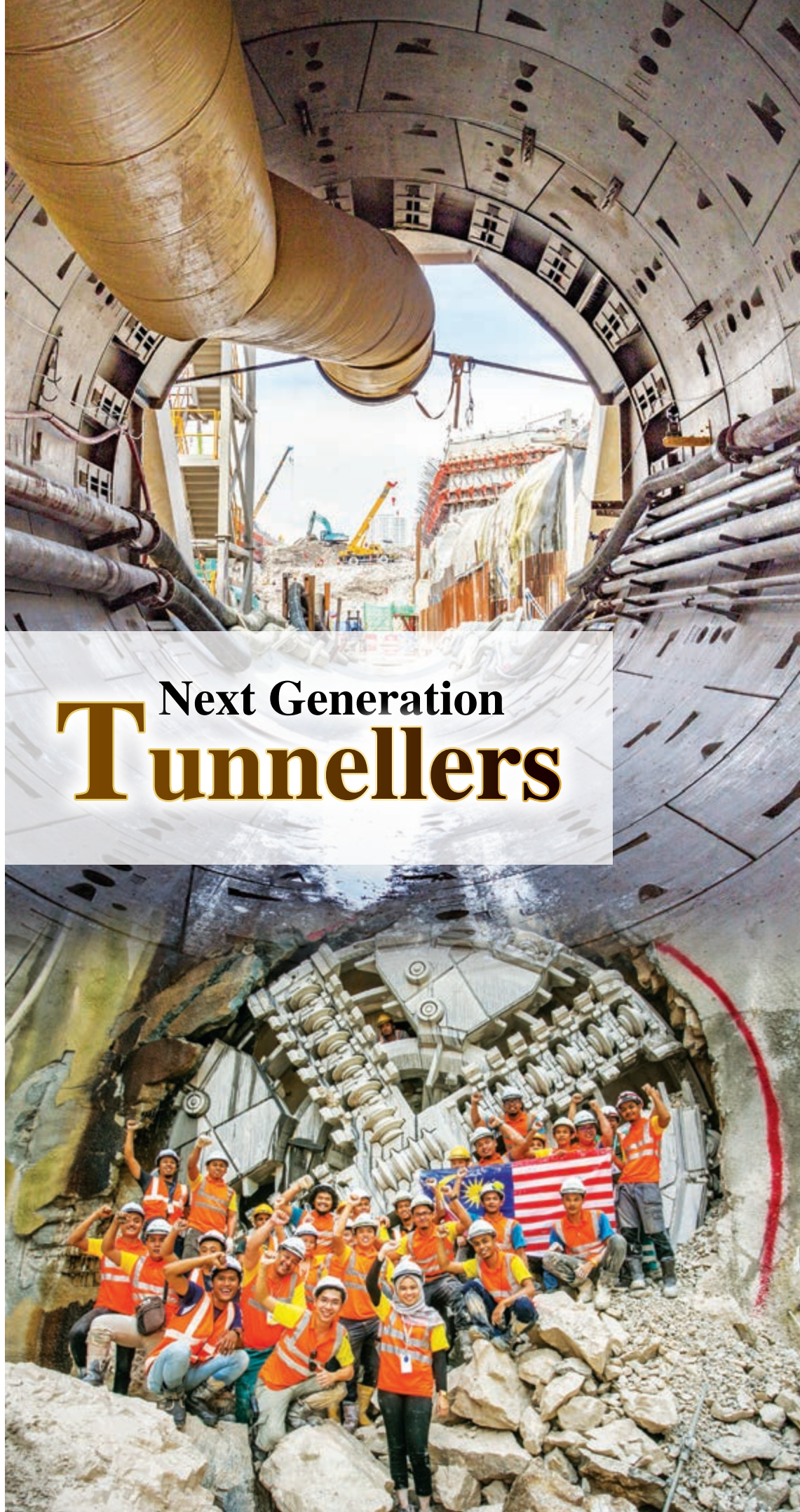


SEPTEMBER 2019



JURNAL TUNNELLERS



Next Generation Tunnellers

JURUTERA

THE MONTHLY BULLETIN OF THE INSTITUTION OF ENGINEERS, MALAYSIA

IEM
The Institution of Engineers, Malaysia

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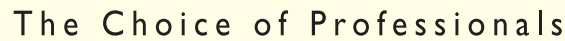
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cover note



Next Generation Tunnellers

by Ir. Khoo Chee Min

Chairman,

Tunnelling & Underground Space Technical Division (TUSTD)

During the last AGM of TUSTD, we made a commitment to nurture young talents as part of our strategy to boost a sustainable pool of tunnelling professionals in Malaysia. The theme for this issue of JURUTERA, Next Generation Tunnellers, is aptly chosen to reflect our initiative to promote opportunities for young professionals. A career in tunnelling is a great opportunity to work in a competence-driven and highly dedicated global environment. This industry will become more important than ever in the coming years.

In the cover story, 5 young professionals share their stories with JURUTERA. They speak about how they started in the tunnelling industry and how their education, training and experiences have helped them in their working lives, in particular embarking on their respective careers. Their enthusiasm and energy are as vibrant as ever to ensure a rewarding journey in their chosen careers.

The future of tunnelling is bright, both locally and globally. As the icing on the cake, IEM is proud to present the World Tunnel Congress 2020. The organising committee is working very hard to undertake various duties and tasks in preparation for this international event. As IEM members, let us contribute to make this event a success and so, put Malaysia on the world map. ■

editor's note

by Ir. Razak Yakob

Bulletin Editor



Salam & Hello All IEMers,

This month, TUSTD features the Next Generation Tunnellers, in line with the mega event, WTC 2020. Help make this international event a success because this is an IEM's event. Let us provide support, in any way we can. Click on the link <http://www.wtc2020.my/>

I know everyone is busy and it's hard to find time for IEM activities. So IEM would make talks and engagement sessions accessible to all members online. The last Mentor & Mentees Engineering Competency Development Engagement session was broadcasted successfully to the Perak and Southern Branches, despite some glitches due to facilities limitation. We hope to have more similar sessions in the future. If you want to do this for your event, please contact the Secretariat.

Take a break and ask "what are we doing and why are we doing this". Sometimes we are caught up with work and we forget why we work so hard. If you are working to support your family, don't forget your family in the first place; if you're working for your own happiness, don't forget to stay healthy. Always stop and think of why we do the things we do.

The Editorial Board wishes all a Happy Malaysia Day.

Let's continue to engineer our country to a greater height! ■



NEXT GENERATION TUNNELLERS

The tunnelling industry has been growing rapidly in Malaysia in the past decade. **JURUTERA** speaks to five young tunnellers who are making waves in this field.

Q Has your university education prepared you for a career in tunnelling?

Derek Eng gained his tunnelling knowledge on the job. "I studied the basics in university but it was skill acquired from actual work experience that became my foundation. When I started, it was a matter of sink or swim; this was something my degree hadn't really prepared me for."

Mandy Ang agrees. "Tunnelling is made up of several disciplines of engineering and the world class

education I received at University College London covered these disciplines. Every quarter, we were involved in high-paced case studies that addressed real life projects including tunnelling; these prepared me for the working world. However, the tunnelling industry is very technical and many skills have to be learnt hands-on."

Dr Boon Chia Weng believes that knowledge is power. "Most people will agree that on-the-job training is required in the construction industry. But what I learnt in university gave

me an edge. It also ensured that I learnt and developed difficult design concepts quickly. At Oxford University, I developed the concept of an interaction diagram to better quantify the role of tunnel lining in relation to rock bolts. This was part of my thesis which won the Rocha Medal Award by the International Society for Rock Mechanics & Rock Engineering in 2016. Theoretical knowledge also enabled me to contribute further to tunnelling impact assessments, which was acknowledged with the Tan Sri Zainal Prize from IEM this year."

COVER STORY

Ir. Frankie Cheah said education gave him the foundation to be the best that he could in this field. "I received an all-rounded tertiary education, and was trained in the basics of civil engineering skills, such as concrete, structure, geotechnical and steel; all these were integral to my tunnelling career. Unfortunately, local universities don't have core bachelor's or master's degrees in tunnelling though the Gamuda Tunnelling Training Academy has done a good job enabling young Malaysians to be equipped with hands-on skills."

Dr Siti Norafida binti Jusoh says her education began at home. "The foundation was laid by my parents and my family. From young, I was encouraged to think out of the box and be creative when solving problems. Growing up in the kampung, nothing was off-limits for me. My mother always encouraged me to face challenges head-on, telling me that there was no problem I could not solve. Tunnelling is complex and one needs to have courage and the desire to try new things."

Q Did you receive any mentorship which helped you to better adapt to the tunnelling industry? Have you offered any kind of mentorship?

"Not specifically but I received guidance from various mentors as I worked, a project-by-project experiential learning," says Derek. "I was fortunate to learn from expats who were experts in their field. These included why a tunnel lining had to be a certain measurement and why a particular skill had to be applied a certain way. There were always challenges, such as a crack in the lining/grout and why the cement didn't set. I learnt to fix problems from those who were willing to share. Knowledge should be transferred coherently and so, in return, I spend a fair bit of time with younger tunnellers. We're always learning from each other and from the best."

From his first day at his company, Dr Boon was fortunate to be able to

work with very capable management staff. "I worked in the geotechnical department and I learnt problem solving skills from my superior, Dr Ooi Lean Hock. In the design and technical department, I developed informal mentoring relationships with my superiors, especially those in the geotechnical team. My superiors at the head office are equally supportive and will check on my career development from time to time. From the operational and contractual perspectives, I realise that cross-exposures are important. I am fortunate that this is easily accessible when various departments work on the same project. But like Derek says, cross transferring exposure is important, and new tunnellers need to learn what they can, where they can."

Mandy says: "My immediate superior was an invaluable guide when I entered the industry, helping me to understand what I was doing, mentoring me and shortening my learning curve. Like Derek, I found expats to be very helpful as TBM tunnelling was still new here then. The expatriate tunnelling experts on my first project were very generous with sharing their knowledge."

Ir. Cheah says he is fortunate to have had mentors throughout his career. "As a young engineer, everyone I worked with became my mentor. Even today, I am still learning and I will keep on learning. Mentorship is not only what we learn from the experiences of seniors, but also respecting them for it. You don't have a future when you refuse to accept the former generation."

Dr Siti has many mentors. "For now, I'm not specifically mentoring anyone, but I have students who learn through the many experiments we conduct at the university. These experiments and projects are as close to real life as possible. As for myself, I was mentored by my supervisors, Prof. Aminaton and Dr Hisham Mohamad as well as my IEM colleagues, especially Ir. Dr Rini Asnida and Ir. Khoo. They led me into this field, and I benefitted from their experiences."



Derek Eng graduated in civil engineering from Universiti Sains Malaysia. The manager for one of the tunnel drives in the Sg Buloh-Serdang-Putrajaya Line is also involved in the development of the Tunnelling Training Academy. He has worked on the Variable Density Tunnel Boring Machine and received the Young Tunneller of the Year award for 2016 from the International Tunnelling Association.



Mandy Ang graduated from University College London, UK on full scholarship. Her academic excellence won her numerous sponsorships incl. ASEAN scholarship. Mandy Ang has over 9 years of tunnelling experience and is currently on her 3rd mega tunnel project with a record of 25 TBMs in total. She is currently an Assistant to Deputy Project Director overseeing Tenders, R&D and Business Development, at Gamuda. She recently completed the 5 km subsea twin tunnels of Hong Kong-Zhuhai-Macau Bridge project and was a finalist for Young Tunneller of the Year Award (2018).



Dr Siti Norafida binti Jusoh is senior lecturer at the Department of Geotechnics & Transportation, School of Civil Engineering, Universiti Teknologi Malaysia. She is deputy quality manager of Civil Engineering Testing Unit and group leader of Future Ready Engineering Education for 21st Century Teaching & Learning. She was previously a Co-Opt member of Tunnelling & Underground Space Technical Division, IEM from 2017-2019.



Dr Boon Chia Weng received his B. Eng. from Nanyang Technological University in 2009 and D.Phil. from Oxford University in 2013. He was awarded the Rocha Medal in 2016 by the International Society for Rock Mechanics and Rock Engineering (ISRM) and was a recipient of the Lee Kuan Yew Gold Medal, Professional Engineers Board Gold Medal (Singapore) and the Yang di-Pertuan Agong Scholarship (Malaysia). He is presently the Malaysian Representative for the International Tunnelling Association Young Member Group (ITAYm), and is working with MMC-Gamuda KVMRT(T) Sdn. Bhd.



Ir. Frankie Cheah received his B.Eng. from Universiti Malaysia Sabah, and MSc from Nanyang Technological University Singapore. He has over 15 years geotechnical experience across the Asia region and is a committee member of the IEM Tunnelling & Underground Space Technical Division (TUSTD). He is associate director of AECOM Malaysia and lead geotechnical design engineer for the KVMRT Line 1 (Sg Buloh-Kajang Line and now Line 2 (Sg Buloh-Serdang-Putrajaya Line) for the Detailed Design Package 4 and Package 6. He is presently the Malaysian Deputy Chairman for the International Tunnelling Association Young Member Group (ITAYm).

Q Have on-the-job training and experiences helped you to advance in your career?

At the start of his career, Derek worked 12-hour days and six-day weeks as a shift engineer. "During this time, I had to know the ins and outs of the job and of those on my team such as how to ensure continuity when using the TBM and how to make sure each lining was accurate. We also had quotas to fill and incentives for speedy work. I had to push the team and make sure we were prepared for the unexpected such as sudden drops in pressure. Tunnelling is a very skills-specific job; you either have the skills or you don't."

Mandy believes that any success in tunnelling is due to the expertise of those working on the projects. "I made the choice to work overseas because I wanted the experience. I worked on building the largest tunnels using TBMs and I took the opportunity to be trained on-the-job as a TBM operator and superintendent on 12-hour shift in the tunnel. This way, I understood better everyone's roles and how we all worked together. We had to be on point in everything we did and through mentorships and training, I became better at making management level decisions."

Dr Boon is a strong advocate of on-the-job training. "I need to monitor and change design as I receive information from the various departments. On Line 1 (Klang Valley Mass Rapid Transit), on-the-job training allowed me to appreciate the importance of getting correctly, before site mobilisation, the capacities required by the machine and accessories for constructing the retaining walls for the shafts and stations launching or retrieving the TBMs. On Line 2, I spent time with the contracts team and the construction managers during the critical site investigation period, pre-empting potential changes to the retaining wall lengths and highlighting the need for pre-treatment works

while site investigation was on-going. Breaking barriers within the organisation allowed us to complete the job on schedule despite the very challenging ground conditions. As a result, we were shortlisted as Finalists for the Technical Excellence Award for Ground Engineering (UK) in 2018."

Ir. Cheah says: "Of course it is what I have learnt, what I practice and what I see that motivates me to move ahead in this industry. From the design point of view, I have to ensure that all relevant departments are consulted and that feedback based on their experiences is applied."

"Exposure to and interactions with other tunnellers when attending courses and conferences help me understand more about the practical work of tunnelling," says Dr Siti.

Q What were your biggest challenges and how did you overcome them?

For Derek, the biggest challenge is absorbing the immense amount of information learnt and understanding the technical skills. "It takes time and we are expected to make informed decisions at all times; we are judged if we make the wrong call. It is hard to remember everything and different personalities can rub others the wrong way. So there is a lot of adjustment and adaptations involved but, over time, as we mature, it all becomes manageable."

Mandy feels that as a woman in a male-dominated industry, she has to work extra hard to be taken seriously. "My biggest challenge is gender. Being a woman means my experience is different from that of male engineers. I've often had to step up and take charge to make myself heard. Getting my hands dirty and be hands-on before navigating or leading the team is important. I think European tunnellers are better at adapting and working with women, while Asians still have to catch up."

Dr Boon says young engineers should be specific and clear when



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- Admixtures for shotcrete and concrete
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conveying information. "They should know their jobs thoroughly and be prepared with answers. Challenges are resolved through team effort and collective deliberation. The young engineer is usually the one most familiar with site conditions, design and how the ground responds. It is important to be able to express ideas clearly in order to contribute positively. I have learnt to digest information, assess the conditions and table possible solutions in group discussions."

Ir. Cheah jokes that lack of height is his challenge and that he may be taken more seriously if he is taller. "Jokes aside, I think my biggest challenge is trying to convince senior engineers. But we are all engineers and as long as we have a good understanding of what we do and are prepared, convincing others should not be too difficult after all. It will be hard though if we walk into the room unprepared."

Dr Siti feels that young tunnelling engineers find it difficult to understand what really happens during the excavation process. "Tunnels are built in complex and challenging geological formations, so meticulous analyses and evaluations of various possible failure modes are needed to ensure the process is carried out within safety margins and with economical design. Understanding the philosophy of tunnelling itself is important and crucial for modelling and design verification. My PhD projects covers the effects of segment joints to global tunnel stability/reaction. With this, I hope advancement and more certainty on soil-tunnel can be achieved to avoid catastrophes."



What do you hope to accomplish in the next 5 years?

Derek is moving to a new field, though still in the tunnelling industry. "I have always worked on big tunnelling but in the past few years, small tunnelling has picked up. It is trickier and uses smaller TBMs, from 800 to 2,000

millimetres. I believe this is the next generation of tunnelling in Malaysia."

Mandy wants to be a construction manager. "Having worked for contractors my entire career, there is always the perception that women are not as capable as the men. So I hope to improve my management skills and engineering knowledge so that I can take on more challenging positions to erode this sentiment. I believe in lifelong learning. Having worked on one of the most challenging projects in Hong Kong, the experience is extremely valuable to me. The more I gain, the more I can contribute and deliver."

Dr Boon wants to continue to achieve more in tunnelling and underground space industry. "It is hard to imagine what I will accomplish but I am looking forward to opportunities to embark on exciting projects as well as to moving on to more challenging roles."

Like Mandy, Ir. Cheah has big ambitions. "I've always wanted to be a technical guy and I want to be the technical director of my company. That's my target."

Dr Siti will continue with academic work. "I want to be a problem solver and solution provider, particularly in enhancing design and analyses via promoting continuum modelling."



In light of the current political and financial climate, how do you think the local tunnelling industry will evolve?

All five engineers are optimistic and yet realistic. Derek wants to see shelved projects restarted. "Large projects involve hundreds or thousands of workers. These projects also benefit the city and the nation, so I hope the government can find a way to incorporate more LRT and MRT projects in their plans."

Mandy agrees. "These projects are expensive but are necessary to development. Transportation is always being overhauled and upgraded. Metro systems need to be a network

to function efficiently and we must constantly plan ahead for future lines."

Dr Boon feels that private businesses will suffer. "Private businesses usually look at potential returns when investing further to retain a skilled workforce or buy new machines. Private businesses will need to find alternatives if domestic demands are limited."

Ir. Cheah is more optimistic. "The local tunnelling industry will definitely evolve to be better. We have been improving for years, and are on par with many countries in Asia, even Singapore."

Dr Siti says: "It may seem like a difficult phase now but as we create more awareness about the importance and benefits of tunnels, tunnelling will evolve further."



Does the current local tunnelling industry attract fresh talents? If not, how can we improve it?

Derek feels it will help if salaries for new engineers are raised. "There is definitely space to learn as this is still a relatively new industry. The platform is available and cross transferring, even across borders, is attractive. But our salaries are still not on par with international standards and there are not enough projects to go around."

Mandy hopes to see more equal opportunities for women to attract women talents into the industry. "Things are slowing down at the moment as many projects have been put on hold with the change of government. But there are many opportunities outside the country. However, we are still far behind when it comes to adapting to female engineers."

Ir. Cheah feels that with the long hours and high pressure environment, tunnelling is still hard to adapt to. "For young engineers, experience will be more important than remuneration."

Again, Dr Boon is optimistic. "Personally, I think the current local tunnelling and underground space industry is attractive. The career

COVER STORY

choices of fresh graduates largely depend on the state of the industry and whether they think it is exciting and rewarding. IEM's Tunnelling & Underground Space Technical Division (TUSTD) has organised several visits to KVMRT project sites to introduce it to those who are curious about or interested in tunnelling. Next year, the World Tunnel Congress (WTC) 2020 will also be organised in Kuala Lumpur."

Dr Siti says: "I find tunnelling really attractive and, from an academic perspective, many fresh graduates want to enter the industry. To give it a boost, organise awareness campaigns in secondary schools to help students learn about, understand the field and see it as a career option."

Q Are local tunnelling players competitive enough to enter the global market?

Mandy believes Malaysia will get there, eventually. "Having worked internationally, I know how tough the market is. If you don't have the experience, penetrating new markets is difficult. The company I work for is very innovation-driven, which is the key to competitiveness. Gamuda is working in that direction in order to penetrate the global market. We have the right approach and mindset. Technically, we are also quite competitive and that helps. We just need more opportunities."

Derek agrees. "Every country has its own policies. A few local contractors are almost there and they meet international standards, but many are not."

For Dr Boon, the challenge for Malaysians in new markets are the cultural and social aspects. "In a recent short course organised by TUSTD, Ir. Dr Ooi Teik Aun showed us that the tunnels we build in Malaysia are competitive in relation to the international setting, in terms of depth, function, diameter and geological conditions. In particular, MMC-Gamuda KVMRT (T) Sdn. Bhd. has won

numerous accolades for the Variable Density Machine for tunnelling in extreme karst. So, in order to venture into the global market, familiarity with the social and contractual setting is important."

Both Ir. Cheah and Dr Siti have an unwavering faith in what local tunnellers can do. "I always feel that Malaysia Boleh," says Ir. Cheah, while Dr Siti adds: "Yes, we are definitely able to take our place at a global level."

Q Do we need more research & development on design and construction to further improve the industry?

Derek feels that project feasibility studies ensure streamlined projects with limited consequences to the environment. "Local engineers are doing wonders. There are many talented local tunnellers who are working on research in technology upgrades and machine updates. We are very strong on innovation, and we need to maintain that."

Mandy agrees. "I am currently leading R&D in my company. The benefits are immense as with this, we can improve safety, increase collaboration across the board, develop better consistency of delivery and make quick, accurate decisions with improved efficiency and productivity. R&D is really important as it accelerates production and increases efficiency. Eventually we will be able to use machines or robots to replace human intervention in hard-to-reach places or in places with extreme low pressure... and all this is due to R&D."

Dr Boon believes there can never be enough R&D. "There is always room for improvement. It also important to be able to communicate the findings well because tunnelling involves many parties, including the authorities and third party stakeholders. Engineers should not neglect the 'human' side of working in a society, as most engineers are inclined to focus at getting on with the technical solution." ■



Obituary

Dato' Ir. Pang Leong Hoon (1932-2019)

Dato' Ir. Pang Leong Hoon, 84, passed away peacefully in London on 18 July, 2019. He is survived by his wife, Datin Lian Lee Choo, their two sons, Albert and Alan, and 4 grandchildren.

Dato' Ir. Pang was born in Kelantan in 1932. He received his Fellowship Diploma in Civil Engineering in 1957 from the Royal Melbourne Technical College, Australia. During his one-year service with the Commonwealth Department of Works Australia, Dato' Ir. Pang was involved in the multi-million pound Pukapunya Military Camp Project. Returning home in 1958, he joined the Drainage & Irrigation Department, Malaysia (Jabatan Pengairan & Saliran) where he served for 29 years until his retirement as Director General in 1987. In his various capacities with DID, he was instrumental in the development and management of drainage, irrigation and flood control projects throughout the country. Upon his retirement, he served on the Panel of the Public Services Tribunal for five years.

He contributed tirelessly to the IEM, especially as President (1984-1986) and, as IEM's long standing Election Officer, he was highly regarded for his integrity and impartiality in conducting the annual elections. At the IEM Annual General Meeting each year, members looked forward to his presentation of the election results which he made both exciting and joyful despite the serious decorum of the AGM.

To keep new members informed on the rich history of IEM, he worked tirelessly, digging into old records and past minutes of AGM, Council and Excomm, to as far back as the formation of IEM, to write articles on its history. He contributed 12 articles to *JURUTERA Bulletin*, ranging from the Inaugural Meeting of IEM to the purchase of the new IEM Building.

Dato' Ir. Pang's distinguished services earned him various State and Federal awards. He was interested in ballroom dancing since school days. He and his wife took dance lessons at the Royal Lake Club from 1972. He sat for the ISTD (U.K.) examinations and won a Bronze Medal (1986) as well as Gold Star (1988) and 2nd Award (1989).

Dato' Ir. Pang will be missed by all those who knew him. May he rest in peace!

Bulletin Editor



LIMITATION OF LIABILITY FOR ENGINEERS



By Ir. Lai Sze Ching

The liability of engineers has been a thorny issue as there is always the fear of "life guaranteed" liability for all design work they do. This issue was finally resolved when the Limitation Act 1953 ("Limitation Act") was amended recently.

The Limitation (Amendment) Act 2018 ("Amended Act") was passed by Parliament on 4 April, 2018. The Act was subsequently granted Royal Assent by the Yang Di-Pertuan Agong on 27 April, 2018 and gazetted on 4 May, 2018. It will come into force on a date to be appointed by the Minister.

The objectives of the Amended Act are to:

1. Postpone the commencement of the limitation period when a person is under a disability at the time the cause of action is accrued;
2. Extend the limitation period in cases of negligence not involving personal injury and the damage was not discoverable prior to the expiry of the statutory limitation period;
3. Provide an overriding 15-year long-stop from the act of negligence giving rise to the damage.

Here, we will discuss the amended new Section 6A of the Amended Act which addresses the last 2 issues. It must be noted that Sarawak and Sabah have their own legislation on limitation, therefore this Amended Act is not applicable in these 2 States.

EXTENSION OF THE LIMITATION PERIODS IN THE LIMITATION ACT 1953

Section 6(1)(a) of the Limitation Act provides that any legal action must be brought within 6 years from when a cause of action accrued.

What is cause of action? In *Lim Kean v Choo Khoon (1970) 1 MLJ 158*, the Court said, "a cause of action normally accrues when there is a person who can sue and another who can be sued, and when all the facts have happened which are material to be proved to entitle the plaintiff to succeed." In the law of contract, the cause of action normally will arise when the terms of a contract are breached, for example when the project fails to complete on time or the contractor refuses to comply with the instructions issued by the contract administrator.

For claims initiated under law of tort, the limitation period is 6 years when a plaintiff suffers damage due to

the tortious act such as negligence by the defendant. The 6-year limitation period applies regardless of when the plaintiff discovers such damage.

However strict interpretation of the said provision may cause injustice when the damage is discovered only after 6 years. In *Pirelli Cable Works v Oscar (1983) 1 All ER 65*, the chimney was constructed in 1969 but the faulty condition of the chimney could not have been discovered with reasonable diligence and was only, in fact, discovered in 1977. The court held that the cause of action accrues at the date when the cracks on the chimney occurred and not when the plaintiff could have diligently discovered it. In this case, the plaintiff's action was time-barred as the date when he discovered the crack was over the limitation period of 6 years.

To address the injustice caused by this, UK has enacted the Latent Damage Act 1986 which provides that where the cause of action could not be discovered when it arises, the plaintiff can sue within 3 years of the time when it could be discovered.

NEW SECTION 6A

The amendment of the Limitation Act introduces a new section 6A as follows:

"Limitation of actions to claim damages for negligence not involving personal injuries"

1. 6A. Notwithstanding subsection 6(1), this section shall apply to any action for damages for negligence not involving personal injuries, where the starting date for calculating the period of limitation period under subsection (2) falls after the date on which the cause of action accrued.
2. An action to which this section applies shall not be brought after the expiration of three years from the starting date if the period of three years expires from the starting date if the period of three years expires later than the period of limitation prescribed in subsection 6(1).
3. Notwithstanding subsection (2), no action shall be brought after the expiration of fifteen years from the date on which the cause of action accrued.
4. For the purposes of this section:
(a) "starting date" means the earliest date on which the

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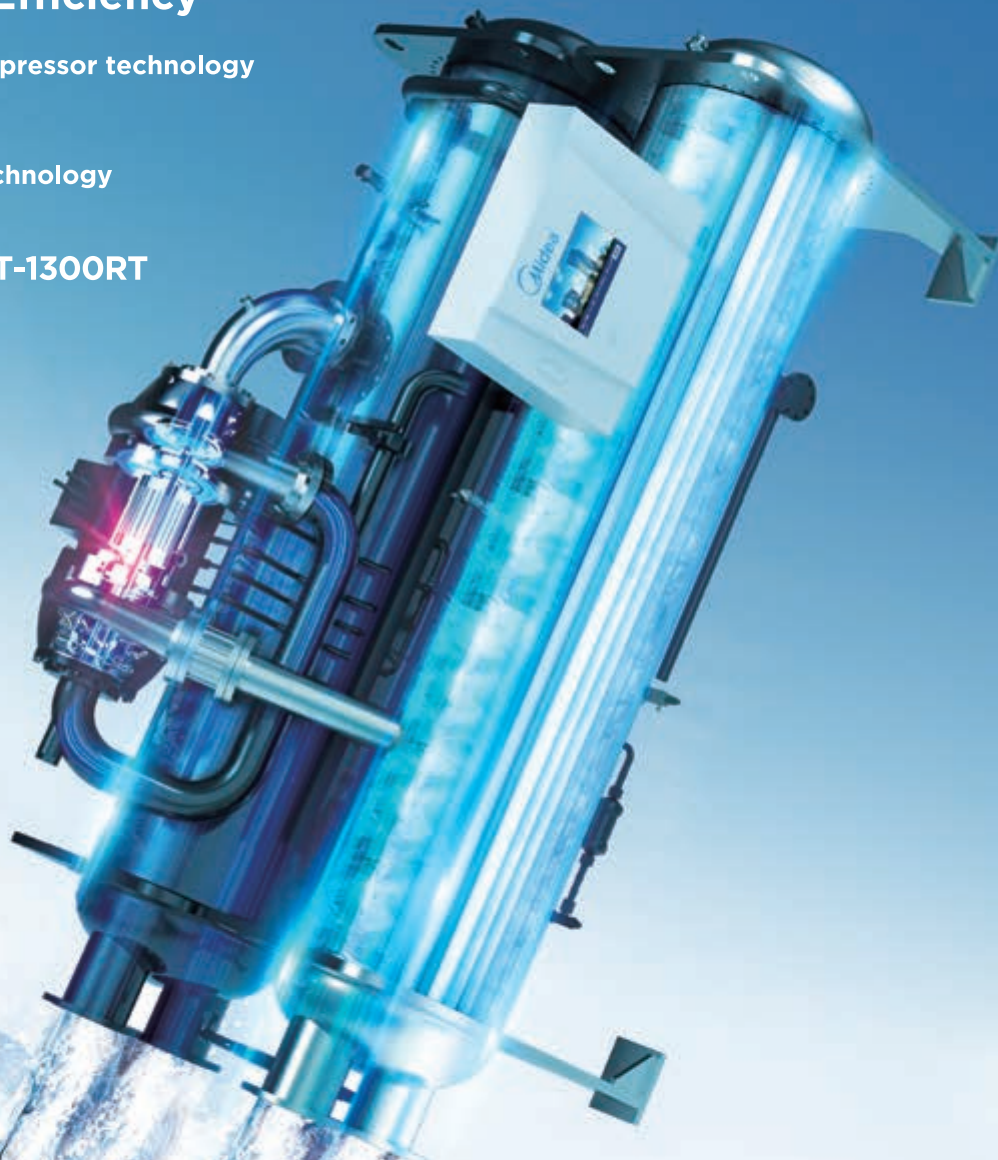
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plaintiff or any person in whom the cause of action was vested before him first had both the knowledge required for bringing an action for damages in respect of the relevant damage and a right to bring such action."

Therefore the new section 6A(1) enables a person to take action founded on negligence not involving personal injuries by allowing an extended limitation period of 3 years from the date of knowledge of the person having the cause of action.

This proposed new section 6A considers negligence cases involving latent damage in construction cases, where the damage was not discoverable through general inspection and that the person having the cause of action did not know or could not have been reasonably expected to know of the damage.

It must first be noted that the 6-year limitation period remains to be the starting point. Section 6A only applies to actions brought after the expiration of the said 6 years, and where the claim is for damages for negligence not involving personal injury only. The limitation period for breach of the contract remains to be 6 years from the date of cause of action arises.

In addition, such action must be brought within three years from the "starting date" and is subject to a longstop of 15 years. In this respect, the Act is similar to the corresponding legislation in the United Kingdom and Singapore.

APPLICATION OF SECTION 6A(1) AND 6A(2)

The new section 6A(1) and 6A(2) provide 3 illustrations to explain the operation of this section.

- C* bought a house from *D* in 2000. In 2010, *C* discovered a crack which damaged the walls badly. A building report made by a consultant revealed that the cracks had occurred in 2002, two years after *C* moved into the house. *C* has three years from 2010 to file an action in court against *D* for damages.
- C* bought a house from *D* in 2000. In 2006, *C* discovered a crack which damaged the walls badly. A building report made by a consultant revealed that the cracks had occurred in 2002, two years after *C* moved into the house. *C* has three years from 2006 to file an action in court against *D* for damages.
- C* bought a house from *D* in 2000. In 2005, *C* discovered a crack which damaged the walls badly. A building report made by a consultant revealed that the cracks had occurred in 2002, two years after *C* moved into the house. *C* has three years from 2005 to file an action in court against *D* for damages.

LIMITED TO NEGLIGENT CASES

Read on its own, section 6A of the Limitation Act is wide enough to cover all instances of negligence involving injury. However there are some limitations to this new section 6A.

The explanatory statement in the Bill initially states that the provision is intended "to enable a person to take action founded in negligence not involving personal injuries by allowing an extended limitation period of three years from the date of knowledge of the person having the cause of action."

However, it then goes on to explain that the provision "considers negligence cases involving latent damage in construction cases, where the damage was not discoverable through general inspection ..."

From the above statement, it appears that Parliament intends for section 6A to apply only to latent damage in construction cases. There are two grounds to support this contention.

First, according to the Minister's statement in the Hansard of 4 April 2018, section 6A "would permit a plaintiff to take action based on negligence involving latent damage in construction cases by extending the limitation period by three years..."



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FEATURE

Second, all three illustrations provided in section 6A(2) to describe the operation of certain sub-sections, are premised on construction cases.

Therefore it remains to be seen whether the Malaysian Courts will apply section 6A to negligence cases which do not involve latent defects in construction cases.

LIMITED TO 15 YEARS

Section 6A(3) provides as follows:

"Notwithstanding subsection (2), no action shall be brought after the expiration of 15 years from the date on which the cause of action accrued."

Therefore section 6A(3) prevents any person from instituting court proceedings more than 15 years after the cause of action accrued, even if it results in the extended limitation period being less than 3 years or even though the damage is discovered after 15 years.

APPLICATION OF SECTION 6A(3)

The new section 6A(3) provides an illustrations to explain the operation of this section.

C bought a house from D in 2000. In 2017, C discovered a crack which damaged the walls badly. A building report made by a consultant revealed that the cracks had occurred in 2001, 1 year after C moved into the house. C could not commence an action because he had already exceeded the 15-year limitation period.

Therefore, an engineer's liability under tort of negligence involving injury is now limited to a longstop of 15 years. He does not have to worry about a stale claim brought against him 15 years or more from the date he designed the project. With this amendment, Malaysia is now in line with the jurisprudence in Singapore and United Kingdom on this issue. ■

Author's Biodata

An EXCOMM member of IEM, **Ir. Lai Sze Ching** is a partner of Lai Teh Adjudication & Arbitration Chamber PLT.

"NOTE - the amendment of the Limitation act has been announced by the Minister that it shall take effect from 1st September 2019."

Upcoming Activities SEPTEMBER - OCTOBER 2019

2-Day Course on "Concept & Design of Sprinkler System Reference to NFPA 13: 2016"

Date : 23-24 September 2019 (Monday - Tuesday)
Time : 9.00 a.m. to 5.30 p.m.
Venue : Wisma IEM
Approved CPD : 12.0
Speaker : Ir. Gary Lim Eng Hwa

2-Day Course on Geosynthetics

Date : 23-24 September 2019 (Monday - Tuesday)
Time : 9.00 a.m. to 5.30 p.m.
Venue : Four Points Hotel, Puchong
Approved CPD : 14
Speaker : Various Speakers



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STRUCTURAL RELIABILITY ANALYSIS FOR FIXED OFFSHORE PLATFORMS



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bin Mat Soom**



**Dr Mohd Khairi
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binti Mohd Zaki**



**Nurul Uyun
binti Azman**

The Structural Reliability Assessment (SRA) methodology was developed for the design or reassessment of offshore platforms. It applies an analytical technique where the criteria for design and reassessment are derived in terms of required platform collapse strength and corresponding failure probabilities. Criteria are derived by reducing the risk to a level that is “as low as reasonably possible” in accordance with ALARP principle.

Jacket platforms are one of the most commonly used fixed platforms in Malaysia. The selection of a fixed jacket platform is based on water depth, design impact, reservoir trajectory, drilling approach and production capacity (Bai, 2003). The fixed jacket platform such as wellhead platform or satellite platform is intended for the drilling of production wells in which the design is suited for the type of drilling rig, either jack-up or tender-assisted rig. Besides, the more prominent and integrated fixed jacket platforms usually intended for house living quarters and production systems are known as central processing and production platforms.

This article will discuss the type of quantified risk assessment, wave in-deck in conjunction to subsidence met-ocean changes, an overview of Structural Reliability Analysis (SRA), pushover analysis, the Probability of Failure (POF) and procedure for SRA for fixed offshore structures.

QUANTIFIED RISK ASSESSMENT

There are 2 types of quantified risk assessment: Qualitative and quantitative risk assessments. Quantified risk assessment is in conjunction with structural reliability analysis. According to Bai (2003), qualitative is subjective prioritisation based on a specific set of basic scenario rankings. It is also a study or method to identify all possible hazards that have the potential to cause damage (David Brown & William, 2007).

Quantitative assessment is a mathematical approach and emphasises the point risk estimate and the probability of distribution which is based on the risk-based assessment (Dziubinski *et al.*, 2006). Risk-based assessment uses design, analysis and the latest underwater and topsides inspection reports or data for reassessment. According to Spouge (1999), quantitative risk assessment is a valuable

tool in the decision-making process as it allows experts to communicate and integrate, to quantify opinions and to combine these effectively with available statistical data.

WAVE IN-DECK SCENARIO

Wave-in-deck (WID) force is one of the main factors linked to structural integrity. It occurs when inundation of water affects the lowest deck (i.e. cellar deck) in which old and newly installed platform structures are affected. Many factors contribute to WID, such as seabed subsidence and the occurrence of extreme environmental conditions (Figure 1).

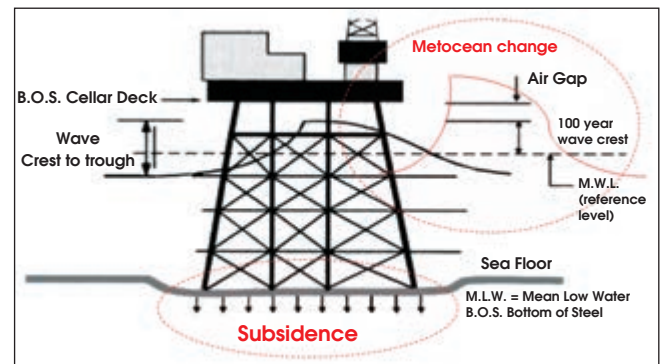


Figure 1: Elements (hazards) that contribute to risk

Subsidence needs to be carefully assessed during the design stage of the platform. This evaluation is essential to avoid a catastrophic incident due to conditions where the water level comes closer to the topside deck or, in other words, the loss of the air gap. Hence, there is a potential of a WID scenario at the affected platform (Amdahl & Holmas, 2016). Apart from subsidence, the air gap may also change due to the revised met-ocean criteria as the results from the use of the latest technology, gives higher accuracy compared to the previous ones (Azman, 2018).

In term of design criteria, the platform height is crucial to provide sufficient air gaps and to protect platforms from the most dangerous part of the storm. Offshore platforms can generally deal with wind and rainfall, but cresting waves can do real damage. The impact of stormy conditions



Figure 2: Actual photo of WID loading scenario

will lead to pressure in wave crests and cause WID load on the platform deck (Figure 2). The WID load can cause significant damage to the deck structures and potential to the collapse of the entire platform.

STRUCTURAL RELIABILITY ANALYSIS

Structural reliability analysis (SRA) methods are used to comprehensively assess the effects of uncertainties in load actions, resistances and modelling of certain parts of a structure and its performance. Structural reliability analysis offers assessments at the level of structural components and the entire structural system (Efthymiou *et al.*, 1998).

Fundamentally, structural system reliability focuses on issues such as redundancy, robustness with respect to damage and rate of inspection. Currently, the analysis method is available for efficient estimation of the reliability of common platforms under push overloads. Structural reliability merely means the field of probabilistic analysis of structural behaviour, serviceability and safety (Abu Husain *et al.*, 2014).

SRA is a superior approach in reliability assessment (RA), due to its extensive application. In reliability engineering, a simplified analytical procedure to evaluate the probability of failure for fixed offshore platforms subjected to extreme storm conditions, was established to assess the structural safety and to perform reliability analysis (Bea & Mortazavi, 1992). The procedure is similar to the concept of demand and supply or load and strength. Demand refers to the load model while supply refers to resistance model or strength model. SRA is used to estimate the integrity of an existing structure based on the pushover analysis (Fayazi & Aghakouchak, 2015). The component failure occurs due to several hidden potentials such as the redundancy integrity of the structure and load distribution.

The most commonly used procedure to evaluate the integrity and reliability level of an offshore platform is Global Ultimate Strength Assessment (GUSA) and Risk-Based Design & Assessment (RBDA), two domains of the structural reliability analysis being used in Malaysian waters.

Shell Global began its structural reliability analysis for offshore structure platform in the North Sea in 1999 using convolution method with the application of integrals formulation. PETRONAS developed GUSA in 2014 to evaluate and assess more than 100 ageing platforms under PCSB in Malaysian waters.

PUSHOVER ANALYSIS

SRA is performed after the pushover analysis to approximate platform reliability. An approximate reliability measure can be established through the determination of the return period of the environmental load which the structure can withstand the (lowest) calculated Reserve Strength Ratio (RSR).



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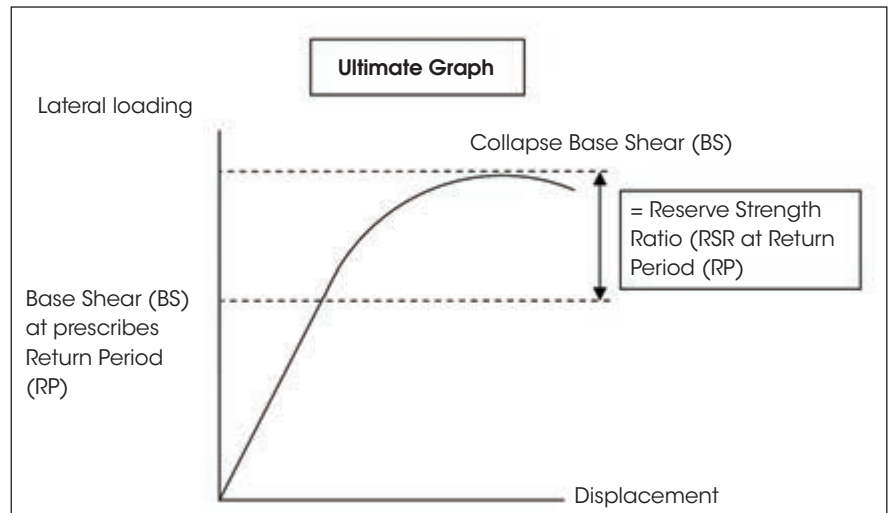


Figure 3: Reserve strength ratio and base shear at return period

The definition of reserve strength ratio at collapse can be subjective as it can be the first "significant" peak or the highest peak of the load-deformation curve. Currently (Figure 3), it is recommended to use the highest peak of the load-deformation curve as the "collapse" reserve strength ratio (Pueksap-anan, 2010).

PROBABILITY OF FAILURE

Probability is a degree of belief regarding the occurrence of an event, rather than the actual frequency. In contrast, the term reliability is defined as the complement of the probability of failure (POF) or precisely known as a probability of safety of the structure over a given period (Robert, 1999). POF for structural capacity can also be calculated by considering its uncertainty as determined from the nonlinear static pushover analysis that was established for probabilistic assessment of platforms under extreme wave loading (Cornell & Krawinkler, 2000; Jalayer, 2003; Moehle and Deierlein, 2004; Manuel *et al.*, 1998).

In general, the structures are more reliable as the POF value decreases. Typically, reliability can be expressed as 1 in 100 or 1 failure in 100 events of the POF. The inverse of coefficient of variance (COV) is known as reliability in statistical terms in which the reliability increases as the COV value decreases, i.e. standard deviation decreases (Naresh, 2007). The chance of a platform collapse due to extreme storms is quantified and can be compared with other risks to personnel offshore.

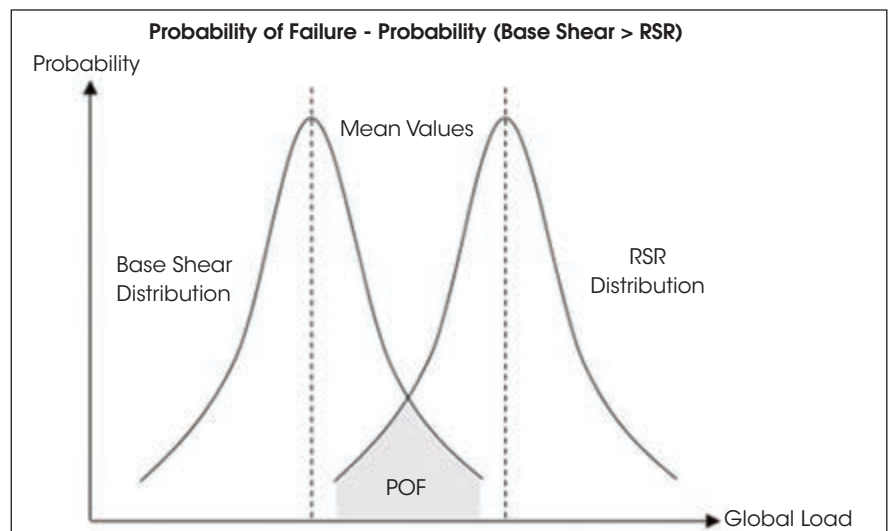


Figure 4: Probability of failure of base shear and RSR distributions

POF (Figure 4) is derived when the load distribution (base shear) is greater than the resistance distribution (RSR). Base shear and RSR derived from the pushover analysis is multiplied by a factor "bias" to obtain an accurate result as the mean value.

GENERAL PROCEDURE OF STRUCTURAL RELIABILITY ANALYSIS

The nonlinear structural analysis, using modern software such as Structural Analysis Computer Software (SACS) collapse or Ultimate Strength for Offshore structural Software (USFOS), is an alternative SRA procedure to obtain the reserve strength ratio based on ultimate base shear over the design of the return period. Commonly, the nonlinear analysis is verified by a static pushover analysis or nonlinear progressive collapse analysis.

SACS is used to model and verify the selected test structures. It is widely used in the industry, especially for fixed template offshore structures. It is capable of performing linear static analysis and comes with several code checks such as ISO (2007), API (2000) and NORSOK standard.

The USFOS computer package is used to perform the non-linear pushover analysis, which is widely adopted by the industry. Its capabilities include the modelling of non-linear element behaviour, non-linear material properties and plastic joint behaviour. At every load level, USFOS is able to calculate platform stiffness based on updated geometry.

SESAM software is used for modelling and wave load generation purposes. The software is suitable to be adopted in offshore structural designs such as fixed offshore structures and floating structures. Finite Element (FE) method has been adopted by the software, which is based on the displacement formulation. The software consists of several modules.

The analysis starts with test structures design data and model verification, followed by a conditional assessment of loads and resistance specific to each test structures, model and data analysis and conversion to SESAM GeniE for verification checks with SACS and pushover using USFOS. SRA is applied and reserve strength ratio, base shear and the probability of failure are calculated at the end of the analysis. Figure 5 shows the overall procedure.

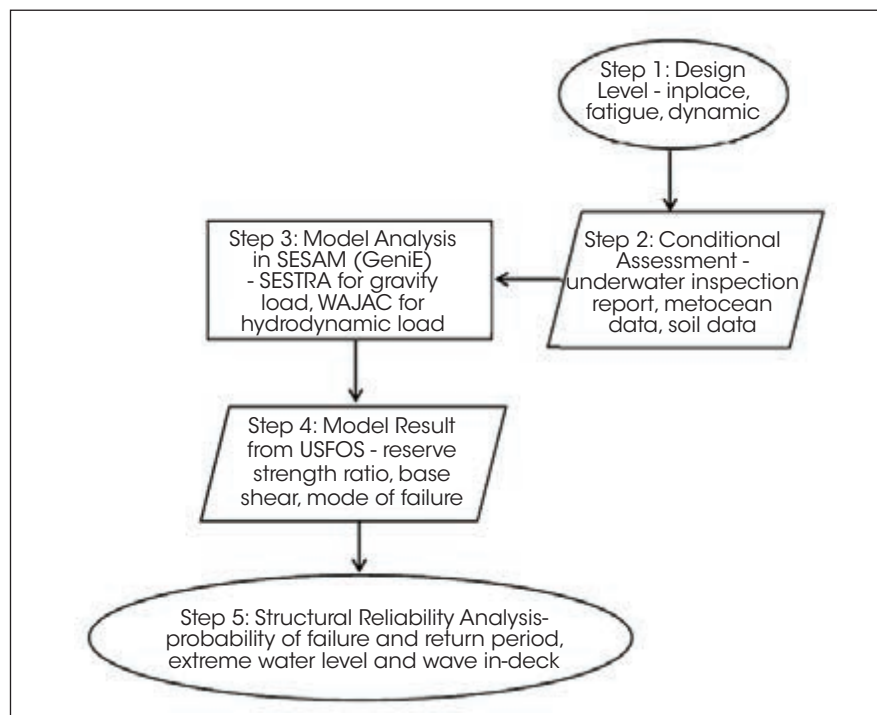





Figure 5: Overall procedure of structural reliability analysis



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CONCLUSION

The concept of demand and supply or load and strength has been utilised through a simplified analytical procedure to evaluate the probability of failure for fixed offshore platforms subjected to extreme storm conditions. A probabilistic model is a combination of load model and strength model. Nonlinear analysis using USFOS is a method for determining the reserve strength ratio and type of failure. The methods allow estimating the duration period for an offshore structure platform to withstand the loading despite its current condition.

The effect of the probability of failure result is based on the experienced wave (several) which is subjected to the increment in wave heights. The structures with a loading exceeding the design prescribed return period (i.e., 100 years, 1,000 years and 10,000 years) can minimise the probability value up to model level with no gross error. The accuracy and effectiveness of this approach will assist the industry, especially operators, in decision-making and, more specifically, for outlining of action items as part of the business risk management. ■

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Nurul Uyun binti Azman has 14 years' experience in the oil and gas industry. Currently pursuing her PhD at Universiti Teknologi Malaysia, she is also senior structural engineer at Brunei Shell Petroleum.

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1-Day Seminar on "Performance Evaluation for Concrete to Concrete Connection: From Qualification to Design"

Date	: 24 September 2019 (Tuesday)
Time	: 9.00 a.m. to 5.30 p.m.
Venue	: Wisma IEM
Approved CPD	: 6.0
Speaker	: Dr Daniel Looi Ting Wee, Ir. Ng Beng Hooi & Ir. Mun Yew Fai



Ir. Dr Oh Seong Por

HERITAGE POST BOX

One of the nation's oldest post boxes is located in Jalan Tuanku Yahya Petra, Penang Hill (833m above sea level). The cylindrical shaped, cast iron post box is 1m tall and 180mm in diameter.

It dates back to British colonial times and has a royal VR insignia on it which stands for Victoria Regina (Queen Victoria). It was made in the United Kingdom by Andrew Handyside & Co. Ltd. during the reign of Queen Victoria (1819-1901).

The first cylindrical post box was manufactured during this period and naturally, Penang, being a British Straits Settlement, also used such a post box. Originally the post box was located near the fire brigade station in Beach Street before Pos Malaysia decided to present it to the Penang Hill Residents Association in 2005.

Although it is now 200 years old, the post box still functions. There are a few similar post boxes located in different parts of the country and each carries a royal insignia coinciding with the reigning king or queen. For example, VR (reign of Queen Victoria), EVIIR (King Edward VII), GR (King George V) and EVIIR (King Edward VIII). ■



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VISITS TO MRT PROJECT SITES AT BANDAR MALAYSIA NORTH AND CHAN SOW LIN

TUNNELLING AND UNDERGROUND SPACE ENGINEERING TECHNICAL DIVISION

reported by



Dr Boon Chia Weng

The Tunnelling & Underground Space Technical Division (TUSTD) organised two technical site visits to the Klang Valley Mass Rapid Transit Project, Sungai Buloh-Serdang Putrajaya (SSP) Line to allow IEM members to see the challenges faced in deep excavations and the solutions adopted in the construction of the underground metro.

The visits included taking a look at deep excavations from viewing platforms as well as at surface plants and facilities used in tunnelling works.

The first visit on 28 March, 2019, comprising 18 participants, was to Bandar Malaysia North site. Upon arrival at the site office, the visitors attended a technical presentation conducted by a team of engineers from MMC-Gamuda KVMRT (T) Sdn. Bhd. They were briefed on the capabilities of the Variable Density Tunnel Boring Machine (TBM), an award-winning innovation developed by MMC-Gamuda KVMRT (T) Sdn. Bhd., in collaboration with TBM manufacturer Herrenknecht, for mining in karstic

limestone conditions of Kuala Lumpur.

The team explained the challenges faced in the deep excavation at 28m below ground level (bgl) at the Bandar Malaysia North site. Secant bored piles of different diameters were constructed down to rockheads of varying depths as a retaining wall. The need to use a heavy lifting crane to lower the TBM into the launching shaft site and the logistic constraints in relation to the retaining system were highlighted.

After the technical briefing and a safety briefing, we visited the TBM control room, where measurements from the geotechnical instrumentation near the TBM position and feedbacks from the TBM sensors could be viewed in real time on a large display screen. An auto-steering function, which had been configured into the TBM, was also introduced and presented. The participants were then led to a viewing platform to look at the deep excavation where a station is being constructed.



Posing for a group photo at Chan Sow Lin Station site at the end of the visit

There were 20 participants for the second visit on 29 April, 2019, to the Chan Sow Lin Station site. The challenges faced in the deep excavation of 40m bgl for construction of the station were described: Careful rock face mappings had to be carried out to enable excavation of shear keys to resist uplift water pressures upon completion of the permanent structure. The face mappings at different elevations of the rock face had to be reconciled to identify the presence of persistent fractures which formed a non-favourable wedge. Depending on the fracture properties, alternative solutions such as using tension piles, were explored.

After a safety briefing, the participants visited the surface plants such as compressed air plant, water tank, centrifuge and slurry treatment plant. Short explanations were given by the tunnel engineers. Then the participants went to a viewing platform to watch the pulling-through of the TBM which was launched from Bandar Malaysia North site. It was pulled across the deep excavation at Chan Sow Lin Station site and re-launched at the opposite face.

The construction of a long TBM network has enabled MMC-Gamuda KVMRT (T) Sdn. Bhd. to efficiently manage the construction programmes of both station sites with respect to excavation and tunnelling works, by selecting strategic shafts or stations for launching, and others for boring or pulling-through and finally, for retrieval. ■

ITEM COUNCIL ELECTIONS 2020/2021

NOTICE ON NOMINATION PAPERS FOR COUNCIL ELECTION SESSION 2020/2021

A notice inviting nominations for the Election of Council Members for Session 2019/2020 would be posted on the IEM Notice Board and IEM website from **16 November 2019** for the information of all Corporate Members of IEM. Thereafter, following the close of nominations on **11 December 2019**, the election exercise will proceed. All Corporate Members residing overseas are requested to take note of the requirements of the Bylaw, Section 5.12, as shown below.

The voting paper shall, not less than twenty eight (28) clear days before the date of the Annual General Meeting, be sent by post to all Corporate Members residing in Malaysia and to any other Corporate Members who may, in writing, request to have the paper forwarded to him. The voting paper shall be returned to the Honorary Secretary in a sealed envelope so as to reach him by a specified date not less than seven (7) days before the Annual General Meeting.

Voting papers will be posted out by **20 February 2020**.

Any Corporate Members residing outside Malaysia, who wish to receive voting papers, are advised to write to the Honorary Secretary on or before 10 January 2020.

Thank you.

Election Officer, IEM



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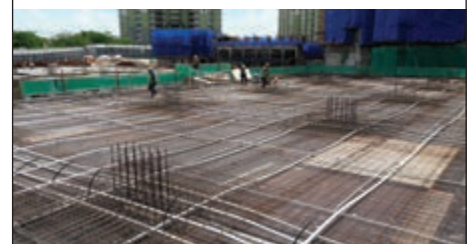
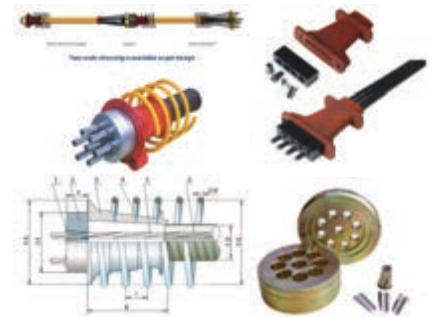
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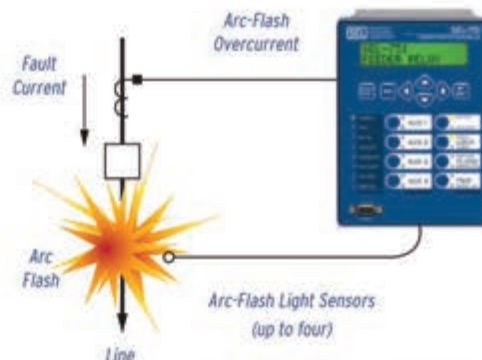
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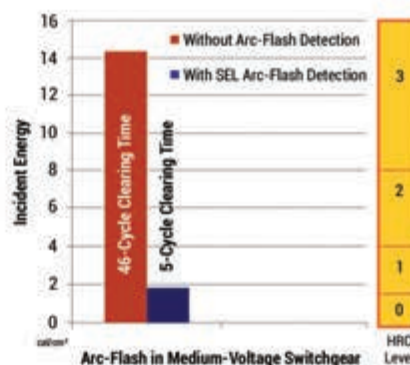
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CONGRATULATIONS

Congratulations to the following recipients for the Awards received during the 81st birthday of Penang Yang di-Pertua Negeri, Tun Abdul Rahman Abbas on 17 July 2019:

Ir. Yau Ann Nian	Darjah Johan Negeri (DJN) Award
Ir. Tiu Jon Hui	Pingat Jasa Kebaktian (PJK) Award
Ir. Dr Leo Choe Peng	Bintang Cemerlang Negeri (BCN) Award
Y.Bhg. Dato' Ir. Dr Goh Teik Cheong	Darjah Setia Pangkuan Negeri (DSPN) Award

Congratulations to Y.Bhg. Dato' Ir. Haji Abdullah bin Isnin for the conferment award "Darjah Setia Pangkuan Negeri (DSPN)" from Jabatan Pengairan dan Saliran Malaysia – Department of Irrigation and Drainage effective 8 July 2019.

Congratulations to the following recipients for the Promotion Titles from Jabatan Pengairan dan Saliran Malaysia – Department of Irrigation and Drainage effective 8 July 2019:

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Sehubungan dengan itu, 9 Pihak Berkuasa Tempatan (PBT) rintis yang telah dikenalpasti bagi pelaksanaan fasa 1 sebelum sistem ini diperluaskan pelaksanaannya ke seluruh PBT di Semenanjung Malaysia adalah:

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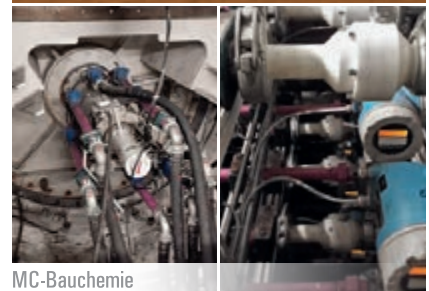
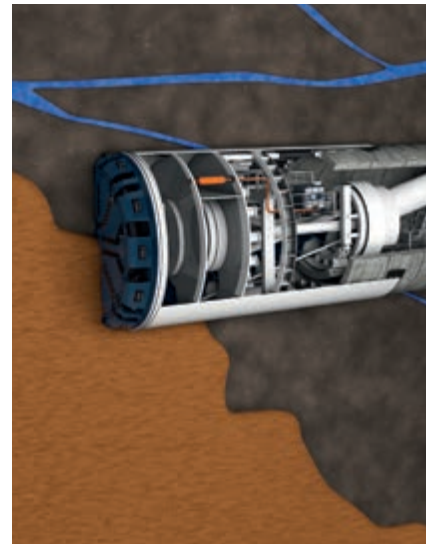
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GEOTECHNICAL IMPACT ASSESSMENTS DUE TO UNDERGROUND TUNNELLING

TUNNELLING AND UNDERGROUND SPACE ENGINEERING TECHNICAL DIVISION

reported by



Ir. Frankie Cheah P.L.

EM's Tunnelling and Underground Space Technical Division (TUSTD) and Geotechnical Engineering Technical Division (GETD) co-organised an evening talk on Geotechnical Impact Assessments Due To Underground Tunnelling at the Tan Sri Professor Chin Fung Kee Auditorium in Wisma IEM, Petaling Jaya, on 2 May, 2019, at 5.30 p.m. There were 65 participants.

There are huge challenges in tunnelling, including its impact on surrounding structures. As such, potential damages and the need for protective works must be assessed before construction work begins.

Dr Boon Chia Weng, senior Geotechnical Engineer with MMC-Gamuda KVMRT (T) Sdn. Bhd., had represented Malaysia at the IEM-CIE-HKIE Tripartite Seminar 2018 on 4 September, 2018, and spoke on Geotechnical Challenges in Infrastructure & Transportation Projects.

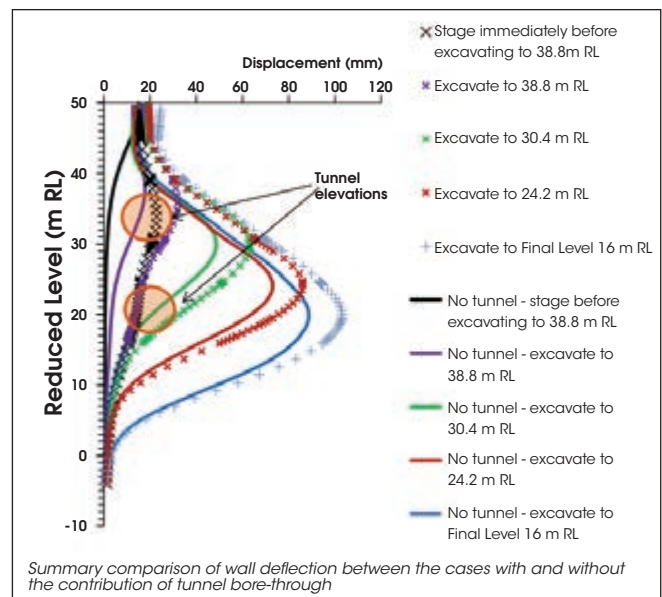
He started the talk by describing the impact to structures with shallow foundations using the work of Burland & Worth (1969) and Boscardin & Cording (1989), in which bending strains and diagonal strains were calculated based on predicted ground settlement profiles. He also highlighted that most cracks were affected by the presence of openings within existing structures.

Using as example a structure on raft foundation, Dr Boon pointed out that 2 methods can be adopted, using Finite Element Analysis (FEA), to model the influence of tunnelling on surrounding structures. These are internal-pressure-reduction and contraction through volumetric strains. For structures on spread footings, a simplified method of using an equivalent beam and discrete springs at the foundation support was discussed. This method takes into account localised settlements which may occur in the Kuala Lumpur Limestone Formation.

For structures with piled foundation, there are two common methods of assessment:

1. Stress-based to calculate the reduction in geotechnical capacity.
2. Greenfield settlements can be obtained and ground deformations can be assigned as input to another software to calculate the pile vertical response due to the loss in mobilised resistance.

Axial responses of piles due to tunnelling works can be predicted following the procedures in Boon & Ooi (2016)



using load transfer t-z and q-z analyses. The implication of downdrag or negative skin friction can be estimated, based on the pile location in relation to the influence zone of tunnelling works. Dr Boon also presented another scenario where the observational approach was adopted during the excavation of a station box that accommodated the boring-through of two Tunnel Boring Machines. Based on his experiences, a few considerations were of notable importance with respect to working with the design-and-build contractor in the Klang Valley Mass Rapid Transit (KVMRT) Project, Sungai-Buloh Kajang (SBK) Line. These considerations were:

- Impact on retaining wall.
- Building damage assessment.
- Impact on tunnel rings (both structural & geotechnical).
- Instrumentation and monitoring.
- Glass Fibre Reinforced Polymer (GFRP) at the soffites.
- Alignment impact.
- Programme impact.

INFLUENCE OF TUNNEL BORE-THROUGH ON WALL DEFLECTIONS

With reference to the observation, the influence of tunnelling work, with the assumption of 1% volume loss in FEA, it was



Mr. Frankie Cheah, session chairman for the evening talk, presenting a certificate of appreciation and souvenir to Dr Boon Chia Weng (left)

observed that 14mm of additional deformation of the diaphragm wall was obtained when tunnelling successfully bored through the station box.

This finding suggested that the impact should not be neglected accordingly in practice. The interaction between the tunnel lining and diaphragm wall was considered.

The convergence and heaving measurements of the upper tunnel, obtained through optical prisms, were studied to enable more optimal design procedures to be adopted for the lower tunnel; 60% backfilling on the lower tunnel was adopted to limit the structural deformations of the tunnel linings, as well as to eliminate potential buoyancy considerations. In practice, the latter depended on seepage and permeability of the ground, although it was found that the mechanism of uplift tended to manifest in effective stress calculations in FEA. The talk ended at 7 p.m., followed by a brief question and answer session. ■

Upcoming Activities SEPTEMBER - OCTOBER 2019



1-Day Seminar on "Passive Fire Protection to Steel Buildings & Convention Centres, and The Challenges and Solutions in Building Envelope Waterproofing"

Date	: 26 September 2019 (Thursday)
Time	: 9.00 a.m. to 5.30 p.m.
Venue	: Armada Hotel, PJ
Approved CPD	: 6.0
Speaker	: Mr. Scott Whitelaw & Mr. Joe Ho



1-Day Technical Seminar on "Lightning and Surge Protection and Power Quality & Reliability"

Date	: 30 September 2019 (Monday)
Time	: 9.00 a.m. to 5.30 p.m.
Venue	: Wisma IEM
Approved CPD	: 7.0
Speaker	: Er. Professor Dr Lock Kai Sang



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TECHNICAL SITE VISIT TO SUNGAI BESI TUNNEL

TUNNELLING AND UNDERGROUND SPACE ENGINEERING TECHNICAL DIVISION

reported by



Ir. Chong Chi Koong

(All illustrations and photographs in this report courtesy of PAAB and CSRK)

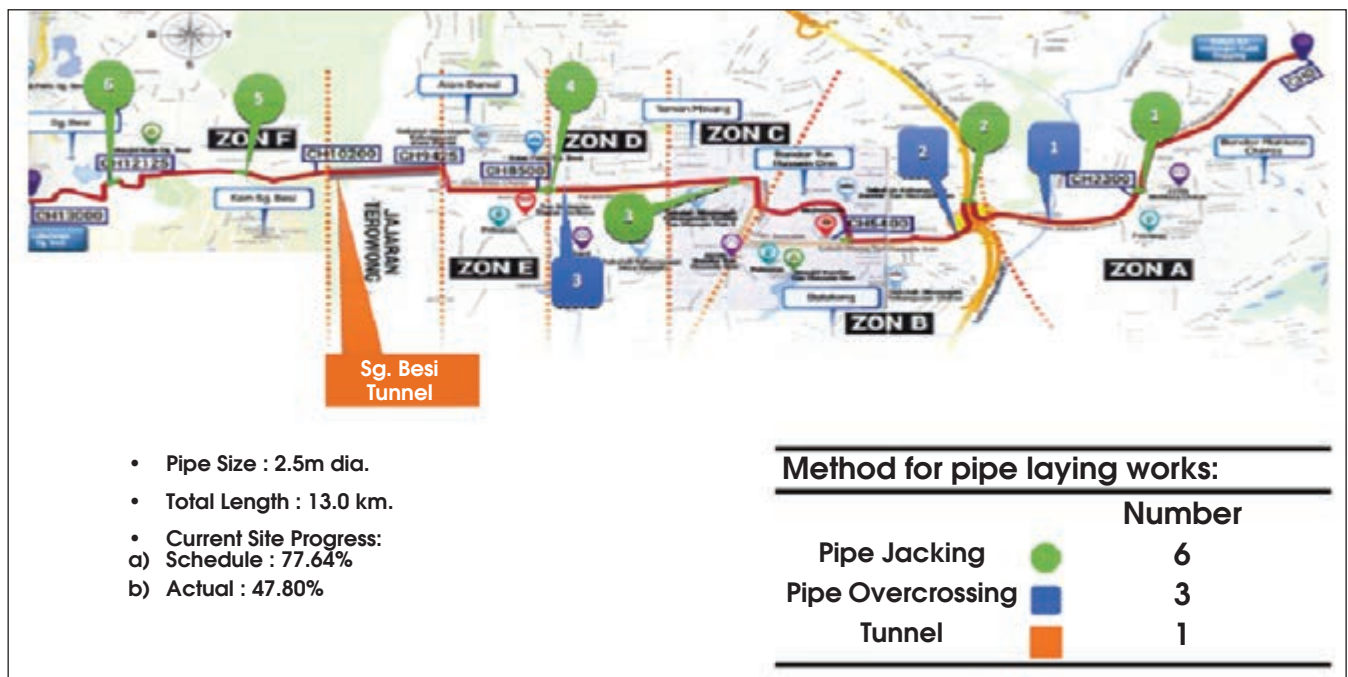


Figure 1: Package 10 pipeline alignment

The Tunnelling & Underground Space Technical Division (TUSTD) of IEM organised a technical site visit to Sg. Besi tunnel on 29 June, 2019, with 11 participants. The group left Bangunan Ingenieur, Petaling Jaya, at 8.30 a.m. and arrived at the project site office in Damai Perdana, Cheras at 9.10 a.m., where they were welcomed by Puan Nurhaidah binti Jamil, project manager from the developer, Pengurusan Aset Air Berhad (PAAB).

Puan Nurhaidah said the Consultant is a consortium of consulting engineers comprising SMHB Sdn. Bhd., Ranhill Consulting Sdn. Bhd. and KTA Tenaga Sdn. Bhd. (CSRK). The main contractor is Pembinaan Ikhlas-Merak Sdn. Bhd. (PIMSB). After a self-introduction session, two videos were presented on PAAB and Langat 2.

Hj. Zariffuddin bin Othman, project executive of PAAB, then gave a slides presentation on the overall water supply scheme, comprising Pahang-Selangor Raw Water Transfer

Tunnel and Langat 2 Projects, followed by Cik Noordini binti Ahmad, assistant RE of CSRK, with a slides presentation on Package 10 (Figure 1), Sg. Besi Tunnel.

Sg. Besi Tunnel is located between Taman Desa Cheras and Sg. Besi Army Camp, crossing a hill from east to west. Besides the tunnel, there are also inlet and outlet portals (Figure 2).

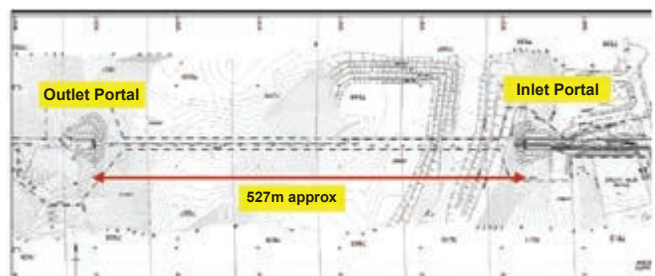


Figure 2: Portals and tunnel locations

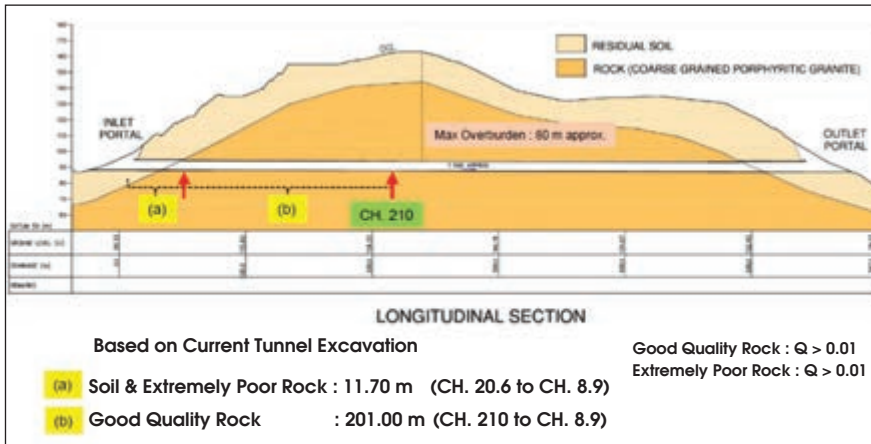


Figure 3: Longitudinal section profile/geology of tunnel

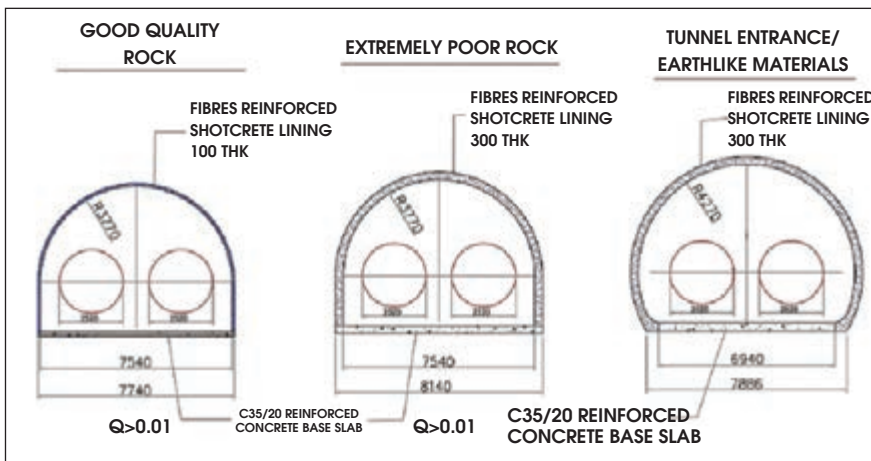


Figure 4: Typical lined tunnel sections

The tunnel is being constructed using the conventional "drill and blast" method. It is of a modified horseshoe shape measuring 527m in length. The heights at both rock and soil faces are 5.78m and 6.28m respectively while the span/width at both rock and soil faces are 7.54m and 8.54m respectively with sectional area of 44 sq m. For good quality rock face, the construction method is of full face "drill and blast", while for both poor quality rock and earth-like material (soil) face, the method comprises of top heading and bottom benching.

Based on site investigations with both geophysical and boreholes data, the sub-surface along the tunnel alignment (Figure 3) indicates that the tunnel, with maximum 80m overburden, is considered to be a shallow tunnel. Current tunnel excavation progress is indicated in Figure 3. The classification of rock quality is based on Q value, for good quality rock, $Q > 0.01$ and for extremely poor

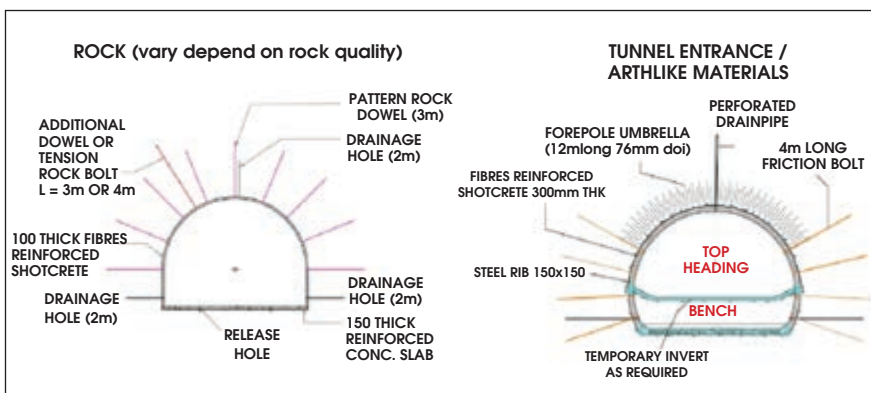


Figure 5a: Typical tunnel support



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Top Heading at Inlet Entrance

Figure 5b: Typical tunnel support



Figure 6: Rock dowel installation



Figure 7: Fibre reinforced shotcrete lined rock face

quality rock, $Q < 0.01$. The Q value at each tunnel face is derived based on face mapping after each blasting operation.

The construction of the lined tunnel (Figure 4) is based on the Q value. For $Q > 0.01$, the fibre reinforced shotcrete lining is 100mm thick and for $Q < 0.01$ as well as for soil face, the fibre shotcrete lining is 300mm thick.

Typical tunnel supports are either rock dowels or forepoles umbrella (Figures 5a & 5b). Rock dowels are installed using jackhammer (Figure 6), followed by grouting of the installed dowels. The pattern of the rock dowels is also based on the Q value, as shown in construction drawings. However, any additional rock dowel required is based on site condition. See Figure 7 for a completed fibre reinforced shotcrete lined rock face.

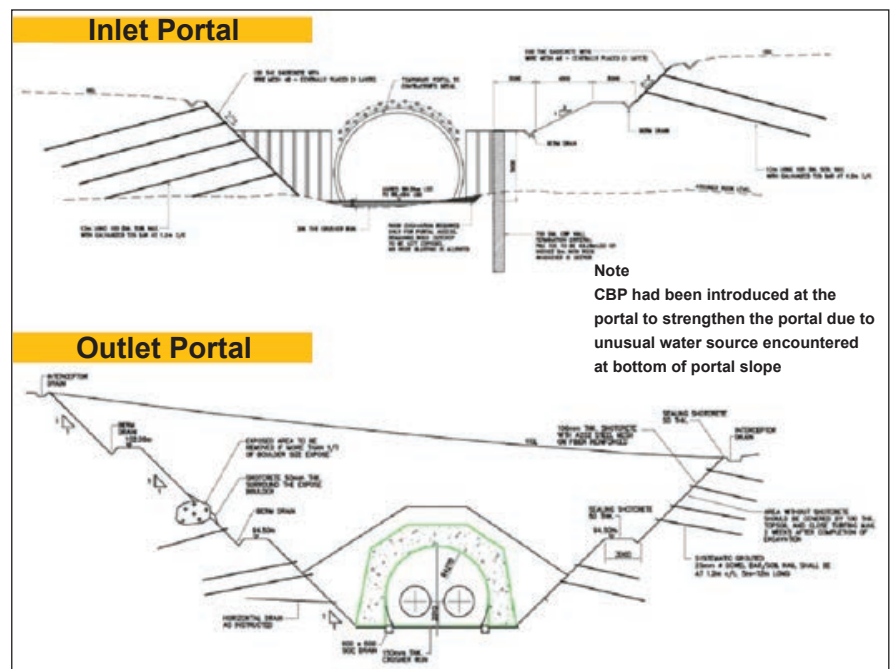


Figure 8: Details of portals



Figure 9: View of portals

For soil face, the pre-support is 12m long, 76mm diameter forepoles umbrella at 300mm centres. The 5 stages of construction in extremely poor rock and soil faces are:

1. Installation of forepoles umbrella including grouting
2. Excavate under the forepoles umbrella
3. Installation of steel ribs
4. Shotcreting
5. Installation of friction bolts.

A contiguous bored piles (CBP) wall was designed and installed along one side of the inlet portal (Figures 8 & 9) due to unusual groundwater source encountered at the bottom of the portal slope. Soil nailing was also designed and installed at both portals (Figures 8 & 9) for slopes stabilisation.

The monitoring aspects (Figure 10) of the inlet portal and tunnel construction are:

- Before construction – dilapidation survey on all buildings within the vicinity of the tunnel site.
- During construction – crackmeters at surrounding buildings, settlement markers at surrounding areas and optical targets on portal slopes.
- Inside tunnel – optical targets at 60m centres for convergence monitoring of tunnel soffit settlement.
- During blasting – vibrometers to monitor vibration in Peak Particle Velocity (PPV) and loudness in decibels (dB). Limits of Jabatan Mineral & Geosains (JMG) for PPV is 3 mm/sec. and loudness is 120 dB.

In general, all instrumentation locations are at surrounding areas and buildings within a 100m radius of the inlet portal site as indicated in the figure.

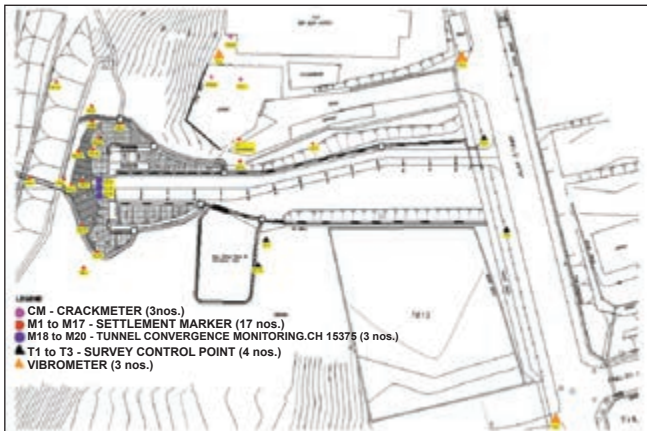


Figure 10: Monitoring Points at Inlet Portal Plan

After the technical briefing was a briefing on Health & Safety in Tunnel Construction. The participants raised many pertinent questions that were addressed by representatives from PAAB, CSRK, main contractor and subcontractor on site. At the end of the tunnel face, a set of explosives was in place at the rock face ready for a blasting operation. The explosives were installed to a horizontal depth of 3m in a specific configuration/pattern to allow split second interval detonations in succession to yield maximum rock breakage.

After the tunnel visit, all participants and personnel exited the tunnel for a group photograph. The highlight of the site visit was the much-anticipated blasting operation.

After the visit, the group returned to the project site office where session chairman Ir. Chong Chi Koong started the Q&A session. Then, he thanked the hosts, saying that the site visit was very beneficial to the participants who not only learnt both the design and construction aspects of the Sg. Besi Tunnel but also about PAAB and Langkat 2.

The visit concluded with Ir. Chong presenting IEM plaques to Hj. Zariffuddin, Cik Noordini and En. Mohd Yusoff bin Ramly, project engineer of PIMSB. Hj. Zariffuddin then thanked the participants for visiting and presented them with PAAB souvenirs. This was followed by a hearty lunch hosted by the project team. The group left the project site office and arrived at Bangunan Ingenieur, Petaling Jaya at 1.30 p.m. ■

Upcoming Activities SEPTEMBER - OCTOBER 2019

1-Day Workshop on "Conceptual Design of Structures"

Date	: 2 October 2019 (Wednesday)
Time	: 9.00 a.m. to 5.30 p.m.
Venue	: Armada Hotel, PJ
Approved CPD	: 6.5
Speaker	: Mr. Rajavel Inbarajan

1-Day Technical Course on "The Potential Tertiary Commercial-Scale Plants Using Palm Oil Mill By-Products. How Feasible, Variable & Viable? Sustainable?"

Date	: 5 October 2019 (Saturday)
Time	: 9.00 a.m. to 5.30 p.m.
Venue	: Wisma IEM
Approved CPD	: 7
Speaker	: Ir. Hor Kok Luen

CONSTRUCTION PROJECTS IN SABAH: FOCUS ON RISK AND INSURANCE

SABAH BRANCH



Ir. Pooba Mahalingam

The Malaysian Insurance Institute (MII) and The Institution of Engineers Malaysia (IEM Sabah Branch) organised a two-day workshop on Construction Projects in Sabah (Focus on Risk and Insurance) at Hotel Horizon, Kota Kinabalu, Sabah on 27-28 February, 2019.

The participants were mainly from the insurance and engineering industry in the state but there were a few who had travelled from Kuching and Kuala Lumpur to attend this inaugural MIHEM collaboration in Sabah. Besides insurance and broking company employees, there were engineers and risk management personnel from related engineering industries who wanted to learn more about this topic.

The course was put together to share and enhance knowledge on construction insurance. As a standard construction industry contract requirement, contractors must procure the Contractors All Risks (C.A.R) insurance before commencing work. This covers project work and third party claims (such as damage to neighbouring buildings).

MI, an education provider/training centre for the insurance industry, was pleased to work with IEM (Sabah Branch) to make the event a success.

The workshop was led by Ir. Pooba Mahalingam (Director of Talent Asia Training & Consulting), an experienced risk engineer based in Singapore, who shared his knowledge and expertise in the project risk and insurance field.

IEM Sabah Branch Chairman Ir. James Yong, a lead consultant for the Pan Borneo Highway project) spoke on the need for risk management in construction projects. There were 2 guest speakers: Ir. Felix Ku, Senior Engineer of DHI Water & Environment (M) Sdn. Bhd., and Mr. Arthur Wong, Operations Manager/Senior Forensic Consultant of Approved Forensic Sdn. Bhd.

During the session, participants were enlightened on the following:

- Policy coverage and clauses
- Endorsements
- How to deal with C.A.R claims
- Case studies
- Construction technology and method of work
- Upcoming projects in Sabah
- Flood issues and flood mitigation related projects in Sabah
- Forensic engineering aspects



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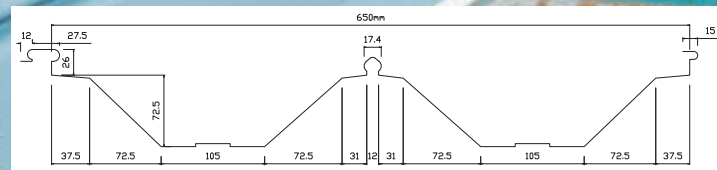
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NEWS FROM BRANCH

On the second day, a site visit to the Kota Kinabalu Outer Ring Road (KKORR) project was organised to show some hands-on risk issues to the participants. This project is part of the upcoming Pan Borneo Highway project. The visit was done with the cooperation of Borneo Highway PDP Sdn. Bhd. Its senior representatives briefed the participants who later donned safety gear before going on a walkabout to inspect a section of the road works.

The event received positive feedback from the participants. Here are some of their comments.

Jais: The facilitator showed us the details of policy coverage and how to relate it to construction issues. As an engineer, I feel that the subject is relevant for better contract administration. I hope MII and IEM will host more such workshops in future.

Siti: The knowledge we have gathered from the event is very useful and applicable to our daily work as engineers. Keep it up, MII and IEM!

Adrian: This is good learning and sharing by MII. The site visit was also very helpful to those of us from the insurance industry as we were able to relate it to the policy wording and clauses.

Pauline: I learnt many new clauses and policy endorsements; which will help me market the insurance products more effectively. ■

For questions and enquiries, contact Branch Chairman Ir. James Yong (Tel: 088-259 122) or Workshop Leader Ir. Pooba Mahalingam (+65-8198 3701).

UPCOMING ANNUAL GENERAL MEETINGS – TECHNICAL DIVISION

DATE	TECHNICAL DIVISION	CPD
5 October 2019	Chemical Engineering Technical Group	2
2 November 2019	Highway & Transportation Engineering Technical Division	2
16 November 2019	Agricultural & Food Engineering Technical Division	2
23 November 2019	Mechanical Engineering Technical Division	2
27 December 2019	Urban Engineering Development Special Interest Group	2

For further details on the various events, please visit our website at www.myiem.org.my or call IEM Secretariat at 03-7968 4001

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TREKKING IN ARGENTINA



Ir. Chin Mee Poon

Ir. Chin Mee Poon is a retired civil engineer who derives a great deal of joy and satisfaction from travelling to different parts of the globe, capturing fascinating insights of the places and people he encounters and sharing his experiences with others through his photographs and writing.

El Chalten is a village of less than 2,000 people in southern Argentina. Situated in a broad valley, this small place has only two main streets and a few side streets. The main streets are lined with hotels, guest houses, restaurants and tour operators. El Chalten is known as the Trekking Capital of Argentina and thousands of people come here every summer to explore the northern part of Parque Nacional Los Glaciares.

Established on 11 May, 1937, with an area of about 727,000 hectares in the Argentina side of Patagonia, Los Glaciares National Park is a region of exceptional natural beauty, with rugged, towering mountains in the north and a vast ice cap, numerous glaciers and glacial lakes in the south. The park was included in UNESCO's list of world heritage sites in 1981. The mountainous north and the icy south are not connected by trails and they appear to be two distinct national parks.

My wife and I, together with my two younger brothers and their wives, came to El Chalten in March this year by night bus and we put up 3 nights in this colourful village.

All of us were keen trekkers with many years of experience and we came to El Chalten with a strong desire to appreciate the natural beauty of Los Glaciares National Park by trekking into the mountains. El Chalten is right at the threshold of the northern part of the national park and 10 trekking trails are within easy reach from the village.

We were blessed with a sunny day and clear skies on day one in El Chalten. This was a good time to do the Laguna Torre trek as the tower-like peaks were usually shrouded by clouds. So, after our wives had prepared a packed lunch, we set out for the 9km long trail at 9.45 a.m.

It was a steep ascent initially, followed by alternating flats and gentle climbs. A view point at the 2.5km mark offered us

a spectacular view of the snow-capped peaks. From there on, it was generally level through a beautiful lenga (beech) forest. We reached Laguna Torre, a glacial lake in front of the saw-tooth peaks, after 3 hours and 50 minutes of pleasant walking, and we spent an hour there enjoying our picnic and feasting our eyes.

We decided to give our legs a rest on day two by joining a cruise in Lago del Desierto, a 14km long x 2km wide lake, 37km north of El Chalten, close to the Chilean border. It was in front of the cruise operator's office that I met my varsity mate, Hon, and his wife. They had come to El Chalten with a tour group. Hon is also an avid traveller and photographer.

We travelled in a large van to the southern tip of the lake.

On the way we had a superb view of Fitz Roy, the majestic peak we would be trekking to on day three. The cruise turned out to be a pleasure, with Fitz Roy and Gran Glaciar Vespignani accompanying us all the while. We even had time to trek to a point close to the glacier.

On our last day in El Chalten, we trekked to Fitz Roy. Three of us started from the trail head at the north-western end of the village, and the other three began the trek from a point 13km along the road to Lago del



Trekking in Argentina

Desierto. I was in the first group. Initially, it was a long ascent along a river. Then we went through a lenga forest and had a rest beside a small lake. The gently undulating trail led us to a point where we met up with the other group.

After the 8km mark and a large campsite, my brothers and I pushed ahead for the gruelling climb up a steep rocky slope to Laguna de los Tres for a close view of Fitz Roy, while our wives started their descent. The climb was a severe test of my endurance and determination. I eventually made it to the glacial lake, but I was thoroughly exhausted.

Septuagenarians like I should be contented with trekking for pleasure rather than going all out as if trying to prove something, shouldn't we? ■

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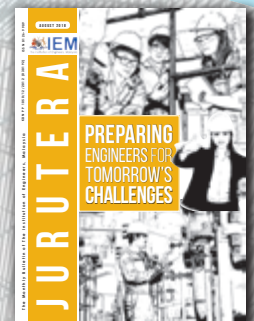
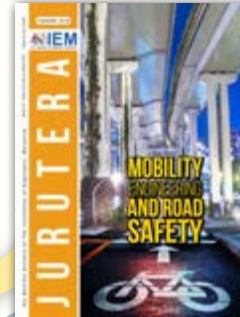
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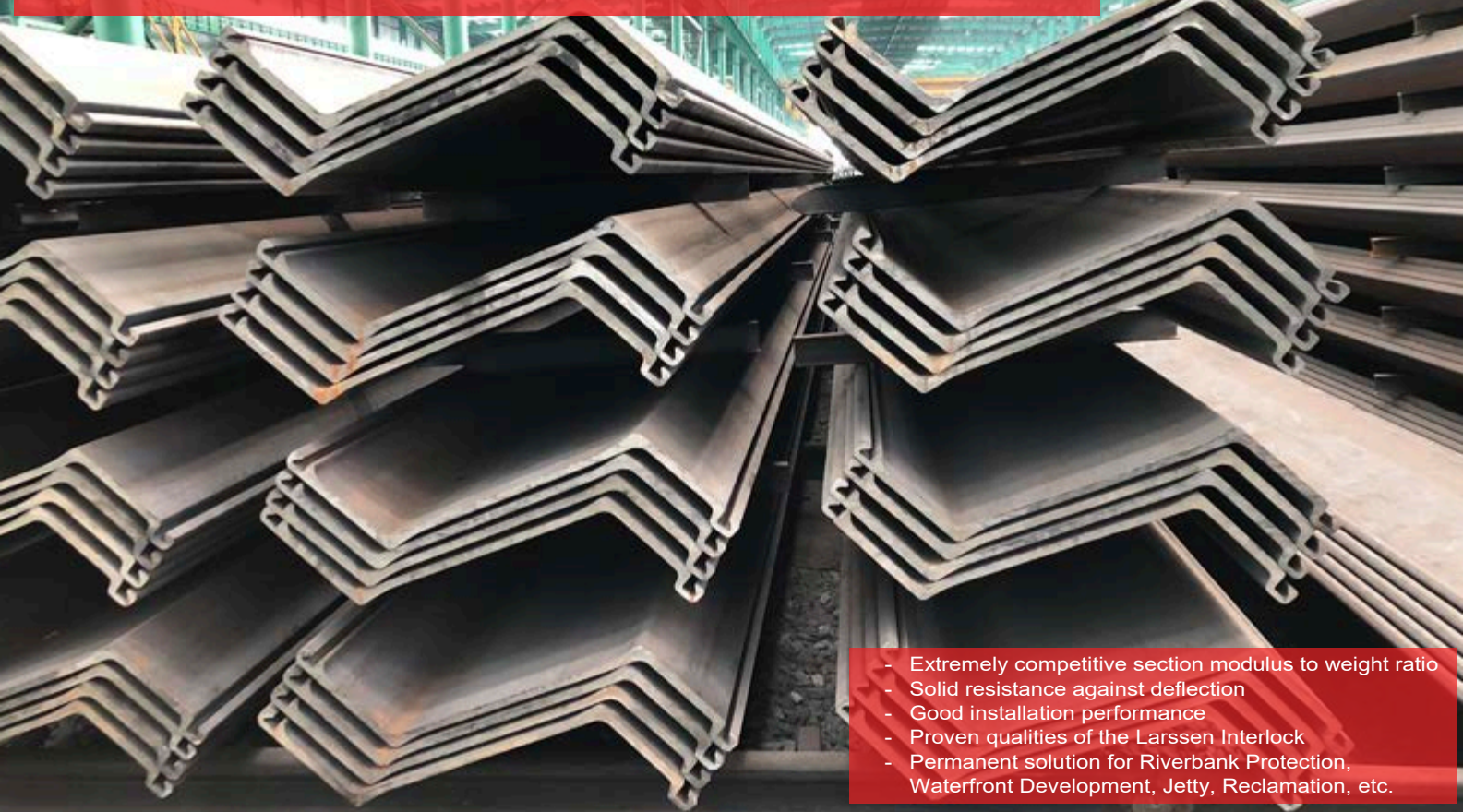


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