

ENSURING SAFETY AND MITIGATING RISK TO TUNNELING AND DEEP EXCAVATION PROJECTS

Singapore and the South East Asia are developing infrastructure in a big way. There are many underground and tunnelling projects on going in this region. In Singapore, there are underground rail and road projects, underground commercial projects as well as underground services such as cable, water and sewer projects on going. Some of the major underground and tunnelling projects are such as MRT projects Thomson-East Coast Line (TEL), LTA North-South Expressway (NSE), PUB Deep Tunnel Sewerage System (DTSS) Projects. There are many risk factors in the underground and tunnelling projects in various aspects of design and construction. It is important to constantly remind ourselves the existence of many risk factors and what are the good practice to avoid and eliminate such risks. It is also important to constantly be reminded of the lesson learnt from past incidents and case histories, as well as all some good experience to learn from.

This Seminar is specially prepared for developers, contractors, consultants, engineers and qualified site supervisors (QSS) – RE & RTO. We have invited experienced speakers from the academic and industry to present on relevant topics on ensuring safety, good practice to mitigate risks, and valuable learning points from past incidents and project experience.

ENSURING CONSTRUCTION SAFETY AND PROTECT OUR RICE BOWL IN TUNNELING AND DEEP EXCAVATION PROJECT

BY: Mr. Mohammed Firadus, Corporate Safety Manager from Tiong Seng Civil Engineering

SOURCE LESS SEISMIC, A GEOPHYSICAL TECHNIQUE FOR SOIL IMAGING AND MONITORING DURING TUNNELING WORKS. CASE STUDY: PARIS METRO

BY: Mr. Clément MOGENIER, Project Manager from Sixense Group

APPLICATION ON GROUND IMPROVEMENT TO MINIMISE GROUND MOVEMENT AND WATER INGRESS IN TUNNELING AND DEEP EXCAVATION PROJECT

BY: Prof. Chew Soon Hoe, Geotechnical Engineering & Centrifuge Laboratory from NUS

UPDATES ON DESIGN REQUIREMENTS AND CHALLENGES IN DEEP EXCAVATION AND TUNNELING PROJECTS

BY: Dr. Poh Teoh Yaw, Director, Geotechnical Engineering Dept from BCA

COLLAPSE OF HEATHROW EXPRESS TUNNELS

BY: Mr. Leslie Pakianathan, Project Director from Changi Airport Group

TBM FACE PRESSURE ESTIMATION AND OVER-EXCAVATION ASSESSMENT OF SLURRY TYPE TBM

By: Mr. Zhang Bin, Principal Geotechnical Engineer, LTA

LESSONS LEARN FROM CASE HISTORIES OF SINGAPORE UNDERGROUND TRANSIT CONSTRUCTION AND FUTURE CHALLENGES

BY: Er. David Ng, Executive Director from OneSMART Engineering Pte Ltd

DETAILS

Date: 10 October 2018

2 STU (Safety) / 4 STU
(Structural)

8 PDUs for PEs and CEngs

Venue: Singapore Marriott
Tang Plaza Hotel
320 Orchard Road

Fees: \$267.50 (IES Members
/ CIJC Members)

\$374.50 (Non Members)

Fees Include:

7% GST

2 Tea Break and 1
international Lunch

**Complimentary Car Park
Coupons (based on first come
first served)*

**e-Cert will be sent via email
within 14 working days after
end of seminar based on **Time
Out***

*We would like to “save the
trees” There will be no handouts
given. (Reading materials are
pre-load in the thumb drive)*



**Organised by Civil &
Structural Engineering
Technical Committee,
Geotechnical Division**

ENSURING CONSTRUCTION SAFETY AND PROTECT OUR RICE BOWL IN TUNNELING AND DEEP EXCAVATION PROJECT

Several keynotes will be highlighted in this sharing session on the importance of safety and workers' livelihood. An introductory topic on the health and safety risks associated in tunneling. Incidents and accidents prevention strategies will be shared with the audience to gain a better understanding of the challenges faced and during tunneling and deep excavation works.



Mr. Firdaus has 10 years of experience in civil engineering and tunneling. He has successfully been fast-tracked through his performance and is currently spearheading the civil and tunnel engineering projects as Corporate Health and Safety Manager for one of the listed construction companies in Singapore. In his working capacity, he has applied innovative solutions to reduce safety risks for the workers on site. Whilst he has accomplished numerous health and safety improvements during his current tenure he genuinely believes that every day is a learning experience where he can improve and make a positive impact for everyone.

SOURCE LESS SEISMIC, A GEOPHYSICAL TECHNIQUE FOR SOIL IMAGING AND MONITORING DURING TUNNELING WORKS - CASE STUDY: PARIS METRO

The New Grand Paris project includes the development and modernization of the existing metro network, by extending four metro lines which will connect Paris with its neighboring towns. We report the first application of Source Less Seismic technique to monitor the underground during tunneling excavation works of one of this extension project, carried out in Paris in 2016. The technology, inherited from seismology, was scaled down to fit a metro construction project size, and adapted to a constrained urban context. Subsurface was imaged and monitored solely by processing ambient seismic noise records, in an urban setting, where conventional active seismic techniques are precisely constrained by this ambient noise and vibrations affecting the quality of the results. Source Less Seismic technique, carried out for several weeks in a very dense urban zone affected by subsidence during excavation works, allowed us to monitor ground stiffness (Shear waves velocity) beneath a building along the tunnel alignment after the crossing of the TBM, during grouting works, and finally over few weeks after grouting to follow ground conditions. It helped the contractor in preventing and mitigating the risks during works, while providing him with feedbacks on the effects of the excavation and remedial works.



Mr. Clément MOGENIER is currently Geophysical Project Manager for SIXENSE Geophysics in Hong Kong. He received his Master's degree in Applied Geosciences in 2006 from Université Savoie Mont Blanc, France.

He spent his whole career as an Engineering Geo-physicist for Européenne de Géophysique (EDG), which became Soldata Geophysics in 2011 and then SIXENSE Geophysics in 2016.

He has been involved in geophysical surveys for several major construction projects in France, his country of origin: the French Eastern High speed railway, Extensions to Paris metro network, Deep Underground

Storage Facilities, etc. and also over-seas in Africa, Western Europe, Asia, for large infra-structures projects like the Alto Tamega dam in Portugal, Qaraoun Dam in Lebanon, or more re-cently the Nam Theun 2 dam in Lao PDR.

APPLICATION ON GROUND IMPROVEMENT TO MINIMISE GROUND MOVEMENT AND WATER INGRESS IN TUNNELLING AND DEEP EXCAVATION PROJECT

In the construction of underground structures, often temporary works of retaining walls and struts would be required for carrying out the deep excavation work. In Singapore ground conditions, there are Kallang Formation which consists soft marine clay, fluvial clay, fluvial sand and peaty clay. These layers of Kallang Formation could be very thick and sensitive to ground water draw down which would lead to consolidation settlement. Elastic deformation of the retaining wall for the deep excavation could also lead to large ground deformation in Kallang Formation. In Bukit Timah Granite Formation of Singapore, the silty clay or clayey silt of the completely weathered granite could also undergo consolidation settlement. In addition there also exist in many areas a highly permeable layer at the interface between the highly weathered granite and the moderately weathered granite. This will contribute greatly to the ground water draw down in an excavation projects. Ground improvement will be a good measures to overcome the problem of ground water ingress and impact to ground movement as well as potential structure damage. This presentation will discuss the various possible ground improvement schemes and case histories from past successful application of ground improvement to arrest ground water ingress and ground movement.



Dr CHEW Soon-Hoe, Assistant Professor of the Department of Civil and Environmental Engineering, National University of Singapore. He is also a Professional Engineer in Singapore, QECP, and Senior Member of IES. He is also currently the President of Southeast Asia chapter of International Geosynthetics Society (IGS), and the president of Singapore Chapter of American Society of Civil Engineers (ASCE).

He obtained his PhD from the University of California at Berkeley, USA. For many years, he was the Deputy Director of the Centre for Protective Technology, which is a R&D centre setup by the Ministry of Defence, Singapore, and NUS. He has just co-authored a book on Blast Protection for infrastructural facilities.

He is a member of HDB's Civil and Structural Advisory Panel. He currently serves as a member of Singapore Accreditation Council (Laboratory Accreditation Scheme). He is a member of "Pile Testing" task force, and working committee for "piling technology", led by BCA and GeoSS.

Dr Chew published very extensively on soft clay and ground improvement related topics, as well as rapid pile load test. He was awarded "Defence Technology Prize", from Chief Defence Scientist, Ministry of Defence, Singapore in 2006. He was also the recipient of the "Minister Innovative Awards" from Ministry of Transportation, 2011, and "2015 Minister's Awards (Team)" by the Ministry of National Development. He was also awarded with "Friends of Waters" by PUB.

Dr Chew is also the key member representing IES in the formation of "ABC Water Features program" led by PUB. Dr Chew teaches several modules in this program. He is also a member of monitoring committee of this ABC program. He has served as consultant/advisor to consulting companies in a number of ABC program in Singapore. Dr Chew is also a member of PUB/IES's Qualified Erosion Control Professional (QECP) committee. Dr Chew is the key lecturer for this course, and he also a member of "Erosion control Monitoring Committee", and "ECM submission review panel".

His research interests include Geosynthetics application, land reclamation, soil improvement (grouting, cement mixing, Prefabricated vertical drains, and dynamic compaction etc), numerical modeling in geotechnical engineering, and pile testing technology. He has many practical experiences based on research and consulting experiences on pile design, deep excavation, ground investigation works, Tunnelling (Soil and rock), and ground improvement (including PVD, jet grouting, permeation grouting, TAM grouting, fissure grouting and low pressure grouting, DCM etc.). His latest involvement is on advanced geotechnical investigation and instrumentation, and especially on real-time monitoring.

UPDATES ON DESIGN REQUIREMENTS AND CHALLENGES IN DEEP EXCAVATION AND TUNNELING PROJECTS

With rapid expansion of rail network and other underground infrastructure projects in our already densely built-up city, more deep excavation and tunnelling works will be carried out in close proximity to existing buildings. Such complex excavation and tunnelling works are likely to impose higher risk to nearby buildings, especially for works in difficult ground conditions. The presentation highlights some challenges faced in such projects. Case studies will also be presented to share some proactive measures implemented to mitigate such risk.



Dr POH Teoh Yaw is a Director with Building and Construction Authority which oversees and administers the regulatory framework on building structure safety in Singapore. He is a geotechnical specialist with over 18 years of practical experience. He has authored over 18 publications in geotechnical design and construction including those published in international peer-review journals and conferences..

COLLAPSE AND RECOVERY OF HEATHROW EXPRESS TUNNELS

Tunnels under airports are subject to additional risks over and above the usual tunnelling risks not only because of their proximity to air crafts, fuel pipes, navigation equipment, 24 hr operations but also arising from the height of construction equipment, wildlife and airside security issues.

The Heathrow Express tunnels were constructed under operational runway, taxiways, disused fuel farm and buildings. Despite careful planning and strict safety control measures a simultaneous collapse of three tunnels occurred in the Central Terminal Area (T1, 2 and 3). At that time, it was named the worst construction disaster of the decade though fortuitously there was no fatality.

The presentation will give from first hand observations an overall description of the project, construction related risks specific to airports, events leading to the collapse as well as the recovery process immediately following the collapse. The detailed

inquiry following the collapse resulted in recommendations for several improvements in the way mined tunnelling was practiced at the time. Some of these improvements will be shared and discussed.



Mr. Leslie J. Pakianathan has been engaged in the planning, design and construction of tunnels since 1986. At present he is working as Project Director with Changi Airport Group.

Prior to current appointment, Leslie worked on several tunnelling projects such as the Victoria Dam hydroelectric project in Sri Lanka; the Channel Tunnel, Jubilee Line Extension, Heathrow Express Railway and Cross Rail projects in the UK; Harbour Area Treatment Scheme Stage 1 in Hong Kong; North South Expressway, MRT and Cable Tunnel projects in Singapore. He is an alumnus of the Imperial College, UK and a Fellow of the Institution of Civil Engineers (ICE).

TBM FACE PRESSURE ESTIMATION AND OVER-EXCAVATION ASSESSMENT OF SLURRY TYPE TBM

Due to expansion of MRT system in Singapore, TBM tunnelling is widely in use and its impact to the surroundings gets much attention by the society. Setting the correct TBM face pressure and using dry volume calculations for assessment of over-excavation by slurry type TBM are two key factors to the success of tunnelling works and mitigating risk to stakeholders in such a congested island country. There are many ways to assess TBM face pressure, such as using the empirical formula, wedge stability analysis and so forth. However, due to various ground conditions and different depth of tunnel overburden, the conventional method may have its own limitations and comparison between different methods or using more advanced 3D FEM analysis becomes necessary. Four case studies on some MRT projects are used to illustrate how the TBM face pressure is analysed in different scenarios. The over-excavation assessment of slurry type TBM is very crucial, especially for tunnelling in mixed-face ground conditions. One case study in MRT DTL project will be used to explain how dry volume calculations are applied to assess over-excavation with relation to volume loss back calculated from surface settlement profile. Experiences gained from past projects and some recommendations will be highlighted in this presentation.



Mr. ZHANG Bin is currently a Senior Principal Engineer with Geotechnical and Tunnels Division in LTA. He holds a BEng degree in Civil Engineering from Tongji University (Shanghai, PRC) and a MSc degree in Civil Engineering with Specialization in Geotechnical Engineering from NUS. Zhang is a registered Professional Engineer (Civil) in Singapore and a Chartered Engineer (UK). He has over 18 years of professional experience in the design, planning and construction management of major tunnelling and underground projects in Singapore, Hong Kong and Southeast Asia. Zhang has extensive management skills and design experiences for tunnelling in various ground conditions using TBM (EPBM and Slurry Shield), NATM and drill-and-blast technique. He has been involved in many infrastructure projects such as Singapore MRT Thomson East-coast Line (TEL), Singapore MRT DTL Stage 1, 2 & 3, Singapore MRT CCL Stage 2, 4&5, Singapore North South Transmission Cable Tunnel, Jakarta MRT Phase 1, Hong Kong MTR South Island Line and Kolkata East-West Metro.

LESSONS LEARN FROM CASE HISTORIES OF SINGAPORE UNDERGROUND TRANSIT CONSTRUCTION AND FUTURE CHALLENGES

The history of the Mass Rapid Transit system of Singapore commences with its planning in the 1960s, leading to its opening in 1987 with the launch of the 6 km section of the North South Line from Yio Chu Kang to Toa Payoh. It now has 6 lines in operation with a total combined route length of 241.5 km and 157 stations. Currently the Thomson East Coast Line and Circle Line are under construction. The Thomson-East Coast Line (TEL) is a joint line between the Thomson Line and the Eastern Region Line. The 43km TEL will add 31 new stations to the existing rail network, with 7 interchange stations, which will link to the East-West Line, North-South Line, North-East Line, Circle Line and the Downtown Line. Commuters can start enjoying the TEL in stages from 2019. There are also several future lines to be rolled out in the near future, such as Cross Island Line (CRL) and Jurong Regional Line (JRL). The Nicoll Highway collapse was one of the major construction accidents that occurred at approximately 3.30 pm on 20 April 2004 in Singapore when a tunnel being constructed for use by Mass Rapid Transit trains collapsed. The supporting structure for the deep excavation work failed, resulting in a 30-metre (100 ft) deep cave-in that spread across six lanes of Nicoll Highway. There have been many challenges encountered and lessons learned from the previous design and construction of the previous lines and there have been several current developments such as use of rectangular TBM, micro TBM and tubular struts. Case histories based on previous projects and current projects will be discussed.



Er. NG Chew Chiat, David, Executive Director of ONE SMART Engineering Pte Ltd and has 16 years of postgraduate working experience in consultancy and research in Singapore. He is a PE (Civil) as well as Specialist PE (Geo) registered with Professional Engineers Board (PEB), Singapore. He graduated in 1999 with a Master Degree in Geotechnical Engineering from NUS where he received the Innovation Award and NSTB Gold Award for his outstanding academic results and research work. Er. David Ng has been awarded The Young Consulting Engineer of the Year 2013 by Association of Consulting Engineers of Singapore (ACES) and The First Prize of Hulme's Prize Technical Paper Competition by Tunneling & Underground Construction Society of Singapore (TUCSS) in 2000, for his technical paper in tunnelling. Er. David Ng has published more than 40 technical papers in the field of geotechnical engineering. He has been elected as SPRING Singapore Technical Committee (15th Term) for The Standards Council (Civil & Geotechnical Works), 2011-2014. He is serving as a member in the Institute of Engineers Singapore (IES) Civil and Structural Technical Committee in the Geotechnical Division. Er. David Ng is also elected as the Council Member of the Tunnelling and Underground Construction Society of Singapore (TUCSS) from 2011 to 2016. He had been a member of the LTA Design Criteria and M&W Specifications Review Committee from 2002 to 2010. He has been involved in the planning, design, project management and instrumentation & monitoring of major infrastructure projects such as DTSS, KPE, CCL & DTL which involve deep excavation, mined tunnels and bored tunnels during his 15 years of working experience.

TERMS & CONDITIONS

Registration

1. Registration is based on first come first served. Please click [HERE](#) to register
2. For Group Registrations /CIJC Members, please click [HERE](#) to register
2. Booking through phone will not be entertained.

Payment Mode

1. Payment via VISA/Master online
2. Payment via AXS Machine (Please click [HERE](#) for procedure). Remember to retain your receipt for verification.
3. Payment by Crossed Cheque payable to “IES”

*For cheque payment, please indicate Participate name & Event name at the back of the cheque and send to:

**The Institution of Engineers, Singapore
70 Bukit Tinggi Road
Singapore 289758
Attn: Shelly Ng**

Confirmation of Course

Confirmation of registration will be given 5 days prior to the commencement date of event via email. Otherwise, please call Ms Shelly Ng @ 6461 1222 to check on your confirmation.
(Please remember to check your Junk/Spam folder if you did not receive the confirmation)

Postponement / Cancellation

IES reserves the full rights to cancel or postpone the Event under such circumstances without prior reasons. And/or due to unforeseen circumstances.

Every effort, however, will be made to inform the participants or contact person of any cancellation or postponement. Fees will be refunded in FULL if any Event is cancelled by IES.

In the event that participants are not able to attend, please inform us in writing **at least 3 working days** before the event date. Otherwise **full payment** is still applicable even if you did not turn up for the talk.

(Please be informed that there will be a cancellation charge of 4.5% if cancelled by participant)