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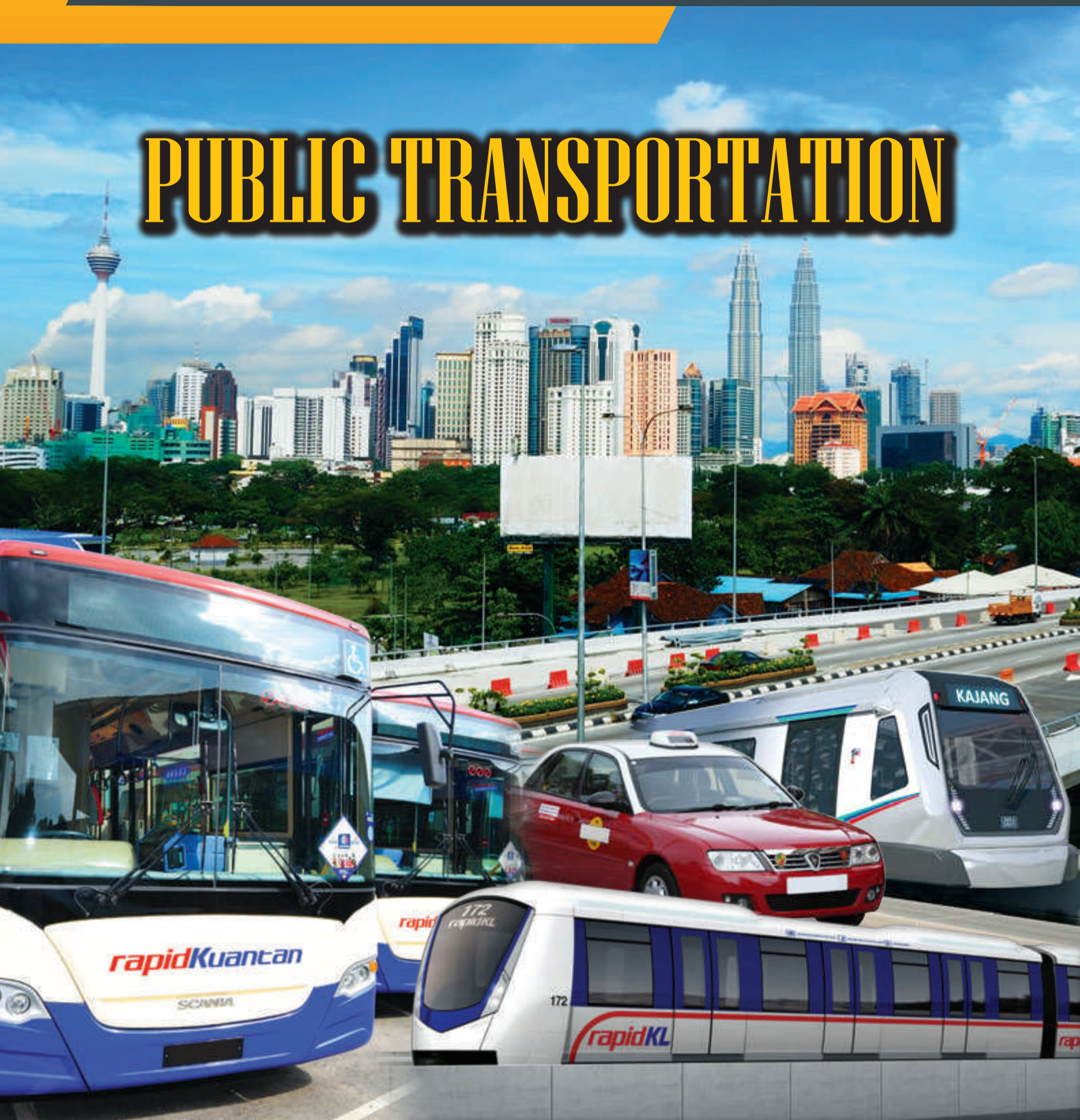

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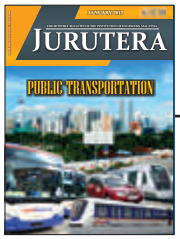

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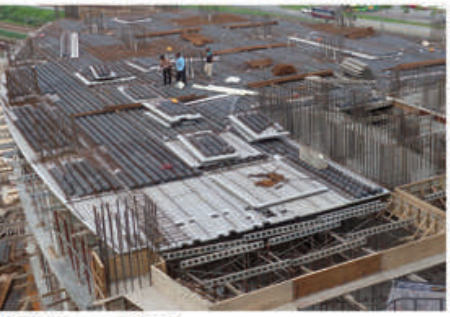



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Public Transport Improvements Must Meet People's Expectations

by Ir. Ong Guan Hock
Editorial Board Member

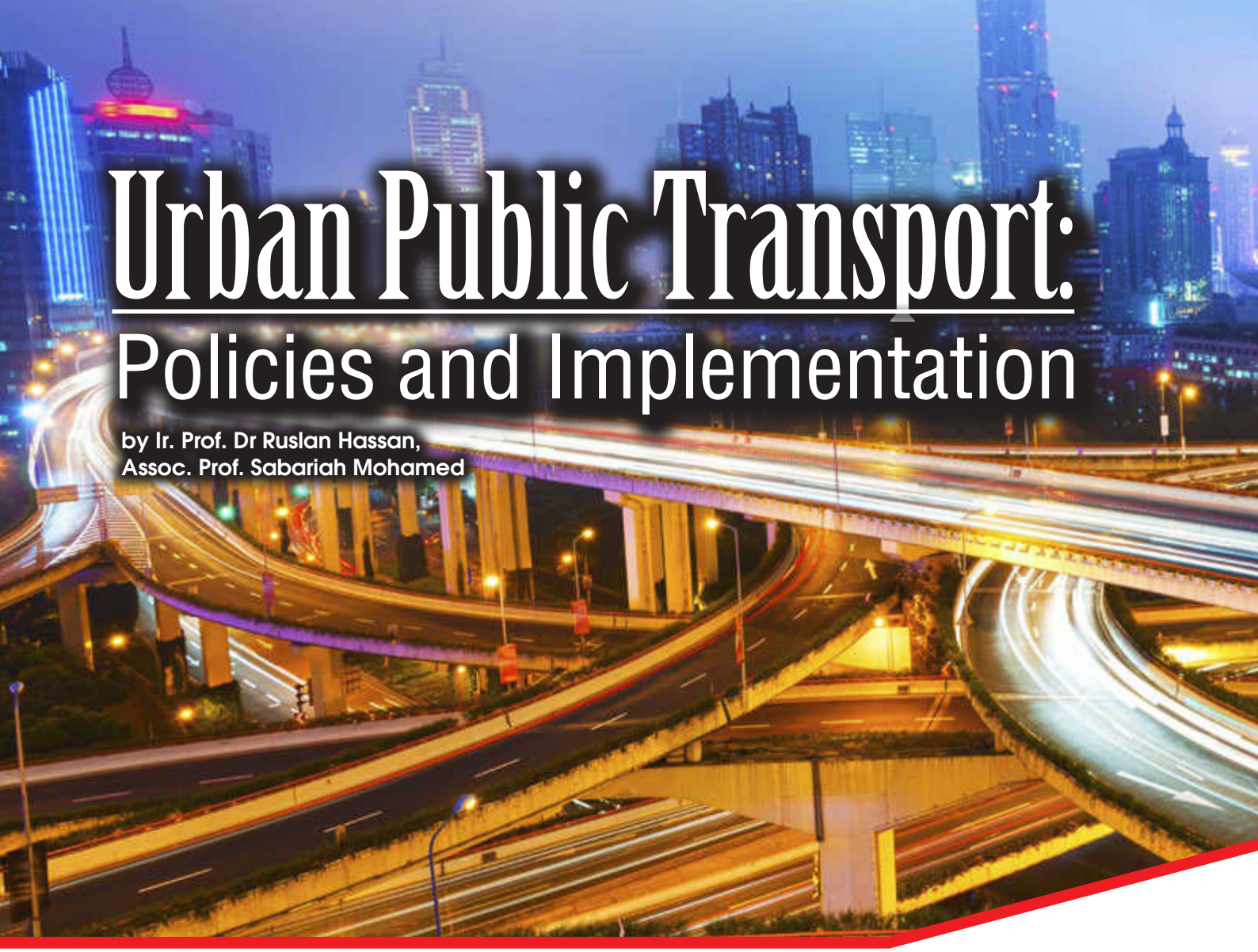
Improvements to the public transport infrastructure require a long lead time before the benefits can become apparent. In 2013, the Government, through SPAD, introduced the National Land Public Transport Master Plan which outlines inter alia the strategic requirements for the planning, development, implementation and integration of land-based public transportation systems within the country. The Master Plan requires all projects aimed at enhancing land public transport services to be properly coordinated and implemented.

A key objective of the Master Plan is to increase usage of public transportation in urban areas such that it accounts for 40% of all related travel undertaken, by 2030. For this to be achieved, the typical office worker must be convinced that it would be more convenient, economical, safe and comfortable to use public transport instead of driving to work. Use of private cars should also be discouraged for non-work related travel.

It is therefore imperative to ensure that buses/trains arrive punctually, with reasonable waiting times in between. Furthermore, there should be adequate feeder services and convenient parking available in order to access the modes of public transportation. Leaving the car at home goes a long way to reduce congestion of our roads as well as improve air quality.

Technology is continually evolving and, together with future changes to the international geo-political scene, one cannot rule out the possibility that public transport may, one day, be extended beyond local or regional boundaries to encompass land, water and air transport modes.

In future, it might just be possible to leave your home, walk to the nearest transportation hub, purchase a ticket and hop on to a passenger drone to take you to your next destination. ■



Urban Public Transport: Policies and Implementation

by Ir. Prof. Dr Ruslan Hassan,
Assoc. Prof. Sabariah Mohamed

People all around the world travel, whether it is on land, by sea or by air. Of these, land transport, naturally, plays the biggest role, both for leisure and commercial purposes. In the ancient world, people walked. Then the wheel was invented and bicycles, rickshaws and carriages became major forms of land transportation. Motor vehicles and trains followed.

Today, major towns and cities in Malaysia are choked with private vehicles. The more highways we build, the faster the increase in the number of private vehicles. Land Public Transport Commission or Suruhanjaya Pengangkutan Awam Darat (SPAD) chairman Tan Sri Syed Hamid Albar was reported to have said that "no country has ever climbed from low-income to middle- or high-income status without a significant and dynamic land public transport. Therefore, it is important for us now to give priority to public transport investment, rather than giving priority to building roads".

Indeed, our country is in desperate need of a good public transport system, one that takes into account the "network commute" of interconnecting trains, city light rail and buses.

At present, travel times for private vehicles have proved to be much faster than that for public transport, except where areas are well-served by rail, such as the LRT. Even buses have proved unreliable as sometimes drivers seem to show a complete disregard for timetable schedules.

With all these woes, it has become a "necessity" rather than a luxury for Malaysians to own a car although this can only mean that it is a matter of time before traffic congestion in our cities will rival those in critically vehicle-choked cities like Bangkok, Manila and Jakarta.

As for rail transport, the peninsula has the Keretapi Tanah Melayu Berhad (KTMB) railway (including commuter and Electric Train Service), light rapid transit (LRT and MRT), monorail, airport rail link and a funicular railway line. The first railway line in Malaya was built between Taiping and Port Weld. It was opened by Sir Hugh Low on 1 June, 1885. Soon it extended to link all the major towns and cities in the peninsula. KTM operates the West Coast Line between Singapore and Padang Besar, Perlis, on the Malaysian-Thai

border while the East Coast Line runs from Gemas in Negri Sembilan to Tumpat in Kelantan. In East Malaysia, only Sabah has a railway line.

A network of buses served passengers within towns and linked most major towns. These were the beginnings of the public transport system in the country. Light rail transport systems followed, especially in Kuala Lumpur and the latest advancement is the Klang Valley Mass Rapid Transit (MRT1) between Sg. Buloh and Kajang, which will be fully operational by July 2017.

The growth of the public transport system was gradual but it became exponential in the past decade, especially with the National Land Public Transport Master Plan (NLPTMP) which had planned to increase public transport usage to 40% in all urban areas.

It is not an easy task. The fragmentation of transport related agencies and institutional legacies have placed huge constraints along the way. The public transport system started as a private sector initiative and comprised mainly of buses. The passenger bus industry relied on the farebox revenue model and operating costs and investment returns were meant to come from passenger fares. Lucrative routes subsidised those that were less so. However, the route expansion could not keep pace with urbanisation because the newly developed areas were less populated and this meant fewer passengers. There was also an increase in car ownership but not in the number of bus passengers. Also, local authorities did not help matters as they did not offer priority in traffic and parking for buses.

There was also the fragmentation of agencies. The Commercial Licensing Board (CVLB) took over licensing functions and Department of Railways (DOR) took over rail based transport. These were on top of existing organisations and, at one point, there were 13 government agencies involved in public transport in some way or other.

In 2010, the planning and regulatory structure for public transport was streamlined with the formation of SPAD (under the Prime Minister's Department). However, although it covered the planning and licensing of bus routes, the approval of drivers, public service vehicle licences and buses were still under the purview of the Road Transport Department.

A similar situation existed in the rail sector with KTMB (owned by Ministry of Finance Inc.), DOR in the planning and regulatory role and Railway Assets Corporation (RAC), managing all assets and liabilities. Both DOR and RAC were placed under the Ministry of Transport. However, the Land Public Transport Act 2010, repealed the Railway Act and the role of DOR was transferred to SPAD. So KTMB reported to the Ministry of Finance while the planning and regulatory role was, through SPAD, under the Prime Minister's Department and the infrastructure development role remained with the Ministry of Transport through RAC.

ISSUES IN PUBLIC TRANSPORT (2)

a. Car Ownership: According to a World Bank Study published in June 2015, Malaysia had, in 2011, the highest rate of car ownership among middle income countries outside of Eastern Europe. Road Transport Department statistics showed that the number of private vehicles registered increased from 8.5 million (1997) to 22.7 million (2012). This was an annual growth rate of 6.7% although the population growth rate was only 2%. Car owners seldom, if ever, use public transport such as buses.

b. Town Planning: With the increase in population, the size of cities grow in tandem. For example, in Greater KL, the built-up area increased by 7.92%, as the population almost doubled to 5.97 million (1999) from 3.08 million (1990).

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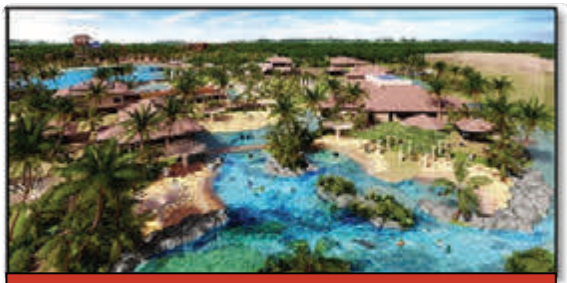

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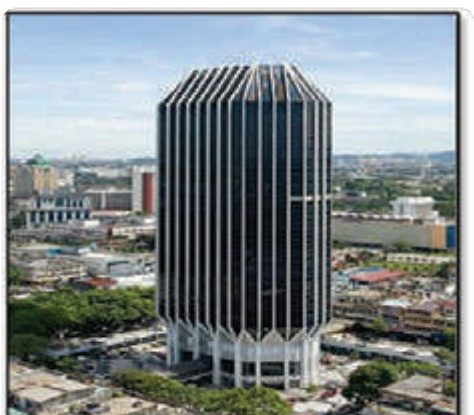

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Furthermore, urban density decreased as population increased, which meant lucrative routes were reduced further. For public transport to be viable, cities have to be compact and connected.

c. Coordination Between Public Transport Planning and Infrastruture: A good road network connects a point of origin to the destination effectively for buses. But ironically, it also encourages car ownership. Using one's own vehicle means greater mobility but there is also a limited capacity for having additional vehicles on the road. Roads in some urban centres, such as Greater Kuala Lumpur/Klang Valley region, are already at or near top capacity, resulting in frequent traffic jams which lead to a loss in productivity. There is a need to coordinate road planning and public transport. The Ministry of Works takes charge of road construction while SPAD is responsible for planning public transport. They also differ in term of need analysis. The Works Ministry looks at the L.O.S. (level of service) of roads for passenger cars while SPAD is more concerned with ridership effectiveness (passenger).

d. Connectivity and The Feeders: Time is what discourages potential bus passengers. For example, feeder buses may take a long time to reach one's destination. Then there is the matter of a long waiting time at the bus stations because there are not many buses operating the feeder routes. All these add up to extended travel time. The 2013 Greater KL Travel study showed that, for the same journey, it took 1.76 times longer to travel by urban rail than to use a private car during the morning peak period. This was generally due to the first-mile connectivity, namely from the home to the railway station. With terraced houses spread out in housing estates, feeder buses had to travel along meandering routes.

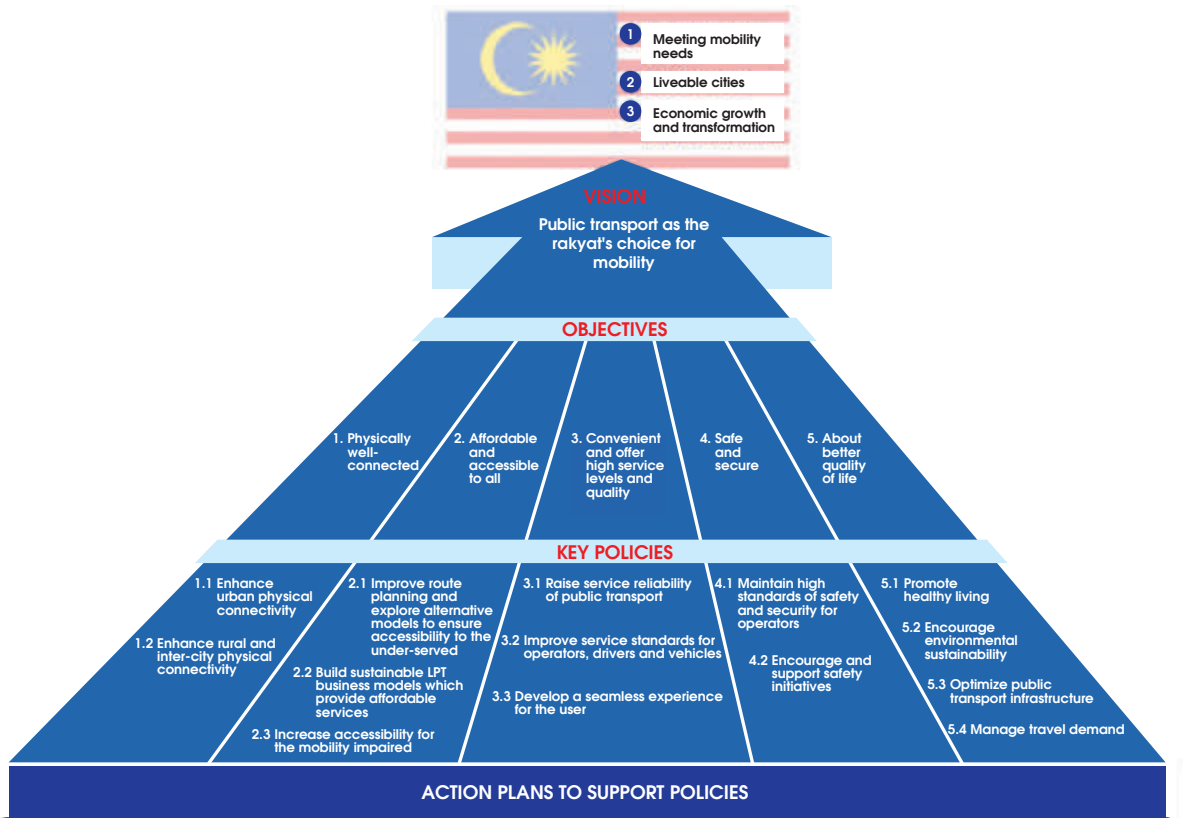
STRATEGIC OBJECTIVES AND POLICIES

In order for the public transport to become the choice for travel, there is a transformative agenda with a specific measurement objective of a 40 per cent increase in urban areas by 2030. In order to achieve this vision, public transport must undergo a transformative agenda in the coming years with the following objectives.

Table 1: Objectives for Land Public Transport

1.	Physically well-connected	People across the peninsula should be able to use public transport to get to wherever they need to go.
2.	Affordable and accessible	Malaysians of all income levels as well as the physically disabled should be able to take public transport.
3.	Convenient, with high quality service levels	Public transport must be efficient and reliable as well as offer commuters a pleasant journey experience.
4.	Safe and secure	Passengers should feel safe when taking public transport.
5.	Better quality of life	Public transport should enable Malaysians to enjoy a better lifestyle.

The key policies towards achieving the above objectives are shown in the figure (Objectives and Key Policies) below:



Objectives and Key Policies [1]

These include enhancing urban physical connectivity a well as rural and inter-city connectivity, improving route planning and exploring alternative models to ensure public transport assessibility to the people, ensuring the reliability of public transport by improving service standards where operators, drivers and vehicles are concerned, maintaining high standards of safety and security for both operators and commuters as well as encouraging an environment friendly lifestyle by having an optimal public transport infrastructure.

IMPLEMENTATION PLANS (1)

To enhance intercity connectivity, there must be proper planning for an inter-urban bus service and an expanded urban light rail network. Moving out of Greater Kuala Lumpur, the federal government should look into a new rail extension to the east coast of the peninsula, with enhanced infrastructure.

1. Electric Train Service

When KTMB introduced the high-speed ETS (Electric Train Service) in Malaysia, travelling by train became a lot faster. ETS is now operating along the West Coast Line from Padang Besar in the north to Gemas in the central south. The last leg to Johor Baru is expected to be completed in 2020.

2. Bus/Coach Service

There needs to be in place a land public transport plan to provide sustainable and affordable services. To this end, the federal government needs to look into fares policies, social needs and accessibility factors. Proper guidelines must be provided for accessible infrastructure measures and stricter

enforcement. A passenger charter must be drawn up and a study on customer feedback carried out. SPAD must ensure buses and coaches are well-maintained and that drivers and operators meet the strict criteria standards.

If we are to encourage people to use public transport, it is necessary to create a pleasant and seamless travel experience for users. This includes enhancing the stations for train and light rail systems, bus stops as well as providing passenger with up-to-the-minute information on arrivals and departures. An integrated smart ticketing system will also go a long way to make travel less stressful for passengers. Running frequent and on-schedule feeder bus services will encourage passengers to use public rail transport instead of private cars.

For the safety of passengers, strict enforcement must be practised to ensure operators maintain vehicles in road-worthy conditions as well as adopt green technologies in the bid for a more sustainable future.

In planning for the future, designs for new residential developments must also include a well-integrated public transport system.

CHALLENGES IN THE IMPLEMENTATION (GREATER KL/KLANG VALLEY) (3)

In the Kuala Lumpur Structure Plan 2020, public transport accounted for only 20% of the Kuala Lumpur passenger movements, compared to 80% for private transport. The wide responsibilities of SPAD limits the possibility to effectively formulate, implement and monitor transport policy in the Klang Valley. A metropolitan authority is needed to govern the area.

With the Transport Policy in place now, the creation of a micro-approach would provide the framework for streamlining the implementation process. There should be better coordination to follow through between policy formulation and policy imlementation, especially to guide the development of the micro framework from the federal level to local level.

Each agency should be clear on what it is responsible for. The availability of legal empowerment to make overarching decisions will facilitate the implementation of the policy. The planning system in our country is such that policies are formulated at federal level while the local level is only for policy implementation without interpreting the cultural values between agencies or level of government.

With the exception of Kuala Lumpur City Hall, the lack of financial and human resources is also a problem for local governments. The centralisation of administrative and financial power has limited the autonomy of local governments in the Klang Valley. There is also the difficulty on the understanding of sustainable transport at the local level. The overriding pressures to achieve economic goals at the expense of social and environmental objectives seem to be the order of the day.

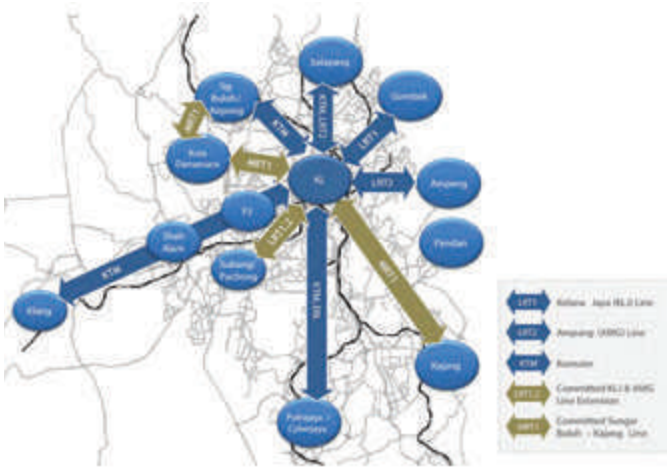
The key to improving the coordination and integration of plans and efforts in the Klang Valley is to strengthen institutional arrangements for planning and implementation. Implementing transport policy requires, among other things, a supportive organisational structure. An area wide strategy can then be imposed with a clear line of leadership and empowerment.

CONCLUSION

The National Land Public Transport Master Plan has aimed for 40% public transport use in all urban areas by 2030. The decision makers have decided to accept the case for rail-based public transport since the higher the demand for public transport, the lower the unit costs. In the Greater Kuala Lumpur region, the committed investment is over RM70 billion.

People-centric mobility requires will-power and tremendous efforts. There must be in place strong transport infrastructure and investment policies. It is no walk in the park and it will take time and the committed effort of the federal government and all agencies concerned to realise our dream of a decent, reliable public transport system for both cities and the whole country.

The lessons we will learn from our infrastructure development will also enrich the skills of local engineers.



Primary Corridors: Greater Kuala Lumpur/Klang Valley [1]

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We do not have to look far for examples of excellent public transportation systems. Take Singapore and Hong Kong. There is minimal traffic in the city-state of Singapore which has high quality public transportation, with its Mass Rapid Transit (MRT) system, Light Rapid Transit (LRT) system and buses. It also uses new audiovisual technology for public safety and live navigation technology for more efficient bus routes. Hong Kong too has an efficient public transport system comprising railways, coach buses, public light buses, ferries and trams. There are other countries with good infrastructure that we can learn from too, such as Japan and South Korea.

Hopefully, someday we will have a public transportation system so efficient that we will think twice before we reach for the car keys. ■

BIBLIOGRAPHY

[1] National Land Public Transport Master Plan (SPAD), p.107, 2016.

[2] Speech, SPAD Chairman, 22 April, 2016.

[3] Noriza R. A & K.Z. Rustam, The Challenges of Implementing Urban Transport Policy in the Klang Valley, Malaysia, Procedia Environmental Sciences 17 (2013) 469-477.

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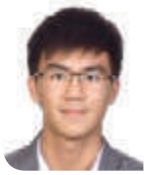
Pipe Roofing Installation by Micro Tunneling Method



Mr. Ivan Leong

ABSTRACT

This article described the process of installing the pipe roofing structure for Maluri underground KVMRT station Entrance A. The pipe roof was constructed using 780mm diameter steel pipes of 10mm thickness, installed via pipe jacking method using a Micro Tunnel Boring Machine (MTBM). The use of a separation plant for slurry treatment was suitable, given the site conditions and greatly improved productivity of the pipe jacking machine in the silty ground condition. The journal described why a pipe roof structure was needed and how it was constructed. The various safety measures and precautions taken were also covered herewith.

The southern most KVMRT underground station, Maluri Station, is located under busy Jalan Cheras. It has 4 entrances: Entrance A to cater to customers going to Aeon Maluri, Entrance B leading to the housing estate, Entrance C to allow for passenger connection between the KVMRT line and the existing Ampang STAR line and Entrance D for the park and ride service located adjacent to the station.

Of all the entrances, the construction of Entrance A posed the greatest challenge. This was due to the existence of utilities buried under that section of Jalan Cheras between Entrance A and the Maluri station box. These included telco lines, a 600mm SYABAS water pipe, and most importantly, 275 kV Tenaga Nasional Berhad (TNB) high voltage electrical cables. The electrical cables served as the main source of supply to the Bukit Bintang region.

Due to these constraints, a different construction approach was required, one that would not affect the utilities and the live traffic during the construction of the adit tunnel for Entrance A.

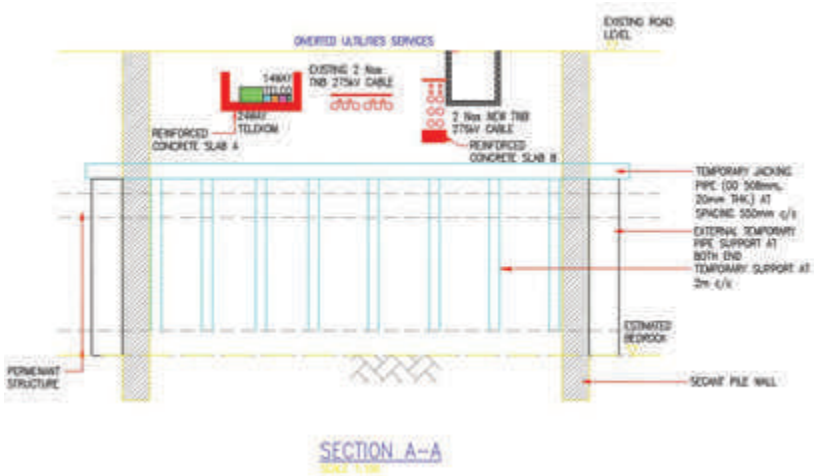


Figure 1: Cross-sectional view of pipe roofing structure

METHOD

Given the complexity of the required works, a special technique was needed to provide the fastest and safest solution. A series of pipes installed next to one another to form a pre-support structure, called a pipe roof, was applied at site. The pipe roof structure was designed using 17 steel pipes of 780mm outer diameter with 10mm wall thickness. The completed length of each pipe would be 17.5m long, with 13m of the pipe underground and the remainder protruding equally at both ends. Eleven metres of tunnelling were required for one pipe installation. Due to the size of the jacking frame, 6m-long steel pipes were used. To complete one installation, three 6m-long steel pipes were required.

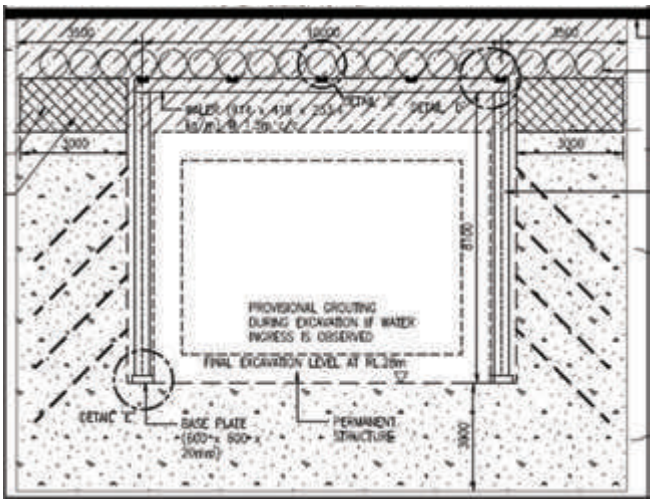


Figure 2: Tunnel adit structure under installed pipe roof

The pipe roofing structure would provide a safe working environment for the excavation to be carried out underneath it. In addition to the installed pipes, permeation grouting was carried out between the installed pipes to further consolidate the ground and reduce water seepage during excavation.

MINING EQUIPMENT

To install the 780mm diameter steel pipes, a Herrenknecht AVN500XC pipe jacking machine was used. The pipe jacking machine, coupled with an extension kit, had an external diameter of 800mm. Attached to the front of the pipe jacking machine was a rock cutting head of 826mm in diameter to allow for overcut. This clearance allowed the machine to steer and correct its alignment throughout the drive. The tolerance of the alignment was capped at 25mm in each direction, reducing the chance of pipe damage. A launch and retrieval shaft had to be constructed to facilitate the launching and retrieval of the machine. During the advancement of the pipes, bentonite was pumped to the external surface of the pipe via 1-inch ports installed inside the 6m length pipes.

This served to lubricate and reduce frictional force of the pipe against the ground and to provide support to the ground in order to prevent settlement. After completing each drive, the annulus gap between the ground and the pipes would be filled with cement grout to avoid ground settlement.

Table 1: Technical Details of Micro Tunnel Boring Machine

Description	Value	Unit
Machine Outer Can Diameter	800	mm
Cutter Head Outer Diameter	826	mm
Overall Length with Trailing Can	5400	mm
Number of Drive Motors	3	Pcs
Max Cutterhead Torque	22.2	KNm
Number of Steering Cylinders	3	Pcs
Max Steering Angle	4.2	°
Number of Jacking Cylinders	2	Pcs
Jacking Cylinder Stroke	4000	mm
Max Jacking Force per Cylinder	3500	kN

Table 2: Mungo separation plant technical details

Description	Value	Unit
Pump Driving Motor	18.5	kW
Classifying Screen Size	2.5	mm
Dewatering Screen Size	0.5	mm
Slurry Volume Capacity	150	m^3/h
Solids Capacity	30	t/h
Max Grain Size	50	mm

The excavated material was removed from the front of the cutterhead via a slurry circuit, which was channelled to a separation plant for processing. The separation plant used was a Schauenburg Mungo slurry treatment plant, which featured a single hydrocyclone stage and 2 separate screens, with the finer screen having 0.5mm slit. The plant was used in conjunction with the Microtunnel Boring Machine (MTBM) to clean and recycle the slurry, thereby increasing its service life. From the station box excavation, it was known that the area around the station box comprised backfilled material that was mainly sandy and silty clay.

WORK SEQUENCE

Prior to commencing installation of the pipes, a working platform was fabricated to achieve the desired axis of the pipes. Once completed, the same work process was repeated 16 times to install each individual pipe. The work process can be summarised as follows:

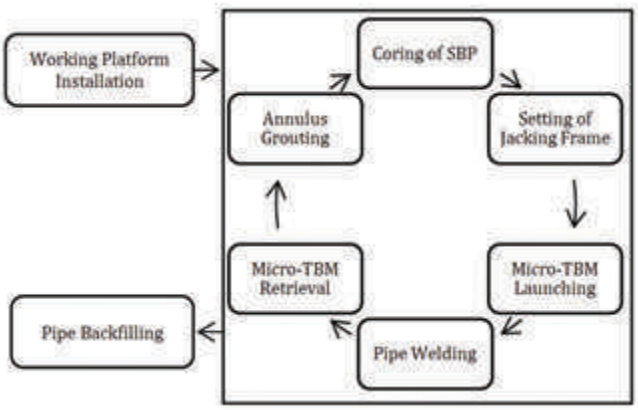


Figure 3: Pipe roof installation sequence

As the cutterhead of the pipe jacking machine could not cut through the steel reinforcement bars of the Secant Bored Piles (SBP), coring had to be done to allow direct access of the machine into the ground.

To set up, the jacking frame was positioned with the help of surveyors. The alignment of the jacking frame and the navigation laser was set before the MTBM could be lowered into the shaft onto the jacking frame. To transfer the jacking force to the SBP, a fixture called a thrust spacer was fabricated and placed between the jacking frame and the SBP. Any remaining space between the thrust spacer and the SBP was filled with non-shrink grout to provide an even surface contact area.


Figure 4: 24 cores to complete stitch coring of secant bored pile

After completing the setup of the machine, a launch seal with a rubber gasket was attached to the launch face. This launch seal would prevent the circulating slurry from leaking out of the cored hole into the jacking pit. By retaining the slurry within the ground, the face pressure of the ground could be maintained, reducing the possibility of a sinkhole formation. A rubber sheet of a suitable Shore hardness and elasticity was selected to allow deformation without failure when the MTBM entered the cored hole.

Figure 5: The setup of the jacking frame had to be done for each individual drive

During a drive, the machine face pressure was capped at 0.35 bars to balance the earth pressure, where the overburden is 3.1m. Throughout the drive, the cutterhead torque was maintained at 130kNm-150kNm to prevent dipping of the machine in the soft clay ground. A jacking force of about 190kN-240kN was maintained, which resulted in an average jacking speed of 150mm/min. The jacking speed was highly dependent on the ground condition at the location of excavation. A summary is as follows:

Table 3: MTBM mining parameters

Parameters	Value	Unit
Face Pressure	0.35	Bar
Cutterhead Torque	130 - 150	kNm
Cutterhead Speed	10 - 13	Rpm
Jacking Force	190 - 240	kN
Average Jacking Speed	150	mm/min

Figure 6: Left: Installed launch shield with rubber gasket; Right: MTBM being launched in the cored SBP

After the full length of the machine had entered the cored SBP, the jacking cylinders were retracted and a 6m length steel pipe was lowered onto the jacking frame. The trailing edge of the machine and the leading edge of the new pipe were clamped using a clamping fixture to be tack welded.

The fixture was removed for complete welding of the full circumference of the pipe machine connection. The welding was done using a Metal Inert Gas (MIG) welding machine. The MIG machine was used for a number of reasons:

a) Faster welds to reduce time wastage.
b) Low skill factor for operator.
c) Better welds as flux was not used.

Three lengths of 780mm outer diameter steel pipes were joined by welding the pipes subsequently, one after another. After each weld, the quality was checked by the supervisor using Dye Penetrant Inspection (DPI).

At the retrieval shaft, a fixture was fabricated to facilitate the retrieval of the MTBM. The fixture allowed the MTBM to slide out onto the fixture. When the full length of the MTBM had exited the ground, an opening was cut into the side of the steel pipe which would allow the disconnection of the umbilical cables and slurry lines to the MTBM. The

Figure 7: Left: Clamping fixture to ensure concentricity of pipes before welding; Right: DPI testing on completed welds

Figure 8: Left: Breakthrough of MTBM at retrieval shaft; Right: Opening for disconnection of umbilical hoses and slurry lines

MTBM could only be retrieved from the shaft after all hoses and pipes were disconnected. The MTBM was placed on a lorry and transported back to the launch shaft for relaunching. This process was repeated for each drive.

After completing each drive, the annulus gap between the SBP and the pipe was sealed with concrete. Annulus grouting was then done via the same bentonite ports to displace the bentonite injected during the drive and to consolidate the soil around the newly-installed pipe to prevent settlement. At least 2 passes of annulus grouting were carried out on each pipe.

Backfilling of the pipe was done only after all pipes had been installed. Backfilling was done using cement grout of water cement in the ratio of 2:1. Both ends of the steel pipe were sealed using steel plates to form end caps. On the launch site end cap, an entry port was fabricated to allow for the administering of the grout. At the retrieval site, a bleed valve was attached to bleed air while pumping grout from the launch site. This pumpable grout was hand mixed on site before pumping.

Figure 9: Top: Sealing of the annulus gap between the SBP and the pipe using concrete; One-inch ports inside the pipe used to inject bentonite during excavation and annulus grouting

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Figure 10: Steel plates were used as end caps for the pipe. Grout was pumped via 2 inch ports welded to the top of the end caps

CONTINGENCY PLAN

A contingency plan was devised to ensure that any situation resulting from the pipe jacking operation could be contained quickly. The plan included:

a) Settlement monitoring of Jalan Cheras.
b) A dedicated Bull Gang.

As shown in the layout below, 18 settlement markers were installed in Jalan Cheras. During pipe jacking, settlement data was taken hourly, using high precision monitoring equipment that was accurate to 1mm. At other times, the settlement data was taken at 4-hour intervals.

At the time of writing, the maximum settlement was 17mm depression, concentrated at the mid span of the pipe roofing structure.

A full-time Bull Gang was stationed at the site to visually monitor the busy road surface and to immediately respond in the case of an incident arising from the pipe jacking operation. Its members would have access to plastic road barriers and traffic flags to divert traffic away from the affected area.

CONCLUSION

The construction of the pipe roofing at Maluri Station proved to be a delicate and challenging task. The highly unpredictable ground condition further complicated the operation. Two strong shifts with the drive to succeed, were of paramount importance in order to deliver the project ahead of schedule while being incident free.

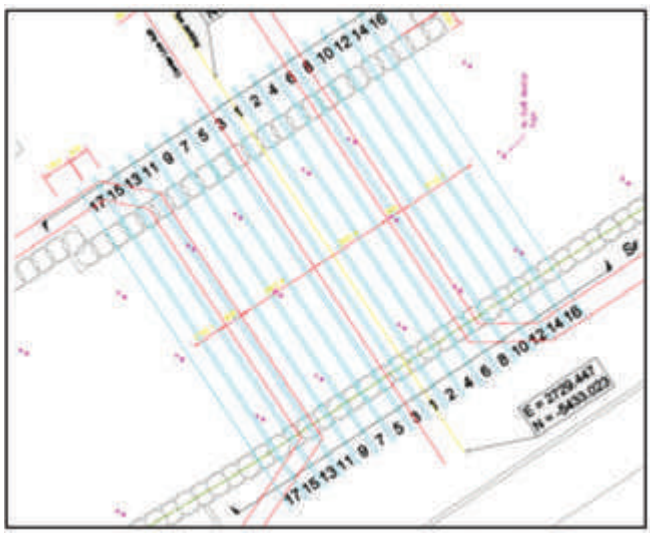


Figure 11: Position of 18 settlement markers along Jalan Cheras

It was found that the backfilling of the pipes should be done after all pipes were complete installed. This allowed for the annulus grouting of the pipe to be done to ensure that the ground around the pipes was consolidated before infilling of grout.

The use of a separation plant was vital especially in an enclosed and isolated urban site such as Maluri Station Entrance A. The separation plant allowed the circulation slurry to be cleaned and recycled. Larger material such as wood and pebbles could be removed easily, while the hydrocyclone allowed finer material to be disposed. This increased the service life of slurry and preveneds material build-up within the storage tank.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to Mass Rapid Transit Corporation Sdn. Bhd. (MRTCorp), Maluri Station Team, Tunnel Team and all those involved in the successful completion of the pipe roofing structure.

Author's Biodata

Mr. Ivan Leong, *is a Plant Engineer currently attached to the Underground Tunnel Department of MMC-Gamuda KVMRT (T) Sdn. Bhd. After graduating with a MEng in Mechanical Engineering from Imperial College London, Ivan worked as shift engineer in a Tunnel Boring Machine (TBM). After completing the final TBM break-through at Pasar Seni, Ivan was tasked to install a pipe roof structure in for an adit excavation at Maluri Underground Station.*

OBITUARY

We wish to inform that **Ir. Dr Abu Majid bin Dato' Abu Kassim** passed away on 17 December 2016. On behalf of the IEM Council and management, we wish to convey our deepest condolences to the family.

IEM Editorial Board

IEM DIARY OF EVENTS

Title: 1-Day Workshop on Competency Talent Management

23 February 2017

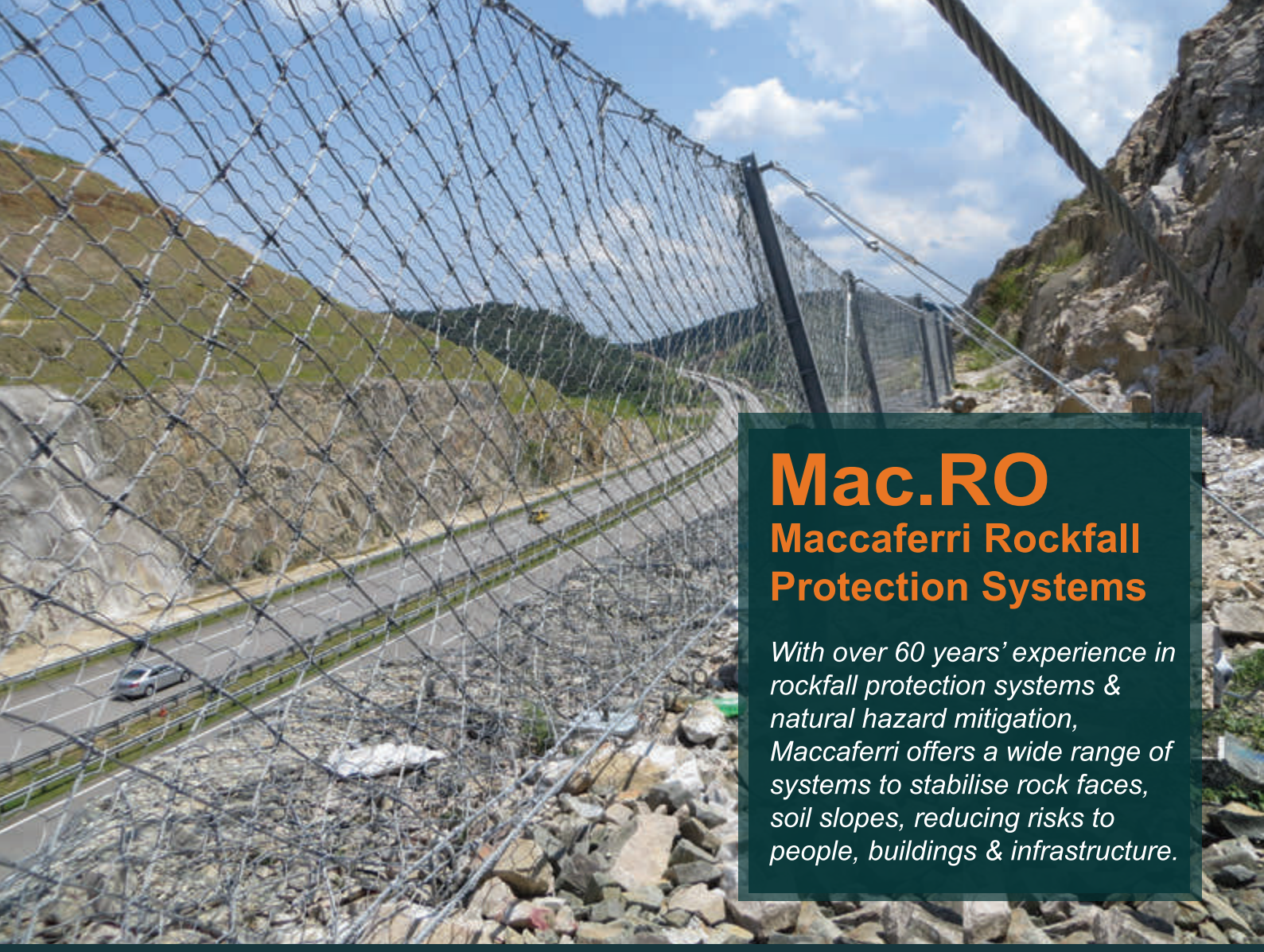
Organised by : Women Engineers Section
Time : 8.30 a.m. - 5.00 p.m.
CPD/PDP : 0

Title: 1-Day Workshop on Programming for Engineers (Part 2) - Visual Studio Community IDE

25 February 2017

Organised by : Information and Communications Technology Special Interest Group
Time : 9.00 a.m. - 5.30 p.m.
CPD/PDP : 7

Kindly note that the scheduled events below are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.



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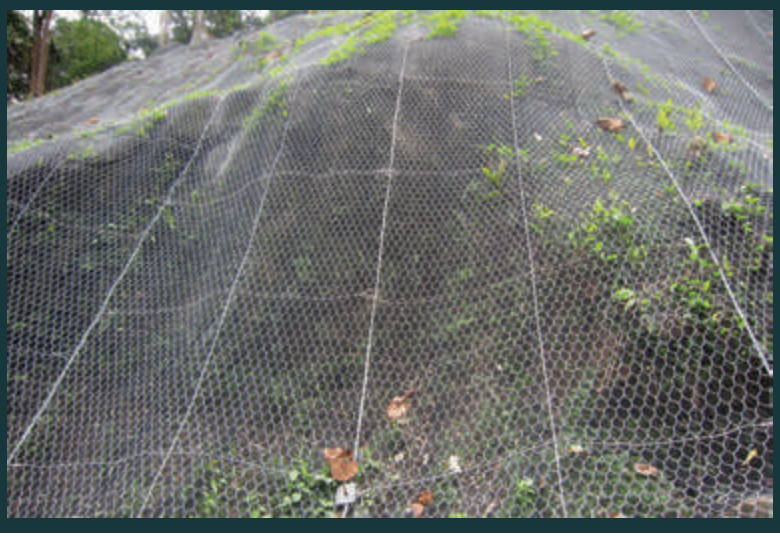

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The Spirit of Prof. Chin Fung Kee Lives On

The name, Prof. Chin Fung Kee, invokes the memory of a man who embodied a value system very much endeared by Malaysian engineers. It stands for the following:

- Dedication to one's chosen career.
- Commitment to the assigned tasks in the service of men.
- Belief in a meritocracy system for the sake of progress.

No wonder Tan Sri Prof. Chin is best remembered as Malaysia's foremost engineering educator and an outstanding practising engineer. The 26th Annual Prof. Chin Memorial Lecture is a fitting occasion that recognises his contributions to engineering education and nation building. *See Jurutera, November 2015, pages 25-28.*

There are many similarities between Prof. Yong and the late Prof. Chin. Both reached the pinnacle of their careers in the academic field. Both were outstanding in research and both contributed greatly to public service.

Prof. Yong studied in the University Of Sheffield, England, under a Grouped Engineering Scholarship. He joined the National University of Singapore (NUS) in 1979 and rose to become Head of Civil Engineering. He now holds the post of Vice President (Campus Infrastructure) and oversees the S$1 billion development of University Town.

Research has always been close to his heart. Prof. Yong has published more than 200 technical papers in international peer-reviewed conference and journals. He has been invited to deliver over 30 keynote/guest lectures at international conferences.

In NUS, he is a dedicated academic and has won the Excellent Teaching Awards (1993, 1994 & 1996). In 1997, he was inducted into the Hall of Fame for Teaching Excellence in the Engineering Faculty.

Prof. Yong's engineering knowledge is well recognised in the construction industry as evidenced by his appointment as Chairman of Land Transport Authority (LTA)'s Independent Investigation Panel on the Nicoll Highway Collapse in 2004.

It is widely accepted that the economic growth of Singapore has been nothing short of a miracle since it separated from Malaysia in 1965. By the 1990s, it had won a ticket to the exclusive First World Club, when its GDP per capita was on par with that of developed nations. The journey was far from straight forward but the island republic was led by the courageous Mr. Lee Kuan Yew. Lee (2000) has been hailed as one of the best text books in economic development detailing precious lessons learned by the city state.

As the nation grew, it faced many challenges, especially in infrastructure development. How did Singapore integrate its infrastructure systems? In the synopsis of the lecture, Prof. Yong pointed out that "cities are complex large-scale systems, of which water and transport systems are as critical as the fragility of the ageing urban centres".

Careful attention to land use, transport needs and meeting the demand for water must be addressed. He added: "Cities around the world are also exploiting innovations in information technologies and data sciences to create the Digital or Smart City of the future."

Instead of reporting verbatim, the authors dealt with certain aspects of the lecture which were deemed particularly relevant to the "Greater Kuala Lumpur". First, we discussed Singapore's integrated infrastructure systems. Second, we dealt with the criteria of smart cities.

Third, as food for thought, we explored two policy change models for decision-makers/engineers.

INTEGRATED INFRASTRUCTURE SYSTEM

This section will be divided as follows:

- Land/land use system
- Transport system
- Water system

1. Land & Urban System

In land-scarce Singapore, to continue with its huge success in providing public housing since 1965, there are plans for residential buildings to go higher and higher (Figure 1).

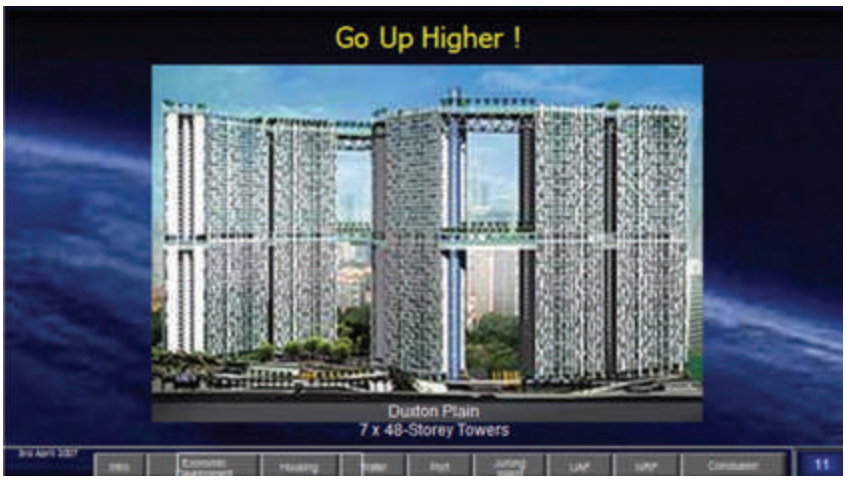

Figure 1: Duxton Plain (7x48-storey towers)

If going higher proves inadequate to create enough space, the other alternative is to go deeper (Figure 2). Construction is on-going to create 60ha cavern for storage purpose where the height is 9-storey tall.

Figure 2: Jurong Rock Cavern

2. Transport System

With the continuously growing population, traffic congestion is the single largest challenge in the management of a growing city. At the heart of the challenge is creating space for an estimated 972,000 motor vehicles

(Figure 3). Its Mass Rapid Transit (MRT) system is among the most efficient in the world and is constantly being expanded.

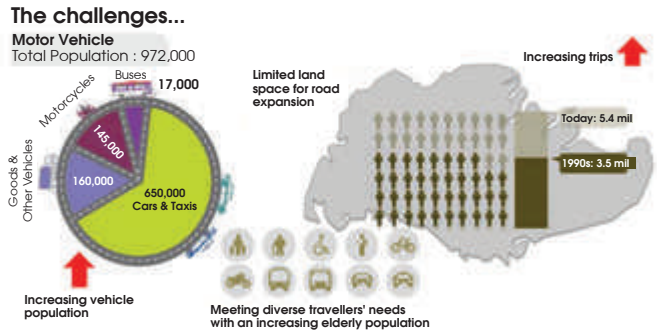

Figure 3: Transport challenges (Source: Land Transport Authority)

Besides this, plans are underway to install an Integrated Bus Fleet Management System where timely information will be provided to public transport operators so that they can attend to areas in need of buses. Another proposal in the pipeline is the installation of a next generation satellite-based road pricing system by 2020. "The end result is a more targeted, flexible and equitable congestion charging system," said Prof. Yong.

3. Water System

Singapore has four sources of water: Imported, desalinated, local catchment and recycled (NEWater). While imported water makes sense, desalinated water is expensive due to cost of the plant. As for local catchment water, this depends on a system of 17 reservoirs, 32 rivers and 8,000 km of waterways and drains for water retention. NEWater is essentially used for industrial purpose (Lee E. T., 2008). Figure 4 shows the close water loop.

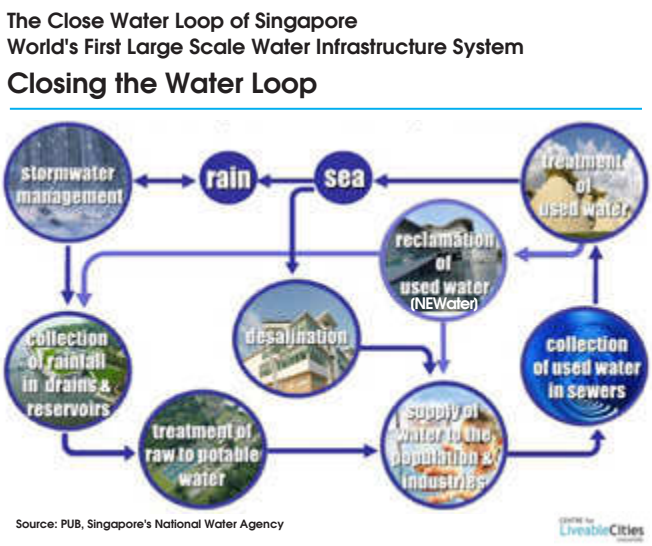

Figure 4: Closing the water loop (Source: PUB)

SMART CITIES

Singapore's Housing Development Board (HDB) endeavours to create smart towns that are liveable, efficient, sustainable and safe. Prof. Yong said such towns will be equipped with enabling infrastructure, sensor network, easy communication and data hubs. These features may sound intelligent but a smart town should look beyond high-tech facilities.

In fact, recent debates tended to urge policy-makers to move "towards economic development, environment, human and social capital, culture, leisure and governance by which it is increasingly becoming known" (Kourtit *et al. 2014*, cited in Deakin, 2014, ed).

If infrastructure systems must be built and integrated, decision-makers would have to look into models of policy change.

ENGINEER'S MODELS OF POLICY CHANGE

In the early part of his lecture, Prof. Yong made it clear that "system theory" is being practised in deciding from a plethora of options for any given problem in infrastructure planning. In the following section, system theory as it is applied to land use and infrastructure planning will be discussed, followed by other models of policy change which may be useful to engineers.

System Theory: McLoughlin (1969) observed the linkage between cities and natural systems. To live in cities, dwellers conform to rules as expected of them. They learn to adapt to their newfound habitat. As time goes on, they create communication links to connect all the locations in order to facilitate transactions. It has the same outcome as the virtual Singapore in the making, as pointed out by Prof. Yong. Consider the remarks made by Ratcliffe (1974, p.104, cited in Allmendinger, 2002, p. 43):

"Any community consists of a wide variety of geography, social, political, economic and cultural patterns which both act and interact to form the nature and condition of society. The relationship between these various patterns is constantly changing, giving rise to new and different conditions, some beneficial to the community, some deleterious. It is the planner's function to comprehend this tangled web of relationships, and where necessary, to guide, control and change their composition. To do this planning is concerned with prediction, not only population size and land use in isolation, but also of human and other activities as well. It has been said that planners are now the prisoners of discovery that in a city everything affects everything else."

So, in essence, system theory in planning is concerned with complex sets of interconnected parts in constant flux, much like an eco-system that emphasises the mutual relationship between different organisms (Allemendinger, 2002, p. 43). A good system should consider the individual utilities and their impact on group utilities and vice versa (McLoughlin, 1969).

As an example, the current weak demand for condominiums in Kuala Lumpur (beginning 2015) has its root cause in oversupply and easy access to end financing in the past few years. The sprouting up of numerous condominium projects in the suburbs of Kuala Lumpur has given rise to several large scaled out-of-town retail centres. The next

challenge is to ensure the viability of these gleaming centers.

Other models of policy change: In a popular text book on public policy analysis, Dunn (2008, pp. 48-55) listed eight policy change models, excluding from the list system theory: Comprehensive rationality, second-best rationality, disjointed incrementalism, bounded rationality, mixed scanning, erotica rationality, critical convergence and punctuated equilibrium. In this subsection, only the first two will be discussed.

In a comprehensive rationality change model, all available alternatives are weighed and the option that produces the greatest benefits will be chosen, as a rational economic actor is seen as Homo economicus (Dunn, 2008, p. 48).

In second-best rationality change model, the proponents hold the view that, in practice, it is impossible to reach a consensus and thereby challenge the validity of economic rationality model. One way out is to delegate decision-making to the political system where majority rule prevails (Dunn, 2008, p. 51).

To perform and make the right decisions for a complex infrastructure system will require an understanding of various challenges in an evolving world. Prof. Yong urged engineers to equip themselves with the right attitude in problem solving.

SPIRIT OF LEARN, UNLEARN AND RELEARN

Why is there a need to learn, unlearn and relearn things that we have been so sure of in the past? Therein lies the real challenge for decision-makers and engineers. Consider Toffler's (1990, p. xxi) remarks about the uncertainty and the flux we are in:

"It seems hardly necessary to add that the future is not "knowable" in the sense of exact prediction. Life is filled with surrealistic surprise. Even the seemingly "hardest" models and data are frequently based on "soft" assumptions, especially where these concern human beings. Moreover, the very subject of these books - accelerant change - makes the details in them subject to obsolescence. Statistics change. New technologies supplant older ones. Political leaders rise and fall. Nevertheless, as we advance into terra incognita of tomorrow, it is better to have a general and incomplete map, subject to revision and correction, than no map at all."

Clearly what is demanded of knowledge-workers is a mind-set of flexibility. While details are important, one should not lose sight of the big picture. "Engineers should avoid specialising only in one area such as hydrology or fluid mechanics. Instead they should be more generalised and think systems," Prof. Yong added.

CONCLUSION

The experience of Singapore in coping with the changing need in infrastructure system as part of its economic development, is a valuable lesson to decision-makers/ engineers in Malaysia.

Singapore may have limited land and natural resources but it has shown the way forward in proper infrastructure planning. The challenges it faces as a city state is similar to what Greater Kuala Lumpur faces as a future mega city, though on a different scale. Kuala Lumpur has the potential to become a world class city, provided the infrastructure is carefully planned, constructed and integrated. ■

REFERENCES

[1] Allmendinger, P. (2002) Planning Theory, Palgrave MacMillan.

[2] Deankin, M. (2014) Smart Cities: Governing, Modelling and Analysing the Transition, London and New York: Routledge.

[3] Dunn, W. N. (2008) Public Policy Analysis: An Introduction, Upper Saddle River, New Jersey: Pearson Prentice Hall.

[4] Lee, E. T. (2008) The Search for NEWater: The Singapore water story 18th Prof. Chin Lecture: IEM

[5] Lee, K. Y. (2000) From Third World To First, The Singapore Story: 1965-2000, Singapore Press Holding.

[6] McLoughlin, B. (1969) Urban and Regional Planning: A Systems Approach, London: Faber & Faber.

[7] Ratcliffe, J. (1974) An Introduction to Town and Country Planning, London: Hutchinson.

[8] Toffler, A. (1990) Power Shift: Knowledge, Wealth, and Violence at the Edge of the 21st Century, Bantam Books.

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IEM DIARY OF EVENTS

Title: Process and Engineering Design of a Crude Oil Refinery and Tank Farm - Premised On Process Safety & Environmental Sustainability

14 January 2017

Organised by	: Special Committee on IEM Structured Training
Time	: 9.00 a.m. – 5.00 p.m.
CPD/PDP	: 144

Title: Talk On Introduction to HAZOP

19 January 2017

Organised by	: Chemical Engineering Technical Division
Time	: 5.30 p.m. – 7.30 p.m.
CPD/PDP	: Applying

Kindly note that the scheduled events below are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.

Empowering Women: Working Towards Equality in the Workplace

Ir. Heng Lee Sun

Women today play a more significant role in the developed world. With an increase in the number of women in leadership positions, the corporate world has greatly benefitted as this has been shown to increase organisational effectiveness. It is estimated that when companies have three or more women in senior management positions, they score higher in all dimensions of organisational effectiveness.[1]

In March 2013, the Chief Executive Officer of Facebook, Sheryl Sandberg, preached her gospel of "leaning in" to female lawmakers in California, saying that having more women in the government was the key to advancing gender equality.[2] In her first published book, *Lean In: Women, Work And The Will To Lead*, she looked at the dearth of women leaders in the corporate world. She said true equality was long overdue and that this could only be achieved if women rose to the top positions in every government and every industry. According to the U.S. Bureau of Labor Statistics (1985-2012), there was a gradual increase in the percentage of women employed in selected occupations, such as pharmacists, financial and purchasing managers, lawyers, architects, engineers and economists.[3]

Gender Equality is a "hot" topic in the market as people challenge the availability of seats for women in managerial and leadership position. This paper will discuss gender equality at the workplace and how we can work together to achieve this.

The results of a survey recently released by Elephant In The Valley[4] grabbed the headlines with its shocking numbers:

- 60% of women in Tech reported unwanted sexual advances and 1 in 3 feared for their personal safety because of work-related circumstances.
- 60% who reported sexual harassment were dissatisfied with the course of action taken.
- 66% of women felt excluded from key social or networking opportunities because of their gender.
- 87% of women experienced demeaning comments from the male colleagues.

We wonder why this is still happening as there are many articles on the importance of women speaking up. It is so easy to feel angry at the statistics. To help the younger generation be more socially evolved, we have to work together to achieve gender equality.

What is Gender Equality? According to the Cambridge Business English Dictionary, "Gender Equality does not imply that women and men are the same, but rather that they have equal value and should be accorded equal treatment".[5] In the context defined by Wikipedia, "Gender Equality is the view that both men and women should receive equal treatment and not be discriminated against based on their gender".

Women and men should not only be given equal access to resources and equal opportunities, but they should also benefit from this equality. Both genders should be free to develop their personal abilities and to make choices without the limitations set by stereotyping, rigid gender roles and prejudices. Gender equality means that the different behaviour, aspirations and needs of women and men

[1] McKinsey & Company, Women Matter 2014. *"GCC Women in Leadership – From The First To The Norm."*pg.6.
[2] Melanie Mason. "Sheryl Sandberg brings 'Lean In' message to California's women lawmakers." *Los Angeles Times, (21st August 2013). Web 28th March 2016.*< http://articles.latimes.com/2013/aug/21/local/la-me-pc-sheryl-sandberg-womens-caucus-20130821>
[3] Current Population Survey, U.S. Bureau of Labor Statistics. <https://www.dol.gov/wb/stats/Womens_Percentage_total_occupations_85_12_txt.htm>
[4] Elephant in the Valley was a collaborative effort between seven women in Silicon Valley with backgrounds including Venture Capital, Academia, Entrepreneurship, Product Marketing and Marketing Research. It collects feedbacks via online survey. http://elephantinthevalley.com/
[5] Cambridge Dictionary Online. <http://dictionary.cambridge.org/us/dictionary/english/gender-equality>

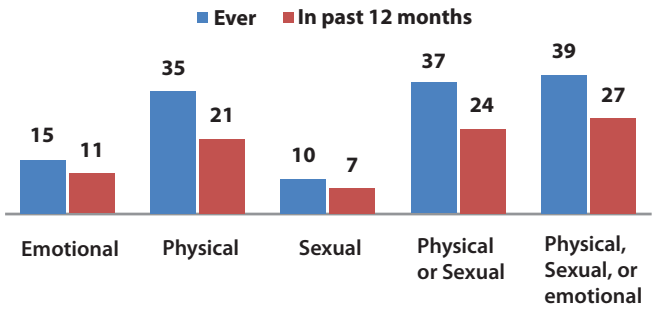

Figure 1: Percentage of currently married women age 15-49 who had ever experienced domestic violence (and in the past 12 months), according to type of violence, NFHS-3, India

are considered, valued and favoured equally. It does not mean that women and men have to become the same, but only that their rights, responsibilities and opportunities do not depend on whether they are born male or female.[6]

A business trip to India in 2012 really opened my eyes to the issue of Gender Equality. In India, only 43% of women were employed compared with 87% of men (age group 15-49) in 2006. Most of these women worked in agriculture and only 7% were employed in professional, technical or managerial occupations.[7] The discriminatory attitude towards women has existed for generations and it affects the lives of both genders.

In India, a significant percentage of women (currently married and aged 15-49) have experience emotional, physical and sexual violence by their husbands. Figure 1 shows not only the high prevalence of different forms of violence, particularly physical violence, but it also suggests that the majority of these women who had been abused by their husbands, continue to suffer abuse.[8] Although India's Constitution grants men and women equal rights, gender disparity still remains.[9] At the workplace, employees are predominantly men while women take on subsidiary or unimportant roles. Women also feel excluded from social/networking opportunities and, regardless of their positions, are often reduced to taking notes in meetings. There is also less opportunity for women to voice up.

For decades, we have struggled to achieve true gender equality in the workplace. Statistics from the International Labor Organization show that women continue to participate in labour markets on an unequal basis with men.[10] In 2013, the male employment to population was 72.2%, while that for females was 47.1%.[11]

In 2015, only half the world's women of working-age were employed, compared to 77% of men in the same age group.[12] To move forward, women and men have to accept that we are different and that we need to work together to achieve true gender equality. Men play an important role as a supportive family member, colleague or employer while encouraging women to aspire to leadership, to sit at the table, to seek challenges and to lean in to their careers.

Both men and women need encouragement and respect for their efforts. There is no equal opportunity unless everyone receives the encouragement that makes seizing those opportunities possible.[13] Empowering women and promoting gender equality is crucial to accelerating sustainable development. Ending all forms of discrimination against women and girls is not only a basic human right, but it also has a multiplier effect across all other areas of development.[14]

I applaud Sandberg's messages, especially those in which she strongly urged that "women shall support women", meaning that the more women help each other, the better and faster they would achieve equity goals. Positive support from women may not be a favour from women personally but it will help achieve equality.[15] Women are the minority; men are the majority at the table. It is crucial that more women be empowered to speak up, especially those who may not have felt they had a voice before. The teamwork comes when there is a mutual goal to achieve. Do not underestimate the power of change when more women lean in. An increase in female leadership will lead to fairer treatment for all women. Be more grateful and open minded. We should expect professional behaviour and even kindness from everyone.

Provide training to employees and management personnel on gender equality. Educate everyone on both the obvious and the subtle discriminations taking place in the corporate world. It is essential that they identify and prevent such discrimination. Provide employees with quality, on-site child care facilities for both female and male employees.

Publicise the efforts being made to promote gender equality. Be a role model; recognise and reward capable women as part of promoting gender equality. Finally, establish a company policy that promotes gender equality in the workplace. Empowering women and girls is not only the right thing to do but it is also smart economics and a vital step towards ending poverty and boosting shared prosperity.[16]

[6] International Labour Office, Geneva. *"ABC Of Women Worker's Rights And Gender Equality"*, 2nd edition,2007, p.48. <http://www.ilo.org/wcmsp5/groups/public/---dgreports/---gender/documents/publication/wcms_087314.pdf>
[7] Ministry of Health and Family Welfare Government of India. *"Gender Equality and Women's Empowerment in India"* < https://dhsprogram.com/pubs/pdf/OD57/OD57.pdf>
[8] Ibid. pg 96.
[9] Wikipedia. Web 13 April 2016 <https://en.wikipedia.org/wiki/Gender_discrimination_in_India>
[10] International Labour Organization (2014). *"Global Employment Trends 2014: Risk of a jobless recovery?"* pg. 19. < http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_233953.pdf
[11] *Best The News, 2016. "The Gender Gap At Davos, And The World."* http://bestthenews.com/article/gender-gap-davos-and-world-thu-01212016-0111.html
[12] Makers, 2015. *"21 Facts You Never Knew About International Gender Inequality"* <http://www.makers.com/blog/21-facts-you-never-knew-about-international-gender-inequality>
[13] Sheryl Sandberg and Nell Scovell. *"Lean In- Women, Work, and The Will To Lead."* WH Allen, pg 161, 2013.
[14] UNDP. *"Sustainable Development Goals (SDGs)"2015.* http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda/goal-5.html
[15] Sheryl Sandberg and Nell Scovell. *"Lean In- Women, Work, and The Will To Lead."* WH Allen, pg 166, 2013.
[16] The World Bank. World. "Bank Group: Gender Equality Is Key to Achieving the MDGs" http://www.worldbank.org/mdgs/gender.html

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Be proactive about welcoming women to the workplace. Make flexibility and work-life balance a part of the wider company culture. Companies should truly embrace gender equality by promoting diversity on a professional and talent basis. State clearly the criteria for hiring. Monitor and evaluate salary scales and promotions on a regular basis to ensure equal treatment. Companies can also offer a broad range of options by practising flexibility at the workplace for employees who are parents. Hold events such as awareness day for gender equality. This way, women will learn more about their company's commitment and become more proactive in sharing, understanding and acting together to make parity a reality. Use the power of networking as networking, mentoring and coaching opportunities can help women build confidence and develop their careers.

Women must work together if they want employers to treat them fairly, based on merit. When they are knowledgeable, passionate and organised, women can collectively dispel the myths used to rationalise gender differences. Women have an obligation to help the women who come after them. Change will not happen without women persevering in their professional lives to end gender imbalances in the workplace.[17] Be bold and proactively lean in to take the challenge of participating in the economic and global foundation. Policy makers and business leaders should act now to boost the participation, salary and advancement of women in education and in the workforce. The results will be faster, with more inclusive growth. Women's Rights are not only human rights but they are also a key determinant of economic prosperity.

According to Jacobs Group (Australia) Pty Ltd, to broaden diversity in the workplace, the leadership needs to develop, promote and advance inclusive leadership and management across the organisation. This way, developing and maintaining gender equality will be seen as everyone's responsibility and leaders and managers should be routinely held accountable, evaluated and rewarded.[18]

[17] Cheryl Lynn Kelsey. *"Gender Inequality: Empowering Women."* Journal of Legal Issues and Cases in Business. Web. 11th April 2016. <http://www.aabri.com/manuscripts/131765.pdf>

[18] Workplace Gender Equality Agency, *"Workplace Gender And Equality Strategy Project Final Report."* https://www.wgea.gov.au/sites/default/files/GE_Report_Final.pdf

REFERENCES

[1] McKinsey & Company, Women Matter 2014. *"GCC Women in Leadership – From The First To The Norm."*

[2] Unit for the Promotion of the Status of Women and Gender Equality May, 2000. *"Gender Equality And Equity."* http://unesdoc.unesco.org/images/0012/001211/121145e.pdf

[3] International Labour Office, Geneva. *"ABC Of Women Worker's Rights And Gender Equality", 2nd edition,2007.* http://www.ilo.org/wcmsp5/groups/public/---dgreports/---gender/documents/publication/wcms_087314.pdf

[4] Ministry of Health and Family Welfare Government of India. *"Gender Equality and Women's Empowerment in India".* https://dhsprogram.com/pubs/pdf/OD57/OD57.pdf

[5] International Labour Organization (2014). "Global Employment Trends 2014: Risk of a jobless recovery?" p. 19. http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_233953.pdf

[6] UNESCO, 2012. *"World Atlas on Gender Equality in Education."* http://www.uis.unesco.org/Education/Documents/unesco-world-atlas-gender-education-2012.pdf

[7] Sheryl Sandberg and Nell Scovell. *"Lean In- Women, Work, and The Will To Lead."* WH Allen, 2013.

[8] UNDP. "Sustainable Development Goals (SDGs)"2015. http://www.undp.org/content/undp/en/home/sdgoverview/post-2015-development-agenda/goal-5.html

[9] The World Bank. *"World Bank Group: Gender Equality Is Key to Achieving the MDGs"* http://www.worldbank.org/mdgs/gender.html

[10] The UN Development Group Task Force on the Millennium Development Goals (MDGs), 2015. *"Promote Gender Equality And Empower Women."* http://www.ungei.org/files/UNDG_MDG3Paper_en.pdf

[11] Workplace Gender Equality Agency, 2016. *"International Gender Equality Statistics."* https://www.wgea.gov.au/sites/default/files/20160428_International_gender_equality_statistics_factsheet.pdf

[12] Workplace Gender Equality Agency, *"Workplace Gender And Equality Strategy Project Final Report."* https://www.wgea.gov.au/sites/default/files/GE_Report_Final.pdf

[13] Women's Environment & Development Organization (WEDO). *"Women's Empowerment, Gender Equity and the Millennium Development Goals."* http://www.wedo.org/wp-content/uploads/mdgtoolkit_eng.pdf

[14] Helena Trachsel. World Economic Forum. *"Six ways to fix gender inequality at work."(Web. 4thApril,2016)* https://www.weforum.org/agenda/2014/10/six-ways-fix-gender-inequality-workplace/

[15] Cheryl Lynn Kelsey. *"Gender Inequality: Empowering Women." Journal of Legal Issues and Cases in Business.* Web. 11th April 2016. http://www.aabri.com/manuscripts/131765.pdf

[16] International Labor Office, Equality and Diversity Branch Conditions of Work and Equality Department. *"Men and Masculinities Promoting Gender Equality in the World of Work Gender."(Working Paper 3 / 2013) Web. 11th April 2016.* http://www.ilo.org/wcmsp5/groups/public/---dgreports/---gender/documents/publication/wcms_232755.pdf

[17] Laura D'Andrea Tyson. *"Promoting gender parity in the global workplace."(2015) Web. 18th April 2016* http://www.mckinsey.com/business-functions/organization/our-insights/promoting-gender-parity-in-the-global-workplace

[18] Ministry of Health and Family Welfare Government of India. *"Gender Equality and Women's Empowerment in India". Web 12th April 2016* https://dhsprogram.com/pubs/pdf/OD57/OD57.pdf

Editor's Note

This feature article was written by the winner in the Women Engineers Section (Penang Branch) Writing Competition.

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Thermal Storage Tank Design Verification Using Computational Fluid Dynamics

Ir. Dr Kannan M. Munisamy

Thermal Energy Storage (TES) has a wide variety of applications, mostly related to heating and cooling purposes. For example, a chilled-water storage system shifts a part of the on-peak cooling load to a time when energy demand is low. Taking advantage of off-peak electricity tariffs, chiller units can be run at night when the cost is relatively low. In addition to the lower operating costs, the plant capacity can be reduced due to distributed load and chiller performance is enhanced due to cooler night air temperature, resulting in improved utility load factors.

In the present design of a TES facility, Computational Fluid Dynamics (CFD) simulation is widely used to ensure laminar heat transfer in the tank during charging and discharging cycles during the day. The charging cycle is operated at night when the tank is cooled down or charged with chilled water pumped into the TES tank and the discharging cycle will be during the day, when the stored thermal energy is being used or discharged to cool the building space.

The simulation result can be used to check the thermocline thickness of the any TES diffuser system, and re-designed if the design criteria are not met. This can be repeated till the design meets the criteria before fabricating a physical TES tank. This can save resources to reduce uncertainties in TES design.

The tank consists of two separate patent diffuser systems, one located at the bottom of the tank and one at the top. Each patent diffuser system is connected to several diffuser nozzles which supply water in to and out of the system.

During charging conditions, cold water at temperatures below 7°C will be injected from the bottom diffuser nozzles. The tank will fill up with cold water, which can take between 7 and 8 hours.

During discharging conditions, hot water from the hot spaces of around 14°C will be supplied from the top diffuser nozzles and the tank will be filled with hot water; this also takes 7-8 hours.

In this article, we will present examples of TES tank design and design verification results.

SIMULATION STRATEGY

The mixed water temperature layer thickness was determined using the real gas model even though the computation time was more than double that of the Boussinesq approximation model. To produce a more accurate simulation result, a real gas model was used to minimise and eliminate numerical errors that might occur in a simulation with the Boussinesq approximation model.

Figure 1 shows the comparison between the real gas and Boussinesq approximation model in temperature distribution. The temperature profile on the left shows the real gas model simulation at 4,380s which was about 1.2 hours. The mixed water temperature layer thickness, determined from the graphic visualisation, was 0.8-1.2m. The total number or operation hours simulation was

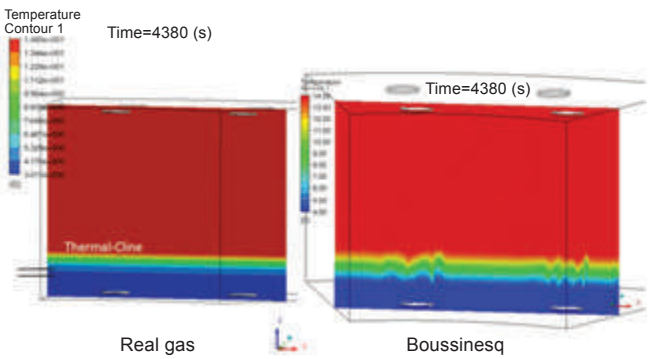


Figure 1: Temperature distribution comparison of Boussinesq approximation and the real gas model

simulated concurrently using the Boussinesq approximation model. The Boussinesq approximation model had faster convergence time in computing performance with some penalty in simulation accuracy.

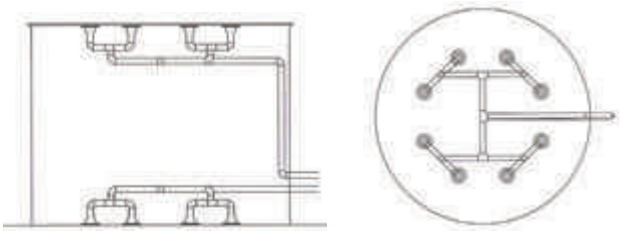
The transient calculation being employed for the CFD software was based on a fully implicit and conservative in time formulation. Each time step consisted of a number of smaller sub-steps, or coefficient loops.

A comparison of the timing required to conduce the analysis with the real gas model and Boussinesq model was done. A single coefficient loop calculation for the case using the Boussinesq approximation was measured to take 16 seconds of CPU time on average, while a single coefficient loop for the case using the real gas model took 23 seconds of CPU time on average.

In terms of the accuracy, it was found that the Boussinesq approximation running at a relatively larger time step, would have a negative effect on accuracy, particularly with numerical diffusion. However, the longer time requirements made this option unfeasible for use.

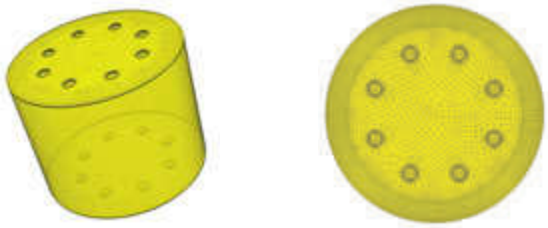
CASE STUDY 1

Case 1: Geometry



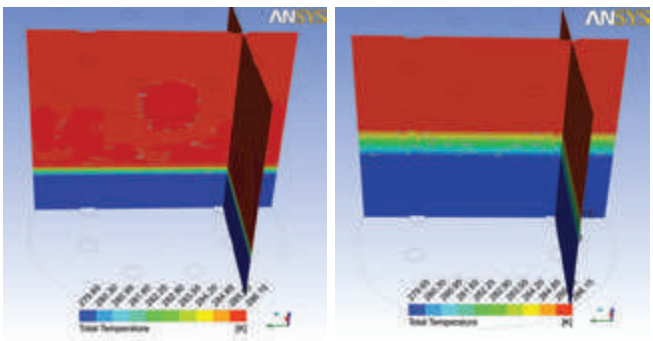
Front View *Top View*

Case 1: Computational Mesh



Isometric View *Top View*

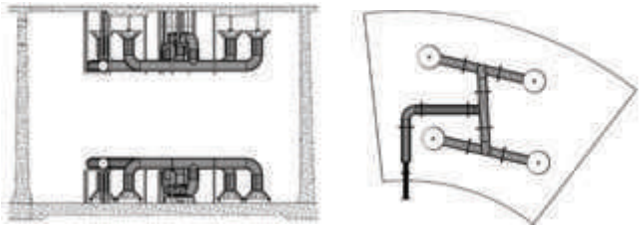
Case 1: Result of temperature distribution in (KELVIN)



Charging mode at 9300s (2hours 35 mins) *Discharging mode at 21600s (6hours)*

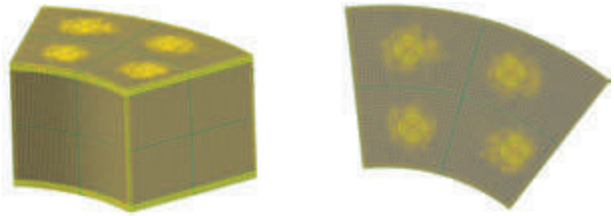
CASE STUDY 2

Case 2: Geometry



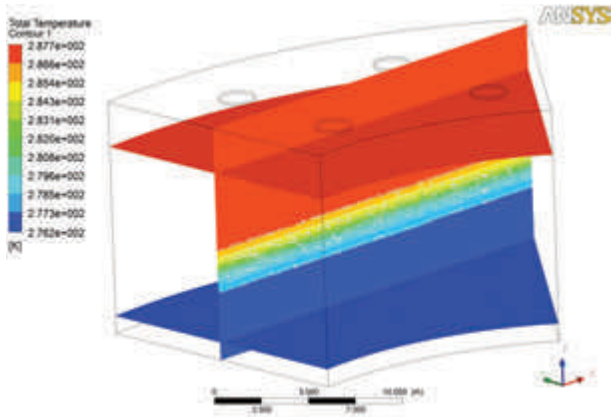
Front View *Top View*

Case 2: Computational Mesh

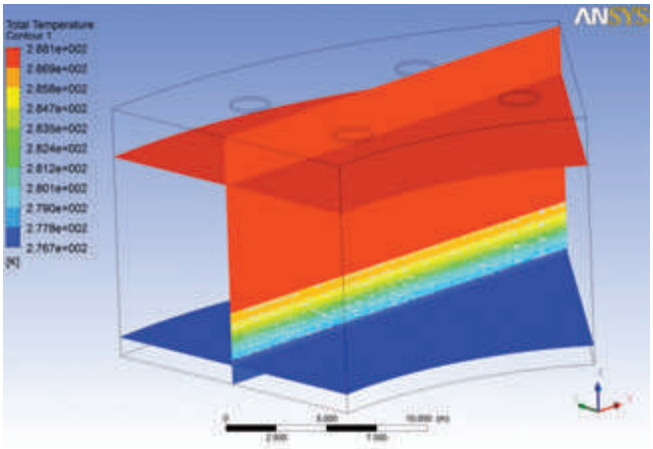


Isometric View *Top View*

Case 2: Result of temperature distribution in (KELVIN)



Charging mode at 12000s (3hours 20 mins)



Discharging mode at 25200s s (7hours)

CASE STUDY 3

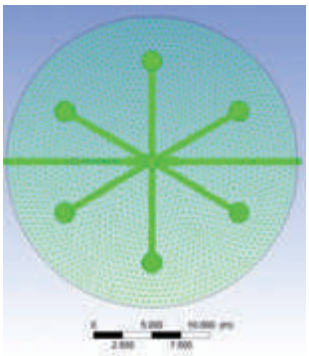
Case 3: Geometry

Side View

Top View

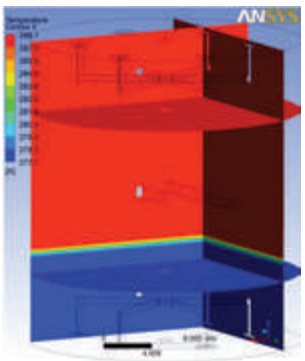
Case 3: Computational Mesh

Isometric View

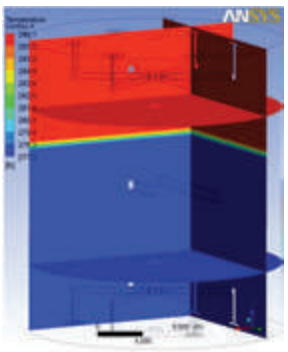


Top View

Case 3: Result of temperature distribution in (KELVIN)



Charging mode at 8400s (2hours 20 mins)



Discharging mode at 10800s s (3hours)

CONCLUSION

The three case studies presented above show that the TES tank design can be of various shapes and configurations. The models have to be based on the actual size of the tank to reduce scaling error.

Computational mesh is developed in consideration of the complexity of the geometry. The transient simulation results can be extracted into a few representations of physical parameters, such as temperature and velocity distribution. Temperature distribution is usually used to verify the thermocline thickness of the design during charging and discharging for effective operation.

The CFD analysis shows that thermal stratification was achieved using both configurations at the given flow rate and temperatures for all three cases. The thermal efficiency is calculated using the thermal cline thickness information and using the equation below:

$$thermal\ efficiency = \frac{Useable\ water\ volume}{Total\ water\ volume}$$

CFD is used to simulate the flow behaviour for a thermal energy storage tank for both charging and discharging conditions. The CFD results are used to show a distinct thermocline and how the thermocline rises/falls with time. The thickness of the thermocline is determined, with thermal efficiency to be >95%.

In addition to predicting thermocline thickness, the numerical study will also prove that the hot water is displaced fully in the given time by the cold water for charging and vice versa for discharging. The direction of the thermocline movement and uniformity of the thermocline distribution horizontally are also determined for both charging and discharging transient operation condition. ■

Author's Biodata

Ir. Dr Kannan M. Munisamy, *is the chairman of Mechanical Engineering Technical Division and also the Organising Committee Chairman of the 15th ACFM. He is currently the Chief Operating Officer at Tenaga Cables Industries Sdn. Bhd., a subsidiary of Tenaga Nasional Sdn. Bhd., focusing on manufacturing of LV and HV power cables and services on cable faults.*

IEM DIARY OF EVENTS

Title: Talk on "iScada to Replace Existing CMS Link to BOMBA"

13 January 2017

Organised by : Building Services Technical Division & Information and Communications Technology Special Interest Group
Time : 5.30 p.m. – 7.30 p.m.
CPD/PDP : 2

Title: Talk on Condition And Life Assessment of In-Service Power Transformer

21 January 2017

Organised by : Oil, Gas and Mining Engineering & Electrical Engineering Technical Division
Time : 9.00 a.m. – 11.00 a.m.
CPD/PDP : 2

Title: 2-Day Course on "Centrifugal Pump Theory And Application-Basic Principles"

23-24 January 2017

Organised by : Oil, Gas and Mining Engineering Technical Division
Time : 8.30 a.m. – 5.00 p.m.
CPD/PDP : 12.5

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Source; Bernama, 18/11/2016

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Wind Related Issues & Use of Supplementary Damping Systems in Design of Tall Buildings

CIVIL AND STRUCTURAL ENGINEERING TECHNICAL DIVISION

reported by
Ir. Low Kai Wah,
Committee Member,
CSETD

The Civil and Structural Engineering Technical Division (CSETD) organised a short talk on "Wind Related Issues & Use Of Supplementary Damping Systems in the Design of Tall Buildings" on 27 July 2016 at Wisma IEM. The invited speaker was Mr. Sudeesh Kala, a registered Professional Engineer (Ontario) with vast experience in wind analysis and exposure to various international projects.

The seminar was chaired by Ir. Dr Ng, Chairman of CSETD. The 78 participants came from various industry backgrounds, including engineers from consultancy services, contracting firms, government agencies and local authorities as well as faculty members from local institutions of higher learning.

Mr. Sudeesh Kala started the talk by highlighting the types of risks associated with wind force such as structural failure, cladding failure and air qualities issues. He explained the need to carry out wind tunnel tests and the limitation on wind codes. Wind load will be difficult to predict for irregular (complex) building shape, surrounding building interference, complex terrain, lack of resolution by building codes and computational analysis.

He advised doing the wind analysis in the early stages of a project (during pre-concept design) as this will allow greater flexibility in the framing and will have the least cost impact on the project. If done during the end cycle of a project (during post occupancy stage), it will only allow minimum changes to the framing and at the same time, it will prove costly to do so.

He suggested that the designer use a holistic approach that combines climate time history, wind simulations and solar simulations to create a comfortable pedestrian zone that will promote walkability.

Mr. Sudeesh Kala then gave an overview of the wind tunnel test and pressure taps located inside an aerolastic model and testing of Burj Khalifa, the world's tallest building. He explained that vortex shedding can drive a structure into oscillation and, if the vortex shedding frequency matched the resonance frequency, the structure will begin to resonate.

Ir. Dr Ng presents a memento to Mr. Sudeesh Kala

He said that to mitigate the effect of wind force, one can adopt shape optimisation such as corner softening (chamfered corners), tapering, varying cross-section shape, spoilers and increasing permeability (openings). He then presented a case study where, by introducing corner softening in Taipei 101 Tower (Taiwan), the base moment reduced by 25%. He also presented a few more case studies, including The ICON Complex (Indonesia), 151 Incheon Tower (South Korea) and US Airforce Memorial (Arlington, US). Apart from shape optimisation, he further advised the designer to also increase the mass towards the top of the structures, increase structure stiffness and increase damping to minimise wind induced problems.

Mr. Sudeesh Kala said that traditionally, most designers will adopt the acceleration criteria that the 10-year peak acceleration shall not exceed 20 milli-g. Lastly, he talked

about the damping of structures: Inherent damping and supplemental damping.

Inherent damping was further divided into external and internal categories. Supplemental damping systems included solid mass type, water/liquid type, semi-active damper and active damper. Factors affecting the selection of dampers included ease of inspection and maintenance, the sensitivity of the dampers as some might not be suitable in low-moderate wind events, cost effectiveness and space constraint.

During the Q&A session, Mr. Sudeesh Kala answered and clarified in detail the questions raised by the participants. Then Session Chair Ir. Dr Ng thanked the speaker and presented him with a token of appreciation on behalf of CSETD.

Based on feedback, most of the participants felt that Mr. Sudeesh Kala was well equipped and very knowledgeable about the topic presented. The talk was delivered in a simple layman concept. ■

IEM DIARY OF EVENTS

Title: 1-Day Workshop On Transforming Your Emotional Intelligence

25 January 2017

Organised by : Women Engineers Section
Time : 8.30 a.m. – 5.00 p.m.
CPD/PDP : 6.5

Title: 1-Day Course on "Advanced Surface Engineering With Superior Properties"

26 January 2017

Organised by : Marine Engineering & Naval Architecture Technical Division
Time : 8.30 a.m. – 5.30 p.m.
CPD/PDP : 6.5

Title: 1-Day Course on "Effective Email Writing"

16 February 2017

Organised by : Oil, Gas and Mining Engineering Technical Division
Time : 9.00 a.m. – 5.00 p.m.
CPD/PDP : 6.5

Title: 12-Day Extensive Design Course on "Fire Protection System"

20 February 2017

Organised by : Special Committee on IEM Structured Training
Time : 9.00 a.m. – 5.00 p.m.
CPD/PDP : 72

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Moving forward, we would embark in step with the contemporary trends in the Rail Transport and Electrical Power Infrastructure, especially in the Transmission & Distribution space (T&D), which is in the brink of massive transformation. This T&D space is estimated to have a market share of over $50 billion globally (incontext.indiana.edu/2010/July), presenting opportunities in the following segments including services, systems and automation.

Global Power Test is already embarking on harnessing new testing methodologies that can improve the quality and reliability of electrical apparatus, by partnering with experts like Doble Engineering, ARBITER SYSTEMS, OMICRON, MEGGER and SCOPE (INDIA). While testing and commissioning, prior energizing, assure proper initial operation, ensuring fault free operation of transformers is a factor of major economic importance. To that end, we have collaborated with Select Solution of Australia, a NATA (National Association of Testing Authorities) accredited company, for Transformer Oil fluid analysis & diagnosis to enrich clients` maintenance plan and thereby extend the downstream equipment`s lifecycle & secure its continuity of service.

As for the Rail Transport network, the Malaysian government envisaged to transform itself into regional logistic hub for ASEAN & Southern gateway and become a high income nation. We are poised to gain substantial business opportunities by taking advantage of our partner, Select Solution`s, advanced mobile and spatial technology solution business arm called, "Geomatic Technologies". This access will enable us to deliver a very niche and specialized service like, "monitoring track condition & track maintenance", "digital imagery of the track and rail corridor", to allow inspections to occur in a controlled office environment.

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InoTech 2016 at APU

ENGINEERING EDUCATION TECHNICAL DIVISION

reported by
Ir. Prof. Dr Vinesh Thiruchelvam
Advisor,
E2TD.

Group photo

InoTech 2016 was held at Asia Pacific University of Technology & Innovation (APU) on 18 August. The annual event was organised in collaboration with IEM's Engineering Education Technical Division (E2TD).

To increase the motivation and competency of students to prepare them for challenges in the real world, elements of competition were incorporated into the exhibition. The aim was to train students to think clearly and constructively, speak persuasively and listen critically while exploring their ability to solve technical problems creatively and sustainably.

Apart from making available judges for the Inotech Design Competition, E2TD helped promote the event in IEM's publications, magazine and bulletins as well as endorsed APU as a partner in design innovation for the development of Science, Technology, Engineering and Mathematics (STEM) education in Malaysia.

Committee promoting the event

The competition was opened to external participants as well and a total of 60 projects were submitted, each showcasing impressive innovations. This year, the judges from E2TD were Ir. Assoc. Prof. Mandeep Singh, Ir. Dr Thariq, Ir. Thavanendran and Chua Yaw Long. E2TD also acted as advisors to students in developing their ideas and innovations. Sit-down sessions were held with the students to encourage them to solve complex engineering problems and to teach them to speak in public.

The first prize went to Sharifah Nazura binti Syed Jasnin, Nur Asmanira binti Che Rohalim and Fitriyaltul Aiman binti Mohamad Badran from UniKL, for their project on "Innovative Technology for Enhanced Extraction of Mahkota Dewa by Ohmic Heating".

The second prize winners were Thefye Prasad a/l Mognna Sunthar, Dinesh Kumar Vijeyan and Subashini Pannerselum, also from UniKL, for their project on "Surface modification of bricks through hydrophobic coating by extracted and deacetylated chitosan (Dendrobranchiata) prawn shell".

Coming in third was Huang Jiann Jer from APU, for his project on "An automated glove defects inspection system based on machine vision". ■

Ir. Thavanendran with the 1st prize winners

Mr. Chua Yaw Long with the 3rd prize winner

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Train-Ferry Ride to Sicily

Ir. Chin Mee Poon | *www.facebook.com/chinmeepoon*

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

FOR a train buff like me, there was no better way to see Italy than by train. Italy has a dense railway network and its train fares are among the lowest in Europe.

Five years ago, my wife and I arrived in this boot-shaped peninsula after a thoroughly enjoyable time in the Swiss Alps. When we were in Salerno in southern Italy and wanted to visit Sicily, the rock at the toe of the boot, going by train was our natural choice. Our destination on Sicily Island was Siracusa, about 130km south of Messina, the town closest to mainland Italy.

Upon further investigation, however, we found that the island was not connected to the mainland by bridge or tunnel. So I thought we'd probably have to cross the strait by ferry and then hop into another train in Messina to continue our journey to Siracusa.

The train departed from Salerno Station at 14:30 hrs and we were expected to arrive at Siracusa 8 hours later. The fare covered the whole journey. The train pulled into the station in Villa San Giovanni, a village at the toe of the boot, at 18:10 and stopped there for almost half an hour, during which time, it moved forth and back.

I did not realise that the train was being split into sections to prepare it for crossing the Strait Of Messina by ferry. I only realised it when our coach started to back into a very large and long ferry. The lower deck of the ferry had several tracks that allowed the whole train to be loaded, in sections. A middle deck held vehicles and the upper deck was for passengers.

The narrow strait was crossed in just 20 minutes. Once the railway track on the lower deck of the ferry was properly lined up with that on the dock, the reverse process began and the locomotive pulled sections of train out of the ferry and reconnected them at Messina Station.

Train passengers were allowed to remain in their coaches throughout the ferry crossing, but getting out and onto the upper deck to enjoy the view was obviously a much better option. One had to remember, though, the way to get back to the right coach later.

The first train ferry was built in Scotland in 1833. Since then, the idea of transporting a train over a body of water by ferry had been adopted in many parts of the world. The decision to opt for a train ferry over other alternatives is usually based on economic considerations. The train ferry on Lake Van in Turkey which forms an essential link in the proposed Trans-Asian Railway from Istanbul to Singapore, for example, continues to operate because a railway line to circumvent the lake would be 250km long in mountain terrain compared with the 96km ferry route.

When the Trans-Siberian Railway was completed at the turn of the 20th century, rolling stocks crossed Lake Baikal in train ferries until the Circum-Baikal Railway was completed at the end of 1905. ■

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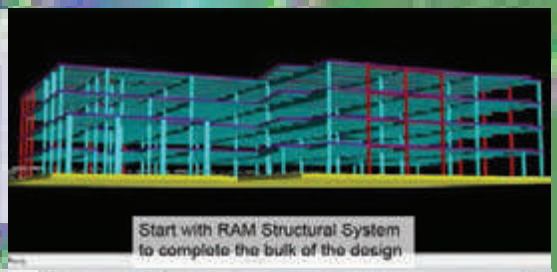

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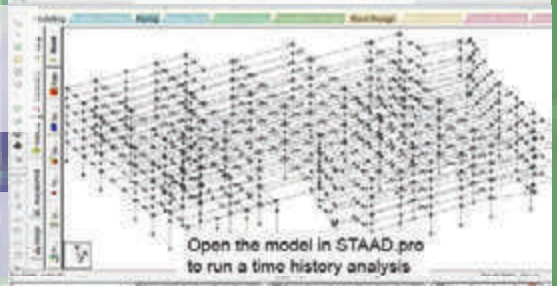

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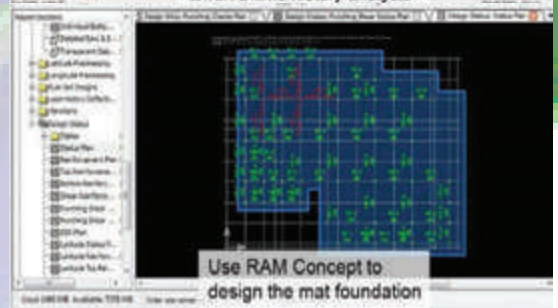

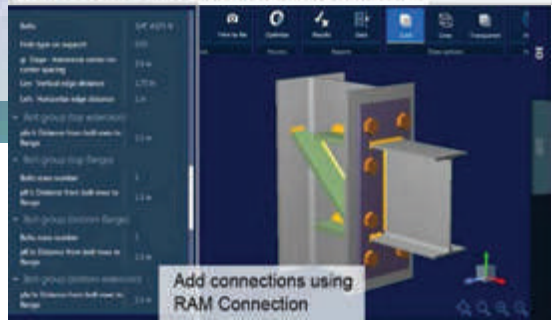

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Ir. Yam Teong Sian
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32076	TAN KAI HONG	BE HONS (USM) (CIVIL, 2011)
23040	WAN SURIATI BTE WAN HASSAN	BE HONS (UTM) (CIVIL, 1996)
44588	ZAKIAH BINTI RAZAK	BE HONS (UiTM) (CIVIL, 2011)
86588	BEH CHAI TERNG	BE (NANYANG TECHNOLOGICAL) (CIVIL, 2007)
28284	TEH CHEU MENG	BE HONS (USM) (CIVIL, 2009)
KEJURUTERAAN ELEKTRIKAL		
66354	AMIR EFFENDI BIN AWALUDIN	BE HONS (UTP) (ELECTRICAL & ELECTRONICS, 2008) CONVERSION (UNITEN) (2012)
38728	AU MANN WAH	BE HONS (NOTTINGHAM TRENT) (ELECTRICAL & ELECTRONIC, 2005) MESc (CURTIN) (ELECTRICAL, 2008)
88292	AZMIR B. MOHD YUSOFF	BE HONS (UTeM) (CONTROL, INSTRUMENTATION & AUTOMATION, 2007)
38602	BALBIR SHAH @ MOHD FADDULLAH	BE HONS (UiTM) (ELECTRICAL, 2008) CONVERSION (UNITEN) (2013)
26210	CHARRLES GEORGI KOLANDAI A/L MARTIN	BE HONS (UTM) (ELECTRICAL, 2006)
49601	HAZLIN AZMIRA BINTI ZAHAR	BE HONS (UTP) (ELECTRICAL & ELECTRONICS, 2006)
27110	LINDA SIMON	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 2002)
34101	MD AZWAN BIN MD YASIN	BE HONS (UiTM) (ELECTRICAL, 2010)
86173	MOHD AZROL ABDUL AZIZ	BE HONS (UNITEN) (ELECTRICAL & ELECTRONICS, 2004)
66053	MUHAMMAD LUQMAN BIN ABDUL HALIM	BE HONS (UNITEN) (ELECTRICAL POWER, 2012)
32735	NASYRAH BINTI YAACOB	BE HONS (UTM) (ELECTRICAL-ELECTRONICS, 2009)
57548	NURUL AZWANI BINTI MAHBOB	BE HONS (UTM) (ELECTRICAL, 2005)
81489	OTHMAN BIN MOHINDO	BE HONS (UPM) (ELECTRICAL & ELECTRONICS, 2003)
72639	TAN YU QUAN	BE HONS (RMIT) (ELECTRICAL, 2011)
KEJURUTERAAN PENGANGKUTAN		
81283	YUEN CHOON WAH	BE HONS (MALAYA) (CIVIL, 2006)
KEJURUTERAAN MEKANIKAL		
49969	AZRUL ASWAD BIN MD ADNAN	BSc (HANYANG) (MECHANICAL, 2007
61166	CHONG THIAM HENG	BE HONS (LEEDS) (MECHANICAL, 2004)
60015	MUHAMMAD HAFIZ BIN AFRAIZAL	BE HONS (UTHM) (MECHANICAL, 2006)

PERMOHONAN BARU/PEMINDAHAN MENJADI AHLI KORPORAT

KEJURUTERAAN ELEKTRIKAL		
70455	HAFIZUL TARMIZI BIN MUHAMMAD MUHYIDDIN	BE HONS (UTHM) (ELECTRICAL, 2003) ME (UTM) (ELECTRICAL-POWER, 2011)
KEJURUTERAAN MEKANIKAL		
25449	MOHD NORHAZLEE BIN NAWAWI	BE HONS (UTM) (MECHANICAL, 2003)
KEJURUTERAAN AWAM		
AHMAD DANIAL RIDWAN BIN MOHAMAD BOLHAIR		BE HONS (UNISEL) (CIVIL, 2008)
ONG LIAN HUAT		BE (NUS) (CIVIL, 1990)

We welcome any comments/feedback from the readers in general in response to the articles published in the JURUTERA bulletin.
Please post your comments to: sec@iem.org.my

Thank you.

Editorial Board Committee

KEAHLIAN

KEJURUTERAAN ELEKTRONIK

79009	CHANG TZIN, RAYMOND	B.SC.(UTM)(ELECTRICAL, 2002)
79065	CHE NORZAKIMAN BIN CHE AHMAD	B.E.HONS.(UITM) (ELECTRONIC, 2015)
78897	CHEW HOO BENG	B.E.HONS.(UTAR) (ELECTRONIC & COMMUNICATION, 2012)
78459	DR LAW KAH HAW	M.E.HONS.(NOTTINGHAM) (ELECTRICAL & ELECTRONIC, 2010) PHD.(NOTTINGHAM)(2015)
79154	FAIDHI AMIN BIN MOHD NAZARNA	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79149	FELIX CEILOMOND ANAK SAMAM	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79064	HABIB BIN SHAWAL	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79142	HAFIDZ BIN AZMI	B.E.HONS.(UITM) (ELECTRONIC, 2015)
78450	HERMAN BIN ABU SAINI	B.E.HONS.(UTM) (ELECTRICAL-MEDICAL ELECTRONICS, 2001)
79144	ISMAIL BIN IBRAHIM EDHAM	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79061	IZAIDI BIN WAN IBRAHIM	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79136	IZHAM KHAIRULFATHI BIN BAHRO	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79038	LAI SUN YUENN	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79058	MD BAHARIN SABRI BIN NASIR	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79104	MIZY SHAMIRUL BIN MASRULHISHAM	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79109	MOHAMAD ARIF AFNAN BIN YAHYA	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79105	MOHAMAD AZIZAN BIN MOHAMAD SAID	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79143	MOHAMAD FAISAL BIN AZLAN	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79151	MOHAMAD SHAFIQ BIN IBRAHIM	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79131	MOHAMAD SYAHMI BIN ZULLKIFFLE	B.E.HONS.(UITM) (ELECTRONIC, 2015)
79103	MOHAMAD SYAMIL BIN KAMARUDIN	B.E.HONS.(UITM) (ELECTRONIC, 2015)
78867	MOHD ARIFF BIN MAT YAZID	B.E.HONS.(UTM) (ELECTRICAL-ELECTRONICS, 2009)
79128	MOHD EEZLEE BIN MOHD SAPUDDIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79137	MOHD FAIZULHAYAD BIN MASHURI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79135	MOHD HARIZ BIN BADRUDDIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
78887	MOHD HILMAN LUKMAN	B.E.HONS.(UITM) (ELECTRICAL, 2008)
79158	MOHD MOKHZANI BIN MOKHSIN @ MISRON	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79140	MOHD NASRUL AFFENDI B ABU HURAIRAH	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79118	MOHD NAZRIN SYAHMI BIN ZAINI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79127	MOHD NOOR ASHRAF BIN MAAMOR	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79025	MOHD NORBI BIN BAHARIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79153	MOHD RAFIUDDIN BIN MOHD ROBI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79316	MOHD REDZUWAN BIN ABU KASIM	B.E.HONS.(UNITEN) (ELECTRICAL & ELECTRONIC, 2006)
79129	MOHD SAFUAN BIN ZULKIFLI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
78486	MOHD SHARIF BIN ZAKARIA	B.E.HONS.(UTM) (ELECTRICAL-MICROELECTRONICS, 2001) M.E.(UTHM) (ELECTRICAL, 2013)
79161	MOHD SHUKRI BIN HUSIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79108	MOHD ZAID BIN TAJUDIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79141	MOHD. AZLAN BIN YUSUFF	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79110	MUHAMAD HAFIZ FARHAN BIN RAFII	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79134	MUHAMAD ZULHELMI BIN ABDULLAH	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79029	MUHAMMAD AFIQ ZIMAM BIN MOHAMED MUNAWAR	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79150	MUHAMMAD AIZAT BIN MD RASID	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79030	MUHAMMAD AIZAT BIN ZAKARIA	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79126	MUHAMMAD AIZUDDIN BIN AZMI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79133	MUHAMMAD AMINUDDIN BIN ABIDIN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79117	MUHAMMAD AZHAR BIN BORHAN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79112	MUHAMMAD DANIAL BIN MOHD RADZI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79163	MUHAMMAD HAFIZ BIN HARUN	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79114	MUHAMMAD SYUKRI MAULA ABDUL SAMAD	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79156	MUHAMMAD ZAHID BIN ZAMRI	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79036	MUSTAFA KAMAL BIN SURIF	B.E.HONS.(UITM) (ELECTRONIC-INSTRUMENTATION, 2015)
79145	MUSTAQIM BIN KAMARU' ZZAMAN	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79159	NABILAH HUMAIDI	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79157	NOOR AZIZAH BINTI ABU KHAMID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79328	NOORFOZILA BINTI BAHARI	B.SC.(GEORGE WASHINGTON) (ELECTRICAL, 1988) M.SC.(UKM) (MICROELECTRONIC, 2007)
79122	NORHASNIZA BINTI WAHID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79115	NORMASLINDA BINTI MOHD SAHAT	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79120	NUR FARAHAIN BTE MOHAMMED	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79116	NUR IZZATI BINTI NASIR	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79123	NUR SYAAHIDAH BINTI MUSTAFA	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79139	NURUL FARAHIN BINTI SAID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79107	NURUL SYAHIDA BT MOHD TAJUDIN	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
78074	RASIDI BIN YAMIN	B.E.HONS.(BRADFORD) (ELECTRONIC, 1995)
79323	RUZITA BINTI ABU BAKAR	B.SC.(WIDENER) (ELECTRICAL, 1992) M.SC.(UPM)(COMPUTER & COMMUNICATION SYSTEMS, 2001)
79119	SALHA BINTI DALHAM	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79132	SHAHRIZAN BIN RASHID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79146	SHARAFUDDIN BIN MOHD KHAIRUDDIN	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79147	SHAZLIEZAWATY BINTI SAHA HU HAMID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79106	SHIMAN BIN SAIMAN	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79113	SITI SARAH BINTI KHALID	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79124	SYAKINAH BINTI ZAKARIA	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
78869	TING TZE MING, SIMON	B.E.HONS.(MMU) (ELECTRONICS-TELECOMMUNICATIONS, 2010)
79162	WAN ABDUL HAZIQULLAH BIN WAN JAMALUDDIN	B.E.HONS.(UITM) (ELECTRONIC-COMMUNICATION, 2015)
79130	WAN MOHAMMAD QODRY BIN WAN KAMIZI	B.E.HONS.(UITM) (ELECTRONIC-COMPUTER, 2015)
79155	WAN MOHD NAIM BIN WAN GHAZALI	B.E.HONS.(UITM) (ELECTRONIC-COMPUTER, 2015)
79138	WAN NUR ATHIRAH BINTI WAN AZAHAR	B.E.HONS.(UITM) (ELECTRONIC-COMPUTER, 2015)
79152	WAN ZUHELMI BIN WAN MUDA	B.E.HONS.(UITM) (ELECTRONIC-COMPUTER, 2015)
79125	ZURAINE AZANEN BINTI ZULKIPLI	B.E.HONS.(UITM) (ELECTRONIC-COMPUTER, 2015)

KEJURUTERAAN INDUSTRI

79507	SARAVIN KUMAR A/L T N BINU KUMAR	B.E.HONS.(UTAR) (INDUSTRIAL, 2015)

KEJURUTERAAN KIMIA

79494	ABDUL HALIM BIN NORDIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79493	AFIF BAZLAA BINTI JUWAHIR	B.E.HONS.(UITM) (CHEMICAL, 2015)
78467	AFIFAH BINTI HAPIDZ	B.E.HONS.(UMP) (CHEMICAL, 2010)
79492	AHMAD FAKHRI SYAHMI BIN MASRUDDIN	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79491	AHMAD FIRDAUS BIN MUHAMMAD ASHA'RI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79490	ANITH ATHIRA BINTI CHE ABD RAHIM	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79489	ASMAA' BINTI ABDULLAH	B.E.HONS.(UITM) (CHEMICAL, 2015)
79488	AYU AZRAINE BINTI MOHAMMED SALLEH	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
78899	AZAD SHAHREN BIN MAT TAP	B.E.HONS.(UTM) (CHEMICAL, 2006)
79411	AZWADI BIN ALI	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
78469	CHANG HAI PENG	B.E.HONS.(MIINESOTA) (CHEMICAL, 2011)
79321	CHIN YONG BAO	B.E.HONS.(UTP) (CHEMICAL, 2013)
79545	CH'NG BOON SIN	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79031	DR LEO CHOE PENG	B.E.(UMP)(CHEMICAL, 2013)
78409	DR SYED SHATIR ASGHRAR BIN SYED HASSAN	B.E.HONS.(NEWCASTLE UPON TYNE) (CHEMICAL, 2003) P.HD.(CURTIN)(2011)
79487	FARHAN FASEEHA BINTI ISMAIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79486	FARHANA BINTI HARUN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79485	HAIRIE BIN HELMAN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79484	HANISAH BINTI SARKAWI @ KAWI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79483	HAZWANI BINTI BASRI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79006	HENG SUI WOOI	B.E.HONS.(MALAYA) (CHEMICAL, 2004)
79482	HIDAYATUL HUSNA BINTI HUSSIN	B.E.HONS.(UITM) (CHEMICAL, 2015)
78455	HO MENG FAN	B.E.HONS.(UTAR) (CHEMICAL, 2013)
79481	IHSAN SABRI BIN ROSLI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79408	IRFAN SYUKRI BIN ISMAIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)

79480	KAIRUL SHA BIN DULDANG	B.E.HONS.(UITM) (CHEMICAL, 2015)
79318	KONG YEAN HUEY	B.E.HONS.(CURTIN) (CHEMICAL, 2006)
78860	LAM KA-MUN	B.E.HONS.(CANTERBURY) (CHEMICAL & PROCESS, 2009)
79532	LIM FUI CHIN	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79409	LUQMAN HAKIM BIN ABDUL RAZAK	B.E.HONS.(UITM) (CHEMICAL, 2015)
79479	LYDIA CHRISTINE AK MARTIN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79526	MAH BEE LING	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79478	MAHIRAH BINTI ABD MUBIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79421	MARCELLE MARTIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79416	MASLAN BIN HASSAN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79418	MD.RAHMADI BIN RASALI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79477	MOHAMAD HAKIM BIN KAMARUDDIN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79476	MOHAMMAD AMIRUL AIMAN BIN AHAMAD	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79475	MOHAMMAD IZWAN BIN ABDUL WAHID	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79474	MOHAMMAD NAZREEN BIN ZAINURIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79473	MOHD ALFIE SABALI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79472	MOHD AMIRUL HAKIM BIN MOHD ZIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79471	MOHD FAIZZUL BIN MOHD ZAIDI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79470	MOHD FAROOQ BIN MOHAMAD KHALIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
78474	MOHD HAFIZ BIN ZAKARIA	B.E.HONS.(UTM) (CHEMICAL, 2009)
78882	MOHD KHAIRUL BIN YA'KUB	B.E.HONS.(UMP) (CHEMICAL, 2008)
79410	MOHD NUZUL AMIN BIN MOHD SALLEH	B.E.HONS.(UITM) (CHEMICAL, 2015)
79426	MOHD RIDZUAN BIN MOHATAR	B.E.HONS.(UITM) (CHEMICAL, 2015)
79419	MOHD ZULFADHLI BIN FAIZOL AZMI	B.E.HONS.(UITM) (CHEMICAL, 2015)
79469	MUFIDAH BINTI MAHFUZ	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
78404	MUHAMAD FAUZAN BIN AHMAD FADZIL	B.E.HONS.(UTM) (CHEMICAL, 2014)
79468	MUHAMAD SHAHIR BIN MOHD SAAT	B.E.HONS.(UITM) (CHEMICAL, 2015)
79467	MUHAMMAD AFIQ BIN IBRAHIM	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79422	MUHAMMAD FADHLI BIN SAMSUDIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79417	MUHAMMAD FAIZ BIN ISMAIL	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
78900	MUHAMMAD FAIZ BIN OMAR	B.E.HONS.(MELBOURNE) (CHEMICAL, 2013)
79466	MUHAMMAD FAKHRI BIN HASAN @ AHMAD	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79465	MUHAMMAD FAREEZUDDIN BIN MOHAMAD KHALIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79464	MUHAMMAD JASVIR BIN SULAIMAN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79463	MUHAMMAD KAMAL BIN ISMAIL	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79462	MUHAMMAD NADZMI BIN RAMLAN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79461	MUHAMMAD NURFIRDAUS BIN RASIDI	B.E.HONS.(UITM) (CHEMICAL, 2015)
79460	MUHAMMAD RAIHAN BIN ABD TALIB	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79459	MUHAMMAD WAFIY BIN AHMAD	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79458	MUHD SYAFIQ IZWAN BIN ZAINAL MURAD	B.E.HONS.(UITM) (CHEMICAL, 2015)
79457	MUZZAFFAR ZAIDI BIN MUSTAPHA	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79414	NABILA SHAFIQAH DABIMEL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79525	NEOH KUANG HONG	B.E.HONS.(UTAR) (CHEMICAL, 2015)
78072	NG KAY WENG, DANIEL	B.E.HONS.(UTAR) (CHEMICAL, 2014)
79456	NOOR HIDAYAH BINTI HASBAH	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79455	NOR FARAHIDA BINTI ABU BAKAR	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79413	NORAINI BINTI ALUWI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79454	NORASYIKIN BINTI MOKTAR	B.E.HONS.(UITM) (CHEMICAL, 2015)
79453	NORMASZIANA BINTI SIDEK	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79452	NORSOLEHAH BINTI HANAFIAH	B.E.HONS.(UITM) (CHEMICAL, 2015)
79346	NU'MAN BIN ABDUL HADI	B.E.HONS.(UTM) (CHEMICAL, 2009)
79428	NUR FATHIN AMIRAH BINTI SHAFIE	B.E.HONS.(UITM) (CHEMICAL, 2015)
79427	NUR RUZAINI BINTI ROSLI	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79451	NUR SYAFIQA BINTI AMAN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79420	NURLIYANA BINTI SHAHADAN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79450	NURRUL SHAFIQAH BINTI MAHAMAD TAIB	B.E.HONS.(UITM) (CHEMICAL, 2015)
79425	NURUL AISHAH BINTI MAZLAN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79449	NURUL AZIANI BINTI SYAARI	B.E.HONS.(UITM) (CHEMICAL, 2015)
79448	NURUL FAZLINA BINTI NOOR FAZIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79447	NURUL HASIDAH BINTI MOHAMAD	B.E.HONS.(UITM) (CHEMICAL, 2015)
79446	NURUL NADIA BINTI MOHAMAD	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79445	NURUL WAHIDA BINTI ABD HALIM	B.E.HONS.(UITM) (CHEMICAL, 2015)
79520	PANG TUNG HEE	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79444	PAZILAH BINTI MOHD YUSOF	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79443	PEREGRINE DAVID	B.E.HONS.(UITM) (CHEMICAL, 2015)
79010	PHOON KOK HOONG	B.E.HONS.(UKM) (CHEMICAL, 2004) PHD. (USM)(MEMBRANES/ MEMBRANE TECH FOR ENVIRONMENTAL POLLUTION CONTROL, 2008)
79442	RAJA MOHD ADLI BIN RAJA ARIS	B.E.HONS.(UITM) (CHEMICAL, 2015)
79441	ROHAZIERAH BINTI CHE OMAR	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79440	ROYDIA LENSY ANAK SIMAN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79439	SALIP ELNALYN SALIP MAWALLIL	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79519	SASHITHAARAN A/L GOVINDASAMY	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79438	SITI AUNI NABILAH BINTI KAMARUDDIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79437	SITI FARAH NADIAH BINTI RUSLI	B.E.HONS.(UITM) (CHEMICAL & BIOPROCESS, 2015)
79412	SITI HAJARNAIMAH KAMARUDDIN	B.E.HONS.(UITM) (CHEMICAL, 2015)
78410	SITI KHATIJAH BINTI JAMALUDIN	B.E.HONS.(UTM) (CHEMICAL, 2005) M.SC.(UITM)(CHEMICAL, 2012)
78076	SITI MARIAH BINTI ABDUL MURAD	M.E.HONS. (MANCHESTER) (CHEMICAL, 2013)
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79436	SITI NORFASHA BINTI ABU BAKAR	B.E.HONS.(UITM) (CHEMICAL, 2015)
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79434	SITI NURAINSYAH BINTI SHARUDDIN	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79433	SITI SARAHNAIMAH BT KAMARUDDIN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79432	SITI ZAKIAH BT RAZALI	B.E.HONS.(UITM) (CHEMICAL, 2015)
79516	SOON ZHENG FOONG	B.E.HONS.(UTAR) (CHEMICAL, 2015)
79431	SUHAILA BINTI SHAWAL	B.E.HONS.(UITM) (CHEMICAL, 2015)
79305	SURENTHRAN A/L K SUNDAR	B.E.HONS.(UMP) (CHEMICAL, 2014)
79424	SYAHIRAH BT HARUN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79415	SYANTA JOSEPH	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79013	TEE PEI FANG	B.E.HONS.(UPM) (CHEMICAL, 2007)
79019	TEY SIU LEE	B.E.HONS.(UTP) (CHEMICAL, 2013)
79023	THIVAGAR A/L SUGUMARAN	B.E.HONS.(UTP) (CHEMICAL, 2014)
79430	WAN AFIFF BIN WAN AZNI	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2015)
79429	WAN FATHI HATIM DIYANA BT WAN NORMAN	B.E.HONS.(UITM) (CHEMICAL, 2015)
79510	WONG KIN KEN	B.E.HONS.(UTAR) (CHEMICAL, 2015)
78488	WONG SENG SIONG, RONNY	B.SC.(IOWA STATE) (CHEMICAL, 2004)
79018	WONG YEE YIEN	M.E.HONS.(NOTTINGHAM) (CHEMICAL, 2010)

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79324	DR NURUL SHAHRIZAN BINTI SHAHABUDDIN	B.E.HONS.(IIUM) (COMMUNICATION, 2006) M.SC.(MALAYA) (PHOTONIC, 2009) PHD.(MALAYA) (PHOTONIC, 2013)

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78879	AMIRUL HAKIM BIN SUFIAN	B.E.HONS.(UPNM) (MECHANICAL, 2012)
79340	ANG PENG CHONG	B.E.HONS.(UTAR) (MECHANICAL, 2010)
79549	AU WING FAI	B.E.HONS.(UTAR) (MECHANICAL, 2015)
79322	AZUREEN BINTI MOHD KAMAL AZMEY	M.E.HONS.(SUSSEX) (MECHANICAL, 2014)
79306	CHAI KOON SENG	B.E.HONS.(UTP) (MECHANICAL, 2014)
79004	CHAN YING WAI	B.E.(SUNDERLAND) (MECHANICAL, 1988)
78463	CHEAH EE GUAN, AARON	B.E.HONS.(UNITEN) (MECHANICAL, 2014)
79352	CHEAH YUANFENG	B.E.HONS.(MALAYA) (MECHANICAL, 2014)
79016	CHENG SEOK THENG	B.E.HONS.(UNIMAS) (MECHANICAL & MANUFACTURING, 2014)
79546	CHIN GUANG MIN	B.E.HONS.(UTAR) (MECHANICAL, 2015)
78421	CHIONG JONG HUA	B.E.HONS.(PLYMOUTH) (MECHANICAL, 2003)
78418	CHOO LIANG FEE	B.E.HONS.(UKM) (MECHANICAL, 2008)
79506	CHOONG BOON HAO	B.E.HONS.(UTAR) (MECHANICAL, 2015)
79297	DINISHKARAN PILLAI A/L VELAYUTHAM PILLAI	B.E.HONS.(UNITEN) (MECHANICAL, 2010)
78460	DR MUHAD ROZI BIN MAT NAWI	B.E.HONS.(USM) (MECHANIC, 2005) M.SC.(MECHANIC, 2008) PHD.(TRINITY COLL. DUBMIN)(2015)
78458	DR NURIN WAHIDAH MOHD ZULKIFLI	B.E.HONS.(MALAYA) (MECHANICAL, 2006) M.E.SC.(MONASH)(2009) PHD.(MALAYA)(2014)

78865	DR NG KEAN ENG	B.E.(MURORAN INST.)(MECHANICAL SYSTEMS, 1998) M.E.(MURORAN INST.)(MECHANICAL SYSTEMS, 2000) PHD.(MURORAN INST.)(PRODUCTION & INFORMATION SYSTEMS, 2003)
79542	FANG WAI HONG	B.E.HONS.(UTAR)(MECHANICAL, 2015)
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78875	KANNAN A/L VIJAYAM	B.E.HONS.(UTP)(MECHANICAL, 2014)
79314	KUANG JIA FEI	B.E.HONS.(UTHM)(MECHANICAL, 2014)
79540	KUEH JIN FONG	B.E.HONS.(UTAR)(MECHANICAL, 2015)
79539	LEE CHUN WAI	B.E.HONS.(UTAR)(MECHANICAL, 2015)
78466	LEE LAI HOONG	B.E.HONS.(UNITEN)(MECHANICAL, 2014)
79535	LEE ZHENG HAU	B.E.HONS.(UTAR)(MECHANICAL, 2015)
79259	LIM CHAN CHENG	B.E.HONS.(MMU)(MECHANICAL, 2009) M.B.A.(UPM)(FINANCE, 2013)
78871	LIM HOOI PENG	B.E.HONS.(UTM)(MECHANICAL-MATERIALS, 2008) M.E.(UTM)(MECHANICAL, 2014)
78407	LIM SOON CHONG, JOHNSON	B.E.HONS.(KUITTHO)(MECHANICAL, 2002)
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78866	MOHAMAD ZULFADELI BIN RIPAN	B.E.HONS.(UNIMAS)(MECHANICAL & MANUFACTURING, 2013)
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78485	NIK MOHD SYAFIQ HAZWAN B NIK AB GHANI	B.E.HONS.(UTM)(MECHANICAL-MATERIALS, 2010)
78484	NORHAMIDAH BINTI OTHMAN	B.E.HONS.(UITM)(MECHANICAL, 2009)
79522	NYIEW MIN WEI	B.E.HONS.(UTAR)(MECHANICAL, 2015)
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79332	RAMKUMAR A/L KARUPPIAH	B.E.HONS.(UNITEN)(MECHANICAL, 2013)
78037	RICHARD BIN TIAM @ ALOYSIUS	B.E.HONS.(UPM)(MECHANICAL, 2002) M.E.(UTEM)(MECHANICAL, 2012)
79040	SHAMINI A/P PATPANAVAN @ PATHMANATHAN	B.E.HONS.(USM)(MECHANICAL, 2012)
79034	SIEW JUN SOON	B.E.HONS.(UTHM)(MECHANICAL, 2011)
78405	SIM CHIA WEE	B.E.HONS.(CURTIN)(MECHANICAL, 2014)
79307	SIM JIA SIANG	B.E.HONS.(UTM)(MECHANICAL-MATERIALS, 2010) M.E.(UTM)(MECHANICAL-MATERIALS, 2012)
79251	SITI SOLIHA BINTI IBRAHIM	B.E.HONS.(UITM)(MECHANICAL, 2015)
79299	TAI YI XIAN	M.E.HONS.(BIRMINGHAM)(MECHANICAL, 2009)
79292	TAN BOON CHAI	B.E.HONS.(UTEM)(MECHANICAL-DESIGN & INNOVATION, 2011)
79308	TAN JEF LLOYD	B.E.HONS.(UTAR)(MECHANICAL, 2010)
78419	TAN KA HOE	B.E.HONS.(UTM)(MECHANICAL, 2014)
79511	TAY SZE YANG	B.E.HONS.(UTAR)(MECHANICAL, 2015)
78482	TAY WEE HUAT	B.E.HONS.(MCGILL)(MECHANICAL, 2004)
79330	WAN AZIM BIN WAN HOSSEN	B.E.HONS.(UPNM)(MECHANICAL, 2012)
79302	WANG CHOO KEN	B.E.HONS.(MONASH)(MECHANICAL, 2010)
79351	YAP LEE LIP	B.E.HONS.(MALAYA)(MECHANICAL, 2014)
78878	YAP YOON LOY	B.E.HONS.(SHEFFIELD HALLAM)(AUTOMATION & MANUFACTURING SYSTEMS, 2004) M.E.(UTM)(MECHANICAL, 2015)
78479	ZULAZFAR HILMI BIN OTHMAN	B.E.HONS.(UNISEL)(MECHANICAL, 2009)

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79544	CHONG TONG JIAN	B.E.HONS.(UTAR)(MECHATRONICS, 2015)
78868	CHOO SHENGYI	B.E.HONS.(MONASH)(MECHATRONICS, 2013)

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