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 wills 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).