PP19483/08/2019(035098)
ISSN: 2710-6608
ISSUE NO. 2/2022

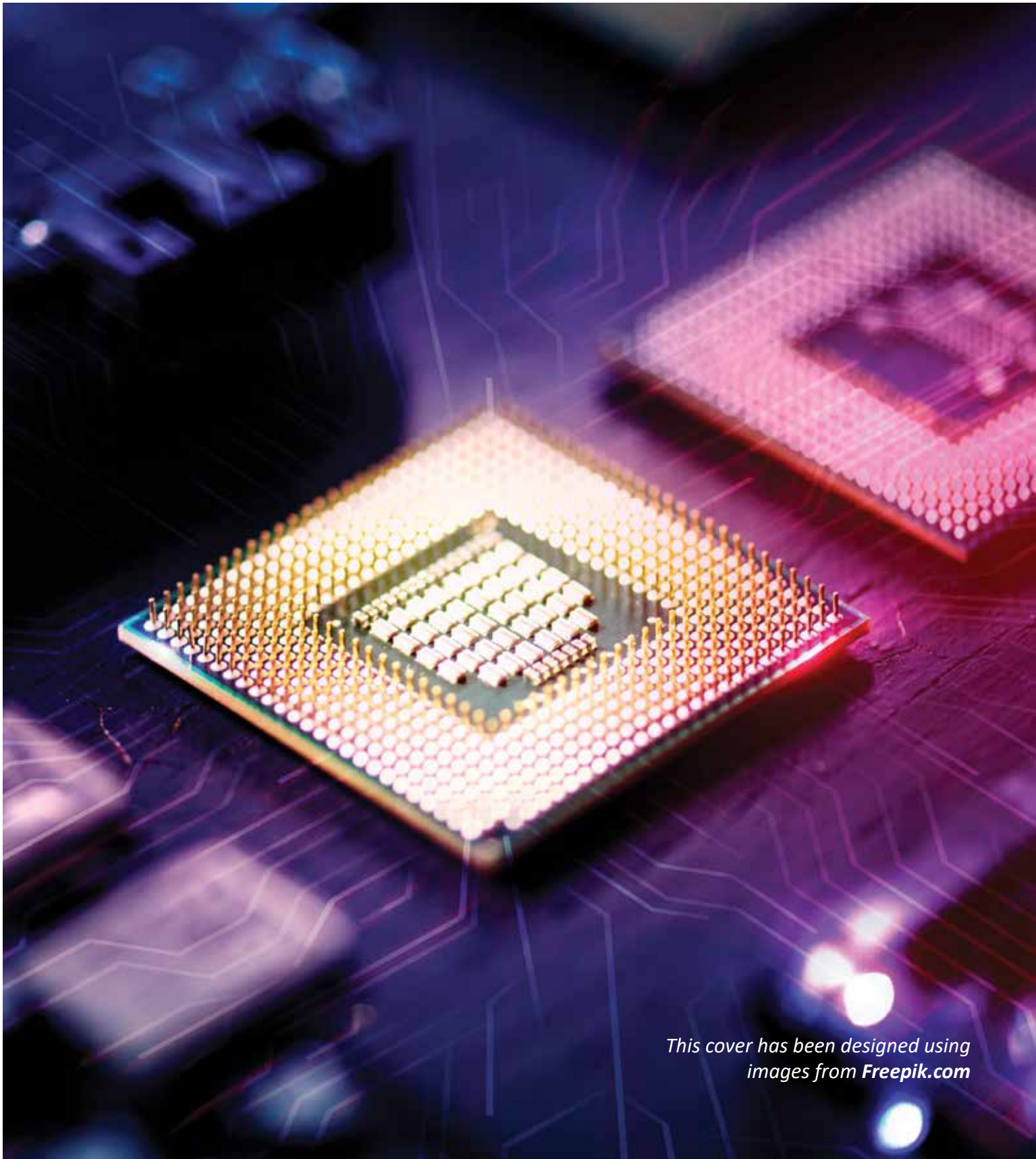
IEM
The Institution of Engineers, Malaysia
(Penang Branch)

INGENIEUR PENANG

The Bulletin of IEM Penang Branch

August 2022

COMPLIMENTARY ISSUE



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Chairman's Corner

Ir. Bernard Lim Kee Weng

Greetings to IEM Penang Engineers,

It is time for me again to pen down a few words for this coming Ingenieur Penang. I pray that everyone is well and safe.

Since I have taken office, this is the 3rd edition of Ingenieur, Penang. This is also my 2nd term office, and it was indeed an honor to serve as IEM Penang Branch Chairman 2022/2023 term. I would continue to do my best to promote sound professional engineering practice as well as contributing towards nation building primarily.

Firstly, I would like to recognize the newsletter editorial team who had been working very hard and persistently pushing and finally come out with this edition of newsletter. I would also like to thank all the contributors of this newsletter. Without all your contribution there is no Ingenieur Penang. The Ingenieur Penang is one of my tools that I would continue to use in keeping our Penang engineers abreast of what is happening.

I am very happy that the various IEM Penang Branch Sub-Committees had been working very hard to organize various activities, like technical webinars, workshops, conferences, technical visits, and CSR activities for all members. With the country transitioning to endemic phase of covid-19, we have started organizing more physical activities, like technical visits and webinars. I hope that all members will come out and support the event.

On Mar 25, 2022, we have also successfully held our IEM Penang branch 55th Annual General Meeting (AGM), through hybrid mode for session 2022/2023. I do have an impressive lineup of energetic committees that is here to serve all of you. Furthermore, in this term, I have setup a few additional sub-committees or interest groups in order to cater for the current needs. The sub-committees or interest groups are as follows: STEM sub-committee, Manufacturing sub-committee and Senior Engineers Interest Group (SSIG). I hope that all of you would support all these initiatives.

To all IEM Penang Members, do remember to lock your calendar and come to attend and make our 55th IEM Penang Branch Annual Dinner a success. The annual dinner will be held at the Spice Convention Centre, on November 26, 2022.

Finally, my sincere gratitude to all my fellow engineers, friends, and sponsors for their warm and generous support to IEM Penang Branch.

Before I end my message, I would like to leave with the following quote, "The strength of the team is each individual member. The strength of each member is the team." — Phil Jackson

Each of us are unique with our own strength, together IEM's strength we can make changes for the betterment of humanity.

From Ir. Bernard Lim
IEM Penang Branch Chairman

Editorial Notes

Ir. Khaw Yao Shun

Greetings from IEM Penang Branch.

Half a year has gone by at the blink of an eye. Most of us including myself may not realize, but we have transitioned to the endemic phase. While we enjoy hanging out and go back to our normal lives, we shall remain vigilant as the virus is still evolving. Even here at the IEM, we have only gradually shifted our activities to a physical setting.

It is my honor to serve the branch as the Editor for INGENIEUR PENANG. I grow with IEM and I hope that I can share more insights and disseminate up to date information to the members via newsletter. The current edition should be an interesting one. We are going to have our annual dinner organized at the end of the year and have more physical activities organized including a walkabout. In conjunction with Penang World Heritage Day, IEM Penang has shown support to Georgetown World Heritage Institute (GTWHI) by attending Georgetown Heritage Celebration 2022.

With the new committee onboard for year 2022-2024, we can anticipate more activities to be organized by more subcommittees. We hope that more members will participate in our activities not just for meeting CPD requirements but to also have fun and grab the opportunities to learn from each other. IEM will always be a platform for engineers to interact and stay connected.

We promise that the newsletter will be power packed with interesting events and updates from the branch. It will be simple yet informative. We also welcome submission of articles from all parties and please contact me if you have any suggestions to improve the newsletter.

Stay safe and stay healthy.

III-V Compound Semiconductor Self-Assembled Quantum Dots for **Mid-Infrared Applications**

Dr. Yeap Gik Hong
Head of School, School of Engineering, Computing & Built Environment, UOW Malaysia KDU Penang University College

Quantum dots (QDs) are zero-dimensional nanostructure that confined carriers in all three spatial dimensions. They possess strong application potential for electronic and optoelectronic devices due to their unique atomic-like electronic characteristics from the 3-D quantum confinement resulting in δ-shaped density of states (DOS) and atomic-like energy level with their spacing typically exceeding room temperature. Figure 1 shows the evolution of the DOS as the effective dimensionality of systems reduces from bulk materials to quantum well (QW), quantum wire (QWR) and subsequently to QD. As more dimensions are confined, the DOS becomes less continuous, and eventually becomes delta-function like in the zero-dimensional QDs. QDs are often referred to as artificial atoms due to the discrete energy level structures.

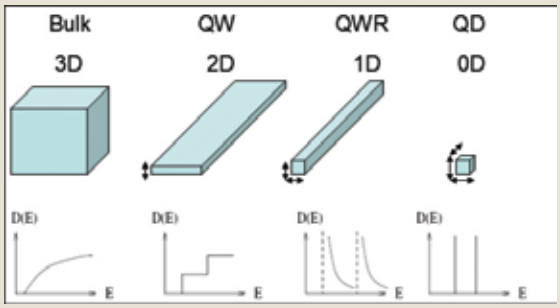

Figure 1: Density of states for various dimensional systems

These unique behaviours of the QDs have been predicted theoretically by Arakawa and Sakaki in 1982. [1] It is believed that the δ-function like DOS and the enhanced electron and hole wavefunctions overlap in a QD may result in decreased threshold current densities, higher temperature stability of the threshold current, as well as higher differential gain for a QD laser. The first such QD lasers were created in 1994, [2] with threshold current of 120 A/cm^2 at 77K.

Since the first demonstration of the QD lasers, further improvements have been achieved and other QD devices have been realised. The strong interest in semiconductor QDs is motivated by the feasibility of active media in future high speed electronic and photonic devices, both in term of lower threshold current densities, better thermal behaviour, high differential gain and longer device lifetime with important societal impact such as photonic sensors for environment monitoring, [2,3] lasers, [4,5] optical amplifier, [6] photodetectors, [7] light emitting diodes (LEDs) [8] and displays. The first commercial application of QDs in displays was the Sony XBR X900A series of flat panel televisions released in 2013. [9] Semiconductor QDs have also found application in quantum computing, quantum information processing and quantum cryptography. [10–13]

Most of the study of QDs structure had concentrated on InAs/GaAs, [14] which of interest in the near-infrared region. However, for novel optoelectronic devices such as long wavelength infrared lasers and detectors, the 3-5 μm window of the mid-infrared (MIR) wavelength range is the window of choice for the devices development due to the low CO_2 and H_2O absorption. Although experimental demonstration and theoretical modelling of a semiconductor laser based on QDs has recently been accomplished and many research papers had been published, but in fact, there is lack of suitable laser diodes operating in 3-5 μm domains. QW laser reached mass production within very few years of introduction because of its low cost, high performance and high reliability. However, there is no QW laser diode is able to operate continuous wave at room temperature at 3-5 μm wavelength range. [4]

The Sb-based material system has been paid much attention to with regard to their potential for optical devices in the 3-5 μm spectral regions and motivated by feasibility of active medium in high speed electronic and long wavelength photonic devices. Sb-based III-V compounds have the smallest bandgaps, which mean applications involving the longest wavelengths of any of the III-V family of semiconductor compounds. The bandgaps of the Sb extend from 1.6 eV for AlSb to 0.14 eV for InSb at room temperature [15] and their ternary compounds such as indium thallium antimonide are able to extend the wavelength >11μm. The small bandgap materials are of interest for many devices, including tandem solar cells and thermal photovoltaics. Their high electron mobilities, also a consequence of the small band gaps, make these materials potentially useful for cryogenic ultrahigh-speed electronic devices. Thus the Sb-containing semiconductor compounds are very promising for infrared detectors and emitters ranging from 1.3 to 1.55 μm range of interest for fiber optic systems through the 3-5 μm range of interest for chemical sensor systems, infrared countermeasures, and future extremely long distance communication systems using non-SiO2 fibers, and even into the 8-12 μm regime of interest for night vision and infrared imaging application. [16]

In spite of these promises, Sb-related compounds remain to this day relatively unexplored in comparison with other III-V compounds. The earliest literature on Sb-based SAQDs dated back around the end of 1995. By analogy with the InAs/GaAs system, most works have been carried out on the InSb/GaSb system. [17] These nanostructures are grown via Stranski-Krastanow (SK) growth mode. Their morphological and optical properties were not suitable for device applications as the QDs densities are as low as 10^9 dot/cm^2, with typically large dot lateral size (50-100 nm). These nanostructures are exhibit photoluminescence (PL) emission only at low temperature and

around 0.68 – 0.75 eV depending on the growth conditions. In the subsequent research by the author, the conduction band within the InSb/GaSb dot shifts to higher energy. This illustrates the dominant effect of the hydrostatic strain which is an increase in the direct band gap. As a result, the band gap of the dot is increased beyond the 3 -5 μm range as shown in Figure 2.

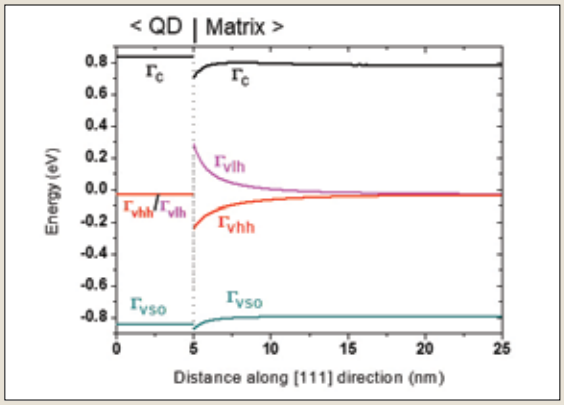

Figure 2: Strain-modified band profile for spherical InSb/GaSb SAQD along [111] direction. Black line – conduction band; red line – heavy-hole band; magenta line – light-hole band; green line – split-off band.

Other Sb-based SAQD systems that being studied include InSb/GaAs, [18] which PL had been observed between the range of 1.1 – 1.5 eV, GaSb/GaAs [19] and AlSb/GaAs, [20] where emissions are observed around 1.16 eV and 1.26 eV, respectively. InAsSb/InP systems also had been studied and PL was observed around 0.56 – 0.73 eV. [21]. A type-II InAsSb/InAs system also had been studied and MIR emission were observed at 0.286 eV and 0.316 eV, which reported as ground and excited state, respectively. [22] The same group has also studied a quaternary alloy system, InAsSbP/GaAs but only low temperature emission around 0.75 eV being observed.

An interesting result has been published by Ivanov et al. [23] from the Ioffe Physico-Technical Institutes. They reported the formation of QDs-like InSb submonolayers (SML) inserted within an InAs matrix by briefly exposing the InAs rich growth surface with an Sb flux, exploiting a very strong Sb-to-As exchange reaction. Further, deposition of 1–2 monolayer (ML) of InSb on such QDs-like nanostructures leads to the formation of true QDs. By using this technique, they report a density of 10^{12} dot/cm^2 of extremely small quantum dot –like structures (2.5 nm as lateral size). These islands show PL between 3.9 and 4.3 μm, but if a thicker layer is deposited (even 1-2 MLs of InSb) growth of non-coherent islands is observed, with consequent dramatic change in optical properties.

Cornet et al. [24] have carried out theoretical study on InAsSb/InP QD system and predicted the emission wavelength to a maximum of about 5 μm at room temperature. However, Pryor and Pistol [25] have predicted something in contrast in the same year. Shusterman et al. [26] have reported the formation of InSb quantum dots by droplet heteroepitaxy using an Metal-Organic Vapour Phase Epitaxy (MOVPE) system. They studied different surfaces (InAs, GaAs and GaSb) and found a PL emission around 4 μm at 10 K for InSb/GaAs QDs. From these studies only As-terminated surfaces seem to be suitable to achieve high density and luminescence in the MIR region.

MIR optoelectronic devices are key elements for various applications, such as medical diagnostics, environmental sensing, military counter-measure, etc. In particular, the 3-5 μm atmospheric transmission window is the region of choice for device development due to low CO_2 and H_2O absorption. For this range, as highlighted above, InSb-based SAQDs might look most promising because the band gap in bulk InSb is the smallest among III-V semiconductors (0.18 eV at 300K). However, due to the lattice misfit, which is inherent to SK growth of SAQDs, the dots are compressively strained. This increases the direct band gap in type-I InSb dots beyond the 3-5 μm range as it has been shown in previous band-structure modeling. Hence, for use in the MIR-range devices, alternative SAQD designs need to be considered.

SAQDs with type-II band alignment offer the possibility of optical transitions within the MIR range (albeit with lower quantum efficiency than type-I systems). In particular, this can be realized for the InSb/InAs SAQD system with an expected type-II broken gap band alignment. Photoluminescence (PL) properties of type-II InSb/InAs periodic nanostructures containing above-monolayer (ML)-thick InSb insertions, grown by molecular beam epitaxy, were studied by using an FTIR spectrometer in wide temperature range. The samples exhibit bright PL in the 3.5–5.5 μm range as shown in Figure 3. [27]

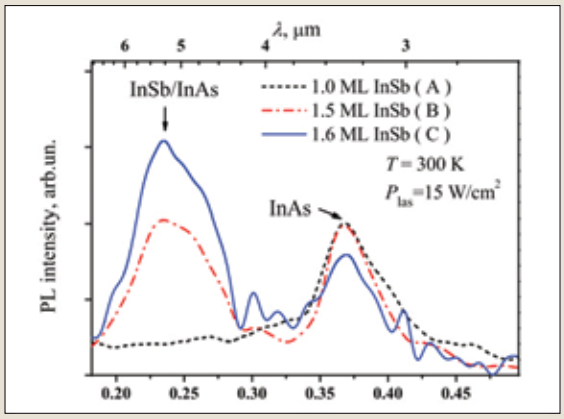

Figure 3: Room-temperature PL for samples with various InSb insertion thicknesses in the above-ML range.

These latest results clearly state that not only the interest in the fabrication of Sb-based dots for MIR applications is growing, but also unusual deposition techniques are required to obtain high performances from such a material, suitable for device applications. These results also show that as far as MIR Sb-based QDs devices are concerned basically everything remains to be done. In addition, investigations of QDs heterostructures have shown that, although some of the anticipated benefits of QDs are indeed realised in particular in terms of device performance, but the actual QDs systems might differ notably from the theoretical model. Their properties can thus depart from the predictions, and refinements of the theoretical models become necessary.

In order to use Sb-based SAQDs in the MIR 3-5 μm range, there are still a few designs can be considered. Designs that utilising type-I band alignment are also possible. These include dot-in-well (DWELL) structure and dilute-nitride materials. DWELL structures can be achieved by incorporating strain reducing layer (SRL) such as AlInAs, InGaAs, InGaAsSb, etc. to the SAQDs

heterostructures. The SRL will reduced the residual compressive strain in the dots and hence reduces the conduction band shift (i.e., reduce bang gap) and extend the wavelength. SRL also suppressed the generation of defects and dislocations, thereby enhancing the radiative recombination. Besides, improved size uniformity as well as increased in dot density also had been observed for SAQDs covered by the SRL. [28]

Incorporation of dilute concentrations of nitrogen to III-V semiconductors will drastically reduce the band gap of the semiconductors due to the strong negative band gap bowing effects. A decrease in band gap of 110 meV has been predicted for dilute InSb:N at 1% of N. In this case, a negative band gap can be achieved by incorporate higher N content to InSb as incorporation of as high as 10% of nitrogen is possible. [29] However, this may give rise to the difficulty in controlling the growth process when high content of N to be added to the epilayer. A systematic theoretical and experimental investigation is needed in order to utilise these dilute-nitride semiconductors.

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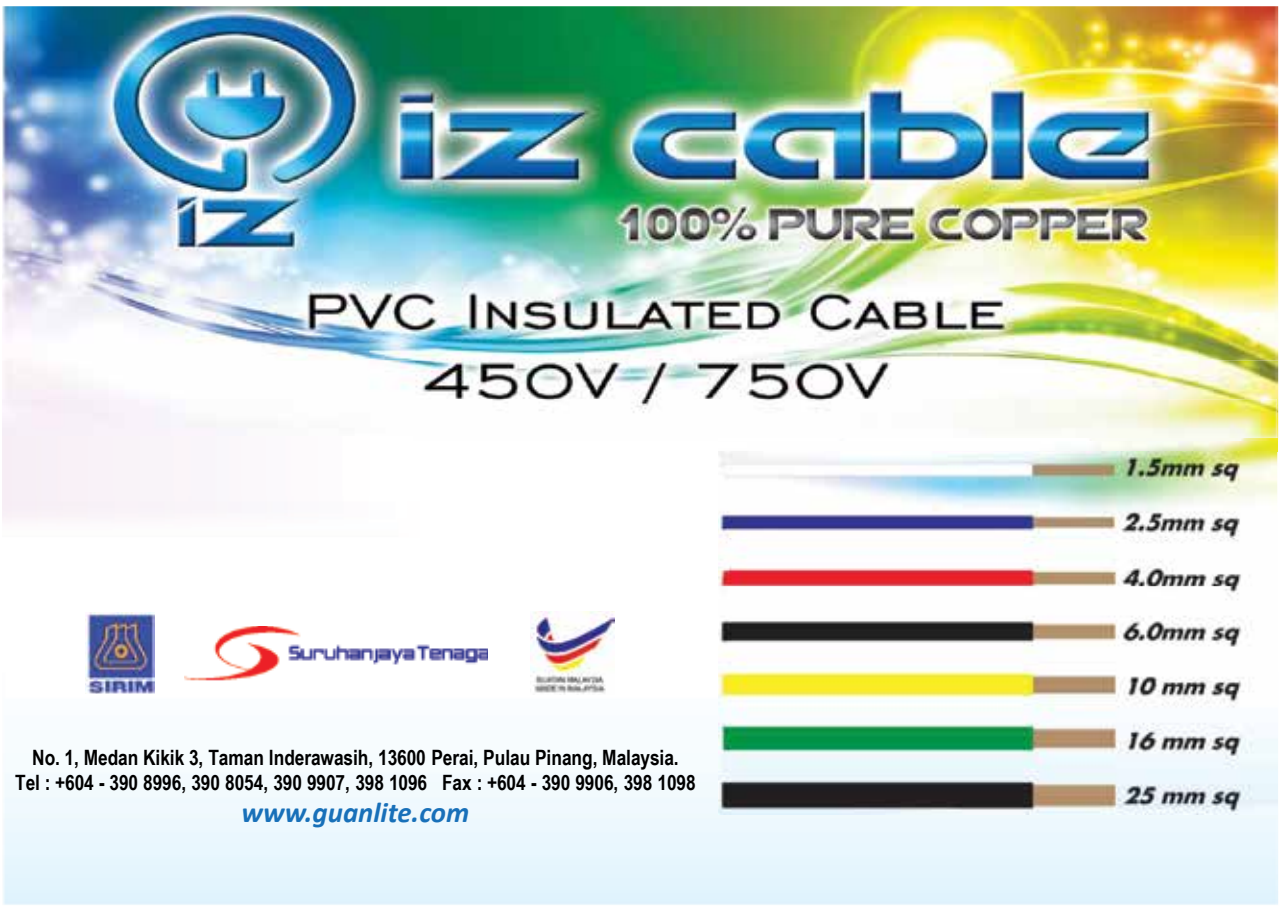

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IEM Penang Branch 55th AGM

Reported by
Ir. Dr. Khor Jeen Ghee

25-Mar-2022. It was coming to 6pm on a Friday evening. Normally, at this time, engineers in Penang would be busy navigating the traffic in the middle of their commute home. But today, they are busy dialing into Zoom. A few are even braving the Friday evening traffic to be at the Branch's Secretariat Office, at e-Gate. They were coming together for the IEM Penang Branch 55th Annual General Meeting. The double '5' is a testament of the Branch's service to the engineering community in this region for more than half a century. As Malaysians are slowly returning back into their pre-COVID routines, IEM Penang Branch held its AGM in a hybrid mode. This caters well for those who prefer to attend the event virtually, while also allowing some to attend the meeting in the traditional way - in person.

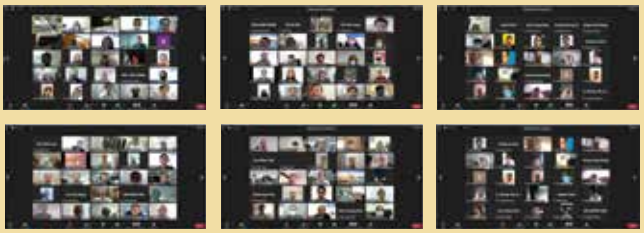
IEM President Ir. Ong Ching Loon

Participants at the Secretariat Office

IEM Penang Branch Chairman, Ir. Bernard Lim

This year's AGM was graced, in person, by the IEM President himself, Ir. Ong Ching Loon. In his Welcoming Address, Ir. Ong spoke about the active participation of regional branches in general, and IEM Penang Branch in specific, highlighting that the Penang Branch is one of the most active branches in the country. As part of the many examples he gave on the activities driven by the Penang Branch, he thanked Ir. Heng Lee Sun and the organizing committee of the Women Engineers Conference Penang on their recent successful event. He then touched on the goal to make the IEM bigger, stronger and to strengthen the profession (of Engineering) as a whole in the past two years, despite the challenges faced due to the raging COVID pandemic. Ir. Ong acknowledged the selfless dedication and undivided support from the branch chairman, executive committee and members of the Penang Branch, without which, many of the programs would not have succeeded.

Following the speech by Ir. Ong, the IEM Penang Branch Chairman, Ir. Bernard Lim duly thanked the President and launched into the meeting proper. Ir. Teh Siew Yin, through the magic of Zoom, presented the Honorary Secretary's Report, which began with the usual obligatory approving of the previous meeting minutes. Following that, Ir. Teh reported on Branch membership status and activities. Once again, we see the



Online Participants

long shadow cast by the pandemic on our activities. Even the number of professional interviews dropped to one third of what they used to be. Nevertheless, it was obvious from the report that the team's perseverance shined through. Without skipping a beat, the team replaced the usual technical talks and seminars with virtual events, and even managed to work in a technical visit to a solar panel company. This allowed the members to continue to participate in continuous development activities throughout the year, albeit most of them via online platforms. Next, Ir. Darren Khoo presented the Honorary Treasurer Report, following which, Ir. Bernard Lim addressed questions from the floor with his usual vigor. He also introduced the members of the Executive Committee for the upcoming term of 2022/23. The AGM concluded with photo sessions and notes of thanks.

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Announcement of Office Bearers IEM Penang Branch (Session 2022/2023)

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Ir. Dr. Chang Chun Kiat
Vice Chairman

Ir. Chan Wah Cheong
Vice Chairman

Ir. Darren Khoo
Honorary Treasurer

Ir. Dr. Khor Jeen Ghee
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Ir. Lian Shin Wai, Andy

Ir. Tean Sze Nee

Ir. Ong Sheng How

Ir. Choo Lay Guat, Juliet

Ir. Khaw Yao Shun

Ir. Tan Bak Ping

Ir. Tan Yan Moy

Representative of Graduate Member

Mr Sim Kai Sheng
YES Chairman
(2021/2022)

COURTESY VISIT TO **PENANG GREEN COUNCIL**

Report by
Ir. Kanagaraj Subramaniam

IEM Penang Green sub-committee members & PGC members at PGC office Renuka Radakrishnan, Tan Thung, Hoo Huey Ching, Ir. Tan Bak Ping, Ir. Teh Siew Yin, Ir. Khaw Yao Shun, Josephine Tan Mei Ling, Ir. Bernard Lim, Dr. Ng Shin Wei, Ir. Chang Chun Kiat, Ir. Ong Pang Wei & Ir. Kanagaraj Subramaniam

On 24th May 2022, the IEM Penang Branch, represented by its 7 committee members paid a courtesy visit to Penang Green Council (PGC) Office, located at 46th floor, KOMTAR Building, Penang. It was a privilege and an honour to be accorded a warm welcome by 5 PGC representatives led by Josephine Tan Mei Ling.

In the meet up the PGC team stated that PGC is mandated by the Penang government to nurture, facilitate and coordinate the environmental causes in Penang. PGC's role is to function as the central hub in harnessing green technology and supporting holistic green initiatives to achieve sustainable development under the Penang Green Agenda2030 and realising the vision of Penang2030 – A Family-Focused, Green and Smart State that Inspire the Nation.

IEM Penang Branch Chairman, Ir. Bernard Lim introduced the IEM Penang Branch as well as its committee members. He briefed PGC on updates of IEM organizational activities and its readiness to work with or partner with PGC towards realizing their green initiatives. He said that the IEM Penang branch and the Penang government have a good collaboration in various areas of activity thus supporting and contributing not only from an engineering perspective but also under its social responsibility programs.

This is evident from the various recent programs conducted by IEM through its close interaction with the Malaysian Association of Local Authorities (MALA) in promoting STEM activities especially those involving government bodies. This is to ensure IEM remains as a responsible professional body that can be depended upon to serve significantly in its advisory role towards achieving the objectives and vision of the government.

IEM chairman highlighted that this visit to PGC is a continuation of this close collaboration between IEM Penang and the Penang state government. He emphasized the importance of communication and a good working relationship. This visit by IEM Penang committee is also to understand the plans and activities curated by PGC team. PGC is glad to be given the opportunity to present its strategic plan and share its direction with the IEM team.

The PGC team stated its main emphasis is to enable, empower and enrich all stakeholders in practicing sustainable development that protects the environment and quality of life. This is done through innovating and facilitating creative green programs including partnering with corporations, training environmental educators and acknowledging outstanding environmentalists with awards.

Its 5 core areas of focus are (i) Penang Green Agenda served as the State framework incorporated UN Sustainable Development Goals (UNSDGs) which outlines the challenges and recommended solutions for the state in achieving a greener and more sustainable state by year 2030; (ii) environmental education and outreach (including award & incentive); (iii) climate change & adaptation; (iv) circularity (focus on circular economy) and (v) sustainable development.

The meet up session resulted in identifying specific areas of collaboration between IEM and PGC. These areas were:

1. **Renewable energy** - Its promotion as an alternative energy source that is based on green technology and carbon footprint reduction. Enhancement & provide valuable inputs on the Renewable Energy & Energy Efficiency Framework which is currently drafted by PGC Team.
2. **Water conservation** – To study on the application of rain water harvesting, greywater reuse system from sewage for landscaping & flushing purposes and utilising wasted storm water.
3. **Disaster management** – Evaluation on data collected, planning on flood mitigation, fire prevention, disaster study and paper policy.
4. **Greening of environment** – Participation in activities and outreach programs by PGC team.
5. **Waste management** –To identify suitable Waste to Energy technologies and effective waste management mechanism and methodologies. Way to improve and enhance Penang Waste Segregation at Source (WSAS) policy.

Presentation of plaque by IEM Penang Branch Chairman Ir. Bernard Lim to PGC General Manager Josephine Tan.

Ir. Bernard Lim said that IEM can assist PGC to evaluate and provide advice based on collected data utilizing its technical expertise pool towards arriving at solutions and effective execution modes. The meeting participants took note that IEM is a member of the state Task Force which serves as a platform to share views. PGC extended its praise for IEM's contributory services provided to it so far.

On this note, PGC welcomed the IEM Penang Branch as a platform to reach out to engineers in Penang to collaborate with PGC in its activities. IEM will also extend technical services to PGC as required. It was agreed that dialogues and workshops should be continued on a regular basis between both parties in the future.

After the courtesy visit, IEM Penang Branch presented a plaque as a token of appreciation to PGC for spending their valuable time to share their green initiatives with the team.

Penang Skills Development Centre

33rd Annual General Meeting (AGM)

Report written by
Ir. Bernard Lim Kee Weng

PSDC AGM at Auditorium

Penang Skill Development Centre (PSDC) held their 33rd Annual General Meeting physically at the PSDC auditorium on May 26, 2022 at 3.00PM. IEM Penang been a founding member attended the AGM and was represented by the IEM Penang Branch Chairman, Ir. Bernard Lim.

Mr Christoph Mueller

There were 47 member companies represented by their senior personnel or representatives attended the AGM.

The AGM started by a brief update by the Chairman of PSDC Management Council, Mr Christoph Mueller.

This was then followed by the PSDC CEO, Mr Tan Eng Tong who tabled the PSDC Annual Report for the year ended December 31, 2021, and the audited financial statements of PSDC for the year ended December 31, 2021.

The PSDC is managed by a Management Council, comprising 11 elected committee members and 4 appointed office bearers with 9 ex-officio members. In this AGM, there was an election for 4 ordinary committee members, who shall hold office for a period of 2 years. A call for nominees was carried out to all PSDC member companies with the closing date on May 19, 2022. Among all the nominated companies, 9 companies or organizations move forward in the election proceeding. Each nominated company representative was required to deliver a few minutes of introduction during the AGM.

Mr Tan Eng Tong

An election was held during the AGM, and the four elected companies or organizations were Eng Tek Group (Dato' Teh Yong Khoon), The Institution of Engineers, Malaysia (IEM) (Ir. Bernard Lim), AMS Osram (Mr Glen Brownlie) and Keysight Technologies Malaysia Sdn Bhd (Ms Angela Cheong).

Congratulations to the 4 elected companies or organizations!!!

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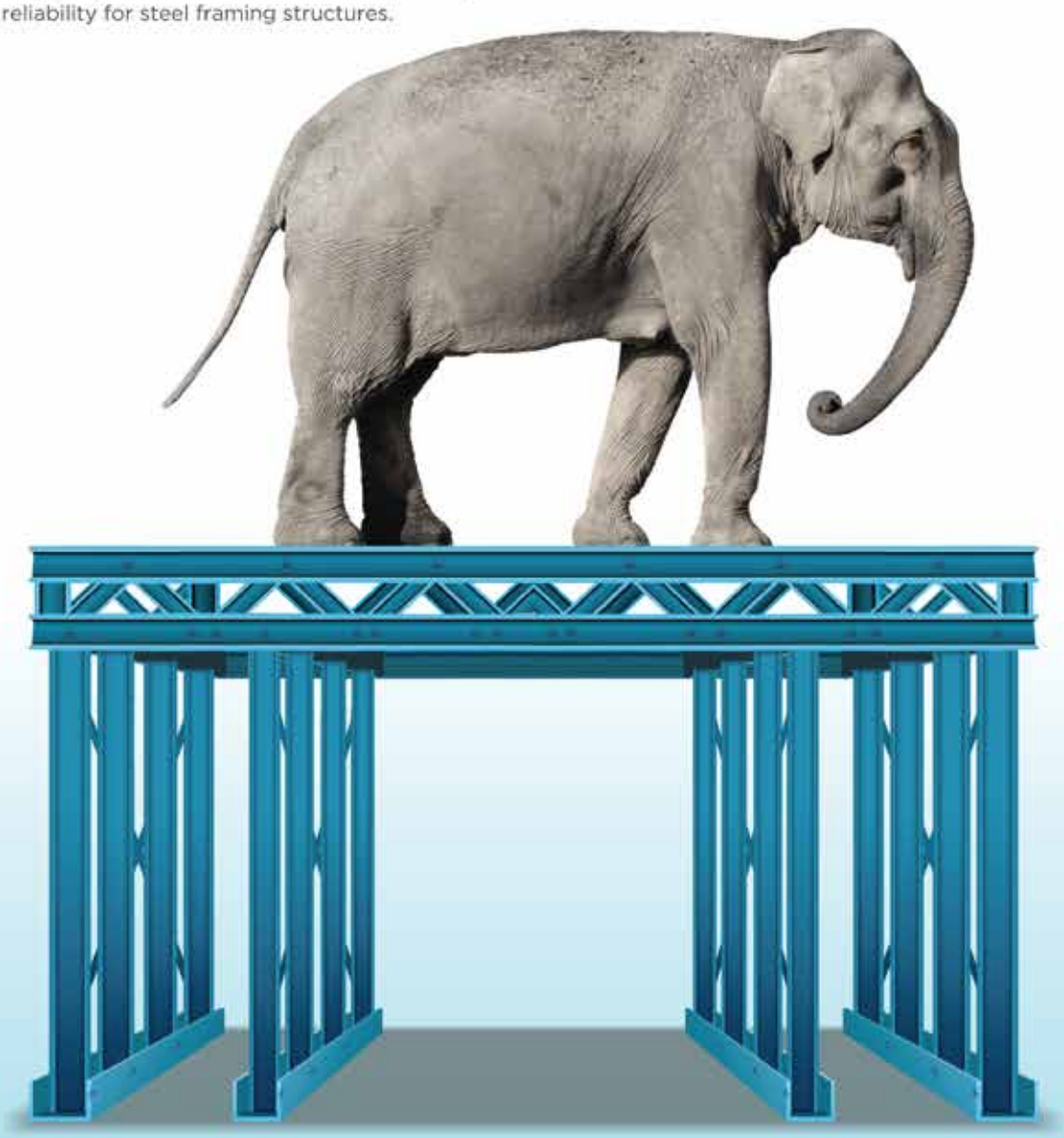

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Indah Geoportal - **The Online GIS Application**

Report by
Ir. Teh Siew Yin

In response to our plea for leniency during the pandemic last year, Ir. Noor Azean Bt. Ahmad, the Manager of Indah Water Konsortium Sdn Bhd (IWK) Penang Certification Agency has promptly responded and scheduled a virtual meeting to discuss issues faced by members of the Institution of Engineers (Penang Branch) the following week on 4th August 2021.

We are indeed very grateful for Ir. Noor Azean's swift response again this year to our request for a workshop on Indah Geoportal. She answered all our calls to ensure that the workshop will be successfully carried out even though she was on her 6th maternity leave. The workshop was initiated due to the request from IEM members who were unable to obtain the sewerage information needed from the Geographical Information System (GIS) online application. With the increase in use of this online system during Covid-19 pandemic, it is necessary to assess the effectiveness with regards to information provided to engineers who will be submitting their plans. The workshop was timely as IWK was in the process of implementing online application across the nation.

On 11th May 2022, IEM Penang successfully co-organized with IWK the online workshop on Indah Geoportal and it was attended by about 50 participants. Dr. Afifa Safira A Gani, the Head of Asset Management Unit in the Planning and Engineering Department in IWK along with Mohd Zubaidi Daud, the Senior GIS Executive of Asset Management Unit, Planning & Engineering Department in IWK conducted the workshop via zoom platform to IEM members. Dr. Afifa presented the development, formulation, implementation and continuous improvement of the IWK Asset Management System which is in line with ISO 55001.

En. Zubaidi showed IEM members the step by step procedure to obtain the information from Indah Geoportal. He also explained in detail information provided in Indah Geoportal thus clearing all the misunderstandings about the information pertaining to aspects of the sewerage system is available from the portal. Amongst the information not provided in Indah Geoportal is the one on the catchment area. IEM members were advised to contact IWK for any information not provided in Indah Geoportal. In the absence of the Manager of IWK Penang Certification Agency Ir. Noor Azean, Ir.Thanabala a/l Krishnasamy has been assigned to assist engineers in such matters.

Certificate presentation to the speaker

At present, image preview for the sewerage system within the area selected in Indah Geoportal is not available before payment is made. Image preview is a great feature for the user to check on the image of the area selected to ascertain its correctness before payment is made since there is no refund for any mistakes made during selection of the area. It was also suggested that the image preview be made blurry, of low-resolution and smaller size because if free images are readily available it negates the necessity to pay for clear images. IWK will analyze the feasibility of this image preview feature.

IEM members were advised to contact IWK for any information not provided in the Geoportal. IWK will continue to improve Indah Geoportal system and their service to everyone.

IEM
The Institution of Engineers, Malaysia
(Penang Branch)

55th IEM PENANG

Anniversary Dinner

LEGACY TALK & EXHIBITION

26 November 2022 (Sat)

@ Spice Convention Centre, Penang

DRESS CODE: **Smart Casual**

COLOR CODE: **Brown / Black / Grey / White**

Program	Time
• Legacy Talks by 3 Distinguished Engineers *Dato' Ir. Addnan b Mohd Razali* *Dato' Ir. Dr. Goh Teik Cheong* *Dato' Ir. Rajendran P Anthony*	9:30 am to 12:00 pm

Free Admission

(CPD In progress)
Refreshment will be served

• Exhibition

• Pre-dinner cocktail and Networking Session

• Dinner and Show

Theme:
Engineers are the **CAPSTONE**
- Things Break down without Us

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(Penang Branch)

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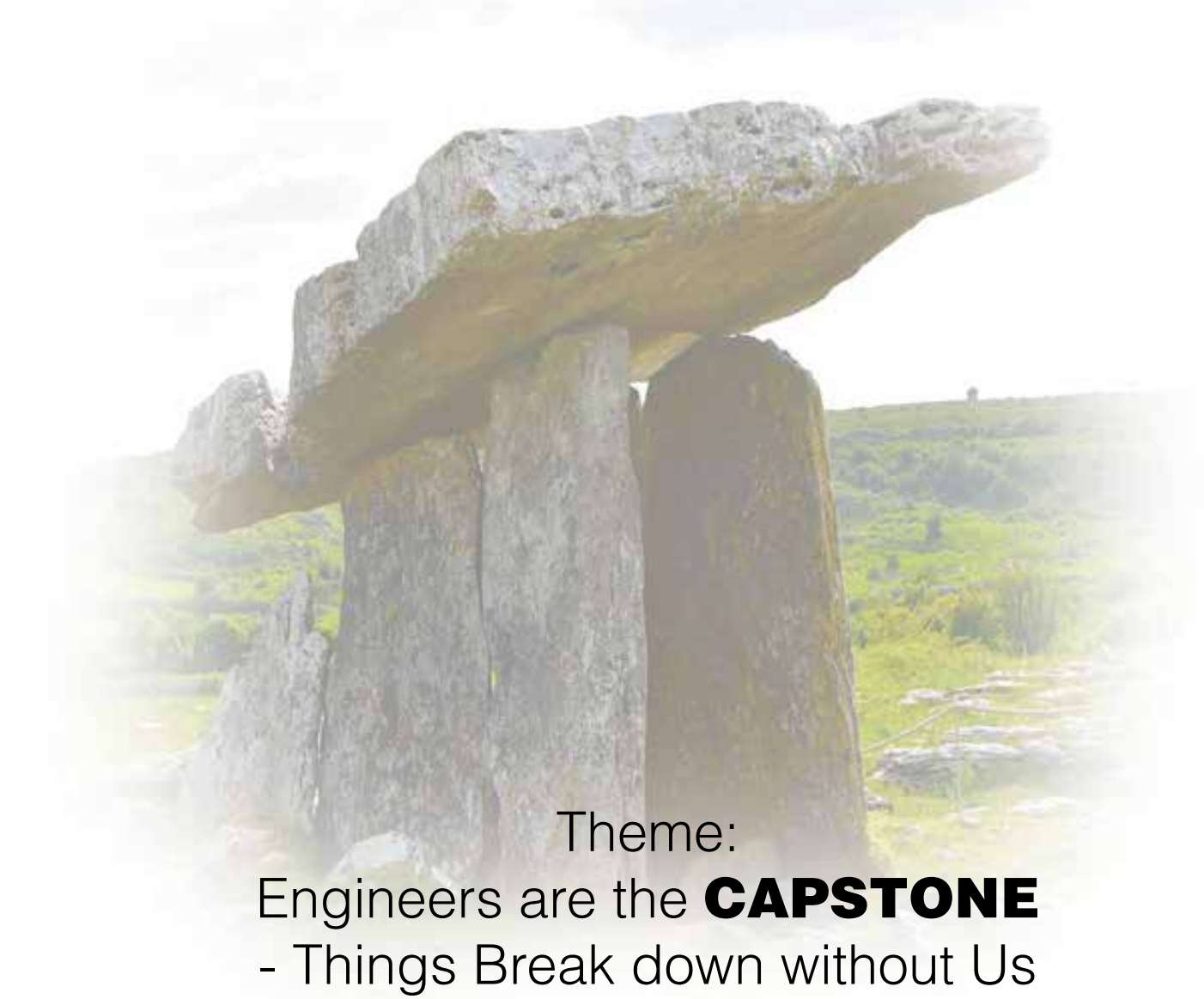
COLOR Advertisement in Program Book	2 Full Pages	1 & ½ Page	1 Full Page	1 Full Page	Half Page
Dinner Table	1 table	1 table	1 table	1 table	½ table
Corporate Video Presentation	3 mins	2 mins	2 mins	2 mins	-
Display Table or Exhibition Space @ Foyer before Banquet Hall	2	1	1	-	-

We look forward to your participation in this special 55th Anniversary Dinner.



Theme:
Engineers are the **CAPSTONE**
- Things Break down without Us

PART IV

PROGRESS DEVELOPMENT ON:

EARTHQUAKE DESIGN CONSIDERATIONS OF BUILDING STRUCTURES IN PENANG ISLAND.

A Collaborative Study Between IEM (Pg) / USM / UiTM

Ir. Chua Beng Seong
Chair, Earthquake Engineering
Sub-Committee

BACKGROUND INFORMATION

This is a continuation of a series of technical sharing on the progress development of the collaboration work between IEM (Pg)/USM/UiTM on the above subject of study. Part III article was published in the Issue No. 1/2022 of the INGENIUR PENANG.

As a recap, Part III paper elaborated on the earthquake design philosophy in Ultimate Limit (ULS) & Serviceability Limit (SLS) States. It also discussed on the subject of Seismic Action in particular, the development of Horizontal Elastic Spectra with reference to Peak Ground Acceleration (a_{gR}) and the "Design Spectrum" S_d (T) to be adopted for Linear Dynamic Analysis.

In this article, a comparison on the analysis results of Base Shear & Story Shear Distribution from the Seismic model (Gk+Qk+EQ) will be discussed.

2.0 PHASE II PROGRESS

The anticipated total number of computer modelling (WL_2, WL_{100} & EQ) to be generated (via ETABS) for test buildings, analyzed, designed and extracting Bills of Material (via CSiDetail) shall be 126 (ie.6 x 7 x 3 categories), starting with a typical building regular in plan with slenderness of λ = Lxmax/Lymin = 1.67 (Fig 1.0: 5 Bays x 3 Bays) to a slenderness of λ > 4.0 (Fig 2.0: max. 15 Bays x 3 Bays) in order to satisfy irregularity requirement. The number of storey of the test buildings shall then be categorized into 10-Storey, 15-Storey, 20-Storey, 25-Storey, 30-Storey, 35-Storey & 40-Storey respectively, thus giving rise to 42 models in total under each WL_2, WL_{100} & EQ category.

In phase II (2021/2022) collaborative study, we had completed until 25-storey for all the 6 floor plans, ie 57% progress. Phase III (2022/2023) study is on-going for 30-40 storey models. Training and tutorial by IEM (Pg) to the USM and UiTM final year project students on computer modelling were being held regularly at the IEM Secretariat.

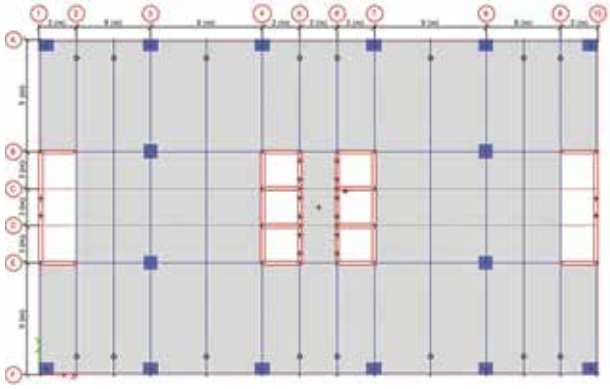


Fig. 1.0: 5 x 3 Bays: λ=1.67

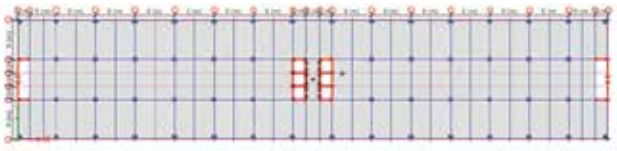


Fig. 2.0: 15 x 3 Bays: λ=5.0

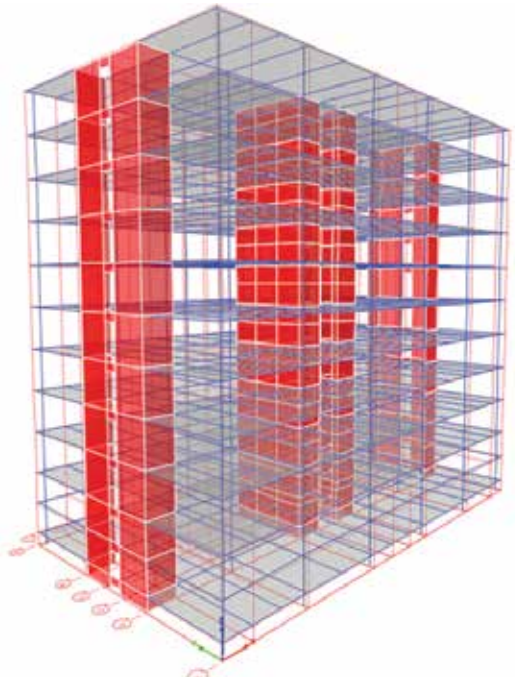


Fig. 3.0: 5 x 3 Bay x 10-Storey

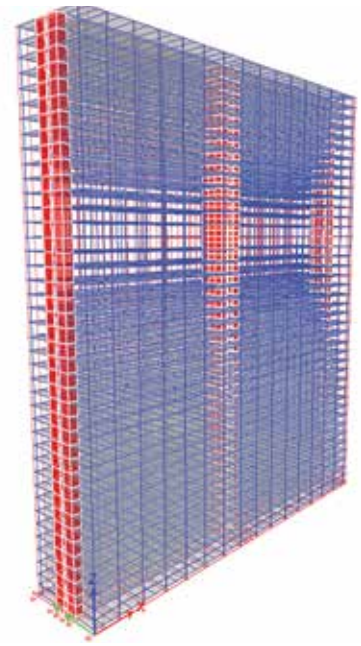


Fig. 4.0: 15 x 3 Bays x 40-Storey

3.0 BASE SHEAR & STOREY SHEAR DISTRIBUTION

Unlike Wind Load (WL) model which is directly dependent on the horizontal wind force, the magnitude of the horizontal inertia force of seismic model depends on:

a. The building mass;
b. Ground acceleration (design horizontal spectrum);
c. Natural periods of building &
d. Type of structure

If a building and its foundation were rigid, it would have the same acceleration as the ground and the peak lateral force would be the mass times the peak acceleration (F=ma).

In reality, this is never the case, since all buildings are flexible to some degree. For a structure that deforms only slightly, thereby absorbing some degree of energy, the force may be less than the product of F=ma.

But a very flexible structure, having a natural period near that of the ground motion, may be subject to a much larger force.

In **Lateral Force Method analysis, EC8 (EN 1998-1)/4.3.3.2.2** states that the seismic base shear F_b, for each horizontal direction in which the building is analysed, can be computed using the following expression:

$$\mathbf{F_b = S_d\,(T_i) \cdot m \cdot \lambda} \qquad \textbf{- Eqn. 3.1}$$

where

Sd (T_i): the ordinate of the design spectrum at period T_1;

T_1: the fundamental period of vibration of the building for lateral motion in the direction considered;

m: the total mass of the building &

λ: the correction factor; λ = 0.85 if $\mathbf{T_i \le 2Tc}$ and > 2 storey, otherwise λ=1.0.

The distribution of the horizontal seismic forces in the **i-th** storey **F_i**, can be estimated using equation **EC8 (EN 1998-1)/ 4.11**.

$$\mathbf{F_i = F_b \cdot Z_i \cdot m_i / \sum (Z_j \cdot m_j)} \qquad \textbf{- Eqn. 3.2}$$

m_i & m_j: storey masses &

Z_i & Z_j: the heights of the masses, **m_i & m_j**

The horizontal forces **F_i** shall be distributed to the lateral load resisting system assuming the floors are rigid in their plane ie floor diaphragm is assigned as rigid.

In Modal Response Spectrum analysis (RSA), EC8 (EN 1998-1)/4.3.3.3(3) states that the effective modal mass m_k, corresponding to a mode **k**, is determined so that the base shear force **F_{bk}**, acting in the direction of application of the seismic action, may be expressed as:

$$\mathbf{F_{bk} = Sd\,(T_k) \cdot m_k} \qquad \textbf{- Eqn. 3.3}$$

subject to:

- the sum of the effective modal masses for the modes taken into account amounts to at least 90% of the total mass of the structure;
- all modes with effective modal masses greater than 5% of the total mass are taken into account.

4.0 COMPARISON OF BASE SHEAR RESULTS

4.1 WIND LOAD MODEL (Gk+Qk+WL_{100})

Test Building 11 bay x 3 bay x 40 Storey

Storey shear distribution in Direction Y (Fig. 5.0) for **V_{100}=28.9m/s**:

593kN (Roof) and 35,107kN (Ground).

4.2 SEISMIC MODEL (Gk+Qk+EQy)

Test Building 11 bay x 3 bay x 40 Storey

Storey shear distribution in Direction Y (Fig.6.0) for EQy:

1,848kN (Roof) and 16,903kN (Ground).

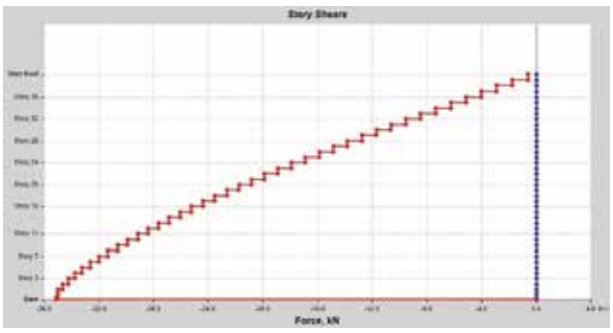


Fig. 5.0: Storey Shear Distribution (in Direction-Y) for V100=28.9m/s on 11 x 3 Bays x 40-Storey

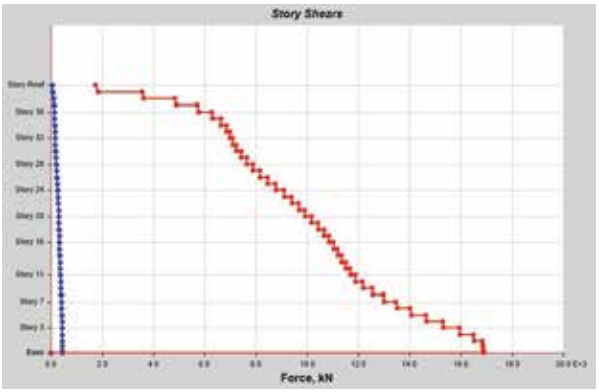


Fig. 6.0: Storey Shear Distribution (in Direction-Y) for EQy on 11 x 3 Bays x 40-Storey

5.0 BASE SHEAR RATIO OF SEISMIC MODEL

Base Shear Ratio ie., base shear force (Vx, Vy) versus total weight of the structure (Vz) above base level, for 11x 3 Bays models is presented in Fig. 7.0 & 8.0.

Although the results from other models are still in progress, the current results indicate that the Base Shear Ratio varies from ±5.0% for 10-storey to ±1.0% for 40-storey models under the Design Horizontal Spectrum, $\mathbf{a_g = 0.06g}$ & reference Peak Ground Acceleration (PGA), $\mathbf{a_{gR} = 0.05g}$.

This is attributable to the fact that as the structure increases in height, the ductility increases, so are the natural periods (T). As a result, the corresponding ordinate Sd(T) of the design spectrum at period T decreases.

6.0 CONCLUDING REMARKS

The collaborative study between IEM(Pg) / USM / UiTM is currently in its third-year phase.

Current results indicate that as the building increases in structural plan slenderness λ (= Lxmax/ Lymin) ratio above 3.0 and the number of storey increase above 25, there is a tendency for the Wind Load models (at V100=28.9m/s) to supersede the Seismic models (at Design Horizontal Spectrum, $\mathbf{a_g = 0.06g}$ with reference Peak Ground Acceleration (PGA), $\mathbf{a_{gR} = 0.05g}$).

More analytical results will be presented in the future articles.

7.0 2022/23 SESSION SUB-COMMITTEE

The current 2022/23 session of the Earthquake Engineering Subcommittee members are as follow:

- **Ir. Chua Beng Seong PKT (Chair)**
  BSc PEng CEng FIEM FICE FASCE
- **Ir. Bernard Lim PJM**
  BEng MBA PEng FIEM SMIEEE MIET ASEAN Eng Int.PE
- **Ir. Yau Ann Nian DJN PKT**
  BSc EC Pt2 PEng FIEM AMICE MMGS
- **Prof. Ir. Dr. Choong Kok Keong**
  BEng MEng DEng PEng
- **Ir. Dr. Shaharudin Shah Zaini**
  BEng MSc PhD PEng MIEM
- **Assoc. Prof. Ir. Dr. Lau Tze Liang**
  BEng MSc PhD PEng MIEM
- **Ts. Dr. Suhailah Mohamed Noor**
  BEng MSc PhD PTech MBOT
- **Ir. Yeap Geok Ngoh**
  BEng MSc PEng MIEM GBIF
- **Ir. Khor Ooi Chong**
  BSc PEng MIEM
- **Ir. Teh Siew Yin PJK**
  BSc MSc PEng MIEM SHO CESSWI
- **Ir. Tean Sze Nee PKT PJK**
  BEng MEng PEng MIEM PMP
- **Chuah Hoi Ching**
  BCivil
- **Wong Bo Zheng**
  BCivil

No of Bays	Lx x Ly = 11 x 3		Storey						
Slenderness Ratio	λ =3.67		10	15	20	25	30	35	40
Height	H	m	43.20	63.20	83.20	103.20	123.20	143.20	163.20
Building Weight (DL+SIDL+Qk)	Vz	kN	409,222.66	603,656.34	796,165.58	1,005,794.34	1,194,882.79	1,420,932.78	1,655,483.99
EQx	Vx	kN	11,805.09	11,341.34	11,207.22	12,618.49	13,778.15	16,122.49	18,278.74
	Vy	kN	675.60	597.59	520.50	617.14	667.18	711.44	434.35
EQx Base Shear Ratio, Vx/Vz	Vx/Vz	%	2.88	1.88	1.41	1.25	1.15	1.13	1.10
EQy	Vx	kN	678.52	598.50	523.64	620.13	670.63	716.59	439.40
	Vy	kN	16,311.12	14,620.00	14,168.95	14,786.62	14,952.49	16,255.91	16,902.97
EQy Base Shear Ratio, Vy/Vz	Vy/Vz	%	3.99	2.42	1.78	1.47	1.25	1.14	1.02

Fig. 7.0: Base Shear Ratio for Lx · Ly = 11 x 3 Models

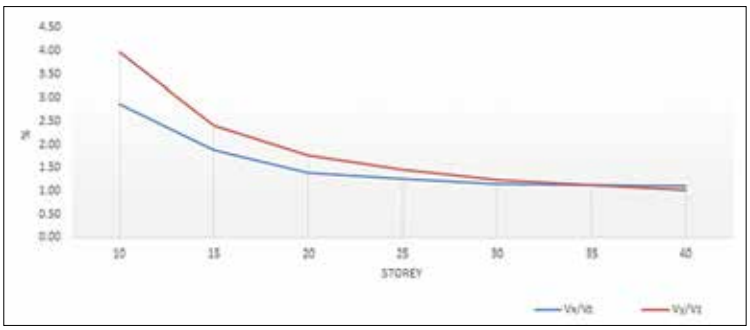


Fig. 8.0: Base Shear Ratio Graph

8.0 TRAINING / TUTORIAL

To ensure consistency in the modelling, analysis and design specification, training and tutorial by IEM (Pg) to the USM and UiTM final year project students (undertaking the collaborative study) on computer modelling were being held regularly at the IEM Secretariat.

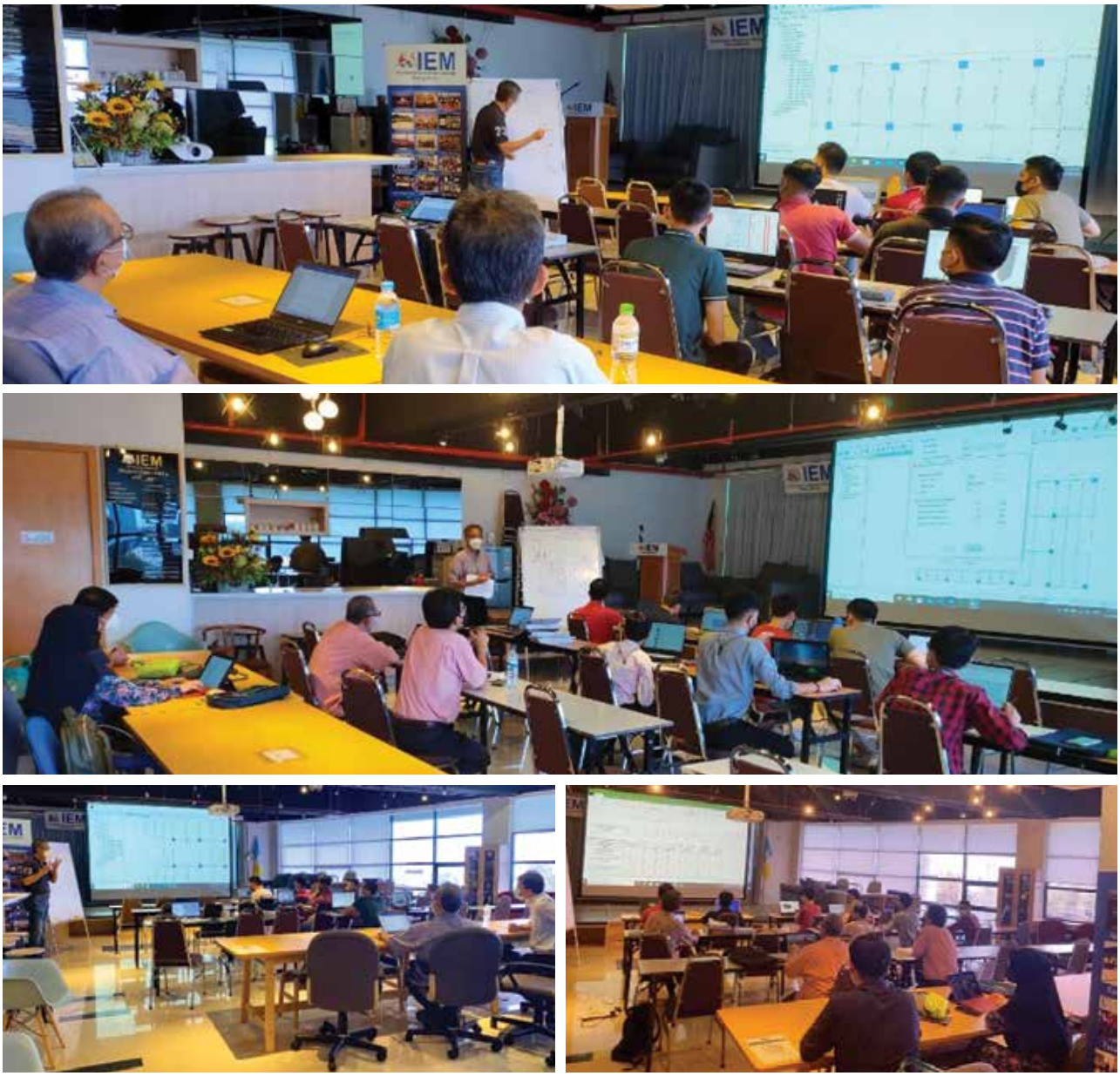


Fig. 9.0: Training & Tutorial Sessions

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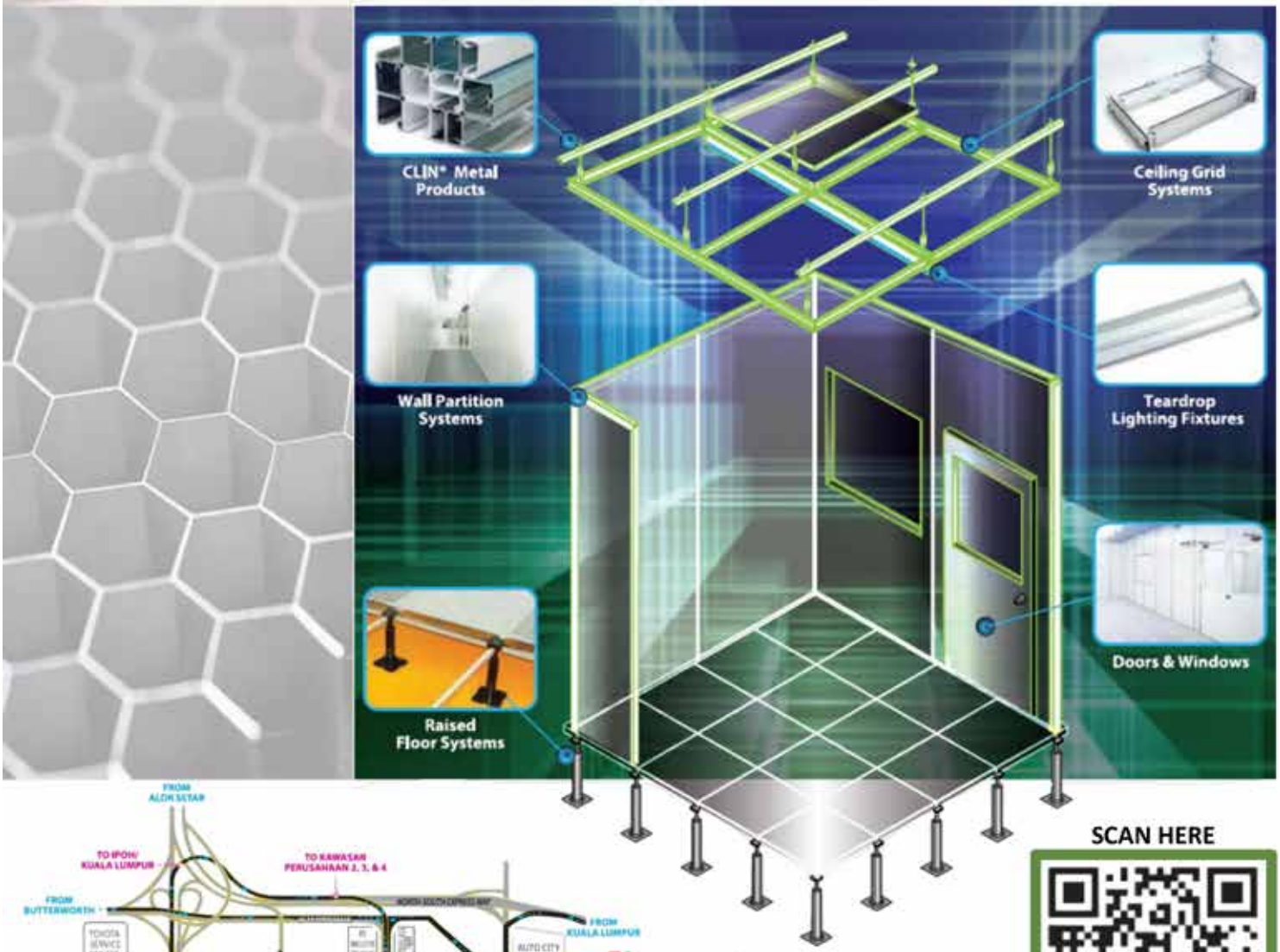

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CIVIL & STRUCTURAL ENGINEERING SUB-COMMITTEE

Ir. Chua Beng Seong
Chair, C & S Sub-Committee

Civil & Structural Engineering Sub-Committee was formed in 2019 in anticipation of a greater technical advisory role to be played by IEM (Pg) to the industries and to the state government of Penang in particular.

The sub-committee strives to play an active role in order to help position IEM (Pg) as an essential technical hub for Penang state government.

To-date, we had responded to the urgent requests from private properties and MBPP for technical advice and had carried out six (6) inspections and appraisals on the existing properties under the jurisdiction of MBPP, that had undergone either structural defects and/or C & S related issues.

i. THE 3-STOREY TAMAN FREE SCHOOL FLATS

Portions of the 2 adjoining blocks of building had undergone vertical and horizontal movements, causing some structural defects.

Fig. 1.0 Block A of Taman Free School Flats

ii. THE PETRON PETROL STATION, GELUGOR

The collapse of Retaining wall behind the petrol station had occurred after a period of high daily rainfall precipitation.

Fig. 2.0 Rear Section of The Petron Petrol Station

iii. TAMAN YEW LEAN FLATS

The ground floor corner unit was observed to have undergone several forms of structural & non-structural cracks.

Fig. 3.0 Internal Corner Unit

iv. MUTIARA INDAH APARTMENT

The back lane of the apartment was facing a steep hill of rock slope with a slope gradient much more than 35 degrees.

Despite the existing measures undertaken, it was reported that the incidence of rock falls from loose boulders of sizes measuring 400 - 500mm had been taking place.

Fig. 4.0 Back Lane Facing Steep Slope

v. TAMAN HARMONI APARTMENT

Ground subsidence at the open space of Taman Harmoni Apartment located adjacent to the JPS drainage reserve was observed after a higher-than-average daily rainfall precipitation had taken place before and during the period of incident.

Fig. 5.0 Arial View of Ground Subsidence

vi. BUKIT KUKUS ELEVATED BYPASS

Ingress from Balik Pulau and Egress towards Balik Pulau sections of the elevated bypass had encountered water ponding issues during heavy rainfall.

Fig. 6.0 Egress Elevated Section

SUB-COMMITTE MEMBERS

The current 2022/23 session of the C & S Subcommittee members are as follow:

- **Ir. Chua Beng Seong PKT (Chair)**
  BSc PEng CEng FIEM FICE FASCE
- **Ir. Bernard Lim PJM**
  BEng MBA PEng FIEM SMIEEE MIET ASEAN Eng Int.PE
- **Ir. Yau Ann Nian DJN PKT**
  BSc EC Pt2 PEng FIEM AMICE MMGS
- **Ir. Yeap Geok Ngoh**
  BEng MSc PEng MIEM GBIF
- **Ir. Khor Ooi Chong**
  BSc PEng MIEM
- **Ir. Teh Siew Yin PJK**
  BSc MSc PEng MIEM SHO CESSWI
- **Ir. Andy Lian**
  BEng MSc PEng MIEM
- **Ir. Ong Pang Wei**
  BEng MBA PEng MIEM ACPE GBIF

MIPNB-IEMPG ACTIVE MOBILITY Walkabout 2022

IEM Penang Branch Traffic,
Transport & Highways Engineering Sub-Committee

by **Ir. Ong Sheng How**

Figure 1: Group Photo – Participants of the Active Mobility Walkabout

MIPNB-IEMPG Active Mobility Walkabout, an unprecedented collaboration event between the Malaysian Institute of Planners (MIP) Northern Branch and The Institution of Engineers, Malaysia (IEM) Penang Branch, was held on 21st May 2022.

This Active Mobility Walkabout was an interesting outdoor event involving walking around the heritage streets of George Town, Penang, which encompassed approximately 2.7km of walkway. Striving to improve the quality of life and making a city more resilient and sustainable, TPr. Amelia Neoh and Ir. Ong Sheng How, both enthusiasts of active mobility, were the hosts and speakers of the day.

The objective and main focus of this Technical Walkabout was to observe, discuss, critic and propose what makes a good pedestrian walkway, and how it relates to our neighbourhood, communities and cities. This walkabout was inspired by the Jane Jacobs Walk, a neighbourhood walking tour which enables members of a community to discover and respond to the complexities of their city through personal and shared observation in informal walking conversations.

A total of 20 people, including the 2 hosts, participated in the walkabout. We gathered in front of the Penang City Hall at Padang Kota Lama at 9am. After some briefing by the 2 hosts, and taking of a group photo, we began our walkabout with much enthusiasm. Our starting point, needless to say, was obviously the new Penang Esplanade, which was just officially launched a week earlier, on 13th May 2022. As it was still very new, many people flocked to the new Esplanade to explore the engineering marvel of its newly upgraded seawall. We had the privilege of having with us an MBPP officer who was involved in the seawall upgrading project, and she delightfully explained to us the

Figure 2: The 2 Hosts/Speakers of the Active Mobility Walkabout

Heartiest Congratulations

to

Dato' Seri Ir. Jaseni Maidinsa (DGPN)
Dato' Seri Ir. Lim Kok Khong (DGPN)
Dato' Ir. Rajendran A/L P. Anthony (DSPN)
Dato' Ir. Ting Chek Choon (DSPN)
Dato' Ir. Zainuddin bin Yusoff (DSPN)
Ir. Catherine Sim Siew Ping (PJK)
Ir. Teh Siew Yin (PJK)
Ir .Ts. Wong Kok Nian (PJM)

for being conferred in conjunction with
T.Y.T. YANG DI-PERTUA NEGERI TUN DATO' SERI UTAMA AHMAD FUZI BIN HAJI ABDUL RAZAK'S 73rd BIRTHDAY.

engineering aspect of the seawall and shared her extraordinary experience throughout the construction of the seawall.

We then proceeded along Jalan Tun Syed Sheh Barakbah until we reached Light Street. From Light Street we crossed over to the other side of the road and walked along Jalan Masjid Kapitan Keling. Along the way while we walked, both the hosts, myself and Amelia, shared our knowledge of good sustainable design in urban designing/planning point of view as well as transport planning/engineering point of view for placemaking and space sharing, the good practice and guidelines for pedestrian and cyclist friendly infrastructures catering for people of all ages and conditions, including public transport facilities such as bus stops provision. Again, we had the privilege of having another MBPP senior office among us who is from the Planning Department, and she shared with us valuable knowledge about George Town city and street planning.

One of the main objectives was to involve everyone to participate in this walkabout, hence as we walked along the walkways, participants were busy taking photos or videos along the way, giving critical and constructive comments on what we saw, and suggesting elements that makes a good pedestrian walkway, including good practices of Universal Design to be incorporated in the infrastructures for OKU folks.

After a long walk along Jalan Masjid Kapitan Keling, we turned into Lebuh Ah Quee and then into Lorong Song Hong, before joining Armenian Street. From Armenian Street, we turned left into Beach Street and headed back North towards the Padang Kota Lama direction. All the way along Beach Street we walked and continued our assignment of observing the walkways, infrastructures and road furniture. We did a slight detour to see the side lane upgrading project beside the Bank of China. This side lane is a good example of placemaking where urban designers create places and focus on transforming public spaces to strengthen the connections between people and the places they share.

Upon reaching the Jubilee Clock Tower at Light Street, we crossed the road and ended our walkabout at Padang Kota Lama. We had our debrief and all of us shared our thoughts on this walkabout, what have we learned through our observation and experience walking around the streets of George Town.

This walkabout gave the hosts the opportunity to share practical knowledge and experiences of walking, cycling and riding public transport from urban planning and transportation engineering perspectives. Intertwined between these discussions were opportunities to review existing pedestrian infrastructures, public spaces, and public transport facilities and its surroundings. We would then explore how walking can contribute to sustainable, resilient, equitable, prosperous, safe and healthy city planning for people – the elderly, OKU, children, women and neurodiverse – leaving no one behind.

In short, much is still needed to be done in George Town to make it a more walkable city.

Figure 3: Participants of the Active Mobility Walkabout

Figure 4: The Hosts, MBPP Officers, and IEM Secretary at the Active Mobility Walkabout

Figure 5: The Route of the Active Mobility Walkabout

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How Electronics Factory Managing Covid-19

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IEM eETD Chairman

"Growth Mindset", a fundamental HP Philosophy that we live and breathe has never been more evident at HP Malaysia Manufacturing (HPMM) than in 2020 and when COVID-19 rolled in.

Like the ever-evolving COVID-19 global situation, HPMM established its Covid-19 Safety Framework from the get-go. We do have two focus areas that underpin the entire framework:

- Safety Enforcement & Compliance
- Safety Mindset/Culture Building

At its core, the safety framework's fundamental expectation is Protection. Why protection? A safe and protected work environment builds trust and confidence amongst the workforces.

Aside from the mandatory implementation of the national SOP, HP continues to seek out new initiatives and technologies to enhance Protection. We have a team that meets weekly to review our Covid19 efforts.

Beyond the national standards, HPMM introduces several enhanced initiatives:

- On-site Face shield requirement to enable additional protection
- Greater than 1.8M enhanced physical distancing (Aligned with global HP protocols)
- RTK Rapid Test as the site entry requirement for early detection and isolation
  - Early detection from this will trigger a series of events (such as contact tracing, self-quarantine, and impacted area disinfection)
- On the People-front:
  - Staggered breaktime and segregated entry/exit time to manage the flow of employees and prevent overcrowding
  - Shift Isolation across each working shift crew to minimize the risk of cross operation shift exposure
  - Safe@work Safety Bubble zones out the various workplace and common areas. To separate teams and manage their routes to protect different segments, should there be a case within our midst
- Technology-assisted Enhancements:
  - Smart Tracking System (STS) was developed to speed up the process of temperature and attendance recording
  - Implemented Auto triggering RFID device was introduced to enhance physical distancing and supplement contact tracing efforts

In the effort of driving enforcement & compliance, we launched the Safe Work Ambassador Team (SWAT) program to reinforce safety measures for all employees who are working onsite during Movement Control Order. This team consists of appointed supervisors, assisted by dedicated outsource personnel. The SWAT team has the mandate to identify and encourage corrective actions amongst our workforce to comply with regulatory requirements on COVID-19 Health & Safety Preventive Control Measures. They led by example through their daily walkabouts and regular communication. Their reports are reviewed weekly at the site leadership meetings.

Processes enhancements can only get us so far, the adoption of a revamp mindset that seeks to "Protect, Detect, Contain and

Recovery" plays a crucial role towards making safety sustainable. We also seek to drive culture change by normalizing early reporting and an interdependent safety mindset.

SWAT & HPMM employees actively use STOP DataPro (SDP) application, a web-based data management tool to report safe and unsafe acts. This application captures and monitors any area for improvement and logs the frequency for corrective action plans. Managers can use the data to perform trend analysis and initiate improvement programs towards health, safety, and operational performance. The same tool also allows us to recognize teams or individuals who demonstrated a proactive safety mindset in quarterly all-employee meetings. That helps to reiterate that "Safety is everyone's responsibility", which is the mindset adjustment needed to drive interdependent Safety culture in the long run.

The team ensures timely communication on-site Covid19 protection initiatives, status, and progress of cases. Safety mindset adoption goes from our General Manager down to each level. At HPMM, we build in weekly safety awareness communications and Covid-19 protection sharing as our new routine and culture. Protection also goes beyond the workplace; we also take the safety of our employees and their families into consideration. We showed that by sending Family Care Packages (each packed with necessary PPEs and supplies) to each employee's home.

HP founders Dave Packard said, “The betterment of society is not a job to be left to a few. It’s a responsibility to be shared by all.” We believe that creating COVID safety awareness and care goes beyond our workplace and needs to be within our communities.

Throughout the period, HP Malaysia looked for ways to support the needs of the government, businesses, communities. To date, with the help of the HP Foundation and employee donations, we have distributed personal protective equipment (PPE), 3D printed face-mask adjusters and HP product donations.

As the country stays home, HP made sure that we roll out enhanced customer support capabilities, enabled remote working and learning initiatives, as well as gave customer and partner reliefs. These efforts are focused on supporting the Malaysian government bodies, businesses, and communities to not just adapt but to thrive in this new normal.

The HP Foundation has also contributed RM2.17million (USD 500,000) to Mercy Malaysia’s Covid-19 Strategic Preparedness and Response Plan. The donation was primarily used to pilot targeted mass Covid-19 testing programs in support of the Healthy Ministry and the National Crisis Preparedness and Response Centre (CPRC). During the lockdown, HP Malaysia launched the #iMovewithHP campaign, a social initiative in collaboration with Teach for Malaysia (TFM). The campaign was aimed at helping students who lacked access to technology continue their education during the MCO periods.

Most recently, HPMM also involved along with the industry companies at Batu Kawan Penang in organizing the PIKAS (Public-Private Partnership Covid-19 Industry Immunisation Programme) vaccination program, partnering together with MITI (Ministry of International Trade & Industry) to accelerate immunization of the community.

At HP, meaningful innovation never stops. HPMM is working with the global team on possible options to model and predict the risks of Covid-19 exposure. Here is a sneak peek of what we are piloting:

- Wastewater testing as a possible detection gate, data collection, and modelling through the correlation with Covid-19 virus presence in wastewater against Covid-19 Rapid test results
- Artificial intelligence model to detect asymptomatic Covid-19 infections through cell phone-recorded coughs (research undertaken by Massachusetts Institute of Technology (MIT) in the US).

The Covid-19 situation remains uncertain, and we are all navigating through it the best way we can. At HPMM, we are immensely proud of the resilience, flexibility, and professionalism of our employees, who have stayed focus on delivering and keeping everyone safe. That's why we are glad to have this avenue to share our Safety Framework to inspire others to keep 'Protection' as a priority, so safety goes beyond our operations to every family, community, and company.

Women Engineers Conference 2022 "Building the Future, WE Lead"

Date: 4th March 2022

Reported by: IEM Penang Women Engineers Publication

Bouquet presentation and photo session with Ir. Heng Lee Sun, Ms. Angeline Goh, Prof. Datuk Ir. Ts. Dr. Siti Hamisah, Ir. Yau Ann Nian, Ir. Ong Ching Loon, YB. Dato' Ir. Hj. Ahmad Zakiyuddin, YB. Chong Eng, Ir. Bernard Lim, Dato' Ir. Dr. Goh Teik Cheong, Ms. Ong Bee Leng and Ir. Catherine Sim. (from right to left)

The morning session's speakers Professor Datuk Ir. Ts. Dr. Siti Hamisah binti Tapsir (fourth from left), Dato' Ir. Dr. Goh Teik Cheong (fifth from left) and Professor Ir. Dr. Taksiah A. Majid (sixth from left) together with committee members of IEM Penang Branch.

In conjunction with the celebration of International Women's Day on 8th March 2022, The Institution of Engineers Malaysia (IEM), Penang branch Women Engineers Section has successfully organised the first Women Engineers Conference 2022 under the theme "Building the Future, WE Lead" on 4th March 2022 at Bayview Hotel Georgetown Penang. The conference was well attended by 82 participants (IEM members and non IEM members), 7 invited speakers from various engineering background, experience and expertise, 46 sponsors and 33 voluntary working crew from IEM Penang Women Engineers Section and Young Engineers Section. We greatly appreciated the time, attendance, effort and support given by all our VVIP guests, committee members, sponsors, speakers, working crews and participants making this conference a great success. We were deeply honoured with the presence of Yang Berhormat Chong Eng, Ir. Ong Ching Loon and Ir. Yau Ann Nian as the VVIP guests for this conference.

The conference commenced with the opening speech by our guest of honour, Penang Deputy Chief Minister 1, YB. Dato' Ir. Hj. Ahmad Zakiyuddin bin Abdul Rahman. The keynote speakers were Professor Datuk Ir. Ts. Dr. Siti Hamisah binti Tapsir, Dato' Ir. Dr. Goh Teik Cheong and Ms. Ong Bee Leng.

The first keynote speaker Professor Datuk Ir. Ts. Dr. Siti Hamisah binti Tapsir talked on "Transforming the Engagement: The Future Feminism". Dato' Ir. Dr. Goh Teik Cheong, the second keynote speaker, spoke on Women Engineers' Leadership in the Construction Industry, and it was followed by Ms. Ong Bee Leng shared on Women Empowerment in Science, Technology, Engineering and Maths (STEM).

The invited speakers Ms. Ong Bee Leng, Ts. Regine Choo Hooi Chin, Dr. Thong Sze Yee, Ms. Angeline Goh Pei Leng and Ms. Selina Tan Wei Syan presented during afternoon interactive session with the participants. (from right to left)

Besides, there were four women speakers invited to this conference to share their engineering knowledge and experience on the topics as below:

1. Professor Ir. Dr. Taksiah A. Majid
   Topic: Wind Loads on Structures: Research Work by Disaster Research Nexus (DRN)
2. Dr. Thong Sze Yee
   Topic: Women Engineers Leadership in Corporate Ladder
3. Ts. Regine Choo Hooi Chin
   Topic: Accelerating Business Decarbonisation with Clean Energy & Artificial Intelligent
4. Ms. Angeline Goh Pei Leng
   Topic: Single Ply Waterproofing Roof System & Rain Water Harvesting System

The conference interactive session with the participants was conducted in each session after the sharing given by speakers. During the interactive session, our invited speakers shared their views and experience on dealing with gender equality in the engineering sector and challenges that women encountered in their course of careers in science, technology, engineering and maths. Creating platforms for women empowerment to narrow the gender gap between men and women in careers was discussed.

The conference ended with a round of applause by all the participants with a presentation of tokens of appreciation to all the keynote speakers, invited speakers, Diamond Sponsor, Emerald Sponsor and Ruby Sponsors by IEM Penang Branch.

A lot of significant achievements and lessons were learned by Women Engineers and Young Engineers from organising and conducting this conference. It is straightforward to the audience and speakers with minimal confusion and systematic attendance system through Google Forms. The time schedule was well managed in good time during the conference. All Members ready for adaptation to situational changes and incorporation of comments from different parties to adopt the best idea. Lastly, we appreciate all the Great teamwork and leadership carried throughout with commitments from all members. Thank you for making our conference an excellent organised Conference.

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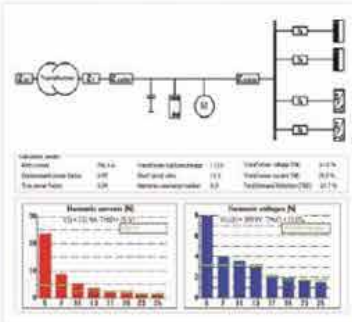

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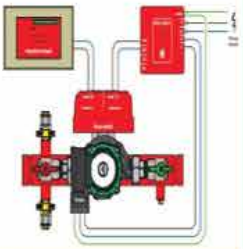

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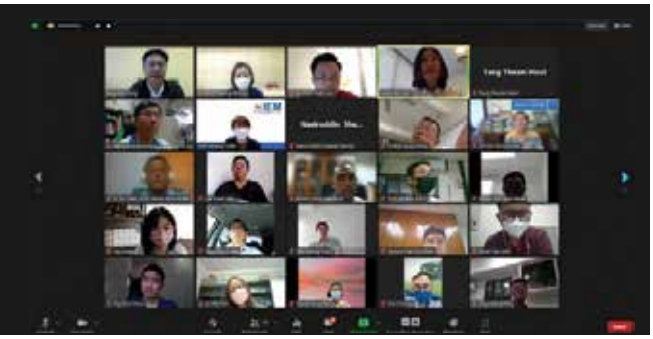
A Full Day Webinar

A simple explainer to the IEM Form of Contract for Civil Engineering Works (CE 2011)

Date: 13th April 2022

Reported by: IEM Penang Women Engineers Publication

Speaker Ir. Ang Kok Keng, Moderator Ir. Catherine Sim Siew Ping



Part of the group photos prior to the end of the full day webinar

The Women Engineers Section of The Institution of Engineers Malaysia (IEM) Penang Branch organised a full day webinar "A simple explainer to the IEM Form of Contract for Civil Engineering Works (CE2011)" on 13th April 2022. The invited speaker for the full day webinar was Ir. Ang Kok Keng and the moderator for the day was our Ir. Catherine Sim Siew Ping.

Understanding of the clauses in IEM CE 2011 is essential for the contracting parties who enter into any construction contract as it is a vital part of the construction contract which confirms and specifies the contractual rights and obligations of all the parties entering into the contract. Unwarranted disputes could be avoided if all the parties understand their respective duties, rights and obligations expressly stipulated in IEM CE 2011.

Ir. Ang Kok Keng is the panel of Arbitrator in Asian International Arbitration Centre (AIAC) & THAC, Adjudicator in AIAC, Mediator in Malaysian Mediation Centre and Expert Determiner in The Academy of Experts (TAE), Fellow of CIARB & MIARB and member of IEM, MSADJ, SCL Malaysia and TAE (Practising Associate).

During the webinar, Ir. Ang Kok Keng categorised the clauses in the IEM 2011 into six parts as below and explained the clauses and provided all participants greater understanding of the IEM CE2011 by sharing his experience in some of the contractual scenarios.

Part 1: roles and responsibilities of the contracting parties (engineer, contractor and employer), contract document, performance security, tender, insurances.

Part 2: patent rights, contractual matters on site, suspension, liquidated damages, certificate of completion, defects liability, remeasurement.

Part 3: site management, administration, drawings and submissions, site safety, environment, quality, site technical issues.

Part 4: variation orders and payment certifications.

Part 5: time and cost matters which related to extension of time and delay events, additional cost events, date for completion, procedures for claim.

Part 6: termination clauses.

Total of 148 participants have greatly benefited from the knowledge and experience sharing from Ir. Ang Kok Keng on the IEM CE 2011.

Token of appreciation from IEM Penang Branch, and notes of appreciation from the participants to our Speaker Ir. Ang Kok Keng

Visit to Silver Jubilee Home: Goods Donation & Grass Cutting

Date: 28th May 2022

Venue: Silver Jubilee Home, Sg Dua

by **Ts. Sim Kai Sheng**

IEM Penang Branch, represented by Ir. Bernard Lim Kee Weng (forth from left) donated urgently needed items to Silver Jubilee Homes, Penang

Before, during and after Grass Cutting Acitivity by IEM Penang Branch Volunteers at Silver Jubilee Home

Covid-19 has rendered some of the old folks home helpless because they were not able to open for public campaigns and visitations in consideration of the lower immunity of the old against the virus. Nonetheless, with good wills from all, various supports can always still reach the people who are in need.

In the morning of 28th May 2022, IEM YES Penang organised a trip to purchase and replenish critically needed items for Silver Jubilee Homes, Sungai Dua. Even though the session coincided with the "Careers in Engineering" program, an IEM Penang STEM's online talk for secondary students, Ir. Bernard, IEM Penang Branch Chairman still took the initiative to come early to support this meaningful CSR activity. Besides offering goods which include cooking oils, diapers, gloves, antiseptic liquids and soap powders to the home, the team also stayed back to clear up the long grasses around the home's compound, which brought pests and untidiness to the old people. The Event Photos 4, 5 and 6 below shows the conditions before, during, and after the grass cutting activities carried out by volunteers from IEM YES Penang, respectively.

For the safety of the old people, the team abstain from visiting the old people in person, and has ensured that all volunteers were tested negative with a saliva RTK test prior to attending. Silver Jubilee Homes expressed their utmost gratitude to IEM Penang Branch for all forms of supports rendered, while IEM Penang has also been grateful to be given this opportunity to serve.

Beach Cleaning at Pantai Bayan Mutiara

(in Conjunction with Earth Day 2022)

Date: 23rd April 2022

Venue: Pantai Bayan Mutiara

In view of the good responses of the Beach Cleanup 1.0 by IEM Penang on 20th March 2022, and in conjunction with the Earth Day 2022 which fell on 22nd April 2022, IEM YES Penang Branch organised a second Community Beach Cleanup at Bayan Mutiara Beach, on 23rd April 2022. This time, we joined effort with WE section and called for the public to welcome all families, friends, and organisations from the public to join our efforts. E-Certificates were designed and provided as a recognition to the efforts of 37 participants who volunteered in the Saturday morning. The event was officiated by IEM Penang Branch Chairman, Ir. Bernard Lim at 7:30am before everybody sprang into action. As a result of the concerted efforts from the large group of people, the team took just half an hour to clean up all thrashes from the beach, grabbed their refreshments and was dismissed just before a heavy downpour at 8:15am. One of the most exciting part of the beach cleaning must have been the drone footage sponsored by Ir. Tan Yan Moy to capture every bit of our memories.

Beach Cleaning in Action

Drone Shot of Beach Cleaning in Action in March 2022

STEM sub-committee report:
IEM Series of STEM Talks

Ir. Dr. JG Khor

Ts. Sim Kai Sheng

The field of science, technology, engineering and mathematics, commonly referred to as STEM, has been a driving factor for the world economy in recent times. Companies such as Google, Facebook (or Meta), Amazon, Tesla and the likes have used science and technologies to revolutionize the way we live, from the way we get information to the way we connect with friends to the way we shop, and so on. Not many people today will disagree with the opinion that STEM has, and will continue, to make an immense impact to the world as we know today. Yet, when we look specifically into STEM education in Malaysia, we see a growing lack of interest by the younger generation - a concern that has been repeatedly highlighted by our government[1,2]. It is along this vein that IEM Penang Branch has set up a STEM sub-committee to work on activities that can help revive the interest in STEM among students. The sub-committee is open to all members who are interested in volunteering their time to the community and the younger generation. Among the various activities conducted by the sub-committee is a series of STEM-themed virtual talks for secondary school students.

The virtual sessions were conducted on a monthly basis from February to May 2022 by well-respected engineering practitioners from both industry and academia as shown in Figure 1. To keep the sessions more interactive and interesting, each of the sessions concluded with a virtual quiz using the Kahoot platform, whereby top scorers of the quiz win various prizes. The sessions received very good response, with participation of about 80 students per session. Although majority of the participants came from the area of Timur Laut (Pejabat Pendidikan Daerah Timur Laut), the sessions attracted participants from all the five areas (daerah) in Pulau Pinang (Figure 2). As such, the program met the requirements to receive recognition as a state-level event by the State Education Department. This recognition is valued by the schools and students as part of their co-curriculum education.

Figure 1: Speakers of the series of talks.

February 2022. "Introduction to Engineering" by Ir. Catherine Sim, IEM Penang Branch.
This talk introduced the students to careers in engineering in general, covering the different engineering disciplines such as Civil, Mechanical, Electrical and Chemical engineering. Ir. Sim, herself an accomplished Civil Engineer, provided a useful insight into the life of an engineer, and the exciting opportunities in the engineering and technology industry. She also shared with the participants well-known engineering achievements from around the world, including the Petronas Twin Tower, as well as inspiring leaders in engineering and technology.

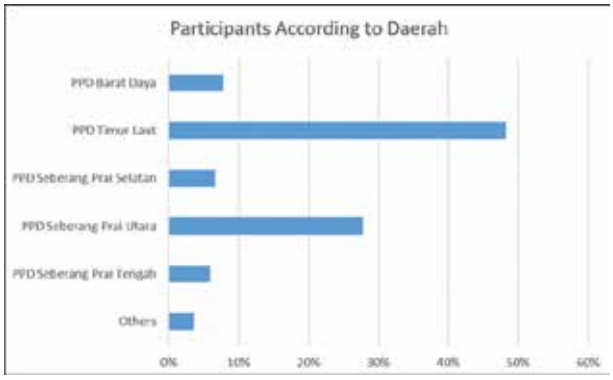


Figure 2: Participants (by percentage) according to area (daerah).

March 2022. "Introduction to Engineering: Academia" by Assoc. Prof. Dr. P. Susthitha Menon, UKM.
This session focused on the academic aspects of engineering education as well as careers in academia. Dr Susthitha covered topics such as 'skills of an engineer' as well as various study options leading to a career in engineering. Students found her talk particularly useful, especially for those who are thinking about their options after SPM or O-levels. Her talk generate a lot of questions from the participants, resulting in an extended Q&A session.

April 2022. "Women in Engineering: Manufacturing" by Ms. Tan Suan Kee, Plexus Manufacturing.
With the manufacturing industry being a major economic driver in Penang, Ms. Tan - a Department Manager in one of the multi-national manufacturing company at Bayan Lepas - duly delivered a talk on electronics manufacturing. Although entitled 'Women in Engineering', Ms. Tan spent a significant amount of time in the talk to explain about the electronics manufacturing industry, a topic that greatly benefited both the girls and boys alike. She then shared inspiring examples of female technical leaders in her field as well as tips for aspiring female engineers – some of which are applicable to both genders.

[1] Bernama. "Interest in STEM education remains big issue to achieve developed nation status, says Mustapa." The Edge Markets, 23 Mar 2022.
[2] Bernama. "Malaysia needs to increase percentage of students in STEM - Dr Adham." New Straits Times, 9 Oct 2021.

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Greenwish Garden at Batu Maung, Penang

Upcoming Project in Paya Terubong, Penang

Apartment at Air Itam, Penang

Green Syntheses of Calcium Precursor derived from biowastes

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School of Materials & Mineral Resources Engineering, Universiti Sains Malaysia

Understanding The Potential Use of Biowaste

Rapid growth in the animal agriculture and food industries has resulted in large scale production of waste. The inedible biowastes or by-products such as animal bones, seafood shells and eggshells are generated from the slaughterhouse, catering, baking, and food processing industries. These biowastes are categorized as having no economic value, therefore, have been discarded directly into the landfill without fully utilizing them [1]. Irresponsible disposal of the waste could lead to numerous undesirable environmental consequences such as the spreading of risk pathogens, emission of noxious odours and the tendency to leach pollutants into the environment. Driven by these environmental and economic impacts, massive research attention has been focusing on transforming the biowastes into functional wealth materials in providing effective approaches for waste management [2].

As an engineer, we are not only responsible to design and inventing new technologies, processes, and products, but have to always consider sustainable development in every aspect. In applying a sustainable development approach, wastes should be recycled, reused and whenever possible converted towards wealth products. The main aims are to obtain value-added products while achieving zero waste standards as well as to preserve the environment that we borrowed from our future generation [2, 5].

One smart approach that adds great value to the animal bones, seafood shells and eggshells waste is to use them as precursors or raw materials in making new biomaterial products. For instance, these biowastes have a big potential to be transformed into a cheap and safe source of calcium, which is the main precursor in making artificial bone material.

Figure 1: Transforming animal agriculture and food industries waste into calcium source

Human Bone

Bone defect resulting from disease, road accidents, sports injuries and ageing is considered as one of the major public health problems. Traditionally bone defect is treated using autograft (using a patient's own bone), allograft (bone from a donor) and xenograft (bone from mammals). However, the need for additional surgical intervention, limited tissue availability, pain at the donor site and a high risk of disease transmission has become the key drawbacks of using these treatments. There is a critical clinical demand for synthetic biomaterials for Bone Tissue Engineering (BTE) applications and it is increasing tremendously due to the rise in bone trauma and cancer cases as well as aging population. The newly develop biomaterial must be non-toxic, chemically similar to the composition of native human bone and provide sufficient mechanical strength in supporting new bone formation [2-4].

Relevancies of using Ca-based bioceramics in BTE

Among various biomaterials, calcium-based materials namely the calcium phosphate (CaP) and calcium silicate (CaSi) families are the most used in making bone material. This is due to their chemical similarity to the composition of human bone which mainly consists of calcium and phosphate, with the presence of minor elements such as silicate, carbonate, magnesium, strontium, cobalt, zinc etc. Therefore, transforming calcium-rich waste such as animal bones, seafood shells or eggshells into a novel calcium source is expected to have a great value in BTE applications.

Hydroxyapatite (HA) with a chemical formula of $Ca_{10}(PO_4)_6(OH)_2$, is one of the CaP ceramics which has been widely used as bone material in the forms of dense/ porous bone substitute, implant coating and injectable cement in the clinical. Since the early 1980s, HA has been considered as the material of choice for the development of bone substitutes to repair bone fractures and other defects due to its good bioactivity, osteoconductivity, and biocompatibility with the human bone tissue. However, the chemical composition of our natural bone differs slightly from the chemically formulated HA as this stoichiometric HA is lacking some of the important minor elements found in bone. Besides HA, akermanite ceramic has been recently discovered as a potential candidate for bone material. Akermanite ($Ca_2MgSi_2O_7$) is a ceramic that contains calcium (Ca), magnesium (Mg), and silicon (Si) ions that have shown excellent bioactivity with good mechanical strength as compared to HA. Mostly, these bioceramics are being synthesized using commercial grade chemicals. Presently, several studies have suggested that the recycling of chicken eggshells is a way of improving the ecosphere. It is found that about 94% of the composition of an eggshell is mainly calcium carbonate or also known as calcite [2]. For the past few decades, Ca-based biomaterials have also been produced from cockleshell waste as it contains about 98% of calcite. This major inorganic substance makes it an essential material to produce Ca-based bone material.

Methods of Producing Calcium Source from Biowaste as Precursor for HA and Akermanite

Several synthesis methods can be applied in producing HA and Akermanite ceramics. A similar method can be used by simply changing the precursors to be reacted with the calcium source obtained from the biowaste. For instance, phosphoric acid

(H_3PO_4) or ammonium phosphate $(NH_4)_3PO_4$is the most used phosphate source in making Hydroxyapatite (HA) ceramics. While magnesium oxide (MgO) and silicon dioxide (SiO_2) are required in preparing Akermanite ceramics.

Despite the synthesis method chosen, the wastes collected must be properly washed, cleaned, and dried. This is then followed by crushing and milling to reduce the particle size. It is important to process these wastes into finer particles prior to the synthesis of HA or akermanite. The smaller the size of the particle, the larger the surface area, resulting in a better reaction between the precursors used.

Solid-state reaction is a relatively simple method that has been prevalently employed for the large-scale production of HA from eggshell waste. In general, the solid-state reaction involves milling of both calcium and phosphate precursors into a homogenous mixture and further undergoing a sintering procedure (firing) at an elevated temperature (≥ 900°C) to yield HA.

Hydrothermal technique is another method for the synthesis of HA from natural resources. This process involves a chemical reaction between calcium and phosphate precursors in an aqueous solution under elevated pressure and temperature. Through the effect of condensation and an increase in reactivity under high temperature and pressure conditions, the hydrothermal method can effectively increase the crystallinity of the products and favorably lead to the formation of HA as the main phase.

$CaCO_3 \rightarrow CaO + CO_2$
$2CaO + H_3PO_4 \rightarrow CaHPO_4 + Ca(OH)_2$
$5CaHPO_4 + 5Ca(OH)_2 + H_3PO_4 \rightarrow Ca_{10}(PO_4)_6(OH)_2$

Recently, our group have also used chicken eggshells in making Akermanite ceramics using high energy planetary milling. Similarly, the biowaste was washed, dried and ground followed by calcination to convert the calcium carbonate ($CaCO_3$) which is the main component in the cockleshell to white fine powders of calcium oxide (CaO). In this case, calcination is needed to transform the $CaCO_3$ into CaO to initiate the synthesis of akermanite. The synthesis process was suggested to start with an oxide compound instead of in the form of carbonate to reduce the amount of carbon released during sintering. This is important to minimize the formation of cracks in the sintered ceramics. In ceramic processing, calcination refers to the general class of thermal processes used to synthesize or prepare a ceramic powder before it is dispersed in a liquid, formed into a shape, and densified by sintering. The main aim of calcination is to thermally decompose sparingly soluble metal oxide precursors (e.g. metal carbonates, hydroxides, and oxalates) which is normally performed at a low temperature (500-900ºC). In our previous study, two calcium precursors which are the wastes of chicken eggshell and ostrich eggshell were investigated. Although ostrich eggshell waste is not as common as chicken eggshells, the size of an ostrich egg is about 20-25 times bigger than a chicken egg, meaning more calcium source can be obtained from just a single egg. Interestingly, akermanite synthesized with ostrich eggshell has greater properties in terms of densification and mechanical strength as compared to akermanite synthesized with chicken eggshell. This might be due to the smaller grain size found in akermanite synthesized with ostrich eggshells.

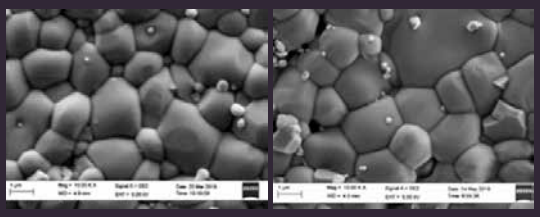

Figure 2: Surface morphology of dense Akermanite prepared using ostrich (left) and chicken (right)eggshells biowaste

For the past few decades, calcium-based biomaterials have been produced from seafood biowaste e.g. cockleshell. This is due to its chemical composition, which is rich in calcium. Besides cockleshells, researchers have also converted rice husks obtained from the paddy and rice industry into silicon dioxide or silica sources. Rice is a staple food for Malaysia and a defining feature of our culture. Malaysians consume the grain daily either as cooked rice or indirectly in the form of rice flour.

The production of rice has increased over the years, meaning the waste generated also increased. This has driven many researchers to utilize this waste as a new and cheaper source of silica. Indirectly, this will also generate extra income for the paddy farmers by selling the waste instead of burning it. Dolomite, in contrast, is a naturally occurring mineral that can be found in sedimentary carbonate rocks. It can be used as a natural source of calcium (Ca^{2+}) and magnesium (Mg^{2+}) due to its low cost. In this study, we had reacted calcite with silicon dioxide (derived from rice husks) and magnesium oxide (obtained from dolomite) in a similar manner according to the following chemical reaction [4]:

$CaCO_3 \rightarrow CaO + CO_2$
$2CaO + MgO + 2SiO_2 \rightarrow Ca_2MgSi_2O_7$

From our study on Akermanite production using cockleshells, rice husks and dolomite waste, a highly densified Akermanite (~94%) was obtained by sintering at a temperature above 1200ºC. This sintered Akermanite also possess tensile strength (~9MPa) and flexural strength (~22MPa) values that fall in the range of human cancellous bone. This highlighted that the biowastes can be employed to be used as precursors in making Akermanite ceramics, particularly for BTE applications (i.e. non-load-bearing bone substitute) [2].

Alternatively, calcium-based biomaterials, particularly HA can be prepared by extracting the calcium and phosphate sources from natural sources, such as fish bones and bovine bones. There are a few methods of extracting HA from animal bones: thermal decomposition, sub-critical water process and alkaline hydrolysis. For instance, in forming HA from bovine bone, one should first boil the bones for about an hour for defatting and easier removal of macroscopic adhering impurities. Afterwards, the bones were washed and cleaned well with water to evacuate all of the attached meat, tendons, bone marrows, and other soft tissues. The bones were then immersed in acetone for two hours and washed with water for several times afterwards. The process was followed by drying the bovine bones to evaporate the absorbed water. The dried bovine bones were crushed into small pieces using mortar pestle and then milled into smaller particle sizes using rotary mill. The as-milled powders were then calcined at 700-1100ºC in the air atmosphere to produce organic free and crystalline natural HA.

Calcium sources derived from biowaste can also be obtained from medical waste. For instance, dental moulds, which is a

component used in making the model structures of dentures for patients with tooth defect, has the potential to be converted as a calcium source. This mould is calcium sulphate hemihydrate, $CaSO_4$. ½ H_2O (also known as Plaster-of-Paris, P.O.P) with some minor elements (e.g. Cr_3+, Sr_2+ etc.) added to provide certain properties to the mould. This calcium-rich mould is patient-specific and will be disposed of once the patient obtains his dentures. Dumping these wastes into the landfills can produce toxic and odorous hydrogen sulphide gas and leaching of toxic ions into the soil. Our group had successfully converted this waste into a novel calcium source [5]. This calcium source will be utilized as the main precursor in making dense/porous bone materials in the next stage of our investigation. The developed method of converting this mould waste can be adopted for other plaster moulds that are used in industries involved in manufacturing ceramic tableware and sanitaryware.

Conclusion & Future Trends

Biowaste derived from animal agriculture and food, medical and ceramic processing industries have multidisciplinary applications. "Reuse, recycle and repurpose of these waste materials" in developing a functional product, could help in avoiding dumping wastes and potentially reduce the impact of climate change. Together we can save our planet for a greener environment and healthy living for our future generation to enjoy.

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Ir. Cheah Chin Kool, PKT, Acting Director of Engineering Department, Majlis Bandaraya Pulau Pinang
Highlights on Engineering Plans Submission to MBPP, the Do's and Don'ts
Mohd Syukri bin Said, Acting Director of Engineering Department, Majlis Banderaya Seberang Perai
Highlights on Engineering Plans Submission to MBSP, the Do's and Don'ts
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8.30am	9.00am	Registration
9.00am	9.05am	Event Speech by Organising Chairlady, **Ir. Catherine Sim Siew Ping,** PJK
9.05am	9.10am	Welcoming Statement by IEM Penang Branch Chairman, **Ir. Bernard Lim Kee Weng,** PJM
9.10am	9.30am	Opening Speech by Penang State EXCO, **YB. Zairil Khir Johari**
9.30am	**9.45am**	Photo Session
9.45am	10.15am	MBPP: **Ir. Cheah Chin Kooi,** PKT - Highlights on *Engineering Plans Submission to MBPP, the Do's and Don'ts*
10.15am	10.45am	MBSP: **Mohd Syukri bin Said** - *Highlights on Engineering Plans Submission to MBSP, the Do's and Don'ts*
10.45am	11.15am	Tea Break 1
11.15am	12.00pm	**Ir. Yau Ann Nian,** DJN, PKT - *Penang Hill-site Development and Agricultural Land, Planning, Design, Stabilisation and Maintenance*
12.00pm	12.45pm	**Ir. Dr. Lee Sieng Kai** - *Wireless Network Automation (WiNA) System, Data Management & Visualisation Platform for Geotechnical & Structural Health Monitoring*
12.45pm	1.00pm	Q&A 1
1.00pm	1.15pm	Presentation of Certificates of Appreciation to Sponsors
1.15pm	2.00pm	Lunch Break
2.00pm	2.45pm	**Dr. Leong Kam Weng** - *Ground Improvement for Reclamation & Developments on Reclaimed Land*
2.45pm	3.30pm	**Ir. Dr. Goh Teik Lim** - *Earth Retaining or Stabilising Structures (ERSS) Works by Silent Piling Method using Advanced Steel Sheet Pile Materials*
3.30pm	3.45pm	Q&A 2
3.45pm	4.00pm	**Presentation of Certificates of Appreciation to Speakers**
4.00pm	4.30pm	Tea Break 2
4.30pm	5.15pm	**Ir. Dr. Wong Fook Keong** - *Case Study of Negative Skin Friction on piles in a Project and Evaluation of Pile Acceptance based on MLT Results*
5.15pm	5.30pm	Q&A 3

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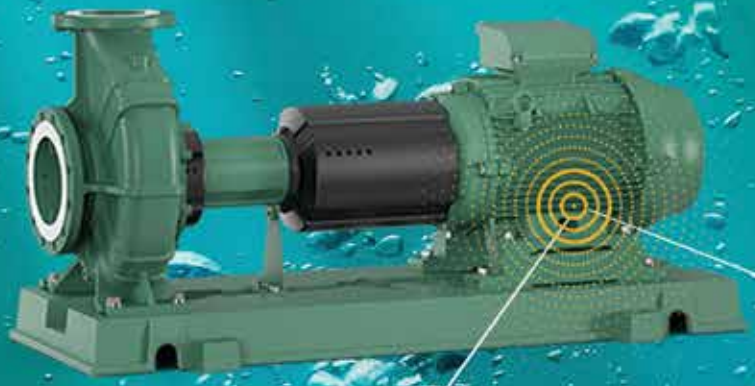

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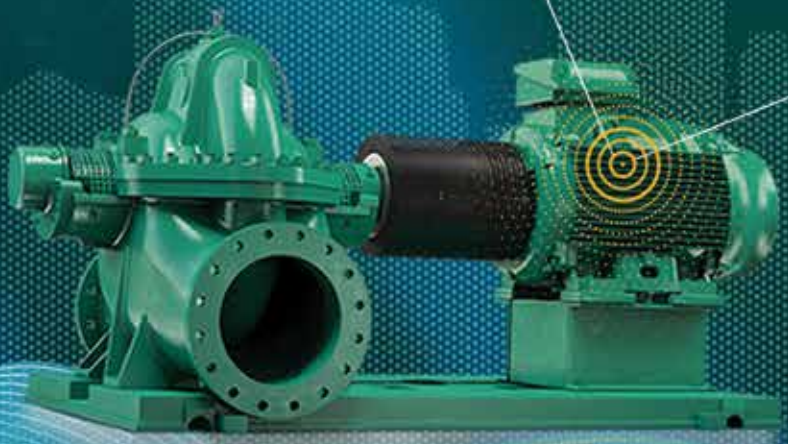

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