**

“The Ceneri Base Tunnel is the southernmost portion of the new railway link through the Alps crossing the Swiss Alps from North to South. The works have been commissioned by AlpTransit Gotthard on behalf of the Swiss Confederation. The

main tunnel is a 15.4km long twin-tube single railway track.

The construction works started in 1997 with the excavation of the geological exploratory tunnel, located approximately in the middle of the alignment. In 2008, a 2.3km long intermediate adit, running parallel to the exploratory tunnel, was excavated using a gripper TBM. The construction of the adit allowed the start of the mining activities of the main tunnels in 2010. The northern tunnel (approx. 8.3km long) and the southern tunnel (approx. 6.3km long) were excavated simultaneously using Drill and Blast . The excavation works were completed in January 2016 and the tunnel was put into commercial service in December 2020.

**Bözberg tunnel for SBB’s 4m North-South corridor**

The new Bözberg tunnel is the largest single project for the Swiss Federal Railways (SBB) on its “4-metre corridor” between Basel and Chiasso. The project is situated on the northern approaches to the



Gotthard base tunnel, which was opened in 2016, and forms part of the scheme to transfer transalpine freight traffic from road to rail. The new Bözberg tunnel has been constructed as a new double-track tunnel under the Jura hills in parallel to the existing double-track tunnel. The existing tunnel, which dates back about 140 years, is being repurposed as a service and rescue tunnel linked to the new tunnel with lateral connector shafts. The new double-track tunnel came into operation on the date of the timetable change on 13th December 2020 together with the 4m freight corridor. Since then, it has been possible for all Europe-wide-compatible shipping containers requiring 4m headroom to transit the Gotthard route on the Swiss section of the Rhine-Alps freight corridor.

### 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 two-lane motorway tunnel was opened in 1980. As part of the 'Gotthard conservation concept', efforts were made to identify and investigate different feasible options for conservation. The best option to ensure that the important north-south connection can remain open during the renovation of the existing tunnel tube was the construction of a second tunnel and subsequent renovation the first tunnel, and on 27 June 2012, the Swiss Federal Council decided in favour of this option. This solution significantly increases the level of safety in the Gotthard Tunnel and 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 70m from the existing tunnel and 40m from the service and infrastructure tunnel located east of the existing Gotthard Tunnel. After preparation works for securing the installations sites from avalanches and other natural hazards undertaken in 2020, the tunnelling construction work started in 2021 with the blasting of the new exits of the service and infrastructure tunnel, which at the moment are situated at the exit of the new tunnel. In order to reduce the risks and optimise the overall construction programme, the northern and southern fault zones (totaling approx. 570m) will be conventionally excavated and secured in advance. Once this has taken place, the two TBMs will be pushed through these areas. The fault zones will be reached via separate access tunnels approaching from the north



(approx. 4.4km) and the south (approx. 5km), which will start in 2021. These tunnels will be excavated using TBMs with a diameter of approximately 7m. The tender for the two main lots (with a 12.3m diameter TBM, each for the excavation of around 7km of tunnel) is due in summer 2021, their adjudication is planned in spring 2022.

### Construction of new safety gallery at Kerenzberg Tunnel

Located in the canton of Glarus on the west-east axis of the A3 motorway, the Kerenzberg Tunnel serves an important function from both a local and trans-regional perspective. After 30 years of operation, Switzerland's fifth longest road tunnel is being refurbished up to 2026 and upgraded in terms of safety. A key component of the project of the Federal Roads Office (FEDRO/ASTRA) is the construction of a safety gallery. The new gallery is being built next to the road tunnel and will have a length of 5,504m. Approximately every 300m there will be a cross connection between the two tubes (emergency exits). In the upper section of the safety gallery, an exhaust duct will be built to extract the fumes in the event of a fire in the road tunnel. The excavation work began in summer 2020 from both portal sides, largely by blasting. In July 2021, a TBM will be in operation, excavating the

main part of the gallery. The new safety gallery is expected to be completed in 2024.

### Expansion of Bern RBS Station

The "Expansion of Bern RBS Station" (Switzerland) project involves building a new underground station as well as the railway line for accessing it. The new RBS Station consists of two 200–210m long, 26m wide and 17m high station caverns, which lie 12m underneath the existing railway tracks of the Bern Central Station. The 1.5km access railway line has different cross sections and runs both underground and above ground (open cut). Several milestones were achieved in 2020:

- The access tunnel ( $\varnothing = 7\text{m}$ ) to the station caverns, which underpasses several tracks west to Bern Central Station was successfully excavated in water-bearing soil by means of ground freezing
- The settlement-reducing measures (among other things, two prestressed 23m and 26m long concrete beams were built underground) for the complex "Postparc" building were put in operation.
- The main construction works for the two station caverns and the access line were awarded without objection
- The excavation works (under cover) in the sector "Eilgut" (east to Bern Central Station) were continued successfully
- The existing RBS Schanzentunnel were uncovered under full operation (this is necessary in order to be able later to link the new access line with the existing RBS infrastructure).

### Riedberg Tunnel

The Riedberg tunnel is located in the canton of Wallis and is part of the national highway network. The road tunnel consists of two tubes with a length of about 550m. The tunnel crosses the sliding slope Riedberg and is a technically very challenging project. After an initial excavation period in 2004–2005 and a revision of the project

due to increased slope movements, the excavation restarted in 2017. The excavation is conducted conventionally under the protection of a pipe umbrella with a rigid in-situ cast concrete support. The successful breakthrough of the northern tube was celebrated in October 2020 and the second breakthrough came in March 2021. The next step are additional measures due to deformations and project adjustments in the area excavated during the first construction period. The tunnel Riedberg will be put into service by 2025/2026.

**FUTURE TUNNELLING ACTIVITIES**

**Rail Tunnels:**

Lötschberg Basetunnel II (BLS, 35,000m), Stadelhofen Tunnel (SBB, 7,000m), Brüttener Tunnel (SBB, 11,000m), Zimmerberg Tunnel II (SBB, 11,000m), Crossrail – Lake Crossing Luzern (SBB, 5,500m), Geneve Station Expansion (SBB, 1,500m), Heitersberg Tunnel II (SBB, 5,000m), Grimsel Tunnel (SBB, 21,720m)

**Road Tunnels:**

Morschacher / Sisikoner Tunnel (Kt. SZ/UR, 8,037m), Vingelz Tunnel (Kt. BE, 2300m), City Tunnel (Kt. BE, 700m), Port Tunnel (Kt. BE, 1,800m), Weidteile Tunnel (Kt. BE, 1,400m), Safety Gallery Fäsenstaub Tunnel (ASTRA, 1,460m), Bypass Luzern (ASTRA, 3,450m), Bypass Bern Ost (ASTRA, 4,000m), Rosenberg Tunnel 3rd Tube (ASTRA, 1,435m), Safety Gallery Tunnel Gei and Brusei (ASTRA, 485m), Twann Tunnel (ASTRA, 1,700m), Nischenberg Tunnel (ASTRA, 1,640m), Rhein Tunnel (ASTRA, 4,500m), Tunnel Melide-Grancia (ASTRA, 1,800m), Tunnel Cargo Station St. Gallen (ASTRA 2,400m)

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:**

7,000m / 35% TBM

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020: €670M**

**3. List of tunnels completed:**

Ceneri-Basistunnel (ATG AG, 15,400m), 5 Tunnel of CEVA (SBB/Kt. GE, 8,200m), Bözberg Tunnel II (SBB, 2,500m), Eppenberg Tunnel (SBB, 3,114m), Eyholz Tunnel (Kt. VS, 4,200m), Safety Gallery Ligerz Tunnel (ASTRA, 2,483m), Safety Gallery Sachseln Tunnel (ASTRA, 5,084m), Safety Gallery Bärenburg Tunnel (ASTRA, 1,028m), Bypass Küssnacht (Kt. SZ, 500m)

**4. List of tunnels under construction:**

**Rail Tunnels:**

Albula Tunnel (RhB, 5,860m), RBS Bern Station Expansion (RBS, 1,200m), Ligerz Tunnel (SBB, 2,119m), Wylerfeld Tunnel (SBB, 290m), LEB Tunnel Lausanne (LEB, 1,700m)

**Road Tunnels:**

Second Gotthard Tunnel Tube (ASTRA, 16,918m), Safety Gallery Leissigen Tunnel (ASTRA, 2,200m), Safety Gallery Cholfirst Tunnel (ASTRA, 1,250m), Safety Gallery Kerenzberg Tunnel (ASTRA, 5,504m), Visp Tunnel 2nd Tube (Kt. VS, 2,600m), Rehabilitation Tunnel Belchen (ASTRA, 3,200m), Gubrist Tunnel 3rd Tube (ASTRA, 3,230m), Safety Gallery Crapteig Tunnel (ASTRA, 1,984m), Riedberg Tunnel (Kt. VS, S: 555m, N: 483m), Safety Gallery Rofla Tunnel (ASTRA, 1,018m), Tunnel de déviation des Evouettes (Kt. VS, 657m), Tunnel des Nations (Kt. GE, 870m), Gallery Schwamendingen and Schöneich Tunnel (ASTRA, 1,680m), Kaiserstuhl Tunnel (Kt. OW, 2,081m)

**Other Projects:**

Nant de Drance Pumped Storage Power Plant, Hydro Power Plant Ritom, CERN HILUMI LHC Project, Cargo Sous Terrain Zurich – Haerkingen (CST, 70,000m)

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University of Applied Sciences, in various cities

# 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 2020 AND TO DATE**

In 2020 the Thailand Underground and Tunnelling Group (TUTG) activities struggled due to the Covid 19 pandemic. However, TUTG continued to contribute to underground and tunneling education via a technical seminar.

TUTG organized the Tea-Talk Seminar on “Tunnel Construction in Urban Area and Tight Curve Tunnelling” dated 11 March 2020.

**CURRENT TUNNELLING ACTIVITIES**

- Flood Diversion Tunnel – Khlong Nong Bon to Chao Pha Ya River – 9.4km

long, 5.7m diameter tunnel (The Bangkok Metropolitan Administration – 4,925.665MB)

- Orange Line - East Section – 20km tunnel length (Mass Rapid Transit Authority of Thailand – 79,221.24MB)
- Mae Tang – Mae Ngud – Mae Kuang Water Diversion Tunnel – 48km tunnel long (Royal Irrigation Department – 9,206.81MB)
- Track Doubling North-Eastern Line – Mab Kabao – Thanon Chira Junction – 7.9km long tunnel (State Railways of Thailand (SRT))
- Conversion of an Overhead Line to an Underground System, Rama III Project: 10.9km tunnel length (Metropolitan Electricity Authority) – 5,635.3MB
- Conversion of Overhead Line to Underground System, Nonsri Project:



- 8.3km tunnel length (Metropolitan Electricity Authority) – 2,899.8MB
- Conversion of Overhead Line to Underground System, Ratchadapisek - Asoke Project: 8.2km tunnel length (Metropolitan Electricity Authority) – 4,554.91MB
- Conversion of Overhead Line to Underground System, Ratchadapisek – Rama 9 Project: 14.3km tunnel length (Metropolitan Electricity Authority) – 4,344.67MB
- Work plan to change electrical cable system to an underground power line “The City of ASEAN”: 127.3km tunnel length (Metropolitan Electricity Authority) – 48,717.2MB
- The High-Speed Rail Linked 3 Airport Project – 0.3km tunnel length at Khao Chi Chan (The Eastern Economic Corridor Office of Thailand, EECO)
- The 9th Bangkok Water Supply Improvement Project – 44km tunnel length of 3/3.2m diameter (Metropolitan Waterworks Authority – 17,012MB)
- Khlong Prem Prachakorn Flood Diversion Tunnel – from Khlong Bang Bua to Chao Pha Ya River – 5.7m diameter and 13.5km long tunnel (The Bangkok Metropolitan Administration - 8,233.35MB)



**FUTURE TUNNELLING ACTIVITIES**

- Orange Line - West Section – 20.4km long tunnel (Mass Rapid Transit Authority of Thailand – 120,000MB)
- Purple Line South – 25.4km long tunnel (Mass Rapid Transit Authority of Thailand

- 124,000MB)
- Outgoing Cable Tunnel at Bang Phli Terminal Station – 1.2km long, 2.6m diameter tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Bang Sue Terminal Station – 2.6km long, 2.6m diameter tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Lad Phraw Terminal Station – 1.6km long, 2.6m diameter tunnel (Metropolitan Electricity Authority)
- Outgoing Cable Tunnel at Erawan Terminal Station – 5.5km long, 3.6m diameter tunnel (Metropolitan Electricity Authority)
- Khlong San Saeb Flood Diversion Tunnel – from Khlong Lad Praow to Soi Lad Praow 130 – 3.8km long, 3.7m diameter tunnel (The Bangkok Metropolitan Administration – 1,701MB)
- Khlong Taweewattana Bottle Neck Flood Diversion Tunnel – 2km long, 3.7m diameter tunnel (The Bangkok Metropolitan Administration – 2,274MB)
- Khlong Samsen to Existing Bang Sue Flood Diversion Tunnel – 3.3km long, 3m diameter tunnel (The Bangkok Metropolitan Administration – 970MB)

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# 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, tunneling and other underground works.

**Number of Members:** As of January 1st, 2021, TRA has 503 members of which 437 are individuals and 66 are corporate members which represent Universities, Consultants, Contractors, Manufacturers and some of the other Governmental Organizations.

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Due to the COVID-19 the 8th National Asphalt Symposium and Exhibition planned to be held in 2020 was postponed. The General Assemblies and meetings were also affected by regulations and restrictions. However, the courses and the seminars on tunneling at our Universities continued online.

## CURRENT TUNNELLING ACTIVITIES

### New Zigana Tunnel

The 14.5km long New Zigana Tunnel project in Turkey is currently under construction. The tunnel is a twin-tube, blast-and-drill NATM excavation, that will connect the state roads between the Gumushane and Trabzon provinces in Turkey's northeast, at an altitude of over 1,200m a.s.l. The construction of the tunnel will replace the existing route over the Zigana Pass, which reaches an altitude a.s.l of 2,032m. The construction schedule is 2016 - 2022. The tunnel's geometrical configuration accommodates all vehicles that use the

roads leading to the tunnel, including overweight vehicles. Upon completion of the tunnel, the existing road will be shortened by 8km. In 2020, 2 x 11,430m lengths of excavation and support, and 2 x 8,130m long final concrete lining were completed.

### Egribel Tunnel

The 5,905m long tunnel is a twin-tube, drill and blast excavation with a construction schedule between 2019 - 2022. The total length of the project with connection roads is 7.7km and connects the Eastern part of Black Sea Region to Central Anatolia. Currently, excavation and support is complete and of 4522m of final concrete lining, 4486m is complete in the right tube, and 36m in the left tube.

### Alacabel Tunnel

The Alacabel Tunnel is on the route connecting the Konya and Antalya provinces. The project is 19.2km long and consist of 2 x 7,360m of tunnel and an 11.8km long divided road. The construction time is from 2016 - 2021 and work progress

rate is at almost 99%. In 2020, 10,595m excavation and support, with 8,532m of final concrete works were completed.

### Kirik Tunnel

The project section is 15.78km long, situated on the axis between the Rize and Erzurum provinces. It includes the 7,105m long Kirik Tunnel. When the Kirik tunnel and the Ovit tunnel open to the traffic on the same route, it will negate sixmonths of road closure in the winter season. The construction time is 2013 - 2023. The progress rate of the project is 37%, and in 2020, 8,606m (61%) excavation and support and 1,537m (11%) of final concrete lining were completed.

### Kop Tunnel

The Kop tunnel lies on the 11.2km long section of the route from Askale to Bayburt and includes 6,500m twin-tube Kop tunnel and 4.7km of connection roads. When complete, access between the Gurbulak Border Gate and the Trabzon Port will be made easier. With the completion of the tunnel, economic and social structures of the Black Sea, Eastern Anatolia and Southeastern Anatolia will be greatly improved. The construction period is from 2011 - 2023 and work progress as of 2020 is 43% in total. 6,920m excavation and 53% of support with 3894m final concrete lining were completed in the tunnel on the previous year.

### Ilgar Tunnel

Ilgar Tunnel is on the route between Ardahan Province and Posof town which is on the Georgia border. 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. The construction period is 2017 - 2023. In 2020, 320m of excavation and support, and 260m of final concrete lining were completed.

### Sertavul Tunnel

The tunnel is on the axis of the connection between the Karaman andmersin provinces. The project is 9.8km in total, with a twin-tube, 2 x 3,300m long tunnel and connection roads. The construction time is 2017 - 2022 and work progress is 25%.

### Salarha Tunnel

The Salarha tunnel and connection road project is 4,300m in length and includes the 2 x 2,958m long, twin-tube Salarha tunnel, three bridges of 231m length, and 1,335m long connection roads. Construction time is 2019 - 2021. The progress is at 80% in total. In 2020, the right tube of the Salarha



Zigana tunnel



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tunnel was completed with connection roads. The planned completion of the tunnel construction works is this year.

### Yusufeli Dam Relocation Road Tunnels

The Yusufeli Dam is located approximately 40km southeast of the Artvin Province and 10km downstream of the Yusufeli sub-province located on the Coruh River. When completed, the 275m high Yusufeli Dam will be highest dam in Turkey, and will be the third highest double curvature concrete arch dam in the world. The Yusufeli Dam Relocation Road has a total 32,911m long, 22 single tube tunnels, 14 of which have completed.

### Trabzon Askale State Road Tunnels:

The road is located in the North South axis of Turkey. The 214.2km long road features 20 twin-tube tunnels of a total 46,747m, and 11 single tube tunnel reaching 5,039m in length. These projects will give drivers amore comfortable and safer experience. Total construction progress is at 52% with 20,998m long of twin-tube tunnels, and 5,039m long single tube tunnels completed.

### Pirinkayalar Tunnel

The Pirinkayalar tunnel is on the 3.34km state road on the connection between Artvin and Erzurum provinces. The project consist of the 2,302m long Pirinkayalar tunnel with a single lane and 1.04km of connecting road. In 2020, 100% of excavation and support, and 50% of final concrete lining was completed in the tunnel. The construction time is 2017 - 2023.

### Mediterranean Coastal Road Tunnels

The mediterranean Coast Road between mersin and Antalya is 440km long and includes a total 45,685m length in 34 tunnels. The construction of 19 tunnels with total length of 15,084m has been completed to date.

### Dudullu-Bostanci Subway Line

The Dudullu-Bostanci Subway Line will be 14km long. The journey will take 21minutes on the Dudullu-Bostanci Subway Line, which will have 13 stations. With the connection to bemade at the Kozyatagi Station, the transfer to Kadikoy-Pendik Subway Line will be provided. In 2020, 70% of the tunnel excavation was achieved.

### Atakoy-Basın Express - İkitelli Subway Line

The Atakoy-Basın Express - İkitelli Subway Line will be 13km long and will have 12 stations. The line starts from İkitelli Guney Sanayi and the road follows a corridor



Yusufeli Dam Relocation Road Tunnels

parallel to the Basin Express Access Road. Construction progress to date is 61%.

### Umraniye – Atasehir – Goztepe Subway Line

This double decked tunnel will have a 13km length with a 21minute long journey. The Umraniye – Atasehir – Goztepe Subway Line is currently under construction. Five TBMs are working on the project.

### Halkali New Airport Subway Line Construction

The Halkali New Airport Subway Line is being excavated between Gayrettepe and Istanbul Airport. The tunnel's total length is 61,184m which and designed as double deck. The Line is under-construction using TBM and NATM methods. Nine percent progress, or over 33.2km has been achieved by TBM. In the NATM tunnel works 3.8% progress of 24.5km has completed.

### Gayrettepe - Kagithane New Airport Subway Line

The Halkali New Airport Subway Line is an under-construction project being built using TBM and NATM methods. The total length of the line is 61,184m with both single and double deck configurations. Excavation is at 97% and lining at 65%.

### Basaksehir – Kayasehir Subway Line

The Başakşehir – Kayaşehir Subway Line

is 6187m with 19minutes of travel time. Themethod of the orbicular subway line's construction is TBM with a double deck tube. Work progress is at 25%.

### Bakırköy Bahcelievler Subway Line

The Bakırköy – Bahcelievler Subway Line is totally 2063, 53m and includes seven stations. Within the scope of the project NATM and TBM tunnel designs are included in the double deck tube.

### Babakaya and Silvan Irrigation Tunnels

Within the scope of 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 two tubes. The Silvan Tunnel is 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, 712.50m of progress has been made at the exit of the tunnel. Efforts are underway to adapt the TBM for trapped underground gas.

### Hadimi Irrigation Tunnel

The Hadimi Tunnel is an 18,136m long tunnel that will transfer water stored in the Afsar Dam to Bagbasi Dam. The Hadimi Tunnel is one of the biggest projects in the region, and in Turkey. 11,505m of the tunnel

Yusufeli Dam Relocation Road Tunnels



has been excavated by TBM, and 6,631m of the tunnel is constructed by conventional drill and blast.

#### Sabiha Gokcen Rail Systems

The Sabiha Gokcen Rail System is totally 14,536m and designed by NATM method. The rail systems are complete and are designed as double deck.

#### Istanbul Bakirkoy – Bahcelievler – Kirazli Subway Line

The Istanbul Bakirkoy – Bahcelievler – Kirazli Subway Line will be 13,111m long. The journey will take 13.5 minutes from Bakirkoy to Kirazli. The line contains eight stations and are designed as double deck and using TBM. TBM Tunnel construction features between the Bakirkoy Incirli stations. Upon completion of the Incirli Truss structure, TBM works resumed from Incirli Station to Kirazli. In this subway 66% of tunnel excavation works, 47% of Station reinforced concrete works, and 25% of rail laying works have been completed. Total progress on the project is 62%.

#### Omerler Underground Coalmine Tunnel

Omerler Underground Coalmine Tunnel in Kutahya, Turkey is currently under operation. It consists of coal production, which is carried out by fully mechanized excavation with block dent from the back using the recyclable longwall method. Panel sizes are in various lengths, and the lengths inside the feet vary between 90 - 110m. The galleries opened are used for the transportation of materials, coal and people.

### FUTURE TUNNELLING ACTIVITIES

#### Drinking Water Tunnels

- Yatagan Tunnel (Mugla) (12.199m)
- Merkez Karakent Pond (Burdur) (555m)
- Emirdag Pond (Afyonkarahisar) (410m)
- Mersin Pamukluk Dam Irrigation Lead Channel and Facilities Construction Work (Mersin) (4,618m)
- Mugla Yatagan Project mugla Drinking Water Transmission Line Project Construction (Mugla) (12,281m)

#### Irrigation Tunnels

- Cermik Kale Project - Kale Dam and Irrigation Project, main Irrigation Line (Diyarbakir) (9,505m)
- Adiyaman Buyukcay Irrigation Tunnel (Adiyaman) (9,269,35m)
- Erzurum Elmali Tunnel (Erzurum) (9,000m)
- Erzurum Pasinler Soylemez Dam and Irrigation (Gemlik Tunnel) (Erzurum) (5,800m)
- Goksu Araban Project Besni Keysun Kizilin and Pazarcik Kizkapanli Irrigation Project (Tunnel 2) (Adiyaman) (4,660m)
- Goksu Araban Project Besni Keysun Kizilin and Pazarcik Kizkapanli Irrigation Project (Tunnel 1) (Adiyaman)
- Asagi Cekerek Project Zile, masat Resadiye Cekerek and mamure Plain Irrigation (Tokat) (983m)
- Samsun Salipazari Dam Irrigation (Samsun) (289.35m)
- Erzurum Pasinler Soylemez Dam Irrigation (Gemlik Tunnel) (Erzurum) (5,625m)
- Erzurum Pasinler Soylemez Dam

- Irrigation (T1 Tunnel) (Erzurum) (2,848.99m)
- Erzurum Elmali Tunnel (Erzurum) (9,000m)
- Kalaba-Seyfe Irrigation Transmission Tunnel-1 (Kayseri/Yamula) (3,360m)
- Kalaba-Seyfe Irrigation Transmission Tunnel-2 (Kayseri/Yamula) (650m)
- Antalya Demre Cevreli Neighborhood Taskin Protection Construction Work (Antalya/Demre) (1,595m)
- Egirdir Tepeli Pond (Isparta) (406m)
- Egirdir Caykoy Dam (Isparta) (372m)
- Sinanpasa Kayadibi Pond (Afyonkarahisar) (116m)
- Merkez Karakent Pond (Burdur) (555m)
- Cavdir Buyukalan Pond (Burdur) (269m)

#### Highway Tunnels - Double Tube

- East-West Ring Road T-1. Tunnel (Samsun) (2,700m - 2,700m)
- East-West Ring Road T-2. Tunnel (Samsun) (2,700m - 2,700m)
- East-West Ring Road T-3. Tunnel (Samsun) (2,700m - 2,700m)
- (Mersin - Tarsus motorway) Ayr.mersin OSB Connection (Mersin) (279.37m - 279.37m)
- Silifke -mut - 3. Bl. Hd (2. Part) T4 Tunnel (Mersin) (861m - 858m)
- Erdemli - Silifke - Taşucu - 13. Regional Border Road Cut Construction (Mersin) (3,975m - 4,015m)
- Refahiye-Kuruçay-İliç Highway Arpayazi Tunnel (Erzincan) (4,615m - 4,615m)
- Refahiye -Kuruçay -İliç Highway Gümüşakar Tunnel (Erzincan) (1,580m - 1,580m)
- İmranlı-(Refahiye - Suşehri) Kızıldağ Tunnel (Erzincan/Sivas) (6,471m + 6,410m)
- Sakaltutan Tunnel (Erzincan) (8785m - 8775m)
- Ahmediye Tunnel (Erzincan) (6,315m - 6,315m)
- Zara-Geminbeli -Suşehri Highway Bozkır Tunnel (Sivas) (2,545m - 2,545m)
- Şebinkarahisar Ring Road T1 Tunnel (Giresun) (4,440m - 4,440m)
- Palandoken Tunnel (Erzurum) (12,140 - 12,155m)
- Karasu Tunnel (Sakarya) (18m - 7,575m)
- Seferihisar - Kuşadası Highway T1 Tunnel (İzmir) (1,349m - 1,360m)
- Seferihisar - Kuşadası Highway T2 Tunnel (İzmir) (1,616m - 1,651m)
- Seferihisar - Kuşadası Highway T4 Tunnel (İzmir) (2,830m - 2,840m)
- Seferihisar - Kuşadası Highway T6 Tunnel (İzmir) (1,225m - 1,245m)
- Seferihisar - Kuşadası Highway T7 Tunnel (İzmir) (798m - 796m)
- Ankara İzmir Highway T1 Tunnel (Manisa) (3,830m - 3,830m)



- Ankara İzmir Highway T2 Tunnel (Manisa) (3,245m - 3,275m)
- Ankara İzmir Highway T3 Tunnel (Manisa) (1,745m - 1,690m)
- Ankara İzmir Highway T4 Tunnel (Manisa) (2,850m - 2,850m)
- Ankara İzmir Highway T5 Tunnel (Manisa) (4,610m - 4,610m)
- Ankara İzmir Highway T6 Tunnel (Manisa) (3,860m - 3,860m)
- Zonguldak Ring Road T3 Tunnel (Zonguldak) (1,625.8m - 1,367.8m)
- Zonguldak Ring Road T4 Tunnel (Zonguldak) (1,613m - 1,588m)
- Karabük Ring Road T1 Tunnel (Karabük) (8,534.59m - 8,525.4m)
- Karabük Ring Road T2 Tunnel (Karabük) (3,286m - 3,290m)
- Karabük Ring Road T3 Tunnel (Karabük) (229.15m - 210.4m)
- Refahiye - Kuruçay - İliç Devlet Road Sünebeli Tunnel (Erzincan) (5,217.5m - 5,230.5m)

#### Highway Tunnels - Single Tube

- (Borçka - Artvin) Ayr.murgul (Dokap) Province Road (Artvin) (1,131m)
- Hopa - Borçka Devlet Road (Artvin) (538m - 597m)
- Seferhisar -Kuşadası Devlet Road T4 Tunnel (İzmir) (455m)
- Seferhisar -Kuşadası Devlet Road T5 Tunnel (İzmir) (690m)
- (Düzce-Akçakoca) Yiğilca Tunnel (Düzce) (292m)
- Tarsus-Pozantı Devlet Road Tunnel (Mersin) (1,420m)
- Tomarza-Tufanbeyli (Göksun-Sarız) Dist. Road Tunnel (Kayseri) (5,955m)
- Aydıncık-Ermir-Sorgun Province Road Aydıncık Tunnel (Yozgat) (2,850m)
- Fatsa Çatalpınar T1 Tunnel (Ordu) (2,373.7m)
- Palu-Beyhan-Gökdere Province Road T1 Tunnel (Elazığ) (1,890m)
- Mardin-Midyat-Savur Province Road T1 Tunnel (Mardin) (440m)
- Mardin-Midyat-Savur Province Road T2 Tunnel (Mardin) (198m)
- Mardin-Midyat-Savur Province Road T3 Tunnel (Mardin) (290m)
- Eruh-Fıfık-Bağgöze Province Road T1 Tunnel (Siirt) (2,190m)
- Tonya-(Tirebolu-Torul) Province Road T1 Tunnel (Trabzon/Gümüşhane) (333m)
- Tonya-(Tirebolu-Torul) Province Road T2 Tunnel (Trabzon/Gümüşhane) (2,260m)
- (Borçka - Artvin) Ayr.murgul (Dokap) Province Road (Artvin) (1,131m)
- Hopa - Borçka Devlet Road (Artvin) (538m - 597m)
- Seferhisar -Kuşadası Devlet Road T4 Tunnel (İzmir) (455m)



Alacabel tunnel

- Seferhisar -Kuşadası Devlet Road T5 Tunnel (İzmir) (690m)
- (Düzce-Akçakoca) Yiğilca Tunnel (Düzce) (292m)
- Tarsus-Pozantı Devlet Road Tunnel (Mersin) (1,420m)
- Tomarza-Tufanbeyli (Göksun-Sarız) Dist. Road Tunnel (Kayseri) (5,955m)
- Aydıncık-Ermir-Sorgun Province Road Aydıncık Tunnel (Yozgat) (2,850m)
- Fatsa Çatalpınar T1 Tunnel (Ordu) (2,373.7m)
- Palu-Beyhan-Gökdere Province Road T1 Tunnel (Elazığ) (1,890m)
- Mardin-Midyat-Savur Province Road T1 Tunnel (Mardin) (440m)
- Mardin-Midyat-Savur Province Road T2 Tunnel (Mardin) (198m)
- Mardin-Midyat-Savur Province Road T3 Tunnel (Mardin) (290m)
- Eruh-Fıfık-Bağgöze Province Road T1 Tunnel (Siirt) (2,190m)
- Tonya-(Tirebolu-Torul) Province Road T1 Tunnel (Trabzon/Gümüşhane) (333m)
- Tonya-(Tirebolu-Torul) Province Road T2 Tunnel (Trabzon/Gümüşhane) (2,260m)
- Tonya-(Tirebolu-Torul) Province Road T3 Tunnel (Trabzon/Gümüşhane) (493m)
- Tonya-(Tirebolu-Torul) Province Road T4 Tunnel (Trabzon/Gümüşhane) (3,640m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T1 Tunnel (Trabzon) (184.65m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T3 Tunnel (Trabzon) (98.88m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T4 Tunnel (Trabzon) (718.82m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T5 Tunnel (Trabzon) (915.84m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T6 Tunnel (Trabzon) (1,276.65m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T7 Tunnel (Trabzon) (597m)
- Yağlıdere-Şebinkarahisar-Alucra Roads

- 1.Part T8 Tunnel (Trabzon) (82.08m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T9 Tunnel (Trabzon) (194m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T10 Tunnel (Trabzon) (232m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T11 Tunnel (Trabzon) (296.4m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T12 Tunnel (Trabzon) (1086m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T14 Tunnel (Trabzon) (164.3m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T15 Tunnel (Trabzon) (283.3m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T16 Tunnel (Trabzon) (248.24m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T17 Tunnel (Trabzon) (749.75m)
- Yağlıdere-Şebinkarahisar-Alucra Roads 1.Part T18 Tunnel (Trabzon) (157.75m)
- (Borçka-Artvin) -murgul (Dokap) Province Road Tunnel -4 (Artvin) (101m)
- (Borçka-Artvin) -murgul (Dokap) Province Road Tunnel -5 (Artvin) (232m)
- Bulancak-Kovancık Province Road 3. Part T1 Tunnel (Trabzon) (2,330m)
- (Muş -Solhan) Kızılağaç -9. Bl.Hd. Road T1 Tunnel (Muş) (797m)
- (Muş -Solhan) Kızılağaç -9. Bl.Hd. Road T2 Tunnel (Muş) (921m)
- Tortum -İspir Road Tunnel Crossing (Erzurum) (6,849m)
- Ankara İzmir Highway T7 Tunnel (Manisa) (2,810m - 2,833m)
- Ankara İzmir Highway T8 Tunnel (Manisa) (860m - 830m)
- Bodrum Ring Road T1 Tunnel (Muğla) (6,647m - 6,407m)
- Bodrum Ring Road T2 Tunnel (Muğla) (2,380m - 2,440m)
- Bodrum Ring Road T3 Tunnel (Muğla) (695m - 695m)
- Bodrum Ring Road T4 Tunnel (Muğla) (1,390m - 1,390m)

Kırık tunnel



- Akşehir - Yalvaç - Şarkikaraağaç Road Cankurtaran Tunnel (Konya) (4,373,6m - 4,403,6m)
- Ankara İzmir Highway T1 Tunnel (Ankara) (3,465m - 3,465m)
- Ankara İzmir Highway T2 Tunnel (Ankara) (1,148m - 1,142m)
- Ankara İzmir Highway T3 Tunnel (Ankara) (1,076m - 1,064m)
- Ankara İzmir Highway T4 Tunnel (Ankara) (2,692m - 2,666m)
- Eskişehir - Seyitgazi - Kırka 3. Bl. Hd. Road T1 Tunnel (Eskişehir) (640.5m - 640.5m)
- Eskişehir - Seyitgazi - Kırka 3. Bl. Hd. Road T2 Tunnel (Eskişehir) (620m - 620m)
- Eskişehir - Seyitgazi - Kırka 3. Bl. Hd. Road T3 Tunnel (Eskişehir) (1,924m - 1,924m)
- Nallıhan -mudurnu Road T-2 (Hodan) Tunnel (Ankara) (4,371m - 4,366m)
- Nallıhan -mudurnu Road T-5 Tunnel (Ankara) (969.4m - 949.6m)
- Nallıhan -mudurnu Road T-6 (Tavşansuyu) Tunnel (Ankara) (305m - 390m)
- Nallıhan -mudurnu Road T-7 (Dokurcun) Tunnel (Ankara) (2,844.9m - 2,809.3m)
- Erdemli - Silifke -Taşucu T4 Tunnel (Mersin) (300m - 288m)
- Erdemli - Silifke -Taşucu Limankalesi Tunnel (Mersin) (850m - 850m)
- (Mersin - Tarsus Highway) D400 Bağcılar Tunnel (Mersin) (135m - 110m)
- Mardin Ring Road T2 Tunnel (Mardin) (426m - 358m)
- Mardin Ring Road T3 Tunnel (Mardin) (1,961m - 1,881m)
- Diyarbakır -Silvan Bingöl road T1 Tunnel (Diyarbakır) (1,662m - 1,667m)
- Rize - İspir (Dap) (Dokap) Road İkizdere - 2 Tunnel (Rize) (1,218m - 1,229m)
- Giresun Ring Road T1 Tunnel (Trabzon) (683.23m - 646.25m)
- Giresun Ring Road T2 Tunnel (Trabzon) (4,150m - 4,162m)
- Giresun Ring Road T4 Tunnel (Trabzon) (1,761m - 1,761m)
- Giresun Ring Road T5 Tunnel (Trabzon) (1,289m - 1,259m)
- Giresun Ring Road T6 Tunnel (Trabzon) (1,310m - 1,310m)
- Giresun Ring Road T7 Tunnel (Trabzon) (1,672m - 1,672m)
- Giresun Ring Road T8 Tunnel (Trabzon) (2,415m - 2,425m)
- Giresun Ring Road T9 Tunnel (Trabzon) (1,108m - 1,115m)
- Giresun Ring Road T10 Tunnel (Trabzon) (125m - 90m)
- Fatsa Ring Road T1 Tunnel (Ordu) (4,080m - 4,100m)
- Fatsa Ring Road T2 Tunnel (Ordu) (1,240m - 1,275m)
- Fatsa Ring Road T3 Tunnel (Ordu) (1,055m - 1,040m)
- Fatsa Ring Road T4 Tunnel (Ordu) (195m - 190m)
- Fatsa Ring Road T5 Tunnel (Ordu) (1,055m - 1,040m)
- Fatsa Ring Road T6 Tunnel (Ordu) (190m - 190m)
- Fatsa Ring Road T7 Tunnel (Ordu) (595m - 575m)
- Fatsa Ring Road T8 Tunnel (Ordu) (1,380m - 1,380m)
- (Van-Gürpınar) Güzelsu Devlet Road T1 Tunnel (Van) (298m - 358m)
- (Van-Gürpınar) Güzelsu Devlet Road T2 Tunnel (Van) (320m - 330m)
- Van-Tatvan Devlet Road Küçüksü (Koruklu) Tunnel (Van) (1,518m - 1,338m)
- Tortum - Uzundere Devlet Yolu T-1 Tunnel (Erzurum) (1,619m - 1,619m)
- Tortum - Uzundere Devlet Yolu T-2 Tunnel (Erzurum) (481m - 481m)
- Tortum - Uzundere Devlet Yolu T-3 Tunnel (Erzurum) (366m - 366m)
- Tortum - Uzundere Devlet Yolu T-4 Tunnel (Erzurum) (189m - 189m)
- Tortum - Uzundere Devlet Yolu T-5 Tunnel (Erzurum) (309m - 309m)
- Tortum - Uzundere Devlet Yolu T-6 Tunnel (Erzurum) (855m - 855m)
- Tortum - Uzundere Devlet Yolu T-7 Tunnel (Erzurum) (309m - 309m)
- Merzifon-Gürbulak Highway T1 Tunnel (Erzurum) (1,555m - 1,555m)
- Merzifon-Gürbulak Highway T2 Tunnel (Erzurum) (1,365m - 1,340m)
- Tercan Aşkale Road T1 Tunnel (Erzurum) (3,166m - 3,184m)
- Tercan Aşkale Road T2 Tunnel (Erzurum) (437m - 402m)
- Tercan Aşkale Road T3 Tunnel (Erzurum) (970m - 992m)
- Tercan Aşkale Road T4 Tunnel (Erzurum) (4,717m - 4,679m)
- Palandöken Tunnel (Erzurum) (12,103m - 12,109m)
- (Yenilehir-Bilecik)-(Bozüyük -Osmaneli) Province Road T1 Tunnel (Bursa) (1,627m - 1,585m)
- (Yenilehir-Bilecik)-(Bozüyük -Osmaneli) Province Road T2 Tunnel (Bursa) (911m - 930.4m)
- (Ankara-İzmir) Bursa Highway Tunnel (Bursa) (7,300m - 7,510m)
- Zonguldak Ring Road T1 Tunnel (Zonguldak) (1,369m - 1,392m)
- Zonguldak Ring Road T2 Tunnel (Zonguldak) (4,884m - 4,969m)

#### Subway Lines - Double Tube

- Halkali New Airport Subway Line Construction Extension (Istanbul) (26,391.5m + 27,237.5m)
- Kirazli-Halkali Subway Extension (Istanbul) (5,960m + 5,940m)
- Halkali New Airport Subway Line Construction Extension (Istanbul) (4,120m + 3,826m)
- Kirazli-Halkali Subway Extension (Istanbul) (1,134m + 1,121m)

#### Subway Lines - Single Tube

- Sefakoy - Beylikduzu - Tuyap Subway Line (Istanbul) (19,000m)
- Haciosman - Sariyer Subway Line (Istanbul) (6,000m)
- Sultanbeyli - Kurtkoy Subway Line (Istanbul) (5,400m)
- Hastane - Sarıgazi - Çekmeköy -Taşdelen



- Yenidoğan Subway Line (Istanbul) (6,900m)
- Eyup - Bayrampasa Streetcar Line (Istanbul) (3,200m)
- Uskudar - Harem Streetcar Line (Istanbul) (2,200m)

**Highway Tunnels - Railway Tunnels**

- Burdur – Antalya Railway Projects (5,5870m)
- ITU – Istinye Funicular Railway (3000m)
- Erzurum – Kars Railway Projects (10,800m)
- Erzincan – Erzurum Railway Projects (57,145m)
- Şanlıurfa –mardin Railway Projects (850m) (Mardin)
- Siirt – Kurtalan Railway Projects (16,620m) (Siirt)
- 3. Airportmüselles – Çatalca Railway Projects (7,385m) (İstanbul)
- Malatya – Elazığ Railway Projects (41,750m)
- Elazığ – Diyarbakır Railway Projects (43,335m)
- Eskişehir – Afyon Railways Projects (15,560m)
- Afyon – Burdur Railways Projects (23,940m)
- Merzifon – Samsun Railways Projects (50,611m) (Amasya – Samsun)

- Aksaray – Kayseri Railways Projects (13,460m)
- Gaziantep – Şanlıurfa Railways (2,110m)
- Adiyaman – Golbasi Railway Project (34,110m)

- Nusaybin – Cizre – Silopi – Habur Railways Projects (Mardin – Sırnak) (9,390m)
- Toprakkale - Bahçe BT04 / KT01 - KT06 Railways Project (Osmaniye) (4,891m)

**STATISTICS**

**1. Length or volume excavated - % mechanized / % conventional during 2020:**

Length 153,104m - (Mechanized 26,84%, Conventional 73,16%)  
 Volume 123,078,713m<sup>3</sup> - (Mechanized 22.84%, Conventional 77.16%)

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2020: 2,538,048,024 USD**

**EDUCATION ON TUNNELLING IN THE COUNTRY**

Afyon Kocatepe University  
 Aksaray University  
 Bilecik Seyh Edebali University  
 Bingol University  
 Bursa Technical University  
 Canakkale Onsekiz Mart University  
 Dicle University  
 Dokuz Eylul University  
 Duzce University  
 Erzincan Binali Yildirim University  
 Giresun University  
 Istanbul University – Cerrahpasa  
 Istanbul Technical University

Karabuk University  
 Konya Technical University  
 Kutahya Dumlupınar University  
 Middle East Technical University  
 Mugla Sıtkı Koçman University  
 On Dokuz Mayıs University  
 Recep Tayyip Erdogan University  
 Sivas Cumhuriyet University  
 Sırnak University  
 Toros University  
 Yalova University  
 Zonguldak Bulent Ecevit University

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# 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:** 800+ members, 90+ corporate members at end 2020



## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

In 2020 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 despite the Covid 19 pandemic.

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.

- Ten 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 his lifetime contribution to tunnelling.
- Lunch for James Clark Medal recipients
- Harding Prize competition for under 35's
- Annual dinner held each year in May.
- 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 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>

The BTS has begun a process for undertaking a further update of the Specification for tunnelling and this work continues.

2021 is 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 BTS intends to publish a book celebrating 50 years of the BTS which will be available for WTC 2022.

The BTS Conference & Exhibition was postponed from 2020 and will now be

held at the QEII Centre in Westminster on 30th September – 1st October 2021 and will also celebrate the Society's 50th anniversary.

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 2020 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.

## 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**

2020 has seen the continuation of the design phase for the main works civils contracts for the proposed high speed rail line between London and Birmingham and the commencement of construction. These contracts comprise 35km of twin bored tunnel. Works are currently in planning for the tunnelling works with the first TBMs arriving in early 2021. HS2 Station contracts have been awarded recently. 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. The 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 of the largest underground railway complexes in the world. The works comprise new entrance, three ticket halls, six lifts, 10 platforms, two 94m travellators, 570m tunnel and a platform for Northern Line.

**Silvertown Tunnel**

Late 2019 saw the contract award for the Silvertown project comprising twin bored tunnels under 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 exciting Blackwall tunnel. Tunnelling is due to commence in early 2021.



**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 tunnel beneath the River Thames East of London with a tunnel diameter of around 15m. The project is currently in planning and development phase with the procurement process for construction continuing through 2021. 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 with procurement for construction underway and tenders to be submitted in mid 2021.

**Coire Glas hydroelectric scheme**

Scottish and Southern Energy continue with plans to develop a new hydroelectric scheme in Scotland. Planning has

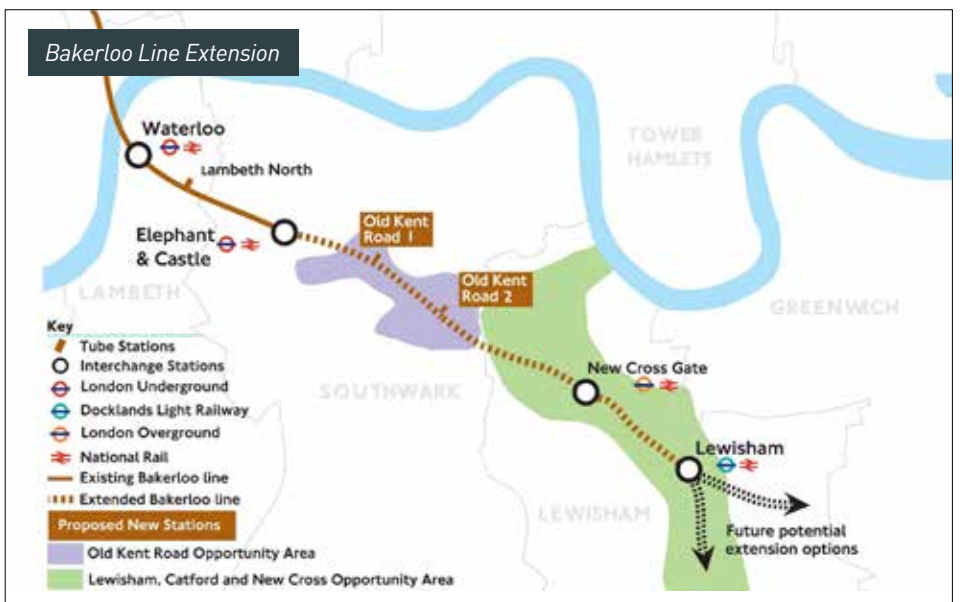
been approved for the scheme and the procurement for the projects will commence in 2021. The project will include extensive tunnelling and large span caverns.

**Haweswater Aqueduct Replacement Project**

United Utilities is planning to replace an existing aqueduct in the Northwest 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. Procurement is due to commence in 2021.

**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.







# MAGNIFICENT BEAST

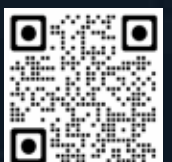


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# United States



**Name:** Underground Construction Association (UCA of SME)

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

**Number of Members:** Total number – 1,238, number of corporate members – 65

## ASSOCIATION ACTIVITIES DURING 2020 AND TO DATE

Throughout 2020 and to date, the UCA of SME continued to promote the wise, efficient and sustainable development and use of underground space. Our work continued in the face of COVID-19. Some of the ways that we are accomplishing this are:

- 2020 George Fox Conference: A one-day in-person conference provides concise information on the theme of design and construction of complex projects (2020).
- 2021 George Fox Conference: This one-day conference was not held in person, but a virtual session was used to educate the industry on some key developments in covid contracting as well as a feature presentation on the history of this conference and George Fox himself.
- 2020 Cutting Edge Conference: Held virtually and included several hours of presentation and discussion on advances in tunnelling technology.
- Held a fully virtual North American Tunneling (NAT) Conference in June 2020.
- Our Young Members and Women in Tunneling groups continued their social and technical activities focused on recruitment and diversity in the tunnel industry.
- We held several technical webinars on lessons learned of business during the time of COVID.
- We began a focused effort to mirror each ITA working group with an in-country USA sub-group that will support our WG representative and assist each working group.
- Published four editions of our magazine, "Tunneling & Underground Construction".
- Published the North American Tunneling Conference Proceedings Book in 2020
- Continued and accelerated efforts to become the main point of contact for underground construction with other professional associations, such as transportation, water and wastewater industry associations with tens of thousands of members.

Due to our inability to boost membership at our in-person events, our membership dropped by 20% in 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 continues. 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

- Los Angeles, CA continues to construct five major subway projects; Crenshaw/

LAX Corridor (tunnelling completed), Regional Connector (tunnelling completed), Purple Line Extension–Phase 1, 2 and 3. 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 is completed, with an extension that is currently under construction.

### Water Supply

- TBM tunnelling is completed, and lining operations continue 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.
- 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 nearing completion of tunnel work.
- St. Louis, MO currently has wastewater tunneling 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. Westerly 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, Ft. Wayne IN and Louisville, KY, San Jose, CA, Alexandria, VA have the first of their wastewater tunnel projects underway.



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Lower operating expenses

In-depth customer application knowledge is the key to providing superior customer value adding technological solutions. Normet has extensive technical experience with the ability to provide on-site support.

Normet provides innovative technologies and advanced solutions through equipment, construction chemicals and services for selected construction processes including:



Scaling



Under-ground Logistics



Charging



Lifting & Installations



Sprayed Concrete



Rock and Ground Support



Water Control



Ground Engineering



TBM Technology



Waterproofing





**A proud heritage  
of innovative  
thinking.**

**Moving forward, one tunnel at a time.**

We're proud of the legacy that the Robbins name represents, but more importantly we're focused on the future of the underground industry and the success of our client partners today. Join us in realizing the next era of underground accomplishments.



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