JURUTERA

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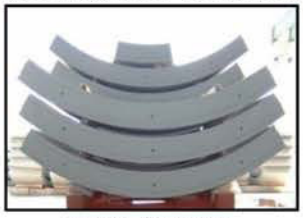

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Promoting Awareness of Fire Safety

By Ir. Fam Yew Hin
Chairman,
Mechanical Engineering
Technical Division

***Ir. Fam Yew Hin** is currently the Chairman of Mechanical Engineering Technical Division.*

"Fire is a good servant but a bad master". This saying aptly describes the danger of fire if it is not being managed. There has been no shortage of reports of industrial fires which cause injury to humans and damage to properties despite many public and private initiatives.

The Mechanical Engineering Technical Division (METD) and other divisions of the Institution of Engineers, Malaysia (IEM) are working to promote awareness of fire hazards and to ensure appropriate safety measures are incorporated into buildings and at the workplace. These include:

- providing inputs and feedback during the review of building code, regulations and directives;
- participating in various working groups for the establishment of standards and guidelines;
- organising courses and talks to continuously updating engineers, consultants, contractors on these requirements;
- promoting public awareness of the risk of fire hazards and prevention measures.

It is important that all buildings have the appropriate safety measures in accordance with engineering and legislative requirements and that these are continuously maintained.

This month's *Jurutera* highlights fire safety related articles as well as an interview with the Director General of Jabatan Penyelamatan dan Bomba Malaysia.

There is still much to be done with regards to fire safety. Industrial fires can be effectively prevented with enhanced permit control and precaution checks, as well as with relevant standards being developed and adopted. IEM will continue to work with all stakeholders in promoting awareness of fire safety. ■

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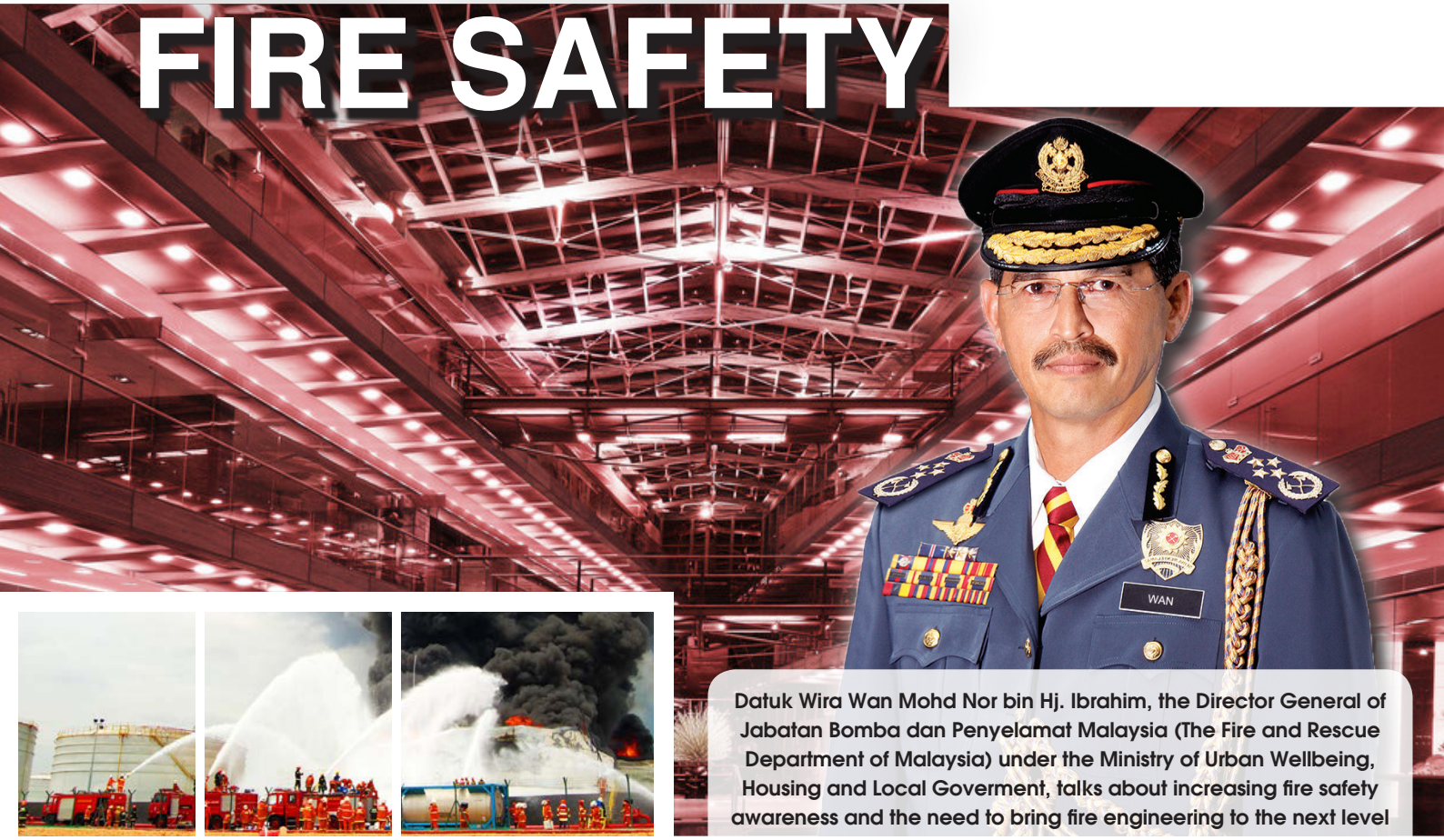
ENGINEERING THE FUTURE IN FIRE SAFETY



Datuk Wira Wan Mohd Nor bin Hj. Ibrahim, the Director General of Jabatan Bomba dan Penyelamat Malaysia (The Fire and Rescue Department of Malaysia) under the Ministry of Urban Wellbeing, Housing and Local Goverment, talks about increasing fire safety awareness and the need to bring fire engineering to the next level

The Institution of Engineers, Malaysia (IEM) and Jabatan Bomba dan Penyelamat Malaysia (BOMBA) have had a long cordial working relationship in improving fire safety standards in the country. As the largest engineering professional body locally, IEM has members who are the submitting persons of plans on fire safety design.

Recently, a team from IEM, comprising Assoc. Prof. Ir. Dr Kannan M. Munisamy, Ir. Soong Peng Soon and Ir. Loo Chee Kin from the Mechanical Engineering Technical Division (METD), had a chat with Datuk Wira Hj. Wan Mohd Nor bin Hj. Ibrahim, the Director General of BOMBA, on a wide range of matters, from future IEM-BOMBA collaborations to fire safety awareness and developing advanced fire safety standards.

> *"Fire safety is a specialised subject but not all engineers have studied the subject."*

Q **IEM-BOMBA working relationship**

Datuk Hj. Wan Mohd Nor: IEM and BOMBA have been working closely all these years. For example, the three main players involved in drafting the Uniform Building By-Laws (UBBL) which was gazetted in 1984, were IEM, Pertubuhan Akitek Malaysia (PAM) and BOMBA, in particular, Chapters 7 and 8 on passive and active fire safety respectively. IEM was actively involved in the amendments to the UBBL in 2012.

There is still active on-going engagement between PAM, The Association of Consulting Engineers Malaysia (ACEM), IEM and BOMBA in the various technical committee work and dialogue as the Government encourages the various departments to work with or

engage stakeholders. For example, BOMBA has one main consulting taskforce working with professional bodies including IEM, ACEM, Lembaga Arkitek Malaysia (LAM), Institution of Fire Engineers (IFE) and others which would be engaged from time to time on arising technical matters and code implementation. These consulting taskforce meetings have been going on for a very long time.

> *"BOMBA is very concerned over certain aspects of the use of dangerous and harmful chemicals."*

Q The recently amended UBBL has the Tenth Schedule expanded to include more occupancy hazard. As Malaysia is getting investments in many high-tech areas, these may not fall into any of those occupancy classes. How would the fire and safety hazards in these high-tech industries be addressed?

Datuk Hj. Wan Mohd Nor: The amendment of the UBBL 2012 has a more comprehensive compared to the UBBL 1984, which includes the use of airports and railway stations (LRT, MRT, etc.). If there is any use that is still not included in the purpose groups listed, the owner/proprietor will need to appoint a competent consultant to submit the Fire Safety Design Philosophy (FSDP) for a review of the existing risks and for a recommendation of fire safety installations required for the project.

There are many high-tech industries and more to come. These could be for semiconductor, data centres, pharmaceutical, etc. These facilities may use gases and chemicals which can pose specific hazards. I believe the current practice is inline with international practices in addressing fire safety issues in high-tech and sophisticated occupancy classes.

Q Submission of fire plans to BOMBA and fire engineers.

Datuk Hj. Wan Mohd Nor: In the plan submission process, there was a change in the procedure. The UBBL was amended in 2012 to make the submitting person responsible for the fire design. Prior to that, in the 1970s and 1980s, a consultant submitted the plans. At times, these were just a simple layout plan. BOMBA officers would then fill in the requirements. But then we realised that this system had flaws:

a) It led to the concept of "authority knew best" which meant professionals needed to follow through even though they might have a better fire safety solution.
b) The authority (BOMBA) would be blamed for any failure of the concept.
c) The authority would be blamed for any delay in the approval of the plan.

So, the amendment was made to the By-Law and the time taken for approval by the authority was shortened tremendously.

Q IEM used to get feedback from members on their challenges and experiences in preparing the designs. IEM committees meet BOMBA officers regularly to discuss contemporary fire design practices, obtain BOMBA directives or guidelines and disseminate the information to the relevant designers.

Datuk Hj. Wan Mohd Nor: According to the law, the consultant is responsible for the design. As the authority on fire safety, BOMBA will still need to check the plans. We need to review this before construction starts or the building is completed. Under the OSC (One Stop Centre), the time given to look into the plan and issue a letter, was only 14 days, so BOMBA had to speed up process.

Previously, about 50% of the plans were returned to consultants as these did not meet our requirements. That number has been reduced to about 30% but it is still quite high. I believe this may be attributed to new engineers. Therefore, there is a need to better educate the new engineers. I believe fire safety is a specialised subject and not all engineers have studied the subject. Fire safety knowledge needs to include mechanical, structure, chemical, electrical, etc. On BOMBA's part, fire officers also need to be trained. Discussions between fire officers and engineers are very important. For complicated projects, engineers can get pre-consultations with fire officers.

Fire engineers need to be recognised and registered as a special discipline. BOMBA will pursue the matter until it materialises. Items to be discussed further include joining conditions, avenues to train them, how to qualify them and who to provide the training. Similar registers are already in place in other countries.

Q More and more underground spaces are being used for infrastructure. The Sarawak mine fire last year reminds us that rescue work in such confined spaces can be very difficult. Do we need more design standards to govern tunnels, mines and other underground spaces?

Datuk Hj. Wan Mohd Nor: The fire safety provision for underground structures are allocated under the UBBL. BOMBA also allows the implementation of standards such as NFPA and etc.

Q Malaysia is adopting Green Energy on many fronts. Solar panels are being installed on the roofs of residential homes. Have there been fire incidents or electrocutions with such installations?

Datuk Hj. Wan Mohd Nor: This is Government policy and it will definitely benefit the nation. But even though solar panels are used in the country, the number is still small. I hope that the installation and use are in accordance with codes and guidelines. So far, there have been no incidents of such fires recorded with BOMBA. We do not compromise on fire safety.

Some solar panels can generate several hundred DC volts. This is a potential ignition source. In some countries, there have been cases of fire due to solar panels, especially when the panels are installed on combustible roofs or the panels have substantial combustible backing.

It would be timely for BOMBA and IEM to set up a working group to look into the fire safety aspects of solar panel installations and to come up with guidelines to avoid any future mishap.

Q What is the trend in recent fire incidents? Is there a rise in industrial type fires?

Datuk Hj. Wan Mohd Nor: Factory fire in Malaysia, from year 2010 to 2014, averages 300 cases per year. The number varies between 5% and 10% each year. This year alone (January to May), there have been 121 fires. It is expected that there will be about 290-300 cases (an average of 24 cases each month) by the end of 2015.

Q Fire safety permits, such as hot work permit and fire protection impairment permits are currently used by large industries, probably as required by insurance companies. Would BOMBA encourage the use of such permits for all occupancies?

Datuk Hj. Wan Mohd Nor: Hot work permits are already included in the OSHA requirement. As for fire protection impairment permits, yes if there is a need. For premises carrying out maintenance work that could compromise existing fire safety installations and affect a part of or the whole system, the local fire department should be consulted to ensure that appropriate protection is still available, whether it's an alternate resource or the need to form an emergency respond team to be on standby. In addition, the following action and security measures must be taken:

1. Limiting the number, scope and duration of the area involved.
2. Stopping all dangerous processes.
3. Removing flammable materials from the area involved.
4. Stopping work on hot work.
5. Increasing the number of fire extinguishers etc.

Q Malaysia had adopted the Globally Harmonised System (GHS) for Classification and Labelling of Chemicals. Will this standardised labelling benefit fire fighters and HazMat response?

Datuk Hj. Wan Mohd Nor: BOMBA is very concerned over certain aspects of the use of dangerous and harmful chemicals. GHS is a uniform standard adopted by all the agencies concerned here and outside the country. This mechanism will assist the BOMBA Special Forces, HazMat Rescue Team, in determining and evaluating hazard and risk analysis with regards to dangerous substances.

Q The recent earthquake in Ranau, Sabah, caught many people by surprise. Are we ready for earthquake events?

Datuk Hj. Wan Mohd Nor: The recent earthquake was a tragic event. The rockslides trigged by the shocks, injured and killed many mountain climbers. However, seismic events in Japan and USA show that fires and equipment damage following an earthquake, are also major causes of property damage and deaths.

In 2012, IEM conducted a seminar on this subject, titled "Earthquake Provisions & Safeguards for M&E Systems in A Building". Imagine what would happen if a fire pump was not properly anchored or sprinkler pipes not firmly braced. These could be damaged by the seismic shaking. Then, in case of a fire breaking out, the fire-fighting system would not be available for use to control the fire. Even worse, the damaged sprinkler pipes could cause water damage.

Q Most fire engineers or fire contractors stumble into their professions by accident or when there was "a job vacancy". We seldom hear of someone who has studied to be a fire engineer. If local colleges or universities do offer a degree or diploma course in fire safety, would it help to improve the standard in this field?

Datuk Hj. Wan Mohd Nor: Even though BOMBA has the most experienced and qualified fire engineers, we will have to do much more before fire engineering becomes a recognised discipline. For example, we must have the training infrastructure to educate those interested in fire engineering.

> *"Fires and equipment damage following an earthquake, are also major causes of property damage and deaths."*

> *I hope fire safety will be included in all engineering studies, perhaps as a subject on its own or as a topic subject.*

We hope that professional bodies, institutions of higher learning and specialist groups can help us realise our aspirations. We want to nurture local fire engineers who are competent in the respective fields and who can contribute to the progress of fire safety in Malaysia.

In the past, we relied on overseas expertise for special fire engineering design but we believe Malaysian experts can do that just as well, if we pay more attention to developing local skills. In order to achieve these objectives, BOMBA has memorandums of understanding with local universities for research in fire safety and BOMBA has its own research centre too.

We look forward to working more closely with IEM, SIRIM, PAM and other professional bodies to develop modern and advanced fire safety standards for the country. I hope fire safety will be included in all engineering studies, perhaps as a subject on its own or as a topic subject, very much like environment or construction. Otherwise, we will lose out to universities offering such courses in US, UK, Australia and other countries.

The many forums and seminars on fire safety organised by IEM recently, with the participation of BOMBA, are encouraging signs that professional bodies are working together to establish and disseminate information on good practices in fire safety engineering. However, a structured training programme is still needed to bring fire safety engineering to the next level.

I agree that we need to further develop fire engineering. I work with many engineers and very often, they do not understand specific fire protection requirements because of the lack of fundamentals. These fundamentals would be fire science, fire loading, fire dynamics, fire and smoke behaviours, life safety concerns, etc.

Datuk Wira Hj. Wan Mohd Nor bin Hj. Ibrahim with Assoc. Prof. Ir. Dr Kannan M. Munisamy, Ir. Soong Peng Soon and Ir. Loo Chee Kin

Q **How can BOMBA collaborate further with the engineering fraternity?**

Datuk Hj. Wan Mohd Nor: BOMBA has a facility in Enstek Township near Sepang, Selangor where a fullscale fire test can be performed. For example, in Australia, full scale testing of foam insulated panels has revealed that some of these plastic foam materials can burn or create drippings when exposed to fire. This may not be observed in a small scale fire.

This will be an opportunity for building owners or engineers to get a first-hand experience on fire development. ■

Y.Bhg. Datuk Wira Hj. Wan Mohd Nor Bin Haji Ibrahim *is currently the Director General of the Fire Rescue Department of Malaysia (BOMBA).*

Y.Bhg. Datuk Wira Hj. Wan Mohd Nor holds a Bachelor of Science in Nuclear Science from Universiti Kebangsaan Malaysia (UPM) and Master of Science in Emergency Planning from Universiti Putra Malaysia (UPM).

Prior to his appointment as Director General of BOMBA, Datuk Wira Wan Mohd Nor has held various positions in the department including the Commander for Fire & Rescue Academy of Malaysia at Kuala Kubu Baru (1991), Assistant to the Director General, Enforcement Division (1994 - 1995), Assistant to the Director General, Research, Planning & Development Division (1995 – 1997), Selangor State Director (1997 – 1999), Deputy Director General in Management (2000 – 2008) and Deputy Director General in Development (2008 – 2010).

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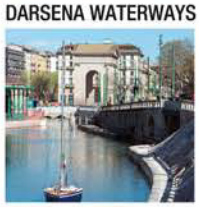

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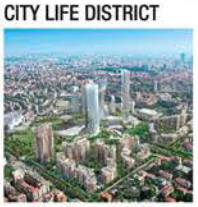

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Dato' Ir. Lim Chow Hock
President, IEM

Dato' Ir. Lim Chow Hock, *was formerly the Director of the Division of River Basin and Coastal Zone Management with the Department of Irrigation and Drainage Malaysia (JPS).*

We're running out of time; Vision 2020 is less than five years' away. As Malaysia gears itself towards a developed nation status by 2020, there is still much to do to get there.

One of the most direct ways is to ensure a sufficient and growing number of engineers in the country. The increase in the number of engineering students is paramount to meet the nation's need for engineers to implement and maintain the many development projects.

On a recent visit to the International Bureau of Education (IBE) in Geneva, Deputy Prime Minister Tan Sri Muhyiddin Yassin spoke of the need for Malaysia to harness skills and knowledge in Science, Technology, Engineering and Mathematics (STEM). He posits its importance across all sectors for Malaysia to remain on the growth trajectory towards economic and social gains.

He mentioned that some countries, which had started at the same level as Malaysia, had moved much further ahead; he credited this to their wisdom in making full use of STEM to boost their country's fortunes. As such, he stressed on the need for human capital development in STEM which he considers vital in the nation transformation process.

He added that to achieve this, a strategy comprising a series of actionable plans is needed to support the production rates needed for generating skilled STEM human capital at two levels, namely secondary schools and tertiary institutions, in order to achieve the target of 500,000 STEM graduates by 2020.

Although the solution is apparent, its execution is the challenge. One of the factors hindering this is getting more students interested in science and science classes. Science and mathematics should be made interesting, easy to understand and be more hands-on and exploratory. This is in line with the Government's aim for a 60% science and technology-based education by 2020.

An interest in science and mathematics, or STEM, will bring direct results to national development, particularly because of the role of engineering in a country's development. For the engineering profession, greater interest in STEM in school will result in more students being eligible to pursue engineering courses in universities. An increase in the number of engineering students will help meet the nation's need for engineers which translates into greater implementation and maintenance of the country's economic development projects.

The Institution of Engineers Malaysia (IEM) lauds the Government's efforts to promote the study of science in schools. Without a large number of science students in schools, universities will not be able to produce the number of engineers needed and this will be detrimental to the progress of the nation.

As a national association with the nation's interests at heart, IEM has been actively conducting school career awareness talks, arranging competitions and exhibiting interesting projects on engineering to school children to promote an interest in engineering. IEM has also set up IEM Student to encourage students to choose sections in the various universities. Engineering students are also encouraged to join IEM as Student Members which will enable them to get access to IEM resources and activities, such as talks and networking.

IEM is one of the supporting members (together with AAET, MiGHT, UTAR and NSC) ofthe Kuala Lumpur Engineering Science Fair (KLESF), an annual programme aimed at promoting interest in STEM among primary and secondary school children, in line with the Government's vision and aspirations.

IEM is of the opinion that career prospect isa major factor when a student is considering tertiary studies and career options. Prospects for engineers include top level positions, attractive remunerations as well as status recognition, all of which will motivate students to take up STEM education and to pursue a career in engineering.

Students must be made aware that job prospects for engineering graduates are bright as the government allocation for infrastructure development supports a growing demand for engineers. The national development towards an industrialised nation has also spurred the demand for engineers.

Students and their parents must realise that engineering is not limited to the five traditional branches, namely Civil, Mechanical, Electrical, Electronic and Chemical Engineering.

Today, engineering has expanded into many new disciplines including Aeronautical Engineering, Environmental Engineering, Maritime Engineering, Mining Engineering, Oil and Gas Engineering. All offer exciting career options for students.

For the uninitiated, an engineer is, basically, someone who has the ability to understand and visualise engineering problems and be competent to improve, overcome or mitigate the problem. Engineering graduates have the opportunity to work in a wide range of industries namely construction, consulting, manufacturing, oil and gas and in various Government agencies.

As the largest employer in the country, the Government should provide equal opportunities and create a structured pathway for all science-based professionals, in particular engineers, to take up high positions in the Civil Service. Recognising the contribution of engineering success and seeing it as a pathway to top positions in the Civil Service will surely motivate students to pursue STEM education in the country. ■

The article was published in The STAR - 7 July 2015 - "Harness STEM for Engineering"

http://www.thestar.com.my/Opinion/Letters/2015/07/09/Harness-STEM-for-engineering/

Fire Safety Permits

by Ir. Loo Chee Kin

***Ir. Loo Chee Kin,** a senior consultant with Global Risk Consultants (GRC), is an active member of IEM who works on many committees. GRC is a pioneer of unbundled loss prevention engineering and is able to provide complete loss reduction benefits to clients.*

Many industrial and commercial premises have some form of safe work permits. Construction and project sites have various types of specific hazard permits. These are typically rolled into the safe work permit and perhaps attachment permits.

More specific hazard permits would involve confined space, working at height or scaffolding, lifting, lock-out tag-out and electrical works. Other permits could be for deep excavation or shoring, excessive noise, floor opening, heavy vehicle usage, fall protection, ladder, blasting and explosion, electrical tools in hazardous location, dust or chemical exposure, barricading, laser light and radiation sources, road/path detour, high pressure or hydrostatic testing, hot work, fire protection impairment, etc.

Major fires happen because two key permits are often overlooked – hot work and fire protection impairment permits.

Metal is used extensively in building construction and services. Arcs welding or oxyflame is often necessary for cutting or joining metal structure components or pipes. However, the people who use these cutting or joining methods frequently do not fully understand that improper use may result in loss of life and damage to property from fire/explosion.

Data from an insurance company shows that about 25% of industrial properties fires are due to insufficient precautions taken while doing hot work. Arcs welding or oxy-flame operations produce lots of sparks and hot slag. The hot molten metals and hot working pieces are potential ignition sources. Most fires are caused by hot slag. These globules of molten metal can splash or jump as far as 11 metres, setting ordinary combustible materials nearby on fire.

Some of these materials may be lying in concealed spaces or between combustible materials and can cause a smouldering fire which can break into flames. In some industrial fires, the content in the pipe line or tank could have been overlooked.

A worker performing hot work (such as welding, cutting, brazing, soldering, grinding) which may generate heat, arcs, sparks, open flames or other fire hazards, is exposing the work place to the risk of fires. However, hot work fires can be prevented if the work area is checked and an appropriate fire watch is in place.

For consistency in implementation, a hot work permit programme should be in place. Figure 1 (see Page 16) is a sample of a hot work permit. The permit should stipulate precautions to be taken and items to be inspected before the hot work is carried out. The precautions on the permit should include the following:

a) The hot work equipment is in good repair.

b) The fire protection system is in service.

c) Appropriate and sufficient numbers of portable fire extinguishers are available.

d) Smoke detectors should be covered with dust caps. Number of caps used to be noted on permit.

e) Fire doors are closed.

f) Combustible materials within a radius of 11 metres should be removed or covered with a listed welding blanket or pad.

g) Combustible floors should be kept wet or protected.

h) Pipe penetrations, openings or cracks in walls or floors within 11 metres are covered, filled or sealed with fire-rated or non-combustible material.

i) Ducts and conveyor systems are shut down and covered.

j) If hot work is done near combustible walls or partitions, protect the combustible construction with a welding curtain or welding blanket. Hot work should not be attempted on a wall that has combustible covering or insulation.

k) If hot work is to be performed on pipes or ducts with combustible insulation, remove at least 11 metres of the insulation and dispose of the insulation debris.

l) Purge and ventilate tanks and pipes containing flammable liquids. Clean and wash pits and trenches where there may be flammable liquids. Perform flammable vapour monitoring.

m) In addition to hot work permit, use confined entry permit for welding, cutting or brazing within a tank or any confined space. Continuously monitor work oxygen-deficient atmosphere in these cases.

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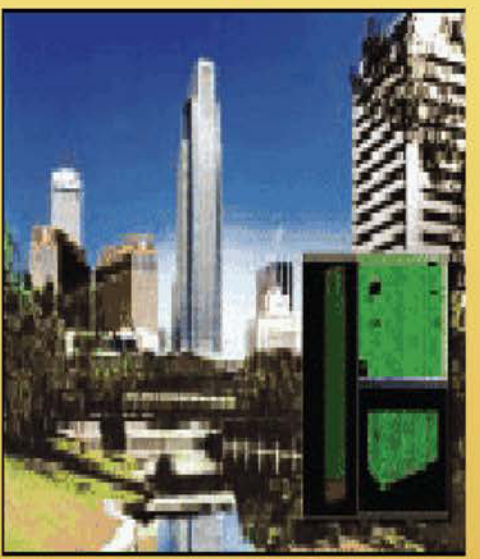

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Hot Work Permit

Permit No.:

☐ *There are no safer ways of effectively/efficiently doing this job.*

Instructions

1. Person doing hot work: indicate time started and post permit at hot work location. After hot work, indicate time completed and leave permit posted for Fire Watch.
2. Fire Watch: Prior to leaving area, do final inspection, sign, leave permit posted and notify Permit-Authorizing Individual.
3. Monitor: Do final inspection at end of monitoring period. Sign and return to Permit-Authorizing individual.

Who, When, and Where?

Hot Work Being Done By
☐ Employee ☐ Contractor

Name of Person Doing Hot Work

Date | Job/Work Order Number

Location/Building and Floor

Description of Job

I verify the above location has been examined, the precautions checked on the Required Precautions Checklist have been taken to prevent fire, and permission is authorized for work.

Signature of Permit-Authorizing Individual

Time Started: | Time Finished:

Expiration Date | Expiration Time

Work area and all adjacent areas to which sparks and heat might have spread were inspected during the fire watch period and there were no signs of fire or smoldering materials.

Time | Signature of Fire Watch

☐ Hours following hot work that work area was monitored with no signs of fire or smoldering materials.

Time | Signature of Fire Monitor

Required Precautions Checklist
(must be retained as record of hot work activity)

☐ Available Sprinklers, hose streams, and extinguishers are in service/operable
☐ Hot Work equipment in good repair

Requirements within a 35 foot "sphere" of work:

☐ Combustible dust or lint-producing equipment shut down
☐ Conveyors, ducts, blowers, and other equipment capable of transporting sparks or burning materials isolated or shut down
☐ Combustible/flammable materials removed, including; dust, lint, oil deposits (from all surfaces), packaging or stored materials, and flammable/combustible liquids.
☐ Explosive atmosphere in area eliminated
☐ Floor swept clean
☐ Combustible floor wet down, covered with damp sand or fire-resistant sheets
☐ Remove other combustibles where possible. Otherwise protect with fire-resistant tarpaulins or metal shields
☐ All wall and floor openings covered
☐ Fire-resistant tarpaulins suspended beneath work

Work on walls/ceilings or enclosed equipment:

☐ Construction is non-combustible. No combustible covering or insulation
☐ Combustibles on other site of walls moved away
☐ Enclosed equipment cleaned of all combustibles
☐ Containers purged of flammable liquids/ vapors

Fire watch/hot work area monitoring requirements:

☐ Minutes after work is completed, including all coffee or lunch breaks, that Fire Watch will be provided.
☐ Fire watch is supplied with suitable extinguishers, charged small hose
☐ Fire watch is trained in the use of this equipment and in sounding alarm
☐ Include additional watch for adjoining areas, above, or below
☐ Hours after job is completed that hot work area will be periodically inspected/monitored

Other precautions taken:

☐ Confined Space or Lockout/ Tagout permit completed if needed
☐ Area smoke or heat detection has been disabled if present
☐ Other:

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WARNING!

HOT WORK IN PROGRESS WATCH FOR FIRE!

IN CASE OF AN EMERGENCY

CALL:

AT:

WARNING!

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Figure 1: Sample of a hot work permit

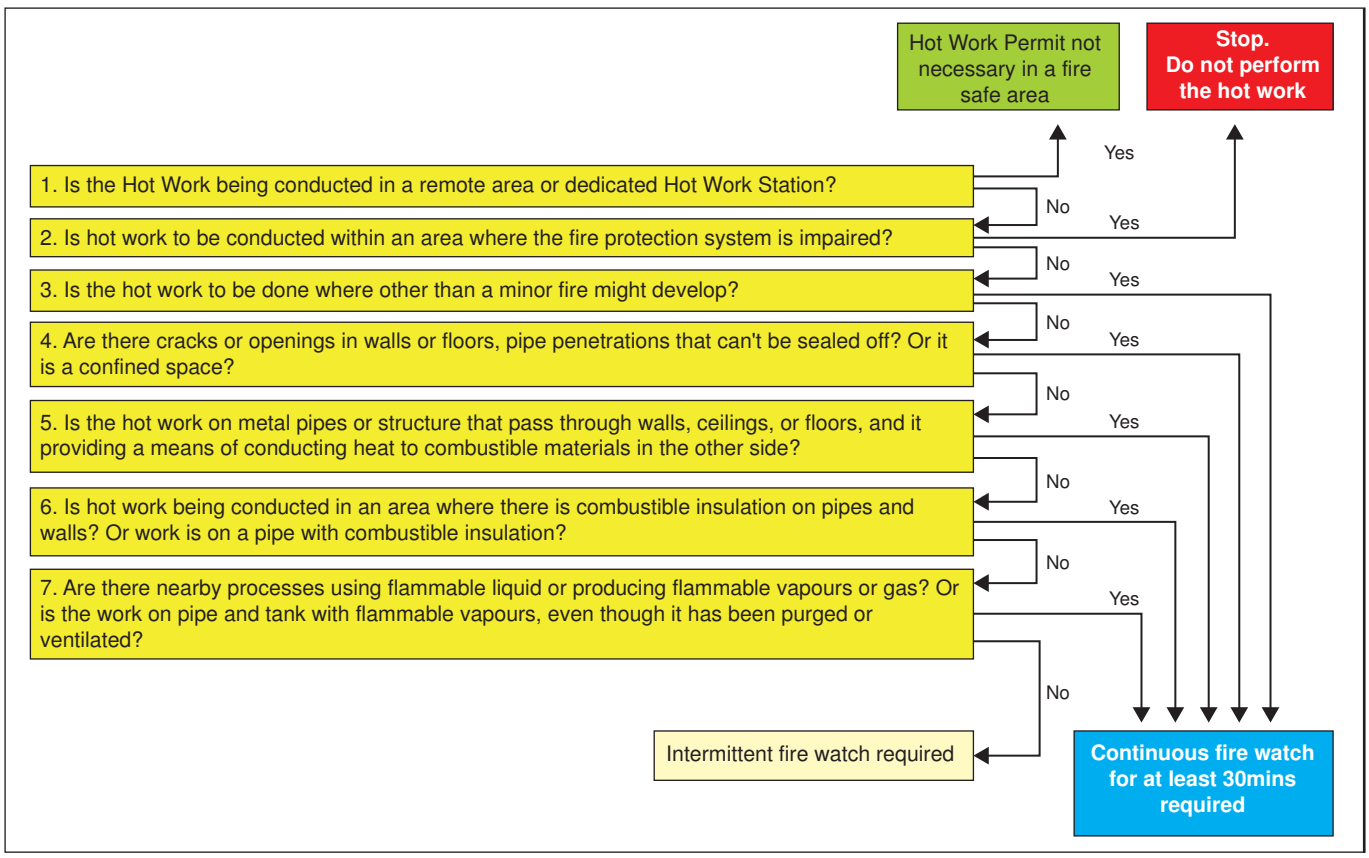

Figure 2: Hot work decision tree

As far as possible, hot work should be avoided. Where possible, work and equipment should be relocated off-site or brought to a designated hot work area. A designated hot work station should be of fire resistive construction or be located away from important areas, has proper ventilation and is equipped with fire protection systems.

A fire watch is required whenever welding or cutting is performed in locations where anything greater than a minor fire could develop. A simple decision tree is shown in Figure 2. The duty of the fire watch is to look out for fires in all exposed areas. He must also be trained to extinguish incipient fires. He should know how to raise the alarm if the fire is too large. The fire watch should stop hot work immediately if there are adverse changes to the working condition or danger to the surrounding.

It's a recipe for a bigger disaster when the active fire protection is out of service and hot work is being carried out. A fire protection impairment permit, or red tag permit as some insurance companies call it, is a system to monitor such impairment. Figure 3 shows a completed sample. Fire protection could be impaired due to:

- Routine servicing, like engine oil change in a diesel driven fire pump and the pump cannot be operated.
- Pipe leak and the sprinkler system riser valve are shut till they can be repaired.
- Faulty smoke detector and the gaseous protection system do not function automatically.
- Water supply disruption and hydrants are without water.

Figure 3: Sample of a fire protection impairment permit. On the left is the front with the impairment data and right is the back with the warning details

The fire protection impairment permit should be used to indicate that a system has been removed from service. The extent and expected duration of the impairment should be indicated on the permit. The areas or buildings involved must be inspected and the increased risks determined. When a permit is issued, the insurance company, the alarm company and property owner should be notified. Even the local fire brigade must be notified if the impairment is extensive or prolonged. The fire system owner should do a risk assessment and make recommendations to the management or the property owner on how the current

occupancy risk is managed and the measures needed to address the impairment, such as asking the local fire brigade to send a fire truck to the site on standby.

Most large industrial fires can be avoided if these two permits are in hand. In the four case studies presented here, the hazards were not understood or identified, so precautions were not taken. These had resulted in large fires, explosions and loss of lives. Permits are tools which will only be effective if used accordingly. Those involved with the permit systems should be trained appropriately. They should be prepared for delays if a permit could not be issued because the precautions were not met. It is better to delay a project than run the risk of fire.

Case Study 1

A renovation contractor was carrying outwork in a transportation terminal. This was in a tenant outlet that was closed off. The work area was a tight space. They were in the finishing stages and lacquer paint was being used. Unknown to them, the sprinkler system had been impaired at the request of another contractor. Some old utility brackets were causing obstruction, so a powered grinding wheel was used. The sparks fell on the paint cans and a fire started. The contactor was not trained in incipient fire fighting and so, left the work area. The sprinklers fused but water was not delivered to douse the fire. A member of the public called the fire department and the fire was extinguished quickly. However, the terminal had to be evacuated and operations were disrupted for half a day.

If there had been an impairment plan in place, the hot work would not have been permitted. The area would have been cleared and the paint cans removed.

Case Study 2

A salvage contractor was new to the pharmaceutical plant. The task was to remove some old tanks and pipes. As the tanks were made of steel, it was proposed to use an oxy-acetylene torch. A permit to work was issued for the task. However, the contractor did not know the tanks previously contained a type of alcohol. There was residual alcohol at the bottom of the tank and because it was a hot day, flammable vapours had built up inside the tank. When the contractor applied the torch on the first pipe, it exploded with a resulting force so huge it lifted the tank from its foundation. There was loss of life in this incident.

Had a hot work permit been used and, if the precautions included purging the tanks, the one with flammable vapours would have been flagged up.

Case Study 3

A cold store was having problems with a cooling unit. The facilities team felt it was time to replace the evaporator unit. To connect the new refrigerant pipes, brazing was done on the copper pipes. The hot work was too close to the cold room panel and the foam insulating material between the panels was ignited. As the fire was within the panel, a fire extinguisher could not be used to extinguish the flames. The thick smoke from the burning plastic insulation soon overwhelmed the workers. Fire fighters with full turn-out gear and self-contained breathing apparatus (SCBA) had to break open the panels to get to the core of the fire to extinguish it. All the food inside the cold store was contaminated and had to be thrown out.

Had a hot work permit included combustible construction identification, extra precaution would have been taken. A facilities team should be aware of combustible construction present. Instead of brazing, a safer method, such as compression fitting for the copper tubes, could have been used.

Case Study 4

There was a large bee hive in a school compound. The school building was made of wood. Standard operating procedure at the time was to light a bundle of dried coconut leaves and smoke the bees out. During the smoking process, amber dropped every where but there was no fire. After they got rid of the bees, the workers packed up and left. Half an hour later, a villager saw flames and called the fire department. But when the firemen arrived 10 min later, the whole block had been razed.

As this was common practice, no hot work precaution was taken. No fire watch was posted after the hot work, and the smouldering ambers lighted the fire minutes later. ■

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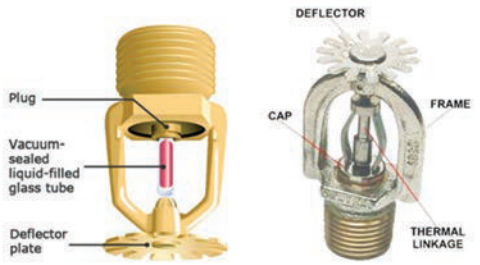
Sprinkler Systems in Malaysia: Design and Installation Guideline

by Mr. A. Vishnushama Ambikapathi

***Mr. A. Vishnushama Ambikapathi** is a Risk Consultant with AXA Matrix Risk Consultants, asubsidiary of AXA Corporate Solutions. It delivers a comprehensive range of risk management and consulting expertise to match the unique risk profile of local and worldwide operations.*

Construction of properties and businesses are becoming bigger and larger investments, so it is becoming more critical to protect these operations. As such, it is essential to have in place adequately designed and correctly installed fire protection systems. This means that, in the event of a fire, the risk of losing the business entirely and loss of human lives, can be avoided.

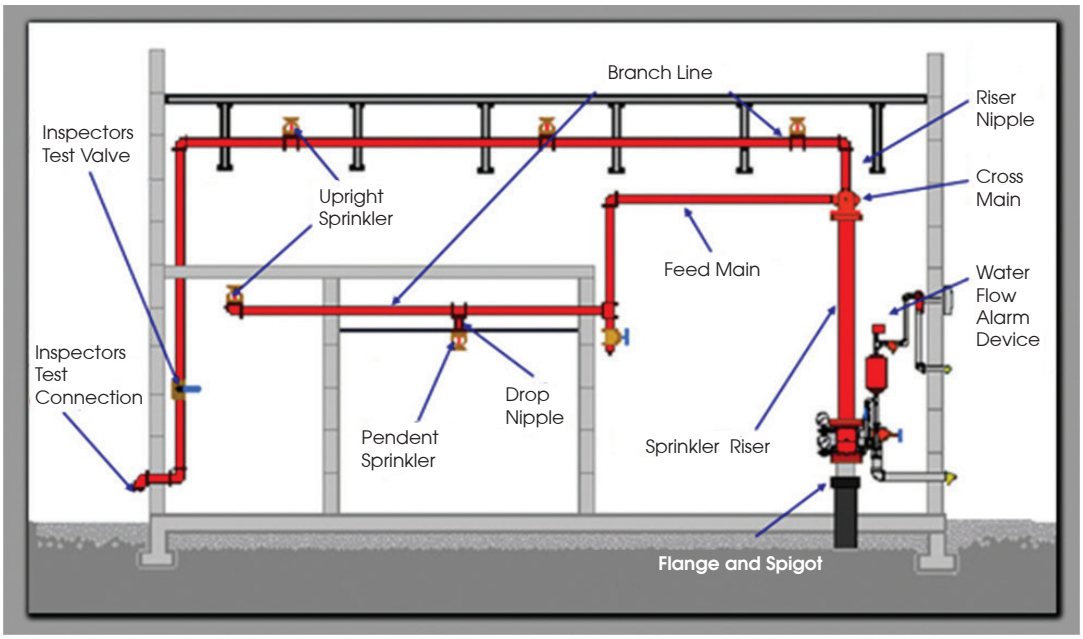
Of all the fire protection systems available, the automatic wet sprinkler system is the most widely used as it is cost effective and has proven reliable. This article serves as reference material on what to look out for when evaluating a sprinkler system.



Different types of sprinkler heads

Before we begin analysing a sprinkler system drawing, it is essential to first identify what code, standard or local rule is being applied to its design. This is because, different codes have different recommended guidelines and it is important to deduce this first to avoid complications. It is also important to verify that all parties involved in designing the system are properly trained or certified. This includes the designer, plan reviewer, installation contractor, maintenance company and any inspection personnel. Other interested stakeholders (such as investors, building operator or key tenant, brokers, insurance company, etc.) should be engaged for input as early as possible as they may have certain predetermined industrial or higher international standards to adhere to.

It is important to select the sprinkler system according to the occupancy of the building. Occupancy refers to the activities that take place in the building; these can range from a basic office to a chemical plant with hazardous processes. Every occupancy category has its own recommended sprinkler demand. Once the right demand is selected, the correct



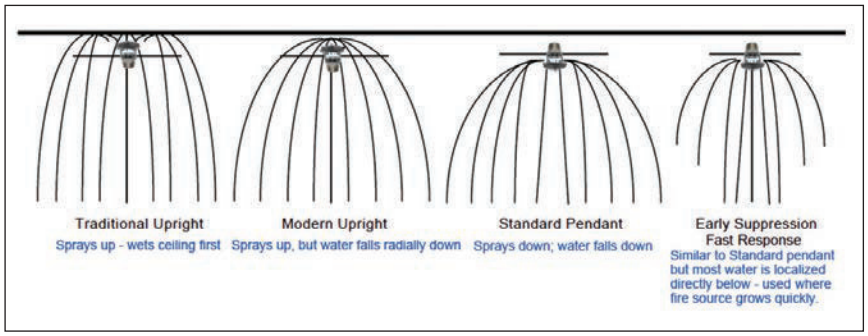
Section view of a typical wet type automatic sprinkler system arrangement (source: http://www.baylinefinre.com)

sprinkler type needs to be selected. These features include the sprinkler orifice size (K factor), response time index (RTI) rating, rated temperature and orientation (pendant, upright or side wall). The pipes, valves and fittings selected should also conform to the codes used. Other considerations could also be aesthetic (for instance, an interior designer may prefer concealed sprinklers), corrosion protection (wax coated sprinklers in waste water treatment plant), environment condition (dry pendant sprinkler to cold store rooms) or increased safety function (deluge sprinkler system to LPG tanks).

Once the demand and sprinkler type have been determined, the sprinkler drawings can then be produced. These include both on-scale plan and sectional view drawing. The main items to look out for in these drawings are as follows:

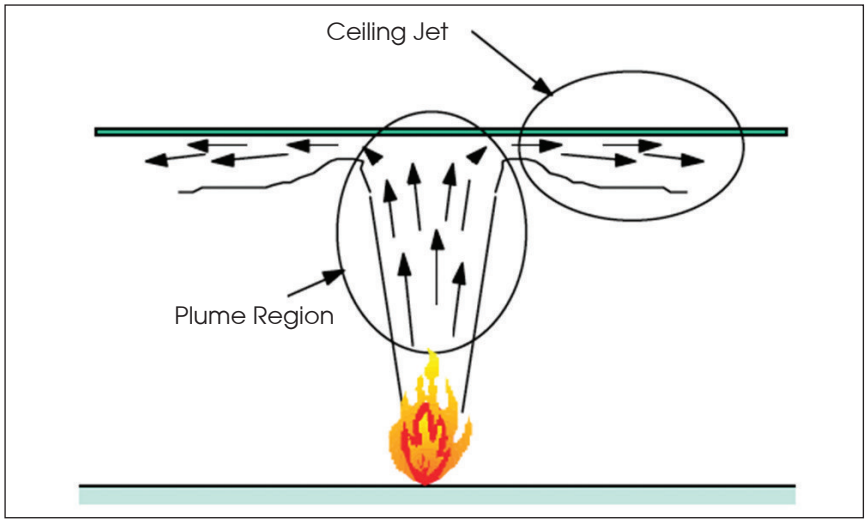
a) **Design criteria should be stated on the drawings:** The occupancy, design standard, sprinkler density, area of coverage, sprinkler type, etc. should be stated on the drawing. This serves as the basis for design verification as well as future reference when the drawings become as-built. Ideally, a summary of the sprinkler hydraulics should be tabulated on the drawings.

b) **Sprinkler head linear and area spacing.** Every sprinkler head has its own effective coverage area and the sprinkler spacing ensures that all areas on the protected floor will be covered by water discharged from the sprinkler heads in an event of a fire. For example, this can be as wide as 36.0 sq. m for extended coverage sprinklers in light occupancies down to just 9.0 sq. m maximum allowable for storage sprinklers.



Different types of sprinkler heads

c) **Vertical distance of sprinkler heads from the ceiling.** A fire creates heat and the heat plume rises to the ceiling. Sprinkler heads operate when the thermal sensing element breaks at a given temperature. When the sprinkler head is installed within the fire plume, the effectiveness of the heads to operate quickly increases.



Heat spread of a fire towards the ceiling (source: National Institute of Standards and Technology)

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50,000	4,284.96	2,198.05	1,503.04	1,185.75	978.31	840.50	742.47	669.31	612.73	567.74
70,000	5,998.94	3,077.27	2,104.25	1,660.05	1,369.63	1,176.70	1,039.46	937.04	857.82	794.84
100,000	8,569.92	4,396.10	3,006.08	2,371.50	1,956.61	1,680.99	1,484.94	1,338.62	1,225.45	1,135.48
130,000	11,140.89	5,714.93	3,907.90	3,082.94	2,543.60	2,185.29	1,930.43	1,740.21	1,593.09	1,476.12
150,000	12,854.87	6,594.15	4,509.12	3,557.24	2,934.92	2,521.49	2,227.42	2,007.93	1,838.18	1,703.22
170,000	14,568.86	7,473.37	5,110.33	4,031.54	3,326.25	2,857.69	2,524.40	2,275.66	2,083.27	1,930.32
180,000	15,425.85	7,912.98	5,410.94	4,268.69	3,521.91	3,025.79	2,672.90	2,409.52	2,205.81	2,043.86
190,000	16,282.84	8,352.59	5,711.55	4,505.84	3,717.57	3,193.89	2,821.39	2,543.38	2,328.36	2,157.41
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d) **Any obstruction to the sprinkler head discharge pattern.** Even though the horizontal spacing of sprinkler heads is within the recommended range, at times there may be elements (building members, ducts, cable conduits, lighting, etc.) within the sprinkler discharge pattern area which may affect the efficiency of water distribution and hence floor wetting. In such cases, additional sprinkler heads may need to be installed under these elements. A ceiling coordination layout drawing will be able to assist in determining if such obstructions exist.

e) **Sprinkler pipe hanger spacing.** When the sprinkler pipes are filled with water, they are subjected to added weight. The design standards usually give the recommended spacing for sprinkler pipe hangers, based on the pipe material and size. This hanger should be considered as a system, meaning the pipe hanger assembly (struts, rods, brackets, straps, etc.) and the structural member attachment (concrete anchor, beam clamp, etc.)

f) **Seismic bracing (where applicable).** Several regions in Malaysia are being recognised as earthquake prone. A seismic bracing system provides both rigidity and flexibility to the sprinkler piping, to avoid pipe swaying and breakage during an earthquake. This needs to be evaluated in the drawings as well.

Lateral and longitudinal sprinkler pipe seismic bracing (source:http:// www.naffcoflow.com)

g) **Valve location.** Automatic sprinkler systems utilise water to extinguish a fire. For water control purpose, valves are usually installed into the system. It is important to identify the location of all these control valves. The valves include the main sprinkler header (riser) and any ceiling level isolation valve. Where valves are provided, they should be installed in easy accessible locations. As a rule of thumb, valves should be within the 1.0 to 1.8 metres high for easy operation. They should be no more than 2.1 metres high and definitely not above concealed spaces, such as above ceiling.

h) **Sprinkler flow switch (water flow detection device) location.** Once a sprinkler head operates, the water flow in the pipes needs to be detected. A flow switch in the system will pick up the flow and sends a signal to the fire

alarm panel. The fire department will then be notified. For quick detection, it is recommended that the flow switch be installed just downstream of the every sprinkler header valve.

i) **Correct installation of Inspector's Test Connections (ITCs).** To ensure the sprinkler flow switch functions well, it needs to be tested. However, it is not practical to break a sprinkler head during each test. An ITC is normally tapped from the furthest branch line of the sprinkler system. A sprinkler head of similar type is then installed at the end of the pipe. This test point sprinkler head should be open and controlled by a valve. When this ITC valve is opened, it simulates one sprinkler head operating at the most remote point (worst case scenario), and the time taken for the flow switch to detect water flow and to send a signal to the fire alarm panel, is measured. Current standard calls for an alarm within 90 seconds.

j) **Crossmain flushing connections.** During the commissioning of the sprinkler system, it is recommended to flush the pipes with water to remove all debris from pipe welding, threading works or infiltrated when left on the floor. To facilitate this test, crossmain flushing connections should be installed at the end of each crossmain at the lowest point.

k) **Water supply.** All sprinkler systems need a water source. This usually comprises a pump and tank. A tank should contain the required water demand for the expected fire duration. This can be one hour for light occupancy (like an office) to several hours for high challenge fires (such as rubber tyre storage). As the pump is the heart of the system, it should be reliable and sized to provide the needed flow and pressure of the highest sprinkler demand. An internationally recognised pump would be the best bet, such as FM Approved, LPC, VdS, UL Listed pump.

Once the sprinkler drawings are produced, a head-by-head hydraulic calculation needs to be performed. This is to ensure that the water supply is able to supply adequate water, based on the resultant flow and pressure of the hydraulic calculation. The drawings and hydraulic calculation are then submitted for approval by a professional engineer and the authorities. Today, of course, there are various computer software available to do the calculations. But a designer should still be aware of the above, as proper input is crucial for the software to crunch out the desired results.

Installation works should begin only after all drawings and calculations have been reviewed and approved, and the sprinkler system components properly selected and approved. As every operation is crucial, it is important that a facility has adequate fire protection, to mitigate large fire losses. Or else, there may be financial penalties for having an improper or inadequate sprinkler installation. In the worst case, the premise could even be denied a building permit by the authorities. An investment done right initially may eliminate the need to spend a lot more in the future. ■

Overview of Roof Mounted Solar PV System Fire Safety

by Mr. Tan Yiing Yee

***Mr. Tan Yiing Yee** is a Professional Engineer with 20 years of experience in the fire protection industry. As he is also a certified GCPV service provider, he believes that the fire safety aspects of solar PV installations will benefit from greater awareness.*

The Government has been promoting clean energy in one form or another for quite some time. Renewable Energy (RE) related policies in the 8th Malaysia Plan were formulated to fulfill the country's obligations to international climate change initiatives and as a form of energy security. Through the years, these initiatives have facilitated sustainable long-term growth of renewable energy sources in Malaysia. Early programmes such as the Sustainable Renewable Energy Programme (SREP), introduced in 2001, paved the way for more ambitious programmes such as the introduction of the Feed-in Tariff (FiT) Scheme in Malaysia at the end of 2011.

Domestic Roof Mounted Solar PV System (Source: pv-magazine)

Although Malaysia has a multitude of renewable energy sources, solar photovoltaic (PV) systems are, by far, the most numerous due to the relative ease of installation, scalability and relatively low cost. As we are blessed with abundant sunshine with an average daily solar irradiance of 5.5 kW/m2, solar PV systems installed under the FiT scheme means comparatively short Return on Investment periods for their purchasers.

Attracted by the promise of quick returns, home and commercial property owners jumped on the RE bandwagon, resulting in consistent growth of the roof-mounted solar PV systems market segment. A rare sight not so long ago, solar PV systems are now common place and can be seen on the roofs of many residential homes and commercial complexes.

A typical grid-connected solar PV system is conceptually simple and comprises only a few main parts as shown in the diagram below:

1. Solar PV Modules arranged in an array and supported by a frame or integrated into the roof itself
2. DC Wiring, including DC Combiner Boxes
3. Inverters
4. AC Wiring and Distribution Boards

Solar PV modules are basically a matrix of PV cells connected together in series-parallel to achieve the specified output power. This matrix of cells is sandwiched between a layer of glass (the top of the module) and one or more plastic sheets including the backing sheet at the back of the model, and encased in an aluminum frame. The electrical connections from the PV cells are brought out to a small junction box glued to the back of the module. For the purposes of this discussion, the actual type of PV cell is immaterial.

DC wiring connecting one or more solar PV modules is brought to DC Combiner Boxes and from there into inverters. Of particular note is that DC wiring carries very high DC voltages and a significant amount of power. Additionally, these cables and associated accessories like connectors, are typically exposed to weather since their function is to bring power from roof mounted PV modules to the nearby inverters.

From the fire safety point of view, however, it is a fact that solar PV systems are still quite new in Malaysia. Although large-scale fires caused by solar PV systems here have not been reported so far, there have been anecdotal reports of numerous failures causing small fires that resulted in equipment and minor property damage. However if the experience of countries with higher solar PV system penetration is anything to go by, large fires caused by solar PV systems are almost a certainty in time to come. Awareness of the issues related to solar PV system fires is then required so that adequate preparations may be made.

Roof Mounted Solar PV Fire (Source: solarexpert.wordpress.com)

Fire can start from any of the parts listed above, as all of them have components that are flammable. Apart from the usual fire hazards presented by live electrical equipment, solar PV components present additional fire hazards due to a unique combination of materials, operating characteristics, installation methods and locations.

For those considering the installation of solar PV systems, the tendency is to maximise profit. This, coupled with an imperfect understanding of the deeper issues related to system reliability and safety, can create many situations where actual installations do not strictly follow industry best practice recommendations. This of course eventually leads to reliability and safety issues with system and increases maintenance costs while decreasing system availability.

Nevertheless, following the adage that prevention is always better than cure, solar PV systems can be made more reliable and safer by the following:

1. Selecting a certified designer for solar PV systems. This is more difficult than it seems due to the proliferation of installers that are only nominally trained.
2. Selection of properly rated components and equipment. A prime example is cabling that is rated for exposure to sunlight and weather. Insulation on incorrectly specified cables deteriorates quickly when exposed to the tropical sun and this can lead to fires caused by short circuits. There are many similar examples such as using the correct connectors, switching components, etc.
3. Installation of solar PV systems by certified installers to internationally recognised standards.

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IEM DIRECTORY is circulated to more than **36,000 registered members** of The Institution of Engineers, Malaysia (IEM), with an **estimated readership of 144,000** professionals.

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The ***IEM DIRECTORY*** is an excellent resource for businesses looking for engineering related products and services, business opportunities and cooperation with engineering firms, suppliers, distributors, consultants and qualified professional engineers for major projects and business interests.

Our content includes:

- A decisive listing of companies providing goods and services to engineers and engineering businesses in a concise format, as well as an easily searchable index of companies sorted by engineering disciplines.
- A complete list of all current IEM Honorary Fellows, Fellows, Members, Graduate and Student Members.

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4. Comprehensive inspection and testing of the completed solar PV system during the commissioning stage.
5. Regular maintenance of the solar PV system during its life time.

The challenges of fighting solar PV system fires are also novel. Although roof-mounted systems are on the outside of a building, fire on the roof with solar PV installation, can quickly spread into the building and cause widespread damage. In case of such fires, fire fighters face many unique challenges such as:

- Recognising buildings with solar PV system installations.
- Isolating or "blacking out" solar PV systems. This is a particular hazard posed by solar PV systems since PV modules continue generating power so long as there is light! It must be assumed that parts of a solar PV system will always remain live even though AC power may have been isolated.
- High DC voltages of up to 1,000VDC in a large commercial system present a greater than usual risk compared to the low-voltage AC power supplies normally found in domestic or commercial environments.
- DC currents affect the human body differently from AC current; volt-for-volt DC electricity is considered more dangerous than AC electricity.
- Solar PV systems place a higher-than-usual mechanical load on roofs, particularly for retrofitted systems. This means that roofs may collapse more easily than normal under fire conditions.
- Tightly spaced solar PV modules and other related obstructions (cable trays, supports, etc.) may restrict the fire fighters' access to parts of the roof.
- Solar PV system installations that are placed off the supporting roof may worsen fire conditions by making the fire harder to get at as well as providing a flame spread path under the solar PV array.

From the above, it is clear that adequate awareness, training and equipment are mandatory for fire fighters responding to a solar PV fire.

This article has briefly introduced the types of fire hazards present in a roof-mounted solar PV system and discussed the unique challenges in dealing with fires involving such systems. As more and more systems become available, what is certain is that the challenges will multiply, and advance knowledge and preparation could minimise loss of life and property to fires in solar PV systems. ■

IEM DIARY OF EVENTS

Title: 29th Annual General Meeting Building Services Technical Division, IEM

15 August 2015

Organised by : Building Services Technical Division
Time : 11.01 a.m. – 1.00 p.m.
CPD/PDP : 2

Title: 1-Day Course on 'Introduction To Building Information Modelling (BIM) For Professionals'

20 August 2015

Organised by : IEM Women Engineer Section
Time : 9.00 a.m. – 5.30 p.m.
CPD/PDP : 7

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

Driving Ownership

by Ir. Shum Keng Yan

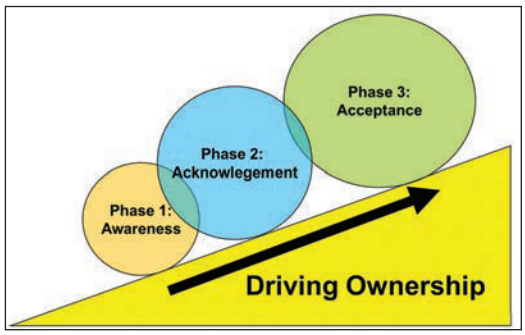
***Ir. Shum Keng Yan** is a chemical engineer and a certified accident prevention and safety practitioner. He advises on EHS in the chemical, fast moving consumer goods, heavy metal manufacturing and building services industries across Asia Pacific and beyond. He regularly delivers talks at conferences, forums and universities.*

Now that we understand the 3As (Awareness, Acknowledgement, Acceptance) of gaining ownership, let us try and apply it.

IDENTIFICATION

In order to be effective, it is important to identify the phase of your audience. Where are they in relation to the ownership phase?

- What is the current phase of our audience?
- What is the next phase of our audience?
- Deploy the desired activity to move the current phase to the next phase.



APPLICATION

After we have identified the phase of our audience, we need to craft the activity that will help drive the audience to the next phase. We may need a combination of activities.

1. Awareness phase

You may use a series of email blasts, posters, banners and information pamphlets to provide the information of what you are doing to your audience. The messages should be coordinated and aligned.

2. Acknowledgement phase

Start by providing an avenue for the audience to share their experience. Perhaps you can prepare your Awareness materials by using stories from the audience. Enlist those who have Accepted to share their experience.

3. Achieving the Acceptance phase

Involve the audience in the actual activity. Let them discover the outcomes via hands on actual activity. This will help build confidence.

4. Maintaining the Acceptance phase

Once Acceptance is achieved, there should be constant Awareness campaigns using the materials developed by the group. This will have a very high buy-in from the organisation.

Enlist the Accepted to become coaches and mentors. This will help support newcomers to move up the 3As faster. Enable an open platform for discourse and feedback. Publish the actions taken on the suggestions to create a more inclusive atmosphere.

REVIEW

Before we end, I need to try and move you to the "Acceptance" phase. In order to do that, I need you to try out a simple exercise.

I have a box with some activities that we do on safety. I need you to sort them out into 3 buckets of "Awareness", "Acknowledgement" and "Acceptance". Please note that some of the activities may fall into more than one bucket; that is fine – nothing is black and white. Put it into the best bucket.

Reading statistics	Looking at audit photos	Sharing a story
Writing audit reports	Attending conferences	Looking at Posters
Conducting joint site inspections	Defining own Roles & Responsibility	Becoming a Subject Matter Expert
Conducting a practical study	Listening to employee testimonies	Conducting self evaluation

If you want to share your buckets with me, you can do that at: *pub@iem.org.my.*

Results come when an organisation is engaged through shared ownership. ■

The safest risk is the one that you did not take. Often it is the gap in the risk perception that leads to a gap in risk control.

Short Course on Flood Emergency Response Planning

MECHANICAL ENGINEERING TECHNICAL DIVISION

reported by
Ir. Fam Yew Hin

***Ir. Fam Yew Hin** is currently the Chairman of Mechanical Engineering Technical Division.*

The recent 2014/2015 floods will, without doubt, be remembered as one of the most devastating calamities in local history. More than 250,000 people were displaced by the floods which resulted in thousands of homes being cut off from outside assistance. The flood waters stayed for days in many areas. Kelantan, Terengganu and Pahang were the hardest hit while Perlis, Perak, Johor, Sarawak and Sabah were not spared either.

To show our concern, the IEM Mechanical Engineering Technical Division (METD) organised a half-day short course on flood emergency response planning on 26 January 2015. All proceeds from the course were channelled to the IEM flood charity relief fund. The fund enabled the IEM Young Engineers Section to help flood victims rebuild their lives in a small way.

Ir. Loo Chee Kin, a senior consultant with Global Risk Consultants (GRC), conducted the half-day course.

What is a flood? "Plainly, flood is a rising and overflowing body of water making its way onto a normally dry piece of land. In a layman's term, it is water where it is not supposed to be," said Ir. Loo.

He started with the fundamentals. Water flows downhill due to gravity. Water flows in the path of least resistance and, according to fluid mechanics, water moves in relation to each other. But the volume remains relatively constant because of the strong cohesive forces between the molecules. As a result, liquid can take the shape of the container it is in, and it forms a free surface in a larger container in a gravitational field.

What causes flooding? Many cities and towns in Malaysia are located on river banks due to historical development as rivers offer easy availability of drinking water, the presence of flat and fertile agriculture land, transportation and development of trading ports.

Floods can occur due to:

- Heavy rain (as witnessed in the recent flood)
- Failed protective devices such as dams, disused mines or aquaculture ponds
- Inadequate drainage systems, flash flood
- Tropical storms (worst in typhoon)
- High tide
- Melting snow (though not in Malaysia)

In hydrology, flood mitigation measure is designated by recognition of the likely

Flood recurrence interval	Time period being considered				
	1	2	5	10	50
10	9.52%	18.13%	39.35%	63.21%	99.33%
25	3.92%	7.69%	18.13%	32.97%	86.47%
50	1.98%	3.92%	9.52%	18.13%	63.21%
100	1.00%	1.98%	4.88%	9.52%	39.35%
250	0.40%	0.80%	1.98%	3.92%	18.13%
500	0.20%	0.40%	1.00%	1.98%	9.52%

Table 1

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recurrence interval of a flood (i.e. 25 years, 100 years, 500 years). The likely recurrence interval of an event gives the average length of time between occurrences. If a structure is built on a 25-year recurrence interval flood level, the chances of flooding in 5 years are 18.13%. And if it is built on a 50-year recurrence interval flood level, the chances of flooding in 5 years are 9.52%. So, by building a structure on a 500-year recurrence interval flood level, the probability of flooding in a given locality is reduced drastically *(refer to Table 1)*.

How does one respond to impending flood? Ir. Loo said we need to know the likely exposure, available warning system and possible actions before, during and after the flood. He shared some useful river data and flood warning data with the participants. The key government website is http://infobanjir.water.gov.my/. Participants had a chance to practise writing a flood emergency response plan in class.

What can you expect when you are driving in a flood? Here are three situations:

- In 150 mm of water, the flood reaches the bottom of most passenger cars and it can cause loss of control and possible engine stalling.
- In 300 mm of water, many vehicles will float or drift away.
- In 600 mm of rushing water, the flood can carry away most vehicles.

In the post-flooding period, damage assessment and task prioritisation checks should be carried out first. Most electrical and mechanical equipment can be salvaged if properly dewatered, dried, corrosion stopped and serviced before powering or attempting to operate them.

In summary, flood can often be predicted and mitigated. Proper flood response planning will limit damage and aid speedy recovery. Knowing what to salvage and recover will help humans and business return faster to normal routine. ■

IEM DIARY OF EVENTS

Title: 11th Annual General Meeting of the Project Management Technical Division, IEM

22 August 2015

Organised by : Project Management Technical Division
Time : 11.00 a.m. – 1.00 p.m.
CPD/PDP : 2

Title: Two Day Course on Basic Project Management for Engineers

25 - 26 August 2015

Organised by : Graduates & Student - The Young Engineers Section
Time : 9.00 a.m. – 5.30 p.m.
CPD/PDP : 14

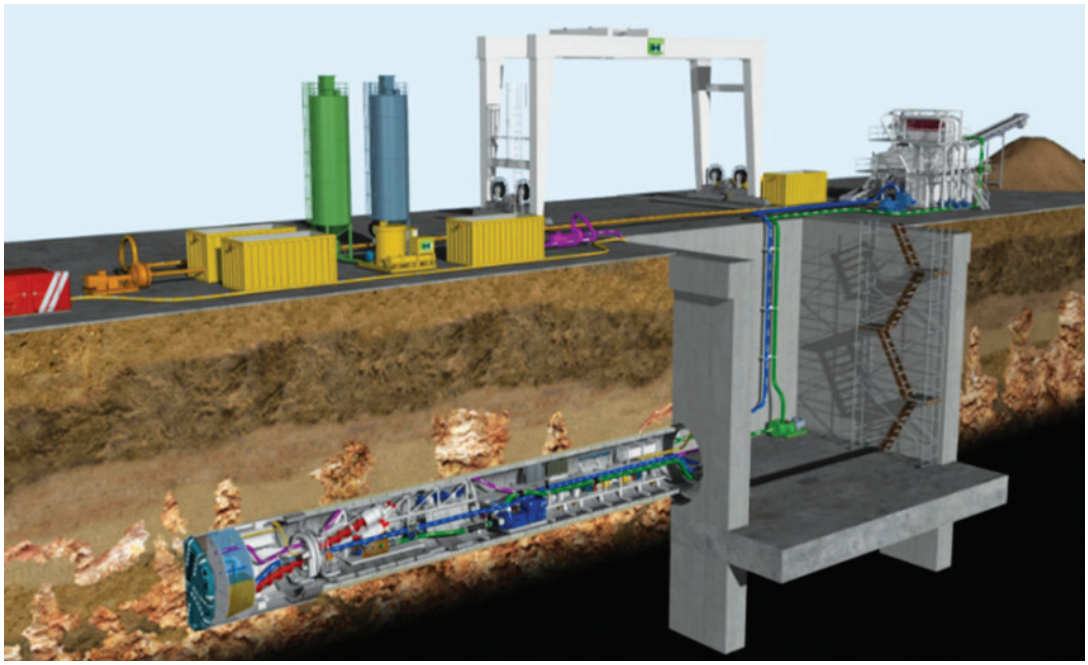
Kindly note that the scheduled events below are subject to change. Please visit the IEM website at www.myiem.org.my for more information on the upcoming events.

Visit to Cochrane MRT Station & Tunnel

MECHANICAL ENGINEERING TECHNICAL DIVISION

reported by
Ir. Yeoh Jit Shiong

Ir. Yeoh Jit Shiong *is Senior Interface Manager with MRT Corporation. He has a Bachelor's Degree in Mechanical Engineering from Universiti Teknologi Malaysia. He currently serves on the Sub-committee in IEM's Mechanical Engineering Technical Division.*



TBM machine operation (picture courtesy of underground space engineering)

The multi-million Ringgit Klang Valley Mass Rapid Transit (KVMRT) is expected to solve part of the traffic woes of the urbanites upon completion. To get an early glimpse into the project, IEM's Mechanical Technical Engineering Division (MTED) organised a visit to its underground station at Cochrane on 16 June 2015 for 16 engineers from various backgrounds.

PRE-TOUR BRIEFING

Before the visit started, an official of MMC-GAMUDA gave a presentation of the project – on the tunnelling process, the cutting edge advance technology used which had earned MMC-GAMUDA the Technical Innovation of the Year Award for the Variable Density Tunnel Boring Machine, the Electrical and Mechanical System, and the Railway Systems. The role of KVMRT in easing traffic congestion in the Klang Valley was explained.

Two types of construction methods were used for underground stations. The top-down method was meant for congested areas while bottom-up method was used where space was limited.

Participants listening to the presentation

All participants were given a safety briefing on the dos and don'ts in the underground station and tunnel before the start of the visit.

ELECTRICAL AND MECHANICAL SYSTEMS

The focus of the visit was on the design and installation of the electrical and mechanical systems (E & M Systems). The Railway System, though important, was beyond the scope of this report. Briefly as discussed herein the E & M systems cover principally the following works:

- Environment Control System
- Fire Detection and Protection System

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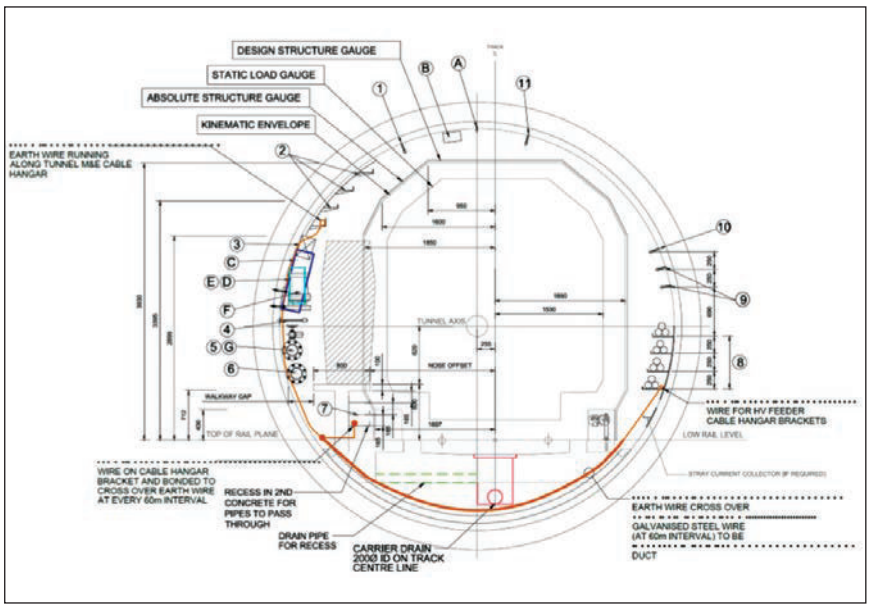
- Plumbing and Drainage Services
- Tunnel Ventilation System
- Electrical Services.

Environment Control System (ECS): ECS of an underground station shares the same design concept as that of an underground structure. In principle, ECS in underground stations are for human comfort and supported the operation of railway equipment. In particular, a smoke control system will be provided in stations for safe evacuation of all station occupants within the public areas in the event of emergency. It is designed according to the latest standards and best practices in the world, such as NFPA 130, American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), Chartered Institution of Building Services Engineers (CIBSE), Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), Malaysia Standard MS1472: 1999 and Malaysia Standard MS1780: 2005 just to name a few.

The Fire Detection and Protection System: In the event of fire, the main objectives of this system are to protect passengers and staff as well as to minimise damage to equipment, buildings and structures. The system is able to detect the presence of smoke or fire and subsequently alert the staff of fire outbreak with minimum delay. The system allows a quick and controlled evacuation to take place without panic. As Uniform Building Bye-Law (UBBL) does not have fire safety provisions specifically for Mass Rapid Transit premises, firefighting equipment and fire safety installations have been proposed based on risk assessment in Fire Safety Design Philosophy which is approved by the Fire Services Department.

Plumbing and Drainage Services: This includes cold water supply, sanitary plumbing, dewatering and drainage pumping system. The dewatering pumping system has two functions. First, it is to dispose water from drainage discharge points to the public drainage system. Second, it will dispose waste and soil water from sewage discharge points to a public sewage system. At all times the system ensures a clean environment in the stations and the tunnels.

Tunnel Ventilation System: The system is used to maintain the tunnel and the track-way at an appropriate environmental condition for train operation and commuters. In the event of a tunnel fire, the system operates as a smoke extraction system to create a smoke-free path for the evacuation of passengers and to ease the operations of fire personnel. Ductworks comprise structural ducts, builders work ducts and heavy



Cross section of a bored tunnel with railway services

gauge fire-rated steel ductwork. Concrete and builders work ducts are treated to minimise corrosion and dust generation.

Electrical Services: The system provides power supply to each station via a 33kV network along the tunnels. Dual 33kV power supply will be stepped down to 415V power supply in power equipment room for distribution. As a reliable and safe power supply to stations and railway system equipment is vital, there are three types of power supply modes. First, the normal mode supply to all load equipment when all power supplies are healthy. Second, the essential mode supply to essential load equipment when one supply source fail. Third, the very essential mode (UPS) supply to critical load equipment when all power supplies fail.

IEM group picture in the tunnel

WORK-IN-PROGRESS

On the day of our visit, the underground structure works at Cochrane Station were mostly completed and ready for electrical and mechanical installations. The underground station was bustling with activities as workers were putting up the blockworks and installing cable ladders for the 33kV power supply at the under-platform level. Masonry ductworks for the overhead track exhaust system to dissipate heat generated by the air condition units of the electric trains had also been completed.

After inspecting the working progress, we were given a glimpse of the finished tunnel. Although the Tunnel Boring Machine (TBM) had completed the whole tunnel, there was much more to be done. We saw many E&M services and Railway systems installations in progress. These included drainage to cater to tunnel water seepage and water carried from outside by the trains, 33kV power cables that supply power to all underground stations, linear head detector (LHD) to detect any abnormality in the tunnel, communication cables, conductor rails to power up the trains, track-work installations, signaling cables, emergency walkways, tunnel lightings and switch socket outlets. Only the installation of cable brackets was fully installed on the day of our visit. ■

IEM Signs MoU with Hang Tuah Jaya Municipal Council (MPHTJ)

IEM MALACCA BRANCH

reported by
Ir. Wong Chee Fui

***Ir. Wong Chee Fui** is the Executive Director of IEM.*

Group photo during IEM MoU signing ceremony with IEM President Dato' Ir. Lim Chow Hock, MPHTJ President Tuan Hj. Mansor bin Sudin, IEM representatives, MPHTJ councillors and head of departments.

The Institution of Engineers Malaysia (IEM) and Hang Tuah Jaya Municipal Council (MPHTJ) signed a memorandum of understanding (MoU) on 28 April 2015 at MPHTJ, Kompleks Melaka Mall, Malacca.

The MoU was signed between IEM President Y.Bhg. Dato' Ir. Lim Chow Hock and MBHTJ President Tuan Hj. Mansor bin Sudin. Present to witness the signing ceremony were IEM Honorary Secretary Ir. Yam Teong Sian, IEM Malacca Branch Advisor Ir. Ooi Kah Huat, IEM Executive Director Ir Wong Chee Fui, committee members of the IEM Malacca Branch as well as councillors, heads of departments and the senior management of Malacca Historical City Council (MBMB).

The purpose of the MoU is to enable IEM to provide engineering support and professional advice to MPHTJ as and when required and for MPHTJ to promote awareness of engineering and safety regulations related to engineering among the public. In this regard, both parties, including representatives from IEM Malacca Branch, have held a series of discussions on the scope of cooperation that would be created through the MoU.

To date, IEM has signed MoUs with MBMB, Petaling Jaya City Council (MBPJ), Ipoh City Council (MBI), Miri City Council and Kota Kinabalu City Council. It is currently in discussion with several other local and city councils to establish similar MoUs.

IEM also hopes to provide opportunities for engineers and technical staff of MBMB to attend courses and workshops organised by IEM to enhance their technical knowledge in latest engineering aspects. To that end, the engineers and technical staff of MBMB will be encouraged to become members of IEM. ■

IEM President Dato' Ir. Lim Chow Hock and MBHTJ President Tuan Hj. Mansor bin Sudin at the MoU signing ceremony

New Training Centre for IEM Sabah

With the newly built IEM Sabah Training Centre, Sabah has become the first IEM branch to have its own training centre. It was officially launched by Sabah Chief Minister YAB Datuk Seri Panglima Musa Hj. Aman on 15 June, 2015.

It started some 20 years ago, when the Sabah Branch wanted to set up its own training centre. Working towards this end, the past chairmen of Sabah Branch worked to purchase a piece of land. They then planned and carried out the ground work, subsequently building and completing the training centre which was designed with many green features to showcase green technology.

The project was made possible with the strong support and assistance of the state government which gave RM500,000 grant as seed money. For a start, the branch will cooperate with TAS Institute of Oil & Gas to conduct relevant training programmes for the oil and gas sector.

Also present at the launch were Deputy Chief Minister Datuk Raymond Tan Shu Kiat, IEM President Dato' Ir. Lim Chow Hock, the Minister of Local Government and Housing, the Mayor of Kota Kinabalu, Chairman of TAS Institute of Oil & Gas and Past Chairmen of IEM Sabah Branch.

IEM Southern Branch 42nd Annual General Meeting

"IEM Southern Branch held its 42nd Annual General Meeting on the 27 June, 2015. IEM president Datuk Ir. Lim Chow Hock and more than 150 corporate and graduate members from Johor and Singapore were present. Ir. Assoc. Prof. Hayati binti Abdullah continues to be the chairman for Session 2015. A pre-AGM technical talk on steel fibre reinforced concrete was arranged for members.

IEM (Southern Branch) Executive Committee 2015/2016

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What are the main activities of your organisation? *(Tick all that apply)*

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- ☐ Structures/steel work
- ☐ Building (commercial, industrial)
- ☐ Housing
- ☐ Construction management
- ☐ Deep mining

Manufacturer of:

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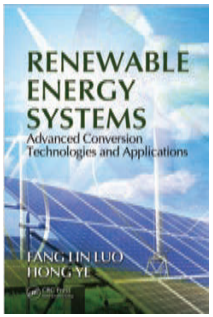

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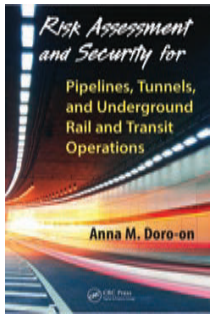

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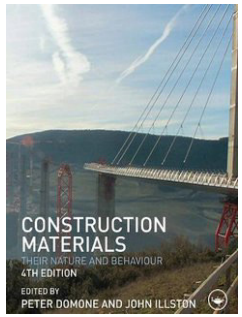

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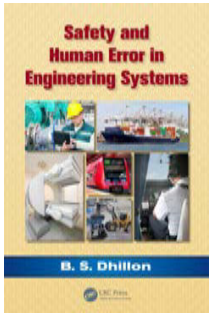

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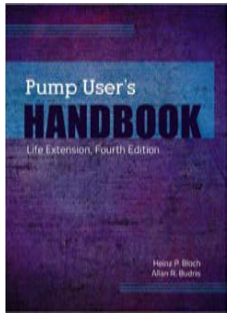

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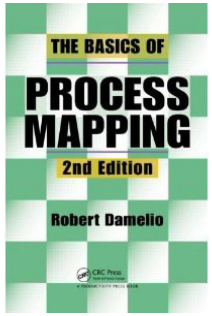

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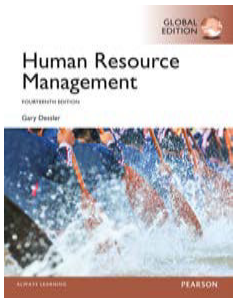

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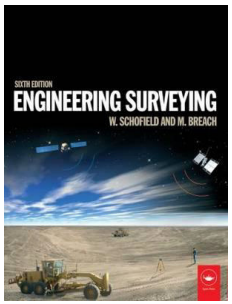

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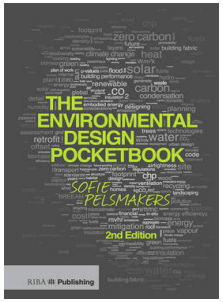

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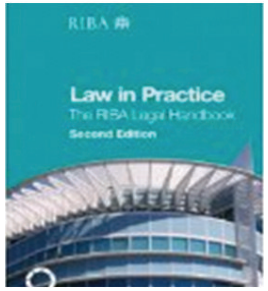

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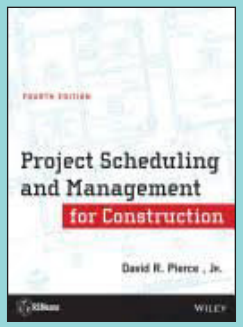

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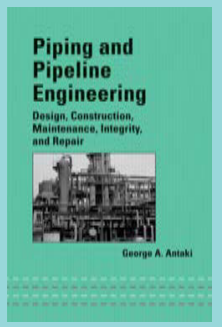

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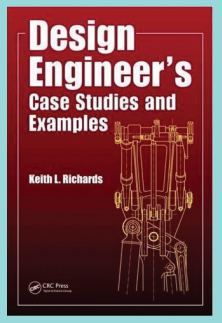

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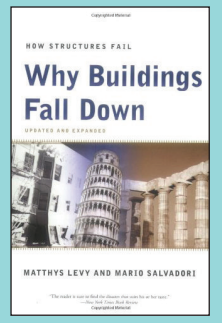

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Mount Kinabalu

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

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

Editor's Note:
We welcome contributions from all members on any travel stories.

On 5 June 2015, an earthquake measuring 5.9 on the Richter scale shook Sabah, causing vast damage to property and the deaths of 18 people. The epicentre was 15km north of Ranau, very close to Mount Kinabalu. Some 90 aftershocks further aggravated the situation. As a result, Mt. Kinabalu was closed to climbers indefinitely.

So what experts have been telling us all this while, that Malaysia is free from earthquake, volcanic eruption, typhoon and other natural calamities, is not absolutely true.

At 4,095.2m high, Mt. Kinabalu is the highest peak in the country as well as the highest peak between the Himalayas and Papua Island. It is situated in the northern part of Sabah on Borneo Island. Contrary to popular belief, it is not the highest peak in South-East Asia as Puncak Jaya (4,884m) and two other peaks in West Papua, the eastern most territory of Indonesia, are significantly higher.

Over the years, Mt. Kinabalu has attracted many Malaysians and foreigners to climb to its peak. Its popularity is in no small part due to the annual Mt. Kinabalu International Climbathon which was first organised in 1987.

The ecosystems within the Mt. Kinabalu National Park harbour such a rich biodiversity of flora and fauna (including many endemic species) that the park was admitted to UNESCO's list of World Heritage Sites in the year 2000.

The climb up Mt. Kinabalu usually takes two days. On the first day, climbers start at either Timpohon Gate (1,866m) or Mesilau Nature Resort (2,000m) and make their way up to Laban Rata Refuge (3,270m). On the second day, they will start the final ascent to Low's Peak at 3a.m. and, hopefully, reach the peak in time to witness a spectacular sunrise. Then, after a short rest, they will descend to Laban Rata for a late breakfast before going down to Timpohon Gate.

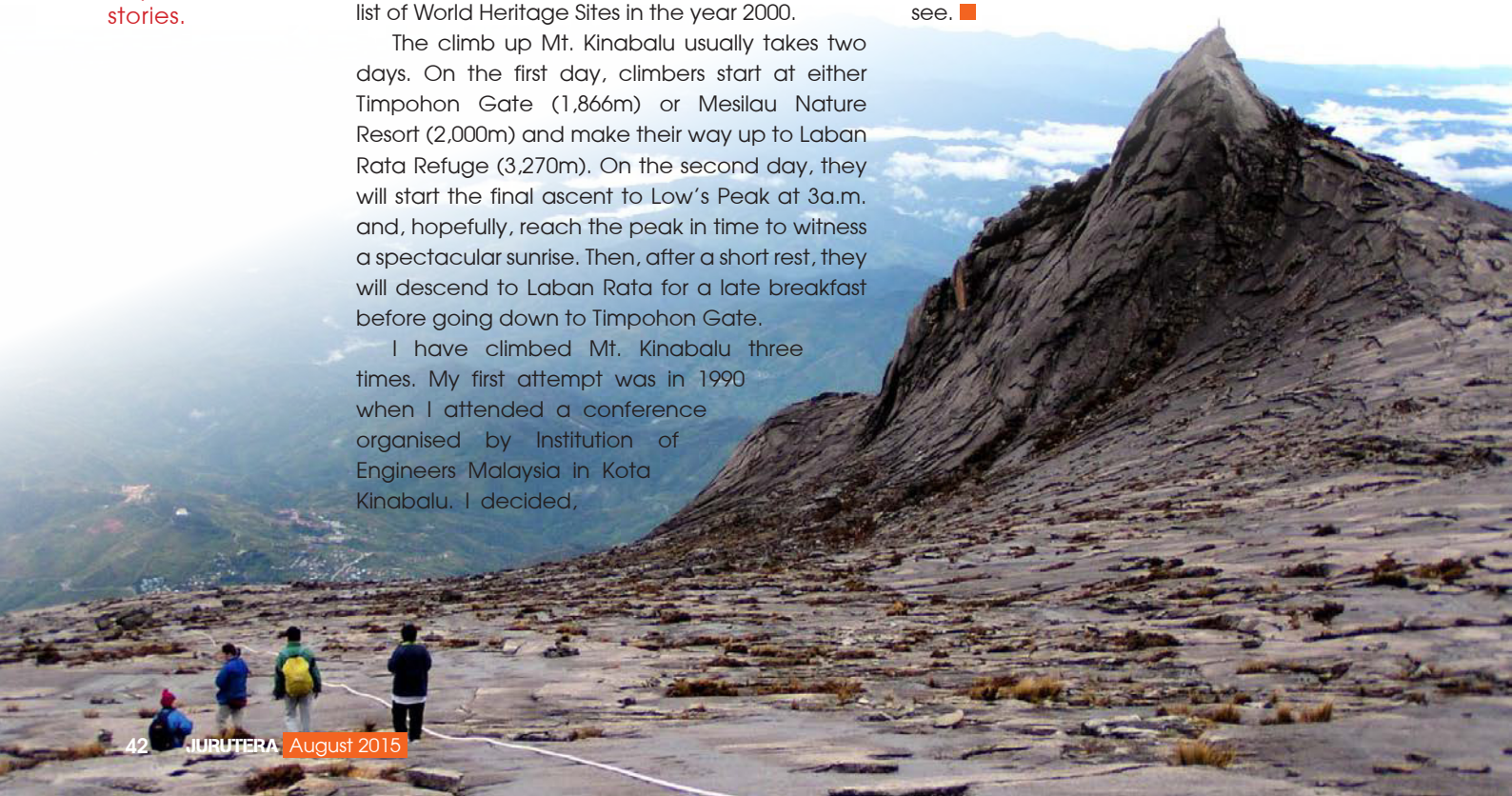
I have climbed Mt. Kinabalu three times. My first attempt was in 1990 when I attended a conference organised by Institution of Engineers Malaysia in Kota Kinabalu. I decided, at the 11th hour, to join the climb up Mt. Kinabalu which was organised in conjunction with the conference.

I had made no preparations and had no inkling what to expect. I was only told to buy a jacket as it would be cold up on the mountain. During the climb from Timpohon Gate to Laban Rata, we were caught in incessant rain and wind that came with a typhoon that had hit Sabah that day. My jacket, which was not waterproof, was soaked totally. I was among the last to reach Laban Rata, completely drenched and so cold that I could not speak because my face was completely numbed from the cold! Unfortunately or fortunately, the final assault for Low's Peak was cancelled due to inclement weather.

Ten years later, I made a second attempt with members of the Rotary Club of Shah Alam. This time, I was physically and mentally prepared for the climb and I made it to Low's Peak with my son and some friends. I received a regular certificate as well as a special millennium certificate to remind me of the achievement.

In 2003, I climbed Mt. Kinabalu again, this time with a group of trekking buddies. This time, with regular training and preparation, I was fitter and stronger, both physically and mentally, than ever. I was among the first to reach the peak.

I have not seen Mt. Kinabalu for over 12 years since. Will I climb Mt. Kinabalu again? Well, let's see. ■



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TEMUDUGA PROFESSIONAL

Tarikh: 14 July 2015

To All Members,

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Mengikut Undang-Undang Kecil IEM, Seksyen 3.8, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2015.

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. Yam Teong Sian
Setiausaha Kehormat, IEM,

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HUANG ZEE MENG	BE HONS (MALAYA) (CIVIL, 1996) ME (NATIONAL UNIVERSITY OF SINGAPORE) (2004)
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MOHD BADRUL HISYAM BIN AB MANAF	BE HONS (USM) (CIVIL, 2007)
MOHD RIDHUAN BIN CHE MUSA	BE HONS (UTM) (CIVIL, 2003)
NORHISHAM BIN NORDIN	BE HONS (UTM) (CIVIL, 2001)
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66382	ERWAN BIN SULAIMAN	BE HONS (MALAYA) (ELECTRICAL, 2002) ME (KUiTTHO) (ELECTRICAL, 2004) PhD (NAGOYA) (2012)
53756	FONG SEIK FOO	BE HONS (UNITEN) (ELECTRICAL & ELECTRONICS, 2008)
61906	KAMARULZAMAN BIN MOHD DAHARI	BE HONS (UTM) (ELECTRICAL, 2003)
39054	KONG KOK KHEONG	BE HONS (UNITEN) (ELECTRICAL POWER, 2006)
50723	MOHAMAD IQBAL BIN YACOB	BE HONS (UTM) (ELECTRICAL, 2005)
59955	MOO KEN JOON	BE HONS (MONASH) (ELECTRICAL & COMPUTER SYSTEMS, 2008) ME (UNITEN) (ELECTRICAL, 2012)
64755	RENO GEDION KOMILUS	BE HONS (UMS) (ELECTRICAL & ELECTRONICS, 2005)
30600	ROSLAN BIN MOHAMED YUSOF	BE HONS (USM) (ELECTRICAL POWER, 2002)
64552	SHAHARUDDIN BIN MD LIAS	BE HONS (UTM) (ELECTRICAL, 2002)
KEJURUTERAAN ELEKTRONIK		
24203	ABDULLAH BIN RAMLI	BE (PORTSMOUTH) (COMMUNICATION SYSTEMS, 1997) MSc (UiTM) (INFORMATION MANAGEMENT, 2000)
21239	MOHAMMAD JUANI BIN SUJANA	BE HONS (UTM) (ELECTRICAL, 1994)
38025	NURUL HAZLINA BINTI NOORDIN	BE HONS (USM) (ELECTRICAL & ELECTRONIC, 2002) MSc (USM) (ELECTRICAL & ELECTRONIC, 2005) PhD (EDINBURGH) (2013)
KEJURUTERAAN MEKANIKAL		
21995	ABD. HALIM BIN ITHNIN	BE HONS (UiTM) (MECHANICAL, 2002)
24487	CHIA HON KIAT	BE HONS (UKM) (MECHANICAL, 2002)
59973	LAU YIN HOCK, KENNY	BE (SWINBURNE) (MECHANICAL, 2010)
32406	MOHD FAHIM BIN ILIAS	BE HONS (UiTM) (MECHANICAL, 2010)
30406	MUHAMMAD IZUAN BIN OTHMAN	BE HONS (UiTM) (MECHANICAL, 2010)
42456	MURTHY A/L RAMARAO	BE HONS (UNISEL) (MECHANICAL, 2007)
41983	NURUL MUKMIN BIN ABDUL RAHIM	BE HONS (UTM) (MECHANICAL, 2009)
KEJURUTERAAN STRUKTUR		
76052	TAY SIO KHUANG	BE HONS (UTM) (CIVIL, 2005)
KEJURUTERAAN TELEKOMUNIKASI		
54548	LIM KOK SING	BE HONS (MALAYA) (TELECOMMUNICATION, 2008) PhD (MALAYA) (2011)

PERMOHONAN BARU MENJADI AHLI

Nama	Kelayakan
KEJURUTERAAN AWAM	
NG SAY AIK	BSc (LEEDS) (CIVIL, 1978)

Pengumuman yang ke-83

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.iem.org.my atau menghubungi secretariat di +603-7968 4001/5518 untuk maklumat lanjut. Senarai penyumbang untuk bulan Julai 2015 adalah seperti jadual di bawah:

NO.	NO. AHLI	NAMA
1.	70290	AMIR BIN ABD RAHIM
2.	51337	AZDZHARULNIZZAM BIN ALWI
3.	51337	AZDZHARULNIZZAM BIN ALWI
4.	22916	CHAN CHEE KIT
5.	22916	CHAN CHEE KIT
6.	33707	CHU CHEE YANG
7.	29769	HA KIM ON
8.	18041	ISMAIL BIN ABDULLAH
9.	22909	LAU WEN ONG
10.	20091	LEE TIAN SIN
11.	09918	LIANG YEW CHI
12.	08503	LOI CHIN HENG
13.	16830	MD. ZAID BIN YUNOS
14.	07326	MOHD. NOR BIN ABD. BASAR
15.	68517	SDR. CALEB LOOI JIA-LER

NO.	NO. AHLI	NAMA
16.	42335	SDR. CARL MCSHANE HENDRY
17.	74151	SDR. MUHAMMAD HAFIY ZULHUSNI BIN TUMIRI
18.	73484	SDR. YEE JHUN KIT
19.	69623	SDRI. FARAH HAFIZAH BT. HAMKA
20.	73620	SDRI. NG SIEW LING
21.	73483	SDRI. WONG LIN HAN
22.	20719	SU LAY CHIEW
23.	29614	SYED MUHAMMAD AFDHAL BIN S AHMAD GHAZALI
24.	06172	TAN HOON KEONG
25.	21169	VASAN MARIAPPAN
26.	49376	VISHNUVARTTAN A/L PUSHPANATHAN
27.	19291	WAN ALWI BIN WAN MUSTAPHA
28.	06522	WONG CHUM HING

IEM ENGINEERING HALL OF FAME AWARD 2016

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 2015.**

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 2016

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 2015**.

Please submit nominations to:

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 2016

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 2015.**

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

CALL FOR NOMINATIONS

IEM YOUNG ENGINEER AWARD 2016

(On behalf of IEM, the YES-G&S Committee is proud to invite nominations for the YOUNG ENGINEER AWARD for year 2016)

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 2015.

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 2016

The Women Engineers Section is proud to invite nominations for the Woman Engineer Award 2016.

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 2015.** 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 2,680,335.00 contributed by IEM Members and Committees

RM 741,502.00 contributed by Private Organisations

TOTAL RM 3,421,837.00

(ANOTHER RM 3,879,767.40 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 44)

KEJURUTERAAN ELEKTRONIK

46985	MUHAMMAD AIMAN BIN AZIZUDDIN	B.E.(UMP)(ELECTRONIC, 2012)
21727	TAN KANG SWEE, ERIC	B.E.HONS.(MMU) (ELECTRONIC, 2006)

KEJURUTERAAN KIMIA

40961	MOHD AIZUDDIN BIN HASHIM	B.E.HONS.(UMP) (CHEMICAL, 2010)
40575	MUHAMAD ZAQWAN HADI BIN AHMED TAUFIQ	B.E.HONS.(UTM) (CHEMICAL, 2013)
43246	TAN YIT ZEN	B.E.HONS.(UMS) (CHEMICAL, 2013)

KEJURUTERAAN MEKANIKAL

57421	ABDUL MUHAIMIN B. MOHD SHAFIE	B.E.HONS.(UTEM) (MECHANICAL, 2013)
23475	AHMAD FIRDAUS BIN ZAWAWIL ANWAR	B.E.HONS.(UITM) (MECHANICAL, 2006)
32310	AHMAD ILMI FAIZ BIN AWANG NOOR	B.E.HONS.(UITM) (MECHANICAL, 2010)
70873	ARAVIND A/L KOTTASAMY	B.E.HONS.(UMP) (MECHANICAL, 2014)
35768	CHONG KIAN WEI	B.E.HONS.(UTM) (MECHANICAL, 2010)
52741	ENG ZE RU	B.E.HONS.(CURTIN) (MECHANICAL, 2014)
26161	FAUZI BIN AHMAD	B.E.HONS.(UTEM) (MECHANICAL-AUTOMOTIVE, 2007) M.SC.(UTEM) (MECHANICAL, 2010)
54403	HEPHZIBAH A/P DAVID	B.E.HONS.(UNITEN) (MECHANICAL, 2012)
16010	JASNI BIN DEWA	ADV. DIP.(UITM) (MECHANICAL, 1995)
38808	KOK JING SHUN	B.E.HONS.(MALAYA) (MECHANICAL, 2011)
40390	LEONG JIAN ZI	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL, 2013)
22794	MAHAMAD HISYAM BIN MAHAMAD BASRI	B.E.HONS.(UITM) (MECHANICAL, 2005) M.SC.(IIUM)(MECHANICAL, 2010)
30336	MOHAMAD AZAHAR BIN AHMAD	B.E.HONS.(UITM) (MECHANICAL, 2010)
38272	MOHAMAD FAIZ BIN ABDUL RAHIM	B.E.HONS.(UITM) (MECHANICAL, 2012)
57454	MOHAMMAD HAZRIN B. ISMAIL	B.E.HONS.(UTEM) (MECHANICAL, 2013)
25110	MOHD RIZUWAN BIN MAMAT	B.E.HONS.(UITM) (MECHANICAL, 2006)
35070	MOHD SYARIFUDDIN BIN MOHD SENUSI	B.E.HONS.(UITM) (MECHANICAL, 2012)
37768	MUHAMMAD ALI AIMRAN BIN GHAZALI	B.E.HONS.(UNITEN) (MECHANICAL, 2010)
39285	MUHAMMAD ILHAM BIN MOHIDIN	B.E.HONS.(UITM) (MECHANICAL, 2012)
46426	MUHAMMAD WILDAN BIN JOHARI	B.E.HONS.(UITM) (MECHANICAL, 2013)
30773	NOR HIDAYAT TAY BIN KHAIRUL AZMI TAY	B.E.HONS.(UTM) (MECHANICAL, 2009)
44799	QISTINA NAFISAH IMAN BINTI KAMARULZAMAN	B.E.HONS.(UTP) (MECHANICAL, 2014)
39431	SAIFUL BAHRI BIN MD NASIR	B.E.HONS.(UITM) (MECHANICAL, 2013)
39482	SITI NOOR AZIZZATI BINTI MOHD NOOR	B.E.HONS.(UITM) (MECHANICAL, 2012)
31505	UMMI ZULAIKHA BINTI ABD RAHMAN @ ABD MALIK	B.E.HONS.(UITM) (MECHANICAL, 2010)

KEJURUTERAAN PEMBUATAN

34437	CHIEW NING KAI	B.E.HONS.(UTEM) (MANUFACTURING, 2009)
37458	MUHAMMAD HAFIZUDIN BIN IDRIS	B.E.HONS.(UKM) (MANUFACTURING, 2009)

PERMOHONAN MENJADI AHLI SISWAZAH

No. Ahli	Nama	Kelayakan

KEJURUTERAAN ALAM SEKITAR

73019	CHUA WEN JYE	B.E.HONS.(WESTERN AUSTRALIA) (ENVIRONMENTAL, 2013)

KEJURUTERAAN AUTOMOTIF

73459	NOR AZRI SHARIZAL BIN ABU BAKAR	DIPL-ING.FH.(FACHHOCHSCHULE ESSLINGEN) (AUTOMOTIVE, 2006)

KEJURUTERAAN AWAM

74203	AHMAD FARUQI BIN KHELIKUZZAMAN	B.E.HONS.(UITM)(CIVIL, 2014)
72712	AHMAD ZUBAIDI BIN MUSTAFA	B.SC.(ALABAMA)(CIVIL, 1992)
75251	AHMED ABDO ABDULLAH AL-MANAKHI	B.E.HONS.(UITM)(CIVIL, 2013)
72603	AL SHARIF BIN SALAZAR	B.E.HONS.(UKM)(CIVIL, 2010)
74331	ALI HAMID HAMOOD DARIS	B.E.HONS.(UTHM)(CIVIL, 2014)
72601	AMEEN ESAM MOHAMMED ALMUTAWAKEL	B.E.HONS.(UITM)(CIVIL, 2012)
72727	AMIR SAIFUL HARIS BIN ABDULLAH	B.E.HONS.(UTM)(CIVIL, 2013)
73278	ATHIRA BINTI ABDULLAH	B.E.HONS.(UTM) (CIVIL, 2011) M.SC.(UTM)(CIVIL, 2012)
74198	AW JIA HAO	M.E.HONS.(NOTTINGHAM) (CIVIL, 2014)
74115	AZLIANA BINTI AZLAM	B.E.HONS.(UTM)(CIVIL, 2011)
74110	BUJANG ANAK KANANG	B.E.HONS.(UTM)(CIVIL, 1997)
73400	CHAI TECK JUNG	B.SC.(UTM)(CIVIL, 2001)
74460	CHANG WAI KHEI, JEFFREY	B.E.HONS.(UTAR)(CIVIL, 2014)
74112	CHE MOHD ROSLI BIN CHE AWANG	B.E.HONS.(UTM)(CIVIL, 2011)
72620	CHIA ERIC	B.E.HONS.(UMP)(CIVIL, 2013)
73390	CHIN CHIEW YEH, GEORGIA	B.E.HONS.(SWINBURNE) (CIVIL, 2011)
74461	CHIN WEE ROON	B.E.HONS.(ADELAIDE) (CIVIL, 2000)
72711	CHONG SHIN YEE	B.E.HONS.(UTM)(CIVIL, 2013)
73014	CHOU KA CHUN	B.E.HONS.(CURTIN)(CIVIL & CONSTRUCTION, 2014)
74558	CHUA CHEE KEONG	B.E.HONS.(UTAR)(CIVIL, 2014)
73387	DAYANG ZANARIAH BINTI ABANG KASHIM	B.E.HONS.(LEEDS) (CIVIL, 2010) M.SC.(LEEDS)(CIVIL, 2011)
72734	DICK HILMI BIN HASSAN	B.E.HONS.(UTM)(CIVIL, 2013)
73102	ELLY NORISSYA BINTI MOHD SAID	B.E.HONS.(UTM)(CIVIL, 2011)
74560	FARHANA BINTI SAMSUDIN	B.E.(UMP)(CIVIL, 2009)
73381	GOH CHEE HUI	B.E.HONS.(UNITEN)(CIVIL, 2007)
74559	HENG WAI KHENG, JAMIE	B.E.HONS.(UTAR)(CIVIL, 2014)
75144	HOH WEN BINN	M.E.HONS.(NOTTINGHAM) (CIVIL, 2012)
72654	IBRAHIM BIN ABD RAHMAN	B.E.HONS.(MALAYA) (CIVIL, 2010)
74302	JONG WEI TAT	B.E.HONS.(SWINBURNE) (CIVIL, 2011)
73394	JOYCE ANAK JANGGU	B.E.HONS.(SWINBURNE) (CIVIL, 2013)
72618	KHOO LIM KIAT	B.E.HONS.(MALAYA) (CIVIL, 2008)
73098	KOO TING CHOONG	B.E.HONS.(UTP)(CIVIL, 2012)
72626	LEE WEI MING	B.E.HONS.(SYDNEY) (CIVIL, 2014)
74098	LEING CHUEN KEIT	M.E.HONS.(NOTTINGHAM)(CIVIL, 2014)
72645	LIM AUN LIM, ALEX	B.E.HONS.(MALAYA) (CIVIL, 2006)
75252	LIM FON LIP, JUNE	B.E.HONS.(SWINBURNE TECH)(CIVIL, 2011) M.E.(SWINBURNE TECH) (CIVIL, 2013)
75263	LIM MING SHIAN	B.E.HONS.(UTP) (CIVIL, 2010) M.E.(UPM)(CIVIL, 2013)
72644	LIM SIEW KIANG	B.E.HONS.(KUITTHO) (CIVIL, 2002)
73403	LING TING ANG	B.E.HONS.(UPM)(CIVIL, 1999)
73378	LOK JUN JIA	B.SC.(NATIONAL CHENG KUNG)(CIVIL, 2013)
72710	LOO CHER FONG	B.E.HONS.(UPM)(CIVIL, 2002)
72724	LOW YOONG LAM	B.E.HONS.(MELBOURNE) (CIVIL, 2013)
72617	LU YEE YONG	B.E.HONS.(CURTIN)(CIVIL, 2012)
74304	MASTURA BINTI MOHD SALLEH	B.E.HONS.(UMP)(CIVIL, 2013)
72732	MAY JAY JONG	B.E.HONS.(KLIUC)(CIVIL, 2008)
73022	MOHAMAD SAIFUL AZLIE BIN AHMAD	B.E.HONS.(UTM)(CIVIL, 2013)
73097	MOHAMED ASRAFF BIN MUIDIN IZAN	B.E.HONS.(UMP)(CIVIL, 2009)
74551	MOHAMMAD FAHMI BIN SHAMSUALHARIS	B.E.HONS.(UITM)(CIVIL, 2010)
75265	MOHANASUNDARAM A/L SINNIAH	B.E.HONS.(UTM)(CIVIL, 2007)
75266	MOHD AZUAN BIN TUKIAR	B.E.HONS.(UITM)(CIVIL, 2009)
72605	MOHD FAHMI BIN ROSLAN	B.E.(VANDERBILT)(CIVIL, 2013)
74562	MOHD FAISAL BIN NAWAWI	B.E.HONS.(UTM)(CIVIL, 2013)
72906	MOHD HAZIQ BIN MOHD ABD WAHAB	B.E.HONS.(UITM)(CIVIL, 2011)
74105	MOHD KHAIRI BIN SAH PRI	B.E.HONS.(UITM)(CIVIL, 2007)
73086	MOHD KHAMDY BIN MUKHTARUDDIN	B.E.HONS.(UTM)(CIVIL, 2009)
75262	MOHD SHAFIQ BIN YAHYA	B.E.HONS.(UPM)(CIVIL, 2012)
75258	MOHD SHAHIR BIN MAHIYUDDIN	B.E.HONS.(IUKL)(CIVIL, 2013)
73093	MOHD SHOFIAN BIN MOHD SHARIR	B.E.HONS.(UTM)(CIVIL, 2005)
73388	MOHD. FIRDAUS BIN IBRAHIM	B.E.HONS.(UNIMAS) (CIVIL, 2011)
73395	MUHAMMAD ALIF BIN JULAIHI	B.E.HONS.(UITM)(CIVIL, 2010)
73090	MUHAMMAD ASYRAF BIN AHMAD	B.E.HONS.(UITM)(CIVIL, 2014)
74116	MUHAMMAD BIN BASER	B.E.HONS.(UTM)(CIVIL, 2009)
72602	MUHAMMAD MUSTAQIM BIN OMAR	B.E.HONS.(UITM)(CIVIL, 2011)
72631	MUHAMMAD NAZRIN BIN RUSLAN	B.E.HONS.(UTM)(CIVIL, 2013)
73015	MUHAMMAD NORAMIN BIN JANI	B.E.HONS.(UTM)(CIVIL, 2012)
75145	MUHAMMAD SYAMSUL HAFIDZ BIN MUHAMMAD SANUSI	B.E.HONS.(UITM)(CIVIL, 2014)
74196	NADJA HANNA BINTI ADNAN	B.E.HONS.(UNITEN)(CIVIL, 2013)
74113	NAZRUL HISHAM BIN MOHD HOLDIN	B.E.HONS.(UTM)(CIVIL, 2012)
74457	NG SOOK PIAN	B.E.HONS.(SEGI)(CIVIL, 2011)
74199	NOORLIYANA BINTI ZAKARIA	B.E.HONS.(UITM)(CIVIL, 2012)
73087	NOR ASMA BINTI ALI AKBAR	B.E.HONS.(UTM)(CIVIL, 2010) M.E.(UTM)(CIVIL-TRANSPORTATION & HIGHWAY, 2012)
73462	NOR ZALINA BINTI ZAKARIA	B.E.HONS.(UNIMAP) (CIVIL, 2013)
73370	NORASEKEN BINTI HAMZAH	B.E.HONS.(UTM)(CIVIL, 2007)
73406	NORFADHILAH BINTI MOHD SAMRI	B.E.HONS.(UTHM)(CIVIL, 2014)
74458	NORNASIHAH BINTI IBNU ABBAS	B.E.HONS.(UNIMAP) (CIVIL, 2013)
73023	NUR NAEMAH BINTI ESA	B.E.HONS.(UTM)(CIVIL, 2013)
72652	NUR ZARINA BINTI ZAKARIA	B.E.HONS.(UNITEN) (CIVIL, 2011) M.E.(UPM)(CIVIL, 2013)
73024	NURSYAKIRAH BINTI ISMAIL	B.E.HONS.(UTM)(CIVIL, 2013)
74102	NURUL FARIHAH BINTI ABU KASIN	B.E.HONS.(UTHM)(CIVIL, 2013)
74552	NURUL NADILAH BINTI MUHAMMAT	B.E.HONS.(UNITEN)(CIVIL, 2012)
73079	NURULZIANA BINTI JAIDIN	B.E.HONS.(UMP)(CIVIL, 2009)
73460	ONG KHIN KIAT	B.E.HONS.(UNIMAS) (CIVIL, 2005)
74459	PANG YI SHIAN	B.E.HONS.(UTAR)(CIVIL, 2013)
74308	PUI YUH TZER	B.E.HONS.(RMIT)(CIVIL, 2002)
73025	QUIN ANAK EMPARAN	B.E.HONS.(UTHM)(CIVIL, 2012)
72619	RHENY ELAIDA BTE RAHIMAN	B.E.HONS.(UITM)(CIVIL, 2012)
74200	NUR SYAKIRIN BINTI ABDUL ROSIK	B.E.HONS.(UTEM) (ELECTRONIC, 2014)
73360	ONG CHONG GENE	B.E.HONS.(RMIT) (ELECTRONIC, 2010)
72722	RODZIDAH BINTI MOHD RODZI	B.E.HONS.(UTM) (ELECTRONIC, 2003) M.E.HONS.(UPM) (ELECTRONIC, 2011)

73012	SHAHRUL NIZAM BIN YAAKOB	B.E.HONS.(UTM) (ELECTRICAL-ELECTRONICS, 2004)
73391	SITI AMINAH BINTI HUSSEN	B.E.HONS.(UNIMAP) (ELECTRONIC, 2008)
72653	SUHAILI BIN HARUN	B.E.(VANDERBILT) (ELECTRONIC, 2005)
72648	SYAHIRAH HUSNA BINTI UDA ZAHLI	B.E.HONS.(UTEM) (ELECTRONIC, 2014)
73401	TAN ZHE SUEN, WILSON	B.E.HONS.(MMU) (ELECTRONIC, 2011)
75253	TEH KENG AUN, ADRIAN	B.E.HONS.(MMU) (ELECTRONIC, 2003)
73377	ZAINUR HANIM BINTI ZAINAL ABIDIN	B.E.HONS.(USM) (ELECTRONIC, 2004)
74204	BUSTAMAN MAZUKI BIN RAZMI	B.E.HONS.(USM) (CHEMICAL, 2002) M.SC. (USM)(CHEMICAL, 2005)
73402	HASNAL BIN KORIS	B.E.HONS.(USM) (CHEMICAL, 2002) M.SC.(USM)(CHEMICAL, 2011)
73379	HOH SHING RUEY	B.E.HONS.(ADELAIDE) (CHEMICAL, 2010)
72650	KIEW PECK LOO	B.E.HONS.(USM) (CHEMICAL, 2010) P.HD.(USM)(CHEMICAL, 2014)
74202	LAU JAY SHEN	B.E.HONS.(IOWA STATE) (CHEMICAL, 2014)
73515	LAU SHA LEE	B.SC.(PURDUE) (CHEMICAL, 2014)
73100	LIEW WAN TENG, EMILY	B.E.HONS.(CURTIN) (CHEMICAL, 2008) P.HD. (CURTIN)(CHEMICAL, 2012)
74312	LIM WING SUN	B.E.HONS.(USM) (CHEMICAL, 2000)
74393	LOKE DIXON	B.E.HONS.(UTAR) (CHEMICAL, 2013)
72720	MOHAMED HAFIZ BIN MD ISA	B.E.HONS.(UTM) (CHEMICAL, 2014)
73327	MOHAMMAD SALMAN BIN HASSAN	M.E.HONS.(ASTON) (CHEMICAL, 2013)
74109	MOHAMMAD YUSOFF BIN ZULKIFLI	B.E.HONS.(UITM) (CHEMICAL, 2013)
72641	MOHD FUAD BIN HELMY	B.E.HONS.(CURTIN) (CHEMICAL, 2010)
74453	MUHAMAD SAIFUDDIN BIN SIDEK	B.E.HONS.(UTM) (CHEMICAL, 2007)
73095	RAYMONDEE JUNIOR JULIUS	B.E.HONS.(UMP) (CHEMICAL-GAS TECHNOLOGY, 2010)
73080	TAN KEE POK	B.E.HONS.(UNIMAP) (BIOPROCESS, 2012)
73404	TANG SHU ANN	M.E.HONS.(NOTTINGHAM) (CHEMICAL, 2013)
72708	TEOW YEIT HAAN	B.E.HONS.(UTAR) (CHEMICAL, 2011) P.HD.(USM)(CHEMICAL, 2014)
75270	MOHAMAD IZRIL BIN ISHAK	B.E.HONS.(UNIMAP) (COMPUTER, 2008)
73106	YAP AI KIN	B.E.HONS.(UPM)(FOOD & PROSESS, 2000)
72632	ABD KABIR BIN ABD RAZAK	DIPL-ING.FH.(COBURG) (MECHANICAL, 2013)
72715	ABDUL MUQSITH BIN AHMAD	B.E.HONS.(UTHM) (MECHANICAL, 2012)
73094	ADIM BIN ALI	B.E.HONS.(UPM) (MECHANICAL, 2006)
74563	AHMAD ADLI BIN ADNAN	M.E.HONS.(CARDIFF) (MECHANICAL, 2013)
72638	AHMAD AFIQ NOOR ZAINEE SHAH	M.E.HONS.(SHEFFIELD) (MECHANICAL, 2013)
73340	AHMAD HUSAINI BIN BAHAMAN	B.E.HONS.(UTP) (MECHANICAL, 2012)
74555	AHMAD SYAZWAN BIN SAMSUDDIN	B.E.HONS.(UTP) (MECHANICAL, 2010)
73375	AHMADIAMRI BIN MOHD GHAZALI	B.E.HONS.(LIVERPOOL) (MECHANICAL, 1999) M.SC.(LIVERPOOL) (MECHANICAL, 2000)
72723	AIMI LYIANA BINTI JAAFAR	B.E.HONS.(UTEM) (MECHANICAL, 2014)
73337	AJMAL FALIQ BIN JAMAL	B.E.HONS.(UTP) (MECHANICAL, 2012)
74553	AKBAR BIN OTHMAN	B.E.HONS.(UTHM) (MECHANICAL, 2006)
74334	AYU NATASYA BINTI KASIM	B.E.HONS.(UTEM) (MECHANICAL, 2014)
74197	AZMAN BIN AHMAD BAKIR	B.SC.(SIU CARBONDALE) (MECHANICAL, 1998)
75267	AZMI BIN HUSIN	B.E.HONS.(UITM) (MECHANICAL, 2005) M.E.(UTM)(MECHANICAL, 2011)
73323	BAKHTIAR SAFFUAN BIN BAHARUDIN	B.E.HONS.(UNITEN) (MECHANICAL, 2008)
73376	CHAN HWA FONG	B.E.HONS.(UTHM) (MECHANICAL, 2005)
75143	CHAY KWOK GOON	B.E.HONS.(UTAR) (MECHANICAL, 2010)
74306	CHONG CHUONG LEONG	B.E.HONS.(USM) (MECHANICAL, 2008)
75147	DAVENDREN A/L VEREYA	B.E.HONS.(UNITEN) (MECHANICAL, 2007)
73342	DENISHLEE A/L MUNISAMY	M.E.HONS.(BIRMINGHAM) (MECHANICAL, 2013)
74108	DHINAKARAN A/L GOVINDASAMY	B.E.HONS.(UTP) (MECHANICAL, 2010)
74106	ERAVINDRAN A/L VELAYUTHAM PILLAI	B.E.HONS.(MMU) (MECHANICAL, 2011)
72614	ESMA NIZA BIN NAWI	B.E.HONS.(UTEM) (MECHANICAL, 2008)
72637	FARAH HANIZA BINTI MIRZA SAFRI	B.E.HONS.(UNITEN) (MECHANICAL, 2012)
73091	HAMIDI BIN ABD HAMID	B.E.HONS.(UNISEL) (MECHANICAL, 2009)
74455	HAMIZI BIN HASSAN	B.E.HONS.(UTM) (MECHANICAL, 2006)
73099	KAMARUL ARIFFIN BIN ZAKARIA	B.E.HONS.(UTM) (MECHANICAL, 1997)
74554	KAMARULZAMAN BIN ZULKIFLI	B.E.HONS.(UTM) (MECHANICAL, 2009)
74303	KHOO SZE WEI	B.E.HONS.(UTP) (MECHANICAL, 2009) M.SC.(UTP)(MECHANICAL, 2011)
74201	KOH WEI HAO	M.E.HONS.(BATH) (MECHANICAL, 2014)
74207	LEONG CHENG BOON	B.E.HONS.(SUNDERLAND) (MECHANICAL, 2012) M.SC.(NOTTINGHAM) (MECHANICAL, 2014)
73393	LEONG KIN MING	B.E.HONS.(UKM) (MECHANICAL, 2012)
72629	LETCHUMANAN A/L LAKSHMANAN	B.E.HONS.(UNITEN) (MECHANICAL, 2008)
73407	LIAW VOON FUI, DANIEL	B.E.HONS.(CURTIN) (MECHANICAL, 2014)
72628	LIM CHUN SEONG	B.E.HONS.(MALAYA) (MECHANICAL, 2011)
73279	LIM TZE SIANG	B.SC.(NEBRASKA - LINCOLN)(MECHANICAL, 2004) M.BA.(BELLEVUE) (MECHANICAL, 2007)
73386	LING SIAW DIH, NELSON	B.E.HONS.(RMIT) (MECHANICAL, 2012)
72705	MANU RAO A/L VENGETA RAO	B.SC.(NEBRASKA - LINCOLN)(MECHANICAL, 2013)
72717	MELISSA AUGUSTINE SAIDI	B.E.HONS.(SWINBURNE) (MECHANICAL, 2013)
74205	MOHAMAD SHAHRUL IZWAN BIN SAMAD	B.E.HONS.(CANTERBURY) (MECHANICAL, 2013)
73463	MOHD AIZAT HAZWAN BIN NOR AZMAN	B.E.HONS.(UPNM) (MECHANICAL, 2012)
73101	MOHD ASRI BIN YUSUFF	B.E.HONS.(UTM) (MECHANICAL, 1995)
72719	MOHD AZLAN BIN ISMAIL	B.E.HONS.(UMS) (MECHANICAL, 2007) M.E.(WOLLONGONG) (MECHANICAL, 2009)
73366	MOHD FAIZ BIN MOHD NAZIR	B.E.HONS.(UTHM) (MECHANICAL, 2008)
73374	MOHD FIRDAUS BIN MOHAMED	B.E.HONS.(UTEM) (MECHANICAL, 2010)
74565	MOHD HISHAM BIN MAKHTAR	B.SC.HONS.(UTM) (MECHANICAL, 1997)
72643	MOHD KHAIRUL BIN MOHAMAD NAZOR	B.E.HONS.(CURTIN) (MECHANICAL, 2010)
72707	MUHAMAD ZAKI BIN YUSUP	B.E.HONS.(UTM) (MECHANICAL, 2005) M.E.(UPM)(MECHANICAL, 2012)
73775	MUHAMMAD AZWAN BIN MUHAMMAD	B.E.HONS.(UPNM) (MECHANICAL, 2012)
74566	MUHAMMAD FAIZ BIN AB MUTALIB	B.E.HONS.(UPNM) (MECHANICAL, 2013)
72604	MUHAMMAD FAREEZ BIN FUAD	M.E.HONS. (SOUTHAMPTON) (MECHANICAL, 2013)
72647	MUHAMMAD RIDHWAN BIN AHMAD NOR @ ANUAR	B.E.HONS.(MMU) (MECHANICAL, 2006)
73353	MUHAMMAD SYAFIQ BIN MOHD SHAH	M.E.HONS.(ASTON) (MECHANICAL, 2013)
73516	NASIRUDDIN ZHARIFF BIN RASIP	B.E.HONS.(UTP) (MECHANICAL, 2014)
74454	NASRULHAKIM BIN MUSA	B.E.HONS.(UTM) (MECHANICAL, 2008)
73396	NG KAH HOO	B.E.HONS.(UNITEN) (MECHANICAL, 2013)
72716	NG KEN KIAT	B.E.HONS.(MALAYA) (MECHANICAL, 2010)
72606	NORAIN BINTI IDRIS	DIPL-ING. FH.(FACHHOCHSCHULE FRANKFURT AM MAIN) (MECHANICAL, 2010)
74561	NUR HAZWANI BINTI MOHAMAD NOH	B.E.HONS.(UTM) (MECHANICAL, 2013)
73464	NUR KAMIL ADLI BIN MOHD NAWAR	B.E.HONS.(UTHM) (MECHANICAL, 2014)
73081	NURUL HILWA BINTI MOHD ZINI	B.E.HONS.(UTM) (MECHANICAL, 2008)
72636	ONG MING HOE	B.E.HONS. (HERTFORSHIRE) (MECHANICAL, 2012) M.SC.(NOTTINGHAM) (MECHANICAL, 2013)
72733	REENA BINTI RAHMAN	B.E.HONS.(UMS) (MECHANICAL, 2008)
72731	SAW CHERN-YANN, JULIAN	B.E.HONS.(MONASH) (MECHANICAL, 2009)
75264	SHARZALI BIN CHE MAT	B.E.HONS.(UITM) (MECHANICAL, 2005)
74107	SHASE KUMAR A/L SOORYA PRAKASH	B.E.HONS.(MMU) (MECHANICAL, 2011)
72728	SITI MARHAINIS BINTI ABU MANSOR	B.E.HONS.(UPM) (MECHANICAL, 2002)
73105	SYAHRUL AZWAN BIN SUNDI @ SUANDI	B.E.HONS.(USM) (MECHANICAL, 2004)
72621	TAN JING XUAN	B.E.HONS.(MONASH) (MECHANICAL, 2012)
73399	TAN QI SUNG	B.SC.(KENTUCKY) (MECHANICAL, 2013)
73096	TAN WEN CHING	B.E.HONS.(MMU) (MECHANICAL, 2013)
72726	TEH KAI LIANG	M.E.HONS.(BIRMINGHAM) (MECHANICAL, 2012)
72635	TENGKU FARIS SHAH BIN TENGKU AZELAN SHAH	M.E.HONS.(UCL) (MECHANICAL, 2013)
74100	TEY MING REN	B.E.HONS.(MALAYA) (MECHANICAL, 2013)
75254	TUAN MOHD HAFEEZ BIN TUAN IBRAHIM	B.E.HONS.(UTHM) (MECHANICAL, 2012) M.E.(UTHM) (MECHANICAL, 2014)
73088	WONG CHOON YAP	B.E.HONS.(UTM) (MECHANICAL, 1998) M.SC.(UPM)(NUMERICAL MODELING, 2010)
73517	WONG JIA HOW	B.E.HONS.(MMU) (MECHANICAL, 2012)
74416	ZHARUDIN BIN NARUDIN	B.E.HONS.(UNISEL) (MECHANICAL, 2011)
73103	ANG ENG LING	B.E.HONS.(UTAR) (MECHATRONICS, 2012)
75257	MUHAMMAD RAZMI BIN RAZALI	B.E.HONS.(UTEM) (MECHATRONICS, 2012)
73373	SYIBRATUL BAZIRAH BINTI KACHI MOHIDEEN	B.E.HONS.(UIAM) (MECHANICAL, 2004)
75146	AMIRA FARHANA BINTI MOHAMAD TAR	B.E.HONS.(UTEM) (MANUFACTURING, 2014)
73085	KHAIRUL IZANI BIN MOHD ZUKEE	B.E.HONS.(UTEM) (MANUFACTURING-MANUFACTURING PROCESSES, 2011)
74114	MAZLIANA BINTI ZAINALABIDIN	B.E.HONS.(UNIMAP) (MANUFACTURING, 2008)
72714	MOHD AFWAN BIN RAWI	B.E.HONS.(UTEM) (MANUFACTURING, 2011)
74333	MOHD AMAL BIN ABDUL HALIM	B.E.HONS.(UTEM) (MANUFACTURING, 2014)
73084	MOHD EZHAR BIN AMIR RAZLAN SHAPAWI	B.E.HONS.(UTEM) (MANUFACTURING-MANUFACTURING MANAGEMENT, 2011)
73372	MOHD HAMIDIE BIN HASSAN	B.E.HONS.(UMP) (MANUFACTURING, 2008)
73083	MOHD ZAIDAN BIN ABDUL AZIZ	B.E.HONS.(UTEM) (MANUFACTURING-ENRG. MATERIALS, 2012)
73774	NOOR AFENDI BIN NORDIN	B.E.HONS.(UTEM) (MANUFACTURING, 2009)
73341	ABDUL WAHID MUNIF	B.SC.(COLORADO SCHOOL OF MINES) (PETROLEUM, 2013)
73339	AHMAD LUQMAN BIN JOHAN	B.SC.(COLORADO SCHOOL OF MINES) (PETROLEUM, 2011)
73338	AINIL IZZYAN BINTI NAFFI	B.E.HONS.(UTP) (PETROLEUM, 2012)

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Electrical Engineering Technical Division
The Institution of Engineers,
Malaysia

IIEC 2015

The Institution of Engineers, Malaysia (IEM) &
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Electrical Conference 2015

The Institution of Engineering and Technology

SAFE, SMART AND INNOVATIVE DEVELOPMENT IN POWER SYSTEMS

30 November - 2 December 2015

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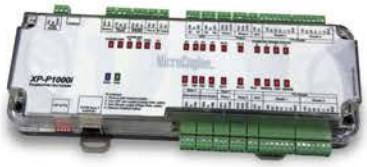

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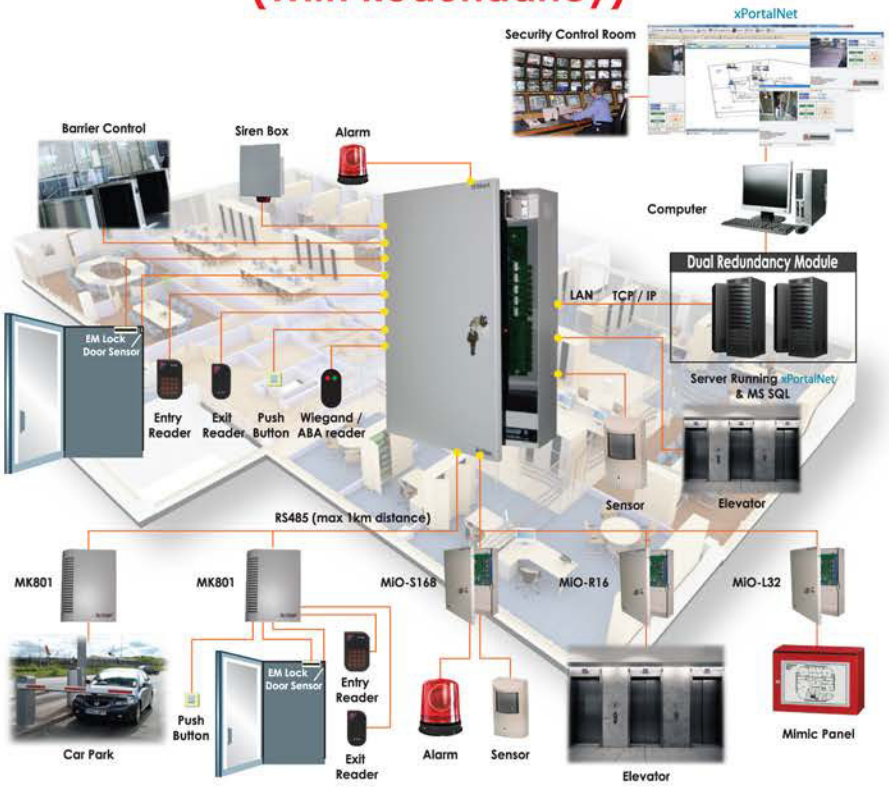

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