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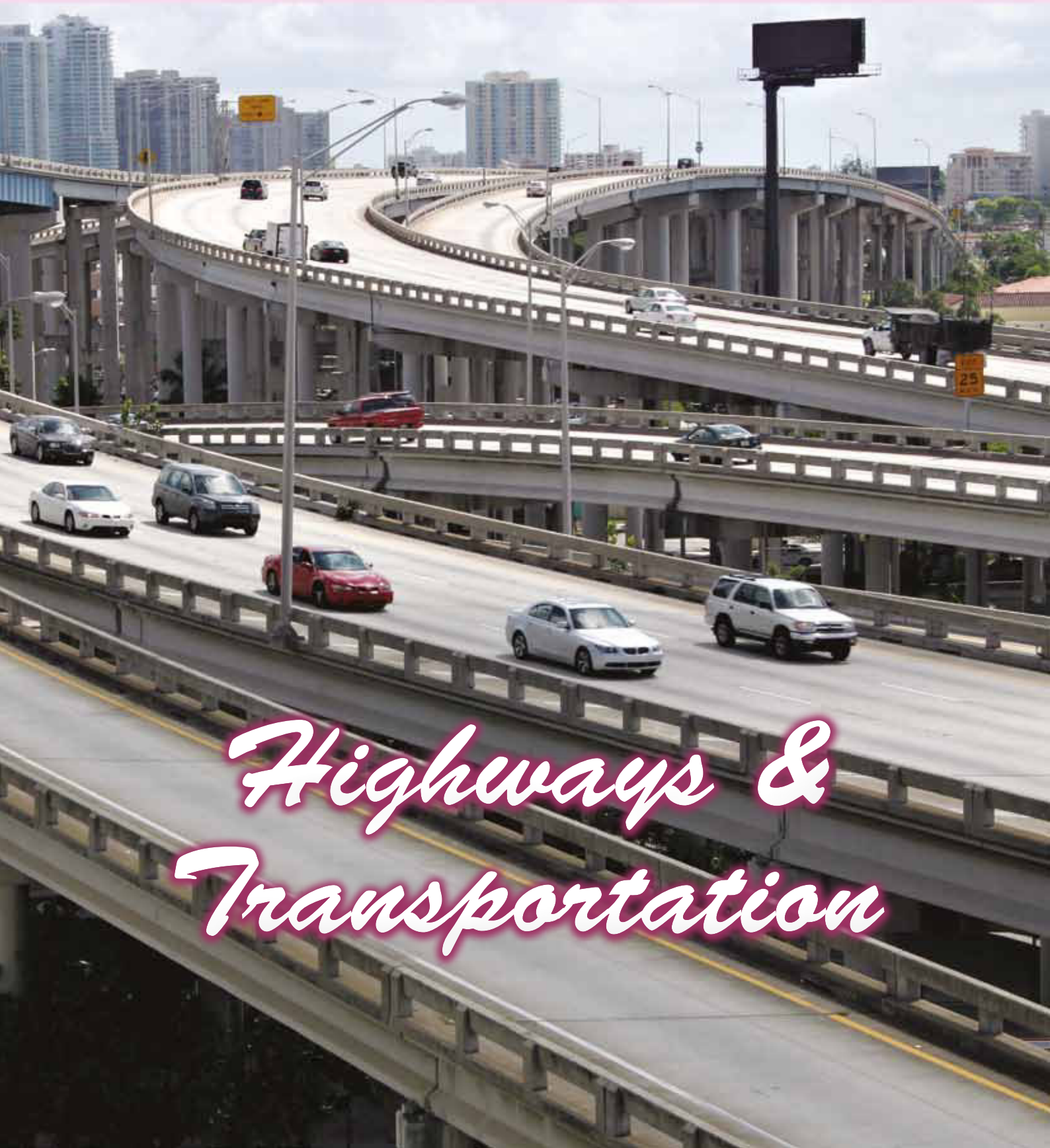

Highways & Transportation

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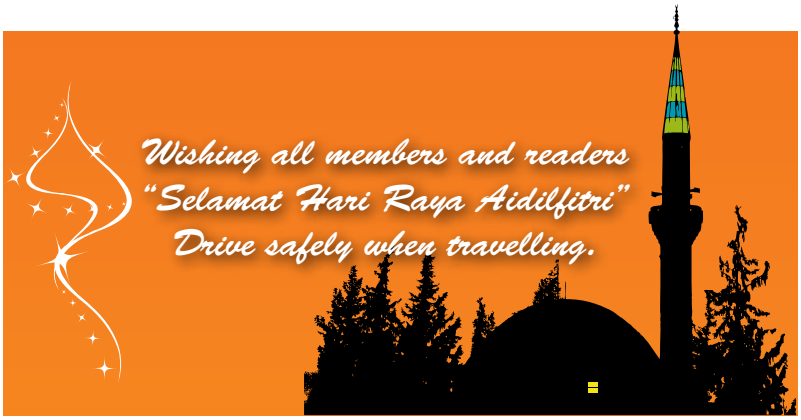

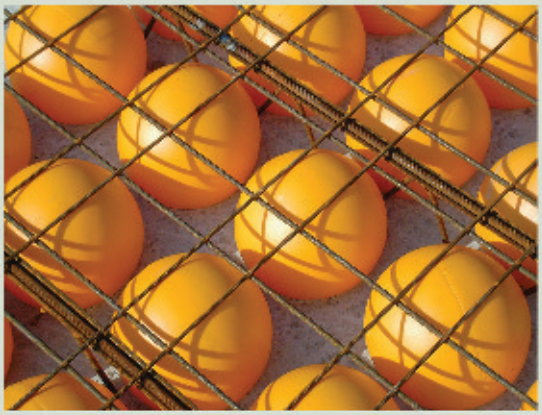

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Transforming The Economy and Changing Lifestyles

by ***Ir. Chin Kar Keong***
Chairman, Highway and Transportation Engineering Technical Division & Managing Director of Atur Trafik Sdn. Bhd.

HIGHWAY and transportation projects and initiatives are transforming the economy and changing our lifestyles. We have heard much about transportation projects of the Klang Valley MRT, High Speed Rail (HSR), a 42 km-long pedestrian walkway in Kuala Kumpur and the transformation of KLIA into a retail hub. Social interactions, human behaviour and habits are influenced by the development of transportation systems adopted by the community. Rail commuters will develop better habits on punctuality and journey planning. A commuter in Tokyo, for instance, knows his transit schedules to the very second, where he should be on the platform so that when he exits, he will be nearest to his destination.

A daily travel distance gets longer with the availability of faster transport modes. We now has more options with regards to the location of our residence and employment. The opening of North-South Highway in 1997 allows an engineer living in Johor Baru to drive after breakfast, for a meeting in Kuala Lumpur and, after lunch, departs for Penang in time to attend a dinner meeting – all within a productive working day. By 2030, he will be able to do the same using HSR, and still return home for dinner with his family. The low-cost carriers and the open skies policy have transformed the economy and our lifestyles too. The number of air passengers in the country had doubled since AirAsia was launched with the tagline, *"Now everyone can fly"*. There are more *"balik kampung"* trips between the peninsular and East Malaysia. Family reunions during festive seasons now take place at overseas destinations instead of at the traditional family home. Airports become shopping malls for both travelers and local community and transit lounges of international airport in London, Amsterdam and Paris become venues for business meetings.

The growth of e-commerce as a mega-trend will invariably further transform physical distribution networks and change our lifestyles. We should be ready in the future for *"all shipments to be trackable in real time, from the instant an order is placed to the instant of delivery, both in transit and in facilities, at the level of individual items and independent of carrier or transportation mode (Material Handling & Logistics U.S. Road Map, January 2014)"*. This will require highway and transportation engineers to think of innovative solutions to serve the microscopic needs of mega-trends. ■

Ir. Chin Kar Keong is an ardent supporter of sustainable development and green mobility. Currently he is benefiting from commuting between Petaling Jaya and Putrajaya in his Prius.

CONGRATULATIONS

IEM would like to congratulate the following members for conferment of these awards at an investiture ceremony held in conjunction with the birthday of His Majesty D.Y.M.M. Seri Paduka Baginda Yang di-Pertuan Agong XIV, Almu'tasimu Billahi Muhibbuddin Tuanku Alhaj Abdul Halim Mu'adzam Shah Ibni Almarhum Sultan Badlishah on 7 June 2014: The ***"Darjah Kebesaran Panglima Setia Mahkota (P.S.M.)"*** Award which carries the title **'Tan Sri'** to ***Y.Bhg. Academician Datuk Ir. Dr Ahmad Zaidee bin Laidin***, ***Y.Bhg. Dato' Sri Ir. Abdahir bin Abdul Majid*** and ***Y.Bhg. Dato' Ir. Gan Thian Leong***; and "*Panglima Jasa Negara* (P.J.N.)"Award which carries the title of **'Datuk'** to ***Y.Bhg. Ir. Prof. Dr Wahid bin Omar***.

Editorial Board, IEM

Lembaga Lebuhraya Malaysia (LLM) – Caretaker of The Highways

by A. Pfordten

Dato' Ir. Hj. Ismail bin Md. Salleh holds a Master of Science in Highway Engineering from the United Kingdom and an Advanced Diploma in Civil Engineering from University of Technology Mara. He has 33 years of working experience in the government sector and is principally responsible for planning, construction, operation and monitoring of all privatised highways; covering over 1,800kms from north to south of Peninsular Malaysia. He is a registered professional engineer, a fellow of the Institution of Engineers Malaysia (IEM), council member of Road Engineering Asia And Australasia (REAAA), council member of Road Engineering Of Malaysia (REAM), president of Intelligent Transport System Assocation of Malaysia (ITS) and chairman of the Chartered Institution Of Highways Transportation (Malaysia branch) (CIHTMB). He has been the director general of *Lembaga Lebuhraya Malaysia (LLM)* since 2009.

Q: Can you elaborate on the role of the LLM in the development of highways in Malaysia?

Dato' Ir. Hj. Ismail bin Md. Salleh: The LLM was established in 1980. Our initial role was to build and operate tolled highways in Malaysia. The government felt that this country needed tolled highways at the time, especially from north to south. We were initially tasked with finding our own financing, designing and operating the North South Highway. Since 1983, the government introduced the privatisation policy and wanted the private sector to build the infrastructure. This included the construction of tolled highways, airports, and power stations. In 1988, the first privatised project that was carried out in Malaysia was the North South Highway. Initially, we were supposed to complete the highway in five years – which meant that the highway should have been completed by 1985. However, because of financial constraints, only 30 per cent of it was completed. The KL–Seremban highway was only extended to Ayer Keroh by 1985. In the north, the highway had been constructed in segments – and sections of it had been built in Kedah, Ipoh, and Changkat Jering. The government thought this was too slow. They wanted the private sector to spur the economy. To hasten the development of the country, they wanted the private sector to participate as well. That's why the privatisation policy was introduced.

After privatisation, the government called for tenders and awarded the project to UEM Group Berhad to build the remaining section of the highway.

So in 1988, the operation and maintenance of the completed sections of the renamed North South Expressway were privatised to *Projek Lebuhraya Utara Selatan Berhad (PLUS)*, a subsidiary of UEM Group Berhad. We became a highway regulator instead.

Q: How has the original role of LLM evolved over the years with privatisation of toll highways?

Although the project had been privatised, somebody had to look after the government's interest, especially on the technical side. This is mainly our role. We make sure whatever has been agreed upon by the government and private sector follows the concession agreement.

In the beginning, our core business was supposed to be as a highway operator. So, we had engineers as well as operations staff such as toll collectors. The main bulk of our staff consisted of toll collectors. When we were privatised, they were absorbed automatically on that side. LLM became very small. There used to be over 1000 staff. This was reduced to about 250.

Q: What do you see in the future role of *LLM*?

This year, LLM will be 34 years old. Currently we are the only highway authority charged with taking care of tolled highways in Malaysia. The Public Works Department takes care of the federal roads. The concessions range between 30 and 40 years. After the concession period expires, the asset belongs to the government. This is what is meant by the built-operate-transfer (BOT) model. When, the asset transfers to the government. LLM will be responsible for it. The government has to decide at that point, whether it will still be tolled or not. As of now, the government has yet to decide on this. For example, the nearest handover, Kesas is due in 14 to 15 years. Other concessions are still far off in the horizon. The Plus Highway for example – is due to be handed over in 2038.

If the government has to continue to privatise these highways, then we will continue.

The highway has to be maintained. If the highway is not maintained, then its condition will decline, until maybe one day – it drops to the level of an ordinary road. It may be possible that the government will not be entirely concerned about profits – and will fix the rate as it is, or maybe increase it just slightly to cover operations and maintenance. After all, we still have to maintain the network. We have not decided that part, but in principle it should be like that. At this moment we have 1,800 km of tolled highways in Malaysia, and a total of 31 highway companies. They are mostly centred in the Klang Valley.

LLM current role will remain as long as there are tolled highways in the country.

Future of tolled highways in Malaysia

Q: How many more highways will be built in Malaysia?

First we must have a highway master plan – a plan for our highway network.

Each country builds a highway network to connect its various States and Malaysia is no exception – we need highways to connect States like Johor and Kelantan.

The highway planning unit does the planning for Malaysia. They do planning for 5 to 10 years in the future, determining the growth centre and planning their network . There are basically two ways to build the highway. Firstly, if you have good traffic volume, then you can privatise. The private sector looks for traffic volume viability, and something that is bankable. If the network is not bankable, we can't have a tolled highway. We have to dig in into our development funds.

Q: Why do we have to charge road users toll on highways when they are already paying a significantly high amount of road tax in Malaysia?

Everybody pays road tax. However, for toll rates – it is considered based on user pay principle.

Normally the highways that we build are new alignment highways. You have got a choice.

If you don't want to pay, you can take the free routes. If you want to use the private highways – you have to pay. We simply don't have enough development funds to build all these new highways. Even if we used the development funds – it would take a longer time – and they would be limited in coverage.

If you want the convenience, then you may choose the tolled highways.

Q: Are our current toll rates comparable to those charged in other middle and high income countries? Is the operation of toll highways sustainable without future increment in toll rates?

Yes. Our toll rate is very cheap, in my opinion, compared to other ASEAN countries – even Indonesia. But you can't compare to Japan and Korea. Actually it's quite hard to compare because each highway has its own different parameters. In general, we are quite competitive and we charge relatively low rates.

The government approaches the building of highways by considering the possibility of privatising. If it is a low traffic volume route which is of high importance, the government will build it using development funds. The government has to take care of the whole country – not just the roads. There are limited funds for other things like hospitals for example. If the private sector can come up with the funds, the government funds can be used for other development projects.

You must understand that a lot of money is put in by the private sector, so there must be viability and returns.

About 80 per cent of the highway development costs incurred by the private sector is financed by banks.

The toll rate must be structured to allow repayment of this loan. The bank has already looked into the proposal and discussed this firmly with the developer.

There are alternative approaches to it. You can start low and increase by 5 per cent at intervals, or you can start high. At the end of the day, you still get the product. If you want to make it convenient, you can charge the same rate from the first day. But if you start high – I don't think the public will accept it. The cost of living is going up every year.

The structured toll rate gives confidence to the private sector to invest. Some projects in Kuala Lumpur and the Klang Valley can be extremely expensive, anywhere from RM75m to RM100m per km.

Elevated highways are all just structure – and they are not cheap. Companies are very thorough when they do their investments.

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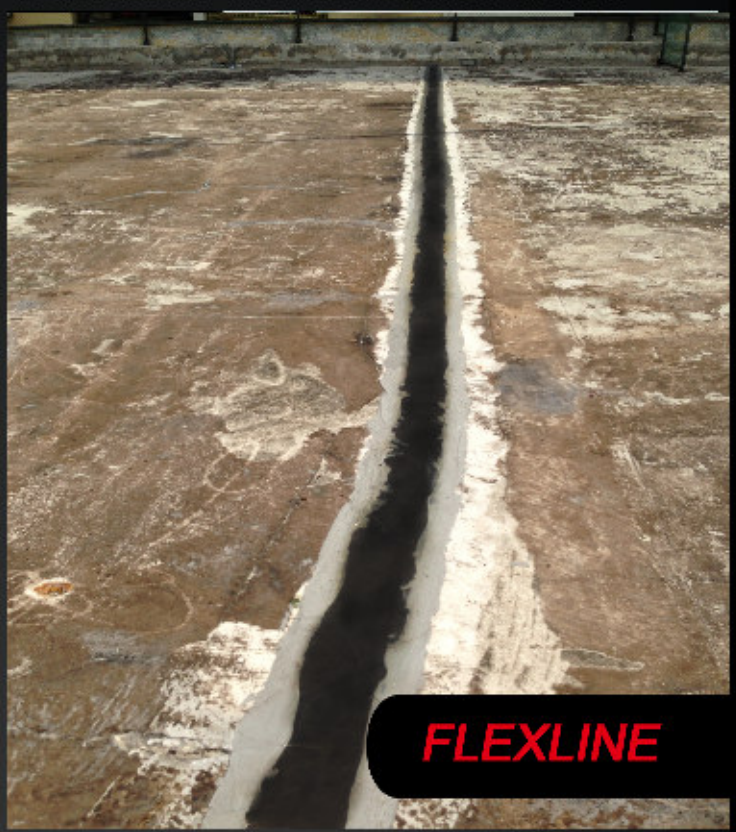

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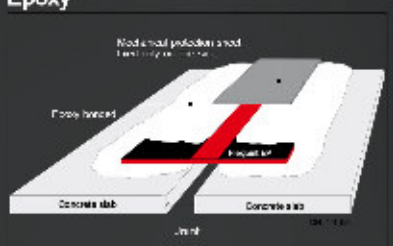

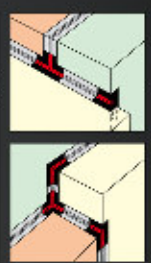

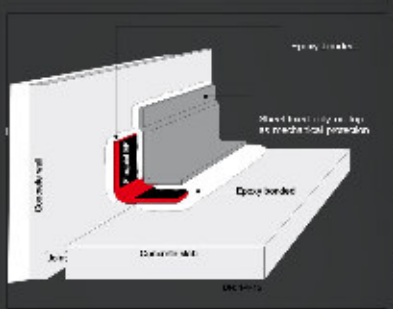

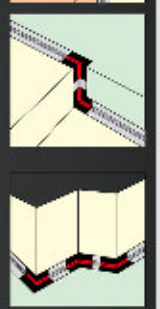

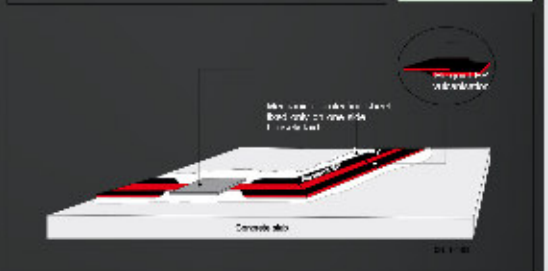

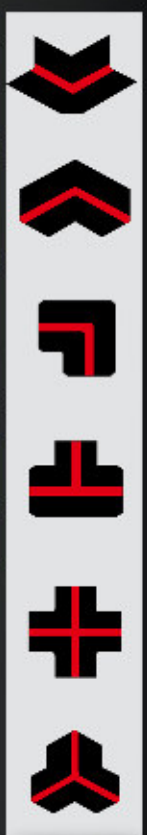

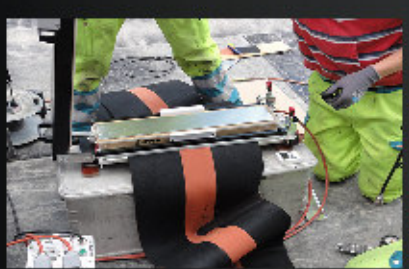

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Road Safety Issues

Q: Accidents on highway involving buses and lorries are often fatal. What is LLM's commitment to make our highways safer for all categories of road users? What is the government's strategy to ensure road safety issues are addressed for existing and new highways?

This is a national issue. Every year, statistics show that there are more than 6,000 motoring fatalities.

Accidents on highways amount to about 4 per cent of these accidents.

In general our highways are quite safe because they are divided highways. There are lane interchanges and drivers don't simply enter and exit as they like. Our highways are also fenced. However, highways are still high speed highways. When an accident happens, the severity can be very high.

Accidents involving buses and lorries are often fatal.

With modern cars, people tend to speed. We can't say our highways are not good because we follow standards and specifications. On the ground however, the rules are not followed. Buses speed. They are supposed to travel at 80-90 km/h but they travel at 120 km/h instead. The enforcement power is not with us. It lies with *Suruhanjaya Pengangkutan Awam Darat (SPAD)* and the Road Transport Department.

We provide good roads. But when there is a good road, people tend to speed.

Q: There are complaints that the dedicated motorcycle lanes are not well maintained especially at tunnels where flooding have caused potholes. Subsequently, motorcyclists are seen on the main carriageway. What is the strategy to overcome this issue?

There are not many highways with dedicated motorcycle lanes like in Malaysia. We have motorcycle lanes on KESAS Highway, the Federal Route 2, BKE, and Guthrie Highways. According to the Malaysian Institute of Road Safety (MIROS), the dedicated lanes reduce accidents by 25 per cent. However, building these lanes are costly. You need two or three metres on the highway shoulders. At the interchanges, they diverge from the main highway and you need to spend additional on street lighting.

Our responsibility is to ensure the safety and security of the lanes. We make sure they are well maintained and lighted.

We try to do our best to maintain the roads that we are responsible for or are under our jurisdiction.

On the Federal highway for example, at Batu Tiga Sungai Damansara was prone to overflow before the Department of Irrigation and Drainage dredged the river. They have made the river wider and the banks higher.

Many motorcycle lanes are prone to flooding. Sometimes you have to pump the water out. The pumping system has to be working well at all times. We put up signboards and gazette the motorcycle lanes, so by law you have to use them. However, there must be enforcement. In Malaysia, if there is enforcement, then only will people follow the rules.

At the end of the day, the public must know how to follow the rules. Our job is to keep the road well maintained and well lighted.

Operations and Maintenance Issues

Q: What is LLM's commitment to ensure that the highways are well maintained?

We have a manual and Key Performance Indicators (KPIs). We are the regulator. However, the concession company is responsible for keeping the highways in good condition.

In fact, most companies want to make sure the road is in good condition. If it is in poor condition then the user will complain. When you collect money for toll, you must also render good service to your customer. It's a business. The customers are another issue. When they pay, they will demand for service. On tolled highways however, smaller issues will be cause for complaints. But it's quite fair after all.

We make sure the KPIs are in the agreements so that there are no disputes later on.

These include items such as the level of service at the toll plazas – which require fast transactions – as well the service standards at the rest areas – even the cleanliness of the toilets need to be of certain standards.

With privatisation, the responsibility is put on the company. We come in on and off. If we inspect and it's not up to standards, we will issue a penalty or warning and so on. If they refuse to buck up, we have money in a maintenance bond. We can use the money to maintain the facilities. No company wants that to happen.

Q: Is there any pavement management system in place in *Lembaga Lebuhraya Malaysia (LLM)*? How it is carried out?

The company itself must know how to manage the pavement. They have their own system, while we provide the KPIs.

They provide us with reports. Suffice to say, we know which pavement will be damaged now, and even 20 years down the road.

This is needed so that a strategy can be set. The pavement is a very expensive item. The company has limited cash flow. You have to make sure that money is spent wisely and that pavements are in good condition all the time. If you make 500 km of new highway, in 5 to 7 years all of it will need to be repaved. Imagine if you had to repair it at the same time.

Some sections of the highway are heavily loaded, and others are not. A study is done every year. We know the stretches which are priorities. For companies like PLUS – which have big assets, they need proper asset management.

We also have to take care of the public. The process of repaving highways is an inconvenience for them.

Companies spend up to RM200 million a year on repavement. They collect RM1 billion, and spend one fifth of it on repavement on highways such as at PLUS highway which is already old. Besides that, companies also spend for operation and maintenance cost, upgrading of highway structures, finance cost and returns for the shareholders.

Q: Many road users are complaining that after paying toll they still get stuck on the highway during peak hours. What has LLM done or can do to ensure that the road users of tolled highways get value for money?

I agree. Some urban highways experience heavy traffic during peak hours.

The highway is connected to local roads. There are many junctions going in and out.

Sometimes, the traffic volume is too high.

On the Lebuhraya Damansara Puchong (LDP) for example, if we look at the issue – the projection didn't expect the Puchong corridor to grow so fast. Some 15 years ago, Putrajaya did not exist and the Puchong area was not what it is today. The road ended in Sunway. When we connect the highway, we see the corridor grow – not just on the sides of the highway but also in the interior. Where does the traffic lead to?

We encourage people to use Smart Tag (An Electronic Toll Payment) to make the transaction quicker. If traffic gets stuck at the interchange, we try to modify the interchange. Sometimes it gets jammed because of a stalled vehicle. We try to clear it up immediately. Sometimes it happens on other roads – but there is a backflow into the highway. We work with the local councils to rectify this. But the problem is complex. For example, on Federal route 2 if a lorry breaks down at PJ Hilton, the traffic is jammed all the way towards Klang. If someone just paid the toll and entered the highway – he will be caught in that congestion.

We encourage people to move from cash to electronic toll payment. The toll booths have very high traffic volumes of up to 1200 vehicles per hour. It's simply not productive, and we can't keep on adding toll lanes. In the last five years, we have been encouraging people to migrate from cash to electronic toll payment.

This is our strategy.

We are going to change the toll payment method eventually to electronic payment. We have already started. For example in many places in Johor, it is all automated.

We will try in Kuala Lumpur too. Perhaps at the Batu Tiga toll plaza, where 70 per cent of people are now using electronic payment methods.

Human Capacity Building

Q: Since its formation, LLM has developed an internal pool of highway engineers capable of planning, designing, supervision and construction of toll highways including mastering new technical competencies in such as specialised areas slope stabilization and protection measures (eg KL-Karak), tunnels (eg SMART), long span bridges (eg Penang Bridges), toll collection system, traffic control and management system, etc. Local highway engineers and contractors employed to implement the highway network development in Malaysia had also benefited from these opportunities created by the privatisation master plan to gain experience in highway engineering. How prepared are our highway engineers to export their expertise to other countries? Can you share with us some success stories and lessons learnt from past experience?

When you want to build a highway, whether you are in the private sector or government, you must first get professional engineers and a consulting firm to design it for you. You need a surveyor, an architect, and many other professionals to design the highway. Then you need a builder to build the highway. Our contractors are capable, that's why the North South Highway was completed. In highway engineering there are many disciplines. There are specialists on geometric alignment and others on drainage, slope and pavement. Although all are under civil engineering, they are all highly specialised disciplines.

Over the years, we have given the opportunity to our professional engineers and so far they have delivered. Our engineers are capable of constructing almost anything today. Many of our engineers are consultants working overseas in India, Philippines and the Middle East.

Q: Are our current local university engineering programmes able to produce quality highway and traffic engineers required by the industry for local and overseas markets?

The Malaysian universities syllabus on civil engineering is quite fixed.

Students can approach the subject from a technical point of view only. There are factors such as land acquisition, environmental road safety issues that they must think about and incorporate in the design of the highway.

There are other factors involved in highway building. Engineers have to take into account these factors as well. There are social, economical and even environmental issues to think about.

You can't build a highway suddenly in front of houses. This will create problems for the residents.

If you build a highway near where the animals cross, you need to provide adequate crossing pathways for them.

If their routes are cut off, they will wander on to the highway. We have to be sensitive to these issues.

These factors also affect the overall highway design and cost.

Our engineers have to be more broad-minded. At the moment, what I see is a lot of text-book smart engineers.

Q: What role do you think IEM can play to ensure that our pool of highway and traffic engineers is able to become more competitive in local and overseas markets?

I see IEM playing a bigger role as they provide professional input to governments and local councils though they are an NGO.

It works to promote professionalism and at the same time they provide a service to the government by helping with the planning.

IEM should have a role in education too, by showing what the industry wants and modifying the syllabus and so on.

Q: Please share with us the availability of publications by Lembaga Lebuhraya Malaysia (LLM) on guidelines and standards of good highway engineering practices.

Our design standards are based on British, American and Australian standards.

What LLM develops on its own are operational guidelines.

This guides us on how to manage highway operations, the levels of service at rest areas and plaza management as well as patrolling services.

We can't easily find these manuals, so we developed our own. So far we have 30 to 40 manuals on the matter. Why does Lembaga Lebuhraya Malaysia (LLM) prepare the manuals? We monitor 31 highways operators – and everyone has to perform up the same standards.

Q: In the early years, foreign experts were attached to LLM and PLUS to transfer technology to Malaysian engineers. What other transfer of technology do we still need today? Are we able to now transfer technology learnt and developed in Malaysia to other developing countries? Please give us some examples of efforts by Lembaga Lebuhraya Malaysia (LLM) in this activity.

Some 25 years ago, there were not a lot of highways being built in Malaysia. So we needed experts from overseas.

It was not just the case with LLM but also with the Public Works Department. LLM had experts from Japan and Italy attached to us. Today, we already have many engineers. The expertise that we now need is in the area of intelligent transport systems, so that we can better manage our highway traffic. Currently we have basic Intelligent Transportation System (ITS) on the highways, but none on the local roads. In the years to come, we need to apply ITS in totality.

Future Challenges for *Lembaga Lebuhraya Malaysia (LLM)*

Q: Can you share with us some of your views on the future direction of highway and transport engineering in Malaysia?

The future generation shouldn't use toll collection booths. That is our challenge now. In the future there will be a gantry which you will drive through.

We have been working on it for the last 3 or 4 years. We are working out the legal and enforcement framework. The technical system is obtainable – many companies in the world can do it, but what happens if people don't pay their tolls which have been accumulated?

We have installed one or two on our highways.

People are now talking about green highway indices and green building indices. This is needed at the planning, design and construction stages.

It can help improve the noise level on the pavement. We can also recycle the pavement. There are also other aspects to it. If there is an accident and an oil spill, there are areas to collect the spillage to ensure the rivers are not contaminated.

On the NKVE, we have converted ordinary street lamps to LED lights to save energy. Slowly, we are making the highways greener.

Conclusion

Since it was established in 1980, Lembaga Lebuhraya Malaysia (LLM) has put all efforts to drive the highway industry to a higher level and to facilitate the efficient transportation and mobility of people while providing a smooth and comfortable ride. Highways have provided employment, stimulated businesses, increase access between urban and inter-urban areas. Our experience in the field has also enabled us to share the Malaysian expertise in highway construction and operation internationally. ■

Introduction Note to Road Safety Audit (RSA)

by Ir. Richard Wong Chuen Fun

ROAD Safety Audit is the formal examination of the planning, design and construction of a road project by independent and qualified examiners to identify any potentially unsafe feature or operational arrangement that may adversely affect the safety of any road user.

RSA is an effective accident prevention strategy, utilising investigative methods and mitigative measures that may be taken to improve the safety level of the road.

Safety is now given priority in road planning, design and construction. There are 5 stages in the development of a road project when it would be most appropriate to carry out a road safety audit. These are as follows:

- Stage 1 – Feasibility and Planning Stage
- Stage 2 – Draft (Preliminary) Design Stage
- Stage 3 – Detail Design Stage
- Stage 4 – During Construction/Pre-Opening Stage
- Stage 5 – After Construction/Existing Stage

The RSA shall identify road safety deficiencies at various audit stages in the development of the proposed road project, so that they can be eliminated at the most opportune time to reduce costs and minimise disruption to design and construction progress.

STAGE 1: FEASIBILITY AND PLANNING STAGE

The Audit at this stage generally identifies safety problems associated with the overall concept of the project. These cover the road network, road standard, design criteria, general geometric standards, intersection types and locations. It will also consider the safety implications of strategic issues such as access control and provisions for various road user groups, namely, pedestrians and motorcyclists, which may need emphasis.

STAGE 2: DRAFT (PRELIMINARY) DESIGN STAGE

At this stage, many of the engineering features should be established. The audit here shall identify the safety aspects and design requirements as per best international practice. The audit features include cross-section elements, intersection layout, lane and carriageway layout, traffic control options and vertical and horizontal alignments and 'Right-of-Way' requirements.

STAGE 3: DETAIL DESIGN STAGE

At this stage, the RSA shall examine the design decisions made against road safety objectives and will identify aspects in which safety has not been given high enough weighting compared to other competing factors. Audit features shall include adverse combinations of vertical and horizontal alignment, gradients, road markings, drainage, roadside safety, traffic signings and controls, street lighting, landscaping features and provisions for special road users.

STAGE 4: DURING CONSTRUCTION/PRE-OPENING STAGE

Audit generally includes traffic management in and around the site during construction. During construction, the project can be viewed in three

dimension for both day and night. The actual placement of guardrails, traffic signs and poles, street lights and landscaping should be looked at in detail. Particular emphasis will be given to all road user groups to ensure that desirable road safety standards are met.

STAGE 5: AFTER CONSTRUCTION/EXISTING STAGE

At this stage, the auditing shall identify safety hazards from the way the landscaping has matured, such as trees and foliage obstructing traffic signs or impairing sight distances. Inspections shall be carried out both day and night to check inadequacies in road delineation and visibility.

The audit shall also pay emphasis to the way each road user group views the road from their particular safety viewpoint. For example, a motorcyclist may view a safety hazard differently from a motorist. ■

Ir. Richard Wong Chuen Fun is graduated from Monash University, Melbourne in 1984 and is presently the Principal of RW Consultancy, a civil engineering consultancy firm that he founded in 2005. He has some 30 years experience in the engineering profession. He has worked in both overseas and local projects and his key experience extends to road safety audits, road and interchange designs, traffic light designs, traffic and transportation engineering, traffic impact assessment and traffic studies. Ir. Richard is a Road Safety Auditor accredited by Jabatan Kerja Raya (JKR), Malaysia and a Committee Member of the Highway and Transportation Division of the Institution of Engineers, Malaysia (IEM).

IEM DIARY OF EVENTS

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.

Tentative Programme for Library Open Day
23 August 2014 Saturday / GETD Room & IEM Library Basement Floor

TIME	EVENT Library Open Day
Venue: 2nd Floor of IEM / GETD Room	
9.00a.m. – 9.05a.m.	Opening remarks by Chairman, Library Sub-Committee
9.10a.m. – 10.30a.m.	TOASTMASTERS: Guide to Public Speaking Leader: Mr. Alex Lu from IEM Toastmasters Club
10.30a.m. – 10.45a.m.	Tea/Coffee (Location at Foyer of 2nd floor)
10.45a.m. – 11.30a.m.	Presentation by SIRIM
Venue: at IEM Library	
11.30a.m. – 11.40a.m.	Official launch of: 1. e-books 2. e-Journal By The President, IEM Networking
11.40a.m. to 2.00p.m.	Free & Easy Exhibition – Display of books by SIRIM and Book Sellers. Within the Library.

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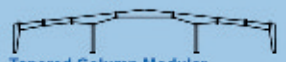
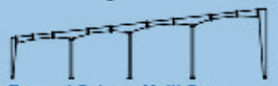
Multi-Span

Tapered Column Modular One Interior Column (TCM1)
Building Width . 18m - 75m
Sidewall Height . 3.5m - 12m and over

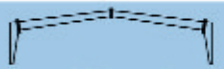


Tapered Column Modular Two Interior Column (TCM2)
Building Width . 28m - 110m
Sidewall Height . 3.5m - 12m and over



Tapered Column Multi-Span Single Slope (TCMSS)
Building Width . 20m - 160m and over
Sidewall Height . 3.5m - 12m and over

Clear-Span



Tapered Column Clear Span (TCS)
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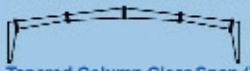
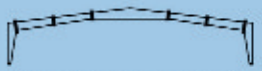
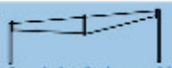
Sidewall Height . 3.5m - 12m and over



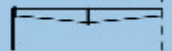
Tapered Column Clear Span (TCS) - Two Piece Rafter
Building Width . 12m - 60m
Sidewall Height . 3.5m - 12m and over



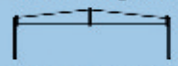
Tapered Column Clear Span (TCS) - Three Piece Rafter
Building Width . 12m - 85m
Sidewall Height . 3.5m - 12m and over



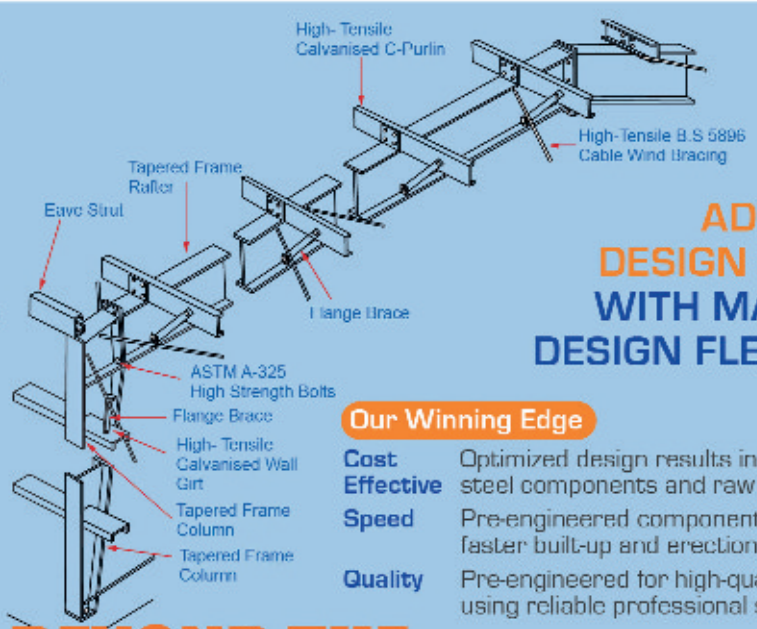
Straight Column Single Slope (SS)
Building Width . 4.5m - 22m
Sidewall Height . 3m - 9m



Straight Column Lean To (LT)
Building Width . 3m - 22m
Sidewall Height . 2.4m - 9m



Straight Column Clear Span (SCS)
Building Width . 6m - 22m
Sidewall Height . 3m - 9m



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Output and Performance Based Contract for Management of Highway Assets


by Nik Airina Nik Jaffar and Chin Chi Haw

INTRODUCTION

Internationally there is a strong trend towards the outsourcing of highway maintenance. However the majority of these contracts still primarily place emphasis on the activity of maintenance and the cost per activity of maintenance.

Thus, bills of quantities and schedule of rates are the usual common features in this type of contracts, with a set of workmanship specifications that will determine the quality of the output product. Although there is some flexibility, there is very little leeway for the outsourced service provider to intrinsically determine the manner that the works or products are designed, prepared or scheduled for completion.

The premise of this type of outsourcing is focused on the exact activity to be performed (what), frequency of activity (when) and at a certain price (worth). These detailed output based contracts are sometimes manifested into smaller works packages and given misnomers such as "Work Orders", "Job Sheets", and "Procurement Orders", where the principles for implementation are basically the same.

As road authorities progress and recognise the need to drive better value for money spent and demand better level of service from the asset, the contract specifications started to evolve towards defining a combination of output and performance levels expected from the highway assets rather than the specific activity and costs per activity of maintenance.

OUTPUT-PERFORMANCE BASED PHILOSOPHY

The spectrum of Performance Based Contracts ranges from simple Routine Maintenance (RM) only performance contracts to the most sophisticated full Performance Specified Maintenance Contract (PSMC) as shown in Figure 1.

The inclusion of performance based measures with the output specifications provide significant advantages to the asset owners (which may be the road agencies or concessionaires depending on the form of partnership collaboration) and ultimately to the end user. This allows the asset owners to dictate the overall budget available, and the service provider with the flexibility to decide where and how to spend the budget allocated to achieve the desired level of service.

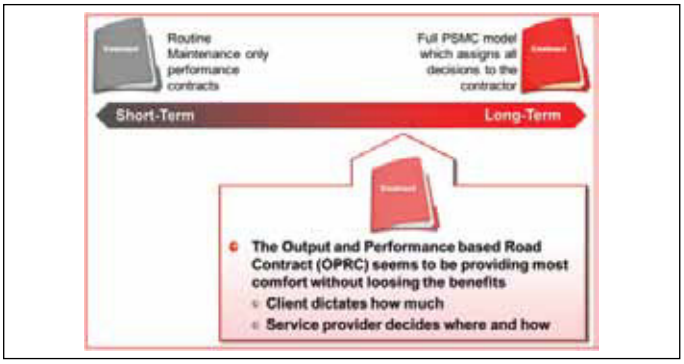

Figure 1: Types of Performance Based Contracts

In such contracts, the specifications of performance measure means that the service provider needs to ensure that the works on the assets or services provided will be able to meet the functionality or levels of service set while the assets are under their tenure and upon handover. Solutions that reduce "whole of life" costs will become the focus of the service provider and so the road authorities and asset owner will also inherit the cost savings.

In addition, as such output-performance based contracts are on considerable time period tenures (some as long as 10-15years), this arrangement forces the parties concerned to clearly identify the risk and cost-benefit issues, which needs to be addressed under long term aspects. It also allows ample opportunity during the tenure to assess the condition of the asset to reduce the risk of defect inheritance to the road agencies/asset owners.

The output-performance specifications of such contracts circumscribe the outcomes expected from the asset and consequently define the level of service required. Typically, such contracts comprise different categories of Performance Measures and Criteria underpinning the required project outcomes (Figure 2). These measures and criteria are ultimately to achieve the goals or objectives of the road authority.

Figure 2: Performance Measures and Criteria

AREAS OF IMPROVEMENTS

Thus, the contracts give rise to a few areas of improvements. These are summarised in Table 1. (Page 16)

MANAGEMENT PERFORMANCE MEASURES (MPM)

provide principle outcomes in the management of the contract

Table 1: Input Based vs Output and Performance Based

Output Based	Output and Performance Based
Finished works according to specified profile, roughness and texture as per design specification by consultants.	Ride quality for road users, resulting in reduction in quantifiable road user costs. (economic) Reduced accident rates, as per accident statistics. (social) Noise and dust control, number of complaints from affected community. (environment) Savings to the owner in terms of providing the right type of work at the right time and the right price. (economic)
Activity driven – what and when to perform tasks	Level of Service – e.g. Road Usability, Road User Service & Comfort Measures, Durability, Road Furnitures' Performance Measures
Does not Promote Innovation	Proactive Innovation – Contractors are incentivized to innovate to save costs in order to participate in the sharing of the cost savings
Work driven	Promotes Optimisation – Level of Service vs Cost of Service: Avoids "overkill" Encourages strategic trade-offs and management of priorities
Payment for inputs or physical works (which they undoubtedly have to carry out)	Payment for output & performance e.g. rehabilitation to pre-defined standards

and delivery of professional services across key performance areas. They are a set of outcome criteria, in which the service provider's performance is measured against and include measures relating to the management of the contract and delivery of asset management related services. The service provider is required to develop and implement asset management practices to limit the extent of asset consumption, while achieving the other performance measures.

ROAD DURABILITY PERFORMANCE MEASURES (RDPM) define the minimum performance criteria for individual assets during the contract term, with which the service provider must comply at all times. The overriding requirement is achieving asset preservation that ensures individual assets are maintained to the desired levels of service and achieve/exceed their design life expectations. The RDPM reflects the overall condition of the assets of the maintained corridor and are based on delivering current levels of service, as determined from road asset condition assessments, performance monitoring, delivery methodologies, and management functions within infrastructure management systems.

In a typical outcome or performance based road maintenance contract, key RDPMs are collected in a periodic (usually annual) cycle. The collection of this RDPM data is targeted at network level, which typically requires network-wide measurements such as high speed mechanised data collection in conjunction with more conventional manual collection methods. This data is classified and reported against functional (road user) and structural (durability) criteria. For example, a key RDPM report the functional aspect of pavement performance via the International Roughness Index (IRI), which is collected on a high speed laser profiler. This performance measure has been gaining worldwide acceptance as the best indicator of level of service offered to the road user in terms of operating savings in Road User Costs (RUC).

OPERATIONAL PERFORMANCE MEASURES (OPM) define the minimum performance criteria for individual assets in terms of day-to-day operations and maintenance standards. These measures are sometimes termed as Road User Service & Comfort Performance Measures (RUS & CPM)

For an output and performance based road contract, this measure defines the required level of service to be achieved by the service provider. This includes works management, information management, responsiveness to incidences, efficiencies in monitoring and reporting to Client and environmental and safety legislative compliance.

END OF TERM REQUIREMENTS (EOTR) specify the condition state for various major assets at time of hand back to the road authority. These requirements are intended to protect the owner from asset consumption during the contract term. The service provider must demonstrate throughout the contract term, via the submitted asset management plan and quality management plan that they will achieve or exceed the End of Term Requirements.

CASE STUDY

As an example, a road agency's goal is the provision of a safe and efficient road transport system. Over the past several years, through a series of studies, it has been determined that, to progress up the value chain, it will implement Output and Performance based Road Contracts (OPRC) for a portion of its road network to assess the benefits from this approach to the management of its highway assets.

The linkage of the various project parties involved in the development of this work is illustrated in Figure 3.

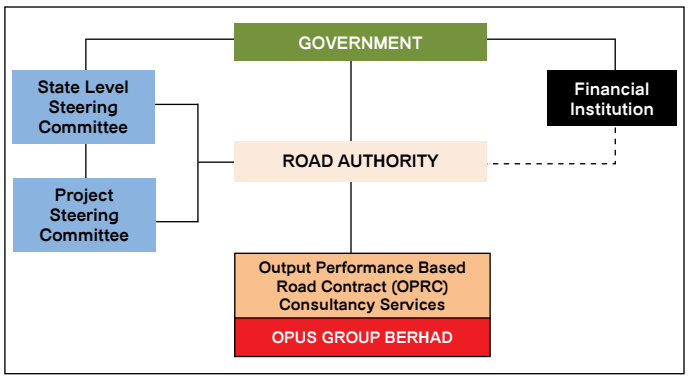

Figure 3: Linkages of various parties

The project seeks to improve management of the network's infrastructure such that the **desired level of service** is delivered for the **least cost** to the agency over the **whole life cycle** of the asset.

The life cycle of an asset can be schematically depicted in Figure 4.

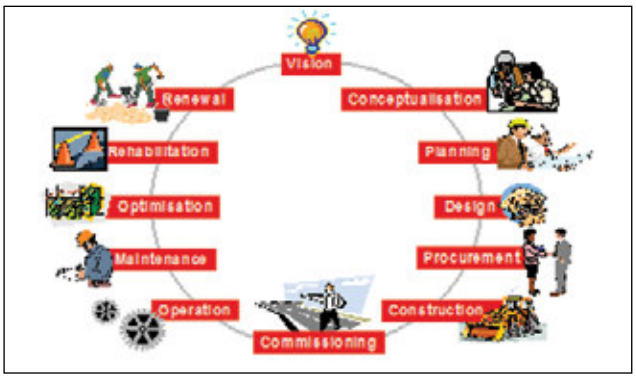

Figure 4: Stages in the Life Cycle of an Asset

The cycle repeats itself at the renewal stage if an upgrading or expansion in capacity is planned at the end of the initial lifecycle.

Network surveys and actual loads per vehicle were collected and used to develop estimates of future traffic loads.

This information has been consolidated up and used to categorise future traffic loads on the Network. In this case, 3 design groups were assumed based on a recommended pavement design along typical categories as follows:

- Group 1 Roads: Future traffic up to 20MSA
- Group 2 Roads: Future traffic up to 50MSA
- Group 3 Roads: Future traffic up to 100MSA

Based on a review of the current condition data and the quality achieved on recent contracts, the proposed Levels of Service (LOS) and performance criteria for the network were then determined. The setting of "fit-for-purpose" service levels is pivotal to the whole OPRC exercise.

The measurement of LOS has been grouped in to the following 3 headings:

Management Performance Measures (MPM)	Set of performance criteria that reflect the Contractor's ability to successfully manage the physical works contract and to provide information to the Client e.g. final Annual Programme, Rolling Three-Year Programme, Report Submission Deadline.
Road User Service & Comfort Performance Measures (RUS & CPM)	Set of performance criteria that reflect the Contractor's ability to successfully complete routine maintenance activities. e.g. No more than 2 potholes within continuous 1km center line length with a diameter greater than 150mm. The maximum diameter of any single pothole shall be 300mm. No pothole shall be more than 50mm in depth.
Road Durability Performance Measures (RDPM)	Set of performance criteria that reflect the Contractor's ability to successfully manage the pavement and surfacing asset for the future and protect it from consumption over the duration of the contract.
	e.g. roughness level – IRI

Taking into account the inventory and the assessment of the road condition, the quantum of measures necessary to ensure that the proper level of service can be adequately defined to meet the objectives of the road authority and realize the appropriate benefits to the road users were then formulated. The quantum varies according to project size and for this example the typical road networks have the scope of measures as follows:

Management Performance Measures (MPM)	11
Road User Serviceability & Comfort Performance Measures (RUS&CPM)	34
Road Durability Performance Measures (RDPM)	9
TOTAL	54

Within the definition of the LOS, it is best to avoid the use of response time based measures wherever possible. This is because not only are such measures more difficult to audit but they also reduce some of the pressure on the service provider to manage the asset to avoid defects – by instead allowing them to rectify once they occur or are identified by others.

In this regard, objective type definitions have to be set for the description of the performance measures and level of services. So, in setting the performance measures, the key principles are along the following criteria:

- **Repeatable** – measured with appropriate accuracy
- **Reproducible** – by different operator or equipment
- **Cost Effective** – in comparison to contract value
- **Manageable** – able to be influenced by contractor
- **Enforceable** – reasonably enforced with penalty/bonus
- **Predictable** – possible to model future outcomes
- **Safe to Measure** – practically requires high speed data

Typical measures for the difference performance measures are as follows:

Table 2: Examples of Performance Measures

Nomenclature	Management Performance Measure (MPM)
MPM-1	Quality Assurance System
MPM-2	Contracting Entity's Programmes
MPM-3	Emergency Works Reporting
MPM-4	Treatment Design
	Road User Service and Comfort Performance Measures (RUS & CPM)
RUS&CPM-1	Pavement Surface Repairs
RUS&CPM-2	Ponding of Water on the Pavement Surface
RUS&CPM-3	Signs Maintenance – General
RUS&CPM-4	Pavement Marking
	Road Durability Performance Measures (RDPM)
RDPM-1	Average Roughness
RDPM-2	Pavement deflection – contract area
RDPM-3	Construction Standards

Intrinsic to this project, was the recognition that it was almost impossible to have a conforming network 100% of the time. An innovative administration mechanism was thus introduced where non-conformance will be managed through a **"non-conformance bucket"**.

Non-Conformance Bucket is akin to a bucket of water where within any time period, as long as the prescribed Non-Conformance is not overflowing the bucket no penalty will be imposed (refer Figure 5).

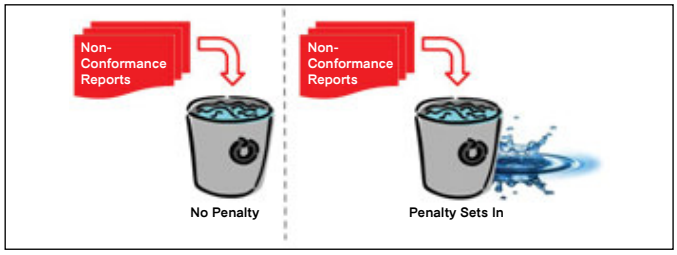

Figure 5: Non-Conformance Bucket

Over time the bucket will be reduced when the contractors begin to appreciate the network and gain efficiency and effectiveness in carrying out the works (refer Figure 6).

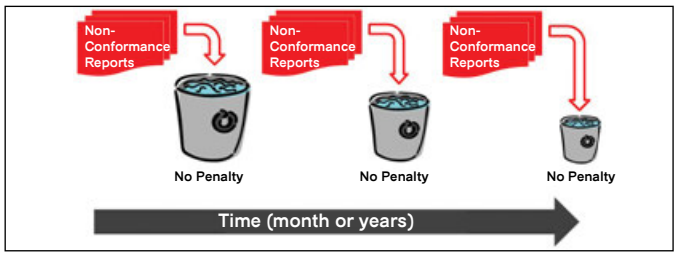

Figure 6: Reducing Non-Conformance Bucket over time

Inter-related with the development of the starting "bucket size" as well as the speed and quantum of progress over time are the **local market development** and **staged improvement** – criteria and objectives that the Client intends to achieve.

The OPRC not only creates a direct economic benefit of approximately USD500 million over 10 years but also creates sustainability and certainty of work flow and order book to the service provider. This in turn creates benefits to the overall construction industry for the following:

- Ability to raise appropriate financing to fund the contract
- Promotes appropriate long term planning for the contractor
- Promotes appropriate long term investment into machineries, manpower and equipment
- Creates economic multiplier effect on the machinery and equipment industry, as well as resources e.g. sand, stones and bitumen

ACKNOWLEDGEMENT

The authors would like to acknowledge the generous exchange of thoughts with our colleagues in Opus from Malaysia, New Zealand, Australia, United Kingdom and Canada, who have provided contributions to the preparation of this paper. ■

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Chin Chi Haw has a background of over 25 years involvement in the transportation infrastructure and built environment sectors and has played key roles in the asset development and asset management of key infrastructures, both locally and internationally.

Challenges for Chemical Engineers in the 21st Century

by Ir. Zaki Yamani Zakaria and Engr. Dr Mazura Jusoh

INTRODUCTION

The future is both uncertain and challenging. Technology is constantly changing at a fast pace but the world of chemical engineering has remained in an equilibrium state in terms of the basic delivery of important areas such as sustainable energy, food, water and well-being in all parts of the world.

The threat of climate change continues and includes increased stress in energy, food and water resources. For these reasons, chemical engineers are advancing to support chemical and related processes in order to develop appropriate yet conceptualised solutions.

Without doubt, chemical engineering is the most vital part of the jigsaw puzzle of 21st Century living. Chemical engineers are the main players in manipulating chemicals, scaling up processes and optimising the economic and environmental performance. Chemical engineers are found in various processes in life and they function in a multi-disciplinary context to encourage the utilisation of applications with innovative thinking to various diversities and nurture links with other disciplines of success across the line.

CHALLENGES AHEAD

Chemical engineering today is changing due to global financial crisis and rapid development of the world. The nuclear disaster in Fukushima, oil disaster in the Gulf of Mexico, potential of shale gas worldwide and renewable biomass/biofuel technology are among the things that are not yet fully understood, although some may think otherwise.

The coal-to-olefin industry, which was commercialised a few years ago in China seemed promising but after the technology was proven viable, issues such as logistics, transportation, energy, environmental, waste and sustainability of the overall process emerged. Solar energy which is green, sustainable and effective, is still considered a challenge, mainly due to the low efficiency and high cost of the materials such as photovoltaic (PV), batteries and others.

Chemical engineers must work together with those in other disciplines to use relatively cheaper and renewable components to build more efficient PVs for solar power installation in Malaysia and elsewhere in the world.

Recently, the Institution of Chemical Engineers UK (IChemE) published "Chemical Engineering Matters – A Review Of IChemE's Technical Strategy". This document can be considered an excellent guide for chemical engineers to systematically face future challenges. It featured four important areas which chemical engineers should focus on, contribute to and improve on such as (a) energy (b) water (c) food and (d) well-being. All these are crucially imperative and the question is whether chemical engineers can design the technologies involved to be sustainable?

SUSTAINABLE ENERGY

Our work population is increasing at a fast pace and we all require energy to live. Looking to the future, chemical engineers must make a case that is greater, more pro-active, useful and can increase resources. The challenge is to promote energy efficiency with improvements which will benefit corporations and the population as well as the environment.

The promotion of sustainable energy has been given a primary role in society and changes vary from nation to nation. Developed countries which are blessed with abundant natural resources and more advanced technology has been given the lead to establish knowledge and develop infrastructures to drive change. The goal is to create vast support to encourage sustainable energy and ensure its progress. Chemical engineers all over the world must demonstrate the productive and sustainable value of chemical engineering. Their role is to uphold and improve quality of life in a more sustainable way.

Chemical engineering promotes a future energy mix that contains carbon-free or ultra-low carbon energy. Imagine the savings in electricity and the positive environmental impact when solar energy is applied on a massive scale to power homes, large facilities and industries and perhaps be distributed internationally and stored in advanced to keep the system more resilient. Imagine when people can travel anywhere without the need to fuel their car with petrol, but instead to charge their electric vehicles in their homes.

Chemical engineers can also use a mix of electric and food-cells propulsion to derive value added product from biomass or food and agricultural wastes. This biomass technology which can produce biofuel and/or precious products is still in its infancy stage and requires more attention. Such an industry may emit carbon and via the utilisation of carbon capture and storage (CCS) as well as energy recycling, environmental threats from carbon can be reduced to zero.

Other unwanted by-products such as glycerol from the biodiesel process which is now abundantly available, can also be catalytically converted to produce useful products such as acrolein, olefin, esters and others.

Figure 1 illustrates the forecasted future trends of both biodiesel and glycerol. However, the concept of such integrated refinery or plant still requires further study. Although chemical engineering researchers have published works on the integrated biomass plant concept, chemical engineers must get together and develop such an integrated green project soon. This quest is what we call future energy mix which must be directed towards a greater development which can be widely deployed as a truly-sustainable and commercial variable process for a renewable energy base. Overall, the transition of these new upgrade systems will bring new challenges in storage and distribution of energy, almost like the coal-to-olefin technology in China. When this occurs, a good combination of commercial, domestic and international settings is then required.

In short, the world is growing and so does the demand for energy. Hence renewable energy must be developed and it must be sustainable, safe and environmentally friendly.

SUSTAINABLE WATER

Ensuring that people have access to clean water is a major global challenge. Water is a basic fundamental but its resources are limited. Nowadays, billions of people do not have adequate supplies of clean, treated water. The population growth has increased and industrialisation is one of the main culprits for the increased demand on water supplies. Figure 2 shows the global increase in water consumption. In fact, water scarcity is being aggravated by various intersectional factors which include sanitation, pollution, climate change and environmental problems.

There are several opportunities to improve the sustainability of industrial and municipal water supplies. Industries rely on chemical engineering technologies to primarily solve the basic challenge of the release of safe water. Chemical engineers are in demand to promote advanced technology solutions. One of the goals is to promote recycling and reusing water. Chemical engineers play essential roles in solving the problems as the primary challenges are associated with better recycling and reuse of wastewater (also known as grey water) in industries and chemical processing companies. One advanced technology to tackle the wastewater problem is Progressive Freeze Concentration (PFC) where wastewater constituents are concentrated and separated from the water via freezing. However, this technology, which was recently patented, is still new and requires further tests, modelling, simulation and economic investigation.

Chemical engineers must be able to support the development and implementation of different strategies to facilitate access to clean water and to improve water conservation in energy efficient ways. Producing safe, clean and readily available water will also help improve sanitation and promote advanced knowledge in human waste management. Chemical engineers can then help resolve water loss by improving infrastructure and

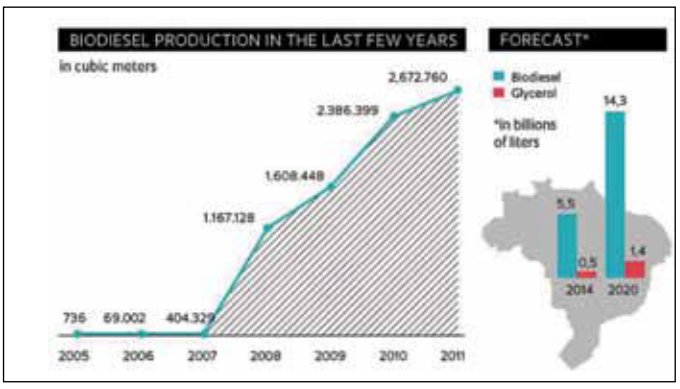

Figure 1: Biodiesel and glycerol production - past and future. It shows the huge potential of sustainable energy from biomass (http://revistapesquisa.fapesp.br/en/2012/09/06/welcome-waste/)

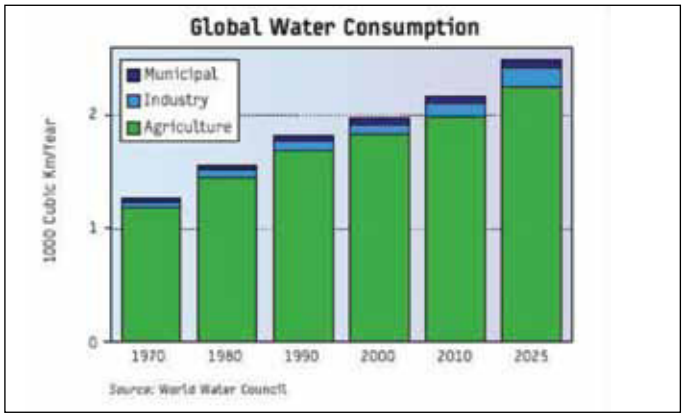

Figure 2: Global water consumption trend

process technology in a variety of settings, from oil and gas extraction, agriculture and mining to processing industries and distribution of potable clean water.

SUSTAINABLE FOOD

The demand for food is increasing too, leading to the need for the best engineering solutions in food production technology. It is possible to meet the specific demands without increase in water, energy and even land use. Indeed, chemical engineers and those in other disciplines are working together to solve global food chain problems.

Chemical engineers support the development of several applications which include efficiency and waste, food security, food quality and product safety while minimising waste generation. A simple yet clear view of this process is shown in Figure 3. The promotion of efficiency and waste should be maximised to make strategies more effective in the use of food waste materials. Chemical engineers will technically support the development of the new process and technology to lessen the generation of waste and to maximise the use of waste that is produced. Indirectly, this promotes food security to ensure that the food is being delivered to what and where it is specifically needed.

Technology involved in storing food cannot be ignored either. Food storage covers a wide area and includes energy, packaging, construction and specific chemicals. The development of process and product safety is primarily achieved by applying significant practices which involve processing food in a safe manner and making appropriate considerations throughout the supply chain. Product safety carries specific challenges for the industry and brings acceptance and better understanding of the role in meeting goals in global food demand.

Moreover, the specific role of engineering in food production is to satisfy and manage demands with limited area, energy, water and raw materials available. Sustainable food sets a broader range of possibilities for chemical engineering in different areas as a measurable framework for discussion and priority setting.

Figure 3: Sustainable food system (http://www.nachicagonorth.com/CHI/July-2012 How-to-Grow/) Sustainable

SUSTAINABLE WELL-BEING

Chemical engineering plays a vital role in facilitating health care needs and improving social well-being by letting people live a healthy and complete life. Having good social well-being carries several elements such as a safe and healthy living environment which can promote physical and mental harmony.

Chemical engineering supports designs and the manufacturing of different materials to make homes safe and more durable. In fact, they play significant roles in developing and refining manufacturing solutions to help people achieve their goals of health and well-being. By optimising the energy and consumption of resources for instance, the environment is safeguarded. Hazardous development can be detrimental and can also create a huge impact on the environment. Chemical engineers are continuously formulating sustainable lifestyles in production and application, in such a way that these can protect the environment and are flexible enough to make changes such as in the efficient use of energy resources, water and food. They also apply the principles of 'green engineering' which also help in facilitating a simple and healthy lifestyle.

CONCLUSION

It is the role of chemical engineers to develop solutions for the four challenging areas of human needs. They have to be as innovative, creative, charismatic and disciplined as possible to handle these challenges and to work diligently to come up with sustainable solutions for the present and the future.

Special solutions may vary from different viabilities available in each sector. Nevertheless, all are and will be accordingly discussed to engage with former opinions based on science and the best engineering practices.

We cannot possibly cover all the important points in this short article but this should trigger an insight into the important roles that chemical engineers play. In the end, by working together as engineers, manufacturers and scientists, they will be able to attain the primary goal which is to minimise the use of energy and to promote effective and easy access to what people need for healthy, happy living. ■

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Standing Against The Storm: Stormwater Management and Road Tunnel – 6 Years on

by Tuan Hj. Ir. Nor Hisham bin Mohd Ghazali

IN THE WAKE OF A STORM

In the aftermath of the floods on 26th April, 2001, the Government pressed for a solution to the problem that was continually plaguing Kuala Lumpur. The hydrological records of the Department of Irrigation And Drainage showed an increasing number of floods in the city centre over the previous three decades and the latest incident could well have been the proverbial straw that broke the camel's back.

For KL to remain a competitive business destination for investors, it was necessary to solve, or at least significantly reduce, the flood risk. But how could that be done when there were hardly any funds left for river widening works? Clearly, the urbanisation of KL had outpaced the capacities of local drainage systems.

Later the same year, proposals were made and approved by the Government for the construction of a tunnel-bypass as a solution. The result was the construction of Kuala Lumpur's Stormwater Management And Road Tunnel (SMART). Now, in its sixth year of operations, we retrace SMART's experience to date.

RADICAL IDEA

The Stormwater Management And Road Tunnel (SMART) was completed in 2007, with the novelty of being the "first of its kind" - a dual-function tunnel that could convey stormwaters during rainstorms and serve as a motorway on a dry day. Like most major flood mitigation structures, its design was based on the magnitude of a relatively rare flood event.

However, unlike its predecessors, SMART incorporated a component that assuaged a common, everyday problem in Kuala Lumpur – traffic congestion. Solving both problems by conventional means would require huge expenditure on land acquisition costs alone. As for constructing a tunnel for both flood waters and motorists, the design engineers would be wading through uncharted waters.

The ambitious 9.7 km tunnel project took 4 years to complete and was a "first" in many aspects. The two German-made slurry shield Tunnel Boring Machines (TBM) used, named Gemilang and Tuah, measured 13.2 metres in diameter and were the largest TBMs in Southeast Asia at that time.

Despite the challenging karstic limestone formations, the tunnel was completed without major complications. It is the longest tunnel in the country.

Even during the construction period, SMART was already capturing worldwide attention. The project was featured in the documentary *Mega Tunnel*, which aired on The Discovery Channel series, "Extreme Engineering" on 8th March, 2006. The documentary was testament to the complexity and uniqueness of the SMART project which, once again, put Malaysian engineering in the spotlight.

The challenges facing the project were not just technical. On 3rd June, 2007, barely a month after the motorway section of SMART was officially open to the public, a major thunderstorm hit KL causing massive floods in the city center. Public uproar was deafening and accusations that SMART was a failure, were rampant.

Why did the tunnel not prevent the floods? The early months of its operations in mid-2007 were dogged by controversy. Drawn into public attention because of its "mega project" status, anything with a slight hint of the negative about the tunnel easily captured media attention and occasionally snowballed into mini-forums on social websites. Most broached the subject: Would this RM1.9 billion project significantly reduce KL's flood woes?.

It became apparent that the publicity on the opening of the motorway section on 14th May, had created the false impression that the flood water diversion system was all in-place when in actual fact, it was still in the final stages of testing. The SMART system, including the critical stormwater detection and diversion operations, became fully operational only on 30th June. But before that, another storm hit KL on 10th June.

WHAT'S IN A NAME?

The acronym SMART was never meant to be grandiose. A two-in-one solution is elegant by any standard but naming something "smart" can also expose it to ridicule when events lead it to be perceived otherwise. How can it be "smart" when it closes during a heavy rainstorm, thus causing massive traffic jams?.

Ironically, SMART was being blamed for merely executing its protocols. Soon, all traffic jams in the city were being unfairly linked to SMART. So much more had to be done to introduce SMART to the general public.

The smart in SMART lies in its *Flood Detection System*, a complex suite of SCADA, hydrologic data management and modelling software that can detect rainfall and predict the consequential incoming river flows. With the predictive capability built into its *Flood Detection System*, operations

personnel at the Stormwater Control Center prepares for diversion operations before the flood flows reach the confluence.

During major rainstorms when water flow at the confluence reaches the threshold of 150 cu. m/s, 90% of flows will be diverted into the tunnel by regulating the control gates at immediately downstream of the Klang-Ampang River confluence. Within an hour of getting notice, the Motorway Control Center evacuates cars from inside the tunnel and prepares it for stormwater transfer. Storms in KL are unpredictable and an hour's lead-time to react, calls for tremendous coordination.

EARLY DAYS

SMART faced its first real diversion situation on the evening of 3rd September, 2007. In what the SMART Standard Operating Procedures termed a *Mode III* operation, 500,000 cubic meters of stormwater were diverted down the tunnel. As the storm duration was brief, the motorway section, although vacated, was not utilised to convey the stormwater.

Safety protocol requires activities to take place sequentially well before stormwater can be sent into the motorway section. First, cars have to be evacuated and detoured to other roads while the lower section of the tunnel, the one dedicated for stormwater, takes in the initial flow. So it is only when the water volume escalates will the decision to flood the upper decks be made.

The first *Mode IV* operation took place on 8th September, 2008 when the entire tunnel was utilised to transfer stormwaters. The 4.00 p.m. event saw 1.16 million cubic meters of stormwater sent down the tunnel to the attenuation pond in Taman Desa.

From its opening in 2007 till December 2008, a total of 67 diversion operations were carried out, including *23 Mode III and 1 Mode IV*.

Year	Mode			
	2	3	4	Total
2007	13	2	0	15
2008	30	21	1	52
2009	20	13	0	33
2010	11	14	0	25
2011	21	19	1	41
2012	26	8	3	37
2013	21	2	0	23
Sum	142	79	5	226

Figure 1: SMART Diversion Operations 2007–2013

In the first year of operations, the feedback received revealed that it was not obvious to the general public that SMART could only intervene for flood flows from the upper Klang and Ampang River catchments. To address this, numerous engagement sessions were held with the public and the Press to further extend their understanding of SMART and flooding issues in general.

It was a lesson learnt. Mega projects needed mega public relations effort. Soon after its opening, documentaries on SMART were produced by independent parties and eventually appeared on prominent TV channels such as National Geographic's *Megastructures* and the Science Channel's *Man Made Marvels*.

2012 – A DIFFICULT YEAR

The significance of 2012 to the SMART fraternity is comparable to the 2004 tsunami to tsunami researchers. On the evening of 7th March, 2004, four rainfall stations in the Sungai Ampang recorded rainfall exceeding 100-year Average Recurrence Interval (ARI) after two hours. At SMART's uppermost station in Bukit Belacan, Ampang, an unprecedented 227 mm of rain fell within three hours. Sungai Ampang burst its banks at approximately 9.00 p.m., flooding Kampung Melayu Ampang for the first time in 30 years.

Even the Stormwater Control Center was not spared. Diversion began at 7.30 p.m. but even as tunnel closing protocols were being executed, water flow at the confluence rapidly rose to 400 cu.m/s. The 600,000 cu. metre-capacity holding pond was filled to the brim while overflow from the confluence, Sungai Ampang and a major hinterland drain merged into a single mass of water before the tunnel was able to fully discharge. Over 3 million cubic metres of stormwater were sent down the tunnel that night – a

measure that could fill a cylinder of 1 km radius to a depth of 1 metre. Yet, despite the exceedingly heavy rain in the city centre, SMART managed to limit bank overflow at Jalan Tun Perak Bridge to only 15 cm. The intensity of the rainfall that day was unprecedented. Water flow in the Ampang River seldom rises from 160 cu.m/s to 270 cu. m/s in under 15 minutes.

Two more Mode IV events followed on 2nd May and 26th November, making 2012 the year with the most Mode IV events to date. The Department of Irrigation and Drainage estimates that SMART prevents about RM112 million in flood damages each year.

SIX YEARS ON

30th June, 2013 marks six years of SMART operations as part of KL infrastructure. With SMART and its sister components – the Gombak-Keroh Diversions and Kerayong River Improvement projects – completed, the initial targets of the KL Flood Mitigation Plan crafted in 2000 had now been achieved. Nevertheless, the effort to reduce flood risks continues as flood mitigation is not one that comes with guarantees.

The Department of Irrigation and Drainage is now looking into the Bunus River sub-catchment to even further reduce flash flood frequency. Structural measures must work in tandem with non-structural measures, hence development planning and waste management play integral roles in the fight against urban floods.

Urban society must also play its part and depart from the apathy shown towards river cleanliness. This is reflected in the amount of household rubbish that SMART's automatic trash rakes extract from the river. As much as 5 tonnes of rubbish a month is not uncommon.

SMART's contribution to alleviating KL's flood risk has gradually become accepted. A customer satisfaction survey of SMART's performance conducted in 2010 revealed that 88% of the population interviewed agreed that the project was beneficial. Most of those agreeing also knew of SMART's influence area. This suggested that project details, especially the spatial extent of the project's influence, should be properly communicated to the public.

SMART has since garnered two local and three international awards, namely the Malaysian Construction Industry Excellence Award 2007, the Gold Award from The Association of Consulting Engineering Malaysia in 2008, the Engineering Excellence Awards 2008 from the Association of Consulting Engineers of United Kingdom, and the British Construction Industry (BCIA) 2008 Awards (International Category). In 2011, it was awarded the ASEAN Outstanding Engineering Achievement Award and the UN Habitat Scroll of Honour for its innovative design and function.

These accolades are tribute to the commitment of all involved in the SMART project. SMART is proof that solutions are needed for chronic situations, engineers should challenge the boundaries of the norm. ■

Tuan Hj. Ir. Nor Hisham bin Mohd Ghazali is currently a committee member of Water Resources Technical Division. He is the Director and Head of Operations of the SMART Stormwater Control Center (SMART SCC) at Dept. of Irrigation and Drainage.

Amcorp Commissions Largest Single Site Solar Power Plant In Malaysia

The largest single site solar power plant in Malaysia has been successfully completed and commissioned by Amcorp Properties Bhd here. The 10.25 MW plant has a power purchase agreement with Tenaga Nasional Bhd (TNB) for 21 years at a feed-in tariff of 87.4 sen/kWh.

It was officially opened by the Yang Di-Pertuan Besar Negeri Sembilan Tuanku Muhriz Ibni Almarhum Tuanku Munawir today. Amcorp Group chairman Tan Sri Azman Hashim said the Amcorp Gemas solar power plant was built at a total cost of RM87 million.

"The plant is capable of producing 41,000 kilowatt-hours of electricity a day or 1.2 million kilowatt-hours a month, to fulfill peak hour demand. The project utilises the latest solar panel known as 'Yingli Polycrystalline 250 Watt'. The manufacturer, China's Yingli Green Energy Holding Ltd, is the second largest solar panel manufacturer in the world."

(Sourced from Bernama, 9 June 1014)

Mini Heartcatcher Team Eyes More Funds To Commercialise Device

The team behind Mini Heartcatcher, the answer to a cheaper and portable device for ECG (electrocardiography) data recording for cardiovascular disease, is looking for more funds as part of its bid to commercialise the device.

Universiti Teknologi Malaysia (UTM) Senior Lecturer at the Electrical Engineering Faculty Dr Eileen Su Lee Ming said the team planned to pitch the idea to Cradle Fund Sdn Bhd for RM150,000 University-CIP Catalyst (Cradle Investment Programme) grant next week.

The team consists of Dr Eileen, who also acts as advisor, as well as final year students from UTM's Faculty of Electrical and Engineering Hiew Furong (Mechatronics) and Lim Ai Jia (Electrical-Medical Electronic).

"We want to make the device affordable to the people. We are looking at making the material cost lower that RM1,000," she said.

At present, patients typically use a holter or loop recorder to record ECG data, then transfer their data at the hospital and queue to make appointments days later to see a cardiologist. However, holter and loop are heavy, bulky and expensive, costing several thousand ringgit per unit.

"At the moment, the holter costs about RM5,000 to RM7,000 while rental from hospital is about RM200 to RM300 a day," she said.

As for the Mini Heartcatcher, it is a portable device that can support up to three electrodes for ECG data recording and can transmit these ECG recordings wirelessly to a smartphone and cloud storage.

(Sourced from Bernama, 20 June 2014)

RM180m to rejuvenate KL Sentral

Malaysian Resources Corp Bhd (MRCB) will shell out close to RM180 million in its regeneration plan for Kuala Lumpur Sentral (KL Sentral), which includes landscape decks that connect to major tourist attractions.

Expanding the more than one-decade-old transport hub would entail two parts, said group managing director Datuk Mohamad Salim Fateh Din.

"The first is to address the needs of the fast-changing landscape in terms of development and demands of tenants and customers, while the second entails connectivity to Muzium Negara and Lake Gardens," he said.

The completion target is three years. KL Sentral is the largest railway station in Southeast Asia.

Meanwhile, group chief operating officer Imran Salim said KL Sentral has outgrown its original use, hence the need for upgraded toilets, escalators, ventilation system, security system and command centre to cope with the influx of people and services.

(Sourced from NST, 6 June 2014)

Hyundai's hydrogen fuel-cell car makes U.S. debut

A Southern California motorist drove off the lot of a Hyundai Motor Co dealership on Tuesday in a zero-emissions car touted by the carmaker as marking the commercial debut of mass-produced hydrogen fuel-cell vehicles in the United States. The fuel cell produces power from hydrogen gas through a electrochemical process that involves no combustion or moving parts. Its only tailpipe emission is water vapour.

With a driving range of 426.5km for each fill-up and minimal cold-weather effects, the vehicle compares favourably to plug-in battery electric cars. Refuelling takes about 10 minutes.

State energy and air-quality officials hailed the occasion in Tustin, California, as a milestone in efforts to curb tailpipe pollution that accounts for about a third of California's greenhouse gas emissions.

Independent industry analysts were less breathless about the announcement, noting that other carmakers, including Honda Motor Co Ltd and Mercedes-Benz, have already put fuel cell vehicles on the road, albeit in very limited numbers.

They said the relatively high cost of building the cars and extremely low number of hydrogen refuelling stations would constrain the market for such vehicles for years to come. But they credited South Korean-based Hyundai with making a high-profile commitment to a promising technology.

(Sourced from The Star, 11 June 2014)

Port Klang Authority To Deepen South Channel Entrance

The Port Klang Authority (PKA) is to deepen the South Channel entrance at Pintu Gedong in Port Klang from its current depth of 16.5 metres to 18 metres to cater to demands from shipping lines for round- the-clock access to the country's premier port.

General Manager Capt. Datuk David Padman said the dredging project to cater for the Ultra Large Container Ships carrying more than 18,000 20ft equivalent units would be undertaken by Integrated Marine Works Sdn Bhd, the government-appointed concessionaire company for dredging works in the major federal ports.

"Internal funds will be used to carry out the capital dredging project, which is expected to be completed by April 2015," he said, adding that an environmental impact assessment study would be conducted prior to the project commencement to ensure any potential negative impacts are addressed and mitigated in accordance to conditions imposed by the Department of Environment.

He said Port Klang's two privatised terminals, namely Northport and Westports have recently built new deep water berths equipped with the state-of-the-art modern high capacity and efficiency quay cranes and that the dredging of the South Channel would ensure that Port Klang received mega vessels from several main line operators.

(Sourced from Bernama, 26 May 12014)

PRESS STATEMENT

Mitigating Accidents at LRT and MRT Project Sites

The Institution of Engineers Malaysia (IEM) is very concerned over the recent serious injuries and damage to properties at LRT and MRT project sites in Klang Valley. These two unfortunate incidents, one at the LRT site along Jalan Lapangan Terbang Subang, and the other at the MRT site near Pusat Bandar Damansara, had resulted in two persons being seriously injured in their vehicles by a falling beam.

In view of these incidents, IEM considers it important to highlight the need to observe strict safety procedures in construction work especially in on-going construction sites located adjacent to public access areas. Some parties adjudged that both the contractor and the client should share the responsibility in ensuring site safety as per statutory requirements. IEM is of the view that all relevant parties should shoulder the need to have precautionary measures in place, right from the beginning of the project, at planning or development stage. Besides the contractor and the client, the consultants and the Government authorities that have given approval for the project to proceed, must also share this responsibility.

Hence, IEM would like to emphasize the need for more stringent or stricter safety requirements through the inclusion and strict adherence to such provisions in design standards and industry codes of practice. IEM is willing to provide the technical expertise and independent advice in conducting the investigation into the cause of these accidents and in reviewing the follow-up measures required to prevent similar accidents from occurring again. Incidentally, IEM had produced a Position Paper on Prevention of Collapse of Scaffoldings and Falseworks in July 2005 which is now in the midst of being reviewed and revised.

Honorary Secretary, IEM
Dated 1 July 2014

The Jalan Hang Tuah/ Jalan Imbi/ Jalan Pudu Intersection Roadway Collapses

The Institution of Engineers Malaysia (IEM) is extremely concerned over the incidence of 2 large collapses in the road at the Jalan Hang Tuah/Jalan Imbi/ Jalan Pudu intersection on 2 July 2014. However, IEM is pleased that nobody was injured in either of the incidents.

IEM strongly urges the authorities to conduct a comprehensive and impartial investigation into the incidents. Until the investigation is completed the cause(s) for the collapses cannot be established.

IEM is willing to provide the technical expertise and independent advice to the authorities in conducting the investigation into the cause(s) of these roadway collapses and in reviewing the follow-up measures required to avoid similar incidents from occurring again. ■

Honorary Secretary, IEM
Dated 4 July 2014

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An Evening with Young Malaysian Musicians

HIGHWAY & TRANSPORTATION TECHNICAL DIVISION

by Ir. Siew Yaw Jen

THE inaugural IEM Charity Concert was held on 14th September 2013 to raise funds for the continuing medical treatment of our member Ir. Lim Kim Hoo who is suffering from lung cancer. Since he is not a civil servant, he is not entitled to pension. His wife is a home-maker and they have two school-going children. Ir Lim had been relying on bank loans to meet his health care expenses and his children's education ever since he could not work because of his illness.

The charity concert was organised with the assistance of maestro Ng Chong Lim, who helped with the arrangement of musicians and music pieces. Performers comprised five young musicians who had won numerous awards and competitions such as Steinway Malaysia Youth Piano Competition, ASEAN International Chopin Piano Competition and Ettlingen International Piano Competition for Young Pianists. The recitals for that evening were:

AUDREY SIEW SZE YEN Chopin – Etude Op. 25 no. 1 Liszt – Sonetto 104 del Petrarca Chopin – Ballade no. 3 Op. 47	**LIEW YEN NEE & DORIS TEOH WAN JIN** Wieniawski – Scherzo Tarantella Op. 16 Lutoslawski – Subito
HOI SHUN – YEEN Chopin – Etude Op. 25 no. 5 Ravel – Pavane For a Dead Princess Rachmaninov – Prelude Op. 23 no. 4 Scriabin – Etude Op. 8 no. 12	**CHIEW ZHI HONG** Scriabin - Etude Op. 2 no. 1 Chopin - Scherzo no. 2 Op. 31

The emcee made a short introduction followed by the welcome speech by the then IEM Deputy President, Dato' Ir. Lim Chow Hock. The music recitals were mainly piano pieces with the exception of Yen Nee and Doris Teoh who combined violin and piano. The musicians were elegantly dressed as though they are performing at a grand concert. They kept the audience captivated throughout the hour-long performance; there was never a dull moment.

The evening ended with Dato' Ir. Lim presenting mementos and bouquets of flowers to the musicians in recognition of their contributions to the success of the concert. Mr. Ng Chong Lim was also presented with an IEM coffee-table book titled Engineering Heritage Of Malaysia. Overall, it proved to be a most entertaining evening and Malakoff Auditorium was proven to be acoustically acceptable for a music concert.

The Highway & Transportation Engineering Technical Division would like to take this opportunity to thank all sponsors, musicians, donors and the IEM secretariat staff who had contributed to the event. After expenses were deducted, the evening raised a sum of RM10,635. ■

The audience in Malakoff Auditorium

Dato' Ir. Lim Chow Hock delivering his speech

Introduction to Hoi Shun Yeen's recital

Chiew Zhi Hong ready to perform

Group picture with the musicians.
From left: Chiew Zhi Hong, Doris Teoh Wan Jin, Liew Yen Nee, Dato' Ir. Lim Chow Hock, Ir. Siew Yaw Jen, Hoi Shun Yeen and Audrey Siew Sze Yen

Presenting Engineering Heritage Of Malaysia to maestro Ng Chong Lim

Ir. Siew Yaw Jen is Secretary of Highway Transportation Technical Division. He is the Organising Chairman of IEM Charity Concert 2014 as well as for 2013. Organising Chairman of IEM Family Day 2011-2014. He regularly organises hikes for IEM.

Dare to Dream

HIGHWAY & TRANSPORTATION TECHNICAL DIVISION

by Ir. Siew Yaw Jen

MR. KHOO SWEE CHIOW is an inspirational speaker, an adventure consultant, an author and a photographer who has climbed Mt. Everest not once, but three times.

He had also scaled many well-known peaks around the world, travelled to both the North and South poles and swam the Straits of Malacca. He had also cycled from Singapore to Beijing, made world longest scuba dive, undertaken the world's longest journey on skates and was also the first to traverse The Philippines in a kayak.

The talk was held on 16 March, 2014, a Sunday afternoon. Mr. Khoo, who resided in Singapore, was in Kuala Lumpur to brief to a group of adventurers preparing for a trip to Annapurna Base Camp (ABC), Nepal.

He started by describing mountaineering, categorising trekking and technical climbs. He talked about some of the mountains he had climbed, highlighting interesting features of each. He offered some interesting facts about Chimborazo (6,268 metres), a dormant strato-volcano in Ecuador. The summit of Chimborazo is said to be the farthest point on the Earth's surface from its center. Because of the oblate spheroid shape of the planet, Earth is "thicker" at the Equator than at the poles. This is why Chimborazo is 2.1 kms farther from the earth's center than Everest (8,848 metres) which is located 28 degrees north of the Equator. Another mountain in Ecuador which Mr. Khoo has climbed is Cotopaxi (5,897 metres), an active, symmetrical strato-volcano with a snow-capped summit. Located at latitude 0° 40' 50" South, it is the point closest to the Equator where one can experience sub-zero temperatures.

Mr. Khoo then discussed the effects of altitude, covering Acute Mountain Sickness (AMS), High Altitude Pulmonary Edema (HAPE) and High Altitude Cerebral Edema (HACE). He further described the symptoms of AMS to look out for when climbing above 3,500m. Prevention of and cure for AMS were widely discussed with enthusiastic inputs from the members.

On the subject of frostbite, the freezing of tissue at the fingertips and toes starts with pain and numbness as well as waxy and shiny fingertips. This is the result of the constriction of blood capillaries close to the skin in an attempt to preserve core body temperature. Preventive measures include keeping dry and warm but one should not dip the affected area in very hot water or walk when toes are frostbitten.

After the engaging and inspiring presentation, everyone adjourned for tea and coffee. The dare to dream attitude seemed to have caught on and overheard at the tea break were discussions on which peak to climb next and taking on new challenges. ■

A group photo after the presentation

Token of appreciation to the speaker on the left

Ir. Siew Yaw Jen is currently the Secretary of Highway & Transportation Technical Division. He is the Organising Chairman of IEM Charity Concert for 2013 and 2014 as well as the Organising Chairman of IEM Family Day 2011-2014. He regularly organises hiking trail for IEM.

A Memorable CAFEO 31 in Jakarta

by Engr. Vivekasugha Alif Gunaalan

YOUNG ENGINEERS SECTION (YES)

10 NOVEMBER 2013 (ARRIVAL)

The 31st Conference of Federation of Engineering Organisations (CAFEO) on 10-14 November 2013 was organised by Persatuan Insinyur, Indonesia (PII).

The annual event is hosted by one of the member organisations on a rotation basis and in alphabetical order. The Malaysian delegation, comprising 73 members, was led by the then IEM President Ir. Choo Kok Beng.

By the afternoon of 10 November, most of the Malaysian delegates had arrived in Jakarta. To welcome us at Jakarta International Airport were student members of Persatuan Insinyur Indonesia (also known as The Institution of Engineers Indonesia). Buses had also been arranged to ferry delegates to the Welcome Dinner at Jakarta Convention Centre.

It was a long way to the Jakarta Convention Centre and the city was known for its traffic jams. On the way, we were very impressed with the vibrant development in Indonesia, especially in Jakarta. Skyscrapers and infrastructure works like those in Kuala Lumpur, could be seen along the way.

The dinner started at 7.00 pm. In his welcome speech, Mr. Rudianto Handojo of PII, said a united ASEAN would bring mutual benefits to all member countries.

With its theme, "Green Infrastructure", CAFEO 31 focused on the interconnected network of open spaces and natural areas, such as greenways, wetlands and forest preserves. The theme was in line with the need for ASEAN countries to look into sustainable development in the process of modernisation.

Besides enjoying the local delicacies at the dinner, delegates took the chance to meet up with old friends and colleagues from the various member countries. The event was a great opportunity for everyone to get to know each other better. The evening also witnessed the presentation of certificates and medallions to the newly elected ASEAN Engineering Members from the member organisations. Honorary conferment was also awarded to some dignitaries from ASEAN member organisations.

DAY ONE: 11 NOVEMBER 2013

Registration was scheduled to start at 9.00 a.m. After their experience with the heavy city traffic the day before, members of the Malaysian delegation left early to ensure they would arrive on time. Our hotel was situated in the southern part of Jakarta, about 20 minutes to Jakarta Convention Centre.

The Malaysian delegates had the chance to experience Jakarta up close and had a glimpse of Indonesian culture as we saw locals going about their daily activities; not forgetting a touch of Korea too as there was a Lotte Mall nearby. The delegations that stayed at other hotels also boarded chartered buses to the Convention Centre. Some delegates who arrived late the previous night proceeded straight to the registration counters while the rest mingled with fellow delegates from neighbouring ASEAN countries. This was another good time to catch up with acquaintances and to meet new friends over a cup of coffee. After all, this is what we Malaysians are good at!

The morning session started with the opening ceremony of CAFEO 31, with the Indonesian Minister of Works, Bapak Ir. Joko Kirmanto, as the guest of honour. Flanked by Indonesian beauties, the Presidents of each and every ASEAN Engineering Organisation marched in to the beat of the kompang. Each President then gave a country report about their respective organisations, upcoming mega engineering projects as well as challenges they faced in development and progress. Ir. Choo Kok Beng made his presentation using a video and the crowd was immensely impressed.

After lunch, the heads of delegations, including the AFEO Secretary General and the AER Head Commissioner, were whisked off to the State Palace to pay a courtesy visit on the President of Indonesia, His Excellency Dr Susilo Bambang Yudhoyono, who was then conferred as Distinguished Honorary Patron of AFEO.

Meanwhile, back at the Convention Centre, it was time for CAFEO/YEAFEO meetings and technical sessions. The programme continued with the FEIAP Workshop on

Accreditation of Engineering Education, the Business Networking session for ASEAN and the Young Engineers meeting. After the trip to the Palace, the AER Commission and the Woman Engineers of AFEO also held their meetings.

The Young Engineers Section (YES) of Malaysia had a meeting with its counterparts from other countries where a short country briefing was also given, with particular focus on the graduates and students category. The Young Engineers of AFEO meeting is popularly referred to as YEAFEO.

CAFEO 31 saw the participation of young engineers from both Japan and the European Union. The YEAFEO meeting on the first day, however, was cut short due to a special presentation as requested by the Indonesian organisers. As the saying goes "A team that 'makan' together, stays together!", so young engineers from Malaysia had a "makan" session with their counterparts from Japan, Cambodia and Thailand, further strengthening the bond between these countries at the end of Day One.

DAY TWO: 12 NOVEMBER 2013

Participants went straight to their respective sessions on the second day of CAFEO 31. A small exhibition featuring country booths and university innovations, was set up at the venue, allowing delegates to visit and gather more information.

Day two was a busy day with parallel sessions of working group meetings and technical sessions as well as paper presentations. The FEIAP Exco and the AFEO Governing Board meetings were the main focus activities for the day. Issues affecting engineers in the ASEAN region were discussed and proposals made for consideration. The customary souvenir exchange between member organisations was held at the end of the AFEO Governing Board meeting.

At the YEAFEO meeting, further discussions were held on how to forge a better ASEAN collaboration. It was agreed that country reports would be compiled and published online, quarterly meetings would be held amongst country chairmen and lastly, internship programmes would be planned and carried out among member countries. The exchange of souvenirs was also carried out at the end of the meeting.

The Woman Engineer's Section (WE AFEO) discussed to adopt the Bylaws and the setting up of the Woman Engineers Section as well as their activities and roles in AFEO. The event was indeed an eye opener as this was the first gathering of women delegates.

The highlight of the day was the closing ceremony of CAFEO 31 and the presentation of the ASEAN Engineering Achievement Award. All delegates received an *angklung*, a traditional musical instrument made of two bamboo tubes attached to a bamboo frame as a souvenir. The emcee managed to coax a large number of participants to give a group presentation. For a moment there, engineers turned musicians!

After this, Indonesia handed over the flag to the incoming President of CAFEO 32 of Myanmar, the next host nation.

Next, each country gave a song presentation and cultural dance performance. The Malaysian delegates sang *"Satu Malaysia, Satu Bahtera"* and *"1 Malaysia for Youth"* at the top of our lungs. During our performance, delegates from other nations joined in to "berjoget-joget". It was truly an unforgettable experience, from the performance of each country to the fun train-ride around the ballroom, as everyone within the ASEAN region and its neighbouring countries were united, regardless of language, race and religion. On the whole, the event went well and all delegates enjoyed themselves. It was also very informative. We are looking forward to CAFEO 32 in Myanmar!

DAY THREE: 13 NOVEMBER 2013

After the official CAFEO event, some delegates stayed on for a free and easy trip to Bandung while the rest flew home. ■

Engr. Vivekasugha Alif Gunaalan (Grad. IEM, AAE) is currently the Chairman of the Young Engineers Section (YES), IEM. He obtained his Bachelor in Electrical Power Engineering (Hons.) from Universiti Tenaga Nasional (UNITEN) and currently pursuing Master's degree in Electrical Engineering in UNITEN as well.

Engr. Vivekasugha Alif Gunaalan has actively involved himself in IEM since 2011, and prior to that in the IEM UNITEN (SIR) Student Section. Throughout the past, he had contributed in various committees in IEM including IEM Family day, IEM Engineering Week, IEM Membership drive sub-committee.

In the industry, Engr. Vivekasugha Alif Gunaalan is now working as a Project Engineer at the Regional Manager (Central) Office, Asset Development Department, Transmission Division, Tenaga Nasional Berhad.

The Engineering of Oil Production

by Ir. Ahmad Rafidi Mohayiddin

OIL GAS AND MINING TECHNICAL DIVISION

THE Oil Gas and Mining Technical Division (OGMTD) organised a talk by Ir. Razmahwata Mohd Razalli at Wisma IEM on 19 October 2013. Trained in Chemical Engineering, Ir. Razmahwata, who was OGMTD Chairman for session 2012/13, talked about the engineering of oil production to the 68 members in the audience.

With his wealth of experience, he shared insights from the perspective of a Process Engineer on the intricacies of getting hydrocarbons out from the reserves and into the final products such as oil, gas and condensates.

He started by introducing his prior work experiences and his current role at Synergy Oil & Gas Sdn. Bhd. Then he slowly eased the audience into the basic properties of hydrocarbons which are important for a process engineer in analyzing a particular hydrocarbon reserves. Fluid samples need to be taken to establish the parameters before a more rigorous analysis such as process modelling, flow assurance and dynamic simulations could be done. According to him, there were process simulation software available but an engineer would need to have a strong understanding of the fundamentals and principles of chemical engineering. He also shared actual samples of what flow assurance and dynamic simulation software could provide an engineer who was doing the analysis.

Ir. Razmahwata then explained the sequence of activities in getting the hydrocarbons from the reserves up until the final sales products in a simplified diagram.

He continued to give a detailed explanation of some of the major activities along the process such as production separation, produced water treatment and gas processing schemes. The gas processing involves a Fractionation process whereby the mixtures were separated into two or more parts. The fractionation of gas results in production of various types of gases such as gasoline, naphthalene, kerosene, diesel and other heavy hydrocarbons.

Besides the technical details of the chemical engineering aspects, Ir. Razmahwata also stressed that engineers must be well-versed in design considerations such as the codes and standards, design conditions, delivery conditions and risk assessment activities related to the oil and gas production.

After the Q&A sessions in which he took a number of interesting questions from the audience members, the event ended with the presentation of a token of appreciation to Ir. Razmahwata for sharing his knowledge with the IEM members. ■

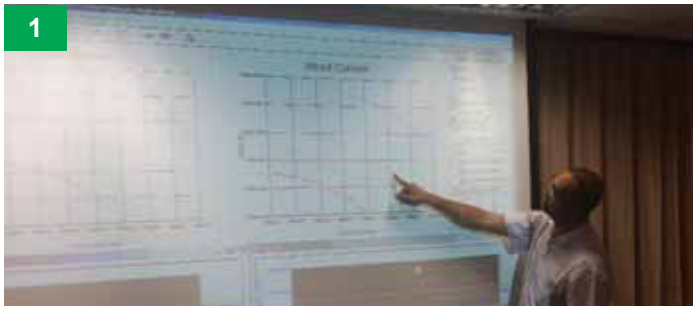

Photo 1: *Ir. Razmahwata explaining a sample output from Dynamic Simulation software*
Photo 2: *Audience members paying close attention to the talk*

Ir. Ahmad Rafidi Mohayiddin is Chairman of the Oil, Gas and Mining Technical Division of IEM for Session 2013/14. He works with a multinational oil and gas company and is serving in one of its subsidiary companies that is listed among the world's largest producers and exporters of liquefied natural gas (LNG). He is currently based in Bintulu, Sarawak.

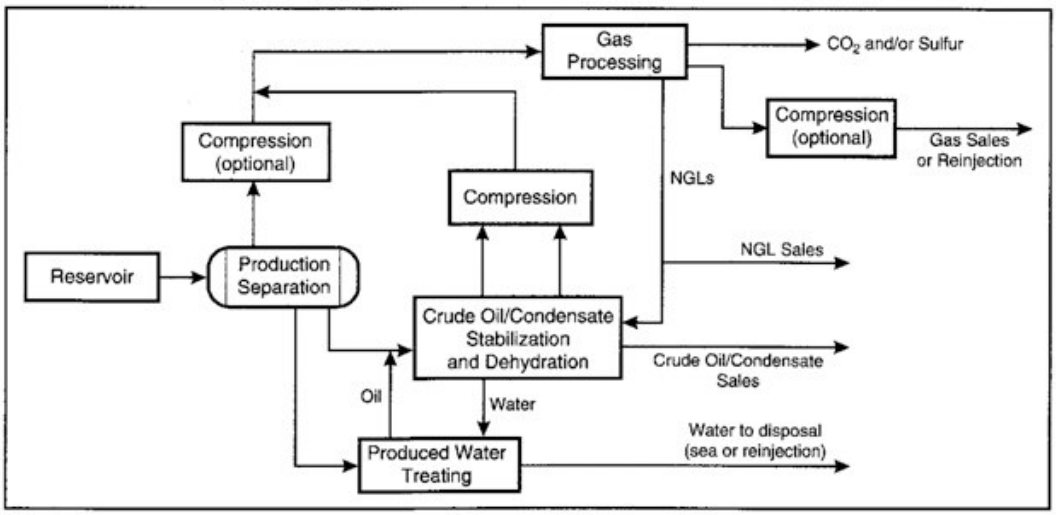

Figure 1: Diagram of hydrocarbon production

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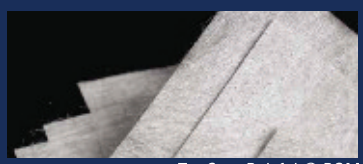

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Building a Library of Hope: IEM-WE Volunteers at Kampung Orang Asli

WOMEN ENGINEERS SECTION

by Engr. Assoc. Prof. Leong Wai Yie and Engr. Dr Habibah @ Norehan Hj.Haron

THE youths of Kampung Orang Asli Ulu Kuang, Selangor were touched when IEM-WE Committee members Engr. Assoc. Prof. Leong Wai Yie and Engr. Dr Habibah @ Norehan Hj. Haron as well as 4 volunteers from a university paid them a visit on 23 February, 2014, as part of the IEM-WE welfare programme.

The activities organised for the 21 Orang Asli youths included Win-Lose Or Draw, English Wording, games and fun-reading exercises which started as early as 9.30 a.m. with breakfast at the village library. The visitors also distributed ang pow (red packets) and souvenirs to the Orang Asli.

IEM-WE had also collected donations of more than 350 books to set up a mini library in the village. The aim was to encourage the reading habit and to improve writing skills of the youths. This initiative would develop story telling materials and text books for use by primary school and secondary school Orang Asli students in the village.

"Story books are the most meaningful gift and are able to promote literacy as they widen a student's world. Using folklore can help children develop pride in their ethnic identity, provide positive role models, develop knowledge about cultural history and build self-esteem," said members of the IEM-WE committee.

One of the youths said: "I am excited about the values that IEM-WE is adding to our heritage. It makes me proud to be able to share stories from my own community with the younger generation. This will motivated us to study hard and move forward. We hope to further our studies to university level so that we could contribute back to our society."

The IEM-WE welfare initiative aims to provide a common platform for youths and women engineers to carry out volunteer activities which benefit targeted communities and social groups. The programme aims to reach out to individuals, non-governmental organisations and the corporate sector by coordinating efforts to encourage youth volunteerism. ■

Photo 1 & 2: *Orang Asli children are thrilled with their new Mini Library*
Photo 3: *Engr. Assoc Prof. Leong Wai Yie and Engr. Dr Habibah giving ang pow and souvenirs to the Orang Asli children.*
Photo 4: *The four university students conducting Win-Lose or Draw, English wording, games and fun-reading.*
Photo 5: *Snapshot with Orang Asli.*

Engr. Assoc. Prof. Leong Wai Yie of Taylor's University is a committee member of Women Engineers Section. She is involved in biomedical signal processing analysis and wireless communications.

Engr. Dr Habibah @ Norehan Hj.Haron of Universiti Teknologi Malaysia (UTM) is a committee member of Women Engineers Section. Her research interest in Engineering Education, Human Factors/Ergonomics, Engineering Business Management.

IEM-WE Penang Branch Launch and Get Together

WOMEN ENGINEERS SECTION

by Ir. Managa Deavi Ramanathan

22 FEBRUARY, 2014 marked another important event in the calendar of IEM-Women Engineers Section. The IEM-WE Penang branch was officially launched by the Chairman of IEM Penang Branch, Ir. Paul Phor Chi Wei at the IEM Penang Secretariat.

The event was organised by IEM-WE Standing Committee of Penang Branch to foster ties among women engineers in Penang and to provide a platform for self-development, continuous learning and networking. The event was attended by both women and men engineers.

The half-day programme included a dialogue session with representatives from IEM-Women Engineers section and a talk on goal setting.

During the dialogue session, Ir. Managa Ramanathan talked briefly about the vision, mission and objectives of IEM-Women Engineer section. Then, Ir. Kumari Nalini talked about some of the challenges that women engineers faced, especially on integrating people from different backgrounds. She also talked about how we can overcome these challenges and highlighted the need for everyone to work together towards a common goal.

Interestingly, the men engineers participated actively during the Q&A session, sharing their experiences working with women engineers in their respective fields. They also highlighted that women engineers are good at details but felt that they should not let this be a hindrance to their ability to do more high level strategic works and to think out of the box.

The dialogue session was an eye opener for everyone present. At the end of the session, the participants are more aware of the strengths and weaknesses of each gender and that a good mix of male and female engineers is needed for an engineering organisation to succeed. ■

Participants at the event

Group Photo Session

Ir. Managa Deavi Ramanathan is a Director of Perunding Faisal, Abraham dan Augustin Sdn Bhd., a Civil & Structural Consulting Engineers firm. She holds a Bachelors Degree (B.Eng. Hons.) in Civil Engineering from University of Sunderland, UK (1991) and Master Degree (DIC, M.Sc.) in Soil Mechanics from Imperial College of Science, Technology and Medicine, University of London, UK (1995). She is also a Corporate Member of Institution of Engineers Malaysia. She served as a Secretary/Treasurer and committee member for IEM Women Engineers Sub-committee since 2010. She is the Honorary Secretary of IEM Women Engineers Section (2013/2014).

Pengumuman yang ke-75

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

Institusi mengucapkan terima kasih kepada semua yang telah memberikan sumbangan kepada tabung Bangunan Wisma IEM. Ahli-ahli IEM dan pembaca yang ingin memberikan sumbangan boleh berbuat demikian dengan memuat turun borang di laman web IEM *http://www.myiem.org.my* atau menghubungi secretariat di +603-7968 4001/5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan May 2014 adalah seperti jadual di bawah.

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6	07160	KOH JIT HUAT
7	18519	LAU ENG TIONG
8	20091	LEE TIAN SIN
9	22936	LIAW WEI LOONG
10	13254	LIM JOO PERNG
11	07078	LOO YEOW CHUEN
12	15677	MASHITAH BT. HAJI MD. JAIS
13	04526	MIOR SHAHAR BIN MIOR NAZRI
14	30667	MOHAMAD BIN AWANG
15	52387	MOHAMAD KUSAIRI BIN ABDUL KARIM
16	54543	MOHAMMAD HARITH BIN AMLUS
17	20097	MOHD FAUZI BIN SHAFIE
18	05043	NG YONG KONG
19	04633	SAW CHING HENG
20	07657	TAN KOK HENG
21	47048	TAN SIN NYAP
22	37979	TAN TEE GIAP
23	16196	WAN MOHAMAD SU'UT BIN WAN MOSS
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Close Encounter With A Gentle Giant

by Ir. Chin Mee Poon
www.facebook.com/chinmeepoon

MY wife and I spent 10 long hours travelling overnight by bus from Manila to Legazpi near the southern tip of Luzon Island, and another 1½ hours in a UV Express van to get to Donsol, all for one purpose – to swim with a whale shark.

Whale shark, with the scientific name of *Rhincodon typus*, is known locally as *butanding*. Able to grow to a length of 15m, it is the largest of sharks and hence the largest fish in the oceans. Unlike most sharks, however, this giant is very gentle in nature and is a filter-feeder. Despite its cavernous mouth which can measure up to 1½m wide, it feeds only on plankton, krill, shrimp and small fish.

With more than 20 years of scuba diving experience, I had seen many creatures in the sea, both large and small, but alas, I had never come across a whale shark in all my dives, and that was one regret that had been bugging me.

Donsol is dubbed "whale shark capital of the world" because the sea off its coast has been frequented by this gentle giant for the past 100 years. Whale sharks are often seen in the waters from November to June every year, attracting hordes of tourists from all over the world.

Tourists must first register with the Tourist Information Centre on the beach and they have to observe strict rules when interacting with the whale sharks. Each motorised outrigger boat, known as *banca*, carries only 6 tourists and a guide, a Butanding Interaction Officer (BIO), out to sea to scout for the whale shark. Only snorkelling is allowed and the necessary gear can be hired. When a whale shark is sighted and the *banca* gets near enough, the fully geared tourists jump into the water at the signal of the BIO and begin an unforgettable encounter with the gentle giant.

When my wife and I were seated in a *banca* with 4 other tourists that morning, we were really excited. I was eagerly looking forward to my first encounter with a whale shark, and my wife was expecting to look at one from the comfort of the boat as she preferred not to snorkel. Five other *bancas* were also circulating in the sea, looking for the elusive shark.

Three hours later and very sunburnt, my initial excitement had but almost evaporated. I was close to desperation when our BIO finally caught sight of a whale shark. With a splash, I jumped into the water, looked down and saw the large polka-dotted head of the shark just before it dived and disappeared. It might have been just a split second sighting but, nevertheless, it was enough to get me all excited again.

A few days later, we were back in Legazpi. We walked to the waterfront early one morning, followed the directions of some locals and joined a crowd gathered at the tip of a breakwater when lo and behold, we spotted a whale shark swimming up and down with its mouth wide open, busy feeding. To our great joy, there was not just one whale shark but several of them. At times, one of them would swim as close as about 10m from the breakwater.

With the 300mm focal length of my camera zoom lens, I was able to capture a few shots of the sharks gliding just beneath the water surface with their big mouths, dorsal fins and caudal fins partly exposed. A few tourists in a *banca* approached the sharks and had a few exhilarating moments interacting with them in the water. Wow! ■

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.

Tarikh: 2 Jun 2014

To All Members,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2014

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2014.

Mengikut Undang-Undang Kecil IEM, Seksyen 3.9, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2014.

Sekiranya terdapat Ahli Korporat yang mempunyai bantahan terhadap mana-mana calon yang didapati tidak sesuai untuk menduduki Temuduga Profesional, surat bantahan boleh dikemukakan kepada Setiausaha Kehormat, IEM. Surat bantahan hendaklah dikemukakan sebulan dari tarikh penerbitan dikeluarkan.

Ir. Gunasagaran Kristnan
Setiausaha Kehormat, IEM,

PERMOHONAN BARU

Nama	Kelayakan
KEJURUTERAAN AEROANGKASA	
ALEXANDER ALEX JIMMY	BE HONS (USM) (AEROSPACE, 2004)
KEJURUTERAAN ELEKTRIKAL	
AHMAD SAYUTHI BIN MAZELAN	BE HONS (UiTM) (ELECTRICAL, 2008)
ESWARAN SUBRAMANIAM	BSc (PURDUE) (ELECTRICAL, 1999)
MUHAMMAD FAUZI BIN ZAMIN	BE HONS (UiTM) (ELECTRICAL, 2008)
ONG TIEN SOON	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 2001)
PANG NYUK YUEN	BE HONS (UMS) (ELECTRICAL & ELECTRONIC, 2001)
KEJURUTERAAN GEOTEKNIKAL	
MOHD KHAIRI BIN KAMARUDIN	BSc HONS (WOLVERHAMPTON) (CIVIL, 2004) MSc (BIRMINGHAM) (GEOTECHNICAL, 2008)
KEJURUTERAAN MEKANIKAL	
ABDUS SAMAD BIN MAHMUD	BSc (MISSOURI) (MECHANICAL, 1994) MSc (USM) (MECHANICAL, 2000) PhD (WESTERN AUSTRALIA) (2010)
HASRIN BIN HASHIM	BE HONS (OXFORD BROOKES) (MECHANICAL, 1997)
MOHD ZULKIFLY BIN ABDULLAH	BE HONS (WALES) (MECHANICAL, 1990) MSc (STRATHCLYDE) (MECHANICAL-THERMODYNAMICS & FLUID MECHANICS, 1994) PhD (STRATHCLYDE) (1997)
MUHAMAD SAYUTI BIN MUSTAPHA	BE HONS (UiTM) (MECHANICAL, 2000)

PERPINDAHAN AHLI

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
16220	AMRAN BIN MOHAMED	BSc (ARIZONA) (CIVIL, 1990)
28799	MOHD ZAKI BIN MOKHTAR	BE HONS (UTM) (CIVIL, 2005) ME (UTM) (CIVIL-STRUCTURE, 2006)
45315	MOHD ZULKARNAIN BIN MOHD SIDIK	BE HONS (UM) (CIVIL, 2009)
43742	NOOR AZLINA BINTI AZHARI	BE HONS (UTP) (CIVIL, 2008) MSc (UTP) (CIVIL, 2012)
16042	POM SUM LOONG	BE HONS (UTM) (CIVIL, 1994) MSc (UPM) (HIGHWAY & TRANSPORT, 2001)
KEJURUTERAAN ELEKTRIKAL		
45289	LEE YUEN HOW	BE HONS (MMU) (ELECTRICAL, 2007)
59141	MOHD FAIZAL BIN OMAR	BE HONS (UiTM) (ELECTRICAL, 2007)
37066	TEOH CHEE PINP	BE HONS (UKM) (MICROELECTRONICAL, 2007)
58064	WIDIASTUTY BINTI JONNAIDY JUSI	BE HONS (UNITEN) (ELECTRICAL & ELECTRONICS, 2007)
KEJURUTERAAN ELEKTRONIK		
61922	LOKMAN BIN MOHD FADZIL	BSc (WISCONSIN-MILWAUKEE) (1990)
52573	MOHD SHAIFUL AZLI BIN MOHD SALLEH	BE HONS (UiTM) (ELECTRICAL, 2004)
KEJURUTERAAN MEKANIKAL		
59907	GERALD VICTOR A/L RICHARD JOSEPH	BE HONS (UTM) (MECHANICAL, 1992) ME (UKM) (MANUFACTURING SYSTEMS, 2005)
22273	HIEW YAT MON	BE HONS (LEEDS) (MECHANICAL, 2001)
52508	MOHAMMAD AZRUL BIN AHMAD	BE HONS (UTM) (MECHANICAL-TECHNOLOGY MARINE, 2006)
49607	MOHD ZUBIR BIN MOHD GHAZALI	BE HONS (UTHM) (MECHANICAL & MANUFACTURING, 2008)
26877	ROWDY IGNATIUS	BE HONS (UNIMAS) (MECHANICAL & MANUFACTURING SYSTEMS, 2002)
48447	WONG KUEN CAN	BE HONS (UNITEN) (MECHANICAL, 2004)
35544	YONG CHEN WEI	BE HONS (SHEFFIELD) (MECHANICAL, 1999)

CALL FOR NOMINATIONS

IEM ENGINEERING HALL OF FAME AWARD 2015

The Sub-Committee of Engineering Hall of Fame under the auspices of the Standing Committee on Professional Practice is proud to invite nominations for the IEM Engineering Hall of Fame Award 2015.

It is timely and expedient to induct and to record the accomplishments of engineers in the country who have or had demonstrated particularly outstanding professional achievements and provided excellent services to the Institution, the engineering industry and the Nation.

The IEM Engineering Hall of Fame is established with the aim to confer recognition and to celebrate the accomplishments of members of the IEM:

- Who have demonstrated outstanding professional achievements.
- Who have made significant contributions to the engineering profession, the Institution of Engineers, Malaysia (IEM) and the Nation.
- Who have rendered valuable service to the Community.

The Engineering Hall of Fame will serve as the focal point or showcase of outstanding Malaysian engineers, past and present, who had or have made great contributions to the engineering profession and to the quality of life in Malaysia. Engineers honoured in the Engineering Hall of Fame will also serve as a beacon and as role models for young engineers as well as create greater interest in engineering in general and awareness of the contributions made by outstanding engineers in the country.

Nominations for the Award are open to Malaysian citizens who are or have been Corporate Members of the IEM.

The closing date for receipt of nominations for IEM Engineering Hall of Fame Award is **30 September 2014**.

The nomination form can be downloaded from the IEM website ***www.myiem.org.my***. For further details, kindly contact IEM Secretariat at **03-7968 4001/2**.

IEM AWARD FOR CONTRIBUTIONS TO THE ENGINEERING PROFESSION IN MALAYSIA 2015

To encourage an interest in engineering and to recognise important services or contributions to engineering in Malaysia, the IEM Award for Contribution to the Engineering Profession in Malaysia is to be presented to the person(s), who has:

- Contributed to the advancement of engineering in Malaysia, and/or
- Designed and constructed an original engineering device or system of merit and applicability to industry.

This Award is open to all Malaysian citizens and permanent residents.

NOMINATIONS

- Nominations will be invited annually. The closing date for receipt of nominations for each year is 30 September.
- Nominations shall be made through a member of the Institution. Each member is restricted to one nomination per year.
- Each nomination shall be accompanied by a brief write up of the services rendered or contributions made or system designed and/or constructed together with relevant photographs and other documents.

AWARD

- The Award is to be made by the Council upon recommendation by the Awards Committee.
- The Award shall comprose a metal plaque, a scroll and a sum of RM1,000.

The closing date for nominations is **30 September 2014**.

Hon. Secretary
The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, Petaling Jaya, Selangor.

The nomination form can be downloaded from the IEM website at ***www.myiem.org.my***

IEM OUTSTANDING ENGINEERING ACHIEVEMENT AWARD 2015

The IEM Outstanding Engineering Achievement Award is created to confer recognition to an organisation or body for outstanding engineering achievements within Malaysia. The award will be given to an organisation or body responsible for an outstanding engineering project in the country.

The basis for the award shall be an engineering achievement that demonstrates outstanding engineering skills which has made a significant contribution to the profession and to the quality of life in Malaysia. In making the selection, the following criteria will be given special consideration:

1. Contribution to the well-being of people and communities,
2. Resourcefulness in planning,
3. Creativity in the solution of design problems,
4. Pioneering use of materials and methods,
5. Innovations in planning, design and construction,
6. Unusual aspects and aesthetic values.

Engineering achievements which include, interalia, the following can be submitted for consideration:

- Bridges, Tunnels, Waterways Structures, Roads
- Telecommunications of national/ international character, Power Transmission and Transportation
- Dams and Power Stations
- Ports and Harbours
- Building and Structures
- Airports
- Water Supply, Waste Disposal Projects
- Military projects such as bases, launching units, harbour facilities
- Drainage, Irrigation and Flood Control Projects
- Local design and manufacture of high technology products
- Energy, Heat, Mass Transfer
- Outstanding work in engineering research and development
- Chemical processing of indigenous raw resources such as rubber, palm oil and various other local plants
- Innovative use of local engineering materials
- Outstanding contribution in engineering education
- Original discovery of useful engineering theory

Nominations are invited from all members of the Institution. Each nomination submitted should contain a brief summary/write-up of the project in approximately 1,000 to 2,000 words together with full relevant reports on the project and three copies of supporting documentation including photographs. A project or component part thereof which has received an earlier award, from IEM does not qualify for nomination.

The closing date for nominations is **30 September 2014**.

The nomination form can be downloaded from the IEM website at ***www.myiem.org.my***

IEM YOUNG ENGINEER AWARD 2015

(On behalf of IEM, the YES-G&S Committee is proud to invite nominations for the YOUNG ENGINEER AWARD for year 2015)

The objective of the Award is to encourage interest in engineering and to recognise potential among young engineers in Malaysia. The Award will be presented to the person who has shown outstanding ability and leadership qualities, **either**

i. in the design and/or construction of an engineering device or system of merit; **or**

ii. in the research and development or teaching of engineering.

In any one year, the Award may be made in either one or both of the categories mentioned above. If the Award is to be made in only one of the two category may be made in the year. The Award is open to candidate who are:

i. Registered member with the Board of Engineers, Malaysia and under 35 years of age

ii. Malaysian citizens or permanent residents of Malaysia

iii. Graduate or Corporate Members of IEM.

Photocopies are allowed. The closing date for nominations is 30 September 2014.

The Proposer may or may not be a member of IEM. However, each nomination shall be supported by a brief recommendation from two Referees who are Corporate members of IEM. If the Proposer himself is a Corporate member of IEM (or higher), then he may also act as one of the two required Referees.

Future nomination will be invited bi-annually.

The Award will comprise a cash prize of RM500.00, a scroll and plaque, to be presented with due ceremony to each recipient of the Award.

The nomination form can be downloaded from the IEM website at ***www.myiem.org.my***.

IEM WOMAN ENGINEER AWARD 2015

The Women Engineer's Sub-Committee under the auspices of the Welfare Committee is proud to invite nominations for the Woman Engineer Award 2015.

The primary objective of the Award is to recognise the contributions by women engineers. This Award may also incidentally encourage interest in engineering among women and encourage them to strive towards greater excellence. The Award will be presented to the woman engineer who has shown outstanding ability and leadership qualities, or has been a pioneer in any more of the following areas:

- In the design and/or construction of an engineering device or system, structural system, planned development, environmental improvements or,
- In the research and development of engineering device, systems, processes and/or materials, publication of paper or,
- In the teaching of engineering or,
- In the management of engineering projects,
- Entrepreneurship in the commercial sector.

In making the selection, the following criteria will be given special consideration:

- Contribution to the well-being of people and communities
- Resourcefulness in planning and in the solution of design problems
- Pioneering in use of materials and methods
- Innovations in planning, design and construction
- Unusual aspects and aesthetic values

The Award is opened to candidates who are:

- Registered members of the Board of Engineers, Malaysia,
- Malaysian citizens or permanent residents of Malaysia,
- Graduate or Corporate Members of The Institution of Engineers, Malaysia.

The closing date for nominations is **30 September 2014**. Please submit nomination to:

The Institution of Engineers, Malaysia
Bangunan Ingenieur, Lots 60&62
Jalan 52/4, P.O. Box 223 (Jalan Sultan)
46720 Petaling Jaya, Selangor.

The Proposer may or not be a member of IEM or BEM, or an engineer. However, each nomination shall be supported by a brief recommendation from two Referees who are Graduate or Corporate member of IEM. If the Proposer is herself either a Corporate or Graduate member of IEM (or higher), then she may also act as one of the two required Referees.

The nomination form can be downloaded from the IEM website at ***www.myiem.org.my***.

CONTRIBUTIONS TO WISMA IEM BUILDING FUND

RM 2,378,596.70 from IEM Members and Committees

RM 741,502.00 from Private Organisations

TOTAL RM 3,120,098.70

(ANOTHER RM 4,734,532.71 IS NEEDED)

The Institution would like to thank all contributors for donating generously towards the IEM Building Fund

HELP US TO PROVIDE BETTER SERVICES TO YOU AND TO THE FUTURE GENERATION

(The donation list to the Wisma IEM Building Fund is published on page 39)

ANNOUNCEMENT

Note: *This is a continuation of the list which was first published on page 52 of the June 2014 issue.*

PEMINDAHAN AHLI KEPADA AHLI KORPORAT

No. Ahli	Nama	Kelayakan
KEJURUTERAAN MEKANIKAL		
43196	THAM CHI MENG	BE HONS (MMU) (MECHANICAL, 2008) ME (UM) (2011)
KEJURUTERAAN PEMBUATAN		
25820	LIM YING PIO	BE HONS (UTM) (MECHANICAL, 1993) MSC (WARWICK) (MANUFACTURING SYSTEMS, 1996) PHD (UPM) (2006)
PERMOHONAN MENJADI AHLI KORPORAT		
	BAHRIN BIN MOHD ZAIN	BE HONS (UTM) (CIVIL, 2000)
	HILMI BIN OTHMAN	BE (MIDDLESEX POLYTECHNIC) (CIVIL, 1987)
	LIM BOON CHIANG	BE HONS (USM) (CIVIL, 2005)
	MARIMUTHU A/L MUNIANDY	BE HONS (UPM) (CIVIL, 1998)
	MOHD ASMAWI BIN ABD RAHIM	BE HONS (UTM) (CIVIL, 2007)
	EDWINA ANAK MANDAK	BE HONS (UM) (ELECTRICAL, 2003)
	BEE SOO TUEEN	BE HONS (UTM) (CHEMICAL, POLYMER, 2006) ME (UTM) (POLYMER, 2009)
	SHARIFAH RAFIDAH BINTI WAN ALWI	BE (UMIST) (CHEMICAL, 2003) PHD (UTM) (CHEMICAL, 2007)
	AHMAD RIDZAUDDIN BIN IBRAHIM	BE HONS (UPM) (MECHANICAL/SYSTEM, 1997)
	AMIR BIN ABD RAHIM	BE HONS (UNITEN) (MECHANICAL, 2002)
	KOO MENG CHIU	BSC (MONTANA) (MECHANICAL, 2000)
	MD NASIR BIN MD ISA	BE HONS (UITM) (MECHANICAL, 2002)
	MUHAMMAD FIRDAUS BIN MUSA	BE HONS (UITM) (MECHANICAL, 2007)
	SHAHZULREZA BIN SAIFUL	BE HONS (UTM) (MECHANICAL, 2003)

PERMOHONAN MENJADI AHLI KORPORAT

Nama	Kelayakan
KEJURUTERAAN AWAM	
BAHRIN BIN MOHD ZAIN	BE HONS (UTM) (CIVIL, 2000)
HILMI BIN OTHMAN	BE (MIDDLESEX POLYTECHNIC) (CIVIL, 1987)
LIM BOON CHIANG	BE HONS (USM) (CIVIL, 2005)
MARIMUTHU A/L MUNIANDY	BE HONS (UPM) (CIVIL, 1998)
MOHD ASMAWI BIN ABD RAHIM	BE HONS (UTM) (CIVIL, 2007)
KEJURUTERAAN ELEKTRIK	
EDWINA ANAK MANDAK	BE HONS (UM) (ELECTRICAL, 2003)
KEJURUTERAAN KIMIA	
BEE SOO TUEEN	BE HONS (UTM) (CHEMICAL, POLYMER, 2006) ME (UTM) (POLYMER, 2009)
SHARIFAH RAFIDAH BINTI WAN ALWI	BE (UMIST) (CHEMICAL, 2003) PHD (UTM) (CHEMICAL, 2007)
KEJURUTERAAN MEKANIKAL	
AHMAD RIDZAUDDIN BIN IBRAHIM	BE HONS (UPM) (MECHANICAL/ SYSTEM, 1997)
AMIR BIN ABD RAHIM	BE HONS (UNITEN) (MECHANICAL, 2002)
KOO MENG CHIU	BSC (MONTANA) (MECHANICAL, 2000)
MD NASIR BIN MD ISA	BE HONS (UITM) (MECHANICAL, 2002)
MUHAMMAD FIRDAUS BIN MUSA	BE HONS (UITM) (MECHANICAL, 2007)
SHAHZULREZA BIN SAIFUL	BE HONS (UTM) (MECHANICAL, 2003)

LULUS PPP (BEM)

Nama	Kelayakan
KEJURUTERAAN AERONAUTIK	
ABD. RAHIM BIN ABU TALIB	BE HONS (SALFORD) (AERONAUTICAL, 1998)
KEJURUTERAAN AWAM	
GAN CHENG TI	BE HONS (UM) (CIVIL, 2002) PHD (NATIONAL UNI. OF SINGAPORE) (2010)
WAN HASNAN BIN WAN MUSA	BE HONS (UM) (CIVIL, 1999)
KEJURUTERAAN ELEKTRIKAL	
NORSHAHFARIZ BIN BISNI	BE HONS (UTM) (ELECTRICAL, 2006) ME (UTM) (ELECTRICAL-POWER, 2010)
KEJURUTERAAN KIMIA	
SALIHIN BIN MOHAMED ISMAIL	BE (MELBOURNE) (CHEMICAL, 2004)
KEJURUTERAAN MEKANIKAL	
RAJA AZIZ BIN RAJA MA'AROF	BE HONS (UM) (MECHANICAL, 1984)

PEMINDAHAN KEPADA AHLI SISWAZAH

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
38571	ATIQAH BINTI ZAINAL	B.E.HONS.(UTM)(CIVIL, 2011)
50241	CHENG KAM HAO	B.E.HONS.(UMP)(CIVIL, 2012)
29531	KHOR KIAH TEE	B.E.HONS.(UPM)(CIVIL, 2010)
29528	LIEW KWANG TATT	B.E.HONS.(UPM)(CIVIL, 2010)
35589	LIM CHUN FATT	B.E.HONS.(UNITEN)(CIVIL, 2009)
44401	MOHAMED NOOR HAFIDZ BIN KHAIRIL ANUAR	B.E.HONS.(UITM)(CIVIL, 2011)
37138	MOHD ARIF BIN ROSLI	B.E.HONS.(UTHM)(CIVIL, 2013)
36527	MUHAMMAD ZULHILMI BIN ALI	B.E.HONS.(UMP)(CIVIL, 2012)
49482	TG MOHD FARIS BIN TG KAMAZERI	B.E.HONS.(UITM)(CIVIL-INFRASTRUCTURE, 2013)
11557	TONG SEECH WI	B.E.HONS.(MALAYA) (CIVIL, 1990)
27091	WAN AZLINA BINTI WAN ABDULLAH	B.E.HONS.(USM)(CIVIL, 2008)
29946	WONG ZI MIN	B.E.HONS.(USM)(CIVIL, 2010)
KEJURUTERAAN ELEKTRIKAL		
48783	AAIZUDDIN-HUSSAINI BIN NOH	B.E.HONS.(UTHM) (ELECTRICAL, 2013)
36548	MOHD SABHI BIN BACHOK	B.E.HONS.(UMP) (ELECTRICAL-POWER SYSTEMS, 2010)
KEJURUTERAAN KIMIA		
34815	CHAN YEN SAN	B.E.HONS.(UTM) (CHEMICAL-BIOPROCESS, 2010) PHD.(USM) (CHEMICAL-2014)
42791	NADIAH RUZANNA ROZLEE	B.E.HONS.(UITM) (CHEMICAL & PROCESS, 2010)
KEJURUTERAAN MEKANIKAL		
50059	BENNY ISAAC PHILIP	B.E.HONS.(UNITEN) (MECHANICAL, 2011)
45105	LAU KAI REN	M.E.HONS.(NOTTINGHAM) (MECHANICAL, 2013)
28645	MOHD GHADAFFI BIN MOHD SOPIAN	B.E.HONS.(UTM) (MECHANICAL, 2009)
37586	NIK IZZATI ATHEERAH BT NIK RAZALI	B.E.HONS.(UMS) (MECHANICAL, 2011)
KEJURUTERAAN PEMBUATAN		
38834	LIU CHIN CHIN	B.E.HONS.(UTAR) (MATERIALS & MANUFACTURING, 2011)

PERMOHONAN MENJADI AHLI SISWAZAH

No. Ahli	Nama	Kelayakan
KEJURUTERAAN AWAM		
70240	AWALUZAM BIN ABDULLAH	B.E.HONS.(UTHM)(CIVIL, 2008)
70280	CHONG KIAN CHIANG	B.E.HONS.(UNITEN)(CIVIL, 2006)
70266	FOO MUI FONG	B.E.HONS.(UNIMAS) (CIVIL, 2013)
69517	IWAN NAZRI BIN MOHMAD NORDIN	B.E.HONS.(UTM)(CIVIL, 2002)
70225	LIDWINA ANASTASIA SEBI ANAK SEBASTIAN GAONG	B.E.HONS.(UPM)(CIVIL, 2000)
70210	LIEW YEE CHOON	B.E.HONS.(UTAR)(CIVIL, 2010)
70261	LING JEN HUA	B.E.HONS.(UTM) (CIVIL, 2006) M.E.(UTM(CIVIL-STRUCTURE, 2008) PHD.(UTM)(CIVIL, 2012)
69523	MANIVANNAN A/L MURUGIAH	B.E.HONS.(UTM)(CIVIL, 2007)
70242	MARDIYAH BINTI ZAHIDI	B.E.HONS.(UTM) (CIVIL, 2008) M.E.(UTM)(CIVIL-CONSTRUCTION & MANAGEMENT, 2010)
70273	MASRI BIN MUDA	B.E.HONS.(USM) (CIVIL,2000)
69524	MOHD AZRAIN BIN MD. YAAKOB	B.E.HONS.(UNISEL)(CIVIL, 2007)
70239	MOHD RASTOM BIN ABDULLAH	B.E.HONS.(UTM)(CIVIL, 2010)
69690	MOHD ZAHRULLAIL BIN BADRUN	B.E.HONS.(UTM) (CIVIL,2010)
70277	NGIAM KEE HWEE	B.SC.(OKLAHOMA STATE UNI.)(CIVIL, 1996)
70272	NOOR AZILAH BINTI ABDUL RAHIM	B.E.HONS.(UITM) (CIVIL-2010)
70204	NOORHIDAYAT BIN ZAINUDIN	B.E.HONS.(UITM)(CIVIL, 2013)
70238	NORAINAH BINTI HUSIN	B.E.HONS.(UITM)(CIVIL, 2011)
70227	PRAKASH A/L G. SELVARATNAM	B.E.HONS.(UNITEN)(CIVIL, 2006)
70250	SITI SAFIRAH BINTI RASHID	B.E.HONS.(UTM) (CIVIL, 2006) M.SC.(SALFORD)(WATER, ENERGY & WASTE, 2010)
70262	TOH CHIN GEE	B.E.HONS.(USM)(CIVIL, 2009)
70244	WAN ANWAR FAIZ BIN WAN NASARUDDIN	B.E.(UMP)(CIVIL, 2012)
70249	WAN HAYATI BINTI WAN ISMAIL@W. MOHAMMAD	B.E.HONS.(UTHM)(CIVIL, 2009)
70211	YAZID ABDULMALEK MOHAMMED AL-RADHI	B.E.HONS.(UITM)(CIVIL, 2013)
70219	YONG JYH GIIN	M.E.HONS.(SWANSEA) (CIVIL, 2008)
KEJURUTERAAN BAHAN		
70246	CHIN SHEUE PIN	B.E.HONS.(UTAR) (MATERIALS & MANUFACTURING, 2010)
70229	MOHD HASHAHRIN FIRDAUS BIN AZ'RI	B.E.HONS.(UNIMAP) (MATERIALS, 2007) M.SC.(UNIMAP) (MATERIAL, 2012)
KEJURUTERAAN BIOPERUBATAN		
70212	LEW SAN JHEN, MARVIN	B.E.HONS.(UTAR) (BIOMEDICAL, 2013)
70216	SAIFUL NIZAM BIN MOHAMMAD	B.E.HONS.(MALAYA) (BIOMEDICAL, 2013)
KEJURUTERAAN ELEKTRIKAL		
70218	ABD RAHIM BIN MOHAMMAD LATIAH	B.E.HONS.(UKM) (ELECTRICAL & ELECTRONICS, 2011)
70257	AHMAD SHARUNIZAN BIN MD. GHANI	B.E.HONS.(UTM) (ELECTRICAL, 2004)
69521	AZMAN BIN HAMZAH	B.E.HONS.(UTEM) (CONTROL, INSTRUMENTATION & AUTOMATION, 2007)
70247	CHAI HUI LIN, VERONISE	B.E.HONS.(UMS) (ELECTRICAL & ELECTRONICS, 2012)
70276	HAFIZAH BINTI IDRIS	B.E.HONS.(UTP) (ELECTRICAL & ELECTRONIC, 2002)
70205	HALIM BIN SAMMURI	B.E.HONS.(UITM) (ELECTRICAL, 2006)
70289	ISZAIDY BIN ISMAIL	B.SC.(SUNGKYUNKWAN) (ELECTRONIC & ELECTRICAL, 2011)
70208	LAU TZE ING	B.E.HONS.(MMU) (ELECTRICAL, 2011)
70215	MAHENDREN A/L JAGANATHAN	B.E.HONS.(UNITEN) (ELECTRICAL & ELECTRONICS, 2002)
70248	MOHD FADZLI BIN WAHIDIN	B.E.HONS.(UTEM) (CONTROL, INSTRUMENTATION & AUTOMATION, 2012)
70265	MOHD FAIRUS KHAFIZ BIN KHALID	B.E.HONS.(UKM) (ELECTRICAL & ELECTRONICS, 2006)
70283	MUHAMMAD JAMIL BIN SAIDIN	B.E.HONS.(UNIMAP) (ELECTRICAL SYSTEM, 2009)
70287	MUHD ASRAR AZLAN BIN BADARUDIN	B.E.HONS.(UITM) (ELECTRICAL, 2008)

70230	NOOR AMIZAN BIN ABD. RAHMAN @ MOHD YAACOB	B.E.HONS.(UTHM) (ELECTRICAL, 2011)
70286	NOOR FARHANA BINTI NORAMAT	B.E.HONS.(UTM) (ELECTRICAL, 2012)
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70260	SITI NOR NABILAH BINTI YAHYA	B.E.HONS.(UMS) (ELECTRICAL & ELECTRONICS, 2010)
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70217	CHUAH CHONG YIT	B.E.HONS.(TAYLOR'S UNI.) (MECHANICAL, 2013)
70259	FADLI BIN MAMAT	B.E.HONS.(UPM) (MECHANICAL, 2003)
70281	GOH ANG KEE	B.E.HONS.(MMU) (MECHANICAL, 2007)
70256	HEZRIL EEZWAN BIN ROSLAN	B.E.HONS.(UTM) (MECHANICAL-MARINE TECH., 2010)
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70267	ZULFAKAR BIN ISMAIL	B.E.HONS.(UITM) (MECHANICAL, 2009)

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70255	MUHAMMAD SYAFIQ BIN HANIPPUDIN	B.E.HONS.(UTEM) (MECHATRONIC, 2013

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69519	MUHAMMAD NAFAIZ BIN ROSLI	B.E.HONS.(KUKUM) (MICROELECTRONIC, 2006)

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PERMOHONAN MENJADI AHLI SISWA

No. Ahli	Nama	Kelayakan

KEJURUTERAAN ALAM SEKITAR

69594	BEH KEAH LOK	1ST YEAR (UTAR) (ENVIRONMENTAL)
69595	CHAI CHARANG CHEW, CLEMENT	1ST YEAR (UTAR) (ENVIRONMENTAL)
69596	CHEH KIT CHUN	1ST YEAR (UTAR) (ENVIRONMENTAL)
69597	CHEN MING HONG	1ST YEAR (UTAR) (ENVIRONMENTAL)
69598	CHIN YIK CHUN	1ST YEAR (UTAR) (ENVIRONMENTAL)
69599	CHRISTINA PREVITHA A/P JOHN DEVA SAHAYAM	1ST YEAR (UTAR) (ENVIRONMENTAL)
69600	LEE JIE YET	1ST YEAR (UTAR) (ENVIRONMENTAL)
69601	LIM WAN CHING	1ST YEAR (UTAR) (ENVIRONMENTAL)
69602	LUK MEI KWAN	1ST YEAR (UTAR) (ENVIRONMENTAL)
69603	NG KANG	1ST YEAR (UTAR) (ENVIRONMENTAL)
69604	NICHOLAS RUBEN A/L ROBERT	1ST YEAR (UTAR) (ENVIRONMENTAL)
69605	QUEK JIAN AI	1ST YEAR (UTAR) (ENVIRONMENTAL)
69606	TAN WEI HAN	1ST YEAR (UTAR) (ENVIRONMENTAL)
69607	WONG JING LIN	1ST YEAR (UTAR) (ENVIRONMENTAL)
69608	YEAP RUI NI	1ST YEAR (UTAR) (ENVIRONMENTAL)
69609	YONG ZI JUN	1ST YEAR (UTAR) (ENVIRONMENTAL)

KEJURUTERAAN AWAM

69727	ABANG AHMED LUQMAN B. ABANG KASSIM	1ST YEAR (UNIMAS) (CIVIL)
69728	ABD. RAMZI B. SABLI	1ST YEAR (UNIMAS) (CIVIL)
69537	ABDI RAHMAN MUHIADIN MOHAMED	4TH YEAR (IUKL)(CIVIL)
69729	ABU RASHID B. ABU BAKAR	1ST YEAR (UNIMAS) (CIVIL)
69538	AHMED ABDILLAHI MOHAMOD	4TH YEAR (IUKL)(CIVIL)
69730	AIDA FATHIRAH BT. MOHD FARIDZ	1ST YEAR (UNIMAS) (CIVIL)
69731	AISHAH NUR DYANA BT. JOHARI	1ST YEAR (UNIMAS) (CIVIL)
69732	AISYAH BT. MOOSAH AL-MUSTAFA YOSHIKATSU	1ST YEAR (UNIMAS) (CIVIL)
69733	ALBERT UNTAN ANAK PIPA	1ST YEAR (UNIMAS) (CIVIL)
69734	AMELIA ITALY TAY	1ST YEAR (UNIMAS) (CIVIL)
69693	AMIR HARIZ B. AMRAN	1ST YEAR (UTM)(CIVIL)
69694	AMIRA MARYAM BT. MD SUKAIMI	1ST YEAR (UTM)(CIVIL)
69735	AMYZZA BT. HAZELI	1ST YEAR (UNIMAS) (CIVIL)
69736	ANDREANA ALLYSSA AK HENRY	1ST YEAR (UNIMAS) (CIVIL)
69737	ANGELA RAMAS ANAK TEMBAK	1ST YEAR (UNIMAS) (CIVIL)
69738	ARLIA NAJEERA BT. ABDUL RAHIM	1ST YEAR (UNIMAS) (CIVIL)
69539	ARVINRAJ A/L RAMAN	4TH YEAR (IUKL)(CIVIL)
69739	ASHRUL KHATTAB B. ABU BAKAR	1ST YEAR (UNIMAS) (CIVIL)
69740	ATHIRAH BT. BAKIE	1ST YEAR (UNIMAS) (CIVIL)
69741	AWANG AZZIZI B. AWANG ZAIDI	1ST YEAR (UNIMAS) (CIVIL)
69742	AWANG JEMALI B. AWANG HOT	1ST YEAR (UNIMAS) (CIVIL)
69743	AZLIN NUR IKMAL BT. SANI	1ST YEAR (UNIMAS) (CIVIL)
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69749	DAYANG IZZATIE BT. AWG DAHLAN	1ST YEAR (UNIMAS) (CIVIL)
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69751	DAYANG SITI AISHAH BT. ABANG SHAMAT	1ST YEAR (UNIMAS) (CIVIL)
69752	DZUL FAHMI B. ZAWAWI	2ND YEAR (UNIMAS) (CIVIL)
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69753	ELTON B. EVESON	1ST YEAR (UNIMAS) (CIVIL)
69754	FAIRUZ HANIM BT. MOHAMAD HEDER	1ST YEAR (UNIMAS) (CIVIL)
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69541	FARID ISKANDAR B. YOSOF	4TH YEAR (IUKL)(CIVIL)
69757	FARIS NUR B. SHUHANI	1ST YEAR (UNIMAS) (CIVIL)
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Sunday,

14 September 2014

7.30 am
Persiaran Barat,
Petaling Jaya
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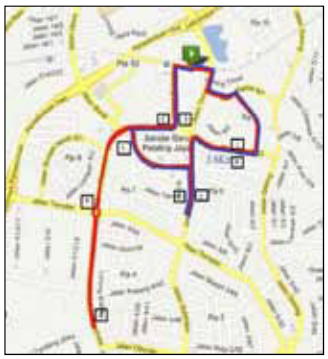
www.myraceonline.com

3.6km Fun Run /6.5km

(Blue Line) **(Red Line)**

Entry Fees RM40.00



CODE	CATEGORY	AGE GROUP
A	Men's open (6.5 km)	Above 17
B	Women's open (6.5 km)	Above 17
C	Boy's IEM family member only (3.6 km)	Above 10 and below 17
D	Girl's IEM family member only (3.6 km)	Above 10 and below 17
E	Men's IEM member only (3.6 km)	Above 17 and below 40
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Category B - First 5 finishers
Category C - First 3 finishers
Category D - First 3 finishers
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Category F - First 5 finishers
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Top 3 Best Engineer's Costume!!
(Participants are required to register at Race Secretariat before and after the run)

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DESCRIPTION	3.6km	6.5km
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Bib Number	✓	✓
Finisher Medals	✓	✓
Certificate of Participation	✓	✓

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(Friday & Saturday)
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