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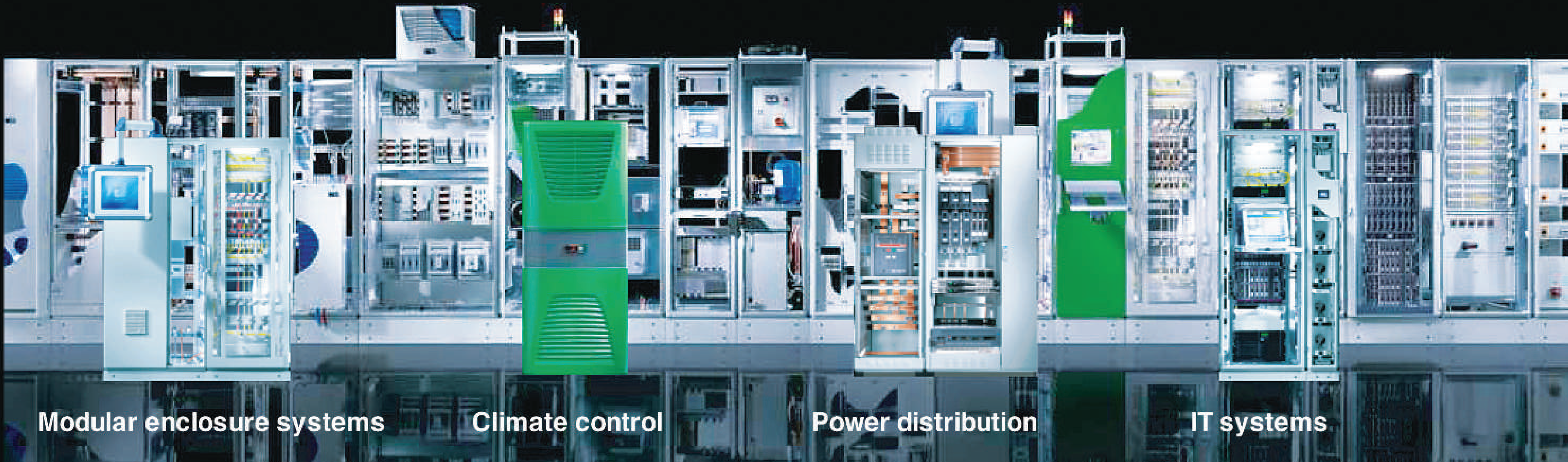

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IIEC 2015

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Electrical Conference 2015

SAFE, SMART AND INNOVATIVE DEVELOPMENT IN POWER SYSTEMS

30 November - 2 December 2015

What is IIEC 2015?

The Electrical Engineering Technical Division of The Institution of Engineers, Malaysia (IEM EETD) & The Institution of Engineering and Technology, Malaysia (IET) is jointly organising an international conference under the theme **"Safe, Smart and Innovative Development in Power Systems"** from 30 November - 2 December 2015. The organiser will be printing 500 copies of its official publication entitled **"IIEC 2015 Souvenir Programme Book"**, to be circulated during the three-day exhibition at the Sime Darby Convention Centre, Kuala Lumpur, Malaysia. A Technical Exhibition will be organised as an integral part of the conference. Project experience, design solutions, and application of sustainable solutions for energy utilisation focusing on technology and state-of-the-art information will be highlighted.

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Safety in Electrical Installations

By Ir. Yau Chau Fong
Chairman of IEM EETD

Ir. Yau Chau Fong, graduated from University Malaya has a total of 14 years of working experience in the consulting industry. He is currently serving as Ex-comm Member and Council Member of IEM. He is also the Vice Chairman of the IEM Standing Committee of Activities.

Are electrical systems in our buildings safe? Are electrical systems designed or installed in accordance with the relevant statutory requirements, standards and code of practice?

There are recent cases of electrocution by faulty water heaters, people struck by lightning, fires caused by short circuit and workers burnt to death while operating electrical equipment. All these indicate negligence in electrical safety and protection.

Such incident shappen again and again as little action has been taken to avoid future occurrences.

This month's highlight is an exclusive interview with Datuk Ir. Ahmad Fauzi bin Hasan, Chief Executive Officer of the Energy Commission of Malaysia (ST) on protection against lightning/electrical installations.

Our cover story is the follow-up to asymposium organised by The Electrical Engineering Technical Division (EETD) on Protection Against Lightning on 27 November, 2014, in Selangor, where experts in lightning protection from the academic, industry and regulatory bodies, presented a wide range of topics.

The newly elected EETD committee also completed a leadership brain storming session recently where it was agreed that a working group would be set up to focus on electrical protection/safety. More awareness talks and seminars will be held to ensure engineers are well versed in electrical systems.

The EETD and The Institution of Engineering and Technology, Malaysia, (IET) will jointly organise an international conference, "Safe, Smart & Innovative Development In Power Systems", from 30 November to 2 December, 2015, to discuss electrical safety in greater depth. ■

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Datuk Ir. Ahmad Fauzi Bin Hasan
Chief Executive Officer,
Energy Commission, Malaysia.

Datuk Ir. Ahmad Fauzi bin Hasan *is the Chief Executive Officer of the Energy Commission of Malaysia since April 2010. Prior to this position, he has held several positions in the Energy Commission, namely as Chief Operating Officer, Deputy Chief Executive Officer and Director of Gas Regulation. Before joining the Energy Commission, he has also served in the Department of Electricity and Gas Supply and the Department of Occupational Safety and Health. He is a professional engineer with over 36 years of regulatory experience, including in the areas of technical, economic and safety regulation and development of the electricity and gas supply industries. He is also actively involved with industry stakeholders in the development and implementation of energy policies, plans and standards as well as in awareness programmes at the national and international levels. He is a Member of the Atomic Energy Licencing Board of Malaysia and President of the National Committee of the International Electrotechnical Commission. Datuk Ir. Ahmad Fauzi received his Bachelor's Degree in Mechanical Engineering from the University of Manchester Institute of Science and Technology (UMIST), United Kingdom, and his Master's Degree from the University of Michigan, United States of America.*

Protection Against LIGHTNING

by Putri Zanina

Malaysia has one of the highest lightning ground flash densities in the world. Because of this, installing an effective lightning protection system for buildings should be one of our top priorities.

THE frequency of lightning strikes in Malaysia is one of the world's highest. According to the US-based geo-science news and information online magazine geology.com, which reproduced the National Aeronautics and Space Administration (NASA) World Lightning Map, more lightning occurs near the equator than at the poles. NASA also said that approximately 70% of lightning occurs on land in the tropics where the majority of thunderstorms happen.

Six areas identified by NASA as experiencing an unusual amount of lightning are the Democratic Republic of Congo in Central Africa, North-western South America, the Himalayan Forelands, Central Florida, the Pampas of Argentina and Indonesia. However, according to The Star/Asia News Network report dated 3 March, 2010, an American scientist and chairman of the US National Lightning Safety Institute (NSLI), Richard Kithil Jr, said Malaysia is the country with the second highest number of lightning strikes in the world.

The Energy Commission headquarters located at Precinct 2, Putrajaya.

What is certain is that our location near the equator makes it prone to thunderstorms and lightning. Unfortunately, many Malaysians are still oblivious to the dangers of lightning strikes. While this is a cause for concern, the country does have a framework in place with respect to protection against lightning.

Jurutera spoke to the Chief Executive Officer of the Energy Commission of Malaysia, Datuk Ir. Ahmad Fauzi bin Hasan, who shared at length the country's regulatory framework to mitigate the risks associated with lightning strikes.

The Energy Commission (EC) is the statutory body regulating the energy sector particularly the electricity supply and piped gas supply industries in Peninsular Malaysia and Sabah. Sarawak does not come under the purview of the EC, as the state has its own regulatory body for electricity and gas supply.

> *"One of the regulatory means towards achieving the objective of reducing risks associated with lightning strikes, is to ensure that parties involved in building development and construction, adhere to the necessary technical standards on lightning protection."*

REGULATING ELECTRICITY SUPPLY

Datuk Ir. Fauzi says: "Malaysia has the mechanism and framework for buildings to be installed with lightning protection system. All buildings should have the system installed."

He adds that the installation of such systems in buildings in the country is at a reasonable level and that the country has consultants and engineers for the design of buildings in terms of protection against lightning.

He says in regulating the electricity supply industry, the EC ensures that transmission lines are equipped with lightning arresters. "This is very much regulated by us. Because of this, there haven't been many incidents resulting in the failure of the power system due to lightning strikes, especially in the peninsula. We are reaching a level of control with regards to lightning causing electricity surges in voltage level."

Datuk Ir. Fauzi notes that industry players, including those in information technology, electronics and manufacturing, are not pleased when power quality-related incidents happen. "These power quality surges may be due to lightning. There is no interruption of supply permanently but surges are still a concern," he says, reiterating that the EC is now going to a higher level to mitigate power quality issues further so that high-tech industries can be set up in the country.

He adds: "The situation in Peninsular Malaysia is good. Sabah is not there yet in terms of lightning protection systems. The state is still experiencing lightning surges, with localised interruptions in supply."

LIGHTNING INCIDENTS

The increase in the number of accidents at electrical installations in the country is a concern. This year alone, 24 accidents have been reported so far. Fourteen of these involved deaths due to electrocution.

"This figure is quite high for just the first part of the year. There were 64 accidents in the whole of last year. If possible, we don't want more than 50 accidents this year. We'd like the figure to be even much lower. Getting zero accident rate may not be possible but we are gearing up to reduce and even eliminate incidents involving electricity. We are always continuing to look at ways to improve the standard of safety in the supply and use of electricity," he says.

As for lightning incidents, on and off, the media has reported cases of lightning strikes that has caused damage to buildings. One such high profile case was the Putrajaya Hospital incident in 2009. A fire broke out at the orthopaedic ward after the hospital was struck by lightning. The staff managed to evacuate all 14 patients in the ward before the ceiling collapsed. Although no one died in the incident, it triggered a public outcry over the safety protection of the country's buildings against lightning.

Several schools and commercial buildings had also been damaged by lightning in the past, causing anxiety among the public on the effectiveness of lightning protection systems.

LIGHTNING PROTECTION ENFORCEMENT

Datuk Ir. Fauzi says there have been disputes on the effectiveness and acceptability of conventional and non-conventional lightning protection systems, adding that such disputes have been raised, not only in Malaysia but also at international levels.

"We are definitely concerned over the issue of lightning protection, which has not been fully addressed, even internationally, to such an extent that safety in the electrical system is compromised. One way to address this is to make lightning protection more effective," he says. "The matter was brought up to the Cabinet and, in 2010, the Ministry of Science, Technology and Innovation (MOSTI) met with the relevant agencies, including the EC to look at ways to resolve the issue."

In Malaysia, says Datuk Ir. Fauzi, it has been a normal practice that the installation of lightning protection systems on buildings are based mainly on the expertise of mechanical and electrical consultants with respect to design and installation requirements if there are no specifications provided by the implementing agencies. In fact, up till last year, there was no specific directive issued by relevant authorities here with regards to lightning

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protection system designs or installation.

As such, he says, the EC, which is responsible for regulating the energy industry, initiated measures last year to address the issue in line with Section 47 of Electricity Supply Act 1990 (Act 447). Section 47 has a provision on Precautions Against Atmospheric Electricity, which states:

"Any department of the Federal Government or any State Government or any other consumer taking or using electricity from any installation shall, if the Commission so requires, provide such means for obviating any risk of damage to such installation by atmospheric electricity as may be directed by the Commission or as may be prescribed by regulations under this Act".

> *"Malaysia has the mechanism and framework for buildings to be installed with lightning protection system. All buildings should have the system installed."*

With this provision in the Act, the EC has been entrusted with looking into means of reducing the risks associated with lightning strikes. This is in line with the functions of the EC, which is governed by the Energy Commission Act 2001, and the subsequent amendments and regulations pertaining to four key areas, namely Economic Regulation, Technical Regulation, Safety Regulation and Customer Protection.

LIGHTNING PROTECTION SYSTEM STANDARDS

One of the regulatory means towards achieving the objective of reducing risks associated with lightning strikes, is to ensure that parties involved in building development and construction, adhere to the necessary technical standards on lightning protection.

Datuk Ir. Fauzi says MOSTI came into the picture to develop a Malaysian Standard (MS) for lightning protection based on the International Electrotechnical Commission (IEC) new lightning protection standard, IEC 62305. In 2007, MOSTI endorsed the IEC 62305 as the new Malaysian standard, MS IEC 62305.

"We've had that standard in place as far back as 2007 for use as the basis for the design and installation of lightning protection systems. We issued a circular in 2011 with the instruction for all to comply with MS IEC 62305 with effect from 1 September, 2011," he says.

Before the circular was issued, the EC consulted with relevant agencies and institutions, such as the Public Works Department (PWD), the Ministry of Urban Wellbeing, Housing and Local Government, SIRIM, Centre of Excellence on Lightning Protection (CELP) of Universiti Putra Malaysia (UPM) and MOSTI to get feedback on the suitability of and the need for mandating the standard.

In fact, the first Malaysian lightning protection standard, the MS 939 (which was based on the British Standard, BS 6651), was developed as far back as 1984. It was used until 2001, when MOSTI endorsed the IEC 61024 lightning protection standard as the new MS IEC 61024.

Meanwhile, the use of some means of ionisation to induce the formation of streamers to intercept lightning strikes, such as the Early Streamer Emission or ESE lightning protection system, became popular around the world and in Malaysia. However, in 2005, the International Conference on Lightning Protection (ICLP), a scientific body that specialises in lightning and lightning protection, issued a global warning about the dangers of using the ESE system and other non-conventional lightning protection technologies.

In the interest of public safety, that same year, The Association of Consulting Engineers Malaysia (ACEM) issued an advisory to its members against the use of the ESE and other non-conventional lightning rods.

In 2006, the IEC published the new lightning protection standard, IEC 62305, and instructed all members to revoke any lightning protection standard that did not comply with the new standard, within three years (i.e. by 2009). In line with this, MOSTI endorsed the IEC 62305 in 2007 as Malaysia's new lightning protection standard (known as MS IEC 62305).

The standard has four parts and provides comprehensive guidelines for the design and installation of lightning protection systems for various types of structures, from domestic houses to large building complexes. The guidelines cover the aspects of protecting buildings and equipment from lightning hazards due to both direct and indirect strikes.

GUIDELINES TO STANDARDS

Datuk Ir. Fauzi says: "MS IEC 62305 is very detailed and comprehensive, in terms of technical requirements. Not all can comprehend and put in practice the requirements. It covers a lot with regard to levels of risk assessments such as the need to calculate the risk levels, for example financial loss and the loss of lives, which are not easy to define.

"We need specialists to decipher these. That's why we came out and published a book on guidelines to the MS IEC 62305 in 2014. These guidelines are meant to help consultants, owners of buildings and the public such as contractors, who are not specialists in lightning protection system, to understand the MS IEC 62305. You will still need to have a certain level of technical knowledge to understand it but reading the guidelines is a good start to understand the standard.

Guidelines published by the Energy Commission: Guide on Lightning Protection System for Buildings (right) and Guide for Safe Work Procedures for Electrical Work.

"UPM's Centre of Excellence on Lightning Protection was again roped in to prepare the guidelines for us. There were many other parties involved too. Both professional and non-professional bodies, industry players and consumers were called in to contribute towards the guidelines. Subsequently the guidelines were published and disseminated to all concerned."

ENHANCING AWARENESS

Last November, the EC organised a symposium on Protection Against Lightning, in collaboration with IEM. "Hopefully it has helped raise awareness among those concerned, to put in place an efficient and effective lightning protection system in the country," says Datuk Ir. Fauzi.

"To improve the country's lightning protection practices, we need to start enforcing provisions of Section 47 of Act 447 on Precautions Against Atmospheric Electricity. For that, we have issued directives on the standards for the relevant parties to follow. We hope consultants, engineers, architects, developers and building owners will abide by our directives and adopt MS IEC 62305 for the design and installation of lightning protection systems. They must comply with the standards. How else will we improve? There's a lot more to be done. We will continue enhancing awareness among all relevant stakeholders."

He said engineers play a big role as they are very much the decision makers in the design and development of buildings here.

"They can work with developers, building owners and consumer groups to create a better understanding of lightning protection systems and to try and improve the level of effectiveness of the system for the country. They can also work with local authorities and government agencies to make it a standard requirement to have a proper lightning protection system installed."

CRUCIAL COLLABORATIONS

According to Datuk Ir. Fauzi, the EC also approached the Ministry of Urban Wellbeing, Housing and Local Government to incorporate the MS requirements in the bylaws that come under the purview of local authorities. "Some have already included in their building bylaws, the provision for the MS as a basis for developing and installing lightning protection systems. Of course, this depends on the various states to adopt the bylaw for their own requirements and to compel the industry and all concerned to abide by this. You need to apply the carrot-and-stick approach; while trying to promote the awareness programme on the standard and getting them to adopt it voluntarily, you also must apply the 'stick' to make them comply," he says.

The EC, says Datuk Ir. Fauzi, will address the lightning protection system issue as much as it can, based on the relevant provision of Act 447. "Everything to do with building construction, not just lightning protection system, is a big challenge because you have many aspects to consider, especially when it comes to optimising cost. The other aspect is the aesthetic requirement, as you wouldn't want the installation to mar the appearance of a building. There are also many other factors, including energy efficiency, safety and maintainability. People in the business know the various factors... architects, engineers (mechanical, electrical and civil)... there are many parties involved. All must work together and collaborate to get the improvements done," he says.

KEEPING TRACK

While acknowledging that the implementation of lightning protection in the country is at a reasonable level, Datuk Ir. Fauzi says a study has not been carried out to compare this with that in other countries. "We will try to carry out a survey to determine our status in terms of lightning protection system effectiveness. We will only know how much we need to improve if we do the survey."

Since Malaysia records high occurrences of thunderstorms and lightning strikes, we need to be active in keeping track with the development in lightning protection systems. When it comes to the ESE lightning protection system, MS IEC 62305 is neutral.

Datuk Ir. Fauzi says: "This does not mean you cannot use ESE or the rod system. If you comply with the MS and position the terminal as required by the standard, it should be fine. That is the international standard at the moment. There's on-going debate in the world about ESE. There are many parties doing research on ESE. There are even court cases related to the standard in the US, for example. We should learn from all these developments and follow only the good practices. How will we know whether the practices are good or not? We follow the internationally accepted standards. That's why we came out with MS IEC 62305 in the first place."

REACHING OUT

The EC also has the monumental task of reaching out to industry players and some 8.2 million customers of TNB. Datuk Ir. Fauzi reaffirms the EC's commitment to continue with its outreach programmes. "We've just launched a programme this year through the media (newspapers and radio) to reach out to and advise the people on electrical safety."

He suggests that IEM and the EC should work together to increase awareness of and to promote good practices in the effort to improve safety performance in the energy sector.

He says: "We have a good scheme under the law to control good practices for electrical installations. We have the provision for competent persons in many categories, such as engineers, supervisors, chargemen, wiremen and cable jointers. In terms of regulating knowledge and skills of industry players who work with electrical systems, we have the framework of certification by the EC."

The EC licenses all organisations, including big licensees such as TNB and local distributors, which want to supply electricity. The EC also registers electrical contractors as well as certain categories of electrical installations, for example 11 kV installations and those with standby generator sets.

Datuk Ir. Fauzi says: "Those who install and operate these must register with us so that we can monitor their safety management practices. We also regulate the importation, manufacturing, advertising or sale of electrical equipment for household use. The products must have our approval and SIRIM-ST certification label before they can be sold to the public. We have quite a rigorous regime to ensure that the supply and use of electricity is done in a safe manner through our legal framework. Engineers are required, in the scheme of things, to ensure that safe infrastructure and equipment are installed, operated and maintained effectively in this country."

TRAINING AND DEVELOPMENT

For human capital development in the electrical sector, the EC has accredited more than 100 training institutions to conduct electrical competency programmes. These are mostly government institutes or are supported by the government, such as Institut Kemahiran Mara and Institut Latihan Perindustrian. These institutions conduct training for chargemen, wiremen and other technical positions in the field. The training is hands-on, with full-time and part-time programmes available.

Datuk Ir. Fauzi says that as a professional body for engineers, IEM can help the EC in educating and disseminating good practices on lightning protection. "Come and talk to us if IEM wants to conduct training in this area. We can collaborate through training programmes for electrical systems," he says.

> *"Getting zero incidents may not be possible but we are gearing up to reduce and even eliminate incidents involving electricity. We are always continuing to look at ways to improve the standard of safety in the supply and use of electricity."*

"IEM can offer programmes to instil competency that complies with our legal requirements. If we can do this, it will be very good for the country as I feel that the implementation of electrical installation safety standards needs to be improved further. The cost factor is a big challenge in improving compliance to the standards."

SAFETY AND COMPLIANCE CONCERNS

There is also a guideline to another relevant standard, i.e. MS IEC 60364 pertaining to electrical installation of buildings. The EC has also issued guidelines to this standard. According to Datuk Ir. Fauzi, this must be complied by those who design and install electrical systems in buildings.

"These guidelines were developed in-house to explain the standards. We worked with industry associations such as The Electrical And Electronic Association of Malaysia (TEEAM) and other relevant parties to get their input when developing the guidelines and to help us disseminate information on the standards," he says.

"We have organised roadshows to explain the guidelines on both MS IEC 62305 and MS IEC 60364, so developers and other related industry players should already be aware of the guidelines by now. Hence, if they still do not follow the guidelines, we will have to take the necessary follow-up actions."

Datuk Ir. Fauzi says IEM members, in particular, should be well-versed in both systems – electrical installation of buildings and lightning protection.

"Electrical safety is a specialised area involving high risks, so you are required to be competent. When it comes to installation, operation, maintenance and repair, you need competency certificates. At present, engineers designing electrical installations are not required to register with the EC but if, in the future, engineers do not incorporate the safety standards in their designs and we find buildings with sub-standard protection systems, we may need to do something," says Datuk Ir. Fauzi.

"We may be compelled to pursue more effective measures, such as requiring electrical engineering consultants to be registered with the EC. This issue has been long debated. We hope we can all work together and contribute to upgrading the professionalism of engineers in this country." ■

Air Terminal Placement: The Key to An Effective Lightning Protection of Structures

by Mr. Hartono Zainal Abidin

***Mr. Hartono** graduated with a B.Eng (Hons) Electrical and Electronics from the Loughborough University of Technology in 1979. He took the lead role in forensic analysis of lightning damages to electronic and IT systems and has been conducting forensic analyses and providing lightning protection design services for various clients including at the Dallas-Fort Worth International Airport, USA. His interest is in analyzing buildings damaged by lightning. He co-developed a new lightning air terminal placement method which is included in the lightning protection standards of Australia (AS1768:2003) and the IEC (IEC62305:2006). He became the first Malaysian invited to give a lecture at the Asian Lightning Protection Forum and the International Nathiagali Summer College. He was also a member of CIGRE Working Group C4.410 "Lightning Protection of Very Tall Structures". He has written and co-authored over 50 reports and conference papers on building lightning protection.*

When Benjamin Franklin invented the lightning air terminal (i.e. lightning rod) in 1752, he gave man a means to protect his home and workplace from the devastating effects of lightning. When it was discovered that the air terminal neither prevented nor attracted lightning strokes, early scientists devised novel methods for placing the air terminals on the roof to protect the structures.

With the construction of higher structures in lightning prone areas in the last 50 years, there has been significant progress in the quest to improve the protection of these structures against lightning. The air terminal placement on a structure is now recognised as the most important criteria in the design and construction of an effective conventional lightning protection (LP) system.

A correctly positioned air termination system can result in almost zero bypasses (i.e. Lightning damages to buildings) since it can intercept all or most lightning strokes while an incorrectly positioned system can render part of or the entire LP system ineffective. In the non-conventional LP system, the air terminal placement was based on erroneous assumptions of lightning behaviour, resulting in multiple bypasses to many tall buildings in the last 25 years.

AIR TERMINAL PLACEMENT METHODS

Several air terminal placement methods have been developed since the 19th Century and these can be found in present day LP standards (Figure 1). These have enabled engineers to design air termination systems that are effective in intercepting lightning strokes. They are described in the recognised LP standards eg. AS1768, IEC62305, NFPA780.

The Protection Angle Method (PAM) was developed by French scientist Gay Lussac (19th Century). In this method, the elevated air terminal provides a limited shielded zone near its base and it can be applied either singly or in pairs of 2 or more depending on the shielding area required. It can be applied on any flat surface, whether on the ground or on the roof top. A special version of the method applied in conjunction with overhead shield wires (OSW) can provide a wider protection zone.

British scientist James Clerk Maxwell (19th Century) developed The Mesh Method (MM) to address the problem of lightning strikes to flat horizontal and vertical surfaces. In this method, the conductor was placed in grid form on the exposed horizontal and vertical surfaces of the building. It was very unpopular with architects and building owners due to its negative aesthetics and cost issues.

The Rolling Sphere Method (RSM), developed by Hungarian scientist Professor Tibor Horvath in the mid-20th Century, was first applied in the Hungarian LP standard in the 1960s. The RSM later appeared in the western LP standards (e.g. BS6651, NFPA780) a decade later. The method was based on studies of lightning interception (i.e. strikes) to high voltage power transmission lines and was later applied to tall buildings. In this method, an imaginary sphere is rolled over and around the structure in order to determine the lightning shielded zones (shaded areas). Although the method is applicable to both simple and complex structures, it is not capable of identifying the more vulnerable parts of the structure which are at higher risk of lightning interception.

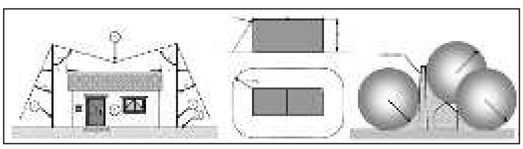

Figure 1: The PAM (left), MM (centre) and RSM (right) (Source: IEC62305)

The Collection Surface Method (CSM) was developed by Malaysian engineers Hartono Zainal Abidin and Robiah Ibrahim in 1995 (1) (2). In this method, the effective air terminal placement was derived from the observed bypass locations on more than 100 buildings in Malaysia and Singapore. The algorithm for determining the collection surface was similar to that used in the RSM but inversed, hence the size of the collection surface at a particular position on the structure determines its vulnerability i.e. the bigger the collection surface, the higher the risk (Figure 2).

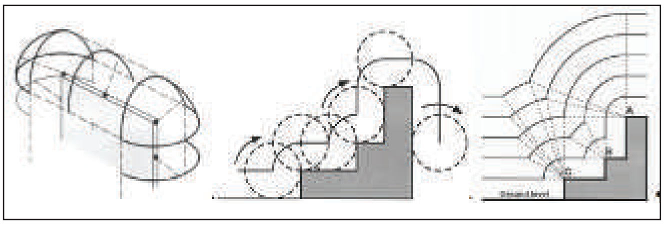

Figure 2: A sample graphical concept of the CSM

The validity of the method was based on the bypass data that corresponded closely with the CSM model. The identified high risk locations on the structures are as shown in Figure 3:

A	:	>>90%
B	:	<5%
C	:	<2%
D	:	<1%
E	:	0%

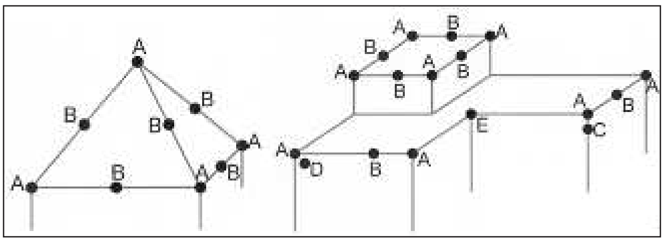

Figure 3: High risk lightning interception locations on structures

THE CSM IN CURRENT LP STANDARDS

The introduction of the CSM in modern LP standards suffered an early setback when it was rejected by the SIRIM working group on lightning protection in 1998. However, it was accepted by the Standards Australia and the IEC TC81 working groups when their respective standards were undergoing revision in 1999 and 2000 respectively.

The basic principle of the CSM (i.e. the placement of air terminals at the high risk positions) has since been included in the Australian Standard AS1768:2003 and the International Standard IEC62305:2006. In 2007, the IEC62305 was adopted as the new Malaysian LP standard, MS-IEC62305 as well as the new British Standard, BS-EN62305.

In the IEC standard, the principle of the CSM is stated as follows: "Air termination components installed on a structure shall be located at corners, exposed points and edges (especially on the upper level of any facades) in accordance with one of the following methods (i.e. PAM, MM or RSM)".

ADVANCEMENTS TO THE CSM CONCEPT

After the CSM was accepted in the IEC standard, some western LP experts conducted further research to improve it. In 2008, Josef and Marek Dudas (3) developed a software

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application that could determine the high risk locations on a structure in 3-D. Alexander Kern (4) developed more advanced software that could numerically determine the lightning interception levels on the various high risk locations. The software suggested that air terminals positioned at building corners could intercept nearly 99% of the lightning strokes (Figure 4).

The Kern software also suggested that a single tall air terminal placed in the centre of a flat roof could only intercept about 60% of the lightning strokes. This explained the high number of bypasses observed on tall structures installed with the non-conventional LP systems in the country.

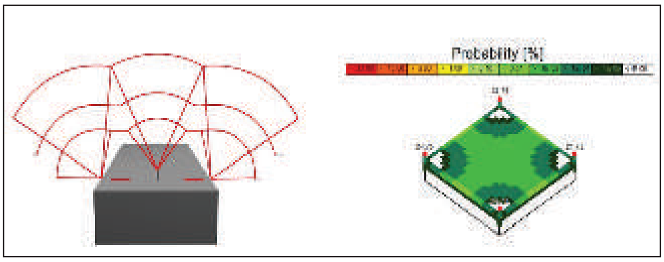

Figure 4: Dudas (left) and Kern (right) software models as depicted in their respective conference papers

COMMON ERRORS IN AIR TERMINAL PLACEMENT OF CONVENTIONAL LP SYSTEMS

A study of conventional LP systems in Malaysia suggested that more than 90% of air terminal placements did not comply with past or current standards (5). This resulted in a significant number of bypasses on buildings that had been installed with the conventional air terminal. Misconceptions about lightning and conventional air terminal which seems to be prevalent among Malaysians engineers have contributed to the widespread errors in air termination system design.

The first misconception is that lightning is attracted to metallic objects and electromagnetic radiation (e.g. from mobile phones). The second misconception is that a conventional air terminal can attract lightning. These misconceptions must be eradicated from the minds of engineers if they are to design effective LP systems.

MISCONCEPTIONS TAUGHT IN LOCAL EDUCATIONAL INSTITUTIONS

The above misconceptions were initially propagated by non-conventional LP system vendors in order to mislead and confuse engineers and the public about lightning protection. Unfortunately, some university lecturers were also found to be teaching these misconceptions to their students and to engineers while some even added new ones. Two local universities that had applied these misconceptions were Universiti Teknologi Malaysia (UTM) and Universiti Putra Malaysia (UPM).

In the book *"Kilat dan Perlindungan"*(6), several new misconceptions were introduced by the author such as:

1. *"Perlindungan yang diberi oleh pengalir rod berdasarkan prinsip iaitu setiap 'ketua' tertapak yang memasuki zon perlindungan konakan tertarik kepada pengalir rod tersebut"* (Translation: The protection provided by the rod conductor is based on the principle that every stepped leader that enters the conical protection zone will be attracted to the said rod conductor).
2. *"Zaman dahulu manusia membina tempat perlindungan daripada kayu adalah untuk melindungi rumah dari terbakar dan rosak disebabkan oleh panahan kilat. Kini manusia telah mendirikan rumah dan bangunan dengan sokongan bahan besi, mengakibatkan ia mudah dipanah kilat dan menyebabkan lebih banyak kerosakan"* (Translation: In the past, mankind built shelters out of wood so that their homes would not be burnt and damaged by lightning strikes. Nowadays, mankind have built their homes and buildings with the support of steel components, thus making them easy to be struck by lightning and causing more damages).
3. *"Kedudukan pengkalan udara mestilah 24 inci dari bucu penjuru rumah"*(Translation: The placement of an air terminal must be 24 inches from the ridge end of the house).

In 2011, UPM applied the same misconceptions that were popularised by the non-conventional LP vendors two decades earlier. In its website, the Centre of Excellence on Lightning Protection (CELP) described the LP system as follows: "When a downward (lightning) channel comes from a cloud, the air termination sends an upward channel (i.e. streamer) much faster than the other parts of the building thus the lightning is attracted to one of the rods (or to the metallic mesh)….. Thus, instead of repelling, a LP system attracts a lightning channel."

The impact of the above misconceptions could be seen in most public and private buildings nationwide, where the air terminals were not positioned at the high risk locations as according to the LP standard i.e. ridge ends and corners (Figures 5 & 6).

Figure 5: Incorrectly positioned conventional air terminal on a house

Figure 6: Incorrectly positioned conventional air terminal on a school

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NON-CONVENTIONAL AIR TERMINALS

Public awareness of the non-conventional air terminals had been raised several times locally since 1993 through the mass media, at a public forum (7) and in a technical journal (8). However, lack of action by the authorities to stop their sale and use resulted in the widespread use of these non-scientific and dangerous devices in the country.

Non-conventional air terminals are categorised as either lightning attractor devices e.g. Early Streamer Emission (ESE) and Collection Volume (CV) air terminals (Figure 7), lightning eliminator/rejection devices e.g. Charge Transfer System (CTS), Dissipation Array System (DAS) and Compound Air-Plasma Lightning Rejection system (CPLR) or lightning current reduction devices e.g. Semiconductor Lightning Extender (SLE) (Figure 8).

In 2007, a UTM lecturer and his colleagues invented a non-conventional air terminal known as the HAS system (Figure 9). However, in order to justify the project budget, they claimed that it was a conventional air terminal but with "attractive powers".

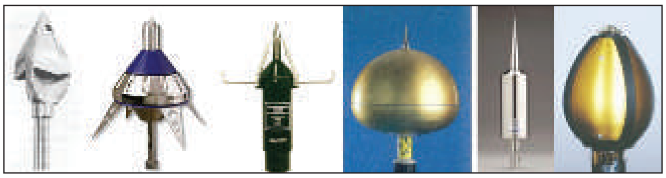

Figure 7: Examples of lightning attractor air terminals

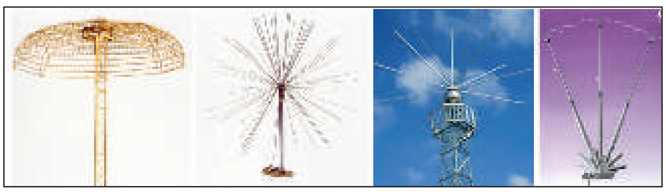

Figure 8: Examples of lightning prevention and lightning reduction air terminals

Figure 9: The conventional lightning air terminal with "attractive powers" invented by UTM

More than 95% of non-conventional air terminals used in the country consists of lightning attractor (i.e. ESE and CV) air terminals which were usually placed at the centre of the roof. One or more bypasses have been observed in most tall or large buildings that have been installed with one or more of these non-conventional air terminals (Figures 10 & 11). Many LP experts have published peer reviewed papers and books on the failures of the ESE and CV air terminals in Malaysia (9) (10) (11) (12). These experts regarded the observed bypasses as indisputable evidence of the failure of such air terminals (13).

Figure 10: A college building installed with the ESE and CV air terminals before lightning struck

Figure 11: The same college building displaying a bypass after lightning struck a corner of the roof

SUMMARY

The application of the Malaysian-developed CSM in the Australian and IEC standards marked the end of two centuries of western monopoly on building lightning protection which began with the invention of the lightning rod.

A conventional LP system that is designed and installed according to the IEC62305 standard, can achieve a high level of protection. An air termination system design that fully complies with the standard can intercept up to 99% of the lightning strokes. The application of the IEC standard in LP design can lead to the reduction or even elimination of bypasses on structures of all shapes and sizes. This increase in safety factor can mean a hefty reduction in losses due to lightning.

The use of the non-conventional air terminals must be discontinued immediately in order to minimise losses in monetary terms and human lives. Since the non-conventional LP systems proved to be non-scientific and dangerous to use, engineers must refrain from using them, in accordance with the respective institutional codes of conduct on public safety. ■

REFERENCES

[1] ZA Hartono and I Robiah, "A method of identifying the lightning strike location on a structure", International Conference on EMC, Kuala Lumpur, 1995.

[2] ZA Hartono and I Robiah, "The collection surface concept as a reliable method for predicting the lightning strike location", International Conference on Lightning Protection (ICLP), Rhodes, Greece, 2000.

[3] J Dudas and M Dudas, "Software for lightning protection system diagnosis according to IEC 62305", ICLP, Uppsala, Sweden, 2008 (http://www.lpsdesigner.cz/data/ICLP2008Paper10-3.pdf)

[4] A Kern *et al.*, "Probability of lightning strikes to air termination of structures using the electro-geometrical model theory and the statistics of lightning current parameters", 2012 (http://www.elab-juelich.de/Kern/Veroefentlichungen/Paper%20750_Strike%20probability.pdf)

[5] ZA Hartono and I Robiah, "Misconceptions about lightning and its relation to air terminal design errors", Invited Paper, CIGRE C4 Colloquium on Lightning and Power Systems, Kuala Lumpur, 2010 (http://www.lightningsafety.com/nlsi_lhm/misconceptions-about-lightning.pdf)

[6] *"Kilat dan perlindungan"*, Hussein Ahmad, Penerbitan UTM, 1998

[7] ZA Hartono and I Robiah, "Conventional and un-conventional lightning air terminals: An overview", ACEM Forum on Lightning Protection, Petaling Jaya, 2004 (http://www.lightningsafetyalliance.org/documents/acem_air_terminals.pdf)

[8] ZA Hartono and I Robiah, "Conventional and un-conventional lightning air terminals: An update", Journal of the Association of Consulting Engineers Malaysia, 1Q 2007 (http://www.lightningsafety.com/nlsi_lhm/ACEM_Journal_Q1_2007.pdf)

[9] D Makerras, M Darveniza and AC Liew, "Review of claimed enhanced protection of buildings by early streamer emission air terminals", IEE Proceedings – Science Measurement Technology, Vol. 44, No. 1, 1997.

[10] MA Uman and VA Rakov, "A critical review of non-conventional approaches to lightning protection", Bulletin of the American Meteorological Society, 2002 (http://www.lightningsafety.com/nlsi_lhm/Uman_Rakov.pdf)

[11] V Cooray *et al.*, "Lightning interception: Non-conventional lightning protection systems", Report of CIGRE Working Group C4.405, Elektra, October 2011 (http://www.iclp-centre.org/pdf/Cooray-CIGRE-2011.pdf)

[12] "Lightning: Physics and Effects", MA Uman and VA Rakov, Cambridge University Press, 2003

[13] "Lightning Protection", edited by V Cooray, The Institution of Engineering and Technology, 2010

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RM 2,672,916.70 from IEM Members and Committees
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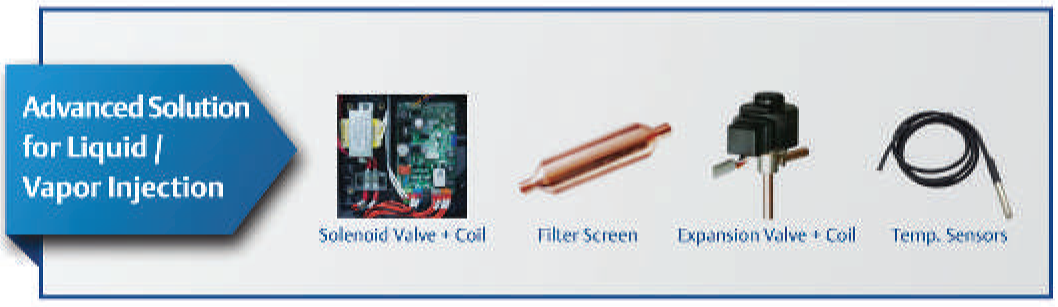

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Lightning & Tall Structures: Problems and Solutions

by Professor Liew Ah Choy

***Professor Liew Ah Choy** is Professorial Fellow at the department of Electrical & Computer Engineering at National University of Singapore as well as the Director and CEO of EquiVolt Pte Lt, a consultancy company specialising in providing design and solutions to lightning protection and electrical engineering problems.*

The incidence of lightning in Malaysia and Singapore is one of the highest in the world. It therefore is no surprise that we experience our share of problems associated with it.

Today, there are tall structures and buildings almost everywhere. There have been many cases of lightning strokes bypassing roof lightning protection systems on tall buildings in Singapore, resulting in dislodgement and spalling of concrete. Examples of some of these and solutions provided and/or required to prevent such damages will be discussed.

We will also discuss the mechanisms and characteristics of lightning strikes to structures for both the more common downward lightning strike and the upward lightning strike associated with very tall structures. The requirement of the Singapore Lightning Protection Code SS555:2010 to address some of these issues will also be discussed.

Other less obvious problems experienced with tall structures and systems that will be discussed include:

Ignition of flammable gases from vent stacks under thunderstorm conditions,

Phenomenon of "hair standing on end" on open roofs of sky-bars.

Another very important consideration in preventing lightning related problems is the requirement for equipotential bonding. We will also discuss case studies relating to injury to personnel in various operations, especially ground handling at airports, and the solutions to reduce such risks.

SOME PROBLEMS AND SOLUTIONS

Protection of corners and edges of roofs and parapet walls of tall buildings

In Singapore, there have been many cases of lightning strokes bypassing roof lightning protection systems on tall buildings, resulting in dislodgement and spalling of concrete. This effect for tall structures, where the sides of the building are struck, is well known. The lightning protection codes (IEC62305:2006 and SS555:2010) address this and require the provision of side lightning intercepting air termination systems from heights of 60m and above.

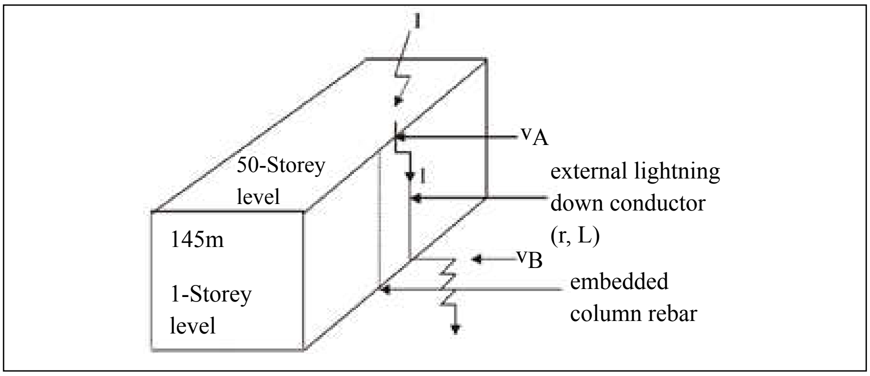
The vulnerability or exposure of the roof and sides of tall structures is seen with the application of the rolling sphere around the structure. For Lightning Protection Level LPL3, the rolling sphere radius, which represents the striking distance of the lightning leader, is taken to be 45m. This gives about 91% protection.

On the roof, the lightning protection codes recommend that roof lightning protection tapes be coursed along the outer edges of the roof perimeter or the roof parapet walls. However, in practice, due to fastening constraints, such tapes are inevitably located with some recess distance from the edges, typically along the centerline of the roof parapet walls. Herein lies the weakness, where lightning attachment is frequently at the corners and edges of the concrete, in preference to the lightning intercepting tape. When this occurs, the lightning current frequently flashes through the concrete to the rebar of the concrete structure in its path to earth. This is followed by dislodgement of the concrete, which is a hazard to persons at ground level of the structure.

A standard practical solution has been to install a finial rod at the corner of roof parapet wall to provide additional protective coverage at the sharp corner. Despite this, there have been cases whereby lightning still bypassed the protective rod to strike the corner of the concrete roof or the parapet wall. As a result, it is proposed that metal capping be provided at the outer edges of roof parapet walls and flat roofs. For roof parapet walls, this can be in the form of metal coping wrapping over the exposed top of the wall. The metal capping or coping must be bonded to the steel rebars of the structure behind it.

Case studies of some of such failures will be shown in the presentation.

NEED FOR BONDING OF LIGHTNING PROTECTION SYSTEM TO THE BUILDING REBAR SYSTEM



The voltage on a strickened lightning protection air terminal system as illustrated in the sketch above is calculated as follows:

$$v_A = L\frac{dI}{dt} + Ir + IR$$

where: I = lightning stroke current (kA)

$\frac{dI}{dt}$ = rate of change of lightning current (kA/μs)

L = inductance of lightning downconductor

r = resistance of lightning downconductor

R = resistance of earth electrode system

$$v_A = L\frac{dI}{dt} + Ir + IR$$

where: I = lightning stroke current (kA)

$\frac{dI}{dt}$ = rate of change of lightning current (kA/μs)

L = inductance of lightning downconductor

r = resistance of lightning downconductor

R = resistance of earth electrode system

The voltage drop across the downconductor = $v_A - v_B$

$$= L\frac{dI}{dt} + Ir \text{ -- } (2)$$

Consider the case of a downconductor (25mm x 3mm standard Cu tape) of length = 145m from the 50th to 1st storey levels.

Inductance of a 25mm x 3mm tape = 1.25μH/m

Total L = 145m x 1.2μH/m = 174μH

r = 0.5Ω

Values of I and $\frac{dI}{dt}$ are distributed statistically and their values are given in the Standards.

Case (a): Take 50% of occurrence or median values of $I_{50\%}$ = 30kA,

$$\frac{dI}{dt}_{50\%} = 25kA/\mu s$$

$$(v_A - v_B) = L\frac{dI}{dt} + Ir = 174 \times 25 + 30 \times 0.5$$
$$= 4350 + 15 = 4365kV$$
$$= 4.4MV$$

Case (b): Take the more severe case of lightning stroke which is exceeded by 10% of occurrence of $I_{10\%}$ = 80kA, $\frac{dI}{dt}_{10\%}$ = 40kA/μs

$$(v_A - v_B) = L\frac{dI}{dt} + Ir = 174 \times 40 + 80 \times 0.5$$
$$= 6960 + 40 = 7000kV$$
$$= \mathbf{7.0MV}$$

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It is seen that extremely large voltage rises and differences can occur. Assuming that the rebar and downconductor tape are fortuitously or otherwise connected at the 1st storey level (near ground), then the voltage difference between the strickened lightning downconductor and the embedded rebar behind the wall/column of the building at the 50th storey can potentially rise to 4.4MV and 7.0MV for 50% and 10% probability of occurrence lightning parameters respectively.

This large voltage difference will cause flashover to the embedded rebar with consequential effects of spalling of concrete within its flashover path. (Note: The flashover strength of air for rod gaps is approximately 1000kV/m; the flashover voltage through concrete is much lower). After this flashover, the lightning downconductor and the rebar will both carry and convey the lightning current to the earth electrode system. To prevent this from occurring, the voltage difference must be eliminated. This is achieved by bonding the lightning protection tape and downconductor to the rebar.

IGNITION OF FLAMMABLE GASES FROM VENT STACKS UNDER THUNDERSTORM CONDITIONS

Ignition of flammable gases from vent stacks during thunderstorms is not uncommon. This is usually attributed to a direct lightning strike to the stack at the time of venting. In such a situation, clearly, ignition of the gas is expected. Solutions have often been suggested and implemented to attempt to overcome such occurrences.

In an investigation by the author, it was discovered that several vent fire incidences involved more than one vent stack (typically 4) in the facility at the same time. The probability of direct lightning strikes to four vent stacks at or around the same time, causing this occurrence is indeed very remote to near impossible.

The occurrence of the phenomenon is attributed to point-discharge corona currents near metallic exhaust vent pipes caused by the high electric field on the top of the tall slender structure of the vent stack under the influence of a charged thundercloud. The onset and magnitude of point-discharge corona currents in vent stacks are likely to be more pronounced due to the presence of the hot gases which will contribute to thermal ionisation as well. With a ready stream of corona currents and oxygen in the air, venting of the flammable gases can lead to ready ignition. Such occurrences are clearly more frequent than ignition caused by a direct light to a vent stack. It also explains why fires can occur at several vent stacks at around the same time.

A case study of such a failure and possible solutions will be shown in the presentation.

PHENOMENON OF "HAIR STANDING ON END" ON OPEN ROOFS OF SKY-BARS

It was reported that during overcast skies with impending thunderstorms, customers and staff at the roof bar of a high rise hotel building, experienced strong electrostatic (ES) phenomenon with their hair standing on end. The roof bar stands at the top helipad level at an elevation level of 142m. Lightning protection masts were installed at the 4 corners of the roof bar level.

It was reported that the effect of hair standing on end was more pronounced near the lightning protection masts. At times, a hissing sound could also be heard during overcast skies conditions.

Investigations confirm that the effect is due to the high electric field caused by a charged overhead thundercloud. This electric field at the roof level is enhanced by the geometry of the tall slender building. The electric field (E) at or near the taller lightning protection masts (LPMs) above the roof helipad level is further enhanced by its distorting effect of the taller and sharper object. The head and hair of a person on the roof will also have opposite polarity charges induced on it by the layer of negative charges (-Q) at the base of the thundercloud. This means that the head and hair will have positive charges (+q) caused by induction from the cloud.

Force F due to an E field on a charge q is given by F = q x E. It is this force that causes the hair to stand on end. For the situation on the roof bar, the E fields at and near the LPMs are clearly greatest due to its enhancement. Consequently, this electrostatic (ES) force F = q x E is greatest in its vicinity.

This case study and possible solutions will be shown in the presentation.

EQUIPOTENTIAL BONDING AND EARTHING FOR REDUCTION OF DANGEROUS VOLTAGE DIFFERENCES

Another very important consideration in the prevention of lightning related problems is the requirement for equipotential bonding and earthing.

In general, during turn-around at airport parking bays, aircrafts are not solidly earthed, apart from the period of re-fueling when a static discharge cable is connected to an earth receptacle at the floor of the parking bay. Voltage rises and voltage differences can occur following direct lightning strikes to the aircraft and nearby strikes in its vicinity. There have been cases relating to injury to personnel in various operations especially in ground handling in airports. Such injury cases can be reduced with equipotential bonding between all systems which interface with the aircraft during airside operations and earthing of the parked aircraft.

This problem and some solutions will be shown in the presentation. ■

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Implementation and Use of Lightning Detection System Network (LDSN) in Malaysia: TNBR Experience

by Ir. Noradlina Abdullah

***Ir. Noradlina Abdullah** is an Electrical Engineer with TNB Research Sdn Bhd. She has more than 10 years working experience in managing and operating Lightning Detection System Network for TNB. She is currently Technical Expert (Lightning Protection) with Lightning &Earthing research group*

Lightning is a major cause of power interruptions at Tenaga Nasional Berhad (TNB) as Malaysia is among the countries with the highest lightning activities in the world.

In 1994, in an effort to reduce the impact, TNB Research Sdn. Bhd. (TNBR) installed a Lightning Detection System Network (LDSN) in Peninsular Malaysia.

This article is about the TNBR experience in the development and use of the data obtained from the network in TNB.

INTRODUCTION

Located near the equator, Malaysia is characterised by high lightning and thunderstorm activities (1). Crude observations performed by the Malaysian Meteorological Services indicate that each year, thunder occurs for 200 days. Thunderstorms are suspected to be the cause of between 50% and 60% of transient trippings in TNB's transmission and distribution networks.

It had been long realised that there was a lack of accurate and reliable lightning data in Malaysia to enable accurate studies on lightning.

The need for accurate lightning data and the desire to reduce the impact of lightning on the supply reliability and quality motivated TNBR to install the LDSN to monitor real time cloud-to-ground lightning activities in the peninsula. The system became fully operational in 1994.

NETWORK IMPLEMENTATION

Two systems for detecting and locating lightning in real-time over large areas were commercially available in the late 1980s. These were Lightning Positioning and Tracking System (LPATS) and the Lightning Location & Protection (LLP).

The LLP system, which employed the Magnetic Direction Finding (MDF) technique, was selected for TNB. Its principles of operation have been well reported in the literature (e.g., (1)). The lightning sensor (DF) has a nominal detection range of 370km, within which 85% or more lightning flashes are detected. The DF can reliably discriminate against intra-cloud flashes and identify the stroke polarity for flashes that occur within 600km of the DF.

In the early network, the LDSN comprised 8 remote DFs, a central processor APA 280-T and a lightning location display. This earlier network was described in (2-3). The location accuracy and detection efficiency were 3km (or better) and 85% (or better) respectively. The communication between the sensors and the central processor was over dedicated lines leased by the local telecommunications operator. In 2003, a major upgrade of the network was carried out to replace the APA 280-T with a software package called Lightning Processor 2000 (LP2000). The LP2000 was able to process all available sensor information in real time and so, could compute a separate location for each individual stroke in the flash. New grouping of strokes to flashes was introduced, based on a time and a distance criterion (4). Five Impact (ALDF 141T) DFs were upgraded to the Impact-ESP sensors that utilised both the Time-Of-Arrival (TOA) and Magnetic Direction Finding (MDF) techniques to achieve improved location accuracy and detection efficiency. After 15 years of operations, the network was upgraded to include sensors with better location accuracy and sensitivity. In May 2009, the existing Impact ESP sensors were replaced with two new LS7001 sensors to enhance the network location, accuracy and detection efficiency.

Ongoing network development includes replacing the old Impact ESP and LPATS IV sensors with new version LS7002 sensors. The

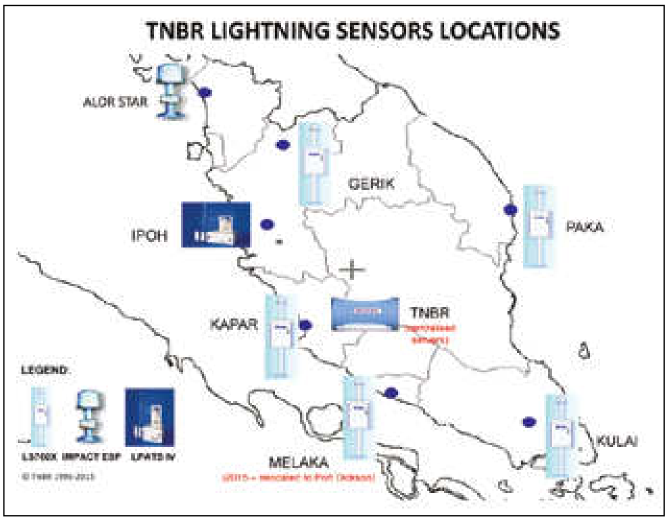

Figure 1: TNBR LDSN Sensors Locations

current LDSN sensor locations are given in Figure 1. The network central processor was recently upgraded to a newer version of CP7000 and AP5000 for database management system, to further enhance the network reliability. With the addition of the new sensors, the current network is expected to provide 95% detection efficiency and up to 500m location accuracy for Peninsular Malaysia.

GROUND FLASH DENSITY

The ground flash densities for the peninsula are shown in Figure 2. The west coast of the peninsula is particularly affected by lightning. Analysis of monthly lightning activities indicates that these "highs" occur during the inter-monsoon and southwest monsoon seasons. In some locations, the flash density reaches as high as 24 flashes per km2 per year (or more).

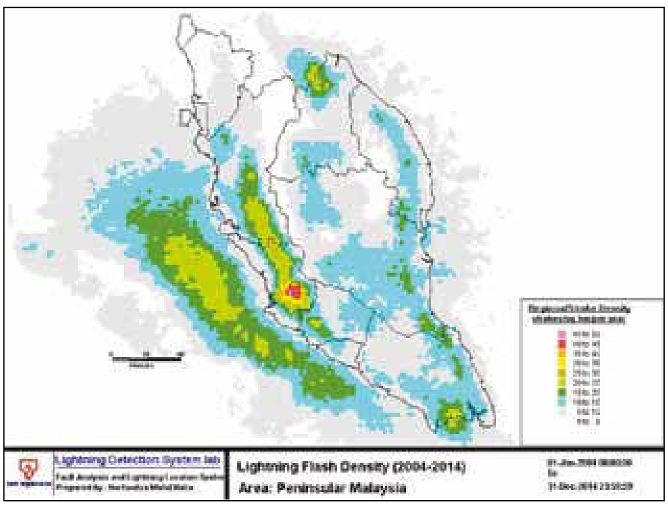

Figure 2: Lightning Ground Flash Density for Peninsular Malaysia (2004 - 2014)

USES OF THE LDSN DATA

The LDSN has made possible monitoring of lightning activities in the peninsula in real-time. Statistics on stroke locations, time and parameters have enabled assessment of lightning severity in Malaysia. Not available previously, this information has provided TNB with the opportunities to be more scientific and quantitative in its approach when dealing with lightning. The LDSN has proved to be a useful tool to facilitate lightning mitigation efforts as shown in Figures 3-5. The operational applications include:

- Monitoring of lightning activities across the transmission and distribution networks across the peninsula to ensure speedy response to potential lightning damages or trips
- Estimating the locations of faults based on the locations of lightning strokes, for speedy restoration of power supply
- Identifying lightning as the (most probable) cause of fault, based on the correlation between the fault and lightning events.
- Ascertaining that a fault is not caused by lightning, based on the correlation between the fault and lightning events.
- Identifying areas or locations that require priority lightning protection or upgrades, based on local ground flash density data
- Justifying the need for a protection or protection upgrade, based on the local lightning severity (9-10)
- Assessing the effectiveness of the protection or upgrade measures implemented based on the fault and lightning event analysis.

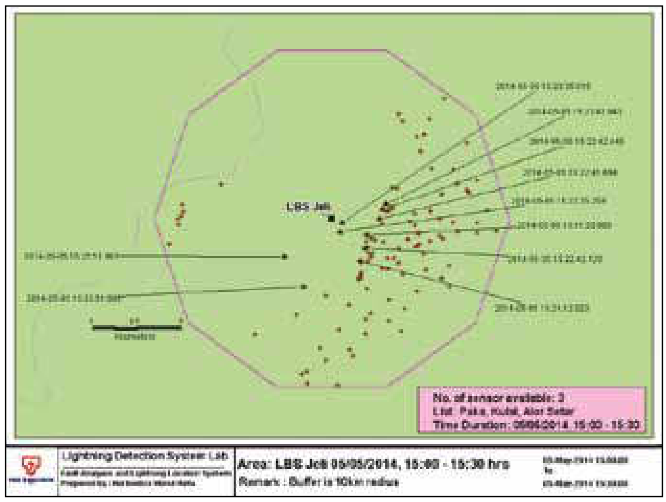

Figure 3: Historical lightning activities data for Equipment Failure Investigation

Figure 4: Historical lightning data for line tripping justification

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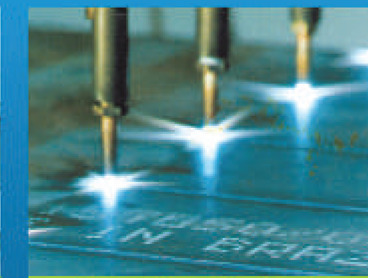
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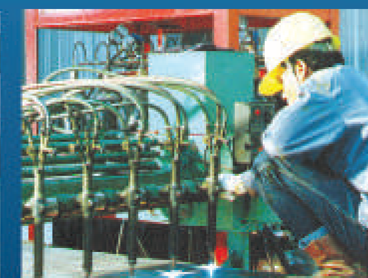
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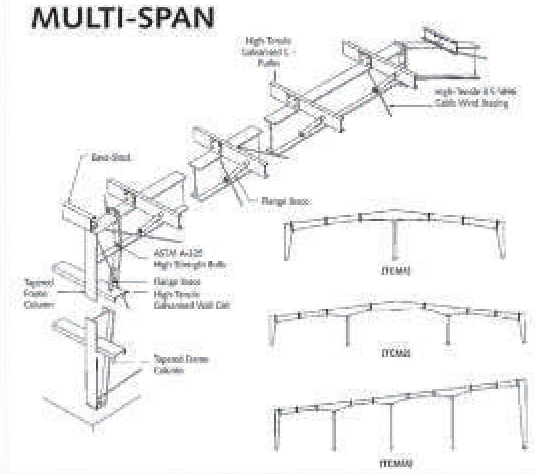
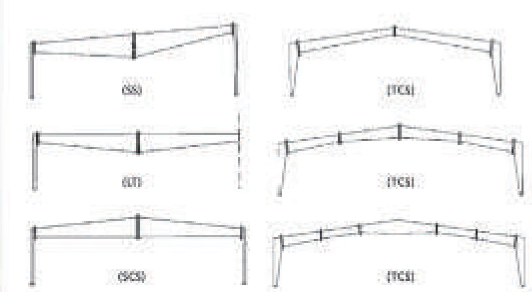


CLEAR-SPAN



		BUILDING WIDTH	SIDEWALL HEIGHT
	Multi-Span		
(TCM1)	Tapered Column Modular One Interior Column	18m - 100m	3.5m - 12m and over
(TCM2)	Tapered Column Modular Two Interior Column	28m - 120m	3.5m - 12m and over
(TCMSS)	Tapered Column Multi - Span Single Slope	20m - 160m	3.5m - 12m and over
	Clear-Span		
(SS)	Straight Column Single Slope	4.5m - 22m	3m - 9m
(LT)	Straight Column Lean To	3m - 22m	2.4m - 9m
(SCS)	Straight Column Clear Span	6m - 22m	3m - 9m
(TCS)	Tapered Column Clear Span	6m - 30m	3.5m - 12m and over
(TCS)	Tapered Column Clear Span - Two Piece Rafter	12m - 85m	3.5m - 12m and over
(TCS)	Tapered Column Clear Span - Three Piece Rafter	12m - 85m	3.5m - 12m and over

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CONCLUSION

The LDSN has made possible the detection of lightning activities in Peninsular Malaysia, in real-time. Quantitative data on stroke locations, time and parameters have enabled accurate estimation of lightning severity in the country.

Nevertheless, it is important that the network implementation issues discussed in this paper be taken into consideration and carefully dealt with to ensure the sustainability and reliability of the network implemented.

REFERENCES

[1] Anderson, R.B.: Lightning research: where do we go from here?, Power Engineering Journal, 1992, pp. 179-190.

[2] Lightning Characteristics Relevant for Electrical Engineering: Assessment of Sensing, Recording and Mapping Requirements in the Light of Present Technological Advancements, CIGRE Technical Report (Task Force 33.01.02), 1995.

[3] Krider, E.P., R.C. Noggle, and M.A. Uman: A Gated Wideband Magnetic Direction Finder for Lightning Return Strokes, Journal of Applied Meteorology, Vol. 15, No. 3, 1976, pp. 301-306.

[4] Yahaya, M.P., H.B. Ahmad, and M.A. Alam: Lightning Detection System in Malaysia, Proc. National Technical Seminar on Standardization and Development of Lightning Protection Technologies- Malaysian Environment, Petaling Jaya, Malaysia, 6-7 November, 1996.

[5] Yahaya, M.P., S.A. Fuad: Characteristics of cloud-to-ground lightning in Malaysia, Proc. Conference on Lightning Protection and Earthing Systems, Kuala Lumpur, 15-16 August 2000.

[6] Peterson, W.A., and S.A. Rutledge: Some characteristics of cloud-to-ground lightning in tropical Northern Australia, Journal of Geophysical Research, Vol. 97, No. D11, 1992, pp. 11553-11560.

[7] Hidayat, S., M. Ishii, J. Hojo, K.T. Sirait, and P. Pakpahan: Observation of lightning in Indonesia by magnetic direction-finder network, Proc. 10th International Conference on Atmospheric Electricity, Osaka, Japan, 10-14 June, 1996.

[8] Cooray, V., and K.P.S.C. Jayaratne: Characteristics of lightning flashes observed in Sri Lanka in the tropics, Journal of Geophysical Research, Vol. 99, No. D10, 1994, pp. 21,051-21,056.

[9] Abdullah, N.; Yahaya, M.P.; Hudi, N.S, "Implementation and Use of Lightning Detection Network in Malaysia", Proc. 2nd IEEE International Conference on Power and Energy (PECon 08), December 1-3, 2008, Johor Baharu, Malaysia

[10] Abdullah, N.; Rahman, N.A; Ariffin, M.F; "Improvement of 33kV Overhead Lines Lightning Performance using Multiple Approaches", 8th 2013 Asia-Pacific International Conference on Lightning, Jun. 26-28, 2013, Seoul, Korea

IEM DIARY OF EVENTS

Title: One-Day Workshop on Arduino

25 July 2015

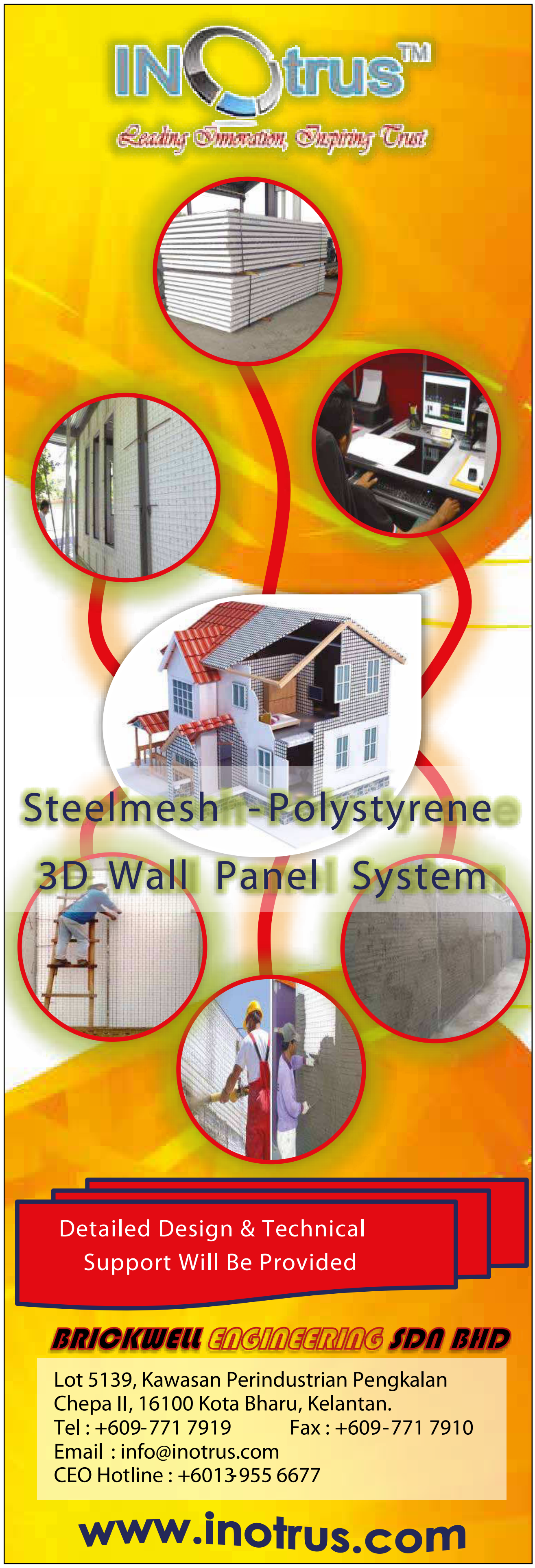
Organised by : Information and Communications Technology Special Interest Group
Time : 9.00 a.m. – 5.00 p.m.
CPD/PDP : 7

PREREQUISITES:

As this is a hands on workshop, participants are required to bring:

1. Your own Notebooks (Win/OS/Linux)
2. Starter kit for Arduino Uno (Loan unit/ purchase on site (workshop day)

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.



Lightning Parameters for Engineering Applications

by Ir. Prof. Dr Mohd. Zainal Abidin Ab Kadir

***Ir. Prof. Dr Mohd. Zainal Abidin Ab Kadir** is Deputy Dean (Research & Innovation) and Professor at the Faculty of Engineering, Universiti Putra Malaysia, Selangor, Malaysia. He is also Director at the Centre for Electromagnetic and Lightning Protection Research (CELP), University Putra Malaysia.*

To the electric utility engineer, the parameters of the flash that are of primary interest are the crest current for the first and subsequent strokes, the waveshape of these currents, correlation between the parameters, the number of strokes per flash and flash incidence rates where the ground flash density, denoted as flashes per square km-year and symbolised by N_g.

The charge lowered by the flash and perhaps the integral of the current squared, frequently called the "action integral, may also be of some interest. The first three parameters, as we know them today, are to a very large extent based on the measurements of Berger. Berger's masts, 70-80 metres high, were mounted on the top of Mt. San Salvatore (Switzerland), which is 650 metres above Lake Lugano.

Although 75% of the 1,196 flashes measured were negative upward, about 11% or 125 flashes were negative downward. When it was realised that Berger made oscillographic recordings of the currents in both the first and the subsequent strokes of the flash, making all waveshape parameters and their correlation available, it was readily noted that these 125 records represented one of the best and most extensive sets of data available to the industry to date. Several studies were done to take photos of the lightning, where the natural lightning channel usually has a 'zigzag' shape with some branches. In addition, the triggered lightning channel usually has a straight shape (or at least at some hundred metres to the ground surface) without any branches. While the triggered lightning remains an important method for the validation of the calculated electric and magnetic fields, this issue of vertical and inclined channel, for instance, remains as one of the parameters that need to be considered which can result in inaccuracy of the calculation.

INTRODUCTION

Lightning is one of the most fantastic natural phenomena in the world. It can result in severe damage to property. Lightning happens when a region of atmosphere acquires a sufficiently huge electric charge that is capable of causing an electrical breakdown. It has been reported that there are 2,000 thunderstorms in progress at any time, resulting in 100 lightning flashes to ground per second; this is 8 million per day. Lightning is the cause of around 100 deaths and 250 injuries in the United States each year, more than from any other weather-related phenomenon.

Even though there is no database available with regards to the victims or survivors due to the lightning, there are some well documented cases, especially related to injuries and deaths caused by the lightning. It has become a significant threat in many countries where the natural phenomenon has previously, been thought of as affecting only those who are careless. Most tropical countries, several southern states of the USA, Japan and several parts of Australia, experience heavy annual lightning occurence density (1)-(12).

Malaysia encounters more than 70% of power outages due to lightning and we are known as the Crown Of Lightning in the world. The effects of lightning on electrical and communication networks and structures account for equipment damage, downtime/ data losses and malfunction of control and automated systems. All these cost the nation over RM250 million annually, not to mention thousands of cases of human injuries and deaths. Both lightning and intentionally generated lightning-like microwave pulses may also disrupt civil and defence systems, giving rise to serious threats to national security.

Malaysia is ranked among the top three countries in the world in terms of lightning density, more than any other country in Asia. Human lives can be saved if people are given proper education in lightning protection. Apart from human injuries and deaths, another matter of concern is the deaths of many animals caused by lightning every year. At present, available protection technologies in Malaysia are more suited to non-tropical environments; the market is also controlled and dominated by developed nations which make over RM50 million in profit from such protection.

This paper highlights some of the selected parameters of interests based on previous CIGRE documents on the subject, published in ELECTRA more than three decades ago by Berger *et al.,* (13), and Anderson and Eriksson (14).

SOME LIGHTNING PARAMETERS OF INTEREST

1. GROUND FLASH DENSITY

This is a fundamental parameter, providing the basis for any estimation of the frequency of lightning effects on electrical system. The ground flash density, N_g, is often viewed as the primary descriptor of lightning incidence, at least in lightning protection studies. Ground flash density has been estimated from records of (1) lightning flash counters or LFCs and (2) lightning locating systems or LLSs. This can potentially be estimated from records of satellite-based optical or radio-frequency radiation detectors. It is worth noting that satellite detectors cannot distinguish between cloud and ground discharges, so in order to obtain N_g maps from satellite observations, a spatial distribution of the fraction of discharges to ground relative to the total number of lightning discharges, is needed. In the absence of ground-based measurements of N_g, IEEE Std 1410-2010 (15) recommends to assume that N_g is equal to one-third of the total flash density (including both cloud and ground discharges) based on satellite observations.

The ground flash density N_g for temperate areas may be estimated from T_d, the keraunic level, using Equation (1) from Anderson *et al.,* (B6):

$$N = 0.04 T_d^{1.25} \qquad (1)$$

where

N_g is the ground flash density in flashes per sqkmper year
T_d is the number of days with thunder per year.

Torres *et al.,* (16) noted that this expression has unacceptably large errors in tropical areas, recommending the alternative expressions for Equation (1), as tabulated in Table 1:

Table 1: Alternative expressions for Equation 1 for tropical areas.

Country	Alternative expression for Equation (1)
Mexico	$N = 0.024 T_d^{1.12}$
Brazil	$N = 0.030 T_d^{1.12}$
Columbia	$N = 0.0017\ T_d^{1.56}$

2. PEAK CURRENT – "CLASSICAL" DISTRIBUTION

Basically, all national and international lightning protection standards (e.g., IEEE Std 1410-2010 (15); IEEE Std 1243- 1997 (17); IEC 62305 series (18-21)) include a statistical distribution of peak currents for first strokes in negative lightning flashes (including single-stroke flashes). This distribution, which is one of the foundations of most lightning protection studies, is largely based on direct lightning current measurements conducted in Switzerland from 1963 to 1971.

It is worth noting that directly measured current wave forms of either polarity found in the literature, do not exhibit peaks exceeding 300 kA or so, although inferences from remotely measured electric and magnetic fields suggest the existence of currents up to 500 kA and even higher.

For the CIGRE distribution, 98% of peak currents exceed 4 kA, 80% exceed 20 kA, and 5% exceed 90 kA. For the IEEE distribution, the "probability to exceed" values are given by the following equation (2)

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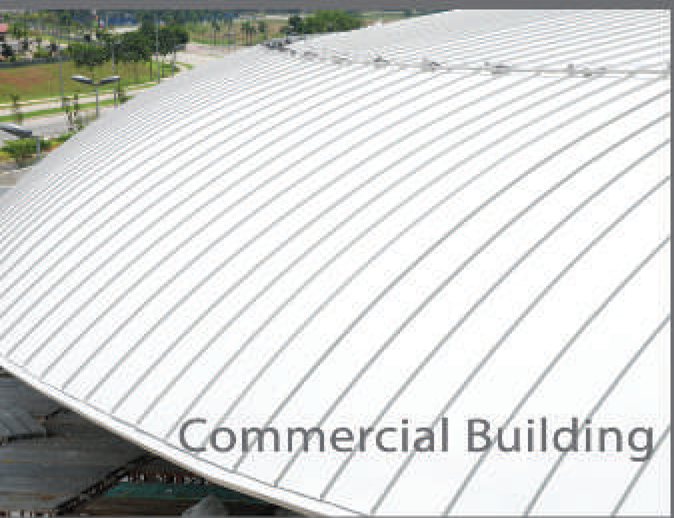

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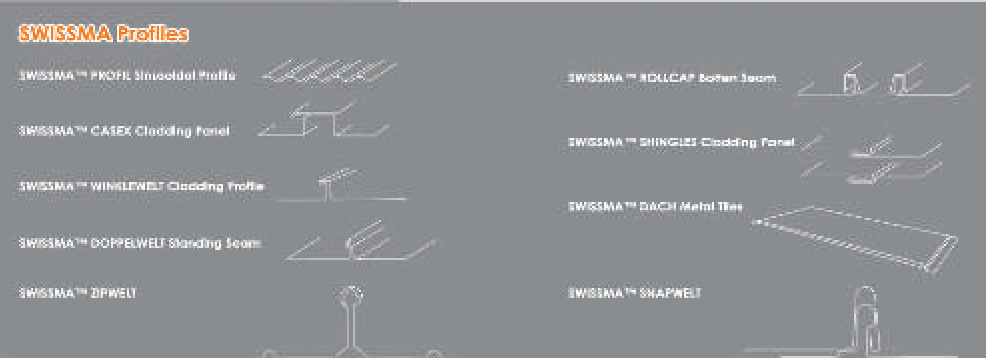

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$$P(I) = \frac{1}{1 + (\frac{I}{31})^{2.6}} \qquad (2)$$

where P(I) is in per unit and I is the first return stroke peak current in kA. Note that this equation applies to values of I up to 200 kA.

According to Hileman (22), this equation, usually assumed to be applicable to negative first strokes, was based on data for 624 strokes analysed by Popolansky (23), whose sample included both positive and negative strokes, as well as strokes in upward lightning.

The distribution of subsequent-stroke peak current values was approximated in Equation (3) by (IEEE Std 1243-1997) (17):

$$P(I) = \frac{1}{1 + (\frac{I}{12})^{2.7}} \qquad (3)$$

Sample sizes for "global" peak current distributions for negative first strokes and the IEEE peak current distributions can be referred to CIGRE TB 549-2013 (18).

3. PEAK CURRENT: RECENT DIRECT MEASUREMENT

Recently, direct current measurements on instrumented towers were carried out in Russia, South Africa, Canada, Germany, Brazil, Japan, Austria and again in Switzerland (on a different tower). Important results from the Brazilian, Japanese, and Austrian studies were reviewed and compared with Berger's data. In addition, recent direct current measurements for rocket-triggered lightning were also considered.

Tables 2 and 3 summarised the distributions of lightning peak currents from individual studies (obtained from direct measurements only) and those synthesized by combining different measurements for first and subsequent stroke (18).

Table 2: Comparison of return-stroke peak currents (the largest peak, in kA) for first strokes in negative downward lightning

References	Location	Sample size	Percent exceeding tabulated value			$\sigma_{lg}I$	Remarks
			95%	50%	5%		
Berger et al. (1975)	Switzerland	101	14	30 (~30)	80	0.265	Direct measurements on 70-m towers
Anderson and Eriksson (1980)	Switzerland	80	14	31	69	0.21	Direct measurements on 70-m towers
Dellera et al. (1985)	Italy	42	-	33	-	0.25	Direct measurements on 40-m towers
Geldenhuys et al. (1989)	South Africa	29	7*	33 (43)	162*	0.42	Direct measurements on a 60-m mast
Takami and Okabe (2007)	Japan	120	10	29**	85	0.28**	Direct measurements on 40- to 140-m transmission-line towers
Visacro et al. (2012)	Brazil	38	21	45	94	0.20	Direct measurements on a 60-m mast
Anderson and Eriksson (1980)	Switzerland (N=125), Australia (N=18), Czechoslovakia (N=123), Poland (N=3), South Africa (N=11), Sweden (N=14), and USA (N=44)	338	9*	30 (34)	101*	0.32	Combined direct and indirect (magnetic link) measurements
CIGRE Report 63 (1991)	Switzerland (N=125), Australia (N=18), Czechoslovakia (N=123), Poland (N=3), South Africa (N=81), Sweden (N=14), and USA (N=44)	408	-	31 (33)	-	0.21	Same as Anderson and Eriksson's (1980) sample plus 70 additional measurements from South Africa

The 95%, 50%, and 5% values are determined using the lognormal approximation to the actual data, with 50% values in the parentheses being based on the actual data.

$\sigma_{lg}I$ is the standard deviation of the logarithm (base 10) of peak current in kA; β= 2.3026 $\sigma_{lg}I$.

* As reported by Takami and Okabe (2007).

**26 kA and 0.32 after compensation for the 9-kA lower measurement limit.

Table 3: Comparison of return-stroke peak currents (in kA) for subsequent strokes in negative lightning

References	Location	Sample size	Percent exceeding tabulated value			$\sigma_{lg}I$	Remarks
			95%	50%	5%		
Berger et al. (1975)	Switzerland	135	4.6	12	30	0.265	Direct measurements on 70-m towers
Anderson and Eriksson (1980)	Switzerland	114	4.9	12	29	0.23	Direct measurements on 70-m towers
Dellera et al. (1985)	Italy	33	-	18	-	0.22	Direct measurements on 40-m towers
Geldenhuys et al. (1989)	South Africa	?	-	7- 8	-	-	Direct measurements on a 60-m mast
Visacro et al. (2012)	Brazil	71	7.5	18	41	0.23	Direct measurements on a 60-m mast
Diendorfer et al. (2009)	Austria	615	3.5	9.2	21	0.25	Direct measurements on a 100-m tower; upward lightning
Schoene et al. (2009)	Florida	165	5.2	12	29	0.22	Direct measurements; rocket-triggered lightning

The 95%, 50%, and 5% values are determined using the lognormal approximation to the actual data. $\sigma_{lg}I$ is the standard deviation of the logarithm (base 10) of peak current in kA; $\beta = 2.3026\ \sigma_{lg}I$. Data for strokes in upward and rocket-triggered flashes are included because those strokes are similar to subsequent strokes in natural downward flashes.

4. OTHER PARAMETERS

Apart from the basic parameter discussed earlier, there are several other lightning parameters needed in engineering applications include maximum current derivative, average current rate of rise, current rise time, current duration, charge transfer, and specific energy (action integral), which are all derivable from direct current measurements. Distributions of these parameters, presently adopted by CIGRE, are based on direct measurements by Berger and co-workers in Switzerland.

There are also more recent direct current measurements available which are obtained using instrumented towers in Austria, Brazil, Canada, Germany, Japan, Russia and Switzerland, as well as those obtained in several countries using rocket-triggered lightning. Furthermore, modern lightning locating systems report peak currents estimated from measured magnetic or electric field peaks. Additionally, lightning parameters such as the number of strokes per flash (multiplicity), interstroke interval, number of channels per flash, relative intensity of strokes within a flash, return-stroke speed, and equivalent impedance of the lightning channel, as well as characteristics of continuing currents and M-components are among other parameters to be considered. Table 4 shows lightning current parameters (based on Berger's data) recommended by CIGRETB 63 (24) and IEEE Std 1410-2010 (15).

SOME ENGINEERING APPLICATIONS

Lightning parameters are of interest in different fields of research and engineering applications, such as airborne vehicles, construction and oil industry engineering, power network components and wind turbines. The protection against lightning for each application follows specific standards.

Several aspects have been covered by previous CIGRETB 63 (19),TB 118 (1997), TB 172 (2000), TB 360 (2008), TB 287 (2006), TB 441 (2010) and by the ongoing activities of other working groups (e.g. WG C4.408 Lightning Protection of Low-Voltage Networks, WG C4.409 Lightning Protection of Wind Turbine Blades, WG C4.410 Lightning Striking Characteristics for Very High Structures, WG C4.23 Guide to Procedures for Estimating the Lightning Performance of Transmission Lines, WG C4.26 Evaluation of Lightning Shielding Analysis Methods for EHV and UHV DC and AC Transmission Lines).

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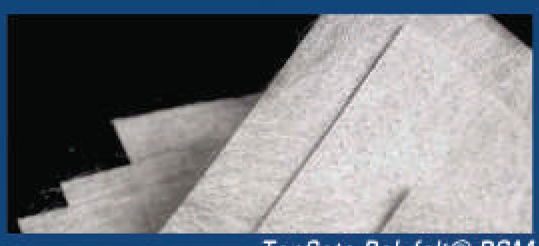

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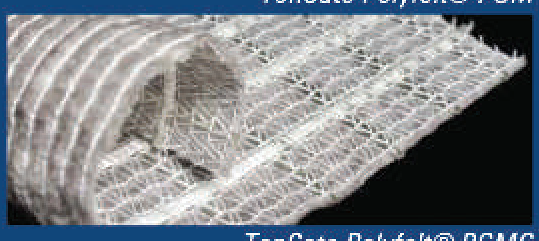

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Table 4: Lightning current parameters (based on Berger's data) recommended by CIGRETB 63 and IEEE Std 1410-2010

Parameters of log-normal distribution for negative downward flashes				
Parameter	First Stroke		Subsequent stroke	
	***M*, Median**	**β, logarithmic (base e) standard deviation**	***M*, Median**	**β, logarithmic base standard deviation**
FRONT TIME (μs)				
$t_{d10/90} = T_{10/90}/0.8$	5.63	0.576	0.75	0.921
$t_{d30/90} = t_{30/90}/0.6$	3.83	0.553	0.67	1.013
$t_m = I_F / S_m$	1.28	0.611	0.308	0.708
STEEPNESS (kA/μs)				
S_m, Maximum	24.3	0.599	39.9	0.852
S_{10}, at 10%	2.6	0.921	18.9	1.404
$S_{10/90}$, 10-90%	5.0	0.645	15.4	0.944
$S_{30/90}$, 30-90%	7.2	0.622	20.1	0.967
PEAK (CREST) CURRENT (kA)				
I_I, initial	27.7	0.461	11.8	0.530
I_F, final	31.1	0.484	12.3	0.530
Ratio, I_I/I_F	0.9	0.230	0.9	0.207
OTHER RELEVANT PARAMETERS				
Tail Time to Half Value t_h (μs)	77.5	0.577	30.2	0.933
Number of stokes per flash	1	0	2.4	0.96 based on median N_{total}=3.4
Stroke Charge, Q_I (Coulomb)	4.65	0.882	0.938	0.882
$\int I^2 dt$ ($(\mathrm{kA})^2 s$)	0.057	1.373	0.0055	1.366
Interstroke interval (ms)	-	-	35	1.066

In the case of transmission lines for instance, the protection is mainly based on the use of shield wires (or overhead ground wires) and selective use of surge arresters. Some special methods have also been successfully used for improving the lightning performance (17). Generally, the grounding system has a great influence on the effectiveness of the protection means. In the IEC 62305 series, those parameters are the basis of the developed standard for the protection of structures, living beings and electrical and electronic systems against lightning.

Effective shield wire protection is characterised by low probability of both shielding failures and back-flash-overs. Modelling and procedures for the estimation of these probabilities are addressed by both CIGRE document (24) and IEEE Standards (15, 17).

CONCLUSION

This paper has briefly discussed some of the basic lightning parameters that are needed in the power engineering calculations, along with relevant references to standards and the recent literature on the subject. Looking at several engineering applications with regards to the obtained parameters, the use of these parameters in the standard series IEC 62305 and several IEEE standards for instance are mainly based on the direct measurements by Bergerand co-workers in Switzerland. Meanwhile more recent direct current measurements were obtained from instrumented towers in Austria, Germany, Russia, Canada and Brazil, as well as from rocket-triggered lightning. Further, modern lightning locating systems (LLS) report peak currents estimated from measured electromagnetic field peaks. ■

REFERENCES

[1] Murty, O. P., Chong, K. K., Husin, M. H. A., Kumar, R. K. N. and Yusuf, W. Y. W. M., “Fatal lightning strikes in Malaysia: A review of 27 fatalities,” Amer. J. Forensic Medicine & Pathology, vol. 30, no. 3, pp. 246–251, 2009.

[2] Chao, T. C.,Pakiam, J. E. and Chia, J., “A study of lightning deaths in Singapore,” Singapore Medical J., vol 22, no. 3, June 1981.

[3] Rakov, V. A. and Uman, M A., “Lightning: Physics and Effects. Cambridge Univ. Press,2007

[4] Hidayat, S., “Characteristic of lightning in Indonesia observed by lightning location system,” Ph.D. thesis, Dept. of Electrical Engineering, University of Tokyo, Japan, 1996.

[5] Hamid, E.Y., Kawasaki, Z., Mardiana, R. and Matsura, K., “TRMM/lis observations of lightning activity over Indonesia and comparison with ground-based measurement around Java Island,” J. Atmos. Electr., vol. 19, no. 2, pp. 153–164, 1999.

[6] G.K. Manohar and A.P. Kesarkar, “Climatology of thunderstorm activity over the Indian region: A study of east-west contrast,” Mausam, vol. 54, pp. 819–828, 2003.

[7] Manohar, G. K. and Kesarkar, A.P., “Climatology of thunderstorm activity over the Indian region: II. Spatial distribution,” Mausam, vol. 55, pp. 31–40, 2004.

[8] Gomes, C. and Kadir, Z., “A theoretical approach to estimate the annual lightning hazards on human beings”, Atmospheric Research, Vol. 101, Issue 3, pp. 719-725, 2011

[9] Asha, N., Manohar, G. K., Dani, K. K. and Devara, P. C. S. “A study of lightning activity over land and oceanic regions of India,” J. Earth System Science, vol. 118, no. 5, pp. 467–481, 2009.

[10] Mir, H., Hussain, A. and Babar, Z. A., “Analysis of thunderstorms activity over Pakistan during (1961-2000),” Pakistan J. Meteorology, vol. 3, no. 5, pp. 13–34, June 2006.

[11] Gomes, C., Ahmed, M., Abeysinghe, K. R. and Hussain, F., “Lightning accidents and awareness in South Asia: Experience in Sri Lanka and Bangladesh,” in Proc. 28th Int. Conf. Lightning Protection (ICLP), Kanazawa, Japan, Sept. 2006.

[12] Shwehdi, M. H., “Thunderstorm distribution and frequency in Saudi Arabia,” J. Geophysical Eng., vol. 2, pp. 252–267, 2005

[13] Berger, K; Anderson, R. B. and Kroninger, H., “Parameters of lightning flashes”, ELECTRA, No. 41, pp. 23-37, 1975.

[14] Anderson, R. B. and Eriksson, A. J., “Lightning Parameters for Engineering Application,” ELECTRA, no. 69, pp. 65-101, 1980

[15] IEEE Standard 1410-2010. 2010. IEEE Guide for Improving the Lightning Performance of Electric Power Overhead Distribution Lines

[16] CIGRÉ Task Force C4.01.02-B, Torres, H. (Chair), “Ground Flash Density: definition of the appropriate grid size and a proposal of relationship Ng vs. Td for Tropical zones,” Activity Report, CIGRE WG C4.01 Meeting, Dallas, Texas, Sept. 2003.

[17] IEEE Std 1243-1997. IEEE Guide for Improving the Lightning Performance of Transmission Lines, 1997.

[18] IEC Standard 62305-1: 2010. Protection against lightning - Part 1: General principles, Edition 2.0., 2010

[19] IEC Standard 62305-2: 2010. Protection against lightning - Part 2: Risk management, Edition 2.0., 2010

[20] IEC Standard 62305-3: 2010. Protection against lightning - Part 3: Physical damage to structures and life hazard, Edition 2.0., 2010

[21] IEC Standard 62305-4: 2010. Protection against lightning - Part 4: Electrical and electronic systems within structures, Edition 2.0., 2010

[22] Hileman, A. R. Insulation coordination for power systems, 767p.,NewYork: Marcel Dekker, 1999.

[23] F. Popolansky, "Frequency Distribution of Lightning Currents," ELECTRA 22, pp. 139 - 147, 1972,

[24] CIGRÉ Working Group 33.01. Guide to procedures for estimating the lightning performance of transmission lines, CIGRE Technical Brochure no. 63, October 1991.

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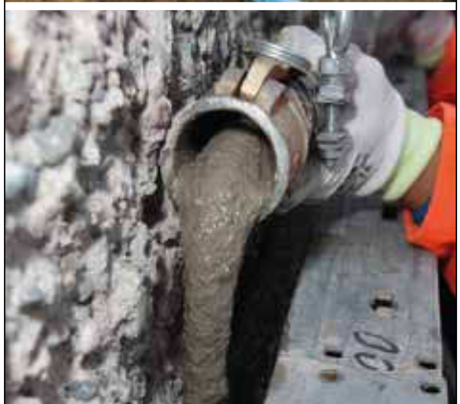

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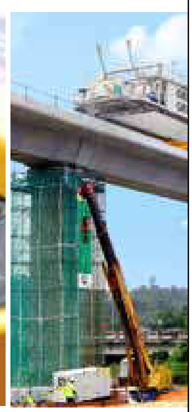

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Protection Against Lightning: Stock Taking for a Better Future

reported by
Ir. Dr Rodney Tan

Ir. Dr Rodney Tan *is a committee member of Electrical Engineering Technical Division (Session 2015/2016). He is Associate Professor of Faculty of Engineering, UCSI University. His research interest include power quality, power electronics and renewable energy.*

reported by
Ir. Dr Matthew Teow

Ir. Dr Matthew Teow *is a co-opted committee member of Electrical Engineering Technical Division (Session 2015/2016). He is the Head of School of School of Engineering, KDU University College, Glemarie Campus. His technical specialization is electronics engineering.*

Damage inflicted on both living things and non-living things due to lightning has been widely reported in the press. Lives have been lost and, when properties are damaged by lightning, millions of ringgit are lost in the process.

Therefore, "appreciating the need for lightning protection and educating engineers about it, is the rightful role of IEM", said IEM president Dato' Lim Chow Hock, at the opening of a one-day symposium on protection against lightning held on 27 November 2014, at Grand Dorsett Subang Jaya.

To promote compliance of the relevant standards on protection against lightning, Datuk Ir. Ahmad Fauzi assured symposium participants that MS IEC 62305 will be enforced by the Energy Commission for the good of general public.

Two keynote papers were presented. The first was presented by Professor Liew Ah Choy who used multiple case studies with respect to current practices on lightning protection and limitations applicable to various types of structure. Dato' Jimmy Lim Lai Ho, who presented the second keynote paper, also relied on case studies with examples drawn from MRT underground stations in the areas of earthing and lightning protection. For an overview of the papers presented, please see the table below.

	Topics	Speakers
Keynote addresses	1. Lightning and Tall Structures—Some Problems and Solutions 2. Application of MS IEC 62305: 2008, BS EN 50164 and IEEE STD 80 Earthing and Lightning Protection Standard for the MRT Project: Case study on MRT Underground Stations.	Prof. Liew Ah Choy Dato' Jimmy Lim Lai Ho
Technical papers	1. Lightning Parameters for Engineering Applications 2. Air Terminal Placement: The key to an Effective Lightning Protection of Structures 3. Protection Against Lightning for TNB Premises 4. Lightning Protection for Solar PV Farm 5. Regulatory Framework, Development of Standards and Requirement for Protection Against Lightning 6. TC81: Development and Requirements of IEC Standards on Protection Against Lightning 7. Protection of Electrical and Electronic Equipment and Systems Against LEMP 8. Design & Maintenance of Lightning Protection Systems	Prof. Mohd Zainal Abidin Ab Kadir Mr. Hartono Zainal Abidin Ir. Noradlina Abdullah Mr. Wee Chek Aik Ir. Hj. Abdul Rahim B. Ibrahim Mr. Masaaki Sato Ir. Lim Kim Ten Mr. Thomas Yeo

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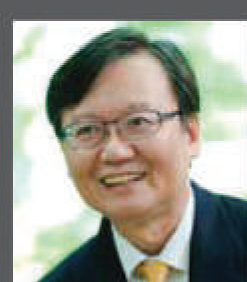
JOINT OPENING KEYNOTE SESSION - TUESDAY 1 SEPTEMBER 2015 - 9:00AM

Dr. Praipol Koomsup, Vice Minister of Energy, Ministry of Energy, Thailand

Dr. Piyasvasti Amranand, Chairman, PTT Public Company Limited, Thailand



Mr. Soonchai Kumnoonsate, Governor of Electricity Generating Authority of Thailand, Thailand

EXHIBITION OPENING HOURS:
Tuesday 1 September 10:30-18:00
Wednesday 2 September 10:00-18:00
Thursday 3 September 10:00-16:00

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A total of eight technical papers covering the design, regulatory framework and application of lightning protection systems were discussed.

In the first paper, Professor Mohd Zainal discussed the types of lightning discharges into the ground and ways to design the surge protection devices. In the second paper, Mr. Hartono Zainal Abidin explained the various types of lightning protection methods and the common errors in interpreting conventional air terminal placements.

On a more practical note, Ir. Noradlina Abdullah of TNB provided an overall view of the lightning detection system network in Malaysia among other things. The fourth paper was presented by Mr. Wee Chek Aik who touched on ways to overcome the disadvantages of air terminal network for solar PV farm.

The next speaker was Ir. Haji Abdul Rahim. He described the arduous journey in the adoption of MS IEC 62305 by the Energy Commission in 2011. An overview of the various lightning protection system related to IEC 62305 and IEC 62561 was given by Mr. Masaaki Sato.

Ir. Lim Kim Ten, a member of the organising committee of IEM Electrical Engineering Technical Committee, gave an account of a typical pathway that could damage equipment. As a fitting conclusion to the symposium, Mr. Thomas Yeo recounted the evolution of CP326 to MS IEC62305. He then went on to share his experience in maintenance, inspection and audit that complies with MS IEC 62305.

The symposium was a success as shown by the active participation in the question and answer session by those who attended. The chairman of IEM Electrical Engineering Technical Division Ir. Lam Sing Yew delivered the closing remarks at the end of the symposium. ■

IEM DIARY OF EVENTS

Title: Talk on Finite Element Modelling (FEM) of Offshore Structures

28 July 2015

Organised by	: Oil, Gas and Mining Engineering Technical Division
Time	: 5.30 p.m. – 7.30 p.m.
CPD/PDP	: 2

Title: 2-Day Course Recognized Good Practices of Project Management

29 July 2015 - 30 July 2015

Organised by	: Project Management Technical Division
Time	: 9.00 a.m. – 5.00 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.

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SABAH EARTHQUAKE - NEW EARTHQUAKE LOADING STANDARD TO BE DEVELOPED

The Institution of Engineers, Malaysia (IEM) would like to express our heartfelt sympathies to the families of the victims of the recent earthquake in Sabah. We are deeply saddened to know that the earthquake, measuring 5.9 on the Richter scale (as reported by Malaysian Meteorological Department), which struck at 7.15a.m. on 5 June, has caused damage to buildings and resulted in death and injuries.

Immediately after the incident, IEM Technical Committee on Earthquake conducted an analysis to predict the level of ground shaking which is measured in terms of Peak Ground Acceleration (PGA) of the incident, based on its earthquake ground motion model. The predicted result of the PGA value is in the order of 0.05g at Kota Kinabalu which is located 50-60 km from the epicentre of the earthquake. This predicted level of ground shaking (PGA of 0.05g) is roughly consistent with the degree of damage to buildings as observed.

IEM is currently working with SIRIM as the Standard Writing Organisation (SWO) to develop the Malaysia National Annex to Eurocode 8: Design of structures for earthquake resistance. This draft National Annex proposed a reference PGA value of 0.12g (level of ground shaking) to be adopted for the design of ordinary buildings in Sabah. IEM is of the opinion that all building designs should take seismic loading requirement into consideration.

Dato' Ir. Lim Chow Hock
President
9 June 2015

The Press Statement was published in the following media: (10 June 2015)

1) The STAR (10 June 2015) – "New Standards for Building Works" (Online and Newsprint)
   http://www.thestar.com.my/Opinion/Letters/2015/06/10/New-standards-for-buildings-in-the-works/
2) Berita Harian (10 June 2015) – "IEM analisis tahap gegaran" (Newsprint)

SABAH EARTHQUAKE - POST-EARTHQUAKE HAZARDS

The Institution of Engineers Malaysia (IEM) is concerned over the recent earthquake and relatively strong aftershocks at the Ranau/ Kundasang area from 5-18 June, 2015. A number of post-earthquake hazards need to be considered by the authorities when undertaking emergency operations.

The authorities must initiate post-hazard assessments on affected buildings and infrastructures as well as to ensure safety of the affected lands before permitting their continued occupation.

The 4 significant potential hazards are:

Landslides: The overburdened earth covers on steep mountain slopes are prone to instability, particularly during wet weather. This may result in landslides. The slopes are especially vulnerable given their weakened state following the earthquake.

Rockfall: Rockslides and rockfalls down the steep mountain sides, from the loosened rock mass and unstable boulder piles, are inevitable. In the natural setting of the steep slopes, the long run-out of rock slides presents great risks to people and properties along the travel paths of the hazards.

Debris laden streamflow: Considering the very steep sided terrains, debris dams tend to be created by earth and rock slide depositions in the valley floors to block off running waterways. These temporarily-stable debris dams can breach and burst without warning and with terrifying consequences when deluging downstream areas after releasing torrents of mud, boulders and uprooted large trees together with the flood waters, to smash through any obstruction. They are powerful enough to gouge into the sidewalls of valleys to induce further landslides and release more debris into the stream channel.

Ground liquefaction related damages: Coastal and waterlogged riverine areas may suffer ground liquefaction (where the ground behaves like liquid (e.g. quick sand) when shaken by an earthquake) and related damages leading to excessive settlement of roadways and severe lateral spreading of the ground.

All the above hazards can result in the destruciton of buildings, bridges, homes and farmlands and the disruption of essential infrastructures such as power lines, gas lines, road links, telecommunications, potable water supply, healthcare and public order.

It would be incumbent upon the authorities to promptly evacuate people from the identified hazard zones to avoid casualties. The evacuees need to be relocated to safety in temporary shelters with food and basic needs until such time that the hazards are identified and addressed and essential services restored to their communities.

To ensure public safety, the post-hazard assessments on the structural integrity of the affected buildings, infrastructures and the safety of the affected land for subsequent usage need to be undertaken by qualified professionals.

IEM, with its large number of members possessing the necessary professional qualifications and expertise available, is ever ready to assist the authorities in assessing the affected areas for safe emergency operations and subsequent reconstruction works.

Dato' Ir. Lim Chow Hock
President
22 June 2015

The Press Statement was published in the following media:
(23 June 2015)
1) The STAR (23 JUNE 2015) – VIEWS (Page 32) : "Engineering group ready to help)" (ONLINE & NEWSPRINT)
http://www.thestar.com.my/Opinion/Letters/2015/06/23/Engineering-group-ready-to-help/
2) The Borneo Post (23 JUNE 2015) – "Ranau, Kundasang face four post-quake hazards – IEM"
http://www.theborneopost.com/2015/06/23/ranau-kundasang-face-four-post-quake-hazards-iem/

(22 June 2015)
3) The Malaymail Online (22 JUNE 2015) – "Post Hazard Assessment needed, professionals say Sabah quake" (ONLINE)
http://www.themalaymailonline.com/malaysia/article/post-hazard-assessments-needed-professionals-say-after-sabah-quake

IEM DIARY OF EVENTS

Technical Visit to Boilermech Sdn. Bhd.

30 July 2015
Organised by : Agricultural and Food Engineering Technical Division
Time : 9.00 a.m. – 1.00 p.m.
CPD/PDP : 3

19th Annual General Meeting of Engineering Education Technical Division, IEM

1 August 2015
Organised by : Engineering Education Technical Division
Time : 11.00 a.m. – 1.00 p.m.
CPD/PDP : 0

Talk on Designing With Computers

6 August 2015
Organised by : Civil and Structural Engineering Technical Division
Time : 5.30 p.m. – 7.30 p.m.
CPD/PDP : 2

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

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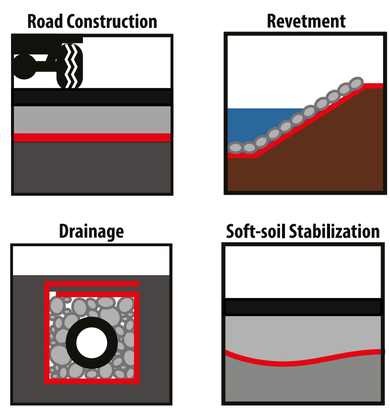

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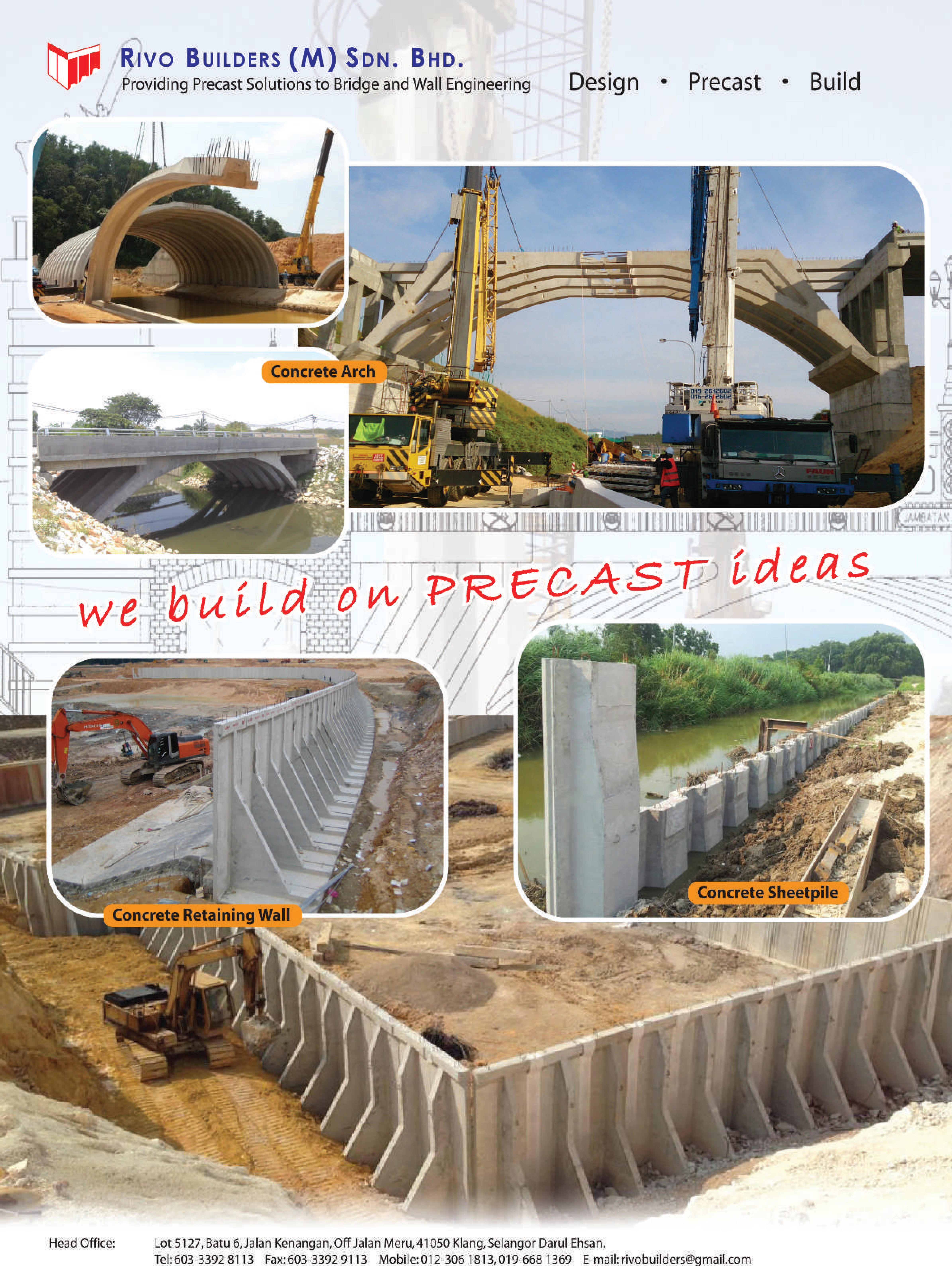
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Eleven Years in the Life of Franz Josef

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.*

Franz Josef is my friend. I visited him in 2003 and again in 2014. In this relatively short period of time, he has changed quite a fair bit and I am very concerned.

I am referring to the famous glacier on the west coast of New Zealand's South Island. German geologist-explorer Julius von Haast named it after Emperor Franz Josef I of Austro-Hungary Empire in 1865. The glacier is located in Westland Tai Poutini National Park which also encompasses Fox Glacier some 20km to the south.

My family and I had stayed the night at the lovely little village of Franz Josef. The following morning, we drove to a carpark 5km to the south of the village and then walked 3km towards the glacier face.

From the temperate rainforest next to the carpark, we emerged at a vast gravel plain left behind by past glacial retreats. The glacier itself loomed majestically ahead, flanked by lofty mountains. Waterfalls tumbled down the cliffs. Boulders coated with orange-coloured mosses covered much of the plain.

The view was one of the most impressive on our trip and the walk was quite relaxed and pleasant. We took about two hours to reach the viewing platform on the terminal moraine. The glacier face was still more than 100m away but that was the nearest we could get to it.

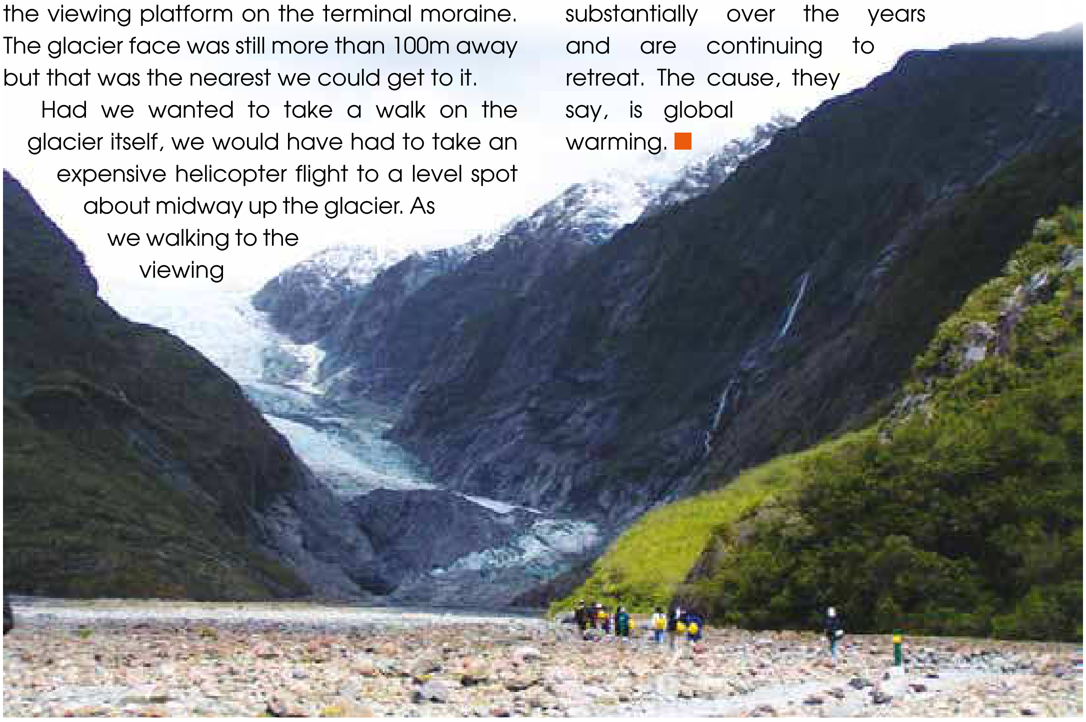
Had we wanted to take a walk on the glacier itself, we would have had to take an expensive helicopter flight to a level spot about midway up the glacier. As we walking to the viewing platform, we could see about a dozen helicopters flying towards the glacier.

The scenario was very different during our first visit to Franz Josef Glacier in 2003. My friends and I were able to walk onto the glacier directly from the valley floor, wearing blue jackets to keep warm and using crampons attached to our shoes to enable us to walk on the ice. These items were provided by the tour company. We had a great time walking on the glacier and we even squeezed our way through one or two crevasses.

Obviously Franz Josef Glacier has retreated quite significantly over the past 11 years. Its rate of retreat is indeed extremely rapid in geological terms.

Over time, Franz Josef Glacier has exhibited a cyclical pattern of advance and retreat, depending on the volume of melt water flowing from the glacier to the river downstream and the volume of snowfall added to the snowfield high on the mountains which feeds the glacier. The glacier advances if the former is less than the latter. On the other hand, it retreats if the former exceeds the latter.

According to glaciologists, most of the glaciers in the world have retreated substantially over the years and are continuing to retreat. The cause, they say, is global warming. ■



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

TEMUDUGA PROFESSIONAL

Tarikh: 15 June 2015

To All Members,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2015

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2015.

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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Nama	Kelayakan
KEJURUTERAAN AWAM	
LEE LEONG WEI	BE HONS (UTAR) (CIVIL, 2010)
MUHAMMAD ERWAN BIN ZULKIFFLY	BE HONS (UiTM) (CIVIL, 2009) MSc (UiTM) (CONSTRUCTION, 2014)
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16559	TEOH BOON LAI	BE HONS (UTM) (CHEMICAL, 1998)
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29798	AMINUDDIN BIN SUHAIMI	BE HONS (UTM) (CIVIL, 2007) ME (UTM) (CIVIL-STRUCTURAL, 2015)
27292	CHIN YIT TING	BE HONS (USM) (CIVIL, 2007)
45322	JERRY BETIE CHIN TIMOTHY ASSON	BE HONS (UiTM) (CIVIL,2007)
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No. Ahli	**Nama**	**Kelayakan**
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51267	ZAFIRAH BINTI ZULKIFLI	BE HONS (UNITEN) (ELECTRICAL & ELECTRONICS, 2009)
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43536	ABDUL JAMEEL BIN A. ABDUL GAFOOR	BE HONS (UNISEL) (CIVIL, 2009) MBA (EAST LONDON) (INTERNATIONAL BUSINESS, 2014)
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39996	MOHD IZWAN BIN A RAHMAN @ AB RAHMAN	BE HONS (UTM)(MECHANICAL-MATERIALS, 2004)

PERMOHONAN BARU MENJADI AHLI

No. Ahli	Nama	Kelayakan
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Pengumuman yang ke-82

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.	22447	AHMAD KHAIRUL HAKIMIN BIN IBRAHIM
2.	00228	BALARAMAN K.G.
3.	27648	CHAN KAM HOY
4.	10908	CHANG CHOOI FOONG
5.	13857	CHIN CHOON SENG
6.	29053	CHIN KOK YOU
7.	20955	CHOK CHING HUAT
8.	10229	CHONG LAI KEONG
9.	59113	CHONG SHIAU IUN, ABRAHAM
10.	01666	CHOY FOOK KUN
11.	14128	CHU CHUN TAU, PETER
12.	44154	CHUE SZE LYN
13.	23901	DALIA UTAMA BINTI ZULNISYAM
14.	12703	DR. MOHD. ZAMZAM BIN JAAFAR
15.	42042	EDDY MOHD FAIRUZ BIN MOHD YUSSLEE
16.	24799	FADZIL HARMAN SHAH BIN MUHAMAD JOHAR
17.	38798	FAIZAL BIN MOHD ISMAIL
18.	38798	FAIZAL BIN MOHD ISMAIL
19.	36775	FAN SHAO SHYEN
20.	02728	HII HIENG HUI
21.	10013	JAMALUDIN BIN TAKEI
22.	12533	KAMARUDIN BIN ABD. KARIM
23.	21430	KHAIRIL AZMAN BIN ISMAIL
24.	15881	KUMARI NALINI A/P P. SUBRAMANIAM
25.	58695	LAI SOO CHIN
26.	07826	LAU LEE YENG
27.	21581	LAW YAN CHEE
28.	09010	LEONG SANG KHIM
29.	16723	LIM SIN POH
30.	14337	LIM YUEK LUH
31.	10697	LOH FOOK GUAN

NO.	NO. AHLI	NAMA
31.	10697	LOH FOOK GUAN
32.	19710	LOK NGAI HEY
33.	12975	MEOR RUSLAN BIN MOHD. IDRIS
34.	11511	MOHAMAD AZMI BIN ABDULLAH @ MAMAT
35.	24170	MOHD SALLEH BIN NGAH MAT DRUS
36.	16217	MUHAMMAD ASHRI BIN MUSTAPHA
37.	24360	MUKHTAR BIN CHE ALI
38.	09016	MUSA BIN OMAR
39.	01408	NG KENG LIAN
40.	25259	NG SENG YEW
41.	21285	NG WENG LIANG
42.	05709	NIK AB RAHIM BIN NIK ISMAIL
43.	19210	ONG THIAM LING
44.	20427	PANG CHIA PIAU
45.	11588	POOK FONG FEE
46.	07279	RAFIEE BIN MAMAT
47.	07029	SIA CHAY THIAM
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50.	08930	SOH THIAM BENG
51.	03273	SYED ZAIN AL-KUDCY BIN DATO' SYED MAHMOOD
52.	10328	TAN BEE YONG
53.	08955	TAN GEEM ENG
54.	14140	TAN HONG BOON
55.	14199	TAN KIM THIN
56.	20099	TEE BENG HOCK
57.	14955	TENGKU HAZIAN BIN TENGKU AB. HAMID
58.	11921	WONG BOON LIM
59.	05023	WONG KA HOW
60.	25758	WONG KING HONG
61.	04610	WONG SOON HIIK
62.	27465	DATUK PROF. ISMAIL BIN HASSAN

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:

- Contribution to the well-being of people and communities,
- Resourcefulness in planning,
- Creativity in the solution of design problems,
- Pioneering use of materials and methods,
- Innovations in planning, design and construction,
- 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**

- in the design and/or construction of an engineering device or system of merit; **or**
- 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:

- Registered member with the Board of Engineers, Malaysia and under 35 years of age
- Malaysian citizens or permanent residents of Malaysia
- 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***.

IEM DIARY OF EVENTS

One-Day Workshop on "From Design to Prototype: Level 1"

8 August 2015

Organised by	: Mechanical Engineering Technical Division
Time	: 8.30 a.m. – 5.30 p.m.
CPD/PDP	: 7

One-Day Workshop on Rock Blasting and Explosive Engineering

11 August 2015

Organised by	: Oil, Gas and Mining Engineering Technical Division
Time	: 9.00 a.m. – 5.00 p.m.
CPD/PDP	: 6

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.

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

KEJURUTERAAN ALAM SEKITAR

No. Ahli	Nama	Kelayakan
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)
74452	RINI ASNIDA BINTI ABDULLAH	B.E.HONS.(UTM) (CIVIL, 2001) M.E.(UTM)(CIVIL, 2006 P.HD.(LEEDS)(CIVIL, 2012)
75261	SHAHIRON BIN SHAHIDAN	B.E.HONS.(UNISEL) (CIVIL, 2007) M.SC.(UPM)(CIVIL, 2010) P.HD.(USM)(CIVIL, 2014)

73280	SHAMALA D/O KOPALA KRISHNAN	B.E.HONS.(UNITEN)(CIVIL, 2006)
74111	SIA CHEE CHUNG	B.E.HONS.(BRADFORD)(CIVIL, 2010) M.SC.(LEEDS)(CIVIL, 2011)
74101	SIEW KHIN WAH	B.E.HONS.(UTHM)(CIVIL, 2012)
73359	SITI NORSITA BINTI MOHD RAWI	B.E.HONS.(UMP)(CIVIL, 2010) M.E.(UMP)(CIVIL, 2013)
72616	SIVARAJ A/L ANNAMALAI	B.E.HONS.(MALAYA)(CIVIL, 2008)
72623	SWEE YENN PERNG	M.E.(BRADFORD)(CIVIL, 2010)
74307	TANEIZ CHELVAM A/L SELVARAJAH	B.E.HONS.(UTM)(CIVIL, 2012)
74119	TEH SIEW FEI	B.E.HONS.(UKM)(CIVIL, 2004)
73277	TEH WEI HONG	M.E.HONS.(NOTTINGHAM)(CIVIL, 2014)
74103	TEW SEOW TING	B.E.HONS.(UMP)(CIVIL, 2012)
73389	TING SIAW LYNN, LAURA	B.E.HONS.(SWINBURNE)(CIVIL, 2010)
73016	WALTER ANAK LAWRENCE	B.E.HONS.(UNIMAS)(CIVIL, 2009)
73368	WAN NOR HAZIERAH BINTI SOED	B.E.HONS.(UITM)(CIVIL, 2012)
74206	WONG SOON YEE	M.E.HONS.(NOTTINGHAM)(CIVIL, 2014)
72630	WOON WAI JACK	B.E.HONS.(UTM)(CIVIL, 2013)
73398	YAP CHUN CHONG, ALVIN	B.E.HONS.(SWINBURNE)(CIVIL, 2011)
72651	YONG JE WEI	B.E.(MONASH)(CIVIL, 2013)
74567	ZAKARIA BIN BESAR	B.E.HONS.(UPM)(CIVIL, 1995)
73369	ZANARIYAH BINTI ABU BAKAR	B.E.HONS.(UTM)(CIVIL, 2012)
73324	MUHAMMAD HAMBALI BIN TOBIAANY	B.E.HONS.(MCMASTER)(MATERIALS, 2013)
72624	TEE JVN YI	B.E.HONS.(NOTTINGHAM)(MATERIALS, 2012) M.SC.(NOTTINGHAM)(MATERIALS, 2013)
74557	ROSMINA BINTI JAAFAR	B.SC.(CASE WESTERN RESERVE)(BIO-MEDICAL, 1991) M.SC.(HERTFORDSHIRE)(BIO-MEDICAL, 2000) P.HD.(UKM)((BIO-MEDICAL, 2009)
73363	ABDUL HADRI BIN AB HALIM	B.E.(UMP)(ELECTRICAL, 2010)
74118	ALEX A/L ELIZABETH ENCHING	B.E.HONS.(UTM)(ELECTRICAL, 2004)
72735	CHIEW CHIN HERN	B.E.HONS.(UNIMAP)(ELECTRICAL, 2013)
74301	CHIN LI HAN	B.E.HONS.(UTP)(ELECTRICAL, 2004)
73384	CHONG KIAT SHIU	B.E.HONS.(UTAR)(ELECTRICAL, 2008) M.E.(UTM)(ELECTRICAL, 2011)
73319	CHOO HUEY MEI	B.E.HONS.(UNITEN)(ELECTRICAL, 2012)
72725	CHUA HOCK GUAN	B.E.HONS.(UTHM)(ELECTRICAL, 2010) M.E.(UTHM)(ELECTRICAL, 2013)
73026	D.KOHULEBALAN A/L V. DANDAPANI	B.E.(NORTHUMBRIA)(ELECTRICAL & ELECTRONIC, 1998)
73461	DR. ZAKARIA BIN HUSSAIN	B.E.HONS.(HUDDERSFILED)(ELECTRONIC & ELECTRICAL, 1997) P.HD.(SHEFFIELD)(AUTOMATIC CONTROL & SYSTEMS, 2010)
74330	EBRAHIM ABDULAZIZ ALI AL-SHALIF	B.E.HONS.(UTHM)(ELECTRICAL, 2014)
72713	EVENDY CHONG	B.E.HONS.(UMS)(ELECTRICAL, 2008)
75260	FARHEEN BINTI SUHAIMI	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
75268	FATEN BINTI HAJI MOHD SAID	B.E.HONS.(UTP)(ELECTRICAL, 2006)
72634	FIRDAUS BIN KHALID	M.E.HONS.(MANCHESTER)(ELECTRICAL, 2013)
73773	GOH JING WEI, JEREMY	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
72633	HISHAMUDDIN BIN BUYONG	B.E.HONS.(UITM)(ELECTRICAL, 2013)
72627	ISHAR BIN ITAM	B.E.HONS.(UITM)(ELECTRICAL, 2004)

74556	KARTHIKUMARAN A/L NADARAJAN	B.E.HONS.(AIMST)(ELECTRICAL, 2010)
73322	KHAIRUN NISA BINTI KHAMIL	B.E.HONS.(UNITEN)(ELECTRICAL, 2009)
72730	KIMBERLY ANDING	B.E.HONS.(UTEM)(ELECTRICAL-INDUSTRIAL POWER, 2012)
73321	LAKSMAN A/L ASIATHAMBY	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
72649	LAW HUAN PING, PETER	B.E.HONS.(UNITEN)(ELECTRICAL, 2011)
74311	LIEW TZE SIA	B.E.HONS.(MALAYA)(ELECTRICAL, 2007)
75259	LIM BOON KIAT	B.E.HONS.(UNITEN)(ELECTRICAL, 2007) MEM.(UPM)(ELECTRICAL, 2014)
73018	MARYAM JAMELA BINTI ISMAIL	B.E.HONS.(UTP)(ELECTRICAL & ELECTRONICS, 2009) M.SC.(UTP)(ELECTRICAL & ELECTRONICS, 2013)
72721	MOHAMAD SABHI BIN HISSAM	B.E.HONS.(UTM)(ELECTRICAL, 2012)
72642	MOHAMAD ZAID BIN MOHAMAD ALI	B.SC.(RENSSELAER)(ELECTRICAL, 2005) M.E.(MALAYA)(ELECTRICAL, 2013)
73721	MOHAMMAD HIZIR BIN ILIAS	B.E.HONS.(UITM)(ELECTRICAL, 2005)
73408	MOHD AZRI BIN MOHD SENARI	B.E.HONS.(UPNM)(ELECTRICAL, 2011)
74305	MOHD EZRAN BIN DARAMI	B.E.HONS.(MMU)(ELECTRICAL, 2005)
73405	MOHD FIRDAUS BIN MOHD ZAKI	B.E.HONS.(MALAYA)(ELECTRICAL, 2009)
73320	MOHD HALMI BIN ABAS	B.E.HONS.(UITM)(ELECTRICAL, 2008)
74104	MOHD IKHWAN KHAIRI BIN MOHAMED RAWI	B.SC.(OHIO STATE)(ELECTRICAL, 2006)
72709	MOHD SAFRI BIN MOKHTAR	B.E.HONS.(UITM)(ELECTRICAL, 2011)
73380	MOHD ZAFROL HAFEEZ BIN SHEE KANDAR	B.E.HONS.(UTM)(ELECTRICAL, 2002)
74550	MUHAMAD FARHAN BIN ABD RAHIM	B.E.HONS.(UITM)(ELECTRICAL, 2013)
74549	MUHAMMAD IKMAL AFIF BIN NORDIN	M.E.HONS.(SHEFFIELD)(ELECTRICAL, 2012)
72646	MUHAMMAD RANDIE BIN ABDULLAH	B.E.HONS.(USM)(ELECTRICAL, 1998)
75255	MUHAMMAD SYAHRANI BIN JOHAL	B.E.HONS.(UTEM)(ELECTRICAL, 2008)
73362	NARESS A/L VIJAYAKUMARAN	B.E.HONS.(UNISEL)(ELECTRICAL, 2012)
73286	NG TZE HERNG	B.E.HONS.(RMIT)(ELECTRICAL, 2013)
73367	NGO KU HEAN, MICHEAL	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
75271	NIK MOHAMAD HASLARIZAL BIN NIK MOHAMAD HASENU	B.E.HONS.(UTM)(ELECTRICAL, 2008)
74120	NIK MOHD HANIF BIN MOHAMED	B.E.HONS.(UTP)(ELECTRICAL, 2012)
73017	NOOR FAZLIANA BINTI FADZAIL	B.E.HONS.(UNIMAP)(ELECTRICAL SYSTEMS, 2012)
72706	NOR IZA BINTI MOHD RAWI	B.E.HONS.(UNITEN)(ELECTRICAL, 2007) M.E.(UNITEN)(ELECTRICAL, 2013)
73361	NURAIDA BINTI MD HASSAN	B.E.HONS.(UMS)(ELECTRICAL, 2001) M.SC.(USM)(ELECTRICAL, 2005)
73284	NUZILAN BIN MUHAMAD	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
73382	ONG BOON LEONG	B.E.HONS.(NORTHUMBRIA)(ELECTRICAL, 1997)
73285	RAJA KHAIRITA AYUNI BINTI RAJA SHAHRIAL	B.E.HONS.(UNITEN)(ELECTRICAL, 2009)
74097	ROHAIDI BIN JAMEIN	B.E.HONS.(UITM)(ELECTRICAL, 2009)
73364	SAKTHIVEL A/L THANGAVELU	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
73318	SITI RAIHAN BINTI AHMAD MAHIR	B.E.HONS.(UNITEN)(ELECTRICAL, 2008)
73772	SUNTHARARAJU A/L SELVATHORAY	B.E.HONS.(UNITEN)(ELECTRICAL, 2013)
73020	TAN BOON KAI	B.E.HONS.(UCSI)(ELECTRICAL & ELECTRONIC, 2012) M.E.(UNITEN)(ELECTRICAL, 2014)

74332	TAN CHEK YAU	B.E.HONS.(UTAR)(ELECTRICAL, 2010)
73013	TAN HAN DIM	B.E.HONS.(UTM)(ELECTRICAL, 2002)
72640	TAN PING YANG	B.E.HONS.(UMS)(ELECTRICAL, 2010)
72639	TAN YU QUAN	B.E.HONS.(RMIT)(ELECTRICAL, 2011)
75269	TEE SIAU CHIEN	B.E.HONS.(MALAYA)(ELECTRICAL, 2013)
74310	THEN KAI HAO	B.E.HONS.(UTHM)(ELECTRICAL, 2006)
72718	TING KEE SIONG	B.E.HONS.(USM)(ELECTRICAL, 2012)
73021	WONG VUI LUN	B.E.HONS.(UCSI)(ELECTRICAL & ELECTRONIC, 2013)
72729	ZAHID BIN JAMUDIN	B.E.HONS.(UMP)(ELECTRICAL-POWER SYSTEMS, 2012)
73383	DR. MAS FAWZI BIN MOHD ALI	B.E.HONS.(UMIST)(ELECTROMECHANICAL SYSTEMS, 1997) M.E.(UTM)(MECHANICAL, 2007) P.HD.(TOKUSHIMA)(EARTH & LIFE ENVIRONMENTAL, 2012)
74336	AHMAD FAIQ BIN MD ZIN	B.E.HONS.(UTEM)(ELECTRONIC, 2014)
75272	AHMAD FAIZUDDIN BIN A BAKAR	M.E.(IMPERIAL COLLEGE LONDON)(ELECTRONIC, 2012)
72907	AL-KHALID BIN HAJI OTHMAN	B.E.HONS.(NOTTINGHAM TRENT)(ELECTRICAL & ELECTRONIC, 1995) M.SC.(NOTTINGHAM)(INFORMATION TECHNOLOGY, 1996) P.HD.(NEWCASTLE UPON TYNE)(2007)
72615	AZIZUL BIN AWANG ANAK	B.E.HONS.(UTM)(ELECTRONIC, 2006)
73281	DR. NABILAH BINTI IBRAHIM	B.E.(SHIBAURA)(ELECTRONIC, 2007) P.HD.(TOHOKU)(ELECTRONIC, 2013)
74309	DR. ZUBAIDA BINTI YUSOFF	B.SC.(OHIO STATE)(ELECTRICAL & COMPUTER, 2000) M.SC.(OHIO STATE)(ELECTRONIC, 2002) P.HD.(CARDIFF)(ELECTRONIC, 2012)
73089	GARY GENT G.R. MOJINGOL	B.E.HONS.(CURTIN)(ELECTRONIC & COMMUNICATION, 2010)
73397	GOH YUET PING	B.E.HONS.(UNITEN)(ELECTRONIC, 2013)
72625	ISMAIL BIN AWANG	B.E.HONS.(UTM)(ELECTRONIC, 2010)
73092	IT SEYAAM A/P SOMPHORN	B.E.HONS.(UTM)(ELECTRICAL-ELECTRONICS, 2010)
73365	KHAIRUDDIN BIN ABDULLAH	B.E.HONS.(UITM)(ELECTRONIC, 2008)
74564	KHAIRUL FAIZAL BIN RAMLI	B.E.HONS.(UITM)(ELECTRONIC, 2009)
75256	KISMET ANAK HONG PING	B.E.HONS.(UNIMAS)(ELECTRONIC, 1999) M.SC.(LOUGHBOROUGH)(ELECTRONIC, 2000) P.HD.(NAGASAKI)(ELECTRONIC, 2009)
73392	KUAN YEE CHIANG	B.E.HONS.(UNIMAS)(ELECTRONIC, 2009)
73082	MOHAMAD HAFIZE BIN RAMLI	B.E.HONS.(UTEM)(ELECTRONIC-WIRELESS COMMUNICATION, 2013)
73371	MOHAMED SAIFUL BIN ZAINAL ABIDIN	B.E.HONS.(UTM)(ELECTRONIC, 2009)
73282	MOHD AZIM BIN MAHMUD	B.E.HONS.(UTM)(ELECTRONIC, 2009)
72836	MOHD KAMARUL IHSAN BIN ZAINAL ABIDIN	B.E.HONS.(UTEM)(ELECTRONIC, 2008)
72622	MOHD. FADZLI BIN HAMIDON	B.E.HONS.(UTM)(ELECTRONIC, 2011)
74335	MUHAMAD NOOR RUSHDAN BIN ABDULLAH	B.E.HONS.(UTEM)(ELECTRONIC, 2014)
74117	NOORAZRENIME BINTI MAHMOD	B.E.HONS.(UTM)(ELECTRONIC, 2000)
74456	NORDIN BIN AMINUDDIN	B.E.HONS.(UTHM)(ELECTRONIC, 2005)

Note: *Remaining list would be published in the August 2015 issue. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at http://www.myiem.org.my.*

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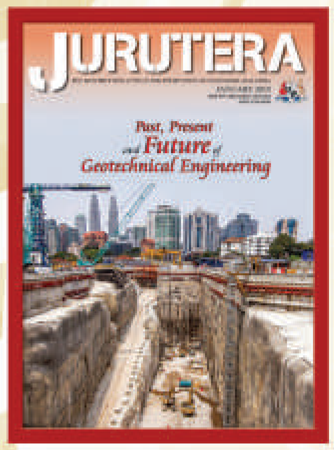

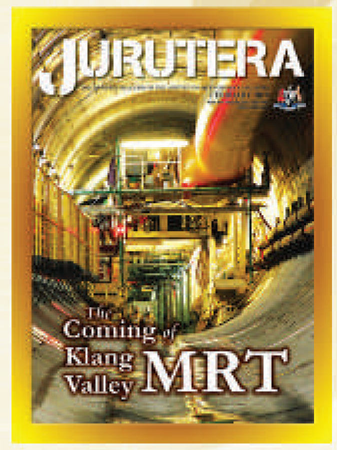

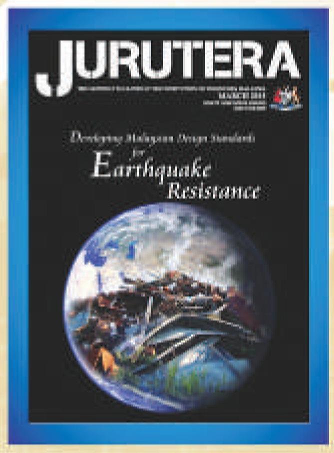

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SPECIFIED POSITION *(Full color ad)*	**1 INSERTION**	**3 INSERTIONS**	**6 INSERTIONS**	**9 INSERTIONS**	**12 INSERTIONS**
Outside Back Cover (OBC)	7,800	7,050	6,750	6,450	6,150
Inside Front Cover (IFC)	7,250	6,650	6,350	6,050	5,750
Inside Back Cover (IBC)	6,750	6,250	5,950	5,650	5,350
Page 1	6,650	6,150	5,850	5,550	5,250
Facing Inside Back Cover (FIBC)	6,150	5,850	5,550	5,250	4,950
Facing Contents Page (FCP)	5,700	5,150	4,950	4,750	4,550
Centre Spread	11,200	9,500	9,000	8,500	8,000
ROP Full Page	4,900	4,500	4,300	4,100	3,900
ROP Half Page	2,900	2,650	2,550	2,450	2,350
ROP 1/3 Page	2,200	2,000	1,900	1,850	1,800
ROP 1/4 Page	1,950	1,750	1,650	1,600	1,550

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