

# ITA MEMBER NATION ACTIVITY REPORTS 2023



TUNNEL EURALPIN LYON TURIN

# CROSS-BORDER CONSTRUCTION LINKING EUROPE

The new Lyon-Turin railway line is around 270 km long and will connect France and Italy to bring the European railway network to the next level. Herrenknecht supplies up to seven TBM for the international section under the Alps. The 57.5 km long Mont Cenis base tunnel – 12.5 km in Italy and 45 in France – will link the international stations of Saint-Jean-de-Maurienne and Susa. The TBMs with diameters of more than 10 meters will be supported by 24 Conveyor Belts Systems and 26 Multi-service Vehicles of the Herrenknecht Group.

› [herrenknecht.com/telt](https://herrenknecht.com/telt)

Client:  
› Tunnel Euralpin Lyon Turin  
Contractor:  
› VINCI Construction / WeBuild JV

**PIONEERING  
UNDERGROUND  
TOGETHER**

HERRENKNECHT



Tunnelling Systems



ITA MEMBER NATION  
Activity Reports 2023

# CONTENTS

- 04 AUSTRALIA
- 05 AZERBAIJAN
- 06 BELGIUM
- 07 BRAZIL
- 09 CANADA
- 11 CHINA
- 15 COLOMBIA
- 16 COSTA RICA
- 17 CZECH REPUBLIC
- 18 FINLAND
- 21 FRANCE
- 23 GERMANY
- 25 GREECE
- 27 HUNGARY
- 28 ICELAND
- 30 INDIA
- 33 IRAN
- 34 ITALY
- 38 JAPAN
- 39 KOREA
- 41 MEXICO
- 43 NEW ZEALAND
- 45 NORWAY
- 46 PAKISTAN
- 47 POLAND
- 50 PORTUGAL
- 51 RUSSIA
- 52 SINGAPORE
- 54 SLOVENIA
- 56 SPAIN
- 59 SWEDEN
- 60 SWITZERLAND
- 65 THAILAND
- 66 TÜRKIYE
- 75 UNITED KINGDOM
- 77 USA

## ARNOLD DIX ITA PRESIDENT



There is a global rush of projects in our post Covid world. There is an urgency to modernise our cities and liked to that a rush to extract valuable minerals and metals for a planet transitioning towards renewable energy sources. The scope and diversity of projects has never been greater - importance placed on of underground projects as a tool for social, economic and environmental benefit almost universally appreciated and – where possible – actioned in new projects.

The urgency of addressing the climate crisis has led to an unmatched emphasis on improving public transportation systems, particularly through the development of underground metro networks in major cities. Furthermore, as emerging economies strive for progress, large-scale nation-building endeavours such as those featuring high-speed rail systems have become emblematic, often incorporating underground components.

In capital poor nations reliant on mining, institutions such as the World Bank are shifting their focus towards leveraging future existing mining infrastructure funding to broader societal benefits, such as repurposing mines for civil purposes like power generation.

Taken together, this convergence of factors has resulted in a remarkable variety of underground initiatives, highlighting the undeniable link between the well-being of our communities and the successful execution and utilization of these projects.

The narratives provided by our Member Nations in their reports serve as a testament to this extraordinary epoch in human history. Within these tangible accounts lie the aspirations of billions, encapsulating the collective spirit of progress and innovation.

On behalf of the Executive Council of the International Tunnelling and Underground Space Association (ITA), I extend sincere gratitude to all the authors of these reports for their invaluable contributions, enriching our global community with insights into their respective underground endeavours.

Special recognition is also extended to our esteemed Member Nations, the Secretariat, and Tunnelling Journal for their unwavering commitment to producing and disseminating this compendium of underground activities. Your dedication ensures that the collective knowledge and experiences shared within these pages continue to inform and inspire advancements in underground infrastructure worldwide.



### Your Contacts

Tris Thomas - Editorial Director  
Email: tris@tunnellingjournal.com

Binda Punj - Sales Manager  
Tel: +44 (0) 1892 710 300  
Email: binda@tunnellingjournal.com

The publishers, authors and printers cannot accept liability for errors or omissions. All rights reserved. No part of this publication may be reproduced in any form without prior permission of the copyright holder and the publisher, application for which should be made to the publisher. TGS Media Ltd.

### TGS Media Ltd

The Old Library, Dudley Road,  
Tunbridge Wells, Kent TN1 1LE, UK

Tel: + 44 (0) 1892 522 585

# AUSTRALIA



**Name of Association:** Australian Tunnelling Society (ATS)  
**Type of Structure:** The ATS is an industry based Technical Society of Engineers Australia (EA).  
**Number of Members:** 835 members, 69 Corporate Sponsors (52 Gold, 17 Silver), 6 Platinum Sponsors

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

**Activities and Events:** With the Covid pandemic largely behind us in 2023, the Australian Tunnelling Society was able to return to more in-person technical events, as was the traditional approach, supplemented by hybrid (in-person + online) as well as some entirely on-line events. The focus of 2023 was preparation for the biennial Australasian Tunnelling Conference (ATC), an event the ATS runs with the NZTS to highlight and celebrate tunnelling projects and innovations in the Australasian region.

The event was held in Auckland, New Zealand and was well attended by presenters and delegates from both Australia and New Zealand and included an address from the ITA President, Arnold Dix and various other Australian Tunnelling entities.

**Publications:** The ATS ANZ Journal was published twice in the last calendar year in conjunction with Tunnelling Journal and is sent to ATS (and NZTS) members in April and October of each year.

**Working Groups:** The Diversity in Tunnelling sub-group of the ATS (formerly Women in Tunnelling) is made up of representatives from the various

ATS chapters interested in promoting and supporting diversity in tunnelling. Since launching in the second half of 2022, they had a busy year in 2023 with several events held. Lately they have just launched a Mentoring & Buddy Program which has been extremely well received. Collaboration with overseas organisations is ongoing, and it is hoped that further connections will be made at WTC2024 in Shenzhen.

The Tunnel Systems sub-group of the ATS is made up of experts in the field of tunnel systems, such as Fire Life Safety, ventilation and lighting. These are important elements of any tunnel and as such the sub-group was formed to provide greater exposure to this work in both new tunnels under construction and tunnel refurbishment, which is itself of ever-increasing importance as existing tunnels age and need to be upgraded with new systems for futureproofing.

## CURRENT TUNNELLING ACTIVITIES

- North East Link, Melbourne, VIC. 21,200 BCM excavated. Tunnelling ongoing.
- West Gate Tunnel, Melbourne, VIC. 311,930 BCM excavated. Tunnelling complete.
- Snowy 2.0 Cooma NSW. Tunnelling ongoing.

- WestConnex Stage 3A - M4-M5 Link, NSW, Sydney. Tunnelling complete.
- M6 Stage 1 Sydney, NSW. 570,000 BCM excavated. Tunnelling ongoing.
- Western Harbour Tunnel Phase 1, Sydney, NSW. 465,000 BCM excavated. Tunnelling ongoing.
- Western Harbour Tunnel - North Driven tunnels, IMT and M&E Fitout, Sydney, NSW. Tunnelling about to commence.
- Sydney Metro West Central package CTP, Sydney, NSW. Tunnelling ongoing.
- Sydney Metro West Western package WTP, Sydney, NSW. Tunnelling ongoing.
- Sydney Metro West Eastern Tunnelling package ETP, Sydney, NSW. 52,000 BCM excavated. Tunnelling ongoing.
- Sydney Metro Western Sydney Airport - Station Boxes and Tunnels Contract, Sydney, NSW. 467,000 BCM excavated. Tunnelling ongoing.
- Cross River Rail Tunnels & Stations Development PPP, Brisbane, QLD. Tunnelling complete.
- Brisbane Metro - Brisbane, QLD. 24,000 BCM excavated. Tunnelling ongoing.
- Kidston Pumped Hydro - Regional QLD. 15,000 BCM excavated. Tunnelling ongoing.

## FUTURE TUNNELLING ACTIVITIES

- Suburban Rail Loop – Package C, Melbourne, VIC.
- Coffs Harbour ByPass, Coffs Harbour, NSW.
- Suburban Rail Loop – Package D, Melbourne, VIC. (under tender)
- North-South Corridor – Torrens to Darlington, Adelaide, South Australia (under tender)
- South West Rail Link Extension – NSW
- Borumba Dam Pumped Storage Hydro, Sunshine Coast, QLD



## TECHNICAL SESSIONS (TALKS) HELD IN 2023

Event Title	Start Date	Event Title	Start Date
■ The Missing Link: Constructing the Westconnex M4-M8 Link Tunnels	16/02/2023	■ Careers in tunnelling – a young engineer’s perspective	20/07/2023
■ Fire testing of tunnel concrete lining segments – requirements and practical advice	23/02/2023	■ Geomechanics of pressure tunnels and shafts – a critical review of existing knowledge	3/08/2023
■ Celebrating diversity in tunnel engineering	9/03/2023	■ ATS QLD – Discrete fracture network approach for underground support design optimisation	24/08/2023
■ Water mist suppression for road tunnels	16/03/2023	■ Mt Coot-tha Quarry site visit	31/08/2023
■ Herrenknecht presentation – Mechanised sinking of deep shafts in hard rock	23/03/2023	■ North East Link Tunnel Project industry updates	6/09/2023
■ Kidston Pumped Hydroelectric scheme design and construction	30/03/2023	■ Inclusion, Everybody Matters	7/09/2023
■ Brisbane Metro Adelaide Street tunnel	20/04/2023	■ Lessons learned from design and construction of Nant-de-Drance Powerhouse	27/09/2023
■ ATS Vic Technical Site Visit – Westgate Tunnel Project	24/04/2023	■ Tunnel systems: planning assets today for the future	28/08/2023
■ North East Link Program tunnel design overview	2/05/2023	■ Revolutionising Australia’s infrastructure through centralised geological and geotechnical data management	19/10/2023
■ Ground challenges in Melbourne’s Metro Tunnel Project	16/05/2023	■ Pathways to sustainable TBM tunnelling using intelligent electrical equipment	1/11/2023
■ Tunnelling Risk Management on the Forrestfield Airport link Project, Perth	18/05/2023	■ ATS Young Members site visit to Brisbane Metro Adelaide Street tunnel	29/11/2023
■ The use of fibre optics to improve tunnel support design	24/05/2023	■ Considerations for designers and constructors to deliver practical operation and maintenance outcomes	7/12/2023
■ ATS Vic – Discrete fracture network approach for underground support design optimisation	25/05/2023	■ Tunnels and underground works for pumped storage hydropower projects: Challenges and Opportunities – Panel discussion	13/12/2023
■ ATS NSW – Discrete fracture network approach for underground support design optimisation	8/06/2023		
■ Getting the most out of the International Tunnelling Association	15/06/2023		

## SEMINARS, SHORT COURSES AND CONFERENCES HELD IN 2023

Event Title	Start Date
■ Building around existing tunnels seminar	27/04/2023
■ Tunnel Fire Safety – short course	3/08/2023
■ Shotcrete seminar	5/11/2023
■ Australasian Tunnelling Conference 2023	6 to 8/11/2023

## SOCIAL EVENTS HELD IN 2023

Event Title	Start Date
■ NSW Charity Golf Day	23/11/2023
■ QLD St Barbara’s Day dinner	1/12/2023
■ NSW St Barbara’s Day social event	4/12/2023
■ VIC St Barbara’s Day social event	7/12/2023

# AZERBAIJAN



**Name of Association:** Azerbaijan Tunnelling Association

**Type of Structure:** Non-profit

**Number of Members:** A nine-member management board and large membership

### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Experts participated in the examination of the 1,700m long tunnel in the Dashkesan region and presented their proposals for remediation.
- A 120-page manual was prepared for those engaged in the construction of metro tunnels.

- The Union has submitted its proposal for an exploration tunnel in the Balakan region of Azerbaijan

### EDUCATION ON TUNNELLING IN THE COUNTRY

Azerbaijan University of Construction and Architecture offers bachelor’s, master’s and postgraduate courses.

# BELGIUM



**Name of Association:** 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:** 14 individual members, 55 corporate members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

Several site visits were organised, including one of the A16 in Amsterdam and a visit to the underground laboratory 'Hades in Mol', as well as the annual seminar with the 2023 topic 'Seminar on Underground Storage of Nuclear Waste in Belgium' on the 30th March. On World Tunnel Day on the 1st December, a successful 2nd Tunnel Asset Owners Day – Suppliers Day - was organized in Antwerp. We strengthened our close cooperation within the EUTF regarding the European Tunnel Community and knowledge sharing objectives. We also continued our close cooperation with the French Tunnelling Society AFTES, with whom we share the magazine T&ES.

Our activities are visible on <https://www.abtus-bvots.com/>

## CURRENT TUNNELLING ACTIVITIES

■ The renovation of the Lemonnier metro station and the start of the new Toots Thielemans Subway station (MIVB/STIB), as part of Metro Line 3. The construction works on the 233m long Toots Thielemans subway station, formerly known as 'Constitution', started in 2020 and will be completed by 2025. The renovation and expansion of the Lemonnier tram station will follow between 2025 and 2028.

- In Brussels, the rehabilitation of the road tunnels on the city's inner ring continues. The old tunnels are being completely refurbished and will be equipped with an up-to-date control system (f.e. The Annie Cordie Tunnel)
- In Liège, the renovation of the Grosses Battes & Kinkempois tunnel has finished.
- In Flanders, renovating several tunnels with safety upgrades continues, such as the renovation of the Kennedy Road & Railway Tunnel with new control and safety systems.

## FUTURE TUNNELLING ACTIVITIES

- On the 27th March 2024, our annual seminar will be held with the topic of "Young Engineers@Work".
- In Brussels, the metro south station will be adapted, and the line extended from the north station, so that the whole line can be converted into a fully automated subway system. The works have started. The tender for the extension from the north station towards the new NATO-building has started.
- In Antwerp the works for the Oosterweel Connection (closing of the northern motorway ring) is in full development.
- The oldest parts of the Antwerp pre-metro for trams and light rail will be renovated.

- The road tunnels on Brussels' inner ring will be further rehabilitated to become safer.
- In the future, a second rail track from Antwerp's main shunting station towards the hinterland will be required. This will be delivered by constructing two single track, 16km long tunnels that will underpass the Albert canal and several motorways to avoid interference with the dense urban surface area.
- In Flanders, several tunnel projects are in the pre-design or building permit stages, such as the Ring of Ronse, North-South Link in Limburg, R4WO Tunnelling Project Ghent (<https://r4wo.be/>)



Extension Metro Line 3 from Brussels North till Bordet, preparation works in Brussels North



Future Toots Thielemans subway station



# BRAZIL



(MND) na Engenharia Brasileira” - Yannis Calapodopulos

**June**

**5th** - Linha 6 – Laranja Metrô SP – Aspectos Construtivos e Operacionais - Gustavo Rodrigues

**22nd** - Ecos WTC 2023

**29th** - Tuneladora TBM - Análise da construção de túneis em Sistemas Metroviários - (CBTYM)

**July**

**31st** - Connecting & Analyzing Data to Reduce Geotechnical Uncertainty - Cristian do Santos

**November**

**28th** – Presentation - Important Aspects of IMT Tunnels – with Harald Franke & Peter van Westendorp at Instituto de Engenharia

**December**

**1st** – Tunnel Day 2023

**Press and social media**

Linkedin: +30 posts; Instagram: +30 posts; Facebook: +30 posts; Monthly CBT@News

**CURRENT TUNNELLING ACTIVITIES**

During 2023, there were several tunnels being excavated, some completed in 2024, with some major projects still ongoing.

Two major metro projects started in one of the biggest cities in the world, São Paulo. Lines 2 and 6 are currently ongoing, with several stations and tunnels, using both conventional and mechanized methods.

Another road tunnel has finished, the Florianópolis Bypass, with four tunnels. This is also the city that hosted one of the CBT activities, the Road Tunnels Seminar, at the start of the beginning of 2023,.

For hydroelectric power plants, there was a total of 3,255m of excavated tunnels in the south of Brazil.

Finally a total of 8.4km of utility tunnels were excavated using pipe jacking technology.

**FUTURE TUNNELLING ACTIVITIES**

In 2024, São Paulo metro projects will continue, with the TBM on Line 6 excavating since 2022 and the TBM on Line 2 also continuing. Several conventional tunnels for both metro projects are currently being excavated and other connecting tunnels for both

**Name of Association:** Brazilian Committee of Tunnels and Underground Spaces

**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:** 275 Individual Affiliate Members and 13 Corporate Affiliate Members.

**ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE**

**March**

**2nd – 3rd** Seminário de Túneis Rodoviários: Contorno de Florianópolis – STR 2023

**9th** - Webinário “Advanced Technologies in Refuge Chambers for Tunneling”, com Michael Rispin, P.ENG

**April**

**6th** - Webinar “Application of Calibrated Multi-Scale Numerical Models for Rockburst Hazard Management in Mines and Tunnels” with Kathy Kalenchuk & Neda Dadashzadeh

**May**

**8th** - Webinar “Método Não Destrutivo



Contorno Viário de Florianópolis: Tunnel 1 begins to be excavated in Palhoça (Photo: Arteris, Disclosure)

projects should start in 2024. Additionally, the extension of Line 2 should start in 2024, connecting São Paulo to its neighbouring city, Guarulhos.

For the São Paulo Metro, several viability and preliminary projects will start through 2024, such as Lines 16-Violet, 19-Sky Blue, 20-Pink and 22-Brown. Regarding road tunnels, the north connection road tunnel project, as part of the city ring of São Paulo, Rodoanel North, could resume soon.

Finally, the new government is promising to release a new railway link, which might include tunnels.

### EDUCATION ON TUNNELLING IN THE COUNTRY

- UnB – Brasilia University – Tunnel graduate course (60h course) and post graduate course (30h course), as well as a research group
- EPUSP - Polytechnic School of the University of São Paulo – Graduate

course that includes tunnel execution (NATM and TBM) and post graduate course, focusing on NATM excavation

- EESC – São Carlos Engineering School – part of the ITACET University Network, includes post graduate courses for a masters, PhD and Post-Doc programs
- Presbiteriana Mackenzie University – a graduate course “Tunnels and Underground Structures”.

## STATISTICS

Project	Type	Total Length (m)	Excavated Length (m)	Area (m <sup>2</sup> )	Excavated Volume (m <sup>3</sup> )	Cost (USD)
PB-01 Tunnel	NATM	240,66	240,66	72,30	17.399,72	5.219.915,40
PB-02 Tunnel	NATM	1847,19	1847,19	76,69	141.661,00	42.498.300,33
PB-03 Tunnel	NATM	52,45	52,45	24,60	1.290,27	387.081,00
PB-04 Tunnel	NATM	45,69	45,69	6,27	286,48	85.942,89
PB-05 Tunnel	NATM	436,76	436,76	20,33	8.879,33	2.663.799,24
SP Metro Station Tunnel	NATM	97,00	13,00	277,24	3.604,12	1.081.236,00
Luís Bom Tunnel 2	NATM	497,00	60,50	88,25	5.339,13	1.601.737,50
Vigário -Ponte Coberta (“By pass”) Tunnel	NATM	4613,00	752,00	42,00	31.584,00	9.475.200,00
Estação da Luz CPTM - Metrô SP Tunnel	NATM	62,31	32,31	96,52	3.118,61	935.583,00
Morro do Vieira BR-280/SC Tunnel	NATM	88,96	88,96	86,00	7.651,00	2.295.300,00
<b>TOTAL</b>					<b>220.813,65</b>	<b>66.244.095,36</b>



**VIP | GLOBALLY APPROVED SEALING GASKETS**

Since 1923 VIP Polymers have offered a range of sealing solutions for tunnelling and construction projects across the globe. VIP's range of tunnel segment profiles have been developed with the material quality and gasket performance required by specifications set in the UK and overseas. Our manufacturing and testing facility in the UK allow VIP to provide technical support and provide bespoke solutions for unique tunnelling conditions.

15 Windover Road, Huntingdon, PE29 7EB. UK. | T: +44(0)1480 411333 | E: info@vip-polymers.com | W: www.vip-polymers.com



**CDM Smith**

**Tunnel Engineering Services:**

- Planning Studies
- Tunnel Hydraulics
- Geotechnical Engineering
- Permitting
- Ground Freezing Design
- Civil Engineering/Site Works
- Shaft & Tunnel Lining Design
- Construction Management

From start to finish, around the world.

**listen. think. deliver.**

cdmsmith.com



# CANADA



Name of Association: Tunnelling Association of Canada (TAC)

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

Number of Members: 558 individual members, 72 corporate members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The year 2023 has been a very successful year for TAC, most notably with the ITA's selection of Montreal as the host city for the 2026 World Tunnel Congress. This culminates many years of work by several dedicated members of TAC in order to put together this successful bid and we are grateful to the ITA to demonstrate confidence in TAC with this award. TAC looks forward to welcoming the worldwide tunnelling community to Montreal in May, 2026!

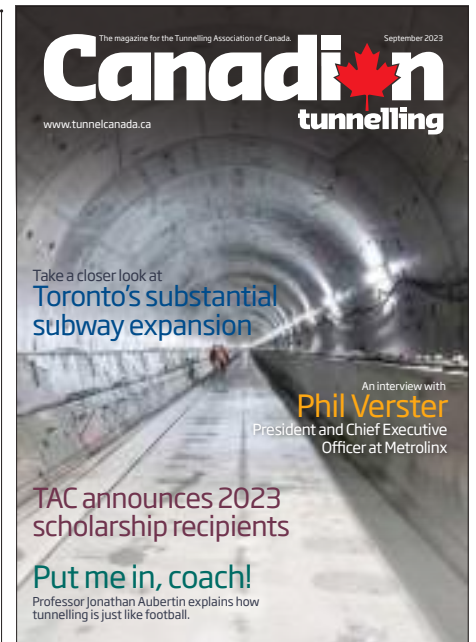
The 2023 TAC Conference was hosted in Toronto, Ontario from September 24 – 26, 2023, under the theme Tunnelling - Smart Solutions, Future Growth. This was TAC's biggest conference so far with over 750 attendees with a sold-out Awards Gala, 62 exhibitors and 31 sponsors. The conference featured two keynote speakers, short courses, two technical tours and 63 technical sessions with 163 speakers. The conference also included a moderated event hosted by the TAC EDI Taskforce on Women in Tunnelling. The Conference also include signing of the ITA – TAC agreement for the WTC2026 to be hosted in Montreal, Quebec in May 2026.

There were monthly events hosted

across the five TAC chapters and the TAC Young Members Group (TACym) was very active hosting five webinars, three site visits, and one social event. The regional chapters hosted 16 in-person events in Vancouver, Toronto, Edmonton, Alberta and Montreal, Quebec.

As part of the conference, the annual TAC Achievement Awards were presented at the Gala dinner held on September 25, 2023. The 2023 recipients included:

- Lifetime Achievement Award – Dr. K. Y. Lo
- Young Tunneller of the Year Award – Michael Dutton and Riley McMillan
- Tunneller of the Year Award – Mike Zegarac
- Canadian Innovation Initiative Award – RockMass Technologies and Hatch for Digital Innovation in Tunnel Mapping using Mobile LiDAR and Machine Learning
- Canadian Project of the Year Award (Up to \$100M CAD) – Trans Mountain, McNally, Kiewit, Hatch and Herrenknecht for the Trans Mountain Expansion Project - Burnaby Mountain Tunnel Project
- Canadian Project of the Year Award (Over \$100M CAD) – City of Toronto, Hatch Ltd. with Jacobs/Baird, and Southland Mole of Canada and Astaldi



Canada Design for the Ashbridges Bay Treatment Plant Outfall (ABTPO) Tunnel Project

- Photo of the Year Award – Yusuf Soliman for Carving Through Bedrock (The Construction of a Cross Passage)
- TAC Outstanding Service Award – Boro Lukajic
- Dan Eisenstein Memorial Scholarship – Captain Chelsey Guo
- TAC Undergraduate Scholarship – Madeleine Gaul

Full 2023 TAC Achievement Award details and videos are posted on the TAC website ([https://www.tunnelcanada.ca/awards\\_2023.php](https://www.tunnelcanada.ca/awards_2023.php)). TAC looks forward to its next annual conference from October 6 to 8, 2024 in Montreal, Quebec.

TAC communicates with its members and the general public through a number of forums:





TAC 2023 at the Westin Harbour Castle in Toronto, Ontario

# DELIVERING EFFICIENCY.



At Trakkom Engineering, innovation is at the core of everything we do. Our products are engineered for precision and performance for tunnel boring technology, and excel in diverse geological conditions, ensuring efficient excavation. With a commitment to quality and years of expertise in the field, Trakkom Engineering delivers innovative solutions trusted by leading tunneling projects worldwide. Join the forefront of underground construction and the future of tunneling with Trakkom Engineering!

**TRAKKOM**  
ENGINEERING & INDUSTRIES

 trakkom  
 trakkom\_tr



- “Canadian Tunnelling” magazine - in partnership with the Tunnelling Journal, this twice-yearly publication focuses on Canadian tunnelling activity and TAC events. Canadian Tunnelling was published in February and September 2023, with issues mailed to the TAC membership. Previous issues of Canadian Tunnelling are now available to TAC members on the TAC website.
- TAC and TACym maintain a full Social Media presence, including an active LinkedIn page (<https://www.linkedin.com/company/tunnelling-association-of-canada/>).
- TAC also implemented a bilingual bi-monthly newsletter which was published with six issues in 2023.

TAC has implemented a series of Special Projects over the years as a means to promote the Association and the tunnelling industry in Canada in general. In 2023, TAC carried out the following initiatives,

- Launch of the “Canadian Tunnelling Projects Dashboard” – a GIS-enabled database that provides TAC members with an overview of current, upcoming and historical projects across Canada. This highly anticipated project provides the most comprehensive and up-to-date information on the tunnelling industry in Canada.

## CURRENT TUNNELLING ACTIVITIES

The tunnelling industry in Canada continues to be very active with tunnelling projects underway in all five Canadian Chapters. The following are some of the key projects currently underway:

## Key Western Canada projects currently in progress or completed in 2023 include:

- In - Construction
- Broadway Subway Project - 5.7km extension of the Millenium Line
- Annacis Water Supply Tunnel – 2.3km below the Fraser River between Surrey and New Westminster
- Burnaby Lake North Interceptor No. 2 – 3km of single pass 2,130mm sewer
- Second Narrows Water Supply Tunnel
- Eagle Mountain Woodfibre Gas Pipeline – 9km tunnel between Squamish and Howe Sound
- Annacis Island Wastewater Treatment Plant Outfall – 575m 4.2m ID tunnel, to outfall within the Fraser River
- Continued works under the Basement Flood relief (BFR) and Combined Sewer Outflow (CSO) programs, separation of 43 combined sewer districts in the City of Winnipeg
- Cockburn and Calrossie Contract C7 and C9A
- Jefferson East Sewer Separation Project Contracts

## Key Eastern Canada projects currently in progress or completed in 2023 include:

- Ontario Line - Southern Civil, Stations and Tunnel
- Eglinton Crosstown West Extension (ECWE) - Advance Tunnel
- Scarborough Subway Extension - Advance Tunnel
- Scarborough Subway Extension – Stations, Rails and Systems
- Bowmanville Zone 1 Feedermain
- REM Montreal
- Lafontaine Tunnel Rehabilitation project

## FUTURE TUNNELLING ACTIVITIES

- Calgary Green Line Segment 2A
- Comox Valley Sewer Conveyance Project
- Stanley Park Water Supply Tunnel
- Pitt River Water Supply Tunnel
- Cambie-Richmond Water Supply Tunnel
- Coquitlam Intake No. 2 and Tunnel
- Coquitlam Main No. 4 City Centre Tunnel
- Lulu Delta Water Supply Tunnel
- Fraser River Tunnel Project (Immersed Tube Tunnel)
- Millenium Line Skytrain Extension to UBC (UBCX)
- Ferry Road and River Bend Combined Sewer Relief Project
- Inner Harbour West
- Taylor-Massey Creek Tunnel
- Toronto Black Creek
- Ontario Line North
- GE Booth Outfall
- Ontario Pumped Storage
- Snelgrove Watermains Phase 2
- Eglinton Crosstown West Extension – Advance Tunnel 2
- Yonge North Subway Extension – Advance Tunnel
- Yonge North Subway Extension – Stations, Rails and Systems
- West Trunk Diversion
- West Vaughan Sewage System Project
- Toronto Midtown Area 17 Sewer
- Montreal Blue Line Metro Extension
- Montreal REM l’Est Project
- Quebec Tramway Project
- Quebec Third Link Project (under tender)
- South West Rail Link Extension – NSW
- Borumba Dam Pumped Storage Hydro, Sunshine Coast, QLD

# CHINA



**Name of Association:** China Civil Engineering Society

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

**Number of Members:** Total number 100,000, number of corporate members 3000

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

### Academic events

1. From April 21st to 24th, 2023, the 2022 China Tunnel and Underground Engineering Conference (CTUC) and

the 22nd annual conference of the Tunnel and Underground Engineering Branch of the China Civil Engineering Society was hosted by the Tunnel and Underground Engineering Branch of the China Civil Engineering Society and

Central South University. The annual conference was successfully held in Changsha City, Hunan Province. This conference set up 12 academic forums on special topics. There was a total of 1,100 registered participants in the conference. It was broadcast live online, with 121,094 people watching. A total of 230 papers were received. Experts and scholars participated in the conference via various forums and conducted extensive exchanges on the latest developments in tunnel and underground engineering. After the conference, more than 100 people visited the manufacturing base of China Railway Construction Heavy Industry.

2. On the morning of October 14th, the “2023 China Tunnel and Underground Engineering Conference (CTUC) and the 23rd Annual Conference of the Tunnel and Underground Engineering Branch of the China Civil Engineering Society” opened in Chengdu. The conference was jointly sponsored by the China Civil Engineering Society Tunnel and Underground Engineering Branch, Southwest Jiaotong University, and Chengdu Tianyou Intelligent Tunnel Technology Co., Ltd. and was co-organized by 28 companies including China Railway 18th Bureau Group, China Railway 12th Bureau Group, China Railway 11th Bureau, Extreme Environment Geotechnical and Tunnel Engineering the National Key Laboratory of Intelligent Construction, the Key Laboratory of Transportation Tunnel Engineering of the Ministry of Education, and the School of Civil Engineering of Southwest Jiaotong University. With the theme “March into the Deep Earth - Meeting the Challenges of High-Energy Geology” the conference conducted in-depth discussion on the progress, innovative technologies and future development of tunnel and underground engineering construction in China’s high-energy geological environment. It also played a positive role in promoting tunnel construction in extremely complex environments, such as the series of JJ railways and highways. More than 500 people attended the meeting, and a total of 15,700 people watched online.

3. On November 30th, 2023 - jointly sponsored by Tunnel and Underground Engineering Branch of China Civil Engineering Society and China Railway Tunnel Group Co., Ltd - the “6th Tunnel and Underground Engineering Science and Technology Innovation Forum” hosted by China Railway Tunnel Survey and Design Institute Co., Ltd., and Guangdong Province Tunnel Structure Intelligent Monitoring and Maintenance Enterprise Key Experiment, and Tunnel Construction Journal (Chinese and English) was successfully held online. Focussing on the theme “Plateau Railway Tunnel Construction Technology”, the forum invited three experts to give special lectures. Duo Shengjun, the tunnel manager of the Changlin Section of the Plateau Railway of the China Railway First Survey and Design Institute Group Co., Ltd., delivered a report titled “Key Technologies for Plateau Railway Design”

on behalf of the national engineering survey and design master, Li Guoliang. From the perspective of plateau railway tunnel engineering characteristics, key technologies for plateau tunnel design and challenges faced in plateau railway tunnel engineering construction were elaborated on. This forum was held by the Tencent conference, with more than 1,840 participants and received more than 1,300 likes.

4. The 21st Academic Exchange Conference of the Waterproof and Drainage Technology Forum of the Tunnel and Underground Engineering Branch of the China Civil Engineering Society was held in Fuzhou City, Fujian Province from November 1st to November 3rd, 2023. More than 120 representatives from railways, rail transit, municipal administration, highways, water conservancy and hydropower, universities and scientific research units attended the meeting. This conference selected 33 papers for publication in the 2023 supplement of “Tunnels and Rail Transit”. Four guests were invited to give subject speeches, and 16 paper authors and corporate exchange speakers were invited to the exchange conference. 33 papers from this conference were published.

5. On April 21st, 2023, the 3rd Symposium for Young Tunnellers of Asia was held in Changsha City, Hunan Province. The Asian Tunnel Youth Forum is an annual international seminar held for young professionals in the Asian tunnel industry. The first and second forums were hosted by Malaysia and India respectively. The 3rd Asian Tunnel Youth Forum was hosted by the School of Civil Engineering of Central South University and the Tunnel and Underground Engineering Research Center of Central South University with the support of the Youth Working Group of the International Tunnel and Underground Space Association. It involves tunnel soil improvement, new tunnel construction technologies, new tunnel calculation methods, disaster prevention and repair and maintenance, energy conservation and emission reduction, and sustainable development. The total number of academic reports was 71, including 17 reports by overseas scholars, respectively from the United States, France, the Netherlands, Australia, Japan, Norway, Pakistan, Ireland, Malaysia and other countries and regions.

## Publications

As the official journal of the Tunnel and Underground Works Branch of the China Civil Engineering Society, Modern Tunnelling Technology published six issues and one special issue throughout the year, featuring a total of 212 articles. These publications mainly focused on cutting-edge technologies, such as AI and BIM, and covered key and challenging projects. They reported on major technological innovations, scientific research outputs, and practical solutions, aiming to promote the dissemination and exchange of tunnelling technology and knowledge within the community.

## 2023 ITA Tunnel Awards, China won three awards

Our association encouraged Chinese tunnel and underground space companies to actively apply for the ITA Tunnel Awards. A total of 21 projects were recommended, and 12 projects were shortlisted. On November 24th, the 2023 Ninth International Tunnelling Association Awards Ceremony was held in Mumbai, India. China won three ITA Tunnel Awards.

## CURRENT TUNNELLING ACTIVITIES

### Shenzhen to Zhongshan Immersed Tube Tunnel

The Shenzhen-Zhongshan Channel Project is an underwater interchange set in shallow to deep silt integrating a bridge, tunnel and island. The project is 24km, including an east artificial island, a west artificial island, a 17,129m bridge, a 6,845m underwater immersed tunnel, and an airport hub interchange (underground ramp part), etc. The design speed is 100km/h and the service life is 100 years.

Shenzhen-Zhongshan Channel Project’s immersed tunnel is a two-way eight-lane steel shell concrete structure. The length of a single standard pipe section is 165m, with a width of 46m, and a height of 10.6m. Its dead weight is about 80,000 tons. The floating transportation distance is about 50km which needs to cross multiple busy public waterways. The underwater docking accuracy is required to be controlled to  $\pm 5$ cm. The immersed tube adopts a new “steel shell-concrete” structure, which has large load-bearing capacity, good waterproof performance, and significant social, economic and ecological value. Construction started in April 2018 and will be opened to traffic in June 2024.



Shenzhen-Zhongshan Channel Project

### Shenzhen-Jiangmen Railway Pearl River Estuary Tunnel Project

The total length of this project is 13.69km. It is a single-tube double-line tunnel structure with a design speed of 200km/h. It is constructed using a combination of TBM tunnelling (6.52km), NATM (5.52km), and open-cut methods (1.65km). The TBM diameter is 13.32m. The “Shenjiang No. 1” TBM has advanced 3.59km from Humen, Dongguan, and the “Greater Bay Area” TBM has advanced 2.93km from Guangzhou Wanqingsha. The engineering characteristics include complex geological conditions, high tunnel depth, high water pressure, and long-distance excavation by TBM. The deepest point of the tunnel is 115m underwater, with a maximum water pressure of 10.6MPa. The project started in July 2020 and will be completed in December 2025.

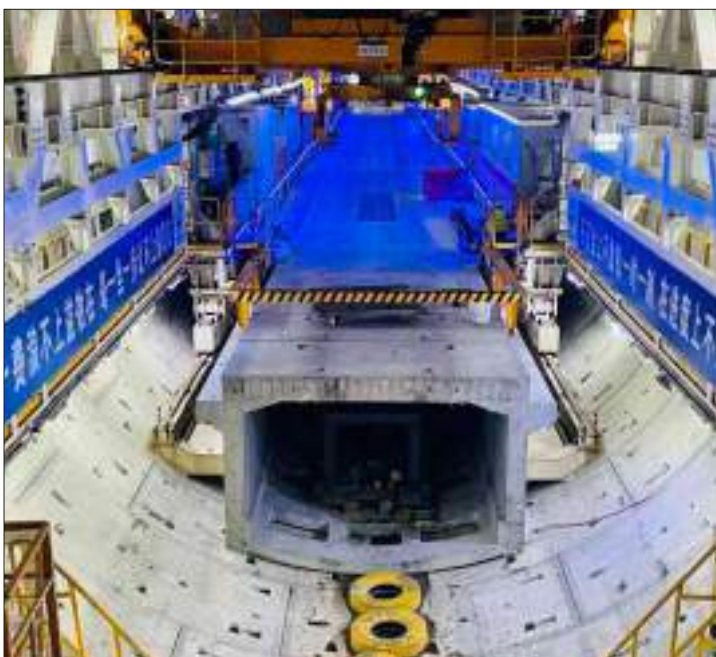
### Guangzhou-Dongguan-Shenzhen Intercity Shield Tunnel Project

This is the largest diameter tunnel under construction for Shenzhen Rail Transit. It is located in the middle of the Pearl River Delta and is the main line on the Pearl River Delta intercity network on the east bank of the Pearl River. The section from Qianhai to Huanggang Port is an extension of the Guangzhou-Dongguan-Shenzhen Intercity. The line passes through the Qianhai Cooperation Zone and Nanshan District, Futian District, with a total length of 21.14km, and a design speed of 160km/h. Construction uses open-cut and shield tunnelling methods. The open-cut section #1 on the Qianhuang section of the Guangzhou-Dongguan-Shenzhen Intercity to Huanggang Port Station is a single, double-track tunnel with an outer diameter of 12.8m, tunnelling is by shield

machine with a diameter of 13.27m. The minimum curve radius is 1300m, a maximum longitudinal slope of 29.6‰, a total length is 3.51km, and a tunnel depth is 10.7m~32.9m. The project section is located in the centre of Shenzhen City. It has complex geological conditions and a sensitive environment along the line. The proportion of composite strata exceeds 50%. Present are long-distance parallel highways, subways and other risk sources. It is one of the most complex shield tunnel projects globally, with some of the highest comprehensive risks during construction. The project started in 2021 and will be completed in 2026.

### Shenzhen Qianhai Comprehensive Transportation Hub

The Qianhai comprehensive transportation hub is an unusual large-scale fully underground hub TOD project in China. The project covers three subway lines, Line 1, 5, and 11, and two intercity railways - the Guangzhou-Dongguan-Shenzhen Intercity Line and the Hong Kong-Shenzhen Western Railway. The total land area is 20 hectares, including the underground hub and superstructure properties, with a total construction area of approximately 2.159M square meters. All underground space within the project land will be utilized. From east to west are; the Metro Lines 1, 5, and 11 stations and their new spaces; the hub transfer hall and property development underground space; the Guangzhou-Dongguan-Shenzhen intercity line station; and the Hong Kong-Shenzhen Western Railway station and



Shenzhen-Jiangmen Railway Pearl River Estuary Tunnel Project



The Guangzhou-Dongguan-Shenzhen Intercity



Shenzhen Qianhai comprehensive transportation hub

port space - including transportation.

The project's underground space consists of a deep foundation pit near the sea. The underground space of the hub transfer hall and property development is a six-story basement with a total length of 830m. The depth of the standard section of the basement is about 30m. The deepest pit within the tower and core tube range is about 37m to protect the safety of subway operations, divided into eight foundation pits for excavation at intervals. The foundation pit of the adjacent Guangzhou-Dongguan-Shenzhen intercity line is 32m deep and is being constructed simultaneously. The construction of large-scale deep foundation pits near the sea and the subway is very complex in terms of safety and cross-construction. The project started in 2011 and will be completed in 2027.

### Shenzhen-Daya Bay Intercity

The area from Shenzhen Airport to Daya Bay Intercity Shenzhen Airport to Pingshan is vital for the development of Shenzhen and Hong Kong, and an important factor in the Greater Bay Area intercity line network. It connects multiple districts such as Baoan, Longhua, Longgang and Pingshan and constitutes an express line that supports the expansion of urban space. It is also an express line that improves tourism transportation for Dapeng and Daya Bay. After completion, it will take just 40 minutes from Pingshan to Shenzhen Bao'an International Airport, which will strengthen the rapid connection between

eastern, western and central Shenzhen. At the same time, the intercity railway will have important strategic significance for the connection of the Bay Area and the integration of the Shenzhen-Dongguan-Huizhou metropolitan area.

The Shenzhen-Daya Bay Intercity Lot 2 mainly includes the section from the No. 1 working shaft in the Baidu section to the Universiade Station. It is a twin-tube single-line tunnel. It uses two double-channel slurry/EPBMs, each excavating 5.2km. The TBMs start from the Universiade Station and pass through the Longgang Central City Water Plant, Jihe Expressway, Shuiguan Expressway, Longgang Public Golf Course, Hangzhou-Shenzhen Railway Tunnel, and reaches the No. 1 Working Shaft in the Baidu Intersection. The geological conditions are complex and changeable within a large-scale karst development with a rock surface line that fluctuates greatly. There is a large number of bead-shaped caves, making construction difficult and risky.

### FUTURE TUNNELLING ACTIVITIES

There are 5,460 railway tunnels planned, with a total length of 13,313km, with 163 extra-long railway tunnels with a total length of 2,511km under construction. Among them, there are 24 extra-long railway tunnels each of more than 20km, with a total length of 643km.

The highway tunnels under construction and planned have a length of more than 100km. The Tianshan Shengli Tunnel (22.1km) is the world's longest highway tunnel, and the Guigala

Tunnel of 12.94km is the world's longest highway tunnel under construction in a high-altitude area, with tunnel elevation of 4248m. The Chaohu Tunnel (16.2km) in the southern section of the G9912 Hefei Metropolitan Ring Line, is undergoing feasibility studies, and is the longest highway underwater shield tunnel in the world. The Ailao Mountain Tunnel (24.5km) in Yunnan is in planning, and is the second highway tunnel over 20km.

### STATISTICS DATA

By the end of 2023, China's railway operating mileage reached 159,000km. 18,573 railway tunnels are in operation, with a total length of 23,508km. In 2023, 622 new railway tunnels will be opened for operation, with a total length of 1,292km, including 23 extra-long tunnels of more than 10km, with a total length of 320km.

In 2023, there will be 27,335 highway tunnels nationwide with a length of 29,460km, an increase of 1,740 tunnels with a length of 2,290km, including 1,927 extra-long tunnels with a total length of 8,750km, and 7,387 long tunnels with a total length of 12,900km.

As of December 31st, 2023, in 55 cities in 31 provinces (autonomous regions and municipalities), 306 urban rail transit lines have opened and are operational, with an operating mileage of 10,165.7km and 5,897 stations. Throughout 2023, 16 new urban rail transit operating lines have been added, with an additional operating mileage of 581.7km. Two new cities, Honghe and Xianyang, have urban rail transit for the first time.

## EDUCATION ON TUNNELLING IN THE COUNTRY NATIONAL TUNNEL ENGINEERING EDUCATION

Serial No.	Province (city)	School	Serial No.	Province (city)	School
1	Anhui	Anhui University of Science and Technology	24	Jilin	Jilin University
2	Anhui	Hefei University of Technology	25	Jiangsu	Southeast University
3	Beijing	Beijing Jiaotong University	26	Jiangsu	He Hai University
4	Beijing	Beijing industry university	27	Jiangsu	China University of Mining
5	Beijing	University of Science and Technology Beijing	28	Jiangsu	Nanjing University of Technology
6	Beijing	Tsinghua University	29	Jiangsu	Army Engineering University
7	Beijing	China University of Mining and Technology (Beijing)	30	Liaoning	Dalian University of Technology
8	Beijing	China University of Geosciences (Beijing)	31	Liaoning	Shenyang Jianzhu University
9	Beijing	China Academy of Railway Sciences Group Co., Ltd.	32	Liaoning	Northeastern University
10	Beijing	Coal Science Research Institute	33	Liaoning	Liaoning University of Engineering and Technology
11	Chongqing	Chongqing University	34	Shandong	Shan Dong University
12	Chongqing	Chongqing Jiaotong University	35	Shandong	Shandong University of Science and Technology
13	Gansu	Lanzhou Jiaotong University	36	Shaanxi	Changan University
14	Gansu	Lanzhou University of Technology	37	Shaanxi	Xi'an University of Architecture and Technology
15	Guangdong	GuangZhou University	38	Shaanxi	Xi'an University of Science and Technology
16	Hebei	Shijiazhuang Railway University	39	Shaanxi	Xi'an University of Technology
17	Henan	Zhengzhou University	40	Shanxi	Taiyuan University of Technology
18	Heilongjiang	Harbin Institute of Technology	41	Shanghai	Tongji University
19	Heilongjiang	Institute of Engineering Mechanics, China Earthquake Administration	42	Sichuan	Southwest Jiaotong University
20	Hubei	Chinese Academy of Sciences University	43	Sichuan	Chengdu University of Technology
21	Hubei	Wuhan University	44	Sichuan	Sichuan University
22	Hunan	Central south university	45	Tianjin	Tianjin University
23	Hunan	Changsha University of Science and Technology	46	Zhejiang	Zhejiang University

# COLOMBIA



**Name of Association:** Colombian Tunneling Committee  
**Number of Members:** 10 members that represent more than 2500 engineers in the country

### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The Committee continues to participate with the Colombian Society of Engineers as part of the revision team for the Colombian Tunnel Design Manual developed by the National Roads Institute (INVIAS). The Committee worked on the following activities during 2023:

- The committee will organize more short talks with invited experts, which will be open to all members of the community
- Attendance at the World Tunnel Congress in May 2023
- World Road Tunnel Seminar: implementation of technologies in tunnel operation
- The committee organized and participated in the 2023 Tunnel Symposium, in which all Working Groups participated within topics discussed during the year

### CURRENT TUNNELLING ACTIVITIES

In 2023, the excavation of the 9,730m Guillermo Gaviria Echeverri Main Tunnel was completed.

In addition to the Guillermo Gaviria Echeverri tunnel, Colombia has seven of the longest tunnels in America:

- La Línea Tunnel – 8.6km
- Oriente Tunnel – 8.2km
- Occidente Tunnel – 4.6km
- Occidente Tunnel (Second tube) – 4.6km
- Buenavista Tunnel – 4.5km
- Renacer Tunnel – 4.3km
- La Quebrada Tunnel – 4.2km

### FUTURE TUNNELLING ACTIVITIES

Studies and designs of tunnels in 2024

- Tunnel 1 (636m) - Mulálo to Loboguerrero
- Tunnel 2 (852m) - Mulálo to Loboguerrero

- Tunnel 4 (3.27km) - Mulálo to Loboguerrero
- Tunnel 5 (1.23km) - Mulálo to Loboguerrero
- Tunnel 9 (5.32km) - Mulálo to Loboguerrero
- Bogotá Metro Line 2 (15.5km)

Construction of road tunnels in 2024

- Fuemia tunnel (2.2km)
- Pamplona tunnel (1.4km)
- La Honda tunnel (0.40km)
- La Llorona tunnel (0.46km)

### STATISTICS

**Completed**  
**La Paz Tunnel**



In 2023, the construction of eight road tunnels was completed, with a length of more than 15.8km. Those tunnels represent an investment of close to \$0.74bn.

**Close to completion**  
**Buenavista II Tunnel**



Approximately, 30 tunnels of different diameters and purpose are under construction in Colombia, comprising a length of more than 22km of underground space.

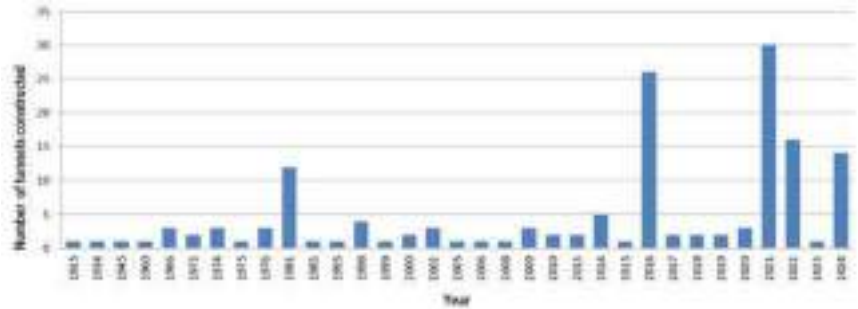
**Under study**  
**Bogotá Metro Line 2**



Currently, the construction of Line 2 of the Bogotá Metro is in the bidding phase - 12.6m of tunnel, 10.5m in diameter.

Colombia has 196 road tunnels built and under construction, totalling approximately 180km

**Historical construction of tunnels in Colombia**



**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Postgraduate course applied to tunnel engineering: University: Universidad Javeriana / Bogotá, Colombia.
- Postgraduate course applied to mining engineering: University: Universidad Javeriana / Bogotá, Colombia.
- Postgraduate course in Road Tunnels: Design, Construction and Management: University: Universidad de Los Andes/ Bogotá, Colombia.
- Postgraduate course in rock embankments and tunnel design: University: Universidad de Los Andes/ Bogotá, Colombia.
- Postgraduate course in underground construction: University: Universidad Militar Nueva Granada / Bogotá, Colombia.
- Postgraduate course in road tunnels: University: Universidad Javeriana / Bogotá, Colombia.
- Geotechnical risk assessment and management: INGETEC / Bogotá, Colombia
- Postgraduate course in underground structures: University: Universidad del valle / Valle del Cauca, Colombia
- Course Tunnel lighting design: University: Universidad Nacional de Colombia / Bogotá, Colombia
- Seminar on mechanized tunneling in soft ground: Herrenknecht-INGETEC / Bogotá, Colombia

# COSTA RICA



**Name of Association:** Asociación Costarricense de Obras Subterráneas, ACROS  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 25 members, 4 corporate

**ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE**

The third Costa Rican Congress of Underground Works, CCROS 2023: "Current practices in the design and construction of underground works", was held from March 9th - 11th, 2023, with a technical program featuring the following four sessions:

- Session 1: Underground works planning course
- Session 2: Design of underground works
- Session 3: Construction of underground works

- Session 4: Monitoring and evaluation of underground works

The number of participants was 121. The speakers were from: Germany 1, Spain 6, France 3, México 3, Chile 3, and Colombia 1.

**CURRENT TUNNELLING ACTIVITIES**

- The pipe-jacked micro tunnel on the Ambiental Improvement of the San Jose Metropolitan Area residual water project has seen the following advance: In the north sector of San José, 1918m of pipe jack micro tunnels of 600mm

diameter, and four shafts of 3.5m diameter with an average depth of 10m.

- The mobility improvement on the Circumvallation Route of San José has had the following advance: Excavation of the underground pass under the Circumvallation Route at the Calle Blancos intersection stands at 355m long and 22m - 35m wide, with a 62% advance.
- Completion of the 510m long at the La Uruca intersection of the Circumvallation Route underground pass.
- A new 60m long underpass at the La Galera Intersection on the National Route No. 2 Florencio del Castillo was completed.
- Corrective maintenance works on Tunnel 1 - 500m long - on the Hydropower Plant Garita, which was built more than 50 years ago. The work consisted of repairing the concrete lining, filling the annular space between the concrete lining and the rock, and



consolidating, at a depth of 3m, the surrounding rock by injecting water-cement grout with a resistance equal to or greater than the resistance of the concrete. As a result, a significant number of voids were found behind the lining and the rock. Large open fissures were also found in the rock that were injected and consolidated.

## FUTURE TUNNELLING ACTIVITIES

- Three tunnels for the fifth stage of the potable water supply project for the Metropolitan Area of San José, with a total length of 11.8km and 3.9m diameter.
- Two tunnels for storm sewage relief for the Metropolitan Area of San Jose, 1300m length, 3m diameter each.
- An ACROS Petit Committee is drafting a Technical Guide for the Development



Above: La Galera Underground Pass  
Right: Garita Hydroelectric Tunnel

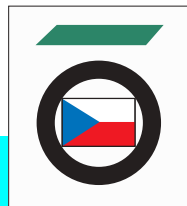
of Underground Works in Costa Rica under the auspices of the College of Civil Engineers of Costa Rica. The guidelines will be complete in December 2024.

## 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).



# CZECH REPUBLIC



**Name of Association:** Czech Tunnelling Association  
**Type of Structure:** Non-profit, open association  
**Number of Members:** Total number – 93, number of corporate members – 43

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

In 2023 the Czech Tunnelling Association (CzTA) continued with the following activities:

- 1) The publishing of the "Tunel" journal – four issues per year ([www.ita-aites.cz/en/casopis/zakladni-informace](http://www.ita-aites.cz/en/casopis/zakladni-informace))
- 2) Organising the public lectures "Tunnelling afternoons", with the topics:
  - Metro D – New Line of Prague Metro
  - Design Preparation of Long Railway Tunnels
- 3) On 29th – 31st May 2023 we hosted the

conference 'UC Prague 2023'.  
 4) The CzTA organised a tour to the Kühltai Pumped Storage Power Plant near Innsbruck, Austria for members

## CURRENT TUNNELLING ACTIVITIES

In 2024 the Czech Tunnelling Association (CzTA) will continue with the following activities:

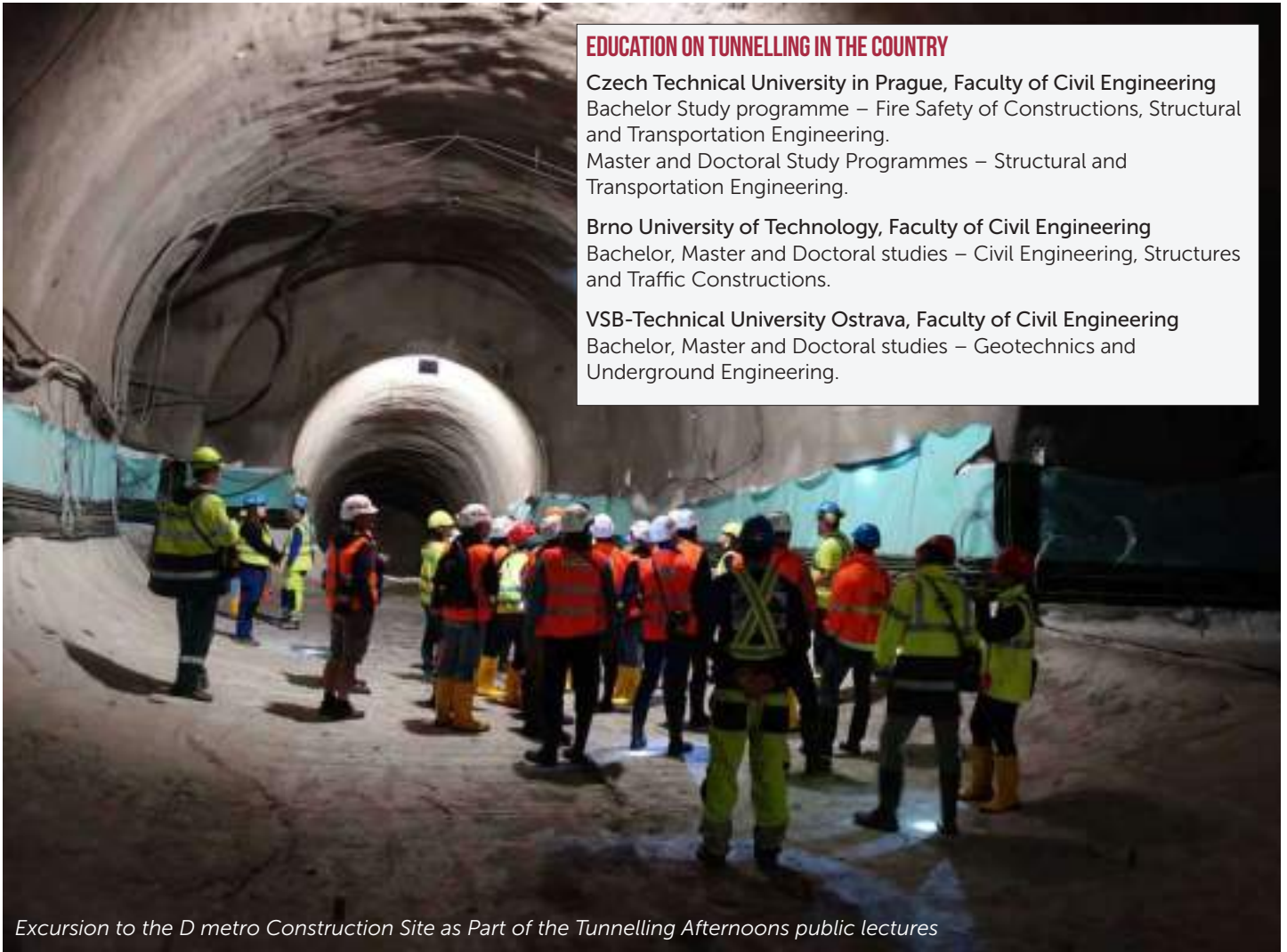
- 1) Publishing of the "Tunel" journal
- 2) Organising public lectures "Tunnelling afternoons", with the topics:
  - Conventional excavations – revision of current knowledge in design and

realisation

- Metro D – New Line of Prague Metro
  - Exploratory galleries
  - Preparation of the Completion of the Prague City Ring Road
- 3) We have started preparing the 16th International Conference UC Prague 2026
- The conference UC Prague 2026 will be held on 24th – 27th May 2026 in Prague

## STATISTICS

1. Length or volume excavated - % mechanized / % conventional during 2023: 1142m; 76,575m<sup>3</sup> / 100 % conventional
2. List of tunnels completed: Brno, Svatka river – flood control measures. Prague Bubny – sewerage tunnel
3. List of tunnels under construction: Prague – Metro D. Prague Milešovská street, Brno Sportovní and Dřevařská street – sewerage tunnels, sewers



### EDUCATION ON TUNNELLING IN THE COUNTRY

Czech Technical University in Prague, Faculty of Civil Engineering  
Bachelor Study programme – Fire Safety of Constructions, Structural and Transportation Engineering.  
Master and Doctoral Study Programmes – Structural and Transportation Engineering.

Brno University of Technology, Faculty of Civil Engineering  
Bachelor, Master and Doctoral studies – Civil Engineering, Structures and Traffic Constructions.

VSB-Technical University Ostrava, Faculty of Civil Engineering  
Bachelor, Master and Doctoral studies – Geotechnics and Underground Engineering.

Excursion to the D metro Construction Site as Part of the Tunnelling Afternoons public lectures

## FINLAND



Name of Association: Finnish Tunnelling Association – MTR - FTA  
Type of Structure: Non-profit, independent association, founded 1974  
Number of Members: 220 Individual Associate Members, 26 Corporate Affiliate Members

### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Nomination of the Finnish Young Tunneller 2023-2024
- Annual Meeting on 13th April 2023
- Seminar on Underground rock facilities - preparation and security of maintenance
- Activities of the Young Member Group
- BoD meetings six times during 2023
- Participation in the work of FISE Qualification of Professionals in Building, HVAC and Real Estate Sector in Finland

### NEWLY COMPLETED PROJECTS

#### Jokeri Light Rail

- The Jokeri Light Rail line 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
- A 400m long tunnel was excavated during 2021 as well as large open rock excavations
- Construction works started in 2019 and the line was placed into operation in October 2023
- The length of the line is approximately 25km (15.5 miles), with 33 stops.

- More info: <https://raidejokeri.info/english/>

### CURRENT TUNNELLING ACTIVITIES

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

- The underground treatment plant will process wastewater for up to 420,000 residents (2040)
- Budget €346M, largest single environmental investment in the Tampere region
- Started in 2018 and will be commenced in 2025/2026
- More info: <https://www.keskuspuhdistamo.fi/>

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

- The final disposal facility consists of two sections:
  - The above ground encapsulation plant, where spent nuclear fuel is received, dried and packed into final disposal canisters
  - The repository locate deep (450m)

inside the bedrock, the most important section is 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<sup>3</sup>m
- 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
- Final disposal starts in the mid 2020's
- More info: Posiva

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

- Two parallel tunnels with a length of 800m and an excavation volume of 270,000m<sup>3</sup>
- The start of the bypass tunnel (20m) in Sörnäinen was excavated in 2023
- An 800m tunnel is waiting for City decision
- Estimated cost of €160M
- Construction estimated for 2023-2029

### Savilahti Underground Sport and Event Center, Kuopio (under construction)

- Re-use of an old underground military depot built 80 years ago
- New, modern facility to serve as an event center for 2,500 people and also as an air-raid shelter for 7,000 people
- Construction period 2021-2024

### Art Cave Saimaa Retretti (under construction)

- Reconstruction and additional spaces
- The new Centre of Art and Culture will be built from 2021-25

### Underground Parking Hall in Keilaniemi, Espoo (under construction)

- Excavation volume of 330,000m<sup>3</sup>
- Underground parking for 1,900 cars
- Construction from 2022-2027

### Underground Parking Hall and other underground facilities for Laakso hospital, Helsinki (under construction)

- Underground parking for 550 cars
- Construction from 2023-2030

### Underground swimming pool and spa in Lempäälä, (under construction)

- Construction from 2023-2024

### Eiranranta heat pump plant (Helen, Helsinki)

- The size of the heat pump plant is about 55,000m<sup>3</sup>
- For the production of carbon-neutral district heating (93MW) and district cooling (60MW)



Savilahti Underground Sport and Event Center. Photo credit: Vicente Serra

- Construction from 1/2023-11/2025

### Teollisuuskatu Waste Water Tunnel, Helsinki (under construction)

- Improve wastewater and storm water handling in Helsinki
- Length 330m
- Construction between 2023-2024

### FUTURE TUNNELLING ACTIVITIES

#### Seasonal Heat Storage, Vantaa

- VECTES (Vantaa Energy Cavern Thermal Energy Storage) is a seasonal energy storage project, which enables the harnessing of the warmth of summer for the cold winter. The facility will be the world's largest thermal energy storage cavern at 1,000,000m<sup>3</sup> in size. It will have a storage capacity of 90GWh of energy – the annual heat consumption of a medium-sized town
- Schedule open
- More info: <https://www.vantaanenergia.fi/en/fossil-free-2026/worlds-largest-cavern-thermal-energy-storage-to-be-built-in-vantaa/>

#### Garden Helsinki

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

### Underground Parking Hall, Mechelininkadun Campus, Helsinki

- Excavation volume of 60,000m<sup>3</sup>
- Underground parking for 350 cars
- Construction schedule open

### West Harbour Tunnel, Helsinki (planning)

- Estimated cost of €290M
- The city council of Helsinki made a positive in-principle decision in Feb 2021
- Planning stage 2025-2027
- Construction schedule open

### Esplanadi Waste Water Tunnel, Helsinki (planning):

- Improve wastewater and storm water handling in Helsinki
- Length 1km
- Estimated cost of €5M
- Construction estimated 2025-2027

### West Railway (planning):

- High-speed railway connection between Helsinki and Turku
- Partly following a current track, partly new route
- Multiple tunnels with a total length of over 14km
- Construction estimated 2026-2033
- More info: <https://lansirata.fi/en/>

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

- 18km of new railway between Lahdenperä and Jämsä
- 4.5km length of railway tunnel
- Construction estimated 2035-2040
- More info: Lahdenperä–Jämsä rataoikaisu ja kaksoisraide - Väylävirasto ([vayla.fi](http://vayla.fi))

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

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



Art Cave Saimaa Retretti

### City Rail Loop Pissararata, Helsinki (awaiting decision):

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

### Airport line (planning):

- 30km of new railway line from Helsinki through Helsinki Airport to Kerava along the main line
- 28km length in railway tunnel
- Schedule open
- More info: <https://suomirata.fi/lentorata/>

### STATISTICS

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

- Area  $2,145,081\text{m}^2 = 2,145 \text{ km}^2$
- Volume  $13,100,000\text{m}^3$ 
  - UG spaces 336
  - Helsinki's surface area  $215,12\text{km}^2$
  - $1\text{m}^2$  UG space for each  $100\text{m}^2$  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.



Tampere Region Central Wastewater Treatment Plant Sulkavuori

### 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 of Association:** French Tunnelling and Underground Space Association (AFTES)

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

**Number of Members:** 1004 members (including 126 corporate members and 129 young members and students)

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

### Tunnels and Underground Space Magazine (TES)

- TES 283: Materials, equipment and products
- TES 284: Long and deep tunnels
- TES 284bis: Special AFTES congress –  
- The underground at the heart of transitions
- TES 285: Doctoral research in the field of tunnels and underground works
- TES 286: Presentation of current main projects (EOLE ITA Award; Lyon-Turin; Grand Paris Express)

### Technical Committee

- 22 working groups (WGs) in operation.
- 4 recommendations in English finalized and approved in 2023:
  - WG 24: Geological, Hydrogeological and Geotechnical Investigations required for the Design of Underground Structures
  - WG 4: Functional diagram of TBMs.
  - WG 4: TBM data sheets – new case studies
  - WG 27: Mechanical ventilation for underground structures during construction and rehabilitation

All the documents and guidelines are available on the AFTES website

### Materials, equipment and products committee

- Regular technical committee meetings and visits
- Advancement of the elaboration of a technical showcase for manufacturers
- Representation of AFTES in WTC Athens in 2023
- Contribution for an issue of the magazine dedicated to materials, equipment and products

### Underground Space Committee

- Preparation for the Underground Space session held during the 2023 AFTES Congress

- Valorisation of the synthesis of the national research project Ville 10D

### Education Committee

- Creation of a steering group (with owners, engineering companies, contractors and professors) to support the actions of the committee around the themes of training and research in the underground field
- Preparation and organization of sessions dedicated to young people at the AFTES 2023 congress
- Presentation and promotion of underground engineering careers to young people
- Organization of continuing education sessions
- Preparation of a special issue of TES dedicated to doctoral research (n°285)

### Youth Members Committee

- Events throughout the year, including technical evenings and site visits
- With the Education Committee, presentation and promotion of underground engineering careers to young people

### Congress AFTES 2023 Paris

- Organisation of the 2023 congress in Paris from 2 to 4 October 2023 at the "Palais des Congrès de la Porte Maillot"  
Topic: The underground at the heart of transitions  
(Final results: 2957 participants; 40 countries; 148 exhibitors; 19 presentation sessions; 70 oral presentations; one training session with 50 participants)

### EUTF – European Underground and Tunnel Forum

- EUTF Forum meetings held in Athens (May 2023) and Paris (October 2023)
- Contribution to the meeting on ITA strategy and functioning
- Specific actions on BIM, rehabilitation of the underground infrastructure heritage and standardization

- Coordination of the European participations in the ITA working groups

### Involvement in AITES/ITA

- Participation of AFTES members in ITA Working Groups and Committees
- Contributions to the ITA reflexions about strategy and WG organisation
- Participation in the organization of ITACET training programs
- Organization with ITACET of a training session during 2023 AFTES congress

### CURRENT TUNNELLING ACTIVITIES

#### Grand Paris Express and Line 14

- 200km of new metro lines (mostly underground lines) – 68 new stations – €35bn
- Since the start of the underground works, 24 TBMs have been launched. In early 2024, three of them are active on lines 16, 17 and 18

#### EOLE- Paris East-West express railway link

- 55km including 47km of renovated existing line and 8km of new line – two new stations – €1.8bn
- In 2023: Finishes and equipment, Final Testing - Opening to operation – planned mid 2024
- Winner of the Major Project of the Year, ITA Awards 2023

#### Toulouse 3rd Metro Line

- 27km - 21 stations – Tender phase in 2022
- 22km underground – five TBM will be in operation
- Commissioning in 2028-2029

#### Lyon - Turin Highspeed railway link (International Tunnel TELT)

- Cross-border section, with a 2 x 57km base tunnel and two international open-air stations at each end, all under TELT project management
- Access on the France side, under study by SNCF, and access on the Italy side, under study by RFI.
- Cross-border section divided geographically into 12 "operational sites", with approximately 45 works contracts and 36 engineering contracts; the main drive lots have already been awarded
- In 2023 – Preparatory works for the main tunnel lots – Excavation of the Avrieux deep shafts

steel fiber reinforced concrete



Dramix®

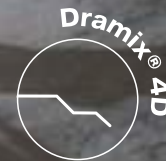
## The future of reinforced low carbon linings

Sustainable & durable solutions

Safely saves concrete, steel & time

EPD certified

© Image by Crossrail



# INNOVATIVE TUNNEL ENGINEERING

TUNNEL DESIGN | GEOTECHNICAL ENGINEERING | CONSTRUCTION MANAGEMENT  
INSTRUMENTATION & MONITORING | WATERPROOFING & WATER CONTROL  
TUNNEL REHABILITATION | MINING SUPPORT SERVICES

[www.dr-sauer.com](http://www.dr-sauer.com)

Salzburg | London | Washington | Toronto | Tel Aviv



# GERMANY



**Name of Association:** 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 and 129 young members and students)

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

### Activities

- STUVA Conference 2023, separate segments on “Tunnelling” and “Tunnel Operation”, attended by more than 4300 participants and 192 exhibitors, 8th – 10th November 2023, Munich
- DACH-meeting (German, Austrian, Swiss Tunnelling Committees) in Switzerland (technical seminar and site visit)
- Meetings of the European Underground and Tunnel Forum (EUTF, consisting of Austria, Belgium, France, Germany, Italy, Netherlands, Portugal, Spain and Switzerland)
- Regular Meetings of Tunnel Committee and Working Groups
- Several Meetings with Workshops of Young Engineering Professionals “STUVA-YEP”
- Workshop “Injections in civil engineering 2.0”

### 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
- Digitalization and Building Information Modelling (BIM) in tunnelling
- Standardization needs for the design of underground structures
- Emergency management for accident, fire and special risks
- Measures to reduce hazardous substances in the air
- Working in compressed air

- Risk management in tunnelling
- Recycling/disposal of excavated material
- Sustainability in Tunnelling

### Publications (recently finished)

- Recommendation BIM in Tunnelling, Model requirements Part 3 “Ground model”
- Recommendation BIM in Tunnelling, Model requirements Part 5 “Allowance of tolerances and superelevation”
- Mission Statement: Sustainability in Underground Construction; Basics, Boundary Conditions and Objectives
- Recommendations for the determination of life cycle costs for tunnels

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

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

### Future Activities

- Regular meetings with Austrian, Swiss and EUTF colleagues
- Munich Tunnel Symposium, 5th July 2024
- InnoTrans, Tunnel Forum, 24th – 27th September 2024, Leading international trade fair for transport technology
- Sealing of buildings by injections; Information on after-sealing of concrete structures, geotechnical

sealing injections, 6th – 7th November 2024

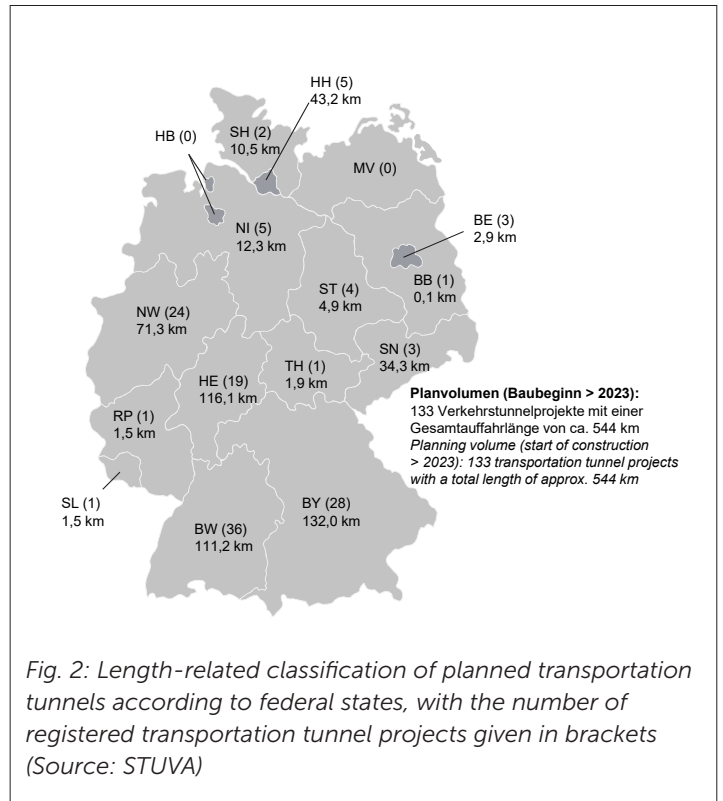
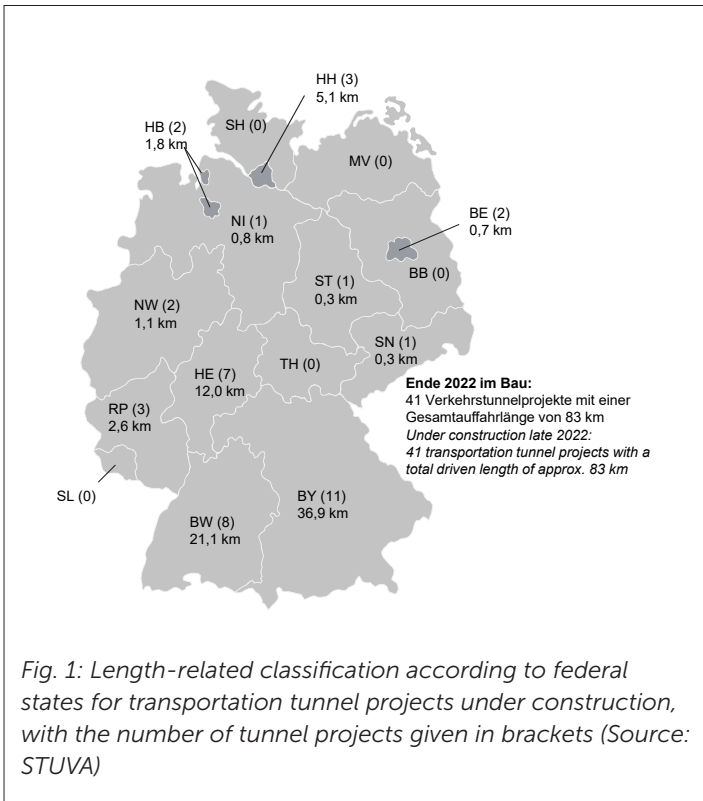
- STUVA-Conference 2025, Separate Segments on “Tunnelling” and “Tunnel Operation”, 25th – 27th November 2025, Hamburg

## CURRENT TUNNELLING ACTIVITIES

About 88km of traffic tunnels were under construction in Germany in 2023.

- This year, tunnelling activities relating to inner-urban rail tunnelling roughly remained at the previous year’s level of 38km. The main activities once again are taking place in Munich, where some 27km of light rail and metro tunnels were under construction at the turn of 2022/23. It should be noted that preparatory construction work is still in progress on the Second Core S-Bahn line and that the main tunnelling work was yet to begin at the time of the survey. This is followed by Stuttgart (3km) and Hamburg (2.6km). Further tunnel projects, each less than 2.5km long, are under construction in Nuremberg, Frankfurt and Düsseldorf. The length-related proportion of trenchless construction methods with regard to inner-urban rail tunnelling amounted to 28.8km at the end of 2022, accounting for about 76% of the total national construction volume for inner-urban rail tunnelling. Of this total, a good 11% was accounted for by shotcreting methods and roughly 65% by shield driving.
- Construction activity relating to main-line rail tunnels is limited to a few ongoing construction sites (a total of just under 15km of tunnelling) in the federal state of Baden-Württemberg. Of the total 56km of tunnels in the major project “Stuttgart 21 rail hub”, a good 5km were still under construction at the time of the survey. A further 8km of main-line tunnels are currently under construction as part of the Karlsruhe–Basel main-line. Currently, 23% of the main-line tunnels are being built using the classic shotcrete construction method, while TBMs are being used for 52% of the excavation volume.
- The drive-up length in road tunnel construction in 2022/23 was approx. 31km throughout Germany. 85% of the road tunnel construction volume takes place in three of





16 federal states: Bavaria, Baden-Württemberg and Hesse. About 71% of all road tunnels are built by trenchless methods. The shotcrete method predominates in the majority of those tunnelling projects.

### FUTURE TUNNELLING ACTIVITIES

About 544km of traffic tunnels were projected but not yet started in 2023.

- A slight decrease in the planning volume compared to the previous year can be observed for metro, light rail and rapid transit tunnels due to contract award effects. Among the listed projects, Hamburg takes the lead with a good 38km of planned tunnelling, ahead of Munich with about 24km. Leipzig is engaged in pre-planning 7km and Frankfurt is planning around 6km of tunnels for regional transport. Further tunnelling activities involving less than 3km are foreseen in the cities of Cologne, Berlin, Dortmund and Stuttgart.
- The planned volume of main-line rail tunnels increases significantly in comparison to the previous year. The planned tunnel drives with a total length of just over 316km (previous year: about 209km) relate to a total of 14 new and upgraded main-line routes. Around 55km (18%) of the planning volume is accounted for by the newly planned routes ABS 36 ("Brenner Tunnel northern junction")



Munich's 2nd Core S-Bahn – Excavation work on level –2 at the Central Main Station construction site (Source: DB InfraGo AG/panterra.tv)

and ABS/NBS Fulda–Gerstungen. The ABS/NBS Hanover–Bielefeld and the NBS Frankfurt–Mannheim, each with around 45km of planned drives, each account for around 14% of the total planning volume.

- Compared to the previous year, the planned volume of projected road tunnels (145km) has increased significantly – on account of the German state's revamped planning requirements, the scheduled volume had already dipped considerably in previous years.

### STATISTICS

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

### EDUCATION ON TUNNELLING IN THE COUNTRY

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



# GREECE

**Name of Association:** Greek Tunnelling Society (GTS)

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

**Number of Members:** 250 members, 18 corporate members



## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The Council Board executed numerous meetings – physically and virtually - for running GTS activities.

The most significant event for GTS was the organization of the WORLD TUNNEL CONGRESS 2023 and the 49th ITA GENERAL ASSEMBLY in Athens, 12th -18th May 2023 - the biggest technical congress ever held in Greece. The Congress theme was “Expanding Underground - Knowledge and Passion to Make a Positive Impact on the World” held at the Megaron Int’l Conference Centre.

During the Opening Ceremony, the work of the late Prof. P. Marinos was celebrated, Dr. M. Panet gave the Muir-Wood lecture entitled “The Tunnel behavior at the face of excavation” while the keynote lecture “Seismic design and risk assessment of tunnels and underground structures” was presented by Prof. K. Pitilakis. Prof. Lord R. Mair coordinated the round-table discussion “Underground Space for Mobility: Frontier/Emerging Technologies.”

The number of attendees was 2,100 from 66 countries, 20% of whom were students and ITA young members. We welcomed the Pakistan Tunnelling & Trenchless Society as a new ITA member. The scientific program included 412

papers from 44 countries, 153 oral and 259 e-posters, while authors numbered 1,221. The Congress proceedings were published by CRC Press, Balkema-Taylor Francis group, and are open-access for the first time in WTC history.

There were special sessions “Women in Tunnelling – Picture an underground expert: paving the road to diversity” organized by the women’s group and “Holistic view of road tunnel safety and risks: composing all factors and perspectives for sustainable projects in difficult times” organised by COSUF. A special off-site event was organized at Lavrion concerning ancient mining and tunnelling works.

The Technical Exhibition with 120 companies’ booths manned by 400 personnel covered almost all the entire Megaron Conference Centre as demand was high.

On the last day (18th May) the Technical Visits program took some 250 attendees to five interesting underground work sites, mining and operations activities, specifically Athens Metro Line 4, the Greek Railway underground corridor, the mined exploitation of Pentelikon marble, and the Hellinikon Project underground coastal road and Metro Operations Control Centre. Two athletics events completed the WTC2023 program; the

Symbolic Marathon; and the Cricket Competition in honour of the latest ITA member Pakistan.

Sponsors totaled 40 companies, both international and local.

During the 49th ITA Gen. Assembly, among the regular issues discussed, was the voting for the 2026 WTC host city where Montreal, Canada was elected. The G.T.S. was honored to have its B.o.D. member and WTC2023 Organizing Committee Chairman Mr. I. Fikiris elected as ITA Vice-President.

The ITA Working Groups, 14 in total with over 100 members, met in person, discussing various important subjects and presented the new technical reports from WGs 11, 17, 20 and ITAtech Group Excavation.

Before the Congress opening, a 2-day seminar on ‘Risk Management in Tunnelling and Sustainable Underground Solutions’ was organized by the ITACET foundation from 12th – 13th May emphasizing young engineers’ education.

In Sept. 2023, GTS published a special issue of its magazine (this year in a physical edition too) focussing on WTC2023 along with the regular recent news, new underground projects in Greece and globally, and other interesting technical publications etc.

On Saint Barbara’s Day (4-12-2024), we organized a worksite visit to the TBM Start Shaft “Veikou” on the Athens Metro Line 4 Project. Numerous GTS members and friends employed in the tunneling field took part and were enlightened on the design and construction of the project.

GTS took part in the 9th Greek Geotechnical Conference held from 4-6/10/2023 at the West Attica University Conf. Centre as a Gold Sponsor with an exhibition booth.



## CURRENT TUNNELLING ACTIVITIES

### Athens Metro - New Line 4 - Section A "Alsos Veikoy – Goudi"

Works for the new Athens Metro Line 4, first section, are continuing. The €15bn, 96 month Design & Built Contract for the 13km long, fully automated Metro Line with 15 stations within the city of Athens was signed in 2021. The Project includes tunnelling works by two TBMs, underground stations, station fit-out, ventilation shafts, mechanical and electrical systems, rail infrastructure and systems, underground train maintenance and washing plant, rolling stock light maintenance facilities and a new central control building.

It is the biggest public project currently executed in Greece. It is foreseen this Metro section will serve 341,000 passengers on a daily basis in 2030.

Preparatory works are in progress at certain worksites including archaeological investigation, utilities diversions, etc.

Construction of retaining structures and excavation works have started at a number of Stations and Ventilation Shafts. Regarding the two TBMs, the first one completed the initial tunnel section while the second is about to start boring from its start shaft.

### Thessaloniki METRO

The first Metro Line for the second largest city in Greece, Thessaloniki, is almost ready to commence operation during the 2nd semester of 2024. The project includes 18 underground stations, some 14.4km of tunnelling and a 50,000m<sup>2</sup> depot area. There will be 18 fully automatic driverless and air-conditioned trains, as well as automatic Platform Screen Doors in each station for improved passenger service and safety. Civil, trackwork and E/M works on the twin single-track tunnels are complete. All but one of the stations are also complete and equipped. Only at Venizelou Station which was delayed due to archaeological findings, are the architectural and E/M works under way. Trains are currently running along the line and all systems are under test operation.

It is expected that the daily ridership will rise to 313,000 passengers. As a result, street traffic will be reduced by 57,000 vehicles/day and CO<sub>2</sub> emissions by 212 tons/day. Venizelos Station will become an open museum that will display the ancient history of the city.

The operation and maintenance of the



Thessaloniki Metro System will be on a public-private-partnership (PPP) basis. The contract was awarded in October 2023 for a period of 12 years with total cost €292M.

### Underground Section of Coastal Road at Hellinikon area, Athens

The project budget is approx. €80M for the under-grounding of the existing coastal road (Poseidonos Street) over a length of 3km in cut & cover tunnel that will host two traffic directions of three lanes each. This is part of the "The Ellinikon", near the former Athens airport, which is Europe's greatest urban regeneration project. Construction works are almost half-way with completion scheduled for 2025.

### Central Greece Motorway (E65) – Othris Tunnel at Lamia – Xyniada Section

The construction of the Othris Tunnel is part of the south section of the Central Greece Motorway (E65) project, between Lamia and Xyniada. It includes a twin tunnel of approx. 3km. Civil and E/M works for the tunnel are 99.5% complete. Boring of the tunnel was challenging, within geologically adverse ground and lasted for more than two years.

### Underground Section of The National Railway Line, Athens

The Greek Public Railway Construction Company (ERGOSE) assigned the construction of a 4-track rail corridor in 2018. At 2.36km long, approx. with 1.9km fully underground, the project starts at the Athens Central Railway Station. This section will connect to the new four-track rail corridor recently completed and opened to traffic. The rail corridor runs mostly within the occupation zone of the surface train tracks. Half of the corridor will serve suburban trains, whereas the rest will be used mainly for intercity services.

Project constrains include maintaining the surface train operations, safe construction close to adjacent buildings, and a close overpassing of a Metro running tunnel and a Water Authority culvert. Therefore, modern instrumented monitoring is implemented. Works are in full progress and the whole project is expected to be delivered in 2026.

### Klissoura Tunnel in the Provincial Road Kastoria - Ptolemaida, Macedonia

The contract for the "Construction of Provincial Road Kastoria - Ptolemaida" project, in Macedonia, Northern Greece, was signed in 2022. Construction of the new 10.4km road includes the Klissoura Tunnel. The tunnel will be 1,365m long and host traffic in both directions and will include an emergency gallery 1,383m long. The tunnel runs through mountainous terrain and drilling has started using controlled explosions that open about 1.5m length per round. The project schedule is 3 years with a total cost approx. €70M. EGNATIA ODOS is the owner.

## FUTURE TUNNELLING ACTIVITIES

### New Athens Metro Line 2 Extension to Ilion

The first phase of the Tender process (Call for Interest) was released in 2023 and four bidders submitted their financial and legal documents. The 2nd phase of the Tender is expected by the end of 2024. This extension of the existing Line 2, from Anthoupoli Station to the Ilion district is being designed in-house by the Metro Project authority ELLINIKO METRO S.A. The double-track tunnel will be approx. 4km long with three underground stations, six shafts and will include both civil and electromechanical works. The estimated cost is €550M and the construction time five years.

### Kimis Road Extension to Athens – Thessaloniki National Highway

The project includes the 1.26km long double tube urban tunnel and a 1.16km long cut & cover tunnel that will connect Attiki Odos (highway) with Athens - Thessaloniki National Highway. The cost will be approx. €350M and the estimated construction period four years.

### Underwater road link Salamina - Perama in Attica region

Three consortia have filed bids for this project that concerns the design, construction, financing, operation, maintenance of an approx. 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 is at the approval phase and following that the tendering process is expected to be finalized. The cost will be approx. €500M and the estimated construction period four years.

### Northern Road Axis of Crete island

A concession project concerning the design, construction, financing, operation, maintenance of an approx. 200km long motorway which includes a significant number of tunnels (i.e. i) Souda - Kalyves section: a 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 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 tenders: 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 €360M for the PPP project.

### Urban tunnels in the Metropolitan area of Athens

The implementation of the Athens Metropolitan Area Master Plan requires some new road tunnels, which include: i) the 3km long Ilioupolis urban tunnel with three traffic lanes per direction which is presently at the design phase, and ii) the 2km long motorway tunnel that will connect Attiki Odos (highway) and Rafina port.

### Underwater road link to connect Lefkada island to the mainland

To connect Lefkada island to the mainland national highways, an underwater tunnel crossing the existing sea strait has been planned. In 2023, the Ministry of Infrastructure & Transport decided to run a tender for the selection of a Technical Advisor who will support the preparation of a PPP Tender for the 'Design, Construction, Funding, Operation and Maintenance' of an underwater connection of Lefkada island to the mainland.

### Thessaloniki METRO line extension

The Thessaloniki METRO line extension to the north-west of the city that will serve six municipalities and include nine new underground stations is currently in the first design phase.

### Bralos-Amfissa Road Tunnel

This tunnel will be part of a new 24km long road on the Lamia-Itea axis. The project was awarded in Feb. 2023 with a budget of €290M approx.

### STATISTICS

1. Length or volume excavated - % mechanized / % conventional during 2023: 1500m - 5% / 95%
2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023: €500M
3. List of tunnels completed: Thessaloniki METRO, Central Greece Motorway (E65) Orthris Tunnel, totalling approximately 3km.
4. List of tunnels under construction: Athens METRO Line 4, underground railway corridor in the Athens area, underground section of Coastal Road at Hellinikon area, Athens.

### 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 of Association:** Hungarian Tunnelling Association  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 56 individual and 17 corporate members



### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The association board had four meetings. Three professional meetings were organized on the following subjects:

1. "50 years practice in the field of tunnelling", Mr. Gusztav Klados lectured on his practice and case studies in tunnelling. Our society granted the Medallion for Tunnelling to Mr. Klados. Participants - 47
2. Earthquake effects on underground

- structures. Number of lecturers 5, participants - 34
3. At the end of the year the St. Barbara social evening was organized. Participants - 35

### CURRENT TUNNELLING ACTIVITIES

Tunnelling activities in progress:

- Expressway M85 Sopron bypass, twin tunnels under Bécsi hill. Both tunnels are nearly finished. Excavation and primary lining completed in February,

with final lining complete in December 2023. Finishing and installation works are ongoing. Each road tunnel started in 2020. The opening will be at the end of this year.

- Reconstruction is on-going at the M3 metro line. Most of the reconstruction is finished.

### FUTURE TUNNELLING ACTIVITIES

#### Tunnel-chain on expressway M100

The M100 expressway will be built to offer a transport alternative towards the capital, and may even replace the environmentally sensitive sector of the M0 North-West (main road No 11 - main road No 1), which currently has no definitive route. The M100 expressway is a 32.3km long 2 x 2 lane expressway with no stopping lanes. Due to the complexity of the project and the topography of the site, special technical solutions

characterize the entire expressway. Its hilly nature ensures the complexity of the route, which includes three pairs of tunnels with a total length of 2 x 1km and five huge valley bridges with a total length of 2 x 2.3km.

### Bátaapáti - Expansion of the underground storage area for radioactive waste

The construction of two additional storage chambers in the western area of the chamber field will be tendered this year, which, together with the four storage chambers built so far, will ensure the safe storage of low and intermediate level radioactive waste.

The storage chambers will be located in the monzogranite rocks of the Móranyi Granite Complex, about 270m below the surface. The previously built chambers have a cross-sectional area of 96 -114.9m<sup>2</sup>, a width of 11.9m - 12.06m, a height of 9.98m - 11.2m and a length of 78.3m - 115m. The new chambers have a cross-sectional area of 133.8m<sup>2</sup>, a width of 13.7m, a height of 11.6m and a length of 131.1m - 144.3m. The chambers were built or will be built in rock classes II, III and IV according to the RMR (Rock Mass Rating) classification.

### EDUCATION ON TUNNELLING IN THE COUNTRY

Miskolc University - a new civil

engineering BSC course will start, one of the main subjects will be tunnel construction and its site management

**Budapest University of Technology and Economics**, Faculty of Civil Engineering - University of Győr, Faculty of Civil Engineering

### STATISTICS

- List of tunnels completed: Ventilation cross-passage for the M4 metro line, 20m long conventional
- List of tunnels under construction: Expressway M85 Sopron bypass, twin tunnels under Bécsi hill. Final lining and finishing works

## ICELAND

Name of Association: Icelandic Tunnelling Society

Type of Structure: Non-profit, open association. Independent Society of corporate and ordinary members, founded 1974

Number of Members: 56 members, 16 corporate members.



### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Three board meetings and one general meeting for 2023
- Annual general assembly took place in November with invited speakers
- The conference, NROCK2023, was held in Reykjavik together with the Icelandic Geotechnical Society. The number of Icelandic and foreign speakers was fourteen, with small working groups discussing special topics

### CURRENT TUNNELLING ACTIVITIES

There is currently no tunnelling activity in Iceland.

### FUTURE TUNNELLING ACTIVITIES

Fjarðarheidi road tunnel (Point 1 on map below), a 13.5km long, 67m<sup>2</sup>, road tunnel in east Iceland. The road tunnel will replace a mountain road between Seydisfjord village on the fjord side to the larger inland community of Egilsstaðir. The existing mountain road peaks over 600m a.s.l. and can be dangerous to pass for several days in winter due to icy road conditions and sudden snowstorms. The tunnel will ease travel for locals and tourists alike. Pre-design is finished and

an Environmental Impact Assessment is ongoing. The tender design is ongoing with tendering planned for fall 2024 and a start in 2025.

The Icelandic Road administration is preparing and designing three tunnelling projects in the Reykjavik area. These are the Sæbraut tunnel (a 1km long cut and cover concrete tunnel), the Miklabraut tunnel (a 1.3km concrete tunnel or 2.4km long hard rock tunnel) and the Setbergshamar tunnel.

More road tunnels are in the planning

phases. The Icelandic government is preparing a plan for the construction of new road tunnels where 12+ new tunnels will be built in the next 30 years.

### Hvammur 95MW hydro power plant

The National Power Company is preparing tender documents for the Hvammur 95MW hydro power plant, including excavation of a 300m long, 45m<sup>2</sup> cross-section access tunnel and 1.2km long, 180m<sup>2</sup> tailrace tunnel, to be excavated in two sections (gallery and bench – drill & blast).



Fjarðarheiðargöng (tunnel). Iceland's longest road tunnel is under planning. Shown is the western entrance on this 13.3km long tunnel.

# Albatross Engineering GmbH

The supplier specialist for the construction industry



**The company**, which was founded 28 years ago by Ing. J. Pichler and Ing. W. Ströbitzer, started its success story as an engineering office. Right from the start, we have always specialized in special solutions for the construction industry. In 1997, the development and sale of truck wheel washing systems and, at the same time, the production of special cable winches began.

Truck tire washing systems are used on large construction sites, landfills, and gravel works, with the range of services ranging from stationery to fully mobile, fully automatic systems.

In the special machine construction division, special cable winches and pipe access systems are developed, which are used in the revitalization and new construction of pumped storage power plants. Another field of activity is jig construction for the aircraft industry.

A highlight in the company's history was the move in 2010 to the new company premises



with an area of 10,000m<sup>2</sup>. A 1500m<sup>2</sup> assembly hall and a 400m<sup>2</sup> administration building offer all the options that a modern company needs.

Albatross is considered a reliable partner and is known for customer-specific solutions.

4175 Herzogsdorf, Rohrbacherstrasse 6, Austria.  
Tel: +43 (0) 7232 34 552 [www.alba.at](http://www.alba.at)



## Elevated thinking, underground

### We are Global Leaders in

- Geotechnics
- Conventional & TBM Tunnel Design
- Tunnel Construction Management
- Tunnel Rehabilitation & Upgrade Programmes
- Ground Investigation & Ground Treatment
- Tunnel Waterproofing
- Building Information Modelling (BIM)

We are proud to have successfully completed over 550km of international tunnelling projects.



**Gall Zeidler Consultants**  
Geotechnics | Tunnel Design | Engineering

London · Washington DC · New York · San Francisco · Toronto  
Salzburg · Santiago de Chile · New Delhi · Singapore



Main picture courtesy of Riverlinx

# INDIA



**Name of Association:** Tunnelling Association of India  
**Type of Structure:** Non-profit, open association  
**Number of Members:** 600

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- TAI organized the biennial event in Mumbai which was attended by the ITA President online. The event was well attended by the about 300 tunnel and underground professionals from Clients, consultants, academia, contractors, manufacturers and suppliers
- Tunnelling Asia Conference – Underground The Need of the Day, 27th - 28th June 2022, Mumbai
- 3rd Edition of TAI-Tunnelling and Underground Space Awards 2022
- Workshop on Observational Approach in Tunnelling: Evolvement, Issues and Challenges, 24th – 25th June, 2022, Mumbai
- TAIYM Annual Conference - Underground Space: Challenges & Opportunities, 28th June, 2022, Mumbai

## Workshops and International conferences

- Workshop on Best Practices for Safe Cross Passage - Investigation, Design and Construction, 27th – 28th April 2023, New Delhi
- International Conference on EPC Contract Management – Challenges and Issues, December/January 2024
- International Conference on Tunnelling for Infrastructure Projects – Challenges and Issues, February 2024, Rishikesh/Guwahati
- Tunnelling Asia 2023 Biennial Conference - Theme: Climate Change Resilience and Sustainability in Tunnelling and Underground Space, November 2023, Goa
- TAI Awards – Distribution in Tunnelling Asia conference
- Hosting of ITA Award Function

## Publications

### TAI Young Member Group

Publications:

- Preparation of Manual and Guidelines
- TAI journal – 2 Nos. (Half yearly)

TAI Publications:

- Guidelines for Precast Fibre Reinforced Shotcrete Segment
- Guidelines for Geo-physical Investigations for Tunnels
- Manual on Underground Works Proceedings of the Workshops
- Observational approach in tunnelling: evolvement, Issues and Challenges
- Tunnel Design and Construction: Issues & Challenges
- Innovation in Tunnelling Technologies
- Risk management in Tunnelling Proceedings of Tunnelling Asia' 2022 Conference

## CURRENT TUNNELLING ACTIVITIES

Large-scale infrastructure projects in India have created significant opportunities in the tunnelling segment. India will invest Rs. 700bn on infrastructure development, which will provide a boost to the country's tunnelling industry as well. There has been a sharp increase in the budgetary outlay for the road (by Rs. 140bn) and railway (by Rs. 100.5bn) sectors. Over Rs. 82bn has been allocated for metro rail projects in the country. There is also a focus on infrastructure development in the north-eastern region, a prime market for the tunnelling industry.

In the past few years, the Indian industry has developed several landmark and strategic tunnel projects. The country's longest rail tunnel, the 11km Pir Panjal Tunnel, and longest road tunnel, the 9.8km Chenani-Nashri Tunnel were put into operation in Jammu & Kashmir. The 8.8km Rohtang Tunnel is the world's longest road tunnel being built at an altitude of 10,000 feet.

The world's longest TBM-driven tunnel without intermediate access – the 43.5km AMR Water Tunnel – is being built in Andhra Pradesh. India's first underwater metro rail tunnel is also being constructed as part of the Kolkata Metro project. Mumbai is building India's biggest urban water tunnel.

Tunnelling methods have also evolved in recent times. TBMs were successfully used for the Hydropower Projects in Jammu & Kashmir for the construction of a 14.6km long tunnel with an impressive monthly tunnelling progress of 816m. DMRC is using the NATM technology for the first time to construct a metro tunnel under the on-going Phase III of the Delhi metro project.

A few projects have faced delays due to long-standing issues. These pertain to geological surprises, weak risk identification and assessment, contractual disputes, old contracting practices, out dated tunnel design practices and construction methods, and inadequate safety mechanisms.

Contractors have started using advanced technologies and methodologies to enhance productivity and ensure timely delivery of projects. In addition, deployment of modern systems for monitoring, lighting, ventilation, safety and security are also being explored.

## North East Frontier Railway

(Construction) is executing a number of new projects to connect the capitals of the North Eastern states. Apart from these, several projects such as gauge conversion and doubling have been undertaken to improve the connectivity and mobility in this area. Since the alignment of these connectivity projects mostly pass through difficult terrain with deep gorges and high hills, construction involves a large number of tunnels. North-east region is geologically one of the most complex formations. The major rock formation consists of sand; silty clay and shale with limestone. The formation in this part is mostly immature and there are several thrust and faults.

Out of 188.6km of tunnelling identified in various sanctioned projects, 12.60km have been commissioned for train operation and another 42km of tunnelling has been completed with track linking shortly.

## Jiribam-Tupul – Imphal New Line

**Project (110.62km):** Out of total 59.5km of tunnelling involved, 42km has been completed. Construction is in full swing to complete the balance of 17.05km. The longest tunnel is between Tupul - Imphal, and is 11.55km.

**Bhairabi - Sairang New Line Project (52.35km) in Mizoram:** There are 23

tunnels with total length of 9.26km, the longest being 1.76km. Of the above, underground excavation and primary support in 5.2km has been completed and the final lining is in progress.

**Dimapur - Kohima New Line Project (88km):** About 30km of tunnelling is involved in this project.

**Barnihat- Shillong New Line Project (108km):** There are 31 tunnels with a total length of 39.06km. The longest tunnel is 4.11km.

**Sevok-Rangpo New Line Project:**

About 38.55km of tunnelling is involved in this project.

With a view to provide an alternative and a reliable transportation system to Jammu & Kashmir, the Gov. of India planned a 326km long railway line joining the Kashmir valley with the Indian Railways network. Jammu-Udhampur-Srinagar- Baramulla Railway line is the toughest project being constructed in mountainous terrain. It passes through the young Himalayas, tectonics thrust and faults. Jammu- Udhampur section (54km) was completed in April 05. Udhampur-Baramulla section i.e USBRL Project (272km) is being executed as a National project.

**Udhampur – Srinagar – Baramulla Rail Link:**

The 326km long USBRL Project involves 38 tunnels (with a combined length of 119km) with the longest being 11.2015km. There are also 927 Bridges ( combined length of 13km).

Out of 326km length from Jammu to Baramulla , 215km have been completed and commissioned (66%) as detailed below:

- Jammu-Udhampur section (54km) commissioned in Apr'05
- Quazigund - Baramulla section (118km) commissioned in phases from 2008 to 2009
- Quazigund – Banihal section (18km) commissioned in June 2013
- Udhampur – Katra section ( 25km) commissioned in July 2014

The balance length of 111km from Katra to Banihal is in progress. This section predominantly involves tunnelling (97km). At present 51km out of 97km of tunnelling and 12 bridges out of 37 have been completed.

**Delhi Metro Phase-IV Project**

The Delhi Metro Rail Corporation (DMRC), is undertaking the mega-expansion of the Delhi Metro Phase-IV to add over 100km of six new metro lines to the existing network, which will connect various parts of Delhi and the surrounding National Capital Region (NCR). The new lines will have a total length of 103.94km, with the addition of 28 new stations to the DMRC network. The Delhi Metro Rail Corporation (DMRC) is making significant progress on Phase-IV of the metro network. This phase comprises a total of 65km, of which 28km will be underground.

The DMRC has already constructed a 10km tunnel while work is ongoing on a 4km tunnel on the Aerocity-Tughlakabad corridor. In the coming months, tunnelling will commence on several other stretches. The underground stations are being constructed using traditional 'cut and cover', whilst TBMs are being employed for the tunnels.

Due to the route's passage through heavily populated areas, the DMRC faces a substantial hurdle in completing the 18 stations it plans to construct on the underground portion of Phase-IV. Throughout the underground work, the structures above the work zones will be continuously observed. A total of 19km of the line's total length will be buried under the Aerocity–Tughlakabad corridor, while 9km will be under the Janakpuri West–RK Ashram Marg sector. By the end of 2025, the DMRC hopes to have finished the Phase-IV project.

**Chennai Metro Rail Project Phase I**

The Metro consist of two corridors approximately 45km in length, with 32 stations of which 19 are underground and 13 elevated. The route within the main city is proposed to be underground with twin tunnels connecting the underground stations whilst the southern section will be constructed on viaducts between the elevated stations. Generally the underground stations have two levels with a concourse above platform level and the tunnels about 12m to 16m below ground level. There will be a total of 37km of tunnels, of which 36km (single tunnel length) will be bored using EPBMs and 1km will be constructed by cut and cover. As part of Phase II, CMRL will be developing an underground network of 80.5km as part of Corridor 3, 4 and 5.

**Mumbai Metro Network**

Plans for the metro network in Mumbai are dynamic and will have the following corridors:

1. Versova-Andheri-Ghatkopar (11km)
  2. Charkop-Bandra-Mankhurd (33km)
  3. Colaba-Bandra-SEEPZ (33.5km) under construction
  4. Charkop - Dahisar (8km)
  5. Wadala-Ghatkopar-Teenhat naka (21km)
  6. SEEPZ-Kanjur Marg (7km)
  7. Andheri(E) - Dahisar(E) (18km)
  8. Andheri - Ghatkopar –Mankhurd (16.5km)
  9. Sewri – Prabhadevi (5km)
- Total: 153km

**Highway Tunnels**

*Zojila Road Tunnel in J&K to Leh:* A 14.1km long single tube road tunnel with two traffic lanes and a parallel egress tunnel (14.2km). The maximum overburden is approx. 660m. The civil construction cost is some Rs 5486 Crore without approaches and the construction period is 7 years.

*Pir-Ki-Gali Tunnel in J&K, NH-244:* The main tunnel length is approx. 8.508km with an egress tunnel length of approx. 8.508 km and a maximum overburden of approx. 660m. The civil construction cost is Rs 4185 Crore and the construction period is 79 months.

*Vailoo Tunnel in J&K:* The length is 8.5km with an approximate cost of 3500 Crore.

*Daranga Tunnel in J&K on NH 244:* 4.5km long.

*Kiratpur-Neharchowk:* 5km  
*Pandoh:* 10km  
*Shimla By-Pass:* 6km

**FUTURE ACTIVITIES**

**Conferences:**

- Tunnelling in Infrastructure development: Issues and Challenges at Guwahati

**Workshop:**

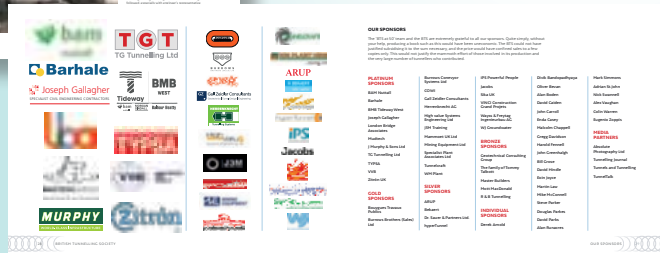
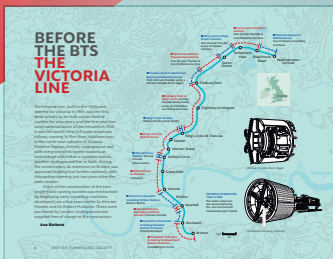
- NATM & TBM Tunnelling including Risk Management
- Health and Safety in Tunnel and Underground Construction

**Software application in Tunnelling Training Programme for Young engineers:**

- Tunnel Design and Construction
- Conventional Tunnelling
- Mechanized Tunnelling
- Sprayed Concrete
- Innovation in Tunnelling Technologies

# Celebrate 50 years of British tunnelling

From Brunel to HS2, discover the fascinating story of tunnels **told by the tunnellers themselves**. Over 200 authors have packed 900 pages full of their most insightful and entertaining anecdotes, photographs and diagrams.



ORDER YOUR COPIES HERE:



Available exclusively through the BTS website. **Orders must be made before 31 May 2024** and will be delivered in September. Reprints are unlikely, so pre-ordering by May will be your **only opportunity** to get hold of this piece of tunnelling history!



# IRAN



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

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

**Number of Members:** 811 individual members, 452 student members, 205 corporate members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Publishing the IRTA internal "Tunnel" Magazine
- Publishing two issues of the bi-annual "Tunnelling and Underground Space Engineering" Journal together with Shahrood Technical University
- Holding the 14th Iranian Tunnelling Conference between 22nd and 25th May entitled "Lessons from past challenges" that included keynote lectures, scientific paper presentations, an exhibition and site visits
- Holding the following 3 workshops:
  1. The challenges of using an EPB machine in deep and highly stressed alluvium
  2. A review of the Konjan Cham long tunnel from a project management point of view
  3. Safety and environmental considerations of the Bazi-Deraz Tunnel
- Holding a scientific meeting entitled "The role of urban underground spaces in sustainable development (Geological and Environmental Issues)" on 18th of December with presentations by national and international experts.

## CURRENT TUNNELLING ACTIVITIES

- Work on the 126km long Tehran-North Freeway which consists of four sections will continue. One section is completed and work in the other three are ongoing. The freeway includes a total of 131 tunnels (in two directions). Several other road tunnels are also under construction in other provinces. During 2023 work on the 2nd section progressed and a total number of 27 tunnels with a length of 18,367m were constructed as part of the highway along with numerous bridges, embankments, etc. It should be noted that approximately 16,947m of tunnel was completed in 2022. The tunnels are constructed using conventional methods.
- Construction of the Niayesh underground parking space with nine levels below ground surface (to the depth of 36m below ground) is being carried out in a property with an approximate area of 5000m<sup>2</sup> by the top-down method. The underground parking space will be able to accommodate 1200 cars and together with two commercial levels will have an area of approximately 51,000m<sup>2</sup>. The construction works are expected to finish in 2025.

- The sewage tunnel for Ahwaz (in the Khouzestan province) is being constructed by Micro-TBM with sizes of 1200mm and 1400mm. The sewage and waste will be transferred from three collectors along the tunnel from the cities of Ahwaz and Karoun. The launch and reception shafts for the equipment are completed. The tunnel will be 11.5km long.
- The following water transfer tunnels are currently under construction:
  1. 2nd section of the Lar-Kalaan Tunnel with a 19km length and 3.8m diameter, constructed using a double shield hard rock TBM
  2. The northern and southern portals of the Safaroud tunnel with a length of 19km and a diameter of 4.5km are being constructed by double shield hard rock TBMs
  3. The Hezar-Masjed tunnel with a length of 8.5km and 3.8m diameter is under construction using mechanized methods
  4. The Kameh tunnel with a length of 1200m and 2.5m diameter is being constructed using drill and blast
  5. The Sabzkouh tunnel with a length of 11km and a diameter of 5.4m is being constructed with a double shield hard rock TBM
  6. The Chamshir tunnel with a length of 7km and a diameter of 5.5m is being constructed using a double shield hard rock TBM

## FUTURE TUNNELLING ACTIVITIES

- The construction of new Metro lines and extension of some existing metro lines in several cities are planned. These include the extension of lines 3, 4, 5,



The single-track Dusse-Alinsky tunnel



The Kerak tunnel

and 6 and the construction of the new line 11 in Tehran. The completion of Metro lines in Tabriz, Isfahan, Shiraz, and Mashhad are also ongoing.

- The work on the Tehran-North Freeway - one of the largest current road projects in Iran - will continue. As already mentioned, the freeway includes a total of 131 tunnels with an approximate length of 143km (in two directions).

- Construction works on the water tunnel projects mentioned above will also continue.

## EDUCATION ON TUNNELLING IN THE COUNTRY

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

- 1) Amirkabir University of Technology;
- 2) Shahrood University of Technology;

- 3) Tarbiat Modares University;
- 4) Urmia University of Technology.

Tunnelling is also taught at Bachelor level in the 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.

## STATISTICS

Statistics of tunnels in Iran during 2023 (values in metres):

State of tunnels	Water conveyance tunnels with average internal diameter of 4m.	Sewerage tunnels with average diameter of 2.5m.	Metro tunnels with average 8.5m diameter for s.t and 5.5m for d.t	Railway tunnels with average 35m <sup>2</sup> cross section	Road tunnels with average 40m <sup>2</sup> cross section and 70m <sup>2</sup> h.w	Total length of tunnels (in metres)
Under operation	349330	650000	370000	210000	450000	2029330
Under construction	90200	25000	148000	45000	21000	329200
Under study and design	72300	150000	325000	60000	179000	786300
Constructed during 2023	2600	17400	15000	5600	17000	57600
<b>TOTAL</b>	<b>514430</b>	<b>842400</b>	<b>858000</b>	<b>320600</b>	<b>667000</b>	<b>3202430</b>

## ITALY

Name of Association: Società Italiana Gallerie (SIG) – Italian Tunnelling Association

Type of Structure: Non-profit, open association

The Italian Tunnelling Society (SIG) promotes and coordinates studies and research in the field of tunnelling and underground construction works.

SIG is a founding nation of the ITA (International Tunnelling Association) and EUTF (European Underground & Tunnel Forum).

Number of Members: About 800 members (among which 86 are corporate and 250 are young members)



## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

Congresses:

- 04-05/05/2023 Samoter Conference (Verona) – “The great underground infrastructures of the next decade and the SIG Working Groups contribution for the development, innovation and safety of tunnelling”
- 16/11/2023 (Brescia) “Precast segments for TBM tunnel linings: “Industrialization and sustainability”
- 01/12/2023 (Milan) S. Barbara Conference, World Tunnelling Day, Adolfo Colombo Lecture (held by Ing. Remo Grandori) “Industrial, logistic, and organizational challenges, as well

as innovations, for the contemporary construction of 300km of tunnels for the expansion and the upgrade of the Italian railway network” (available on Youtube in Italian)

Publications:

- Handbook on Tunnels and Underground Works (Volume 2: Construction – Methods, Equipment, Tools and Materials)
- Quarterly journal “Tunnels and Major Underground Works” (since 1976, with issue n. 144 in December 2023), with technical papers, news from construction sites and tenders, editors’ letters, reports on the tunnelling market, etc.

Events:

- 10-11/03/2023 – EUTFym Regional Event – Visit to the construction sites of the Giovi 3rd Pass + Social Event in Genoa – With 50 young tunnellers from France, Switzerland, Austria, Germany, Netherlands, Spain, and Portugal.

Technical Visits:

- 20/01/2023 – State road SS685 “delle Tre Valli Umbre” (structural restoration interventions of the damage suffered due to the seismic events of 2016)
- 01/02/2023 – Lonato tunnel and S. Giorgio in Salici tunnel on the Brescia-Verona high-speed railway
- 16/03/2023 – Modane/Avrieux ventilation shaft on the Mont Cenis base tunnel (Turin-Lyon railway)
- 14/04/2023 – San Fermo tunnel (A9 Lainate-Como-Chiasso highway)
- 13/09/2023 – Grottaminarda tunnel (Napoli-Bari high-speed railway)
- 24/10/2023 – Merano north-west road by-pass (Lot 2)

Webinars:

- In early 2023, the SIG Young Members group launched a series of live webinars (recordings available on the SIG Youtube channel) where young tunnellers can present a project or research they have been working on.



The goal is to share their experiences across the tunnelling industry (clients, contractors, consultancies, universities, etc.).

By the end of 2023, five episodes were successfully made, all with over 300 views.

- 29/03/2023 – Analysis of an urban excavation: the St. Mary Abchurch case study
- 07/06/2023 – Accelerating digital change: automation and innovation in the tunnelling world
- 26/07/2023 – Mechanised tunnelling with pipe jacking: the “La Batiáz – Le Verney” power utility tunnel case study
- 25/10/2023 – The safety of tunnels in operation within the TERN network: the Italian Law 264/2006 and the role of Tunnel Safety Officer (Responsabile di sicurezza gallerie)
- 13/12/2023 – Monitoring of tunnel induced deformation phenomena by means of satellite interferometry: settlements in urban areas and reactivation of landslides

## CURRENT TUNNELLING ACTIVITIES

**Third Giovi Pass, Genoa - Tortona Railway:** 37km of twin tunnels along the 53km section between Genoa and Tortona. About 65% conventional excavation and 35% by EPBM (10m dia), with squeezing ground and the presence of gas and asbestos. The Valico tunnel (27km) is going to be the longest in Italy, on a par with the Hirpinia Tunnel on the Napoli-Bari railway. At the end of 2023, 87% of tunnelling activities were completed.

**Brenner Base Tunnel:** a 55km twin bored tunnel between Tulfes/Innsbruck (Austria) and Fortezza (Italy) with three underground safety areas and a pilot/service tunnel. Including the junction

within the Innsbruck urban tunnel, it will have a max. underground length of 64km (the longest in the world). There are two sections on the Italian side:

- 1) The section Mules 2-3, involving 65km of tunnelling (20km conventional and 45km with TBMs), currently at 91% progress;
- 2) The section under passing the Isarco river (with artificial ground freezing underneath the river) completed in 2023.

Since April 2023, all the contracts on the Austrian side have been awarded.

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

two 57.5km long twin tubes (45km 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. It is going to compete with the Brenner Base tunnel for the title of longest railway tunnel in the world.

The section on the Italian side is:

- 1) CO 03/04, 12km, between the French border and Susa, awarded in September 2023. This area was previously studied by means of a 7km exploratory tunnel excavated between 2012 and 2017. Also, there is a 1.9km twin bore junction tunnel (not part of the base tunnel) to link Susa to the Italian railway network, which is part of the CO 01 section, that was issued for tender in 2023 and will be awarded in 2024.

### Brescia-Verona high speed railway:

6.6km of twin bored tunnels (Lonato) and 10.2km of cut&cover to underpass twice the A4 highway (Lonato and Sona) and an urban centre. The TBM completed the first bore of the Lonato tunnel in 2022, and started the second bore in 2023, which will be completed in 2024.

### Verona-Fortezza new railway line:

as a southern access to the Brenner Base Tunnel, seven lots will be built, giving priority to the sections currently limiting the line's performances the most. Construction started in 2023 for the Trento by-pass tunnel (11.5km) and the Fortezza - Ponte Gardena section (Scaleres, 15.4km, and Gardena, 6.3km), with five TBMs to be launched in 2024 and three TBMs between 2025 and 2026.

Two additional sections in future will include the tunnels Val d'Ega (10km), and Zugna (16,7km).

### Napoli Bari high Speed Railway:

- 1) Napoli-Cancello section: the Casalnuovo c&c tunnel is under construction (first example in Italy of cut&cover excavation in hyperbaric conditions below water table)
- 2) Telesse-Vitulano section: conventional tunnelling activities on Tuoro S. Antuono (1.6km), Cantone (0.98km), Limata (0.3km), S. Lorenzo (1.7km), Ponte (0.45km), Roventa (0.2km), Le Forche (2.4km)
- 3) Apice-Hirpinia section: One TBM is excavating the Grottaminarda tunnel (2km) and will then start the Melito tunnel (4.4km); One TBM will start excavating the Rocchetta tunnel (6.5km) in 2024 (all single bore tunnels).
- 4) Orsara-Bovino section, two TBMs are going to start excavating a 10km twin bore tunnel in 2024
- 5) Hirpinia-Orsara section: Four TBMs will start excavating a 27km twin bore tunnel between 2024 and 2025 (longest in Italy on a par with the Giovi 3rd Pass tunnel). Complex clay formations with squeezing and swelling, presence of methane gas, within a highly seismic area.



### Florence high speed railway junction:

An 8km twin bore tunnel, excavated by two EPBMs underpassing the city centre of Florence to speed up the high-speed services along the Rome-Milan route and free up capacity on surface for regional commuter trains. Construction with the first TBM started in 2023.

### CURRENT AND FUTURE TUNNELLING ACTIVITIES

**Messina-Palermo railway:** On the Fiumetorto-Castelbuono section, a 10m diameter TBM is working to excavate the 6.7km long Cefalù tunnel (twin tubes). Also, an underground station is going to be built to serve the town of Cefalù.

**Genoa urban railway junction:** The project involves the sextuplication of tracks along the Brignole-Principe section and quadrupling of the Voltri-Sanpiederarena sections which are the busiest portions of the Genoa urban railway junction. The project was completed in 2023 and included the extension of the existing Colombo tunnel and S. Tommaso tunnel.

**Palermo-Catania railway:** More than 70km of tunnels through the central areas of Sicily, such as: Alia (20km), S. Catena (7.8km), Marianopoli (6.6km), Salso (3.9km), Trinacria (13.4km), Montestretto (2.3km), Sicani (5.3km), Dittaino (2.3km). The Alia tunnel will be the 3rd longest in Italy. All the contracts were tendered in 2022 and awarded in 2023. 17 TBMs will be used, with 11 of them to be launched in 2024.

**Messina-Catania railway:** 37km underground over a 42km alignment (Giampilieri-Fiumefreddo section), including an underground station in Taormina. Construction started in 2022,

with four TBMs out of five starting the excavation in 2024 (the 5th one in 2026).

**Salerno – Reggio Calabria high speed railway:** Section 1a (Battipaglia-Romagnano) was awarded in 2023 and four TBMs are expected to be launched in 2024. Section 1b and 1c (Romagnano-Praia) will require 11 additional TBMs to be launched between 2025 and 2026.

**New Santomarcò tunnel:** A 15.8km twin bore tunnel (with four TBMs) to replace the existing ("old") Santomarcò tunnel between Paola and Cosenza. The tender is expected to be issued in 2024.

**Naples Metro - Line 1:** A twin bore TBM tunnel is currently under construction between Capodichino Airport station and Poggioreale station, on a 1km length. One bore has been completed while the second one is going to be finished in 2024. In 2024 the last TBM section (about 1km) between Capodichino and Di Vittorio is going to be awarded to close the Line 1 metro ring.

**Rome Metro - Line C:** while completing the stations of San Giovanni and Colosseo/Fori Imperiali, in 2023 works started on Piazza Venezia station, surrounded by millenary monuments and through archaeological finds which are unique in the world. This new station will be 45m deep, with 85m deep diaphragm walls, and will have three direct underground accesses to the Fori Imperiali, the Altar of the Nation and the Venezia Palace. It will require 10 years of works and €700M (15-20% of which is for archaeology).

**Turin Metro – Line 2:** The route will be 27km long with 33 planned stations and

will run entirely through twin bore tunnels TBM. The alignment will intersect the existing metro line 1 at Porta Nuova railway station. The tender is expected to be issued and awarded in 2024, with construction works to start in 2025.

**Catania Metro:** 6km of new twin tunnels to extend the existing metro at both ends of the current line, to reach the densely populated towns north-west of Catania (Misterbianco and Paternò) as well as the international airport of Catania Fontanarossa. By the end of 2023, all the contracts were awarded.

• **Naples Metro – Line 10:** A 12km long brand-new metro line with twin bore tunnels. Trains and stations will be short (about 50m) to minimise the extension of station boxes and hence the risk of delays due to archaeological findings or unexpected utilities diversion. The tender was issued in 2023 and will be awarded in 2024.

**Milan Metro – Line 5 extension:** 12 new stations over 11km of new underground alignment. The tendering should be issued in 2024 with construction starting in 2025.

**Gronda di Genova:** 70km of new highway, 54km of which will be underground, with 23 tunnels. Preliminary construction activities started in 2023 (utilities diversion, base camps, explosive ordnance clearance, etc.) with construction to start in 2024.

**Genoa sub-port tunnel:** A twin bore 4km road tunnel (16m excavation diameter) undercrossing the Genoa port bay. Preliminary construction activities started in 2023, while proper construction should start in 2024, with a cost of €900M.

**State road SS 340 "Regina" (Tremezzina by-pass) –** nine bored tunnels with a total length of 17.5km are under construction with both conventional and mechanised tunnelling, with about 1km excavated by the end of 2023.

**State road SS 106 Jonica –** eight twin bored tunnels, with a total length of 11.8km are under construction with conventional method, with about 4km of twin tunnels completed by the end of 2023.

**Bisagno stormwater tunnel (Genoa):** a 6km tunnel (1km conventional and 5km by TBM) is under construction to prevent

flooding and hydrogeological damage in the city of Genoa during severe storm events.

**Campolattaro dam tunnel (Benevento):** A 7.5km TBM tunnel to use the reservoir for drinking water supply to 2.5M people as well as the irrigation of about 15,000 hectares for agricultural production. The tender was awarded in 2023 and construction is going to start in 2024.

**Peschiera aqueduct (Rome):** A 27km tunnel (internal diameter 3.6m) will be built parallel to the existing aqueduct, allowing its maintenance and hence increasing the resilience of water supply to 3M people in Rome. The tender is going to be issued in 2024.

**Marcio acqueduct (Rome):** 36km of tunnelling (from 1.8m to 2.5m internal diameter) to replace two 100 years old existing aqueducts. The contract for the first section of 7.5km was awarded in 2023 and construction is going to start in 2024.

**New SMAT median sewer collector (Turin):** a 14.4km sewer tunnel (3.2m internal diameter) will be excavated with a 4.1m TBM, with 20m deep and 25m wide shafts along its alignment. The tender was issued in 2023 and will be awarded in 2024.

## STATISTICS

### 1. Length or volume excavated - % mechanized / % conventional during 2023

	Conventional	Mechanised
Railway	4.7km	6.5km
Metro	1.1km	0km
Road	9.7km	0km
Total	15.5km	6.5km

### 2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023

Railway	Road	Water
5.5bn	0.8bn	0.5bn

About 40 TBMs expected to be in operation at the same time in Italy between 2024 and 2026.

### 3. List of tunnels completed

- Isarco river underpass (4.5km twin bore main tunnels + 1.7km junction twin bore tunnels)
- Turin metro line 1 (3.4km section Fermi – Cascine Vica)
- State Road SS20 Col di Tenda tunnel (3.3km)

### 4. List of tunnels under construction

- Valico (Giovi 3rd Pass), 27km (twin bore)
- Brenner Base Tunnel (Mules 2-3, 20km twin bore)
- Lonato, 6.6km (twin bore)
- Grottaminarda, 2km
- Tuoro S. Antuono, 1.6km
- Le Forche, 2.4km
- Florence HSR underpass (8km, twin bore)
- Cefalù (6.7km, twin bore)
- Comancina, 3.5km (twin bore)
- Trebisacce, 3.5km (twin bore)
- Roseto, 1.1km (twin bore)
- Naples metro Line 1, 1km section (twin bore)

### 5. Tunnels in operation

- > 1600 railway tunnels, with a total length > 1500km of railway tunnels
- > 2000 highway and road tunnels, with a total length > 1350km
- > 150km of metro tunnels

## EDUCATION ON TUNNELLING IN THE COUNTRY

Given the huge increase in tunnelling activity expected in Italy in the years to come, tunnelling modules and courses are growing and multiplying more and more within universities, often including collaborations with the industry to prepare the next generation of tunnellers for the challenges they will have to face.

### 2nd Level Master (after a Master Degree)

- Politecnico di Torino and Politecnico di Milano – Master in “Tunnelling: design, construction and management”



developed in English, endorsed by SIG and by ITA-CET. <https://www.masterstunnelling.polimi.it/>

- 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/en\\_GB/-/15391805-ma\\_icea\\_geotecnica-per-le-infrastrutture](https://www.unina.it/en_GB/-/15391805-ma_icea_geotecnica-per-le-infrastrutture)
- Politecnico di Torino, Politecnico di Milano and Politecnico di Milano School of Management. Supported by Autostrade per l’Italia (Italian Autostrade Group). Master in “Integrated engineering and management of motorway networks” <https://www.masterinfrastruttureautostrade.it/>

### MEng courses with tunnelling modules (after a Bachelor Degree)

- Politecnico di Milano, Milan
- Politecnico di Torino, Turin
- Università di Roma “Sapienza”
- Università di Roma Tor Vergata
- Università di Napoli “Federico II”
- Università di Bologna “Alma Mater Studiorum”
- Università Politecnica delle Marche
- Università di Trento
- Università degli Studi del Molise

### Education events for university students

The Italian Tunnelling Society (SIG) is also organising specific teaching days of a high education level to students within the main Italian universities. This is managed by Prof. Daniele Peila (SIG Vice-President) and by Prof. Carlo Callari (Member of the SIG ExCo). Universities are selected between those having specific teaching courses focused on tunnelling and underground works, and the lectures involve professionals from Italian contractors and consultants.

By the end of 2023, two events took place at Turin University and Milan University, both with great success:

- 09/06/2023 – “Full face mechanised excavation” (in English)– Polytechnic University of Turin
- 27/10/2023 – “Advanced numerical approaches to the modelling of tunnel excavation and construction” (in English) – Polytechnic University of Milan

Participation was also open to SIG members, and many of them indeed attended the event

# JAPAN



**Name of Association:** Japan Tunnelling Association  
**Type of Structure:** Non-profit, association  
**Number of Members:** Total number 1446, number of corporate members 203

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

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

- Investigation, research and information interchanges on general techniques and on subjects of specific projects.
- Meetings such as 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" Biearly magazine "Tunnelling Activities in Japan"
- International cooperation

## CURRENT TUNNELLING ACTIVITIES

### Repairing the pilot tunnel of the Seikan Tunnel Tappi Pilot tunnel Repair Works

The Seikan Tunnel is a long undersea tunnel with a total length of 53,850m. The undersea section of 23,300m consists of three tunnels (the main, working, and pilot tunnels). The deepest part of the tunnel is 240m below sea level and is subject to strong water pressures. Due to the unique environment of the Seikan Tunnel, various measurements have been continuously implemented since its opening. A wide range of measures are taken including the displacement of the inner space of the main, working, and pilot tunnels, the amount, pressure, and quality of water inflow, the neutralization and strength of the concrete, and the deterioration of the injection material. Significant changes were discovered in the pilot tunnel which had to be controlled via various measures.

To fix the reduction in the inner space cross-section and a rise in the roadbed, the effect of rock bolts and invert concrete was verified by reproducing the deformation using numerical analysis. As a result,

the placing of six rock bolts per section following the removal of the roadbed concrete was decided upon as the best method for minimizing the amount of internal air displacement. As a result, the existing roadbed concrete was removed, and the invert concrete reconstructed after the rock bolts were placed on the uplifted roadbed concrete. The concrete was manufactured on site as it took 90 minutes to transport the concrete 23km from the above-ground plant to the project. Since the tunnel is too narrow to install the plant, the concrete was mixed on site using a small mixing machine.

As a result, the work was completed safely without any internal air displacement. Three years have passed since the repair work was completed, and no deformation - such as internal air displacement or uplift of the roadbed - has occurred. We will continue to conduct follow-up investigations on the repaired roadbed in the future.

### Mountain Tunnel Construction Using ICT

The Shin-Tomei-Nagoya Expressway Kawanishi construction project was designated to make full use of ICT to improve productivity through the joint efforts of the contractor and the client. ICT technology is being actively utilized in the construction of the Yagayama Tunnel at each stage of the work process.

A ground-based laser scanner was used to acquire point cloud data before and after the lining concrete was placed, which was superimposed on a 3D model to create a cross sectional drawing, and the thickness of the lining concrete and the tunnel interior were measured for use by the client in the formwork inspection.

We acquired point cloud data for the entire underground tunnel line, creating a 3D model, adding traceability such as construction information and inspection records to the BIM/CIM model as attribute information, and updated the data at each stage of construction. Centralizing and upgrading data in 3D in all processes from survey and design to construction,

inspection, maintenance management, and renewal was expected to improve productivity.

## FUTURE TUNNELLING ACTIVITIES

### The Chuo Shinkansen is a line

This Line will be built to create a dual transportation system of Japan's main arteries, which have long been carried by the Tokaido Shinkansen (Tokyo to Osaka). The plan is to construct shield tunnels deep underground (depth of 40m+) in urban areas that are already highly urbanized. The launch shaft for the shield tunnel nearest to Nagoya Station is situated at the Meijo Emergency Exit. This emergency exit is used for ventilation and maintenance work in the tunnel under normal operation, and as an evacuation route for passengers in the case of an emergency. The Meijo Emergency Exit is a cylindrical shaft with a depth of approximately 89m and a diameter of approximately 38m.

The construction was carried out using the open-cut method with an RC diaphragm wall of approximately 130m length.

After excavating to a depth of approximately 50m, water inflow occurred from around a blocked observation well, but excavation was successfully completed after water sealing work was carried out. The water sealing works are described here:

It was planned that the groundwater level would be lowered by pumping out the pore water in the aquifer just below the diaphragm wall. To reduce the amount of pumping, a single row of injection holes - with a spacing of 0.8m - was placed into the aquifer just below the diaphragm wall, and chemical grouting was carried out.

When the excavation proceeded to approximately 50m, water inflow occurred around the observation well, which was already blocked. To estimate the cause of the water inflow, an acoustic tomography survey was conducted.

This found that the unevenness and inclination of the stratum was larger than expected, leading to the disagreement of the watertight packing of the well closure, thus forming the water path.

It was decided to construct a cutoff wall inside the diaphragm wall using chemical grouting, because the water path was considered to exist just below the diaphragm wall due to the unevenness of the stratum. The

purpose of chemical grouting was not to reduce the water inflow into the shaft, but to stop it. The volume per step was increased compared to that of normal chemical grouting because of the large depth and high artesian water pressures. In addition, thorough construction management was carried out by drilling the injection hole by two stage excavation and confirmation of the drilling position by gyroscopic survey to accurately inject the chemical solution into the deep area and confirm the injection effect via check injections to maximize the effectiveness of the chemical grouting. In particular, the injection pressure of all the holes located in the middle of the three rows were checked, and check injections were carried out in the steps where no pressure increase was observed. The check injections were able to compensate for the lack of improvement, and the upward trend of pressure was confirmed in all of the injection areas. As a result of the pumping test, the amount of pumping required for drawdown was 1.2 L/min on average, which was very small, and it was considered that a good quality cutoff wall could be constructed by chemical grouting. After excavation resumed, the excavation was completed to approximately 89m without any water inflow.

## STATISTICS

1. Length or volume excavated – 27.5% mechanized /57.9% conventional during 2023
2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023 About US\$29B

## 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,  
Tottori 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,  
Kindai 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,  
Kansai University,  
School Of Science And Technology  
Graduate School Of Science And  
Technology  
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,  
National Institute Of Technology,  
Kagawa College,  
National Institute Of Technology,  
Kochi College,  
National Institute 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,  
Utsunomiya University,  
Osaka Institute Of Technology,  
Kyoto University,  
Kobe University

# KOREA (SOUTH)

Name of Association: Korean Tunnelling and Underground Space Association

Type of Structure: Non-profit, open association

Number of Members: 3449 members, 76 corporate members



## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

Established in 1992 as a non-profit incorporated association, KTA is the tunnel-oriented national organization that complies with the international aims of ITA. Most of the KTA members are

tunnel engineers, but not limited to the civil engineering field. Recent expansions into the field of fire, disaster prevention and ventilation within tunnels, among others, are noteworthy.

In 2023, KTA hosted the international conference (ICTUS, International

conference on Tunnels and Underground Spaces) under the platform of the 2023 World Congress on Advances in Structural Engineering and Mechanics (ASEM23) (Theme: Tunnelling a Sustainable Way for a New-Normal World) 2023/08/16-18, Seoul (300 domestic participants, 50 international participants).

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

- 2023 KTA General Assembly and Annual Spring Conference
- 2023/04/14, Seoul (250 domestic participants)



- 2023 KTA Tunnel Construction Policy Forum & Seminar on Underground Safety (Theme: Technological Trends for Tunnel Safety Construction), 2023/11/09, Seoul (110 domestic participants)
- Tunnel Face Mapping Short Course on NATM tunnelling for Korea National Railway, 2023/05/30-31, Seoul (160 domestic participants)
- Special Education Course on Utility tunnelling for TBM application, 2023/06/13, Daejeon (150 domestic participants)
- The KTA Short Course on tunnelling with Tunnel Boring Machines, 2023/07/13, Seoul (45 domestic participants)
- Technical Seminar for Underground Disposal of Radioactive Waste in Waste Disposal Facilities, 2023/07/18, Daejeon (68 domestic participants)
- Forum of Tunnel Construction/ Maintenance and Smart Construction Technology (Theme: Recent Issues and Latest Smart Technologies in Tunnel Construction and Maintenance) 2023/08/31-09/01, Seoul (246 domestic participants)
- KTA-Annual WG Activity Reports: 19 WG activity reports, 12 WG technical reports

#### Publications

- Domestic technical journal "Journal of Korean Tunnelling and Underground Space Association" (six issues with 36 papers in 2023)

- Quarterly magazine "Nature, Tunnel and Underground Space"

#### CURRENT 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

##### 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 over a section of 4km)
- Project cost will be about \$1.3bn

##### 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

##### Chuncheon-Sokcho Double Line Railway Construction Project

- Railway connection east and west Korea
- Total length of 93.7km
- Project cost will be about \$1.8bn

##### Great Train eXpress (GTX) Higher-Speed Commuter Rail Network Project

- Densely-populated Seoul capital region
- GTX-A 83.1km with 11 stations, GTX-B, GTX-C, GTX-D will be continued.

- speeds of up to 180km/h in tunnels built 40m below ground, bypassing existing infrastructure, and reducing commute times significantly
- Project cost will be about \$61bn

##### Dobongsan Mountain-Pocheon Subway Extension Project

- Railway extension of Subway Line No. 7
- Total length of 33.1km
- Project cost will be about \$1.6bn

##### Pocheon-Sejong Highway Construction Project

- Railway extension of Subway Line No. 7
- Total length of 177.6km
- Project cost will be about \$5.5bn

##### Incheon Urban Railway Line 1 Geomdan Extension Line Construction Project

- Railway extension of Subway Line No. 1 of Incheon Urban Railway
- Total length of 6.8km
- Project cost will be about \$560M

#### FUTURE TUNNELLING ACTIVITIES

##### 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 two



long-span marine bridges

- Consideration of transport security and weather accident

### Namhae-Yeosu Undersea Tunnel Project

- New 8.09km four-lane highway connecting Shindeok-dong in Yeosu and Seomyeon in Namhae on the country's southern coast
- Total length of 8.09km (undersea section of 5.76km)
- Project cost will be about \$530M

### Indeokwon-Dongtan Double Track Railway Construction Project

- Expansion of metropolitan transportation functions in the southwestern metropolitan area
- Total length of 34.3km
- Project cost will be about \$2.1bn

### Wolgot-Pangyo Double Track Railway Construction Project

- Providing rail transportation convenience to local residents through

direct connection between the metropolitan area and the Gangwon area

- Total length of 34.16km
- Project cost will be about \$1.7bn

### Pyeongtaek-Osong Double Track Construction Project

- Providing rail transportation convenience to local residents through direct connection between the metropolitan area and the Gangwon area
- Total length of 34.16km
- Project cost will be about \$1.7bn

### Southern Inland Railway Construction Project

- In order to expand the capacity of the Pyeongtaek-Osong section, which has insufficient track capacity, an additional high-speed rail double track was constructed (two tracks) to improve convenience for high-speed rail users.
- Total length of 46.4km
- Project cost will be about \$2.5bn

## STATISTICS

### List of tunnels completed

- Daegok-Sosa Railway Tunnel
- Yulchon Thermolectric Power Plant Tunnel

### List of tunnels under construction

- Youngdong Main Street Underground Complex Development Project
- Kimpo-Paju 2nd Seoul Outer-ring-road Project
- Gangneung~Jejin Single Line Railway Construction Project
- Chuncheon~ Sokcho Double Line Railway Construction Project
- GTX A (Ilsan - Dongtan) Project
- GTX C (Uijeongbu - Geumjeong) Project
- Dobongsan Mountain~ Pocheon Subway Extension Project
- Pocheon~ Sejong Highway Construction Project
- Incheon Urban Railway Line 1 Geomdan Extension Line Construction Project

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Publication of editions 37, 38, 39 and 40 of OS magazine
- Participation in CAPIT courses, co-responsibility for structural safety, March 2023
- Participation in the Costa Rican Congress of Underground Works, CCROS, March 2023
- Organization of Technical Talks at the UNAM Engineering Institute, June 2023
- Organization of the course Anchors in

# MEXICO

Name of Association: Asociación Mexicana de Ingeniería de Túneles y Obras Subterráneas

Type of Structure: Non-profit association

Number of Members: 143 individual members, 11 corporate members



- soils|Design and interpretation of tests, problems and solutions, April 2023
- Participation in WTC 2023

- Participation in the IV Latin American Congress on trenchless technologies, May 2023
- Organization of seminar "Development and research directions in pipe jacking and microtunneling" with Prof. Raymond Sterling
- Participation in No Dig 2023, NASTT Mexico chapter
- Organization of seminar "Interactions between large landslides and infrastructures" with Dr Marco BARLA, April 2023
- Organization of the 5th National Congress of AMITOS, November 2023



## EDUCATION ON TUNNELLING IN THE COUNTRY

AMITOS is an important part of the Master's degree in tunnels and underground works, certified by ITA-CET. National Autonomous University of Mexico, UNAM.



## MONITORING, SURVEYING & DATA MANAGEMENT FOR INFRASTRUCTURE & MINING



- > Tunnel Surveying
- > Machine Guidance Systems
- > Control Measurements

- > Geotechnical Monitoring
- > Instrumentation
- > Geophysics

### GeodataHub KRONOS

- > Tunnel Information
- > Alarming System
- > Data Visualisation

**GEODATA SURVEYING & MONITORING GROUP**  
 Hans-Kudlich-Strasse 28  
 8700 Leoben, Austria  
 office@geodata.com  
 www.geodata.com

01 | Instrumentation & Monitoring, Software & Systems

02 | Infrastructure & Mining

03 | Industrial Surveying

**WE TURN DATA INTO INFORMATION**

LEOBEN | GRAZ | ADMONT | SATTLEDT | VÖCKLABRUCK | WINDISCHGARSTEN | VIENNA (AUT) | ATHENS (GRC) | BUCHAREST (ROU) | COPENHAGEN (DEN) | LONDON (GBR) | MUNICH (GER) | OSLO (NOR) | WARSAW (POL) | ZAGREB (CRO) | DELHI (IND) | SANTIAGO DE CHILE (CHL) | SYDNEY (AUS)



Innovation is a constant necessity, requiring frequent meetings to exchange ideas and information on new technological advancements.

Concrete is the most used construction material in the world. All joined effort and innovation for sustainable use of concrete has significant positive impact on our future.

### Key dates:

Abstract submission : 10. March  
 Full paper submission: 1. May  
[www.sprayedconcrete.no](http://www.sprayedconcrete.no)

Themes:

- Low-carbon solutions
- Waterproofing (including injection)
- Equipment technology
- Materials development
- Projects and cases
- Application, quality control, documentation
- Others

*Meet new people - meet people you already know – Find time to share knowledge about sprayed concrete and the latest development trends!*

30th International Symposium on Sprayed Concrete  
 Seisjøfjord, Norway, 17. - 20. June 2024

# NEW ZEALAND



**Name of Association:** New Zealand Tunnelling Society  
**Type of Structure:** Incorporated non-profit society  
**Number of Members:** 151 individual members, 9 sponsors

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The highlight of 2023 for the New Zealand Tunnelling Society was hosting the incredibly successful 18th Australasian Tunnelling Conference in Auckland. This event brought together a large and engaged group of tunnelling enthusiasts from across New Zealand, Australia and beyond to share knowledge, to network and to celebrate the merits of underground space. The technical programme of the conference was of a very high standard, with a broad range of topics covered in the more than 100 papers presented. This was complimented by the thought-provoking keynote speakers, which included Arnold Dix, ITA President, interactive plenary sessions and some great social events.

The society also held its inaugural Golf Day in 2023 along with a number of seminars and presentations for members. The NZTS also focussed on actively building closer ties with other national tunnelling societies in the Asia Pacific region.

## CURRENT TUNNELLING ACTIVITIES

Current tunnelling activity in New Zealand is primarily centred around two major project; The City Rail Link and the Central Interceptor. These projects are in different stages with the Central Interceptor presently tunnelling on a number of faces and the City Rail Link progressed to track laying, fit out and commissioning.

There are numerous smaller tunnelling project also underway. These are primarily in the three waters space and consisting of shaft construction and microtunnelling or direct pipe.

A selection of the current live projects are summarised as follows:

### The Central Interceptor

A lot was achieved on Watercare Services Limited Central Interceptor project over the last year and there is another busy year ahead in 2024.

The main TBM, Hiwa-i-te-Rangi,



Central Interceptor

continues her journey north and is making great progress having successfully passed through the Walmsley Park site and now being just 1km away from her next milestone: Haverstock Road, Sandringham. Hiwa-i-te-Rangi has covered a distance of more than 8.8km, with the installation of 5,500 segment rings.

The smaller micro-Tunnel Boring Machine (mTBM), Domenica, is working her way along the Link Sewer

B. Domenica will be launched from Rawalpindi Reserve in Mt Albert soon to tunnel her final drive of 300m to the Norgrove Avenue site. The Link Sewer B tunnel runs from Mt Albert War Memorial Reserve to Rawalpindi Reserve and has an internal diameter of 2.4m and a length of 1.1km.

All 16 of the construction sites on the project are open and there are significant construction activities underway at the majority of them.

### Te Whatu Ora | Te Toka Tumai Auckland Hospital Central Plant and Tunnel project

The Auckland Hospital Central Plant and Tunnel project entails construction of a 250m long tunnel that will connect the central plant building to other main buildings. The tunnel runs at up to 20m deep with a width of 3.5 – 4m all constructed by cut and cover. Works have been progressing well with 19,000m<sup>3</sup> of excavation up to depths of 20m below existing ground, along with the application of 650m<sup>3</sup> of shotcrete inside the 240m tunnel completed last month.

### Warkworth to Snells pipeline

This project includes three tunnelling drives constructed using direct pipe techniques. The TBM (Piper) has already successfully tunnelled the first 1,360m drive, taking roughly four months to complete this first phase of her work on the pipeline. Drives 2 and 3 comprise a further 3,411m combined.

### City Rail Link

Tunnelling on Auckland’s first metro was



City Rail Link



Waitemata Crossings

completed in 2023 but there are still significant works remaining. The project has just completed installation of the second and final railway line below the central city.

The newly laid 3.4 km of track will carry trains underground north from Maungawhau Station at Eden Terrace and connect with the two new central city ones – Karanga-a-Hape and Te Waihorotiu – and downtown’s Waitematā Station (Britomart).

The focus is shifting now to train testing and finishing the fit out of the stations and tunnels, alongside landscaping and urban realm enhancements. The fit-out programme includes the installation of lifts, escalators, security systems, CCTV, electricity, signalling and communications.

### FUTURE TUNNELLING ACTIVITIES

With a recent change of Government in New Zealand there has been a significant shift in focus and prioritisation of infrastructure projects. This has seen a number of tunnelling projects discontinued in favour of other projects. Some of the future tunnel projects which are being progressed currently are listed below.

### Waitemata Crossings

A second crossing of the Auckland Harbour is supported by both main political parties in New Zealand with agreement that construction needs to start this decade. A crossing of some description is essential to enable the reliable functioning of the Auckland Transport network moving into the future. The previous Labour government preferred an option comprising two three-lane tunnels for vehicles and a 21km light rail tunnel between the CBD and Albany that was priced at \$56bn. This option is not supported by the current government who are currently commissioning their own reports on the various options and will select a preferred option to support.

### Victoria Tunnel

The National government have confirmed that they will prioritise a second Victoria tunnel and an upgrade of the Basin Reserve in Wellington, estimated to cost \$2.2bn. The tunnel would provide two lanes for traffic going towards the airport and the two lanes of the existing tunnel would provide a route into the city. The current tunnel was built in 1931 and services 37,000 vehicles per day - it is long overdue an upgrade.

### Kaimai Tunnel

A road tunnel passing under the Kaimai ranges as part of an improved connection between Hamilton and Tauranga is currently being considered by the National Government. Options for this tunnel range from 1.2km in length upwards.

### 3 Waters

The significant focus on three waters infrastructure upgrades and capacity increase in New Zealand will include the procurement of a number of tunnel projects. The projects currently planned for the next three years are up to \$120M in value and are primarily located in Auckland and Wellington.

### Warkworth to Wellsford

The extension of the four lane motorway heading north of Auckland is being prioritised by the current government who have indicated that they would like construction to commence within three years. Within this scheme there is likely to be at least one significant set of tunnels.

### STATISTICS

Length or volume excavated - % mechanized / % conventional during 2023

1. 13.7km (95% mechanised, 5% conventional)
2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023 - \$68m
3. **List of tunnels completed**  
Clinker Stormwater Upgrade, Barber Grove to Seaview Pipe Duplication, Ports of Auckland Outfall, Stanmore to Fife SW Upgrade
4. **List of tunnels under construction**  
Central Interceptor, Mt Messenger Bypass, Hills Stormwater Upgrade, Wellpark Avenue Stormwater Upgrade, Auckland Hospital Service Trench, Warkworth to Snells Pipeline, City Rail Link.

### EDUCATION ON TUNNELLING IN THE COUNTRY

- Three universities in New Zealand offer Civil Engineering Degrees with Geotechnical specialisation – University of Canterbury, University of Auckland and University of Waikato.
- A one day Sprayed Concrete in Tunnelling shortcourse was held by the NZTS/ATS/AUSS in 2023.
- A Tunnelling Short course will be held by the NZTS in 2024.

# NORWAY



both tunnels and rock blasting above ground. The same goes for new E6 between Hamar and Vestnes. The new E6 both south and north of Trondheim includes both rehabilitation of old tunnels and excavation of new ones. The Norwegian Public Road Administration continues the construction of Rogfast. This project will include the longest and deepest subsea tunnel to date. The large contract including 18.5km of subsea tunnel from the north was signed in December 2022, and the large contract including 18.5km of subsea tunnel from the south was signed in January 2023. The contract for the middle part of the tunnel is planned to be signed in 2024. The new water supply scheme to Oslo continues. The water will go through a

**Name of Association:** Norwegian Tunnelling Society  
**Type of Structure:** Non-profit, open society with members from the whole value chain, both corporate and personal member.  
**Number of Members:** 1000 personal members, 100 corporate members (incl. research institutes, academia, and public clients)

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The Norwegian Tunnelling Society has a set of yearly events such as conferences, courses and evening meetings. Among these, the largest being Fjellsprengningsdagen, which gathers more than 800 rock blasting and TBM enthusiasts to share knowledge and the latest news.

The society publishes handbooks and technical reports in Norwegian and one English publication every year. The title of the English publication in 2023 was "Norwegian Rock Bolting". Together with other industry partners we also make films. The film in 2023 was about informing neighbours and guards during blasting. The films are in Norwegian and available through YouTube.

## CURRENT TUNNELLING ACTIVITIES

Tunnelling activity in Norway had an increase of 884,000m<sup>3</sup> from 2022, from over 5.1Mm<sup>3</sup> in 2022 to 6Mm<sup>3</sup> in 2023. The statistics shows that we have had an increase of more than 1Mm<sup>3</sup> in road tunnels, otherwise just smaller changes in volumes.

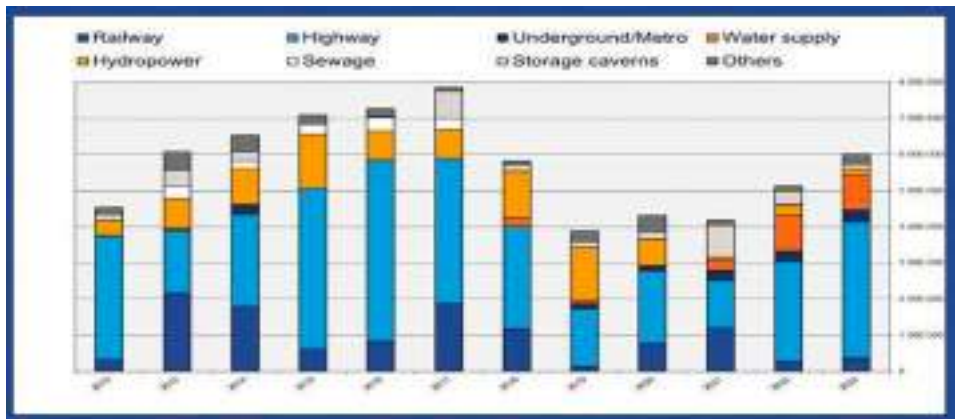
A new pedestrian and cycle path opened in 2023. It is part of a long and continuous effort to make Bergen a more environmentally friendly and sustainable city. The project provides a 9.8km long new continuous walkway and cycle path from the district of Fyllingsdalen to the centre of Bergen. The path goes through two tunnels, the Fyllingsdalen tunnel 2.9km long and Kronstad tunnel 475m long (in an old railroad tunnel). The Fyllingsdalen tunnel is the world's longest tunnels built for pedestrians and bicyclists. Link to YouTube: <https://www.youtube.com/watch?v=YxrT7LnJfPk>

## FUTURE TUNNELLING ACTIVITIES

The new railroad between Drammen and Kobbervikdalen is a project that will complete the double track railroad from Oslo to Tønsberg and will open in 2025.

The project will include 6km of hard rock tunnelling, almost 300m of soft ground tunnelling and about 700m of cut-and-cover.

Nye veier will also continue road building along the E18 from Porsgrunn to Stavanger. These projects will include



## THE SOCIETY ALSO ARRANGE A PHOTO COMPETITION EVERY YEAR:

- Picture 1 Happy tunnelers (Photo Lars Hage)
- Picture 2 Preparing electronic ignition (Photo Tor Kleiven)
- Picture 3 Smiling tunneler (Photo Sina Digernes Aarskog)
- Picture 4 Doble effort (Photo Sliva Khalaf)



long tunnel from Holsfjord west of the city into the existing net of water pipes. The TBM, going eastward from the Holsfjord, started in January 2023 and the TBM going westward towards the Holsfjord started excavation in March 2023. In addition, The Fornebu Line continues. This will be a metro tunnel that will connect Fornebu with the rest of the metro system in Oslo. Several of the tunnelling contracts are up and running. The project will open to traffic in 2029.

As a curiosity, we also have to mention

the Stad tunnel – the world’s first tunnel for ships? The request for tenders is planned for this year. Construction work could start in 2025 with preparatory work starting earlier.

### STATISTICS

Length or volume excavated - % mechanized / % conventional during 2021

- 78,488min total, including 6,945m with TBM
- 6,010,948m<sup>3</sup> in total

### EDUCATION ON TUNNELLING IN THE COUNTRY

Norway has several universities giving both bachelor and master degrees within 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 students through a four-year program for the certification for rock blasters. In addition to these educational institutes, there is a set of courses and classes with different levels of classifications and certifications.

## PAKISTAN



Name of Association: Pakistan Tunneling and Trenchless Society (PTTS)

Type of Structure: Non-profit, open association

Number of Members: Total number-142, number of corporate members-08

### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

#### Workshops (x2)

- Workshop #1: 03-02-2023 (Topic: Concrete Mix Design & Sand Analysis through Sika App by Dr. Oscar Marazzini & Kashif Gardazi, Sika Pak)
- Workshop #2: 27-09-2023 (Topic: Bendable Concrete by Dr. Rao Arsalan, Bendcrete Pak)

#### Tunnel Talk Series (x4)

- Tunnel Talk #3: 02-02-2023 (Topic: Soft Ground Tunneling by Dr Oscar Marazzini, Asif Riaz (FWO), Ashraf Hussain (TIP))
- Tunnel Talk #4: 02-08-2023 (Topic: Innovative Solutions for Underground Waterproofing by Mr. Johnny Poulsen, Dolenco Tunnel System)
- Tunnel Talk #5: 10-10-2023 (Topic: What do we learn from Tunnels by Prof. Shahzad Bhatti)
- Tunnel Talk #6: 22-02-2024 (Topic: Importance of Monitoring in Tunnels and Current Technologies Available by Mr. James Matley, CODEL, UK)

#### Site Visits (x3)

- Site Visit #1: 17-08-2023 (Project Name: 969MW Neelum Jehlum Hydropower Project)
- Site Visit #2: 29-09-2023 (Project Name: 48MW Jagran-II Hydropower Project)
- Site Visit #3: 17-11-2023 (Project

Name: 4500MW Diemer Basha Dam Project)

#### Publications (x2)

- Publication#1: Title: Impacts and challenge faced during deep excavation 1125.3m, rock encountered its effects on support and solution: A case study review from Suki Kinari Hydropower Project 870MW Pakistan, Authors: Asif Riaz, Haris Waheed, Ashraf Hussain, Dr. Abdul Qudoos Khan, WTC-23
- Publication #2: Title: Mixed used potential of existing road tunnels for conveying water for hydropower generation: A case study of motorway tunnels in swat Pakistan, Authors: Asif Riaz, Ashraf Hussain, Ajdar Nawaz, Dr Zia ud din, WTC-23

### CURRENT TUNNELLING ACTIVITIES

#### Ongoing Tunnelling & Hydropower Projects:

##### Diemer Basha Dam & Hydropower Project (4500MW)

- Location - Kohistan & Diemer Districts in KPK and GB Province
- Total Length of Tunnels: 17km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 4500MW

##### Dasu Hydropower Project

- Location - Kohistan District, KPK Province
- Total Length of Tunnels: 26km



Diemer Basha Beach Project



Suki Kinari Hydropower Project

- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 4320MW

##### Suki Kinari Hydropower Project (880MW)

- Location - District Mansehra, KPK Province
- Total Length of Tunnels: 40km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 880MW

##### Mohmand Dam & Hydropower Project (800MW)

- Location - KPK Province
- Total Length of Tunnels: 8km
- Tunnelling Method: Drill & Blast
- Design Capacity: 800MW

##### Gorkin Matiltan Hydropower Project (84MW)

- Location - District Swat, Province KPK
- Total Length of Tunnels: 7km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 84MW

**Jagran-II Hydropower Project (48MW)**

- Location - AJK
- Total Length of Tunnels: 8km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 48MW

**Kurram Tangi Dam & Hydropower Project (83.4MW)**

- Location - District North-Waziristan, KPK Province
- Total Length of Tunnels: 3km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 83.4MW

**Gorkin Matiltan Hydropower Project (84MW)**

- Location - District Swat, Province KPK
- Total Length of Tunnels: 7km
- Tunnelling Method: Drill & Blast/ conventional
- Design Capacity: 84MW

**FUTURE TUNNELLING ACTIVITIES**

- Project Name - Lahore Water & Wastewater Management Project (LWWMP)
- Project Owner - Lahore Water & Sanitation Agency(LWASA)
- Financier - AIIB (Asian Infrastructure Investment Bank)  
Project Cost: US\$533.3M)  
- \$400M – by AIIB & \$133.3M by local Govt
- About 28km of Sewerage Tunnel
- Surface Water Treatment Plant (SWTP) at BRBD Canal, Lahore

**STATISTICS**

**1. List of tunnels completed**

River Diversion Tunnel on the Diamer Basha Dam project

**2. List of tunnels under construction**

Adits and tunnels on the Dasu, Mohmand, Suki Kinari, Kurram Tangi, Diamer Basha hydropower projects

**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Tunnel Talk Series and Training Workshops initiated by the joint efforts of the Pakistan Tunnelling and Trenchless Society (PTTS) and Tunnelling Institute of Pakistan (TIP)
- Diploma Certification Course at Tunnelling Institute of Pakistan (Third Batch)
- MSc Tunnelling at UET Lahore, Pakistan (First Batch)

# POLAND



Name of Association: Polish Tunnelling Association (full name: Subcommittee of Underground Construction of Polish Committee on Geotechnics)

Type of Structure: Non-profit, open association

Number of Members: 64 members, 5 corporate members

**ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE**

The representatives of Poland were present at the ITA General Assembly on May 14th 2023 and May 17th in Athens and at the Extraordinary General Assembly of ITA, virtual meeting on September 26th 2023. Monika Mitew-Czajewska is active as a Member of the Executive Council of ITA for 2022 – 2025. Anna Siemińska-Lewandowska was a Member of Scientific Committee WTC2024 and chaired one of the technical sessions in Athens. Monika Mitew-Czajewska (treasurer) is the member and Tutor of WG20, Anna Siemińska-Lewandowska (president) - WG15, Bartłomiej Dziuban and Dymitr Petrow-Ganew – WG14, Maciej Ochmański – WG2 and WG22, Jerzy Lejk - WG3, Urszula Tomczak – WG23.

The Association organised two conferences – the 5th Polish Tunnelling Forum (live and digital) on 6th - 7th February 2023 in Warsaw and, Geotechnics and Underground Structures, Cracow, 19th – 21st September 2023 (live and digital). During the Polish Tunnel Forum President of ITA prof. Arnold Dix presented an invited lecture on the Emerald Fidic Book and Executive Director Olivier Vion on the ITA organisation. For the conference in Cracow prof. Arnold Dix gave a special lecture on 20th September 2024.

**CURRENT TUNNELLING ACTIVITIES**

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

In a west direction three stations and 6km of tunnels are under construction from September 2023. EPBM + cut & cover.



# Reliable overload protection for TBM cutter head drives!

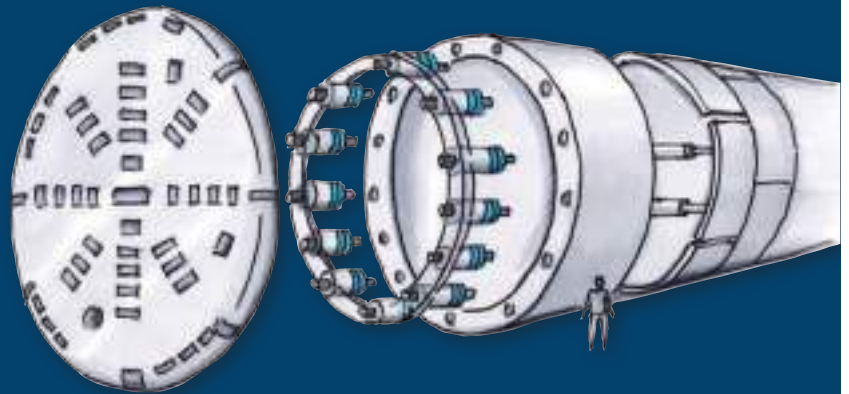


[www.mayr.com](http://www.mayr.com)



## EAS®-HT torque limiters

The destruction-free overload protection for high torques!

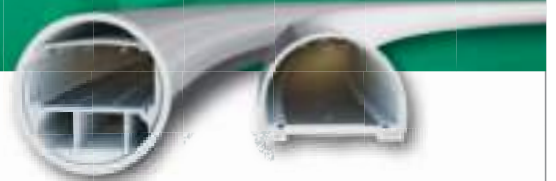







# TPC

# KEEP EVERY PROCESS IN CHECK

Dive into the future of construction monitoring and data analysis with our comprehensive TPC product family!

From TBM tunneling to conventional methods and pipe jacking, we've got your tunnel construction projects covered.



-  **TBM TUNNELLING**
-  **PIPE JACKING**
-  **CONVENTIONAL T.**
-  **GROUP SOLUTION**
-  **INDIVIDUAL SOLUTION**

[www.tunnelsoft.com](http://www.tunnelsoft.com) 



## Construction of the 3rd metro line in Warsaw

Building Permit Design in preparation, construction method: EPBM + cut & cover.

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

The 1.44km long tunnel connecting the islands Uznam and Wolin from July 2023. Construction method slurry TBM – 13.46m diameter.

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

Length of the tunnel – 3km of double track tunnel, 4.5km of single track/tube tunnels; two underground stations; construction method EPBM + cut&cover. Two TBM's – diameter 13.04m and 8.76m started in 2021. Two stations are under construction, 1000m of double track tunnel and 900m of single track tunnels are completed. Drilling works are in progress. Due date end of 2024.

## 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. The excavation works were completed in February 2022. Finishing works are in progress. The due date June 2024.

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

Two road tunnels (830m and 980m) on the S1 motorway to the south state boarder, design and build contract. Tunnelling method NATM. Due date 2025.

## Utility (storm water retention) tunnel along the Vistula river in Warsaw

Microtunneling – 3.2m diameter, total length approx. 9km. In operation from end of 2023.

## Carpatia, Rzeszów - Babica

2.18km twin tube, 15.2m diameter EPBM road tunnel on the S19 from Rzeszów to the state border. Construction works began in 2023, with TBM launch scheduled for September 2023 delayed due to an unexpected occurrence of methane.

## Road tunnels on the north city ring of Cracow

12km long north city ring for Cracow S52 with 3 x 3 line road tunnels (496m, 653m, 100m), cut&cover method, one of the tunnels crosses under the river Prądnik, Due date end of 2024.

## 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 - Babica to the state border. The conceptual design is in progress. Construction time scheduled for 2023-2026.

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

Two road tunnels; 2 x 3 lines in each direction, at building permit design stage.

### Road Tunnel on the S6 motorway,

Road tunnel on the west city ring of Szczecin, under Odra river, 5km, construction method 14m Slurry TBM. Tender for the building permit design and construction opened in April 2023.

### Podłęże-Piekietko rail route in the south of Poland

Eleven (11) Rail Tunnels – 12km length in total on a planned 58km long new rail route. In addition two Rail Tunnels – 5.8km length in total on the rail route Chabówka – Nowy-Sącz will be modernized. Preparatory works and the design was completed in 2023. The construction and modernization is planned for 2023-2026.

## 2.5km long railway tunnel in Łódź

On the railway line 85, this high speed train tunnel will connect the Central National Airport (under design) with Warsaw and Wrocław. Building permit design.

## 2.25km long TBM road tunnel under the Bronistawa Hill and 850m long TBM road tunnel under Vistula river in Cracow

The closing section of the road ring in Cracow, 2024 – in conceptual design and environmental decision permit design.

## STATISTICS

### 1. Length or volume excavated - % mechanized / % conventional during 2023

80% TBM; 20% conventional

### 2. List of tunnels completed:

Road tunnel under Luboń Mały 2.3km; South of Poland; roads tunnels: S3 under Świna river; utility tunnels: storm water retention tunnel along the Vistula river, Warsaw.

### 3. List of tunnels under construction:

S3 Bolków-Kamienna Góra, S1 Węgierska Górką, S19 Via Carpathia, S52 North city ring of Cracow; railway tunnels: single track and double track Łódź

## 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 Civil Engineering. Faculty of Civil Engineering, 2nd degree studies – Wrocław University of Science and Technology, Faculty of Civil Engineering; Tunnels and underground passages – 2nd degree studies – Cracow University of Technology, Faculty of Civil Engineering; Underground structures – (1st degree studies) – Silesian University of Technology, Faculty of Civil Engineering; Underground structures (2nd degree studies) – Białystok University of Technology, Faculty of Civil and Environmental.



TBM transport.

# PORTUGAL



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

**Type of Structure:** Committee of Portuguese Geotechnical Society (SPG), non-profit association. The board of the CPT is made up of President Raúl Sarra Pistone, Vice-Presidents: Nadir Plasência and Isabel Fernandes, General Secretary Luis Miranda, Assistant Secretary João Gouveia and Treasury Gonçalo Diniz Vieira.

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

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Registration of the UW in Portugal and constructed by Portuguese companies in other countries
- Analytical work on the practice and contractual forms for public procurement in underground works
- Development of contributions to the revision of the Public Contracts Code
- Publication of the document "Technical Guide on Safety and Health in the Design and Construction of Underground Works" aimed at the legislative framework on safety and health in underground works (GT3)
- In March 2023 the GT4 organized a BIM event in Lisbon, with great success, together with the counterpart working group of the Geotechnics of the Transport Commission
- Life Cycle Asset Management: Identification of the different methodologies used in the inspection and monitoring of the different tunnels. Participation in the EUTF group on "Predictive maintenance and refurbishment"

### Events organized during 2023:

- 1st Workshop BIM/SIG on Linear Infrastructure, Lisbon, 1st March 2023
- Workshop on Construction of Tunnels of Lisbon Drainage Master Plan, Lisbon, 27th October 2023
- 6th International Seminar - Rethinking our Cities using the Underground Space, Porto, 17th November 2023

## CURRENT TUNNELLING ACTIVITIES

Currently there are five urban underground projects in progress, located in the cities of Lisbon and Porto. Lisbon Metro Projects

- a) two projects integrated into the Expansion Plan of the Lisbon

Metropolitan Network for the extension of the Yellow and Green lines. New lines from Rato to Cais do Sodré.(approx. 2km long, two new stations and new links to the existing stations (Contractual cost: c. €120M).  
 b) Red line, new line between São Sebastião and Alcântara, in Lisbon, 4km long, four stations (Contractual cost c. €330M).

**Porto Metro:** Two projects integrated in the Expansion Plan of the Porto Metro network are under construction. The Pink

line between Casa da Música/Boavista Station and Aliados Station/Praça da Liberdade, over 3.2km in length, three ventilation shafts; and the diversion tunnel of the Vila River (contractual cost: €189M).

**The Yellow Line:** between Santo Ovídio and Vila D'Este, aprox. 3.2km extension on double track, three new stations and one Ventilation and Emergency Shaft (PVE) (Contractual cost: c.€99M).

- a) New Ruby Line, estimated cost €299M, would have a length of 6.3km and includes two tunnels, a new bridge over the Douro River and six new stations, three of which are on the surface.
- b) The General Drainage Plan of Lisbon (PGDL), of the Lisbon Municipality. Includes the construction of two tunnels with an internal diameter of 5.5m. The first is the Monsanto-Santa Apolónia tunnel (TMSA, about 5km long) and the second is the Chelas-Beato tunnel (TBC, about 1km long). The excavation of these tunnels is being carried out by an EPBM with a cutting diameter of 6.41m.

## FUTURE TUNNELLING ACTIVITIES

1. Workshop BIM/SIG flyer



2. Workshop Site visit



3. Lisbon Drainage Tunnels



4. 6th International Seminar: Rethinking our Cities



5. Expansion of the Lisbon Metropolitan Network. Santos Station construction



6. Porto Metro works in progress



# RUSSIA



Name of Association: Russian Tunneling Association (RTA)

Type of Structure: Non-profit, open association.

Number of Members: Total number - 74

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- Scientific and technical conference "Application of advanced technologies in underground construction", Kazan, May 29th – June 1st, 2023.
- International scientific and technical conference "Development of underground space in megacities and transport tunnels", Moscow, November 14th – 15th, 2023.
- International Chinese-Russian Forum "Young Scientists in the Field of Geotechnics and Underground Construction", Online format, November 21st, 2023.

### Professional competitions

- S.N. Vlasov "Engineer of the Year of the Tunnel Association of Russia"
- Scientific (thesis) works for university students
- "The best use of technology in the construction of tunnels and underground structures"

During the year, four issues of the professional magazine "Metro and Tunnels" were published, as well as one issue of the newsletter.

## CURRENT TUNNELLING ACTIVITIES

### Moscow Metro Development Program

On March 1st, 2023, construction was completed and the Big Circle Line (BCL) of the Moscow metro was fully commissioned!

The last 9 BCL stations were put into operation: Maryina Roshcha, Rizhskaya, Sokolniki, Tekstilshchiki, Pechatniki, Nagatinsky Zaton, Klenovy Boulevard, Kashirskaya and Varshavskaya. It is currently the largest circular metro line in the world. The length of the BCL is 70km with 31 stations and three electric depots.

On September 6th, 2023, construction of the Solntsevskaya Line of the Moscow Metro was completed. The last two stations were opened - "Pykhtino" and "Vnukovo Airport". In just 10 years, a new line of more than 30km was created with 14 stations, in a zone in which more than 1.5M Moscow residents live. For the first time in Russia, the metro extends to the airport, which will radically improve transport services for millions of air passengers.

As part of the Moscow Metro development program, on September 7th, 2023, the construction and commissioning of three metro stations on a 5.8km section of the Lyublinsko-

Dmitrovskaya line: Yakhromskaya, Lianozovo and Fiztekh" was completed.

In Krasnoyarsk, Samara and Nizhny Novgorod cities, four TBMs were installed in their start pits, and are ready to start digging metro tunnels at the end of the year.

### Development of the railway infrastructure of the Eastern range

On December 15th, 2023 the Kerak tunnel, located in the Amur region on the difficult section of the Trans-Siberian Railway Kovali – Ulruchyi, was opened to traffic. A new double-track railway tunnel with a length of 926m was built 25m from the old existing tunnel. Construction was completed nine months ahead of schedule. The excavation was carried out through hard rock and two geological faults.

The construction of a new Dusse-Alinsky railway tunnel continues on the Urgal - Komsomolsk-on-Amur section of the Baikal-Amur Mainline of the Far Eastern Railway in the Khabarovsk Territory. The length of the new tunnel will be 1824m. The excavation work is at the final stage and the new tunnel is planned to be launched at the end of 2024 - beginning of 2025.

In the Primorsky Territory, between the villages of Shkotovo and Smolyaninovo, the construction of two new railway tunnels with a length of 1,420m and 1,450m continues. These two tunnels will make it possible to bypass the existing Shkotovsky Pass and eliminate the need for additional traction on this section of the Far Eastern Railway. Completion of tunnelling work is planned for April



Dusse-Alinsky railway tunnel



2024, with completion of construction in December 2024.

During the construction of the new Dzhebsky tunnel in the Kuraginsky district of the Krasnoyarsk Territory, a breakthrough was achieved on December 27th at the Koshurnikov railway section in Sayany. A new tunnel, 267m long, was built in rock in six months using drill-and-blast simultaneously from the western and eastern portals. It is planned to complete the work and open to train traffic by the end of 2025.

Member companies of the Russian Tunnel Association continue to take part in the implementation of large-scale programs to increase the capacity of the Trans-Siberian Railway and the Baikal-Amur Mainline.

## FUTURE TUNNELLING ACTIVITIES

### Work continues in Moscow and other megacities

In 2024, further construction of the Troitskaya line of the Moscow metro will be carried out, and by the end of the year it is planned to complete the

construction of 11 stations between ZIL station and Kommunarka station.

Construction of the first section of the Rublevo-Arkhangelskaya on the Moscow Metro, 12.6km long, will continue, within which six metro stations will be located.

Work will also continue on the design of the Biryulyovskaya metro line, a promising radial branch of the Moscow Metro, which will serve areas in the south of the capital. There will be 10 stations on a 22.2km section of this Moscow Metro line.

In St. Petersburg, by the end of 2024, three metro stations are planned to be opened.

Work will continue on the development of the metro in Nizhny Novgorod, Kazan, Krasnoyarsk, Chelyabinsk and Samara.

### Development of railway infrastructure in the Eastern range

Design work continues on the third stage of development of the Eastern training ground.

On September 11th, 2023, at the Eastern Economic Forum in Vladivostok,

an agreement was concluded on the joint implementation of four projects on the BAM. In particular, the agreement deals with the creation of the Second Kodar Tunnel, the Second Kuznetsovsky Tunnel, the Second Severomuysky Tunnel and a bridge over the Amur River.

## EDUCATION ON TUNNELLING IN THE COUNTRY

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

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

# SINGAPORE



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

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

**Number of Members:** 1312 members, 112 corporate members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

In 2023, TUCSS continued to promote tunnelling and underground construction and sharing knowledge by organising monthly evening seminars, training courses, a conference & site visits. These activities were attended by over 300 participants and helped the dissemination of tunnelling & underground related information and best practices from around the world. In addition, the society held social networking events to bring together the practitioners from the different sectors of the industry. TUCSS also continued to support the accreditation of tunnelling resident supervisory staff during the year.

### Monthly Seminars/Lectures for members:

19th January 2023

### Settlement Monitoring using Satellite Technology

*Mr Fahmi Mahony, Land Transport Authority*

16th February 2023

### Kai Tak Development Stage 3B

*Mr Haung Kan, Shanghai Tunnel Engineering Co (Singapore) Pte Ltd*

16th March 2023

### Tunnelling below Existing Buildings – Challenges and Mitigation Measures

*Er Jee Yi Yng, AECOM*

20th April 2023

### Infrastructure Instability and Ground Subsidence Monitoring with Satellite InSAR

*Mr Kyi Yu, Betime Engineer Pte Ltd & Mr Alastair Belson, Global Remote Sensing*

10th May 2023

### Construction Noise and Vibration

*Mr Vincent Hii, Affinity Engineering Consultancy Pte Ltd*

21st June 2023

### Correlation between Safety and Type of Fastening System in Tunnels

*Mr Ivica Duzic, Leviat GmbH*

20th July 2023

### Large Diameter Tunnels – Selected Projects over Twenty Years

*Mr Don Hall, Paras Hartamas Sdn Bhd*

17th August 2023

### Large-scale Subaqueous Tunnels – Tunnelling Methods, Challenges and Solutions

*Mr Ozturk Ozgur, AECOM*

21st September 2023

### Hulme Prize competition

*Ms Ye Qinyi, T.Y. Lin International Pte Ltd  
Mr Ng Wei Jie, Land Transport Authority  
Mr Podianko Surya, Arup*

25th October 2023

### Annual Lecture: A Case Study on

## Understanding TBM Operation in Weathered Granite (Mixed Ground) using TBM Data

Mr. Nick Shirlaw, WSP

16th November 2023

## Underground Eyes (Ueyes): Detecting and Mitigation Deep Subsurface Anomalies in Urban Cities

Dr Wu Wei, Nanyang Technological University

### Annual Lecture

The TUCSS Annual Lecture was held on 25th October 2023 at Singapore Management University Mochtar Riady Auditorium. The topic was "A Case Study on Understanding TBM Operation in Weathered Granite (Mixed Ground) using TBM Data" by Mr. Nick Shirlaw, C.Eng, MICE. The Annual Lecture was attended by 195 TUCSS members.

### Hulme Prize Award

This annual competition is set up for young engineers or students (below 35) to submit and present technical papers on subjects related to tunnelling and underground construction. The three winners are:

- First Prize: Performance of Deep Excavation using Island Method – Temporary Beams and Buttress Wall Retaining System, presented by Ye Qinyi, T.Y. Lin International Pte Ltd.
- Second Prize: From Runways to Tunnels: Navigating the Challenges of Tunnelling Underneath Singapore's Changi Airport, presented by Ng Wei Jie, Land Transport Authority.
- Third Prize: TBM Face Pressure Calculation – A Review of the Industry's Design Approach in Singapore' Thomson-East Coast Line, presented by Podianko Surya, Arup.

### Training Courses

TUCSS held two Tunnel Courses on 13th April and 26th October 2023 at Paradox Singapore Merchant Court. The courses were attended by 170 and 135 participants respectively. The purpose of the courses were to provide a comprehensive background to certain contemporary practices in design and construction of tunnels and underground structures.

### Conferences

TUCSS held "Underground Singapore 2023" on 14th – 15th September 2023 at PARKROYAL on Beach Road Hotel. The

Conference is the eleventh in a series of successful conferences held since 2001. The purpose is to provide a forum to share and discuss issues relevant to the planning, design and construction of underground projects in Singapore and the region. The aim is for contractors, engineers, owners and researchers to come together and contribute their experiences. Over 30 technical papers were accepted, and the presenters shared their research and findings over the 2-day conference. More than 300 participants attended the conference which included robust discussions, exchange of ideas and engaging networking that is important for the continuity in the industry.

### Annual Dinner

TUCSS celebrated its Annual Dinner on 6th October 2023 at Sands Expo & Convention Centre. The event was attended by 600 members and guests.

### Golf Friendly

TUCSS organised its Golf Friendly on 19th May 2023 at Orchid Country Club.

### Site Visit

A technical site visit to LTA C883 Cantonment Station was organised for members on 25th February 2023. The station is the 31st station in the Circle Line. A total of 25 participants attended the site visit to view the construction of a Civil Defence station comprising four underground levels with four Entrances and a Centralised Cooling Tower.

### CURRENT TUNNELLING ACTIVITIES

- Tunnel construction works for the Deep Tunnel Sewerage System Phase 2 (DTSS2) have been completed, utilising a total of 19 Pressure Balance Tunnel Boring Machines (TBM) for a combined tunnelling length of approximately 50km. Tunnelling was carried out in an urban environment and involved the undercrossing of expressways, cable tunnels, and live MRT tunnels, with a section under the seabed.
- The first stage of tunnelling for the Thomson East-Coast Line MRT extension within future Changi Airport terminal 5 has been completed. The second stage of tunnelling will resume in 2024.
- The construction of the North South Corridor, a 22.5km long expressway with a 12.5km underground section, is currently in progress.
- The eighth MRT line, the Cross Island

Line (CRL), will be the longest fully underground line at more than 50 km long once completed. Construction contracts for the Cross Island Line (CRL) Phase 1 and CRL-Punggol Extension have been awarded and preparatory works for tunnelling are in progress. Contracts for CRL Phase 2 are being progressively awarded.

- Singapore Powergrid is constructing Southeast Asia's largest underground substation.

### FUTURE TUNNELLING ACTIVITIES

Singapore will continue to explore greater use of its underground space to further optimise land use and provide capacity for future needs. Where it is feasible and meaningful, going underground would be the approach to optimise land use and improve the quality of our living environment. In general, the shallow levels of the underground would be used for people-centric activities that require connectivity to above-ground; while the deeper levels would be used for utilities, infrastructure, storage and logistics.

The transportation sector will see the expansion of the Mass Rapid Transit (MRT) system, currently spanning approximately 230km. The target by 2030 is to expand the rail network to about 360km. With most of the lines running underground, Singapore will see major tunnelling projects in the next years.

- The construction of the 29km long Phase 1 of the CRL (CRL1) targeted to be completed by 2030, is in progress and will see the use of 17 Earth Pressure Balance and 3 Slurry Pressure Balance, out of which two will be large diameter (>12m) TBMs able to accommodate both rail tracks.
- The 7.3km CRL – Punggol Extension, targeted to be completed by 2032, will provide a direct link for commuters travelling between eastern and north-eastern areas of Singapore. It will see the use of four EPBM including one 12.6m diameter large TBM.
- Civil contracts have been progressively awarded for the 15km long Phase 2 of the CRL (CRL2), where several tunnel boring machines will be used.
- Engineering studies for the CRL Phase 3 are ongoing and more details will be available at a later date.
- As indicated in the Land Transport Authority 2040 Master Plan, future tunnelling will also include the

extension of the Downtown Line (DTL) to serve the north-western region of Singapore.

- The Thomson East-Coast Line (TEL) extension, targeted to be completed by around 2040, will provide a direct rail connection from Changi Airport to the city.
- Changi international airport's new passenger Terminal 5 (T5) in Singapore will have an annual passenger capacity of 50 million. The project, expected to be completed by 2030, will include approximate 18km long network of tunnels to be built to establish airside connections within Terminal 5, as well as between T5 and existing terminals 1, 2, 3 and 4. The tunnels will allow for convenient movement of baggage, passengers, and airside vehicles.

## EDUCATION ON TUNNELLING IN THE COUNTRY

Two universities in Singapore offer Post Graduate Civil Engineering Degrees with

Geotechnical specialisation.

- The National University Singapore offers a MSc (Civil Engineering) with Specialization in Geotechnical Engineering and a Graduate Certificate in Geotechnical Engineering.
- The Nanyang Technological University (NTU) offers a Master of Science in Civil Engineering with specialisation in Geotechnical Engineering.

The Singapore Institute of Technology offers a Certificate Course in Tunnel Engineering. The course, developed in collaboration with the Land Transport Authority under the Centre for Infrastructure and Tunnel Engineering, aims to upskill professionals specialising in bored and mined tunnelling projects and supports Professional Engineers (Civil) in attaining accreditation as Specialist Professional Engineer in Tunnel Engineering. The courses comprise 3 modules of 36 teaching

hours each: TE1 - Geology of Singapore and Tunnel Design, TE2 - Tunnelling Construction and TE3 - Tunnelling Operation and Impact Assessment.

The Building and Construction Authority Academy offers a Specialist Diploma in Underground Construction (SDUC).

To support education in tunnelling in Singapore, TUCSS awards postgraduate scholarships for outstanding candidates on the MSc in Geotechnical Engineering programme in NUS, a scholarship at the Singapore Institute of Technology for B.Eng with Honours in either Civil Engineering or Sustainable Infrastructure Engineering (Land), and an Endowed Bursary Fund at NTU for second-year undergraduates in Civil & Environmental Engineering studying Geotechnical Engineering.

Full details of the available scholarships may be found on the TUCSS website (<http://www.tucss.org.sg>).

# SLOVENIA



Name of Association: Slovenian Society Underground Structures

Type of Structure: Non-profit, open association.

Number of Members: 120 members, 30 young members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

- 14th International Tunnelling and Underground Structures Conference (15th – 17th November 2023, Ljubljana, Slovenia).  
*Link to website: <https://www.ita-slovenia.si/14-mednarodna-konferenca-o-predorih-in-podzemnihobjektih/>*
- Construction site visit – tour of the construction site of the Karavanke tunnel (11th May 2023)  
*Link to website: <https://www.ita-slovenia.si/ekskurzija-na-gradbisce-predora-karavanke/>*

## CURRENT TUNNELLING ACTIVITIES

### Karavanke Tunnel

Construction is underway to augment the existing single bidirectional transalpine base tunnel with an additional tube, creating a twin highway tunnel system. Spanning 8km with over 1,000m of overburden, the tunnel crosses diverse

geological formations, ranging from Permian, Carboniferous to Triassic, including areas with squeezing ground and challenging hydrogeological conditions. Initiated in the latter half of 2020, the excavation from the Slovenian side has progressed approximately 3000m, leaving about 450m remaining until the breakthrough.

### Divača-Koper Railway Line, Second Track

Work has begun on adding a second track to the existing railway line between Divača and Koper. This new segment includes eight tunnels (T1-T8), totalling 38km. All tunnels are single-tube, with T1, T2, and T8 featuring service tubes for rescue operations, and T4 and T7 equipped with transverse exit tubes. The second track's path traverses various carbonate rock formations, heavily characterized by karst phenomena such as sinkholes, fissures, caverns, and underground caves. The karstification level is high in certain sections.

### Tunnel Pekel

Construction of the 1.5km double-track railway tunnel on the Maribor – Šentilj – state border line began in early 2021. With a cross-section of about 135m<sup>2</sup>, the tunnel's overburden peaks at 90m, reducing to less than 10m near the H2 highway crossing. Construction was finished in autumn 2023.

### Tunnel Konovo

Construction of a 495m single-tube tunnel commenced in 2023. This tunnel is a part of the access road connecting to the main route.

## FUTURE TUNNELLING ACTIVITIES

### Third Development Axis - North

The design for the Third Development Axis – North covers the execution of a new road link from the access point to Koper – Šentilj motorway A1 near Šentrupert to the Slovenj Gradec access point. The total length of the planned expressway amounts to 31.5km, and it will include four cut-and-cover tunnels with a total length of 1,840m and six tunnels in a total length of 3,700m.

### Third Development Axis – South - Tunnel Gorjanci

The design for the Third Development Axis – South covers the execution of a new road link from the access point to Ljubljana–Obrežje motorway near Novo



mesto to the Maline access point. The total length of the planned expressway amounts to 17.9km. It will have three bridges, four viaducts, two cut-and-cover tunnels, a 2,341m long tunnel under the Gorjanci hills, 10 overpasses, nine underpasses and two lay-by niches.

**Upgrade of the Second railway track of the new Divača-Koper railway line**

Preliminary design for the upgrade of the currently under construction railway line Divača – Koper. The new left track has a 17.05km total length of the planned tunnels.

**Second rail Ljubljana-Jesenice-Karawanke tunnel**

The spatial planning for the optimisation, and improvement into two lanes of the existing railway track Ljubljana – Jesenice – Karawanke tunnel is in progress. As a candidate rail line for inclusion in the extended TEN-T network, it requires its infrastructure to allow higher train velocities. For trains to meet the requirements on this

section of 70km, the line must pass through 13 newly built tunnels (8800m of total length) and three cut and cover tunnels (2200m of total length).

**Ljubljana Railway Junction**

An alignment study for a railway junction below the Ljubljana city area including the city centre is in progress. Around 16km of tunnels will be excavated by TBM, whereas NATM will be used for bifurcation caverns. The project will put freight train traffic below the urbanized surface and will enable higher volumes of freight traffic.

**STATISTICS**

**1. Length or volume excavated during 2023:**

18.5km (100% conventional)

**2. Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023:** €400M

**3. List of tunnels completed:**  
Pekel Tunnel

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

- a. Second tube of Karawanke Tunnel
- b. Second Track of the Divača-Koper railway line:

- Lokev Tunnel
- Beka Tunnel
- Stepani Tunnel
- Tinjan Tunnel
- Osp Tunnel
- Mlinarji Tunnel
- Škofije Tunnel
- Konovo Tunnel

**EDUCATION ON TUNNELLING IN THE COUNTRY**

- Department of Geotechnology, Mining and Environment (OGRO)/ Faculty of Natural Sciences and Engineering, University of Ljubljana
- Department of Civil Engineering/ Faculty of Civil and Geodetic Engineering, University of Ljubljana
- Department of Civil Engineering/ Faculty of Civil Engineering, Transportation Engineering and Architecture, University of Maribor

# SPAIN



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

**Type of Structure:** Non-profit, open association, founded in 1974

**Number of Members:** Total 319 (211 individual members, 67 corporate members, and 41 young members)

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

During 2023, to comply with AETOS purposes, several activities were carried out, in both hybrid face-to-face and virtual modes. These include, among others:

- XIX Máster Universitario in Túneles y Obras Subterráneas AETOS (endorsed by ITA-AITES).
- Activities of the Working Groups coordinated by the AETOS Tunnel Forum (FAT).
- Meetings of the European & Tunnel Forum EUFT and GIT and other counterpart Associations.
- Monography issue num. 3642 of tunnels in the ROP (Journal of Public Works). A new special issue of ROP on Tunnels and Underground Works was presented, as a continuation of the collaboration that the Spanish Association of Tunnels and Underground Works (AETOS) and the Journal of Public Works (ROP), has been developing since 2009, to publish monographs which disseminate the

experiences related to performance in tunnels and underground works.

- The fulfilment of the objective of AETOS to promote the study and research of underground works, facilitating contact and collaboration between professionals within related organizations via, among other avenues, the yearly publication of the monograph.
- Technical Conference: "Tunnels in Gipuzkoa and other singular tunnels". Donostia, 14th – 15th Feb 2023.
- Technical conference on "Innovations in tunnels and underground structures". Madrid, 21st June 2023.
- Participation as a European Underground & Tunnel Forum (EUTF) member, in AFTES: "Strategies and guidelines for sustainable underground infrastructure". Paris. AFTES - October 2nd, 2023".
- Participation in the 5th Mexican Congress on Tunnel and Underground Engineering: "Aspects of design

and modelling of tunnels built with conventional methods" Mexico November 29th, 2023.

- Spanish presence at the WTC-2023, and 49th ITA-GA. Athens, September 2nd – 8th, 2023. Participating in WGs activities.
- September, 20th, 2023, 49th General Assembly of AETOS, including:
  - Medal of Honor to Emeritus Prof. Eduardo Alonso, and to Helena Castellví, the 2023 AETOS Young Tunnel Engineer
  - Diploma of recognition for Daniel Jaen Matute, AETOS Young Member Group past president
  - Posthumous tribute to Miguel Fernandez-Bollo, and Antonio Soriano Peña
  - Special Conference: "Think Deep for Sustainable Development" by Antonia Cornaro, ETZH & ITACUS co-chair

## CURRENT TUNNELLING ACTIVITIES

Throughout 2023, the design, construction, maintenance, and modernization of tunnels in Spain is on-going. Some examples are listed below:

### Railway Tunnels

During 2023 high-speed rail is progressing with among many, the following:

- The "Basque Y", 140km long, including 80 tunnels, with a total length of 104.3km, meaning 60.6% of the route is underground.



Udalaitz tunnel "Y" vasca



- Also starting - and considered crucial for the improvement of the system – are the Puerta de Atocha access to Madrid and, for Valencia, the new access channel and reformation of the Joaquín Sorolla high-speed station. At the end of December 2023 the administrator of the railway network awarded the contract for the execution of these works, which will have a construction period of 60 months and a budget of €443M.
- Progress is also reported on the underground works at the Bergara Junction (Kortazar and Udalaitz tunnels) on the Vitoria–Bilbao–San Sebastián High-Speed Line.

### High speed railway tunnel in construction, during 2023

- Túneles de Udalaitz (Vitoria-Bilbao-San Sebastián): 2 x 7.3km
- Artificial Bajo Valle del Cuarto Chico (Castejón-Cadreita): 0.13km
- Monte Plano (Olite-Tafalla): 1.9km
- Canal de Navarra (Tafalla-Tafalla): 0.6km
- Túnel del Rincón\_tramo Lorca-Pulpí (LAV Murcia-Almería): 0.93km
- Túnel de Viator\_tramo Nijar-Río Andarax (LAV Murcia-Almería): 0.88km
- Túnel artificial Fuente Flores\_tramo Pulpí-Vera (LAV Murcia-Almería): 0.29km
- Túnel de Sorbas (bitubo) (tramo Vera-Los Arejos): (2 x 7.52km)
- Túnel del Almendral (tramo Vera-Los Arejos): 1.11km
- Dehesa Terzuelo (Malpartida De Plasencia-Est Plasencia/Fuentidueñas): 1.45km



Elorrio tunnel "Y" vasca

The tests and commissioning of the Pajares tunnels are completed for commissioning

The Madrid Metro expansion project is ongoing, which will see the construction of 40.5km of new tracks, by 2028 with an investment of over €1.200M

- Line 3 - Section: Villaverde Alto-El Casar, 2.5km
- Line 11 – from Plaza Elíptica to Conde de Casal, 7km
- Line 11 – from Conde de Casal to Mar de Cristal, 18.6km

In total, these projects will add more than 17km of Metro and two new stops near the Hospital Enfermera Isabel Zenda, and Ciudad de la Justicia and Valdebebas Norte which will be an interchange. The new layout will pass through the existing Madrid underground station T4, at one

of the ends of Line 8, which will facilitate a new more direct connection between the Adolfo Suárez Madrid Barajas Airport and Atocha.

The Madrid Metro today includes 302 stations and 294km of tracks, the fifth largest network in the world behind London, New York, Shanghai and Paris. If on schedule, within seven years it will have 309 stations and 334km of tracks. The extension of L8 of the Barcelona Metro and Line 5 of the Bilbao metro are also under construction.



Madrid Metro L3 in construction



Pajares Tunnel. Passenger evacuation drill

### Road Tunnels

In compliance with the European Directive on minimum safety requirements, the adaptation of road tunnels of the RGE to R.D. 635/2006 required 65 tunnels to be put out to tender, with a cumulative length of over 32km. Among others the following projects for road tunnels are ongoing:

- San Juan Tunnel (Alicante)

- Aguadulce, Bayyana, La Parra and La Garrofa tunnels (Almería)
- Adaptation of various tunnels in the province of Barcelona
- Llado, Collaguets, Fogá and Juan Carlos I tunnels (Lérida)
- Montefurado, Piedrafita San Pedro, Doncos, Cereixal and Neira tunnels (Lugo)
- Villafranca, Trabadelo and La Escrita (León)
- Capistrano, Tablazo, Frigiliana, Lagos, Torrox, Churriana and San Pedro tunnels (Málaga)
- El Carmen, Llovio, Tezangos, El Fabar, Arenal de Morís, Ángel Uriel, El Padrún and Duestos tunnels (Asturias)
- Gedo, Somaconcha, Lantueno, Las Caldas, Riocorvo and Pedredo, Caviedes, Hoz, Torrelavega, Gibaja, Astillero, La Marga, Maliaño, La Albericia, La Morcilla and Limpías tunnels (Cantabria)
- La Canda, Padornelo, Padornelo N-525 and La Canda N-525 tunnels (Zamora)

Throughout 2023, more than 400 conservation actions have been performed in tunnels on the M-30. These are carried out after detailed inspections, which are supported by laser scan and thermographic images.

This year, 6,000 miles of roadways, 55 enclosures (including emergency exits) technical rooms and ventilation shafts were inspected, as well as the 21,500 bearings that support the roadway platform of the twin tunnels that make up the M-30 by-pass.

For the inspection of the 8,000m of extraction galleries on the by-pass, an autonomous vehicle was used due to the complexity of access, on which a 360° camera was placed, with the images later analyzed at the office.

In Gran Canaria, the final La Puebla tunnel (number five) between the La

Hoya and La Palma ravines, and tunnel number 11 were completed. These were added to the already initiated project that will preserve the La Aulaga archaeological zone. In total, 8.4km has been excavated between the nine tunnels and the three evacuation galleries in case of an emergency.

### Hydraulic Tunnels

- The Mularroya tunnel that will transfer water between the Jalón and Grió river basins. Of its almost 13km, a total of 11km is programmed to complete in March of 2024. The tunnel has an internal diameter of 2.9m and an external diameter of 3.3m, and will cross the municipalities of Calatayud, Paracuellos de la Ribera, El Frasno and Morata de Jalón, with the capacity to transfer 8 cubic meters of water per second.
- In 2023, the first construction works for the San Silvestre began, with an internal diameter of 3.6m, and a water transfer capacity of 10m<sup>3</sup>/s, the tunnel will have a total length of 7km.
- In the Basque Country, the Galindo stormwater tank, which will have a storage capacity of 90.000m<sup>3</sup>, is under construction by roadheader.

### FUTURE TUNNELLING ACTIVITIES

#### Forecast for during 2024

- 50th Anniversary AETOS celebration. Including General Assembly. 28th – 30th Oct 2024, Madrid
- Seminar: “Túneles en Cataluña” (pending programme)
- Seminar: “Madrid Metro lines” - new extensions (pending programme)
- EUTF, regular meetings and sharing European initiatives to strengthen ITA interest
- AETOS WGs activities coordinated by AETOS Technical Forum (FAT) are on-going

### EDUCATION ON TUNNELLING IN THE COUNTRY

Tunnelling Master and Degree course 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).

Edition XIX “Master in Tunnels and Underground Works” (2023-2024) is ongoing. The Master degree is currently a Post-Graduate Master Course 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 scope through collaboration with the ITA Member Associations, especially those with development in Spanish-speaking countries, such as: ACTOS, AMITOS, APTOS, etc. within which AETOS maintains collaboration agreements.

The teaching cycle, which includes 1250 teaching hours and a Master thesis (plus individual study, design practices, etc.), has allowed us to train numerous specialists in the fields of Design, Construction and Maintenance of Tunnels and Underground Works over the last 16 years, and many of our students have been successfully incorporated into tunnelling works in different areas of the Public and Private sectors.

To offer the highest quality of teaching, since 2014, AETOS has been collaborating with the National University of Distance Education (UNED) (through its Permanent Training program) and with the College of Civil Engineers (CICCP), to offer distance learning possibilities, to access a greater number of students.

### STATISTICS

#### 1. List of tunnels completed: (A tunnel data base it is being promoted by AETOS) Activity of High-Speed Railway tunnels during 2023

Status	Number of tunnels	Cumulative length (km)
Panning	4	1.8
At the start of construction	1	3.4
In construction	12	37
In service	3	55.1
Total	20	97.3

#### 2. List of tunnels under construction: Commented on in this report



# SWEDEN



**Name of Association:** Swedish Rock Engineering Association

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

**Number of Members:** 115 corporate members from public and private clients, contractors, suppliers, mining companies, consulting firms, institutions and research organizations

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

Four committees constitute the backbone of the Swedish Rock Engineering Association (Svenska Bergteknikföreningen). These working groups are 'Yearly Congress', 'Young Members', 'International' and 'Professional certification'. The association works towards a sustainable use and development of underground space.

The main activity of the association is the annual Swedish congress where a significant part of the Swedish industry gathers. This physical event was held in March of 2023 and brought together about 700 delegates over 2 days. Young Members' mentor program DevelopYM that was launched in 2018 continues.

'International' have been working towards an increased Swedish participation in ITA activities. We are represented in all relevant Working Groups within the ITA. Since 2020, 'Professional certification' is the group within the Swedish Rock Engineering Association that is responsible for accreditations of educators and certification of grout-bolt-and shotcrete workers. During 2021 this was developed to include shot fire licensees as well.

One of our proudest accomplishments is the development of the Children's book "Vinnie and the Metro". The book has been distributed for free to more than 12,000 children between the ages of 3 and 6 years old where they learn how to build tunnels in hard rock. It is planned to be available as an e-book at the WTC 2024. The association has launched a new website during 2023 that will be available in English in 2024.

## CURRENT TUNNELLING ACTIVITIES

### Stockholm Bypass (E4 Förbifarten, Stockholm)

This project includes an 18km long road tunnel. When ready this tunnel will be one of the longest and most complex highway tunnels in the world. By 2035, the Swedish

Transport Administration (Trafikverket) estimates that The Stockholm bypass will be used by approximately 140.000 vehicles per day.

### West Link – Korsvagen station (Västlänken, Gothenburg)

The West Link is an 8km long double track railway, including a 6km railway tunnel, underneath the city of Gothenburg. With the West Link, Gothenburg central will acquire a new underground station in the northern part of the Nils Ericson Terminal. Two completely new stations will also be available at Haga and Korsvägen. The Railway Study demonstrates that this alternative best fulfils the project's primary objective of contributing to sustainable growth in both Gothenburg and the country as a whole.

### Reconstruction of Slussen Stockholm including a 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 2023.

### City Link tunnel

The so-called City Link Project, the Anneberg-Skanstull Tunnel, serves to improve the power supply in the Greater Stockholm area. At a length of around 14km and a diameter of 5m, the tunnel is being driven about 50 - 100m below the Swedish capital using a tunnel boring machine. The City Link project also includes six ventilation shafts, elevator systems as well as the construction of technical buildings for electrical equipment in the Anneberg area and at the shafts. Completion of construction works is scheduled for 2024.

### Extensions of the subway in Stockholm

The Blue Line is being extended from

Akalla to Barkarby and includes two new stations at Barkarbystaden and Barkarby. In service 2026.

The Green Line is being extended from Odenplan to Arenastaden, and includes three new stations: Arenastaden, Södra Hagalund and Hagastaden. In service 2028.

The Blue Line is being extended from Kungsträdgården to Södermalm, Söderort and Nacka. Six brand-new stations: Sofia, Hammarby kanal, Sickla, Järla, Nacka, Slakthusområdet. A new platform for the Blue Line will also be built under the existing Gullmarsplan station. In service 2030.

The depot in Högdalen is being expanded to service, clean and repair more trains from both the Green Line and the Blue Line. Expected to become operational in 2025.

## FUTURE TUNNELLING ACTIVITIES

### The East Link high speed rail (Ostlanken)

New high-speed rail south of Stockholm. Design and planning is ongoing. The project includes 12 single rail tunnels and 15 double rail tunnels. The longest tunnel will be 6km and the shortest will be 100m long. Procurement of major design and build is planned to start in 2024.

### SKB Forsmark, final repository nuclear fuel

Planning is continuing regarding Sweden's final repository for spent nuclear fuel. The construction is ready to start as soon as permission is granted.

### Hydrogen storage in Gellivare

Large lined rock cavern project in northern Sweden in Gellivare municipality. This is the full scale Hydrogen Storage facility for fossil-free iron and steel production. It will be the world's largest facility for Hydrogen storage when completed.

### The Yellow Line to Älvsjö (Subway)

The completely new Metro line between Fridhemsplan and Älvsjö will link central and southern Stockholm together. This also enables the building of 48,500 new homes with sustainable communications. The line will provide new travel possibilities with convenient hubs for changing to other means of public transport, while also relieving the pressure on T-Centralen and the Red Line. The new line between Fridhemsplan and Älvsjö with six stations. Construction is expected to

start in 2025 with services expected to start running in 2034.

### Host of the WTC 2025 in Stockholm

At the WTC 2022 in Copenhagen, Sweden was chosen to host the WTC 2025 and the 51st General Assembly. This will take place on the 12-18th of May in 2025.

### EDUCATION ON TUNNELLING IN THE COUNTRY

- 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 and hydrogeology.
- 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.

## SWITZERLAND



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

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

**Number of Members:** 534 members (thereof 120 young members), 91 corporate members

### ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

STS was hosting/organizing/supporting/participating in the following main activities:

- June General Assembly 2023 and 50th anniversary celebration in Lucerne, Switzerland
- June Swiss Tunnel Congress and Colloquium 2023 in Lucerne, Switzerland
- September D-A-CH (Germany-Austria-Switzerland) annual meeting in Bern, Switzerland
- October European Underground & Tunnel Forum (EUTF) annual meeting in Paris, Italy
- May – September 2023, 'Insight in Underground' public visits/events in relation to the STS 50th anniversary celebration, carried out over five days in different regions of Switzerland
- Activation of the new Swiss Tunnel-Database (available via website)
- Activation of the new STS website

Additionally, the STS young members (STSym) were hosting/organizing/supporting/participating in the following events:

- March 2023 ym Regional Event in Genua, Italy
- March Excursion Mauderli AG, Switzerland
- June Young Members' podium at the STS 50th anniversary celebration in Lucerne, Switzerland
- Nov/Dec STSym-Drinks in different locations in Switzerland (Olten, Zürich, Lausanne)

### CURRENT TUNNELLING ACTIVITIES

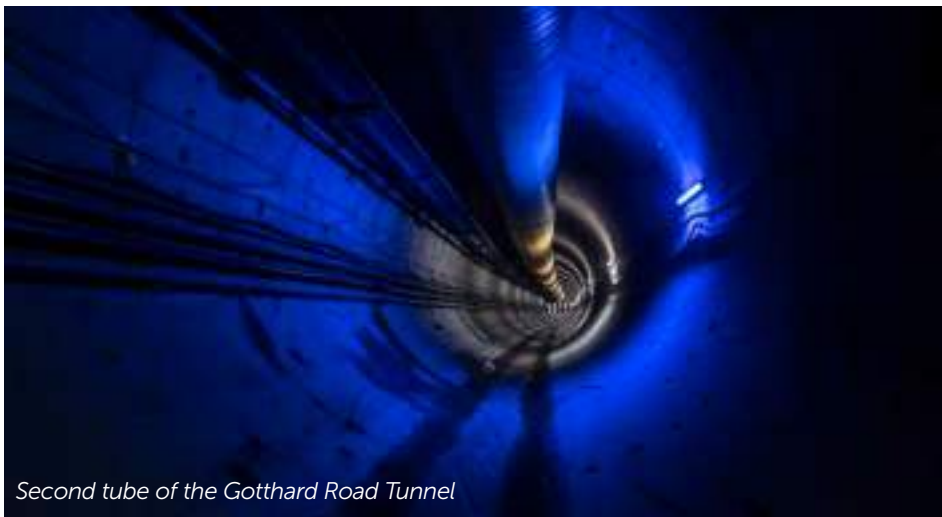
#### Second tube of the Gotthard Road Tunnel

The second tube of the Gotthard Road Tunnel includes the construction of a new two-lane tunnel with a length of 17km which runs parallel to the existing Gotthard Road Tunnel, 67 new cross-passages to the existing service gallery, five new underground ventilation

caverns linked to the existing ventilation shafts of the existing tube, two new technical buildings in the portal areas Göschenen and Airolo and several comprehensive preparatory works, such as two access adits of 5km length each, and two new sections of the service and emergency gallery.

In 2023 the project achieved several milestones:

- In the northern part, the Lot 243 completed the excavation of several logistic galleries and caverns and also finished the excavation of the northern access adit using an open gripper-TBM with a length of 4km. The excavated tunnels and caverns were handed over to the main contractor to continue the installation works underground, as these tunnels and caverns will be used to host the main concrete production plant and the plant for the production of the segmental lining.
- The closed shield TBM for the southern access adit, with an excavation diameter of 7.46m, successfully completed the excavation of the 5km long access adit. Currently, the machine is being disassembled in an underground cavern. Afterwards, the access adit will be handed over to the main contractor for the excavation works in the geologically complicated fault zone "Guspis."
- Progress on the primary lots, both north (Lot 241) and south (Lot 341), is on schedule, and the construction site is in full operation.
  - 1) In the northern section the contractor started with the excavation of the open-pit for the northern portal and almost completed a counter-excavation by D&B. Additionally the works for the logistics caverns for the excavation of the main fault zone north called "Mesozoikum" started.
  - 2) In the southern section, the open-pit for the southern portal has been



Second tube of the Gotthard Road Tunnel

completed, and excavation for the launch tube of the main TBM has commenced using conventional methods (excavator and D&B). Furthermore, the contractor has executed extensive installation works, including those for the water treatment plant, the primary concrete production facility, and the hallway designated for the production of the segmental lining.

- The lot responsible for the material management and logistics of the entire project (Lot 111) started the main installations in the southern area of the project (foundations and structures of the conveyor belt running from the southern portal to its main construction site, silos for the transfer of the excavated material in the train stations of Airolo and Göschenen, and foundations for the main material treatment plant).
- As part of the events commemorating the 50th anniversary of the Swiss Tunnelling Society, the client opened the construction site to the public, celebrating two days of open doors and welcoming more than 2000 visitors each day in the northern and southern construction sites. It was an extraordinary opportunity to showcase this megaproject to the wider public.

### Flood protection for the Sarneraa valley (central Switzerland)

In 2005, the city of Sarnen was repeatedly flooded by a rapidly rising lake. To protect the Sarneraa valley, including the city of Sarnen, the canton of Obwalden decided in 2014 to build a 6557m long flood protection tunnel. The tunnel is designed with a discharge capacity of 100m<sup>3</sup>/s. The tunnel was excavated using the S-1216 TBM. Tunnelling began in January 2021 and ended on 15th March 2023. Very difficult geology was encountered during TBM advance. Large water inflows of more than 400 l/s from karstic caves within exceptionally hard limestone had to be managed during the initial excavation. More than 1541 steel rings were installed to secure faulted limestones and marls, in particular during the last 2km. The inner lining with 20cm of shotcrete has been under construction since summer 2023 and is scheduled for completion in winter 2024. The town of Sarnen will then be protected from further flooding by spring 2026.



*Flood protection for the Sarneraa valley*

### New RBS underground station (Bern)

The existing RBS station in Bern was opened in 1965. Designed for around 16,000 passengers a day, it is now used by up to 60,000 passengers a day. With the construction of the new RBS station, the capacity will be adapted to current needs and the forecast development. The new four-track RBS station will be located below tracks two to seven of the Swiss Federal Railways (SFR) station. The current RBS station will be abandoned for rail operations.

The new four-track RBS station will be built below the current SFR station. It consists of two large underground caverns, each with two tracks and a 12m-wide central platform. Escalators

and lifts will lead from the platform level to the RBS distribution level and on to the new central underpass. From there, passengers can reach the mainline and suburban train tracks and the city. The trains enter the RBS station through a new, almost 1km long, partly double-track tunnel. This new tunnel branches off from the existing RBS-Schanzentunnel and runs largely under road and railroad land.

Parallel to the RBS work, SFR is building the new central underpass and the city of Bern is adapting the road network around Bern station. The project is extremely complex, challenging and fascinating. The new facilities have to be built in the middle of the city in full operation. A



*New RBS underground station (Bern)*

wide variety of construction methods are being used. One of the main difficulties is the technical and, in particular, temporal coordination of the project components of the various project partners.

The new Bern RBS station is scheduled to go into operation in the second half of 2029. The project is scheduled for completion in 2032. The total costs, financed by the federal government, the canton of Bern and the city of Bern, amount to around CHF1,217M (prices as of fall 2016, excluding inflation and VAT).

### Gubrist highway tunnel, 3rd tube and refurbishment of the existing ones (Zurich region)

The 3rd tube of the Gubrist tunnel is a construction project designed to alleviate the bottleneck at the Gubrist tunnel in Switzerland. The tunnel has a total length of 3.3km and was constructed using mechanized rock excavation (MUF) from the Affoltern side. The breakthrough in Weiningen took place on September 22nd, 2020 after around three years of driving and the 3rd tube was put into operation on April 20th, 2023. The tunnel was cut using a roadheader (TSM) with excavation support of fibre-reinforced shotcrete and steel arches as well as partial rock anchors. One cycle of excavation and support took approx. six to eight hours. With three cycles in three-shift operation, the tunnel advanced by up to 6m a day. The excavated cross-section is 180m<sup>2</sup>.

In Weiningen, 200m of tunnel were built whilst at the same time, the new Weiningen half connection with an additional 100m-long overpass was built. On the Affoltern side, 95m of cut-and-cover was constructed and a temporary loading station was built with a connection to the Swiss Federal Railways line to allow removal of the excavated material.

The tunnel excavated material was transported to the loading station via conveyor belt and loaded onto freight trains. During the tunnel excavation, two to three trains with 18 wagons each transported a total of around 700,000m<sup>3</sup> of rock to the former quarry near Wildeggen every day. This meant that a total of 160,000 truck journeys could be avoided.

The operating and safety equipment was installed by specialist companies by summer 2022. This included the signalling, lighting and ventilation in the 3rd tube and the three operations centres. This was followed by extensive



Gubrist highway tunnel 3rd tube

functional and safety tests up to spring 2023, with the first traffic rolling through the tunnel in April 2023.

Once the 3rd tube has been commissioned, the two existing tubes of the 3,250m long Gubrist tunnel (commissioned in 1985) will be repaired one after the other as part of the expansion of the Zurich northern bypass (ANU) and extended by around 100m. The main work includes the removal of the existing carriageway slab, the service and exhaust air ducts, the lateral walkways, and the intermediate slab. The dismantled elements are reinstalled in an adapted position so that the available traffic space is optimized or enlarged. The lowered roadway will rest on a buried utility duct. In addition, new SOS niches in the 2nd tube, a new service duct in the Weiningen open-cast mine, and anti-circulation walls in the Affoltern portal pre-zone will be built. In both tunnel tubes, the surface protection system, the hydrant line and the operating and safety systems will be replaced.

Construction work for the repair started in July 2023. Traffic should be flowing through all three tunnels by the end of 2027. The shell construction costs for the repair of the 1st and 2nd tunnel tubes amount to CHF 245M.

### Evouettes road tunnel (Wallis)

The Evouettes bypass on the H144 is a two-way road which improves the link between Villeneuve in Switzerland and

St-Gingolph on the border between Switzerland and France, south of Lake Geneva. The road continues on the French side to the thermal town of Evian.

The topography led to the following works: Two road junctions (total L = 473m); two tunnel entrance passages (total L = 163m); two rectangular cut-and-cover tunnels (total L = 49m); two cut-and-cover tunnels with a profile similar to that of the main tunnel (total L = 59m); a tunnel (L = 657m, internal radius = 5.3m); and an emergency tunnel (L = 120m).

The tunnel is curved, with two traffic lanes, excavated in an alluvial fan through loose ground (sandy-gravelly and silty-gravelly moraines). The geological conditions are described as difficult. Systematic ground reinforcement is required. The excavation of the tunnel ascends for around 150m before descending for around 500m from the north portal to the south. The full cross section is excavated using a mechanical excavator.

The standard ground support enabling works include: 45 near-horizontal overlapping jet-grouted columns (min. diameter 80cm; length 12m) distributed around the excavation perimeter of the tunnel and at the bridge piers. The columns have been installed at an angle of 7.29° to the axis of the tunnel to enable successive sets of columns to overlap each other by 3m. Thirteen jet-grouted columns (min. diameter 80cm, length

12m) are positioned at the leading edge of the excavation. These columns are inclined at between 0 and 5° to the horizontal. The ground support consists of sprayed fibre reinforced concrete followed by sprayed concrete reinforced with steel girders and a welded mesh.

The temporary invert is formed using poured concrete reinforced with HEB 180 or 220 beams. The permanent invert and lining are of unreinforced concrete.

The main difficulty was the passage under the village, due to greater than expected settlement (~8cm) which occurred during the installation of the jet piles. Work resumed in February 2022 after an 11-month stoppage. In the most critical section, the company proposed using a double cantilever vault. The tunnel was open on 13th November 2023 for a total cost of the Les Evouettes bypass of around CHF134M, including CHF85M for the tunnel. It will be financed mainly by the Swiss trunk road fund.

## 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, 6,000m)
- Heitersberg Tunnel II (SBB, 5,000m)
- Grimsel Tunnel (SBB, 21,720m)
- Svitto Tunnel II (SBB, 300m)
- Morges-Peroy tunnel (SBB, 9,000m)
- Neuchâtel-La Chaux-de-Fonds (SBB, 14,500m)
- Täsch-Zermatt Tunnel (MGB, 4,120m)
- Fideris Tunnel (RhB, 1,385m)

### Road Tunnels

- Morschacher/Sisikoner Tunnel (Kt. SZ/UR, 8,037m)
- Vingelz Tunnel (Kt. BE, 2,300m)
- City Tunnel (Kt. BE, 700m)
- Port Tunnel (Kt. BE, 1,800m)
- 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)



Evouettes road tunnel (Wallis)\_

- 3rd Tunnel Melide- Grancia (ASTRA, 1,800m)
- Tunnel Cargo Station St. Gallen (ASTRA 2,400m)

### Other Projects

- Cargo Sous Terrain Zurich – Haerkingen (CST, 70,000m)

## STATISTICS

### 1. Length of tunnels excavated during 2022:

12,000m/80% TBM in 2023

### 2. Amount (Eur) of tunnelling / underground space facilities awarded in 2022:

€1,450M in 2023

### 3. List of tunnels completed

Rail Tunnels: None.

Road Tunnels: 3rd Tube Gubrist Tunnel

Other Projects: CERN HILUMI LHC Project (main works)

### 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, 300m).

**Road Tunnels:** Second Gotthard Tunnel Tube (ASTRA, 16,918m), Safety Gallery Cholfirst Tunnel (ASTRA, 1,250m), Safety Gallery Kerenzerberg Tunnel (ASTRA, 5,504m), Visp Tunnel 2nd Tube (Kt. VS, 2,600m), Refurbishment Gubrist Tunnel 1st and 2nd Tube (ASTRA, 3,230m), 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), Refurbishment Tunnel Melide-Grancia (ASTRA, 1,800m)

**Other Projects:** Hydro Power Plant Ritom, Sarneraa spillway tunnel (Kt. OW, 6,557m)

## EDUCATION ON TUNNELLING IN THE COUNTRY

- ETH Zurich, Department of Civil, Environmental and Geomatic Engineering
- University of Applied Sciences, in various cities

# ALWAYS ADVANCING

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



## CHENNAI METRO RAIL PHASE-II CORRIDORS PROJECT

Five TERRATEC's 6.61m diameter Earth Pressure Balance Tunnel Boring Machines (EPBMs) are being used for the Chennai Metro Rail project in India.

In recent years, TERRATEC's order book has demonstrated significant growth & diversity globally including projects in South America, Europe and Asia which have been the result of robust custom made TBM designs, a readily available stock of TBM spares and consumables, and a highly skilled team offering specialised TBM support and prompt onsite assistance throughout tunnelling operations.



# THAILAND



**Name of Association:** 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 2023 AND TO DATE

- Tea-Talk Seminar on "Solutions to stop water leakage in Underground Construction" dated 25 May 2023.
- Training on "Tunnelling in Soft Ground" (Generation 5), dated 12-14 July 2023.
- Special Lecture on "Roles of Pile Load Tests in Rational Design of Pile Foundations", dated 19 December 2023.
- Tea-Talk Seminar on "Press-in Method", dated 20 December 2023.

## CURRENT TUNNELLING ACTIVITIES

- Flood Drain Tunnel – Klong Nong Bon to Chao Pha Ya River, Bangkok – 5.7m diameter EPB shield tunnel, 9.4km in length (Bangkok Metropolitan Administration – 4,925.665MB- 1MB = 0.3 M US dollars)
- Bangkok MRT Orange Line - East Section –20km long bored twin tube EPB shield tunnels and Stations (Mass Rapid Transit Authority of Thailand – 79,221.24MB)
- Mae Tang – Mae Ngud – Mae Kuang Water Diversion Tunnel , Chiangmai, Northern Thailand– 48km tunnel in length, 3 Double shield TBMs tunnelling and Drill and blast excavation, 4 contracts, (Royal Irrigation Department – 9,206.81MB)
- Railway Track Doubling Project, North-Eastern Line – Mab Kabao – Thanon Chira Junction – 3 twin tube tunnels, total length 7.9km (State Railways of Thailand (SRT) - 9,200MB)
- Klong Prem Prachakorn Flood Drain Tunnel, Bangkok – Khlong Bang Bua to Chao Pha Ya River – 5.7m diameter EPB shield tunnel 13.5km in length (Bangkok Metropolitan Administration - 8,233.35MB)
- Klong Taweewattana- Bottle Neck Flood Drain Tunnel, Bangkok, 3.7m diameter EPB shield tunnel, 2km in length (Bangkok Metropolitan Administration- 2,219MB)
- Power Cable Tunnel Projects (Metropolitan Electricity Authority -Bangkok)

- Work plan to change electrical cable system to underground power line "The City of ASEAN" : 127.3km tunnel length– 48,717.2MB
- Conversion of Overhead Line to Underground System, Rama III Project : 10.9km tunnel– 5,635.3MB
- Chong Nonsri Project : 8.3km tunnel in length– 2,899.8MB
- Ratchadapisek - Asoke Project : 8.2km tunnel length– 4,554.91MB
- Ratchadapisek – Rama 9 Project : 14.3km tunnel length– 4,344.67MB
- South Bangkok -Chao Phraya River Crossing Project : 3.6m diameter, 0.95km EPB Shield Tunnel, 366MB
- Denchai-Chiang Rai-Chiang Khong Railway Project, New railway line in Northern Thailand – 323km in length, consists of 4 twin tube tunnels, - 1.18km, 6.24km, 2.70km, and 3.40km tunnel in length (State railways of Thailand(SRT) - Project Cost = 72,919.26MB)
- Eastern Line - High-Speed Rail Linked 3 Airport Project - 1 tunnel of 0.3km tunnel length at Khao Chi Chan, Pattaya (The Eastern Economic Corridor Office of Thailand, EECO)
- Northeastern Line High Speed Rail Tunnel (Thai-China Cooperation) – 1st Section - Bangkok to Nakorn Ratsima, 3 single tube double-track D&B tunnel, combined length 12.2km (State Railway of Thailand- 4,220MB)

- The 9th Bangkok Water Supply Improvement Project –Water Transmission tunnel- 44.0km in length and 3.0-3.2m diameter EPB Shield Tunnels, (Metropolitan Waterworks Authority – 17,012MB)
- Bangkok MRT Purple Line South – 25.4km long twin-tube EPB shield tunnels and Stations (Mass Rapid Transit Authority of Thailand – 124,000MB)

## FUTURE TUNNELLING ACTIVITIES

- Studies and designs of tunnels in 2024
- Bangkok Orange Line - West Section –20.4km tunnel (Mass Rapid Transit Authority of Thailand – 96,000MB)- To start in 2023
  - Klong San Saeb Flood Drain Tunnel, Bangkok – from Khlong Lad Praow to Soi Lad Praow 130 – 3.7m diameter and 3.8km tunnel in length (Bangkok Metropolitan Administration – 1,701MB)
  - Klong Samsen to Existing Bang Sue Flood Drain Tunnel, Bangkok – 3.0m diameter and 3.3km tunnel in length (Bangkok Metropolitan Administration – 970MB)
  - Klong Bang Nam Jued Flood Drain Tunnel, Samut Sakorn, - West of Bangkok – 6.0m diameter EPB Shield Tunnel, 11.71km in length, with 4 shafts (Royal Irrigation Department- 5,290 MB)
  - Klong Likit Flood Drain Tunnel, Nakorn Pathom&Samutsakorn -West of Bangkok – 4.0m diameter, EPB shield tunnel, 7.3km in length (Royal Irrigation Department- 2,430MB – Tunnel cost only)
  - Power Cable Tunnel ((Bangkok) Metropolitan Electricity Authority)
    - Outgoing Cable Tunnel at Bang Phli Terminal Station – 2.6m diameter EPB Shield Tunnel, 1.2km in length



- Outgoing Cable Tunnel at Bang Sue Terminal Station – 2.6m diameter EPB Shield Tunnel and 2.6km in length
- Outgoing Cable Tunnel at Lad Phraw Terminal Station – 2.6m diameter EPB Shield Tunnel, 1.6km in length
- Outgoing Cable Tunnel at Erawan Terminal Station – 3.6m diameter EPB Shield Tunnel, 5.5km in length
- Bhumipol Water Diversion Tunnel, From Western to Central Thailand, 62km in length, 10m in diameter, TBM tunnelling + D&B Adits (Royal Irrigation Department of Thailand- Project Cost 92,000MB - PPP project)
- Tak-Mae Sod Railway line – Single Track Twin Tube D&B rail tunnels, 15.1km, 1.43km, 0.74km and 11.9km in length = 29.1km in total with 2 access adits (State Railways of Thailand –30,200MB)
- Phuket : Kratu-Patong Toll Road Tunnel – Twin Tube Road Tunnel, 1.2km in length – (Expressway Authority of Thailand- 5,200 MB)- PPP Project
- Phuket Airport-Patong Link: Khoh Kaew- Kratu Expressway – Twin Tube Tunnel, 1.1km in length - (Expressway Authority of Thailand) – Under detailed design
- Krabi City By-pass roadway, 3 parallel tunnels of 1.30km in length – Detailed design completed - under a Cooperation with Japan
- International Cooperation Agency (JICA)
- Tak-Mae Sod Motorway – 3 twin tunnels of 10.35km, 3.78km and 15.19km –(Department of Highway)
- Railway Track Doubling Project, Denchai – Chiang Mai, 8 Double Track Single Tunnels with total length of 16.0km approximately – (State Railways of Thailand)

## EDUCATION ON TUNNELLING IN THE COUNTRY

Tunnelling in Soft Ground, TUTG, The Engineering Institute of Thailand under H.M. The King's Patronage Tunneling and Underground Construction, King Mongkut's University of Technology Thonburi.

# TÜRKIYE



Black Sea Coastal Road (İstanbul – Sinop Road). Twenty five tunnels of the 102 tunnels of the route were completed in the past years, 12 tunnels with a length of 22,999m are still under construction.

### 3. Karaman – Mut – Silifke Route

Four out of the nine tunnels located along this mountainous area on the 149km long Karaman-Mut-Silifke road have been completed, however electromechanical works are still underway. Construction works are being carried out on the remaining five tunnels mentioned below:

- Sertavul Tunnel: A 3,300m long double tube tunnel, being constructed at an elevation of 1,460m. Excavation works are being carried out in poor and very poor rock conditions. 738m of the left tube and 750m of the right tube have been excavated (56.69% of the target) and 12.43% of the concrete lining works are completed
- T1/A Tunnel: 2.865m long double tube. Excavation support works have been completed. 65.40% of the concrete lining works are completed
- T1/E Tunnel: Total length 3,408m. Excavation support works are being carried out and so far, 100% of the works have been completed
- T2 Tunnel: Total length 884m. There are ongoing excavation support works on four tunnel faces located at the 661m section of the tunnel with a current excavation support work completion rate of 46.04% on the left tube and 39.93% on the left tube
- T4 Tunnel: A Double Tube, 859m long, project design works are being carried

**Name of Association:** Turkish Road Association (TRA)

**Type of Structure:** Charity: TRA is an open association. Its function is to promote, coordinate and conduct studies and research in the fields of roads, highways, motorways, tunnelling, and other underground works.

**Number of Members:** 540 members of which 472 are individuals and 68 are corporate members that represent Universities, Consultants, Contractors, Manufacturers, and other Governmental Organizations.

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

A doctoral thesis, two master's thesis, and three papers/articles on Highway Engineering and Transportation were given awards in 2023 under the conditions specified in the "TRA AWARD".

The "5th National Highways Congress and Exhibition" was organized by the General Directorate of Highways (KGM) and the Turkish Highways Association (TRA). In addition, the 33rd Ordinary General Assembly of TRA was held with the participation of the General Manager of Highways and TRA President, Mr. Ahmet GÜLŞEN.

## CURRENT TUNNELLING ACTIVITIES

As of 2023, there are 495 tunnels on intercity highways in Turkey with a total length of 753km. In 2023, In addition to the opening to traffic of the 14,500m Zigana Tunnel (the longest tunnel in Turkey), construction works on 11 tunnels with a length of 42.5km have been completed. Tunnel work located on Turkey's intercity highways is summarized here:

### 1. Antalya – Mersin Route

Highway tunnels on the Antalya-Mersin Highway, of 440km length, include 33 tunnels with a combined length of 5,190m. Twenty tunnels have been completed, amounting to a total length of 15,935m. The remaining 12 tunnels with a combined length of 35,005m are under construction and the remaining one will be tendered. The following list provides further details of some tunnels on the route.

- Gökçebelen Tunnel: Double Tube, approximately 11,000m in length. 23.92% of the excavation and 6.57% of the concrete works have been completed
- Siphili T3 Tunnel: Double Tube, 6,634m long. 99.54% of the excavation in poor rock conditions and 10.85% of the concrete works have been completed
- Siphili T4 Tunnel: Double Tube, 1,382m long. 54.51% of the excavation support works have been completed in poor rock conditions

### 2. Western Black Sea Coastal Route

There are 102 tunnel on the Western

out which is revised due to a landslide that occurred at the entrance portal. Aproximately 6.74% of the excavation works have been completed

#### 4. Konya – Hadim – Alanya Route

Thirty tunnels with a total length of 31,207m have been designed along the Konya-Hadim-Alanya route. Thirteen of the 30 tunnels with a combined length of 9,524m have been completed. Currently, there are ongoing works on three tunnels. Completion of construction works is planned for the Karapınar (697m) tunnel and for excavation support works on Kaplanhanı 3 (665m) and Kaplanhanı 2 (363m) tunnels.

#### 5. Konya - Seydişehir – Manavgat Route

This particular route connects the Central Anatolian region to the Mediterranean region. The 7360m double tube Alacabel Tunnel is being built on the Konya-Seydişehir- Manavgat axis. This tunnel passes through the route at an elevation of approximately 1,525m. Excavation and concrete lining works is continuing in both tubes.

#### 6. Rize – Erzurum Route

There are 13 tunnels (36,509m) along the 238km long Rize-Erzurum route which connects the Eastern Black Sea Region to Eastern Anatolia. Nine out of these 13 tunnels with a combined length of 21,849m have been completed, while work on four of the tunnels is still ongoing.

■ Kırık Tunnel: A 7,091m long double tube at an elevation of 2,000m. 84.90% (12.123m) of the excavation works have been completed while concrete lining work is at 65.60% (9,943m)

■ İkizdere 1 Tunnel: A 3,296m long double tube at an elevation of 450m. 69% of the excavation and 13% of concrete lining works has been completed

■ İkizdere 2 Tunnel: Construction works will begin on this double tube tunnel, with a 1,198m long right tube and a 1,189m long left tube

■ Dallıkavak Tunnel: This is a 3,105m long double tube at an elevation of 2,100 – 2,300m. 91% (5,790m) of the excavation support work has been completed and 57% (3,693m) of the concrete lining work has been completed

#### 7. Erzurum – Çat – Bingöl Route

The 2 x 4,750m long double tube Çirişli Tunnel is under construction on the Erzurum-Çat-Bingöl Highway. This tunnel is expected to be completed in 2026. To reduce the risks and costs associated with the threat of avalanches on the current route, a new divided road will be constructed. Of the tunnel on the route 5,438m of excavation work, and 2,496m of concrete lining work has been completed.

#### 8. Yalova – Çınarcık – Armutlu Route

There are six tunnels with a combined length of 5,952m located along the Esenköy Pass which is a part of the

Yalova-Çınarcık-Armutlu Highway. Excavation support works have been completed on the T1 (2,053m) and the T2 (1,579m) tunnels where concrete lining work is ongoing. There are ongoing excavation support works on the T3 (862m), T4 (693m) and T5 (294m) tunnels. The secondary works supply tender will be held for the T6 (471m) tunnel.

#### 9. Refahiye - Kuruçay - İliç - Kemaliye - Dutluca Route

Nine tunnels with a combined length of 28,122m have been designed along the 173km long route that connects the Eastern Black Sea Region to Eastern Anatolia (Refahiye - Kuruçay - İliç - Kemaliye - Dutluca Road). There are ongoing works on eight of these tunnels, whilst the remaining one will be tendered. Progress of three of these eight tunnels is:

■ Sünebeli Tunnel: A 5,220m long double tube tunnel being constructed at an elevation of 1,600 – 1,800m. 96% of the excavation works and 34% of the concrete works are completed

■ Yakaköy T 1 Tunnel: A 1,650m long single tube tunnel at an elevation of 900m. All construction works have been completed

■ Kemaliye T 2 Tunnel: The Tunnel is located at an elevation of 950m, on this 3,170m long single tube tunnel 72% of the excavation work has been done

#### 10. Trabzon – Aşkale Route

Construction works have been completed on 32 of the 36 tunnels located along the 278km long Trabzon-



Aşkale highway which connects the Central Black Sea Region to Inner and Eastern Anatolia. The combined length of these 32 tunnels is 29,805m. The remainder, namely the Zigana tunnel is complete and opened to traffic in 2023, and the Vauk 1 & 2, and Kop tunnels which are under construction.

- Kop Tunnel: A 6,498m long double tube tunnel at an elevation of 2,000 – 2,400m. 8,333m of the excavation works have been completed, amounting to 6,364m of the concrete lining works have been completed amounting to 5,250m
- Vauk 1 and 2 Tunnels: 6.723m long double tube tunnel located at an elevation of 1,600m. 5,770m of the excavation works and 1,600m of the concrete works have been completed

## 11. Zara-Geminbeli-Suşehri Route

The 8,566m (2 x 4,283m) long Geminbeli Tunnel which lies along the Zara-Geminbeli-Suşehri Road has undergone 8,566m of excavation and support works, along with 7,960m of concrete lining works.

## 12. Ordu Ring Road Route

There are six double tube tunnels with a combined length of 9,492m on the first section of the Ordu Ring Road. The length of both sections is 21.4km. The double tube tunnels, Boztepe (2 x 3,311m) and Öceli (2 x 2,019m) have been completed. Section, excavation works have been completed on the Terzili Tunnel (2 x 1,180m) whereas concrete lining works are ongoing. Concrete lining works on tunnels Akçatepe -1 (2 x 440m) and excavation works on Akçatepe -2 (2 x 1,740m) have been completed, whereas the Turnasuyu Tunnel (2 x 802m) is designed and expropriation work is continuing.

## 13. Other Tunnelling Works

- The final phase of the high-speed railway project connecting Turkey to Bulgaria has begun, with work on the Halkali to Ispartakule double tube tunnel (2 x 6,180m) being constructed by TBM as a part of the Halkalı - Kapıkule (İstanbul) Railroad Project. The Halkalı Kapıkule Railway Project began in 2019 and was described as the first part of the Asia-Europe Railway Corridor, with the 229km-long project marking the main rail link between Turkey and Western Europe connecting to the Trans-European Transport Network. It is planned for

completion in 2025.

- Within the scope of the Gayrettepe-Kağithane - New Airport Subway Line, TBM construction works have been completed at a section measuring 2 x 34,140m. The Gayrettepe – Istanbul Airport Metro Line is located in the northern area of Istanbul’s European Side, on an east–west axis. It passes through the Şişli, Kağithane, Eyüp and Arnavutköy districts and consists of Gayrettepe, Kağithane, Hasdal, Kemerburgaz, Göktürk, İhsaniye, Airport-2, Istanbul Airport Metro Station and Technical Support Area stations, respectively. These stations are connected with two main line tunnels, each with an inside diameter of 5.7m and a length of approximately 37.5km. The entire line is being built underground.
- The Başakşehir – Kayaşehir Subway Line is 6,187m long with an estimated travel time of 19 minutes through eight stations. A double tube was being constructed via TBM and was put into the service in 2023
- The Istanbul Bakırköy – Bahçelievler – Kirazlı Subway Line will be 13,111m long. The journey will take 13.5 minutes from Bakırköy to Kirazlı. The line contains eight double-deck stations constructed by TBM and to be put into service in February of 2024. There are TBM Tunnel construction works between the Bakırköy - İncirli stations. Excavation works have been completed on the 2 x 1,035m section using the NATM method. Construction works are being carried out via the TBM method on the 2 x 6,500m section.
- Construction works on the double tube metro line tunnel, 15.4km long, are being carried out on the Kocaeli, Gebze - Darıca Coastal Metro line.
- Within the scope of the Southeastern Anatolia Project, the Babakaya and Silvan Tunnels are being built to transport water from the Silvan Dam currently under construction. Two parallel tunnels each 5,320m long are being constructed by TBM. A corrugated steel channel is being excavated using the drill and blast method. The Babakaya Tunnel is 5,278m long, with a 7m inner diameter on the two tubes. This tunnel will transport the water from the dam into the Silvan Tunnel, which will carry 212m<sup>3</sup> of water per second. It is being constructed as a single tube

with a length of 13.4km and a diameter of 10m. The water in the dam will be transferred to the 97.6km long main canal through the Silvan and Babakaya Tunnels. 84% of the Silvan Project and 46% of Babakaya Dam has been completed.

- The 18km long Hadimi irrigation tunnel, which transfers the water from Afşar Dam to the Bağbaşı Dam, is under construction with 5000m bored so far.

## FUTURE TUNNELLING ACTIVITIES

### Subway Lines

- Haciosman - Sariyer Subway Line (İstanbul) (5.70km)
- Sultanbeyli - Kurtköy Subway Line (İstanbul) (5.40km)
- Esenyurt Meydan – Saadetdere Subway Line (İstanbul) (5.40km)
- Söğütlüçeşme - Yenidoğan Subway Line (İstanbul) (24.90km)
- İstanbul Yenikapı – İncirli -Sefaköy Subway Line
- Sefaköy - Beylikdüzü - Tüyap Subway Line (İstanbul) (18.51km)
- Hizray Subway Line (İstanbul) (74.50km)
- Vezneciler - Sultangazi - Fenertepe Subway Line (İstanbul) (23.70km)
- Ambarlı - Hadimköy Subway Line (İstanbul) (26.70km)
- İtü - Kağithane Subway Line (İstanbul) (7.40km)
- Metrokent - Habibler Subway Line (İstanbul) (5.5km)
- Taksim - Okmeydanı Subway Line (İstanbul) (3.60km)
- Maltepe Sahil - Samandira Subway Line (İstanbul) (9.3km)
- Kartal Sahil - Uğur Mumcu Subway Line (İstanbul) (4.8km)
- Altunizade - Çengelköy - Kavacık Subway Line (İstanbul) (11.1km)
- Yıldız - Ortaköy Füniküler Subway Line (İstanbul) (1.50km)
- İtü - İstinye Füniküler Subway Line (İstanbul) (2.65km)
- Eyupsultan (Feshane) - Bayrampaşa Tramvay Subway Line (İstanbul) (1.70km)

### Highway

- T1 (Antalya – Alanya Highway Tunnel) (1086m – 1086m)
- T2 (Antalya – Alanya Highway Tunnel) (1683m – 1683m)
- T3 (Antalya – Alanya Highway Tunnel) (1080m – 1080m)
- T4 (Antalya – Alanya Highway Tunnel) (2231m – 2231m)
- T5 (Antalya – Alanya Highway Tunnel) (566m – 566m)
- T6 (Antalya – Alanya Highway Tunnel)



# **Reinforcing Solutions**

With a solution for every need, reliable on-time delivery and the expert technical back-up of our teams in your region, we're able to provide the products and support you need to keep your projects on track – even in the event of emergencies. The combination of Sandvik machines with our DSI Underground ground support products offer cost-effective and safe solutions for your tunneling projects.

- (875m – 875m)
- T7 (Antalya – Alanya Highway Tunnel) (805m – 805m)
  - T8 (Antalya – Alanya Highway Tunnel) (2976m – 2976m)
  - T1 (Ankara – Kırıkkale – Delice Highway Tunnel) (1095m - 1095m)
  - T2 (Ankara – Kırıkkale – Delice Highway Tunnel) (1160m – 1255m)
  - T3 (Ankara – Kırıkkale – Delice Highway Tunnel) (475m – 475m)
  - T4 (Ankara – Kırıkkale – Delice Highway Tunnel) (878m – 878m)
  - T1 - Tunnel (İstanbul) (526m – 686m)
  - T1 - Tunnel (Mersin) (4540m – 4518m)
  - T2 - Tunnel (Mersin) (3751m – 3718m)
  - T1 - Tunnel (Elazığ – Diyarbakır) (605m – 665m)
  - T2 - Tunnel (Elazığ – Diyarbakır) (402m – 470m)
  - T3 - Tunnel (Elazığ – Diyarbakır) (188m – 159m)
  - T4 - Tunnel (Elazığ – Diyarbakır) (1085m – 475m)
  - T6 - Tunnel (Elazığ – Diyarbakır) (395m – 310m)
  - T5 - Tunnel (Elazığ – Diyarbakır) (1085m – 820m)
  - T7 - Tunnel (Elazığ – Diyarbakır) (293m – 335m)
  - T8 - Tunnel (Elazığ – Diyarbakır) (980m – 1035m)
  - T9 - Tunnel (Elazığ – Diyarbakır) (680m – 705m)
  - T10 - Tunnel (Elazığ – Diyarbakır) (640m – 655m)
  - T11 - Tunnel (Elazığ – Diyarbakır) (830m – 780m)
  - Köşmür Tunnel (Bingöl) (6697m)
  - Kulp Tunnel (KULP-MUŞ) (730m – 730m)
  - Tersun Tunnel (Gümüşhane) (4520m – 4510m)
  - Başkale Tunnel (Van) (3087m – 3090m)
  - T1 Tunnel (Balıkesir) (1404m – 1356m)
  - T1 Tunnel (Zonguldak) (2666m – 2666m)
  - T3 Tunnel (Zonguldak) (392m – 415m)
  - T4 Tunnel (Zonguldak) (782m – 812m)
  - T5 Tunnel (Zonguldak) (2576m – 2617m)
  - Ilgar Tunnel (Ardahan) (4455m)
  - Sahilyolu Tunnel (Trabzon) (1,865m – 1,865m)
  - İkizdere-2 Tunnel (Rize) (3,300m – 3,300m)
  - T3 Tunnel (Kastamonu) (2,060m – 2,060m)
  - T4 Tunnel (Kastamonu) (5,277m – 5,277m)
  - T5 Tunnel (Kastamonu) (555m – 620m)
  - Gümüşakar Tunnel (Erzincan) (1,580m – 1,580m)
  - T4 (Kozlupınar) Tunnel (Erzincan) (3,325m)
  - T5 (Vali Recep Yazicioğlu) Tunnel (Erzincan) (4,315m)
  - T6 (Dutluca) Tunnel (Erzincan) (2,735m)
  - Kızıldağ Tunnel (Erzincan/Sivas) (6,471m – 6,410m)
  - Arpayazı Tunnel (Erzincan) (4,615m – 4,615m)
  - Çamlıbel Tunnel (Tokat/Sivas) (4,735m – 4,735m)
  - Sakaltutan Tunnel (Erzincan) (8,785m – 8,775m)
  - Ahmediye Tunnel (Erzincan) (6,315m – 6,315m)
  - Bozkır Tunnel (Sivas) (2,545m – 2,545m)
  - Çamoluk1 Tunnel (Sivas) (120m)
  - Çamoluk2 Tunnel (Sivas) (872m)
  - Kemah1 Tunnel (Erzincan) (2,764m)
  - Kemah2 Tunnel (Erzincan) (2,585m)
  - Kemah3 Tunnel (Erzincan) (307m)



- T1 Tunnel (Erzincan) (289m)
- T2 Tunnel (Erzincan) (1,040m)
- T3 Tunnel (Erzincan) (988m)
- T4 Tunnel (Erzincan) (708m)
- T5 Tunnel (Erzincan) (590m)
- T6 Tunnel (Erzincan) (1,690m)
- Üçdam Tunnel (Tunceli) (3,841m)
- Şaplıca Tunnel (Giresun) (1,61m)
- T1 Tunnel (Sivas) (425m – 425m)
- Sincan Tunnel (Sivas) (325m)
- Sincan Tunnel (Sivas) (2,415m)
- T1 Tunnel (Giresun) (4,440m – 4,440m)
- Bursa – Osmangazi- Recep Tayyip Erdoğan and Ata boulevard connection tunnel (2,435m – 2,435m)

### Railway Tunnels

- Ankara – İzmir Railway high speed train line (Kütahya) (390m)
- Ankara – İzmir Railway high speed train line (Kütahya) (315m)
- Ankara – İzmir Railway high speed train line (Uşak) (4,330m)
- Ankara – İzmir Railway high speed train line (T9-T10-T11-T17-T18-T19-T20) (Manisa) (2,062m)
- İspartakule – Çerkezköy railway project (Aç Kapa Tunnel-1-2-3-4-5-6) (İstanbul) (2,885m)
- İspartakule – Çerkezköy railway project (T-1 Tunnel and T-2 Tunnel) (İstanbul) (2,785m)
- İspartakule – Çerkezköy railway project (Acil Kaçış 1 Tunnel and Acil Kaçış 2 Tunnel) (İstanbul) (1,017m)
- Yerköy - Kayseri Railway high speed train line (Tunnel 2-4-5-6-7-8) (Yozgat) (9,748m)

### Irrigation Tunnels

- Mersin Aksıfat Dam Tunnel Project (Mersin) (5,260m)
- Mersin Gülnar Sipahili Dam Tunnel Project (Mersin) (5,260m)
- Erzurum Pasinler Söylemez Dam İrrigation (Erzurum) (5,625m)
- Erzurum Pasinler Söylemez Dam İrrigation (Erzurum) (28,489m)
- Erzurum Elmalı Dam İrrigation (Erzurum) (9,000m)
- Gümüştaş Tunnel İrrigation (Şanlıurfa) (5,370m)
- Payamlı Tunnel İrrigation (Şanlıurfa) (9,030m)
- Eğirdir Tepeli irrigation pond (Isparta) (406m)
- Uluborlu Dereköy irrigation pond (Isparta) (205m)
- Yalvaç Kumdanlı irrigation pond (Isparta) (120m)
- Merkez Sav irrigation pond (Isparta) (267m)

- Eğirdir Çayköy irrigation pond (Isparta) (372m)
- Sultandağı Arslanlı Pond Derivation Tunnel (Afyonkarahisar) (320m)
- Emirdağ Pond Derivation Tunnel (Afyonkarahisar) (410m)
- Sandıklı Ekinhisar irrigation pond (Afyonkarahisar) (555m)

- Merkez Karakent irrigation pond (Burdur) (269m)
- Büyükçay irrigation tunnel (Adıyaman) (9,269m)
- Göksu Araban T1 irrigation tunnel (Adıyaman) (3,820m)
- Göksu Araban T2 irrigation tunnel (Adıyaman) (4,660m)

### STATISTICS

Length or volume excavated - % mechanized / % conventional during 2023

Total Excavation			
Length (m)		Volume (m <sup>3</sup> )	
125.698,72		6.536.333,44	
Mechanized (%)	Conventional (%)	Mechanized (%)	Conventional (%)
35	65	35	65

Amount (USD or EUR) of tunnelling / underground space facilities awarded in 2023  
**€461.006.013,4**

### List of tunnels completed

#### Subway Lines

- Ataköy - Basın Ekspres - İkitelli Metro Line (İstanbul) (11300m)
- Eminönü - Eyüpsultan - Alibeyköy (Haliç) Tramvay Line (İstanbul) (311m)
- Dudullu - Bostancı Metro Line (İstanbul) (76m)
- Fahrettin Altay – Narlıdere (stage 4) Metro Line (İzmir) (6337m – 6434m) (876m)

#### Highway

- Alacabel Tunnel (Antalya-Konya) (7.355m - 7.361m)
- T-1 Tunnel (Çorum) (1.406m - 1.372m)
- T10 Tunnel (Bingöl) (359m)
- Çukurçayır 1 Tunnel (Trabzon) (342m – 336m)
- T1 Tunnel (Artvin) (290 m)
- Yeniköy Tunnel (Gümüşhane) (620m – 560m)
- Yağdonduran Tunnel (Sivas) (850m – 850m)
- Aşık Şenlik Tunnel (Ardahan) (2,304m – 2,312m)
- Zigana Tunnel (Gümüşhane-Trabzon) (14,500m – 14,500m)
- Demirkapı Tunnel (Konya) (5,680m – 5,680m)
- Honaz Tunnel (Denizli) (2,640m – 2,640m)
- Badal Tunnel (Merzifon – Osmancık) (921m - 921m)

#### Railway Tunnels

- Ankara – İzmir Railway high speed train

line (Eskişehir) (260m)

- Ankara – İzmir Railway high speed train line (Eskişehir) (300m)
- Ankara – İzmir Railway high speed train line (Afyon) (340m)
- Ankara – İzmir Railway high speed train line (Afyon) (300m)
- Ankara – İzmir Railway high speed train line (Afyon) (540m)
- Ankara – İzmir Railway high speed train line (Afyon) (373m)
- Ankara – İzmir Railway high speed train line (Afyon) (195m)
- Ankara – İzmir Railway high speed train line (Afyon) (460m)
- Ankara – İzmir Railway high speed train line (Afyon) (279m)
- T8-1 Ankara- Sivas railway project (Yozgat) (720m)
- T8-2 Ankara- Sivas railway project (Yozgat) (885m)
- T14-6 Ankara- Sivas railway project (Yozgat) (70m)
- T18-1 Ankara- Sivas railway project (Sivas) (275m)
- T11 Bursa-Gölbashi Kuzey-Yenişehir high speed train project (Bursa) (2853m)
- Bursa-Gölbashi Kuzey-Yenişehir high speed train project (Bursa) (4913m)
- Karaman- Ulukışla railway project (Niğde) (2491m)
- Nurdağ- Başpınar T4 (Gaziantep) (1900m - 1904m)
- Nurdağ- Başpınar T5 (Gaziantep) (5695m - 5702m)

#### Irrigation Tunnels

- Reyhanlı dam T2 Tunnel irrigation (Adana)

- Yeni Yusufeli irrigation tunnel (Artvin) (196m)
- Yeni Yusufeli irrigation tunnel (Artvin) (1409m)

#### 4. List of tunnels under construction

##### Subway Lines

- Bağırcılar Kirazlı - Küçükçekmece Halkalı Subway Line (İstanbul) (9700m)
- Kaynarca Merkez - İçmeler Subway Line (İstanbul) (7000m)
- Çekmeköy - Sancaktepe - Sultanbeyli Subway Line (İstanbul) (2600m – 2943m)
- Mahmutbey - Bahçeşehir - Esenyurt Subway Line (1. part) (İstanbul) (3148m – 3031m)
- Pendik Merkez - Kaynarca Merkez - Fevzi Çakmak Subway Line (İstanbul) (1458m – 157m)
- Göztepe - Ataşehir - Ümraniye Subway Line (İstanbul) (13000m)
- Fahrettin Altay – Narlıdere (stage 5) Subway Line (İzmir) (13500 m -13500m)
- Gayrettepe – İstanbul airport Subway Line (İstanbul) (3507m - 3507m)
- Halkalı – İstanbul airport Subway Line (İstanbul) (28132m - 27611m)
- Bakırköy Bahçelievler Subway Line (İstanbul) (8400m - 8400m)
- Gebze Darıca Subway Line (Kocaeli) (15400m - 15400m)
- Altunizade – Bosna rail system line (İstanbul) (4000m – 4000m)
- Emek city hospital Subway Line (Bursa) (6000m – 6000m)

##### Highway

- T4 Tunnel (Çanakkale) (503m)
- T5 Tunnel (Çanakkale) (2,558m)
- Sertavul Tunnel (Karaman) (3,308m – 3,292 m)
- Alacabel Tunnel (Mersin) (6,637m - 6.634m)
- T4 Tunnel (Mersin) (1.412m - 1.382m)
- T1A Rev.Tunnel (Mersin) (2.860m - 2.830m)
- T1E Rev.Tunnel (Mersin) (3.380m - 3.426m)
- T2 Tunnel (Mersin) (884m – 884m)
- T4 Tunnel (Mersin) (861m - 858m)
- T1 Tunnel (Mersin) (705m – 830m)
- Akçatepe-1 Tunnel (Ordu) (440m – 440m)
- Akçatepe- 2 Tunnel (Ordu) (1.740m - 1.740m)
- T1 Tunnel (Bingöl) (1.943m)
- T11 Tunnel (Bingöl) (305m)
- T1 Tunnel (Siirt) (2.190m)

- T2 Tunnel (Siirt) (1.929m)
- T1 Tunnel (Şirnak) (2.845m)
- Ortabağ 2 Tunnel (Şirnak) (1.955m)
- Değermendere Tunnel (Trabzon) (1.961m - 1.977m)
- T-1 Tunnel (Rize) (189m)
- T-2 Tunnel (Rize) (298m)
- İkizdere-1 Tunnel (Rize) (3.165m - 3.296m)
- Vauk T1 Tunnel (Gümüşhane-Bayburt) (1.585m - 1.585m)
- Vauk T2 Tunnel (Gümüşhane-Bayburt) (5.895m – (5.895m)
- T5-Tunnel (Trabzon) (1.525m – 1.593m)
- T6-Tunnel (Trabzon) (896m – 983m)
- T1 Tunnel (Giresun) (185m)
- Pekün Tunnel (Gümüşhane) (6.347m - 6.381m)
- T1 Tunnel (Trabzon) (722m – 722m)
- T2 Tunnel (Trabzon) (1.238m - 1.238m)
- Aktütün Tunnel (Hakkari) (5.700m)
- T-1 Tunnel (Hakkari) (3.965m - 3.961m)
- T-2 Tunnel (Hakkari) (4.566m - 4.566m)
- Başkale -Güzeldere Tunnel (Van) (3.116m - 3.108m)
- T2 Tunnel (Bitlis) (1.270m - 1.270m)
- Kop Dağı Tunnel (Erzurum - Bayburt) (6.526m - 6.533m)
- Olur Ardanuç Tunnel (Erzurum) (3.490m)
- Çirişli Tunnel (Erzurum) (4.749m - 4.751m)
- Dallıkavak Tunnel (Erzurum) (3.115m - 3.095m)
- Kırık Tunnel (Erzurum) (7.102m - 7.080m)
- Oba Tunnel (Antalya) (620m - 620m)
- Kaplanhanı-2 Tunnel (Antalya) (303m)
- Kaplanhanı-3 Tunnel (Antalya) (666m)
- Karapınar Tunnel (Antalya) (701m)
- Gökçebelen Tunnel (Antalya) (11.088m - 11.000m)
- Doğancı Tunnel (Bursa) (1.998m)
- T1 Tunnel (Yalova) (2.053m)
- T2 Tunnel (Yalova) (1.579m)
- T3 Tunnel (Yalova) (871m)
- T4 Tunnel (Yalova) (676m)
- T5 Tunnel (Yalova) (294m)
- T6 Tunnel (Yalova) (471m)
- T4 Tunnel (Bartın) (4.627m - 4.587m)
- T5 Tunnel (Bartın) (3.090m - 3.090m)
- Kırık Tunnel (Kastamonu) (5.321m - 5.333m)
- T1 Tunnel (Kastamonu) (6.426m - 6.460m)
- T2 Tunnel (Kastamonu) (3.690m - 3.690m)

- T1 Tunnel (Zonguldak) (2.660m - 2.660m)
- T3 Tunnel (Zonguldak) (400m – 380m)
- T4 Tunnel (Zonguldak) (1.945m - 1.985m)
- T5 Tunnel (Zonguldak) (2.490m - 2.520m)
- T6 Tunnel (Zonguldak) (1.705m - 1.665m)
- T7 Tunnel (Zonguldak) (2.999m - 3.000m)
- Geminbeli Tunnel (Sivas) (4.288m - 4.279m)
- Sünebeli Tunnel (Erzincan) (5.220m - 5.220m)
- T1 (Yakaköy) Tunnel (Erzincan) (1.650m)
- T2 (Kemaliye) Tunnel (Erzincan) (3.170m)
- T3 (Toybelen) Tunnel (Erzincan) (1.510m)
- Sarıçiçek-1 Tunnel (Sivas) (1.585m)
- Sarıçiçek-2 Tunnel (Sivas) (1.115m)
- Ilgar Tunnel (Ardahan) (4.810m - 4.972m)
- Sarıyer – Kilyos Tunnel (İstanbul) (6875m – 6840m)

##### Railway Tunnels

- T1 KYHT Tunnel (Yozgat) (1020m)
- T3 KYHT Tunnel (Yozgat) (2640m)
- T1 MAOG Tunnel (Gaziantep) (884m – 884m)
- T2 MAOG Tunnel (Gaziantep) (2325m – 2325m)
- T3 MAOG Tunnel (Gaziantep) (5135m – 5139m)
- T4 MAOG Tunnel (Gaziantep) (1904m – 1903m)
- T5 MAOG Tunnel (Gaziantep) (5695m – 5702m)
- T6 MAOG Tunnel (Gaziantep) (1281m – 1290m)
- Ankara – İzmir Railway high speed train line (Afyon) (660m)
- Ankara – İzmir Railway high speed train line (Afyon) (480m)
- Ankara – İzmir Railway high speed train line (Afyon) (5160m)
- Ankara – İzmir Railway high speed train line (Afyon) (1260m)
- Ankara – İzmir Railway high speed train line (Kütahya) (740m)
- Ankara – İzmir Railway high speed train line (Kütahya) (868m)
- Ankara – İzmir Railway high speed train line (Kütahya) (696m)
- Halkalı – Ispartakule railway line (İstanbul) (6185m – 6168m)
- Ankara – Sivas railway project (T3-1, T3-2, T5-1, T5-2, T5-3, T9-1, T9-2, T9-3) (Yozgat) (6466m)
- Ankara – İstanbul high speed train project (T26) (Bilecik) (5589m)





- Sapanca – Geyve high speed train project (T1-T2-GT3-GT4-GT5-GT6) (Sakarya) (11310m)
- Nurdağ – Başpınar railway line (Gaziantep) (2325m – 2334m)
- Nurdağ – Başpınar railway line (Gaziantep) (5135m – 5139m)
- Erzurum - Kars railway line (Erzurum) (10580m – 30500m)
- Erzincan – Erzurum railway line (Erzincan) (54520m)
- Siirt – Kurtalan railway line (Siirt) (16380m)
- Malatya – Elazığ railway line (Elazığ) (28450m)
- Elazığ – Diyarbakır railway line (Elazığ) (43335m)
- Afyon – Burdur railway line (Burdur) (23940m)
- Adıyaman – Gölbaşı railway line (Adıyaman) (28440m)

#### Irrigation Tunnels

- Bolu seven taşıyayla irrigation pond (Bolu)
- Alaca irrigation tunnel (Erzurum) (827m)
- Acar irrigation tunnel (Erzurum) (1129m)
- Bezirhane irrigation tunnel (Erzurum) (735m)
- Altınpınar irrigation tunnel (Erzurum) (623m)
- Ağrı Ovası Yazıcı irrigation tunnel (Erzurum) (3889m)
- Kale Baraj irrigation tunnel (Diyarbakır) (9375m)

- Silvan part 2 irrigation tunnel (Diyarbakır) (13236m)
- Babakaya irrigation tunnel (Diyarbakır) (5320m – 5320m)
- Çavdır Büyükalan irrigation pond (Burdur) (51m)
- Koçali irrigation tunnel (Adıyaman) (5191m)
- Koçali irrigation tunnel (Adıyaman) (332m)
- Koçali main transmission line irrigation tunnel (Adıyaman) (2422m)
- Çelikhan irrigation tunnel (Adıyaman) (215m)
- Obrucak irrigation tunnel (Kastamonu) (1477m)
- Değirmençay dam construction (Mersin)
- Savrun dam construction (Osmaniye)

#### Mining Tunnels

- Armutçuk I. ve II. Block Underground Coal Mine (Zonguldak) (110m)
- Kozlu -560 Underground Coal Mine (Zonguldak) (90m)
- Kozlu -630 Underground Coal Mine (Zonguldak) (10m)
- Üzülmöz Asma-Dilaver-320 Underground Coal Mine (Zonguldak) (199m)
- Kilimli -540 east side Underground Coal Mine (Zonguldak)
- Gelik -460 Underground Coal Mine (Zonguldak) (60m)
- Klimli -460 Underground Coal Mine (Zonguldak) (42m)

- Gelik -540 Underground Coal Mine (Zonguldak) (78m)
- Amasra -250/-350 Underground Coal Mine (Zonguldak)
- Ömerler Underground Coal Mine (Kütahya) (115m)
- Emet sulfuric acid plant water transmission line (Kütahya)

#### EDUCATION ON TUNNELLING IN THE COUNTRY

The Tunneling courses in the country are given as both graduate and undergraduate programs. The universities are: Adana Science and Technology University; Afyon Kocatepe University; Atatürk University; Baskent University; Bilecik Şeyh Edebali University; Bingöl University; Bulent Ecevit University; Çanakkale Onsekiz Mart University; Cankiri Karatekin University; Dicle University; Dokuz Eylül University; Duzce University; Eskisehir Technical University; Erzincan Binali Yıldırım University; Muğla Sıtkı Koçman University; Nigde Omer Halisdemir University; Nisantasi University; Pamukkale University; Recep Tayyip Erdogan University; Sivas Cumhuriyet University; Giresun University; Istanbul University – Cerrahpasa; Karabuk University; at Dokuz Mayıs University; Middle East Technical University; Sivas Cumhuriyet University; Sırnak University; Toros University; Zonguldak Bulent Ecevit University.

Sometimes the best way from point A to point B is underground.

# DELVE underground

Founded in 1954 as Jacobs Associates, Delve Underground is an employee-owned firm with 25 offices delivering state-of-the-art, sustainable heavy civil infrastructure throughout the United States, Canada, Australia, and New Zealand.

[delveunderground.com](https://delveunderground.com)



# UNITED KINGDOM



**Name of Association:** British Tunnelling Society

**Type of Structure:** Charity: The Trustees of the British Tunnelling Society are the ex officio and elected members of its committee, with the Committee consisting of elected members, nominated members, co-opted members, and ex-officio members. Ten members of the Committee are elected by electronic/postal ballot, the result of which is announced at the Annual General Meeting. Members elected to the Committee serve for a term of three years and then retire from the Committee unless they are elected Chairperson or Vice-Chairperson.

**Number of Members:** 828 with 85 corporate members

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

The BTS published the fourth edition of the BTS Specification for Tunnelling on December 13th, 2023. This comprehensively reviewed and updated edition incorporates the lessons mega projects such as Crossrail and High Speed 2 have learned from working with the previous third edition and removes prescriptive clauses from the specification to open it for emerging sustainable products and ways of working. Specific attention was given to all areas where technology has evolved over the last decade, this includes safe and efficient use of sprayed concrete and water proofing, and an in-depth review of segmental lining technology including segment accessories and primary grout. The latest revision of British and European standards has been baselined. The industry wide multi round peer review by the British tunnelling industry together with workshops held with the supply chain has resulted in a widely accepted document which we expect to retain its highly merited role as one of the global go-to baseline specifications for tunnelling projects both large and small.

BTS SCL Best Practice guideline: This has been reviewed and contact has been made with Emerald publishing to see it published in 2024.

BTS Monitoring Underground Construction - a best practice Guide: a sub-group has been established to update this document with advances in the field since last publication. Target publication early 2025.

BTS Segmental lining production control guidance: a sub-group has been established to create a document that builds on ITA segmental guidance to address issues of QA/QC during segment

production. It will include gaskets. This will be a short pamphlet rather than full book.

BTSYM carbon calculations/how to guides: further to ITAtech sustainability sub-groups and the Pipejack Association carbon calculator, it is proposed that the BTS prepare examples to aid the industry and allow benchmarking. A BTS technical sub-committee will provide guidance to the BTSYM who will lead this activity. The BTS has begun a Tunnels Net Zero initiative that will work with ITA and other organisations to support the global target of Net Zero.

A Tunnel Industry Steering Group on Shift Fatigue Guidance Development has been established through the BTS which is focused on developing a client lead guidance on shift patterns to support health and well-being of operatives underground. This work is being supported by the wider UK infrastructure sector through the Infrastructure Industry Innovation Partnership (i3P), legacy of the Crossrail/Elizabeth Line Innovation programme.

BTSYM held a successful well attended conference in September 2023 at Arup's London Offices a rebound from the pandemic period showcasing some incredible projects and talent from within the BTSYM.

## CURRENT TUNNELLING ACTIVITIES

### ■ Tunnelling Segments Depart

**Hartlepool for HS2:** Rail deliveries from STRABAG facility in Hartlepool, which has a direct rail link, manufacturing pre-cast concrete segments for HS2's next London Tunnel drives commenced.

These segments will be part of the Northolt East twin bore 5.5km tunnel connecting to the Northolt West Tunnel totally 13.5km taking HS2 services from Old Oak Common Station to the edge

of London. Transporting the Tunnel segments by rail rather than road will cut CO<sub>2</sub> emissions by 76%.

### ■ Thames Tideway Construction

**Completion:** Construction of the Thames Tideway Super Sewer in London has been completed, with the project now moving into commissioning phases with full completion in the first half of 2025. The project faced setbacks due to the pandemic's impact on working however it has been able to minimise this disruption to be on target for delivery with less than 12-month delay.

### ■ London Power Tunnels Phase 2:

Phase 2 started in Spring 2020 and spans 32.5km from Wimbledon to Crayford in southeast London with tunnels between 3 - 3.5m in diameter around 10-63m below street level, with the majority at around 30m deep, tunnelling was completed in October 2023.

■ **HS2 Chiltern Tunnelling:** In December 2023 the HS2 Chiltern Tunnels reaching 90m deep completed 90% of their 16km journey with completion expected in early 2024.

■ **HS2 Long Itchington Wood and Bromford Tunnels:** TBM Dorothy completed 1.6km long Second Bore in March 2023. The first TBM for the 5.6km, 8.3m diameter Bromford Tunnel launched in 2023 with the second due to be launched in early 2024.

■ **HS2 Atlas Road Tunnel:** This 835m long logistics tunnel was started in Spring 2023 and completed in winter 2023/ beginning of 2024.

■ **Woodsmith Mine Material Transport Tunnel:** 37km long tunnel between Woodsmith Mine near Whitby in North Yorkshire and the Wilton International Complex on Teesside, England. This is a single bore single TBM tunnel with 25.8km bored as of December 2023.

■ **Hinkley Point C Nuclear Power Station:** Connection of the underwater tunnels to the six shafts in the seabed to complete the stations cooling water system. The station will be cooled by water being drawn in through the intake into 10km of tunnels.

## FUTURE TUNNELLING ACTIVITIES

■ **Lower Thames Crossing:** The planning and construction of the UK's longest Road tunnel beneath the Thames estuary is being pushed back by two years. The project linking Essex and Kent in southeast England was on course



Coire Glas Hydro

to begin in 2024 and be completed in 2029 but this has now been pushed back to 2026 to allow for inflationary pressure to ease and consider stakeholder views on the project with target completion date of 2032.

- **A303 Stonehenge Tunnel:** Preliminary work and archaeological field work begins in 2024. The government approved the £1.7bn tunnel in July 2023, however challenges persist around the archaeological sensitivity of the site and the wider heritage concerns that the project may jeopardise this UNESCO world Heritage site.
- **HS2 Tunnelling:** 1. The 5.6km Bromford Tunnel bore between Water Orton in Warwickshire and Washwood Heath in Birmingham due to start in early 2024. 2. Euston Tunnel twin bore 7.5km tunnel between old oak common and London Euston is expected to start construction in 2026.
- **Coire Glas Pumped Storage:** The development and planning for the 1.5GW Coire Glas Pumped Storage scheme continues. Tendering is underway by SSE. An advance contract has been let to undertake an adit as part of the investigation works for the construction of the main tunnels.
- **Cruachan 2 Pumped Storage:** Drax has plans in development for a new 600MW pumped storage plant adjacent to the existing and using the same reservoirs. The 600-megawatt (MW) power station will be located inside Ben Cruachan – Argyll’s highest mountain – and increase the site’s total capacity to 1 gigawatt (GW). The new power station would be built within a new, hollowed-out cavern which would be large enough to fit Big Ben on its side, to the east of Drax’s existing 440MW pumped storage hydro station. More



HS2 Long Itchington

than a million tonnes of rock would be excavated to create the cavern and other parts of the power station. The existing upper reservoir, which can hold 2.4 billion gallons of water, has the capacity to serve both power stations.

- **Haweswater Aqueduct Resilience Project (HARP):** The HARP project is a major scheme to maintain drinking water supplies across Cumbria, Lancashire and Manchester for future generations. The Haweswater Aqueduct is a 110km pipeline which runs from the Lake District, through Lancashire and into Greater Manchester. Completed in the 1950s, the pipeline needs essential maintenance to ensure it can continue to supply customers for generations to come. Plans include the replacement of six tunnel sections along the pipeline route. Construction is expected to begin post 2025.
- **Water for Life:** A water transfer, and recycling project to address water issues in Hampshire.
- **Teddington Direct River Abstraction:** This project is a new river abstraction on the River Thames close to Teddington Weir. Water abstracted from the river would be transferred via an existing underground tunnel to the Lee Valley reservoirs in East London. Highly treated

recycled water would be moved from Mogden sewage treatment works upstream to compensate for the additional water taken from the river to protect the environment and wildlife. The project will provide up to 75 million litres per day as a drought resilience project. It would only be used during periods of prolonged dry weather. Detailed consultations with the regulator are underway.

## STATISTICS

### List of tunnels completed:

Thames Tideway, London Power Tunnels Phase 2, HS2 Chiltern Tunnels, HS2 Long Itchington Wood, HS2 Atlas Road Tunnel

### List of tunnels under construction:

HS2 Bromford Tunnel, Woodsmith Mine Material Transport Tunnel

## EDUCATION ON TUNNELLING IN THE COUNTRY

### BTS Tunnel Design and Construction Course

The 2023 course was held from 3rd July to 7th July at the University of Warwick and was once again a successful event. A total of 80 delegates attended the course, five of whom were students sponsored by the BTS. Many thanks to all the presenters from industry that gave their time to help make the course a success. The 2024 Course will be held at Warwick University on 1st to 5th July 2024, although there are limited residential places in 2024 because of work on the accommodation at the University.

### BTS Underground Health and Safety Course

The annual BTS Underground Health and Safety Course was held at the ICE on 21st & 22nd Nov at the ICE London, with 41 delegates attending. The 2024 Course will be held at the ICE in London on 20th and 21st November 2024.

### Level 2 Tunnelling Operative Apprenticeship

Successful qualification of the Align/TG Tunnelling apprentices in February 2023. The training provider of the programme worked well due to client, contractor and subcontractor working together to ensure apprentices supported within teams and ‘rotated’ to gain full experience. Two new cohorts planned for 2024 – one to start April in London, and one later in West Midlands.

# UNITED STATES



**Name of Association:** Underground Construction Association (UCA), a division of the Society for Mining, Metallurgy & Exploration (SME)

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

**Number of Members:** 1,982, Number of corporate members: 54

## ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

In 2023, UCA membership grew 14%. The year was full of conferences and programs that produced valued content and record participation.

### Conferences

- The George A. Fox Conference, held on January 31st, 2023, in New York, NY, was attended by 481 participants.
- The Rapid Excavation and Tunneling Conference (RETC), held June 11th – 14th, 2023, in Boston, Massachusetts, drew 1,400 attendees and featured a record number of exhibit booths.
- The Cutting Edge Conference, held November 13th – 15th, 2023, in Austin, TX, had a record attendance of 327 and featured a field trip to the Brushy Creek

Regional Utility Authority.

- The George A. Fox Conference, held on February 8th, 2024 in New York, NY, had a record attendance of 515 participants.

### Programs

- The Student Outreach Committee or “Down for That” hosted eight tunnel tours and a full-day field course for students.
- Three academic and 30 conference participation scholarships were provided to students.
- The Teach the Professors program helped ten professors develop a tunneling and underground construction curriculum for implementation in 2024.
- The Owners Form hosted a panel session

at RETC and two virtual networking opportunities for project owners.

- Women in Tunneling hosted a breakfast at RETC attended by 300+ participants. The group held a tunnel tour in October for approximately 20 participants.
- The Government & Public Affairs Committee (GPAC) hosted a federal fly-in in conjunction with the American Society of Civil Engineers (ASCE). The Tunnel Watch List Committee outlined projects that, if funded, would provide great value to the US.

### Additional Content

- Tunneling & Underground Construction (T&UC) magazine launched a new website at: [www.tucmagazine.org](http://www.tucmagazine.org)
- US Working Groups that shadow the ITA structure are building capacity, and it is expected that these groups will transfer information from ITA back to the UCA membership. Groups are expected to meet on a regular basis and provide webinars or articles to be published in T&UC in 2024.

### CURRENT TUNNELLING ACTIVITIES

UCA does not track current tunneling activities but works with media partners that do to provide current information to members.

## FUTURE TUNNELLING ACTIVITIES

Tunnel	Owner	Location	Length (FT)
Potomac River CSO Tunnel	DC Water and Sewer Authority	Washington	24,000
Minneapolis Central City Parallel Tunnel	City of Minneapolis	Minneapolis	4,200
I-70 Floyd Hill Highway Tunnel	Colorado Dept. of Transportation	Denver	15,840
Alameda Street Wet Weather Conveyance Tunnel (formerly Folsom Area Storm Water Improvement)	SFPUC	San Francisco	4,000
The Portal (Downtown Extension (DTX))	TJPA	San Francisco	3,400
California High Speed Rail (Northern Section)	CA High Speed Rail Authority	Fresno	TBD
California High Speed Rail (Southern Section)	CA High Speed Rail Authority	Bakersfield	TBD
West Santa Ana Line	LACMTA	Los Angeles	TBD
Ontario Airport Tunnel	San Bernardino County Trans. Auth.	San Bernardino	22,000
Gateway Tunnel Project	Amtrak GDC	Newark/NYC	2 x 14,600
Gateway Hudson River Ground Stabilization	GDC (SEP for delivery- PANYNJ)	Under Hudson river	1200
Gateway Palisades Tunnel	GDC (SEP for delivery- PANYNJ)	Union City / Hoboken	2 x 5,100
Gateway Manhattan Tunnel	GDC (SEP for delivery- PANYNJ)	New York City	2 x 700
Gateway Hudson River Tunnel	GDC (SEP for delivery- PANYNJ)	Hoboken / NYC	2 x 7,400
Gateway Systems and Fit Out	GDC (SEP for delivery- Amtrak)	Secaucus to NYC	2 x 22,000
Gateway NJ Surface Alignment	GDC (SEP for delivery- NJTransit)	Secaucus to North Bergen	2 x 7,400
Gateway Existing Tunnel Rehabilitation	GDC (SEP for delivery- Amtrak)	Union City/NYC	2 x 13,000
Second Ave. Subway Phase 2, Contract 2 (116th St Station, 125th St Station, TBM Tunnels)	NYC-MTA	New York	16,000
Second Ave. Subway Phase 2, Contract 3 (106th St Station Box)	NYC-MTA	New York	89,600
Amtrak Frederic Douglas Tunnel	Amtrak	Baltimore	40,000
Alum Creek Relief Tunnel - Phase 1	City of Columbus	Columbus	30,000
Alum Creek Relief Tunnel - Phase 2	City of Columbus	Columbus	21,000
Ontario Line North Extension	Toronto Transit Commission	Toronto	29,500
West Vaughan Sewage Servicing Project	York Region	Toronto	36,000
Yonge North Subway Extension	Toronto Transit Commission	Toronto	40,000
Blue Line Extension	Societe de transport de Montreal	Montreal	19,000
REM-S Project	Societe de transport de Montreal	Montreal	23,000
Southerly Storage Tunnel	NEORS	Cleveland	18,000
DELCORA Wastewater Tunnel	DELCORA	Chester	45,500
Enbridge Line 5 Tunnel	Enbridge	Traverse City	23,760
Mill Creek Trunk Improvements	City of Nashville	Nashville	13,800

Continued...

## FUTURE TUNNELLING ACTIVITIES CONTINUED

Tunnel	Owner	Location	Length (FT)
Green Line LRT Project	City of Calgary	Calgary	9,000
Nose Hill Park Tunnel	City of Calgary	Calgary	10,800
Kensico-Eastview Connection Tunnel	NYC-DEP	New York	11,000
Silver Line Extension	Boston Transit Authority	Boston	8,400
Stanley Park Water Supply Tunnel	City of Vancouver	Vancouver	5,000
ALCOSAN Ohio River Tunnel	Allegheny Co. Sanitary Authority	Pittsburgh	20,000
ALCOSAN Allegheny River Tunnel	Allegheny Co. Sanitary Authority	Pittsburgh	28,000
ALCOSAN Monongahela River Tunnel	Allegheny Co. Sanitary Authority	Pittsburgh	28,000
Germantown Winghocking Relief	City of Philadelphia	Philadelphia	28,000
Project Connect Subway Program	City of Austin	Austin	8,500
West Seattle to Ballard Extension (West Seattle Ext.)	Sound Transit	Seattle	2,800
Northside Interceptor Tunnel	City of Akron	Akron	6,660
Taylor Massey Tunnel	City of Toronto	Toronto	20,000
Quebec City - Levis Tunnel	Quebec Transportation Ministry	Quebec City	27,230
Del Mar Bluffs Tunnel - design review	NCTD	San Diego	TBD
Fraser River Tunnel	BC Ministry of Transportation	Vancouver	3,000
Queensway Tunnel	Region of Peel	Toronto	18,000
Stormwater Control Program	Harris Co. Flood Control Dist.	Houston	52,800
LA Metro Sepulveda Pass Corridor	Los Angeles MTA	Los Angeles	55,500
D2 Subway - 2nd Light Rail Alingment	Dallas Area Rapid Transit	Dallas	7,230
Flushing Bay CSO Tunnel	NYC-DEP	New York	16,500
Cross Harbor Freight Tunnel	PANYNJ	New York	25,000
Superconducting Maglev Project - Northeast Corridor	TNEM / BWRR	Washington	146,520
Big Creek Storage Tunnel	NEORS	Cleveland	22,450
Metropolitan Tunnel Program - Northern Tunnel	MWRA	Boston	23,760
Metropolitan Tunnel Program - Southern Tunnel	MWRA	Boston	50,160
Horizon Lateral Tunnel	Southern Nevada Water Authority	Las Vegas	42,000
Inner Harbour West Tunnel	City of Toronto	Toronto	18,400
Cemetery Brook Drain Tunnel	City of Manchester NH	Manchester	11,600
West Seattle Link Extension (Central/Downtown Segment and Ballard Ext.)	Sound Transit	Washington	10,500

optimas.com | tunnel@optimas.com



Download Brochure



## Sofrasar Tunnel Solutions

Easy Installation

Time Saving

Quality Improvement



Less Maintenance

**AN INNOVATIVE & EFFICIENT FIXING METHOD**  
for sockets in the segment formworks

Trusted by tunnel infrastructure teams globally for over

# 30 years

## 4 Millions

parts with OPTIFIX version supplied since 2016

All product ranges now available with Optifix solutions



**World Tunnel Congress**  
19-25 April, 2024  
Shenzhen, China

Come & say Hi!

Booth G54

## World's Leader in Underground Grouting Equipment

- Cable & Rock Bolts
- Void Fillings
- Shaft Sealing
- Waterproofing





# ChemGrout

The World's Widest Selection Of Grouting Equipment

1963 - 2024

www.chemgrout.com

708.354.7112



ArcelorMittal

# Supporting CO<sub>2</sub> reduction in tunnel construction projects around the world



**XCarb<sup>®</sup>**

Recycled and renewably  
produced

Our steel fibres allow the design and construction of tunnels with lower embodied CO<sub>2</sub>, taking a positive step towards carbon neutrality.

**The right support  
The right advice  
The right fibres**

[arcelormittal.com/steelfibres](https://arcelormittal.com/steelfibres)



## WORK SMARTER WITH INNOVATIVE TECHNOLOGIES

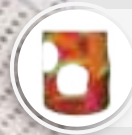
# SAVE CARBON & COST

Today's challenge is to reduce your carbon footprint on major projects. Through Normet's holistic approach, combining low carbon materials, the latest in battery driven equipment, digitalisation coupled with the best on-site process expertise, we can get focused on carbon reduction together and ultimately lower your project costs too. Lower carbon, lower cost.

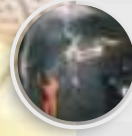
## SUSTAINABLE TUNNELLING

**normet**

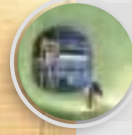
NORMET.COM



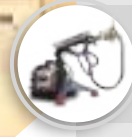
Design know-how for thinner linings



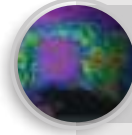
Low carbon concrete



Spray membranes



Electric drive spraying robots and concrete transport



Digitalised sprayed concrete process



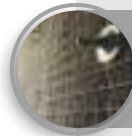
Simulator training



Expert site support



Injection technologies



Rock and ground support



Concrete supply partnerships



Pre-cast concrete solutions



TBM solutions