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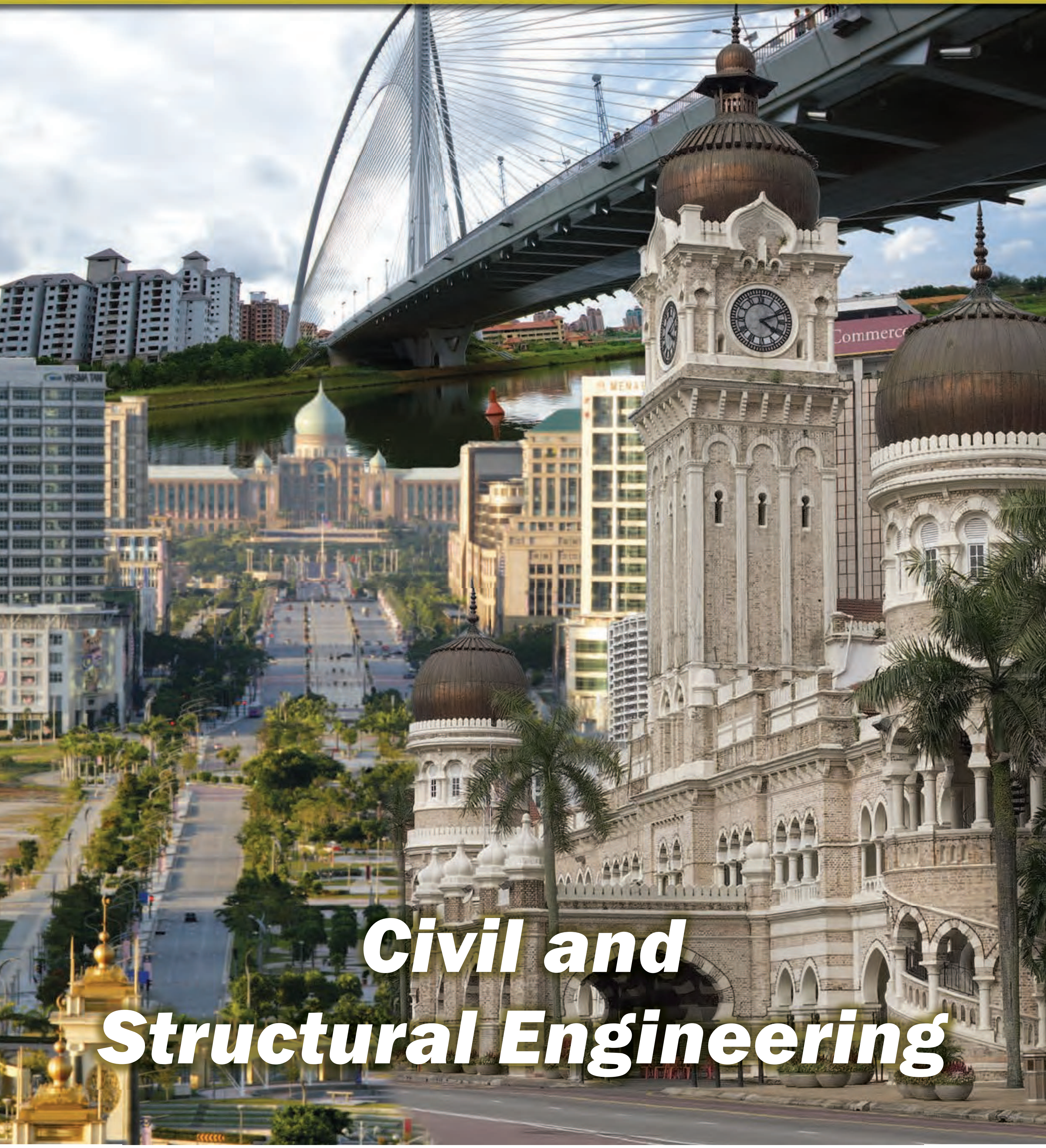

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Reshaping the World

by ***Ir. Ong Sang Woh***
Chairman,
Civil & Structural Engineering Technical Division

IN this fast-paced and dynamic world, the growth of infrastructure projects and the rapid phase of development in Malaysia have created a much greater demand for engineering talent especially civil and structural (C&S) engineers. The changing market forces of greater mobility and demand for quality (and not quantity) have created the shortfall in the supply chain of competent engineers.

In the field of engineering education, the Civil & Structural Technical Division (CSETD) has moved forward in line with the times in terms of the use and adoption of Eurocode 2 and the Malaysian Annexure for the basis of Concrete Design and also in organised talks, road shows, seminars and courses for the training and re-development of C&S engineers. We are also pleased and proud to inform that CSETD has been at the forefront and has completed the work on the Recommendation on Earthquake Loading Model for Malaysia (refer to accompanying Paper).

C&S engineers have been and are still actively involved in "Reshaping the World" in the provision of the fundamental basic need for shelter – the everlasting goal of providing the housing needs of every family. It is envisaged that the present government emphasis on the 1M housing programme and on green technology along with the contribution from C&S engineers will certainly benefit everyone.

Some other current and planned mega projects in Malaysia in which the engineers play a significant role in their implementation include the Selangor – Pahang Interstate Water Supply project, the Kuala Lumpur mass rapid transit (MRT) system, the double rail track project and the numerous upcoming projects for the various states of Malaysia.

In summary, the continuous contribution of C&S engineers and in particular the CSETD under the umbrella of The Institution of Engineers, Malaysia (IEM), would definitely enhance the engineering standards, through the Standards Writing Organisation (SWO) with the Department of Standards Malaysia (DSM) and the development of IEM Position Papers. This marvelous body of ideas will eventually enrich and promote a sustainable living standard for all Malaysians. ■

IEM FAMILY DAY 2013

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Venue: To Be Confirmed
Time: 9.00 a.m. to 1.00 p.m.

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Recommended Earthquake Loading Model for Peninsular Malaysia




by Engr. T.W. Looi, Ir. M.C. Hee, Dr H.H. Tsang and Dr N.T.K. Lam

1.0 INTRODUCTION

1.1 Background

Geographically, Malaysia is located outside the *Pacific Ring of Fire* on the stable Sunda plate (a part of the Eurasian plate) and is conventionally perceived as an earthquake free zone. However, in recent years, Malaysia has experienced frequent reports of earthquake tremors generated mainly from the Sumatra fault zone (as shown in Figure 1). The generally increasing rate of earthquake activity in South East Asia in the aftermath of the Sumatra 2004 earthquake has been observed [5], as compiled in the database available from the National Earthquake Information Center (NEIC) of the United States Geological Survey (USGS).

Whilst no structural damage was reported, thousands of people in Malaysia were shaken by the earthquake tremor prompting the inevitable inquiring over the issue of structural safety of buildings in Malaysia [40, 41]. To address this potential threat, the Institution of Engineers, Malaysia (IEM), has formed a Technical Committee on Earthquake and published a position paper in 2007 [12], followed by the publication of a series of articles over the potential implementation of the Eurocodes for structural design [14]. The specific questions to address are whether or not there is a need for seismic design in the nation and whether Eurocode 8 (hereafter abbreviated as EC8) is suitable for providing the framework for codification.

Whilst most of the publicity has been on the Sumatra mega-thrust earthquake, a series of small earthquakes (M 0.3 to 4.2) were recorded by the local seismological network [28] within the Peninsula itself in the Bukit Tinggi area, Pahang, in November 2007. In other words, the threat of potential intraplate earthquakes generated by local inactive faults (including the Bukit Tinggi fault zone, refer to Figure 1) has been underrated. Given this combination of potential threats, it is appropriate to categorise Malaysia as a low-to-moderate seismicity region, similar to Australia, Central and Eastern North America, Northern Europe and South China.

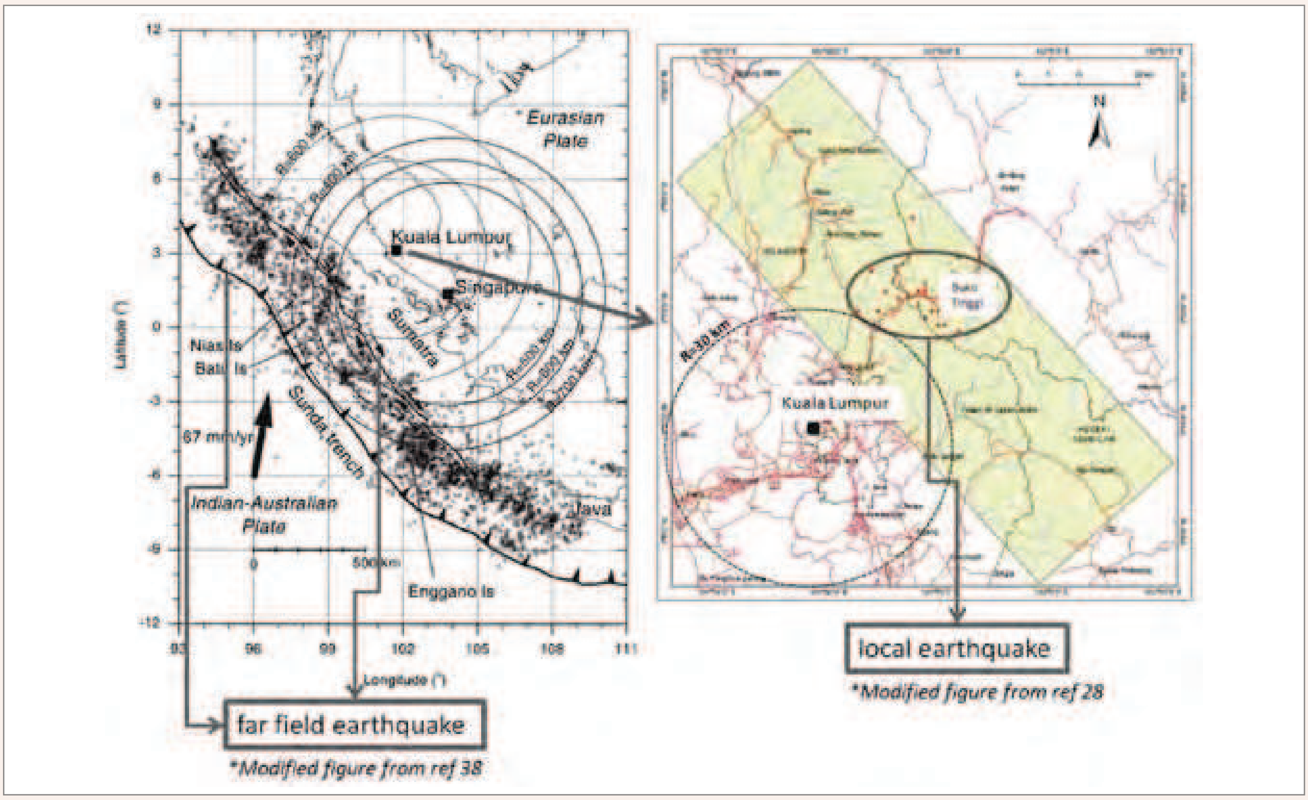

Figure 1: Regional tectonic settings and the potential earthquake threat (far field and local) of Malaysia

The situation has been evaluated seriously by the IEM Technical Committee. A series of technical meetings and symposia were conducted with the participation of invited international experts. Key events include a one-day workshop in June 2010, a two-day symposium and workshop in December 2011 [13] and the upcoming two-day symposium and workshop in April 2013. This paper aims to summarise the research work that has been undertaken in the past 18 months which shall form the basis of the recommended earthquake loading model for Peninsular Malaysia.

1.2 Seismic Hazard Assessment (SHA)

Since 1979, the Malaysian Meteorological Department (MMD) has installed 19 seismological stations in the Peninsula [25]. In addition, hundreds of years of historical data of major far field earthquake events generated from the Sumatra fault zone has become available from the USGS/NEIC database [42]. This has enabled the implementation of the conventional Probabilistic Seismic Hazard Assessment (PSHA) methodology in determining the recurrence rates of various ground motion intensity levels at different locations around the nation. PSHA can be viewed as a statistical method for incorporating the information of seismotectonic features and all historic events in the prediction of a certain ground motion level with a finite probability of occurrence. The most commonly adopted algorithm was initially developed by Cornell (1968) [6] and further coded by McGuire (1976) [26] into a computer programme.

On the contrary, only a limited amount of local earthquake data was recorded from within the Peninsula itself. It is noted that the probabilistic approach would not be reliable in modelling the recurrence rates of local seismic events for the future if local (intraplate) earthquakes are being under-represented in the existing database. This lack of data syndrome is a common issue in many low-to-moderate seismicity regions. In this context, it is considered appropriate to adopt Deterministic Seismic Hazard Assessment (DSHA) as a supplementary or alternative approach of modelling [17].

DSHA was the *de facto* standard approach of seismic hazard modelling during the said period (until the 1980's) when the amount of recorded data was scarce. With an increasing amount of recorded data around the world, the use of PSHA has become more popular. However, recent destructive earthquakes raised concerns over the full reliance of results from PSHA for determining the required level of protection with the built infrastructure. There has been an ongoing debate over this issue in the field of seismology and engineering. Notwithstanding this, PSHA is well recognised in terms of its role in risk management and is undoubtedly an essential tool for assisting policy making by governments and the insurance industry.

From an engineering perspective, the safety of the built infrastructure in countering potential earthquake hazards is the most important consideration in determining the required level of seismic design loadings. It is reasonable to be conservative and take into account uncertainties and unknowns through international benchmarking of seismic design practices, and with particular references to countries in a similar situation. The approach for determining the earthquake loading model should also be tailor-made to address local constraints as well as consider regional specific seismotectonic and geological conditions. It is therefore prudent not to simply adopt a commonly used code of practice for Malaysia.

Ground Motion Prediction Equation (GMPE) (commonly known as attenuation model) is the key component in SHA. GMPE predicts the intensity of ground shaking, based mainly on a given earthquake scenario which is expressed in terms of a Magnitude (M) and Distance (R) combination. Ideally, such a model should be developed based on locally recorded data. References to other generic models can also be made should they be deemed suitable. For far field Sumatra earthquake (both Sunda-Arc subduction and Sumatran fault), the authors adopted two regionally specific models, namely that of CAM [31, 4] models by Megawati and co-workers [19], and a (generic) model developed by Atkinson & Boore (2006) [15, 16]. On the other hand, eight GMPEs as summarised in Ref.[22] have been adopted to assess the attenuation characteristics of ground motions in local earthquake events in Peninsular Malaysia.

1.3 National Annex (NA) to EC8

The long existence of British Standards in Malaysia will be replaced by the Eurocode, with the provision of the National Annex (NA) to take into account local conditions. EC8 (BS EN 1998-1:2004) [8] is the document recommended for the design of buildings against seismic actions. A design Acceleration Response Spectrum (RSA) which is scaled in accordance with the notional Peak Ground Acceleration (PGA) value is stipulated. Importantly, EC8 (Part 1 *Cl. 3.2.2.2 P*) has the flexibility of being adaptable to different spectral shapes. An appropriate design spectrum model for Malaysia has become a crucial matter that is ought to be considered.

In view of the unique pattern of far field and local (background) seismicity that is affecting Malaysia, a hybrid approach of modelling (incorporating results from both probabilistic and deterministic assessments) was discussed and proposed in the workshop that was conducted in December 2011. Due consideration was given to international practices when the proposal was made. The recommendation of this hybrid approach was formally endorsed by all the participants of the workshop where representations from various stakeholders, the local professions and the academia have also been included.

Upon the endorsement, the IEM Earthquake Technical Committee has set up a working group (WG1) to elaborate on the recommended hybrid approach. This article provides a summary of the relevant research work that has been undertaken for the determination of the earthquake loading model for rock sites in Malaysia based on the endorsed approach. This involves the probabilistic assessment of distant seismic hazard as well as the determination of local earthquake scenarios for engineering design purposes. A unified hybrid earthquake loading model for Malaysia as developed in this study is recommended for codification purposes.

The potential effect of amplification by near-surface soil sediments (as represented by the S-factor in EC8) is another important element of considerations in the NA to EC8. The incorporation of the site natural period as an additional parameter for site classification [10, 11] (along with the use of the conventional SPT and shear wave velocity values) has been considered as a more appropriate approach for regions of low and moderate seismicity. This recommendation has also been endorsed by all the participants of the December 2011 workshop. A site-specific design spectrum model has been developed by the authors and will be presented and discussed in the upcoming workshop (which is not included in this article as it only considers the ground motions on bedrock).

2.0 DISTANT SEISMIC HAZARD MODELLING

2.1 Far Field Earthquake Sources

Earthquake hazards from Sumatra have been generated from two major sources (Figure 1): (1) Sunda Arc subduction fault source off-shore of Sumatra; and (2) Sumatran strike-slip fault source.

(1) Sunda Arc subduction fault source off-shore of Sumatra

The subduction fault source is formed by convergence between the Indian-Australian plate and the Eurasian plate. Megathrust earthquakes including that of Aceh 2004 (M9.3) and Nias 2005 (M8.7) events were generated from this fault source. The distance from this fault source to Peninsular Malaysia is approximately 530 km – 730 km.

(2) Sumatran strike-slip fault source

The distance from the 1,500 km long Sumatran strike-slip fault source to Peninsular Malaysia is some 300 to 400 km and is much closer than the distance from the subduction fault source. The magnitude of recorded historical earthquakes generated from this fault source within the Sumatran island is limited to about M7.8.

2.2 Previous Studies

Numerous research groups have contributed to the assessment of the aforementioned far field seismic hazards affecting Peninsular Malaysia. This section provides a brief review of the work done by five major research groups:

1. Lam, Chandler, Tsang, Balendra and co-workers from the University of Melbourne, the University of Hong Kong and the National University of Singapore
2. Megawati, Pan, Koketsu and co-workers from the Nanyang Technological University Singapore and the University of Tokyo
3. Pappin and co-workers from Arup Hong Kong
4. Adnan, Irsyam and co-workers from the University of Technology Malaysia and Institute of Technology Bandung
5. Petersen and co-workers from the United States Geological Survey.

The literature review (presented in the 2011 workshop) provides coverage of some twenty research articles spanning the period 2002 – 2011 [1-3, 7, 9, 16-21, 23, 24, 27, 32, 35-39]. This database features a combination of PSHA and scenario-based DSHA studies. The research methodology and assumptions adopted in the DSHA studies have been clearly explained in Refs.[32, 19]. Numerous representative GMPEs for predicting ground motion levels as functions of magnitude and distance have been developed in these studies. Meanwhile, investigations adopting the PSHA as reported in eight research articles (e.g. [3, 16]), involved the use of a more extensive list of input parameters and modelling assumptions. The analysis output depends on the historical earthquake catalogue, completeness criteria, de-clustering method, source zoning and the use of the logic tree.

Most of the adopted GMPEs are empirically based and were derived from regression analysis of strong motion accelerogram data (e.g. Joyner and Boore, Campbell, Sadigh). Due to the paucity of recorded data for empirical regression analysis (which is common in low and moderate seismic regions including Malaysia), various researchers proposed GMPEs which were developed from studies involving the use of stochastic simulations of the seismological model (e.g. CAM, Atkinson and Boore), and finite-fault ground motion simulations based on the kinematic method (e.g. Ref.[19]). In view of the inconsistencies of the predicted ground motion values from different GMPEs, verification analyses have been undertaken to identify models which give results that match well with limited field observations [4].

Two GMPEs reported in the literature have been validated based on benchmarking against ground motion data instrumentally recorded from a long distance. A brief introduction of the two GMPEs is presented below.

(1) Component Attenuation Model (CAM)

The generic CAM was first developed and coded into programme GENQKE for generating synthetic earthquake accelerograms based on stochastic simulations of the seismological model [29, 31]. Even though CAM was initially developed for the prediction of ground motions generated by local earthquakes, the modelling framework was found to be capable of predicting ground motions generated by large magnitude earthquakes from the far-field [4]. CAM has successfully demonstrated its capability of modelling distant earthquakes affecting Singapore [32, 36, 37].

The mathematical framework of the seismological model underpinning CAM is defined by equation 1:

$$A(f) = CM_0S(f)\ G_AA_n(f)\ P(f)V_a(f) \qquad \textit{Eq 1}$$

where $CM_0S(f)$ is the "source" component, $G_AA_n(f)$ is the "path" component and $P(f)V_a(f)$ is the "local" component.

A detailed review of the seismological model and stochastic simulation methodology can be found in [31].

(Continued on page 11)

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(2) Megawati attenuation relationship

Megawati and co-workers developed an attenuation relationship for modelling ground motions generated from the Sumatran fault source [20] and those from the Subduction fault source [21] in 2007 [39], and was revised in 2010 [19]. Synthetic seismograms which were derived from the analysis of a finite-fault kinematic model have been verified. This attenuation relationship is based on hard rock conditions and site-source distance ranging between 200 and 1,500 km. The use of the developed relationship for making predictions outside this distance range should be treated with caution.

The latest attenuation relationship is defined by equation 2 below:

$$\ln(Y) = a_0 + a_1(M_w - 6) + a_2(M_w - 6)^2 + a_3 \ln(R) + (a_4 + a_5M_w)R + \varepsilon_{\ln(Y)} \qquad \textit{Eq 2}$$

where all parameters can be obtained from Table IV in Ref. [19].

In addition to the deterministic studies as described above, Pappin and co-workers [15, 16] conducted PSHA for Malaysia based on historical earthquake data which has been recorded over the past 40 years since 1972, along with the use of the Megawati (2007) attenuation relationship [39] (i.e. not the most updated one). Based on the earthquake catalogue compiled from the USGS database, the seismic source zone was divided into four categories of seismogenic depth ranging between 50 and 500km, and an earthquake database in which small events (<M5) and aftershocks have been removed. Local seismic hazards were analysed using the attenuation relationship of Atkinson & Boore (2006) which was developed for the mostly cratonic crustal conditions of Eastern North America.

A summary of PGA values, corresponding to a return period (RP) of 475 years (10% probability of exceedance in 50 years) and 2475 years (2% probability of exceedance in 50 years), hereafter rounded off to 500 years and 2,500 years respectively, derived from various studies are presented in Figure 2 along with results from deterministic predictions based on the long distance scenario of M9.3 R530 and the use of CAM (*Eq 1*) and Megawati (2010) (updated) (*Eq 2*) attenuation relationship.

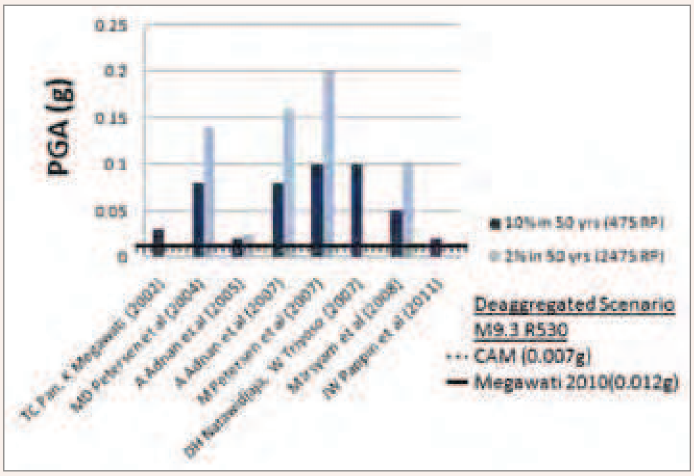

Figure 2: PGA (g) from literature review

Whilst the PGA parameter is conventionally used for scaling a design response spectrum, the response spectral behaviour in the intermediate to long period range is actually represented by response spectral velocity parameter (RSV_{max}) which is a more robust and appropriate parameter for representing the effects of hazards on the built infrastructure.

The developed Uniform Hazard Spectra (UHS) have been de-aggregated into contributory earthquake scenarios [27, 3, 15]. For example, the earthquake scenarios of M8 R400 and M9.3 R530 have been identified to correspond to the mean hazard level for a RP of 2,500 years based on projected events generated from the Sumatran and subduction fault sources respectively. Values of RSV_{max} obtained from the de-aggregation analysis are presented in Figure 3 along with the predictions from CAM (*Eq 1*) and from the Megawati (2010) attenuation relationship (*Eq 2*).

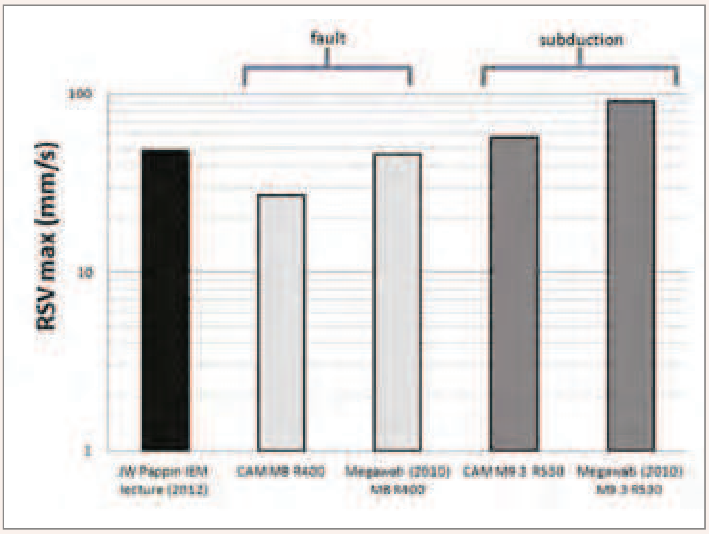

Figure 3: RSV_{max} RP 2500 years on a rock site in Malaysia for Sumatran far field earthquake (fault and Subduction zone)

2.3 Recommended Distant Earthquake Model

In addition to the deterministic studies that have been conducted to model the behaviour of distant earthquakes, comprehensive probabilistic studies have been undertaken more recently to model the aggregated earthquake hazards. The response spectrum produced by the aggregation analysis is known as the Uniform Hazard Spectrum (UHS) in which contributions from multiple fault sources have been taken into account [15, 16]. The attenuation behaviour of the simulated ground motions in the development of the UHS was based on GMPEs developed by Megawati (2007) for the large magnitude distant earthquake and by Atkinson & Boore (2006) for local earthquakes generated from a stable crustal structure. Different parts of the UHS can be identified with very different contributory earthquake scenarios. For example, the short period range of the 2,500-year UHS in Figure 4 is controlled by ground motions generated by moderate magnitude earthquakes whereas the longer period range by the much larger magnitude earthquakes from longer distances.

There is a global trend to benchmark design seismic hazard level to a RP of 2,500 years as opposed to 500 years, in order to achieve a higher level of protection for civil engineering assets. In the low seismicity regions of the United Kingdom a RP of 2500 years has been stipulated in the NA of EC8 for collapse prevention limit state design. Similar design criterion has been adopted in Canada and China. In view of this trend, it is considered that the UHS of Malaysia should be based on a RP of 2,500 years.

It is noted that the UHS model as presented in Figure 4 requires modifications because of subsequent improvements in the accuracies of the regional specific attenuation relationships. For example, the original attenuation relationship of Megawati (2007) [39] has been updated to Megawati (2010) [19]. In parallel with improvements made by the Megawati model, CAM has also been shown to be able to simulate ground motions that match the instrumental field recordings from major events including the Aceh earthquake of 2004 and the Nias earthquake of 2005. To achieve a more robust UHS, the attenuation model has been revised in this study to incorporate both the updated model of Megawati (2010) [19] and the latest development of CAM [32]. A logic tree weighting factor of 0.5 has been allocated to both attenuation relationships in the aggregation analysis.

The modified UHS was obtained by an adjustment procedure comprising the following steps (refer to Figure 4):

a) Three earthquake scenarios, namely (1) M9.3 R530, (2) M9.4 R650 and (3) M9.5 R730 were first identified by calibration analyses to be represented by the original UHS. Earthquake ground motions simulated for these calibrated scenarios based on the use of the (original) attenuation model of Megawati (2007) [39] have been checked to ensure that their respective response spectra were consistent with the UHS at the four reference natural periods of 0.5s, 1s, 2s and 5s.

b) For each of the calibrated earthquake scenarios their respective response spectra were then recalculated using the updated attenuation model of Megawati (2010) [19] along with CAM based on equal weightings. The modified UHS at the reference periods were taken as the geometric mean of results associated with the three calibrated scenarios.

c) Scaling factors at the four reference periods were taken as the ratio of their respective revised and original response spectral values. The period dependent correction factor of the UHS was determined accordingly based on interpolation between the four reference periods.

The (modified) UHS so obtained from the three-step procedure as described is presented in Figure 5 along with scenario specific response spectra of five earthquake events: (1) M9.3 R530 (median prediction simulated by CAM), (2) M8 R300 (median prediction simulated by CAM), (3) M9.3 R635.13 (Aceh earthquake recorded at Ipoh station), (4) M8.7 R500 (Nias earthquake recorded at FRIM Kepong station) and (5) M7.6 R492 (Sumatra fault earthquake recorded at Pusat Sains, Bukit Kiara station).

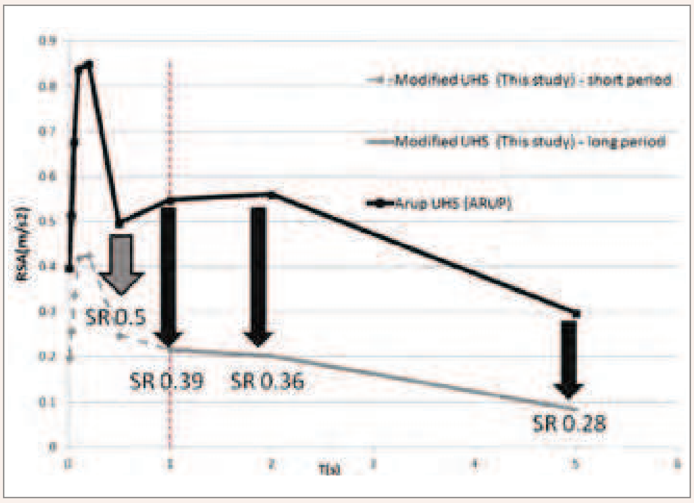

Figure 4: Modified 2500 Return Period UHS by scaling with period-dependant Spectral Ratio (SR)

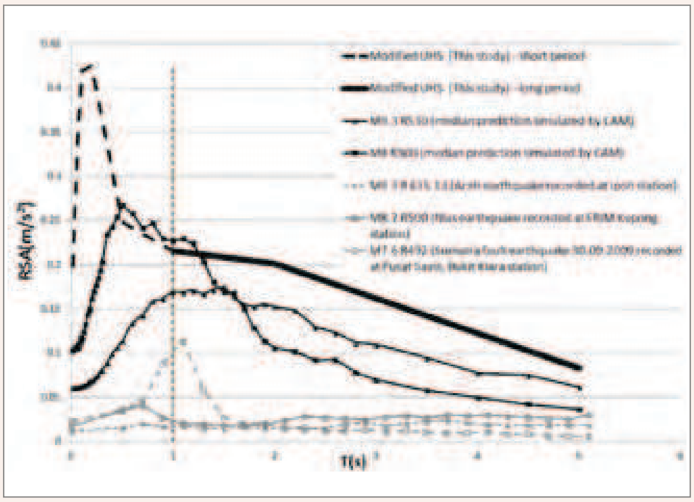

Figure 5: Superimposed modified UHS with 5 distant earthquake events

3.0 LOCAL SEISMIC HAZARD MODELLING

3.1 Local Earthquake Activities

In 2007, the Bukit Tinggi area in Pahang had experienced a series of earthquake tremors. About 24 tremors of magnitude 0.3-4.2 were recorded by MMD over a period lasting for five days [28]. Cracks were detected at the Bukit Tinggi secondary school buildings and the police headquarter at Bukit Tinggi.

The occurrences of earthquake tremors outside Bukit Tinggi have also been documented. Tremors with epicentres located within Peninsular Malaysia were widely felt in the mid 1980's. These tremors have been interpreted as "induced earthquakes" following the filling of the large Kenyir reservoir in Terengganu. 24 weak tremors were reported to have occurred in the period 27.7.1984 – 15.11.1985. Other isolated events have also been located in Jerantut Pahang, Manjung Perak and Kuala Pilah in 2009 [28].

3.2 Scenario-based Modelling and Recommended Local Earthquake Model

In view of uncertainties associated with local earthquake sources and the scarcity of recorded data, results from PSHA are considered to be unreliable for predicting future recurrence rates of earthquakes. In this context, SHA can be undertaken by the alternative scenario-based modelling methodology which is essentially deterministic in nature. This is referred herein as the DSHA approach.

Suitable M-R combinations will have to be pre-determined if DSHA is to be used. The "newly discovered" Bukit Tinggi fault has been recorded to have generated earthquakes of up to M4.2. Distance of this identified fault source from Kuala Lumpur and the Klang Valley is around 15km to 60km (Figure 1). Although the M-R combination of M4.2 R15 may well be considered to be the "critical earthquake scenario" in view of what has been recorded in recent times, it is inappropriate to do so simply because a larger magnitude event from the identified fault source cannot be completely ruled out. It is therefore prudent to make reference to seismicity information on a global scale as opposed to restricting the scope of reference to the very limited database of records that has been collected from within the Peninsula to date.

From the global perspective, reference PGA values for RP of 2,500 years have been compiled from the literature for a number of major cities around the world. The level of seismicity around the globe is broadly classified herein into three major zones:

a) **Low** seismic zones: e.g. London (**lower**), Melbourne (**mid**), Hong Kong (**upper**) – <0.25g
b) **Moderate** seismic zones: e.g. Wenchuan (Sichuan), Christchurch (New Zealand) – 0.25g-0.50g
c) **High** seismic zones: e.g. Taiwan, Tokyo, Los Angeles – >0.50g.

A brief introduction of GMPEs has been given in Section 2.2. Eight GMPE models which have been developed independently in different regions around the globe, including two *New Generation Attenuation* (NGA) model (Abraham and Silva (2008), and Campell and Bozorgnia (2008)) [34] which were originally intended for applications in Western and Eastern North America, have been reviewed. Their Response Spectral Displacement (RSD) values have also been collated for comparison in [22]. CAM [30, 31] that has been developed and used by the authors in numerous studies for different countries in the past has also been included as one of the considered GMPEs.

The database of earthquakes used in Lumantarna *et al.* [22] features events of magnitudes in the range M5.5-M6.9, and much of the data were sourced from the PEER NGA database [34], published by the Pacific Earthquake Engineering Research (PEER) Center. RSD values predicted by the considered GMPEs are shown to be more consistent as the magnitude and distance values increase within the considered range: M5.5 R20 – M6.9 R40. The predicted mean Peak Displacement Demand (PDD) values (i.e. maximum value on displacement response spectrum) associated with an array of considered M-R combinations are listed in Table 1. The range of reference distances in the array is based on information shown in Figure 1. The four M-R combinations for the projected local earthquakes correspond with conditions of "low seismic zones" (PGA <0.25g) as defined above in the context of international benchmarking. Thus, every individual M-R combination listed in Table 1 can be aligned with one of the following classification sub-categories: "**lower**", "**mid**" or "**upper**".

In Figure 6, the modified UHS is shown along with the response spectra estimated for a range of local earthquake scenarios. The original UHS model (primarily based on the considerations of distant events) has also incorporated local earthquake scenarios of up to M4.2 [15]. A PGA value of less than 0.04g is predicted for a RP of 2,500 years. Clearly, when it comes to international benchmarking the predicted level of seismic hazard by the presented UHS is somewhat too low for any area with a background seismicity. It is noted that the "lower" classification sub-category within the low seismic zone (in the case for London) is 0.1g which is aligned with the projected scenario of M6 R50.

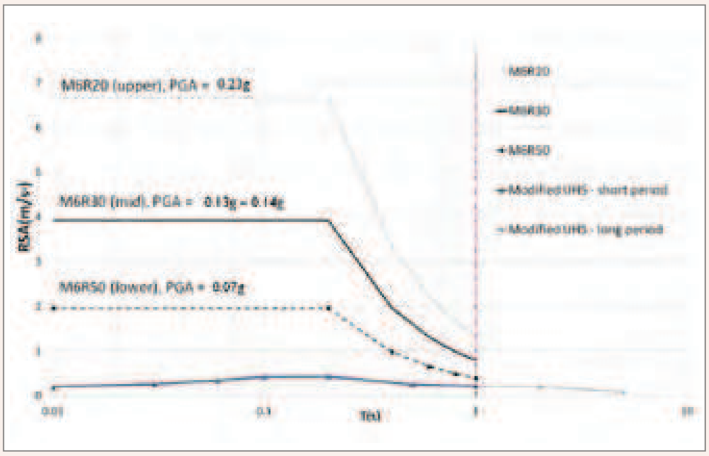

Figure 6: Superimposed modified distant earthquake UHS with RSA (<1s) of 3 selected projected local earthquake scenarios

Table 1: Selected local earthquake scenario based on PDD table [22], with estimated corner period T1, T2 and notional PGA [33]

Bound	Scenario		PDD (mm)	T1 (s)	T2 (s)	RSA_{max} (g)	Notional PGA (g)
	M	R					
Lower	6	50	10	0.2	1	0.20	0.07
Mid	6	30	20	0.2	1	0.40	0.13
	6.5	50	33	0.25	1.25	0.42	0.14
Upper	6	20	34	0.2	1	0.68	0.23

(Continued on page 15)

WORKSHOP ON CASE HISTORIES OF SLOPE FAILURES: INVESTIGATION, ANALYSIS AND REMEDIATIONS E057

Date & Time: 22 June 2013 (Saturday) 9.00a.m – 5.30p.m
Venue: Room Arista, Level 3, Hotel Armada, Petaling Jaya
Participants: Civil Engineers, Geotechnical Engineers, Structural Engineers, Building & Piling Contractors, Consultants, Project Managers, RE, Lecturers, Academics
Fee: A) Normal Price - RM 550/person
B) Promotion Price - RM 450/person * for 2 or more people
Speaker: Ir. Neoh Cheng Aik KMN

COURSE OUTLINE

- Introduction, overview & enlightening statistics for slopes
- Common destabilizing causes & factors for fill & cut slopes with examples
- Common defective design & defective construction for cut & fill slopes
- Case histories of cut & fill slope failures in various site conditions plus remediation proposals with necessary step-by-step design verification/ calculations & design validation to show compliance with the requirements stipulated by Codes of practice (Local authorities/JKR, EC 7, relevant BS, etc).
- Useful reference materials & notes (>100 pages) and slides (>250 nos) will be given and illustrated & elaborated.

WORKSHOP ON EARTHWORKS AND ENGINEERED FILLS E058

Date & Time: 28 September 2013 (Saturday) 9.00a.m – 5.30p.m
Venue: Room Arista, Level 3, Hotel Armada, Petaling Jaya
Participants: Civil Engineers, Geotechnical Engineers, Structural Engineers, Building & Piling Contractors, Consultants, Project Managers, RE, Lecturers, Academics
Fee: A) Normal Price - RM 550/person
B) Promotion Price - RM 450/person * for 2 or more people
Speaker: Ir. Neoh Cheng Aik KMN

COURSE OUTLINE

- Building and civil engineering projects on or with compacted or uncompacted fills form the major part of the construction industry's activities. Large man-made structures such as earth dams, road embankments, building platforms, reclaimed land, etc., are built of engineered fills. The need to understand the behavior of various types of fills in various conditions and mitigations against what can go wrong are an important part of the continuing education of practicing engineers.
- Earthwork practice, specification and preparation of geotechnical report to meet the requirements stipulated by local authorities/DBKL/JKR will also be elaborated & illustrated with case histories.
- Selected case histories of building projects with step-by step detail design verification/calculations & design validation to show compliance with the requirements stipulated by local authorities/Codes of practice will be illustrated & explained.
- Useful reference materials & notes (>100 pages) and slides (>250 nos) will be illustrated & elaborated.

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DATE	CPD HOURS/POINTS	LIST OF COMING SEMINARS	SPEAKERS	PRICE
22 June 2013 (Saturday)	7 IEM13/PP/008/W	Workshop on Case Histories of Slope Failures: Investigation, Analysis & Remediations (E057)	Ir. Neoh Cheng Aik KMN B.Eng. (Hons) Civil (UM), FIEM, MICE, MASCE, P. Eng, MIEM, EAC.(BEM), ACEM, M.(REAM)	Normal Price RM550/pax 2 or more RM450/pax
28 September 2013 (Saturday)	7 IEM13/PP/009/W	Workshop on Earthworks & Engineered Fills (E058)	Ir. Neoh Cheng Aik KMN B.Eng. (Hons) Civil (UM), FIEM, MICE, MASCE, P. Eng, MIEM, EAC.(BEM), ACEM, M.(REAM)	Normal Price RM550/pax 2 or more RM450/pax

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Irrespective of what has been recorded historically in the area it is considered reasonable to adopt the "mid" classification sub-category and the corresponding projected scenario of M6 R30 which has been identified with the notional PGA values of around 0.13g on rock sites. This level of ground motions can be taken as the basis for defining the design local hazards for the metropolitan area surrounding the capital city of Kuala Lumpur and other major cities. These recommendations are based on international benchmarking and are irrespective of what has been recorded to date in the area over a very limited time span.

4.0 THE UNIFIED EARTHQUAKE LOADING MODEL FOR MALAYSIA

In Section 2 and 3, two design response spectrum models have been developed separately for far field and local earthquake hazards respectively forming a hybrid model. Considerations for distant earthquake hazards are based on the modified UHS for a RP of 2500 years using Kuala Lumpur as reference (i.e. an epicentral distance of 600km is considered). Considerations for local earthquake hazards are based on international benchmarking as described. A design scenario of M6R30 (consistent with the "mid" hazard classification sub-category) has been adopted to model the response spectrum in the natural period range of up to 1s. In summary, the long period range (> 2s) of the response spectrum is controlled by the considerations of distant earthquakes (as represented by the modified UHS) whereas the short period range (<1s) by the projected local earthquake scenarios.

In unifying the two parts of the response spectrum (for distant and local earthquake hazards) there is a transition zone in the period range of 1s-2s. The RSD in the transition zone of this proposed hybrid model features a straight line bridging the two parts of the displacement response spectrum (Figure 7(a)). The same response spectrum is also presented in the conventional acceleration format in Figure 7(b).

4.1 Distance Effects

The general framework of the hybrid model as introduced herein can be extrapolated for use in different cities across Peninsular Malaysia by making use of the "path" component of the seismological model (*Eq 1*), which is principally a function of distance R [31]. The nearest distance of a city to the Sunda Arc subduction fault source off-shore of Sumatra will control the value of PDD which characterises the response spectrum in the long period range. The unified model as presented in Figure 7(a) refers specifically to the capital city of Kuala Lumpur which is identified with distance R = 600 km from the Subduction zone off-shore of Sumatra. The response spectrum for another city such as Penang (R = 400 km) which is closer to the Subduction zone than Kuala Lumpur can be scaled accordingly by the use of the Distance Factor (DF) (refer *Eq 3* and Table 2), which was derived in this study. The RSD value at T = 2s can be scaled using *Eq 4*. The values of DF and the corresponding RSD value at T = 2s of some selected cities can be found in Table 2.

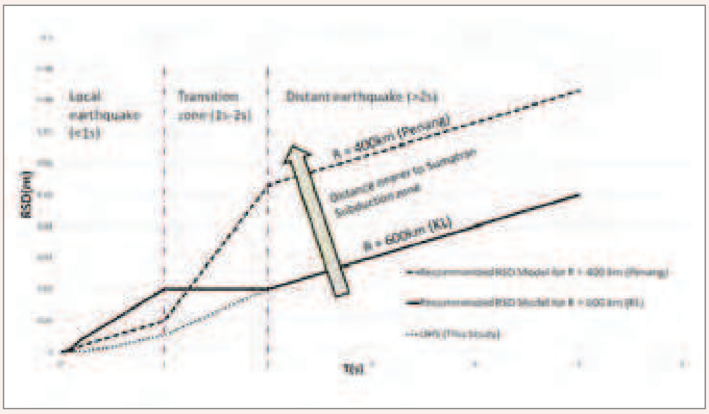

Figure 7(a): The unified RSD model

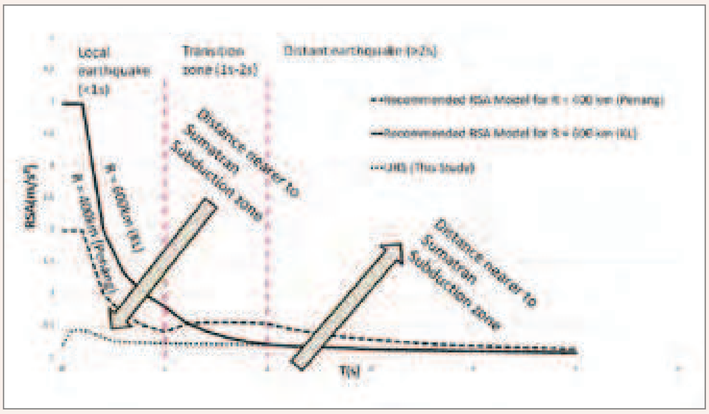

Figure 7(b): The unified RSA model

Distance Factor (DF) = $(600/R)^{2.4}$; R in unit km *Eq 3*

$S_D(2) = 20 * DF \geq S_D(T_D)$; S_D in unit mm *Eq 4*

Table 2: Distance effect of Path Component Attenuation

City	Kuala Lumpur	Penang	Klang, Melaka
R (km)	**600**	400	500
Distance Factor (DF)	**1.0**	2.373	1.525
$S_D(2)$ (mm)	20	47	30

For codification purposes, displacement spectral ordinates SD(T) are as defined by *Equation 5-8*, along with the parameters summarised in Table 3, whilst the compatible spectral ordinates of the conventional acceleration response spectrum can be conveniently calculated using *Eq 9*.

<u>RSD</u>

$T \leq T_C$: $S_D(T) = S_D(T_D) * T^2 / (T_C\ T_D)$ *Eq 5*

$T_C \leq T \leq T_D$: $S_D(T) = S_D(T_D) * T / T_D$ *Eq 6*

$T_D \leq T \leq 2$: $S_D(T) = S_D(T_D) + [S_D(2) - S_D(T_D)] * (T - T_D)$ *Eq 7*

$T \geq 2$: $S_D(T) = S_D(2) + 10 * (T - 2)$ *Eq 8*

<u>RSA</u>

$$RSA = RSD * (2\pi / T)^2 \quad \textit{Eq 9}$$

In effect, the format of the benchmark design response spectrum model for Kuala Lumpur is consistent with that stipulated in EC8 up to T = 2s. Considering the unique distant hazard in Peninsular Malaysia, location-dependent spectral ordinates would result beyond T = 2s.

Table 3: Values of the parameters describing the design response spectra

Location	$S_D(T_D)$	$S_D(2)$	T_C	T_D
Kuala Lumpur	20	20	0.2	1.0
Others	10	$20 * (600/R)^{2.4}$	0.2	1.0

4.2 A Comparison with Recorded Data

Three recorded data of far field earthquakes are shown in Figure 5, indicating that the modified UHS is conservative to envelope them. Despite the scarcity of recorded data for local earthquakes (e.g. Bukit Tinggi), the highest recorded data M4.2 is taken as comparison with the unified RSA model of Kuala Lumpur. Data from two MMD stations (1) FRIM Kepong (R = 25 km) sitting on granite foundation and (2) Ulu Yam (R = 16 km) sitting on soft soil foundation are superimposed in Figure 8. It is shown that the unified RSA model is conservative enough for civil protection with a 2,500 year RP.

4.3 A Comparison with EC8

The simulated response spectrum for the large magnitude distant earthquake scenario of M9.3 R530 (which is identified with notional PGA value of 0.095 m/s²) is used to scale the model response spectrum of EC8 Type 1 (for M>5.5) based on the same PGA value as shown in Figure 9(a). Similarly, the simulated response spectrum for the local earthquake scenario of M6 R30 (which is identified with notional PGA value of 1.6 m/s²) is used to scale the model response spectrum of EC8 Type 2 (for M<5.5) as also shown on the same figure. Rock site conditions and a *q* factor of 1.5 as stipulated by EC8 have been adopted in the comparison. It is shown that the shapes of both Type 1 and 2 model spectra are comparable to the respective (scenario specific) simulated response spectra except that the spectral values could have been understated by both EC models in the longer period range depending on the location of the city. The same response spectra are also presented in the conventional acceleration format in Figure 9(b).

4.4 The 1.5% Notional Load

As shown in Figure 9(b), the notion of adopting a nominal horizontal design load of 1.5% gravity load as a simplified format of providing coverage for the seismic design requirement in the Peninsula is proven to be flawed. In view of the non-conservatism of this simple provision, the importance of incorporating proper seismic design requirement for Peninsular Malaysia is now evident.

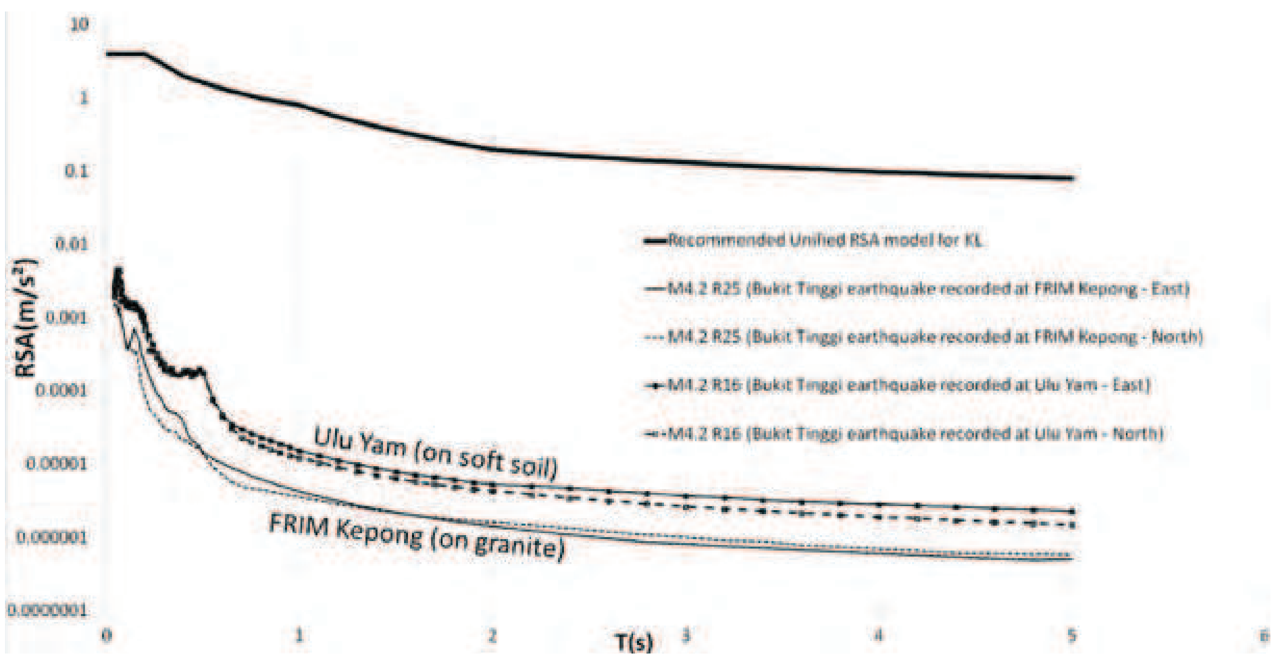

Figure 8: The unified RSA model superimposed with recorded local earthquake data

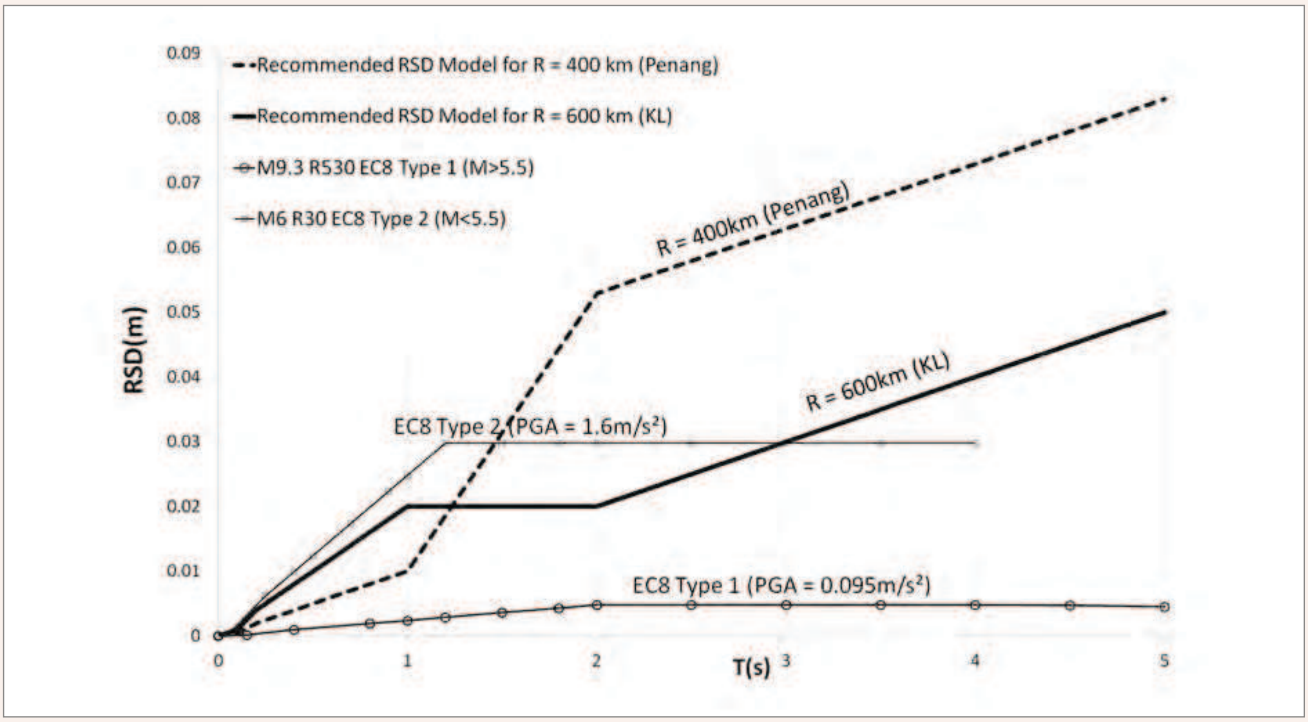

Figure 9(a): The unified RSD model superimposed with EC8 Type 1 and 2

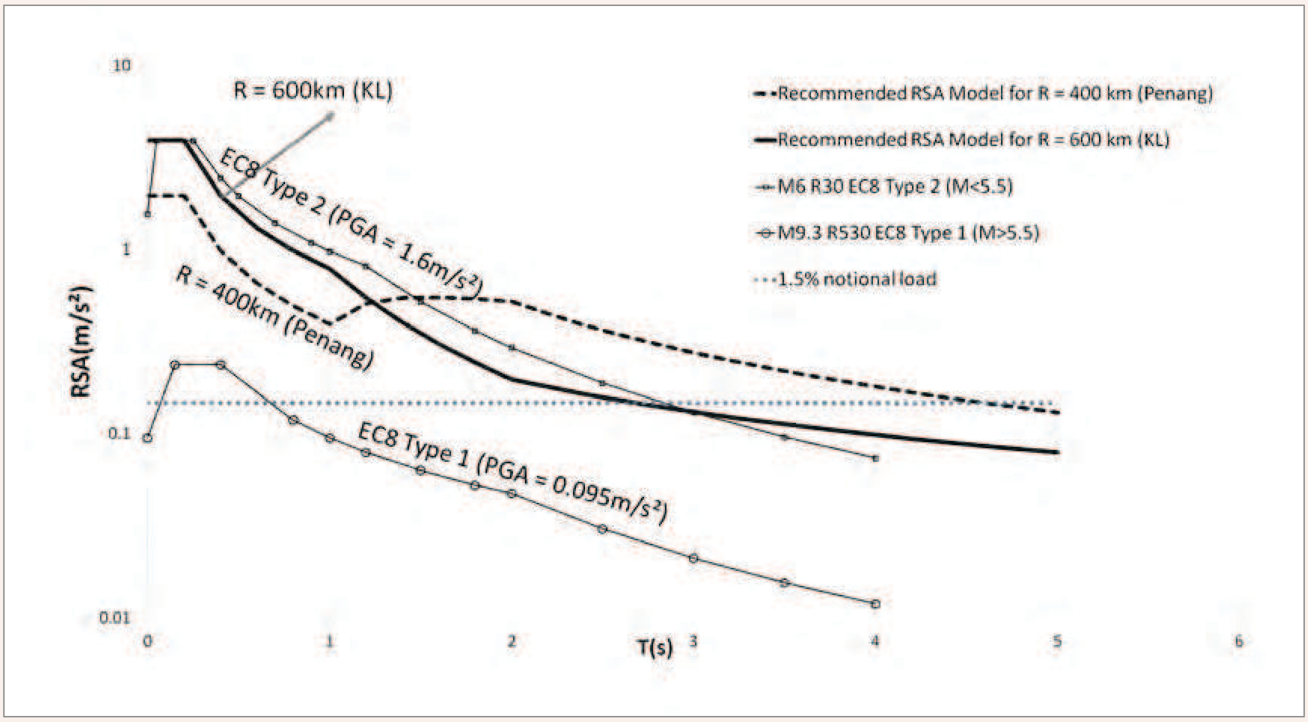

Figure 9(b): The unified RSA model superimposed with EC8 Type 1 and 2, and 1.5% notional load

5.0 SUMMARY AND CLOSING REMARKS

The peninsula of Malaysia is subject to a combination of earthquake threats that can be generated from a multitude of seismic sources. The Sunda Arc subduction source off-shore of the Sumatra Island has been attracting most of the publicity following the aftermath of the phenomenal M9.3 Aceh earthquake event of 2004. Although the level of ground shaking experienced in the peninsula was not of engineering significance in that event, a much higher level of hazard is predicted for a much closer epicentral distance which is deemed possible. Another notable distant fault source is from the

(Continued on page 19)

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SMOOTH FINISH
Unsurpassed superior off-form finishing.

COST EFFICIENT
Substantial total cost saving for the whole project.

OCCUPATIONAL HEALTH & SAFETY
No razor sharp edges exposed after stripping. No dangerous scrap left on site, dramatically reduced injury risk.

LIGHT WEIGHT & EASY TO HANDLE
Makes a safer worksite.

Sumatran island itself. Although this second fault source is much closer to the Peninsula, its estimated response spectral level in the high period range is not as critical because of its relatively modest upper magnitude limit. Both elements of distant earthquake hazards have been subject to detailed research investigations based on large quantities of seismological data recorded to date from the region. Research findings that have been reported from the literature to date have been associated with these two distant earthquake generating mechanisms. The third potential earthquake source is what is known as background seismicity which refers to local earthquakes generated from within the Peninsula.

Local earthquakes that have been documented to date were only generated from the Bukit Tinggi fault which is located some 15 to 60 km away from the metropolitan area surrounding the capital city of Kuala Lumpur. None of these local earthquake events were of engineering significance because of their low magnitudes. However, given that earthquakes of magnitude 6 are well within the credible limit in regions of low-moderate seismicity (intraplate) areas, the potential hazard that can be generated from local earthquakes can be much higher than what can be inferred from the very limited current historical archives.

The very complex combination of seismic activities affecting the Peninsula means that the generic EC8 (Type 1 and 2) response spectrum models should not be adopted automatically. Thus, the response spectrum model proposed herein has been derived from first principles.

Numerous response spectrum models have been developed from probabilistic, or deterministic, seismic hazard analysis for the region, but most of the data used in these analyses were associated with the two distant fault sources. Because of the infrequent and random nature of local earthquakes, their potential hazard has been under-represented in (the usual) probabilistic evaluation analysis conducted to date. Applying probabilistic analysis in an area which are so lacking in local seismicity data will only produce hazard maps featuring "bull eyes" which are clearly counter intuitive. The disastrous consequence of paying blind faith to results from probabilistic analysis was well demonstrated in the destructive earthquake events in the recent past including the Christchurch Earthquake in the South Island of New Zealand in February 2011.

Hence, a hybrid modelling approach has been adopted to address this shortcoming. In the hybrid model, the part of the response spectrum in the long period range (>2s) is based on the considerations of distant earthquakes. A mega large magnitude (M9.3) earthquake from some 400 to 600km distance has been considered for design purposes. The original UHS model of ARUP has been modified in accordance with predictions from the latest attenuation models for such distant earthquake scenarios. A logic tree approach was employed to take into account contributions from different research groups. The part of the response spectrum in the shorter period range (<1s) was derived from international benchmarking in which seismicity patterns around the world are resolved into the "High", "Moderate" and "Low" seismic zones. The Peninsula on the whole has been ranked as a "low" seismic zone. Seismicity classification sub-categories of "lower", "mid" and "upper" were accordingly defined within the "low seismic zone" category. The seismicity of the capital city of Kuala Lumpur and the surrounding metropolitan area has been assigned to the sub-category of "mid". The earthquake scenario of M6 R30 that is considered to be consistent with this classification has been identified accordingly. Response spectra for this earthquake scenario can be predicted based on GMPE's that have been developed around the globe for local earthquakes. A high level of consistencies amongst the models in their predictions of long period spectral properties offers robustness to the predictions and adds confidence. A transition zone in between the two period ranges is also featured in the hybrid model to complete the construction.

6.0 ACKNOWLEDGEMENT

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IEM DIARY OF EVENTS

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

Geotechnical Engineering Technical Division

15 June 2013: 24th Annual General Meeting

Water Resources Technical Division

29 June 2013: 26th Annual General Meeting

THE INAUGURAL MEETING OF IEM

This is a compilation of articles under the Sub-Committee on Documentation and Recording of IEM Historical Events

by Dato' Ir. Pang Leong Hoon

AS planned, the Inaugural Meeting of IEM was held on 1 August 1958 at 9.00 p.m. at No. 23 Perak Road, Kuala Lumpur, the residence of Mr. Lau Foo San. The meeting was attended by 39 engineers from various government agencies and the private sectors (refer to list of names attached). The participating engineers had elected Encik Yusof bin Hj. Ibrahim as the Chairman and Mr. Lau Foo San as the Hon. Secretary to officially facilitate the meeting.

The items on the Agenda were efficiently dealt with and subsequently, the drafts of the Constitution and By-Laws were deliberated, voted, and accepted in principle.

During the deliberation, an important issue was raised by Mr. Ng Ek Poh (Telecoms) and Mr. M. Tharmalingam (Mech. P.W.D). They feared that *"the Constitution was not sufficiently represented"*. However, Encik Yusof had reassured them that the Committees would see to it that an even representation would be obtained in the future.

(Note: The above concern of the two engineers and the assurance given by the Chairman were again addressed to the late Tan Sri Ir. J.G. Daniel during an interview on 20 March 2011. He recalled that these had resulted in an unwritten rule or understanding. He said that *"In those days, we had an unwritten rule that the President of the Institution would rotate among different disciplines so that whether a member belongs to one discipline or another, you would have the chance to lead the new Institution"*. Thus, the unwritten rule of not having the President and Deputy President from the same engineering discipline has been a practice of the IEM for many years).

Apart from the above, it was proposed by Mr. Chew Kam Pok that *"… all engineers present here this evening will be considered as founder members of the Institution"*. The motion was seconded by Mr. A. Navaratnam and it was put to a vote. The motion was carried out.

The next item of the Agenda was the election of the first IEM Council Members. The elected Council Members were as follows:

President	:	Encik Yusof bin Hj. Ibrahim	P.W.D
Vice President	:	Raja Zainal b. Raja Sulaiman	C.E.B
Hon. Secretary	:	Mr. Lau Foo San	Private Practice
Hon. Treasurer	:	Mr. Chew Kit Lin	P.W.D
General Members	:	Mr. Chew Kam Pok Mr. A. B. Bhatt Mr. Philip Chow Mr. Aw-Yong Hong Chiew Mr. Chan Peng Khoon or Mr. Dalip Singh	Telecoms Petaling Jaya Private Practice D.I.D Malayan Railways

P.W.D now known as J.K.R C.E.B now known as TNB

The Inaugural Meeting was adjourned at 10.30 p.m. with a note of thanks to the then President and the Secretary for their unfailing support towards the success of the Institution.

With the formation of IEM, the Joint Overseas Group of U.K. professional bodies was advised to dissolve itself. The Group later donated its entire funds to the IEM and decided not to hold any further activities in the country. ■

1.	Yusof bin Hj. Ibrahim	P.W.D
2.	A. B. Bhatt	Petaling Jaya
3.	Chew Kit Lin	P.W.D
4.	Lau Foo San	Private Practice
5.	J.D. Daniel	D.I.D
6.	Aw Yong Hong Chiew	D.I.D
7.	Kong How Wah	P.W.D
8.	Chan Boon Teik	P.W.D
9.	Philip Chow	Steen Sehested
10.	Tong Kay Chor	P.W.D
11.	Chong Koon Kee	P.W.D
12.	K. Ratnasingam	P.W.D
13.	S.V. Navaratnam	P.W.D
14.	Lum Yun Foo	Telecoms
15.	Yap Seong Kee	P.W.D
16.	Bugong Hj. Abdullah	Telecoms
17.	Shamsuri Hj. Ali	P.W.D
18.	Ng Ek Poh	Telecoms
19.	M. Tharmalingam	P.W.D
20.	A. Navaratnam	P.W.D
21.	Lee Chye Watt	Telecoms
22.	Kok Ah Lok	P.W.D
23.	Koh Ah Seng	Telecoms
24.	Chew Kam Pok	Telecoms
25.	T.A. Narayan	Telecoms
26.	V.A. Thomas	Telecoms
27.	A. Hamid Ahamd	P.W.D Terengganu
28.	Ismial Marzuki	P.W.D Pahang
29.	R. Rozairo	P.W.D
30.	S.Y. Chung	P.W.D
31.	Lim Tong Peng	P.W.D
32.	T.G. Seshan	P.W.D
33.	Yun Min Ying	P.W.D
34.	Halaluddin	P.W.D
35.	Cheong Yoong Hoi	P.W.D
36.	J. Ponnudurai	P.W.D Ipoh
37.	S. Sivapathasundran	P.W.D Muar
38.	K.S. Bal	P.W.D Headquarters, Kuala Lumpur
39.	Low Tat Cheung	P.W.D Headquarters, Kuala Lumpur

Y.Bhg. Dato' Ir. Pang Leong Hoon was formerly the Director-General of the Department of Irrigation and Drainage, Malaysia. He was also the Past President of IEM for Sessions 1984/1985 and 1985/1986.


Gurney Paragon, Gurney Drive, Penang


2nd Penang Bridge, Malaysia


Sabah Oil & Gas Terminal, Sabah

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Precast Segmental Box Girder with Dry Joints and External Tendons


by Ir. Teh Tzyy Wooi and Ir. Tan Wang Khai

INTRODUCTION

In some early and a few more recent segmental bridges erected through span-by-span erection in Malaysia, especially those associated with metro rail bridges, dry joints between precast segments were primarily utilised to reduce cost and construction time as well as to eliminate potential problems with epoxy applications.

The structures were generally designed with only external post-tensioned tendons protected by High Density Polyethylene ducts. No reinforcing or prestressing steel extended across the joints.

The code of practice to be used in Malaysia for concrete bridge design is BS5400 Part 4. This code does not cover the use of external tendons or dry joints. Reference to the Highways Agency Design Manual for Roads and Bridges (DMRB) documents BD58 and BA58 can be used to supplement BS 5400 Part 4 and to provide design guidance and requirements on the use of external unbonded prestressing. However, no specific guidance on the design of dry joints is given.

It is generally accepted that dry joints give a lower ultimate moment and ultimate shear capacity than glued match-cast joints with precast segmental construction. It is therefore necessary to take this into account by introducing adjustments to the design approach and requirements. This design note compares the commonly available methods used in the design of precast segmental decks and recommends the design approach to be employed where dry joints and external tendons are used.

Design references used in the comparison include:

- BS5400: Part 4 – 1990 Code of Practice for the Design of Concrete Bridges,
- BD58/94 The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing,
- BS EN 1992-2: Eurocode 2 Design of Concrete Structures,
- AASHTO Guide Specification for Design & Construction of Segmental Concrete Bridges 2nd Edition 1999,
- Prestressed Concrete Bridges: Design & Construction by Nigel Hewson,
- Dry Joint Behaviour of Hollow Box Girder Segmental Bridges – fib Symposium,Segmental Construction in Concrete' New Delhi, 26-29.11.2004.

1. ULTIMATE MOMENT LIMIT STATE CAPACITY

Decks with dry joints behave differently in bending with ultimate loads to those using glued joints. The epoxy glue used between the segments creates a bond of greater strength than the concrete between the segments. No such bond is present with dry joints meaning that when ultimate limit state loading is applied the joints decompress and open up. This will lead to a reduction in structural stiffness and the occurrence of larger deflections with the rotations concentrated at joints. The ultimate limit state failure mechanism with dry joints and external tendons is due to concrete crushing on the compression side due to excessive strains.

As shown on Table 1, of all the design codes investigated, the only design code to recognise the different ultimate bending failure mechanism of dry jointed decks as compared to glued joints is the AASHTO Guide Specification for Design of Segmental Bridges. A lower strength reduction factor, ϕ, is applied to the ultimate bending resistance for dry joints as compared to glued joints. For glued joints $\phi = 0.90$ and dry joints $\phi = 0.85$. However, this guide specification is now superseded and AASHTO has prohibited the use of dry joints since 2003.

Table 1: Precast Segmental Decks with Dry Joints – The Ultimate Bending Moment Capacity

Design Code/Reference	Notes
BS5400: Part 4 – 1990 (Note: Not applicable to dry jointed decks)	No specific guidance given for the design of decks using external tendons with dry joints.
BD58/94: The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing	No specific guidance given for the design of decks with dry joints.
BS EN 1992-1-1:2004	No specific guidance given for the design of decks with dry joints.
AASHTO Guide Specification for Design & Construction of Segmental Concrete Bridges 2nd Edition 1999	Lower strength reduction factor, ϕ, used for dry joints as compared to glued joints. $\phi = 0.90$ *Glued Joints* $\phi = 0.85$ *Dry Joints*

It has been successfully shown that there is a good correlation in behaviour of dry jointed segmental bridge decks determined using finite element methods and test data. This is described in the paper, "Precast segmental box girder bridges with external prestressing – design and construction by Prof. Dr Ing. G. Rombach".

It is proposed that a non-linear finite element model to be created to determine the ultimate limit state response of a typical standard span. The mid-span deflection can be plotted against increasing applied live load bending moment. The bending moment being increased incrementally until the model shows the deck has failed due to concrete crushing in the extreme compression fibre. This is the approach described in BS EN 1992-2 to verify the ultimate limit state capacity. The Figure 1 from the finite element software MIDAS FEA illustrates the dry joint behaviour at the ultimate limit state, with the joints opening up over mid-span. This analytical approach can be used to determine the ULS moment capacity of the span and the increase in stress in the tendons at failure.

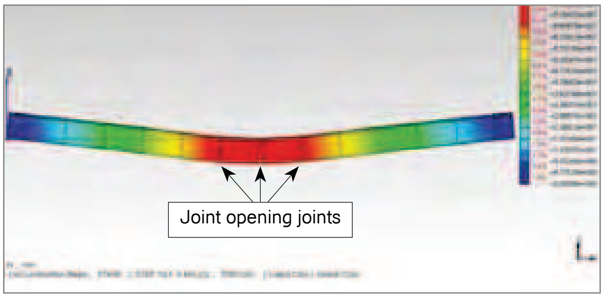

Figure 1: Dry Joint Behaviour at Ultimate Limit State

2. ULTIMATE SHEAR LIMIT STATE CAPACITY FOR SECTIONS BETWEEN JOINTS

The design rules for shear of sections between joints described in BS5400: Part 4 are based on test results for bonded tendons. Consequently their use for external unbonded tendons is inappropriate. Designing prestressed concrete bridges with external tendons in the UK requires the BD58/94 standards to be used.

The DMRB document BD58/94 does give a method for designing sections with external unbonded tendons. This is to treat the section as a reinforced concrete column section with an externally applied load. However, in general this approach is generally considered conservative and it also does not make any allowance for the opening that may occur at dry joints. The opening at the joint reduces the depth through which the web shear compression strut can pass.

The AASHTO Guide Specification for Design of Segmental Bridges also uses a strut and tie model to determine shear capacity. However, it makes no reference to the design of decks with dry joints or limitations on the size of the compression strut due to the opening of the joints. The strength reduction factors, ϕ, for both glued and dry joints is $\phi = 0.85$.

It is proposed that BS EN 1992-2 to be used for the shear design of sections between joints. Specific reference is made to the design of segmental structures with precast elements and unbonded prestressing. The code makes allowance for the decompression of joints under ultimate limit state loading and the subsequent reduction in depth through which the compression strut can pass.

3. SHEAR CAPACITY OF DRY JOINT BETWEEN SEGMENTS USING SHEAR KEYS

Typically, the shear design of dry joints relies on the friction capacity of the concrete interfaces between shear keys and the shear resistance of the shear key. A comparison between the various codes of practice and methods available for the design of joints in segmental bridges has been completed. Specific reference has been made to the design of dry joints. Details of the comparison are provided in Table 2 and an example of typical shear capacities are given in the attached calculations shown in Table 3.

Table 2: Precast Segmental Decks with Dry Joints – The Dry Joint Ultimate Shear Capacity

Design Code/Reference	Equation	Notes
BS5400: Part 4 – 1990 (Note: Not applicable to dry jointed decks)	ULS Shear Capacity, $V = 0.7 \times (\tan \alpha_2) \times \gamma_{fl} \times P_h$	α_2 = Joint friction angle γ_{fl} = Prestressing force partial safety factor = 0.87 P_h = Horizontal component of force after losses (kN)
BD58/94 The Design of Concrete Highway Bridges and Structures with External and Unbonded Prestressing	No guidance given for the design of decks with dry joints	
BS EN 1992-1-1:2004	$v_{Edi} \leq v_{Rdi}$ Design shear stress, $v_{Edi} = \beta \times V_{Ed} / (z \times b_i)$ Design shear resistance, $v_{Rdi} = (c \times f_{ctd}) + (\mu \times \sigma_n) \leq 0.5 \times v \times f_{cd}$	V_{Ed} = Shear force (kN) z = Lever arm of composite section (mm) β = longitudinal force ratio b_i = width of interface (mm) c = Friction coefficient = 0.35 σ_n = Compressive stress in concrete after all losses (N/mm^2) f_{ctd} = Design tensile strength (N/mm^2) μ = Friction Coefficient = 0.60
AASHTO Guide Specification for Design & Construction of Segmental Concrete Bridges, 2nd Edition, 1999	Shear Strength, $V_{uj} = \phi_j \times V_{nj}$ Nominal Shear Capacity, $V_{nj} = A_k \times \sqrt{f'_c} \times (12 + 0.017 f_{pc})$ $+ (0.6 \times A_{sm} \times f_{pc})$	ϕ_j = Strength reduction factor for the design of dry joints = 0.75 A_k = Area of the base of all shear keys in failure plane (*in*^{2}) A_{sm} = Area of contact between smooth surfaces on failure plane (*in*^{2}) f_{pc} = Compressive stress in concrete after all losses (*psi*) $\sqrt{f'_c}$ = Characteristic concrete compressive stress (*psi*)
Prestressed Concrete Bridges: Design & Construction by Nigel Hewson	ULS Shear Capacity, $V = \dfrac{[(1.4 f_c \times A_{sk}) + (0.6 f_c \times (A_w - A_{sk}))]}{F.O.S}$	f_c = coexistent compressive stress on the web (N/mm^2) A_{sk} = Area of Shear Key (mm^2) A_w = Area of Web (mm^2)
Dry Joint Behavior of Hollow Box GirderSegmental Bridges – fib Symposium, Segmental Construction in Concrete, New Delhi, 26-29.11.2004	Shear Strength, $V_{uj} = \phi_j \times V_{nj}$ Nominal Shear Capacity, $V_{nj} = (\mu \times \sigma_n \times A_{joint}) + (0.14 \times A_k \times f_{ck})$	ϕ_j = Strength reduction factor for the design of dry joints = 0.5 A_{joint} = Area under compression (mm^2) A_k = Area of the base of all shear keys in failure plane (mm^2) σ_n = Compressive stress in concrete after all losses (N/mm^2) f_{ck} = Characteristic concrete compressive stress (N/mm^2) μ = Friction Coefficient = 0.65

Table 3: Sample Calculations of Dry Joint Shear Capacities using Various Codes

	Section: Deck Segment **Calcs for: Joint Shear Capacity Comparison – Typical Example**	**Date: 8/5/2012** **By: twk/ttw**
	Prestressed Concrete Bridges: Design & Construction ULS Shear Capacity $V = ((1.4f_c \times A_{sk}) + (0.6f_c \times (A_w - A_{sk}))) / \text{F.O.S}$ where f_c = 6 N/mm^2 A_{sk} = 480000 mm^2 A_w = 539750 mm^2 F.O.S = 2.0	V = 2124 kN
AASHTO 12.2.21	**AASHTO Guide Specification for Design & Construction of Segmental Concrete Bridges 2nd Edition 1999 (Clause 12.2.21)** Shear Strength $V_{uj} = \phi_j \times V_{nj}$ $V_{nj} = A_k \times \sqrt{f'_c} \times (12 + 0.017f_{pc}) + (0.6 \times A_{sm} \times f_{pc})$ where ϕ_j = 0.75 A_k = 744 *in*^{2} f'_c = 5800 *psi* f_{pc} = 870 *psi* A_{sm} = 93 *in*^{2} Note: The use of Type B (Dry) Joints was prohibited by AASHTO 2003	V_{uj} = 5226 kN
BS5400:4 6.3.4.6	**BS5400 Part 4 1990 – Code of Practice for Design of Concrete Bridges (Clause 6.3.4.6)** ULS Shear Capacity $V = 0.7 \times (\tan \alpha_2) \times \gamma_{fl} \times P_h$ where α_2 = 0.942 Rads γ_{fl} = 0.87 P_h = 15000 kN	**NOT APPLICABLE TO DRY JOINTS** V = 12561 kN
	Dry Joint Behaviour of Hollow Box Girder Segmental Bridges – fib Symposium Segmental Construction in Concrete, New Delhi 26-29/11/2004 Shear Strength $V_{uj} = \phi_j \times V_{nj}$ $V_{nj} = (\mu \times \sigma_n \times A_{joint}) + (0.14 \times A_k \times f_{ck})$ where ϕ_j = 0.5 A_{joint} = 539750 mm^2 f_{ck} = 40 N/mm^2 σ_n = 6 N/mm^2 A_k = 480000 mm^2 μ = 0.65	V_{uj} = 2397 kN
1992-2 6.2.5	**BS EN 1992-2 – Eurocode 2 Design of Concrete Structures** Design Shear Stress $v_{Edi} = \beta \times V_{Ed} / (z \times b_i)$ Design Shear Resistance $v_{Rdi} = (c \times f_{ctd}) + (\mu \times \sigma_n) \leq 0.5 \times \nu \times f_{cd}$ where V_{Ed} = 1200 kN z = 1250 mm β = 1.0 b_i = 425 mm c = 0.35 σ_n = 6 N/mm^2 f_{ctd} = 1.67 N/mm^2 μ = 0.6	v_{Edi} = 2.26 N/mm^2 v_{Rdi} = 4.18 N/mm^2 V = 2223 kN

(Continued on page 29)

The code of practice to be used in the design, BS 5400: Part 4, does not contain any guidance on the use of dry joints. The clause relating to the shear design of joints in segmental bridges is not applicable for the use of dry joints. The Highways Agency DMRB document BD 58/94 can be used to supplement the code. This document permits the use of dry joints with external unbonded prestressing. However, it does not give any direction on the design of the joints.

Since the shear design of dry joints is not covered in BS 5400: Part 4, alternative design methods have been examined. The use of dry joints is covered by BS EN 1992-2 and guidance is given to enable joint shear capacity to be determined. Reference has also been made to the AASHTO design standards. The use of dry joints has been prohibited in precast segmental bridges by AASHTO since 2003. However, before this date, dry joints were allowed. The AASHTO Guide Specification for Design of Segmental Bridges, 1999, has been used to determine the capacity of a typical dry joint. Finally, reference has been made to the paper, Dry Joint Behaviour of Hollow Box Girder Segmental Bridges – fib Symposium, Segmental Construction in Concrete, New Delhi, 26-29.11.2004.

As shown in the example in Table 3, calculations for a typical box section of the codes that give specific guidance on the shear design of dry joints, AASHTO gives the greatest capacity followed by BS EN 1992-2. The BS EN 1992-2 capacity compares well with the values determined using the paper presented at fib Symposium and Prestressed Concrete Bridges: Design & Construction by Nigel Hewson.

It is also common to allow for shear keys to be damaged during construction. It is therefore proposed to base the joint design on the area of shear keys reduced by minimum 5%.

CONCLUSION

Since the current BS 5400: Part 4 does not cover the design of precast segmental box girder with dry joints and external tendons, it is inappropriate for the designer to treat the dry joint design as a wet or epoxy joint design by using the formulae in BS 5400: Part 4, which will give a higher shear and moment capacity as compared to the actual resistance capacity. ■

Ir. Teh Tzyy Wooi graduated from Universiti Kebangsaan Malaysia with a degree in Civil Engineering and obtained his M.Sc. in bridge engineering. He is a corporate member of IEM and IStructE and has received the "Young Engineer Award 2009". He has 13 years of working experience in the field of designing, independent checking and inspection for various types of bridges, both locally and abroad.

Ir. Tan Wang Khai graduated from the University of Technology with a degree in Civil Engineering. He also holds a Masters degree, majoring in construction management and currently works as a Principal Engineer in a consulting firm. He has 10 years of working experience in the field of designing various types of bridges.

NON-IEM EVENT

8-11 May 2013

Second FEIAP Convention 2013

Organised by The Institution of Engineers, India

Venue : Hotel Taj Krishna, Banjara Hills, Hyderabad, India
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Website : www.tajhotels.com
For more details, go to *www.ieindiaapscfeiap2013.org*

URBAN FLASH FLOODS – WHAT COULD HAVE GONE WRONG?

THE flash flood that occurred on 18 February 2013 along KM21.36 and KM23.50 of the Damansara-Puchong Highway (LDP) had caused a considerable damage and inconvenience to local businesses, to motorists and the public.

The main cause of the flood cannot be attributed to heavy rainfall or the low ground level of the affected areas. JPS's telemetric rainfall station in the vicinity recorded 68 mm of rain in the late afternoon of that day which is not exceptionally heavy. Statistically, such rainfalls could generally have been exceeded several times in a year.

It is however, heartening to note that MPSJ was prompt in responding and had called for a meeting of the parties involved namely LITRAK, MRCB, SPNB and JPS to identify the causes of the flood. It was established that one of the three underground culverts was not functioning properly and was therefore unable to drain off excessive rainwater. The reasons behind such dysfunction of the said underground culvert ought to be thoroughly investigated.

There could be many reasons as to why the culvert has 'malfunctioned'. For instance, littering by irresponsible people on a daily basis would eventually get the culvert clogged with rubbish. The public must be informed that the water drainage system is NOT a rubbish disposal system. There are other facilities for proper rubbish disposal which should be provided for and used whilst enforcement against indiscriminate dumping of rubbish must be carried out. It is time for everyone to be aware that their irresponsible doings can contribute to floods as well as other negative environmental effects. In addition, local authorities and road concessionaires should also ensure that periodical and continuous clearing of rubbish and silt from flood-prone areas is carried out efficiently.

Another possible reason for the flood in this case could have been the ongoing construction and excavation works near and around the flood affected areas. During recurring rainfall, silt and debris from the construction sites could have been washed and deposited at the culvert. The earth deposits on the bottom of culverts would reduce the cross-sectional area of the culvert and thus, impeding the capacity of the culvert to carry water away.

Ongoing construction works had been the culprit in causing many flash floods. Some irresponsible contractors often take shortcuts in temporary diversion works, taking risks in order to reduce their costs. Hence, contractors must adopt a more professional approach and use appropriate rainfall data in their design of temporary works. Best management practices on silt traps, culverts and drains must also be incorporated. Again, law enforcement by the relevant authorities is crucial.

The Institution of Engineers, Malaysia (IEM) is keen to assist the authorities in resolving recurrence of such flood incidents and if there is a need, we would be pleased to nominate our members to offer their expertise. ■

Contributed by: Water Resources Technical Division

LIFTS ARE DESIGNED TO BE "FAIL-SAFE": HIGHLIGHTING THE BASIC SAFETY FEATURES OF LIFTS

WE refer to the news reports on 20 February 2013 whereby a woman was killed when a lift plunged five floors after its cable snapped in a 10-storey apartment block at the Lumut naval base in Perak.

It is shocking to note that yet another public facility had failed to function and killed a woman passenger. We should be thankful the lift was not fully occupied. The loss of a single life is horrible enough. The question that begs to be asked is why did this incident happen? Could we have taken necessary precaution to ensure such incidents do not occur?

thestar online

Saturday March 2, 2013

Have proper lift maintenance programme

WE refer to the news report on Feb 20 where a woman was killed when a lift plunged five floors after its cable snapped in a 10-storey apartment block at the Lumut naval base.

It is shocking that yet another public facility failed to function, resulting in the death of a woman passenger.

We should be thankful the lift was not fully occupied. The loss of a single life is horrible enough.

The question that begs to be asked is, why did this happen? Could we have taken necessary precautions to ensure such incidents do not occur?

The answer is a resounding "Yes" and hinges on a good and committed maintenance programme.

For centuries, lifts have proven to be effective vertical transportation systems and as engineers we can attest to this.

We also know that poor maintenance and even negligence can result in mishaps but we do have preventive measures that can save lives.

Each lift has a minimum of five hoisting cables and in the event one cable snaps, the remaining four would ensure safe travel in the lift.

So, why did all five cables give way simultaneously?

This wire rope must be properly installed, aligned and calibrated by an experienced technician to function effectively.

Even with the snapped hoisting ropes, the free falling lift car would be stopped by the mechanical brakes on the main guide rails as the last line of defence before it slams on the buffer in the pit.

What is baffling is how all these safety features failed to work.

The mechanical and material specialists will be able to give their professional and analytical views on this impulse force which was so powerful that all strands of wire rope failed instantly and all at the same time.

We can definitely speculate that poor maintenance or even no maintenance could be the cause of this incident.

The persons assigned to conduct regular maintenance work should provide a definitive explanation on the level of maintenance that has been carried out.

The question is whether the quality of maintenance service provided was below par. Were skilled technicians assigned to carry out maintenance works? Were genuine spare parts used?

If the answers are NO, it is only right that appropriate action, in accordance with the relevant regulations, be taken against the maintenance supplier.

We also believe that Department of Occupational Safety and Health (DOSH) should do their part to ensure that only authorised lift vendors are registered as maintenance companies to perform maintenance.

We further urge the regulatory agency to oversee all such maintenance companies to ensure only competent and qualified individuals are appointed to carry out all maintenance work and to certify the work done at the site.

We understand that there is a shortage of competent and qualified persons specialising in lift installation and maintenance work.

We strongly recommend that DOSH certify more of such persons under a National Occupational Skill Standard (NOSS).

The IEM hopes that proper investigations will be carried out to determine the cause of the mishap.

If there is a need, the IEM will be pleased to offer its services.

IR PROF DR JEFFREY CHIANG CHOONG LUIN
Honorary Secretary
THE INSTITUTION OF ENGINEERS, MALAYSIA

The answer is a resounding 'yes' and it hinges on a good and committed maintenance programme. For centuries, lifts have proven to be effective vertical transportation systems and as engineers we can attest to this. We are aware that poor maintenance and even negligence can result in mishaps but we do have preventive measures that can save lives.

Let us take a closer look at the safety features of a lift. Each lift has a minimum of five hoisting cables and in the event one cable snaps the remainder four would ensure safe travel in the lift. So why did all five cables give way simultaneously? This wire rope must be properly installed, aligned and calibrated by an experienced technician to function effectively. Even with the snapped hoisting ropes the free falling lift car would be stopped by the mechanical brakes on the main guide rails as the last line of defence before it slammed on the buffer in the pit. What baffles us is how all these safety features failed to work.

The mechanical and material specialists will be able to give their professional and analytical views on this impulsive force which was so powerful that all strands of wire rope failed instantly and all at the same time. We can definitely speculate that poor maintenance or even no maintenance could be the cause for this incident. The persons assigned to conduct regular maintenance work should provide a definitive explanation on the level of maintenance that has been carried out.

More importantly, whether or not the quality of maintenance service provided was below par is the main concern. Were skilled technicians assigned to carry out maintenance works? Were genuine spare parts being used? If the answers are NO, it is only right that the appropriate action in accordance with the relevant regulations be taken against the maintenance supplier.

We also believe that the Department of Occupational Safety and Health (DOSH) should do their part to ensure that only authorised lift vendors are registered as maintenance companies, and only such maintenance companies are allowed to perform maintenance works. We further urge the regulatory agency to oversee all such maintenance companies to ensure only the competent and qualified individuals are appointed to carry out all maintenance work and to certify the work done at the site.

We understand that there is a shortage of competent and qualified persons specialising in lift installation and maintenance work. Hence, we strongly recommend DOSH to certify more of such persons under the National Occupational Skill Standard (NOSS).

The IEM hopes that proper investigations will be carried out to determine the cause of the mishap. If there is a need, the IEM will be pleased to offer its services. ■

Contributed by: Mechanical Engineering Technical Division

USM Launches Mini Bio-Gas Energy Plant to Produce Electricity

Universiti Sains Malaysia (USM) has launched a mini biogas energy plant capable of generating 600 kilowatt of electricity a day from food waste in the campus. USM vice-chancellor Prof. Datuk Omar Osman said the pioneer project carried out in cooperation with the university's industry partner, Enerbon Sdn. Bhd., was aimed at building a prototype plant for the use by interior communities which had problems in obtaining regular electricity supply. Food waste provided by all cafeterias and canteens in the campus will be converted into methane which will in turn be used to generate electricity. The plant had two tanks which could accommodate 400 kg of food and organic waste. The electricity would be channelled to the university's power supply grid. It was designed according to industrial standard but it could also be modified into a smaller version to suit a community of 500 people. – BERNAMA

(Sourced from the New Straits Times, 2 March 2013)

Eversendai Teams Up with Technics

Eversendai Corp Bhd. has set up a joint-venture (JV) company with Singapore-listed Technics Oil & Gas Ltd. to jointly develop a fabrication plant and facilities for offshore and onshore works in the Middle East. In this JV, Eversendai holds a 69.99% stake in Eversendai Technics Pte. Ltd., Technics a 30% interest, while Eversendai Construction (S) Pte. Ltd. (ECS) will own the rest. Eversendai and ECS will pay US$700,000 (RM 2,177,700) for its equity in the JV company through internal funds. It aims to bid for projects in the oil and gas (O&G) industry, which includes detailed engineering design, construction fabrication, building and upgrading of rigs, vessels, jackets, topsides, processing modules and other O&G facilities, mainly in the Middle East.

(Sourced from The Sun Daily, 12 March 2013)

Halliburton Energy Plans to Double Senai Plant Output by 2015

Halliburton Energy Services (M) Sdn. Bhd. plans to double its manufacturing output in Senai, Johor, by 2015. Halliburton Energy is the local unit of US-based Halliburton group, a global provider of products and services to the oil and gas industry. Area Vice President Rao Abdullah said the Senai plant was now running at full capacity, producing RM300 million worth of output annually. He said, "We will invest an additional RM105 million for this purpose, on top of more than RM500 million investment spent there. In the next two years, we hope to double the output to RM600 million in value annually". The plant, which has a built-up of 190,000 sq ft, manufactures completion tools and cementing product service lines. Key products made there include float equipment, sliding side doors, permanent packers and retrievable packers. Currently, the products were for local and export markets which included the Middle East, Latin America and Africa. Halliburton Energy also plans to double its workforce at the facility from 300 people to 600 in two years. The company would be talking to Malaysian Investment Development Authority (Mida) to find a solution to source additional employees, as high-skilled engineers and machinists are required. – BERNAMA

(Sourced from The Star, 11 March 2013)

HSR, New MRT Line Tenders Likely in 2014

The Land Public Transport Commission's (SPAD) expects the Kuala Lumpur-Singapore high-speed rail (HSR) project and the next mass rapid transit (MRT) line to reach their tender and award phases in one-and-a-half years, said CIMB Research. "Although feasibility studies have been completed, approval of alignments and the Cabinet go-ahead have yet to be secured with project structures yet to be finalised," said its analyst, Sharizan Rosely. The next MRT line is likely to be a circle line. Its detailed feasibility study has been completed and the government will make a decision by end of 2013. Factoring in the time needed for the Cabinet's approval, public displays of alignments and tendering, the award is likely by mid of 2014. On the RM30 billion widely reported cost estimate for the HSR project, Sharizan said it is still questionable, pending a decision on the rail's final alignment, track profile and number of stops. The alignments (320-330km) will be entirely new and are likely to cover the major part of the western corridor of Peninsular Malaysia. What is more certain is that the HSR will not likely adopt magnetic levitation (maglev) technology as this would be costlier.

(Sourced from The Sun Daily, 7 March 2013)

Resolving Power Issues

Renewable energy is one of society's greatest needs of the century. Universiti Kebangsaan Malaysia's (UKM) Fuel Cell Institute researcher Dr Mostafa Ghasemi said he and other scientists were experimenting with various low-cost material alternatives for the components of a microbial fuel cell. A microbial fuel cell (MFC) or biological fuel cell is a device that converts chemical energy to electrical energy by the catalytic reaction of microorganisms such as bacteria and algae. A typical MFC consists of anode and cathode compartments separated by a cation (positively charged ion) specific membrane. Dr Ghasemi explained that the features of a MFC make it suitable for simultaneous wastewater treatment and energy production.

Microbes that exist naturally in the sewage will produce electrons as they metabolise or digest organic material in the sludge. When the electrons are transferred to the cathode compartment of the fuel cell, they generate the current and voltage to make electricity. Therefore, wastewater is treated while at the same time, electricity is generated for use as a power source. However, the important components required for a combined water treatment and power generation plant are still quite expensive and the engineering issues such as low current density and low power must first be resolved before a viable large-capacity facility can be operational. 90% of the cost of a MFC is due to the cathode catalyst and Proton Exchange Membrane used in the fuel cell. Platinum is the best material for the cathode and it can last for about six years in the MFC.

(Sourced from The Star, 10 March 2013)

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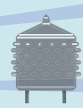

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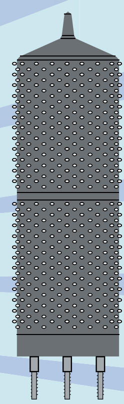

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**ICAO* Annex 14: Aerodromes, Vol I: Aerodrome Design and Operation, Chapter 6: Visual aids for denoting obstacles

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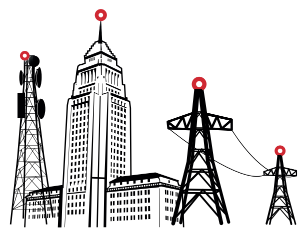

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Consideration of Explosions, Fire and Impact Loads in Building Structural Design to Mitigate Disaster


by Ir. Mun Kwai Peng and Ir. M.C. Hee

CIVIL AND STRUCTURAL ENGINEERING TECHNICAL DIVISION

A short course entitled, "Life Threatening Incidents of Explosions, Fire and Impact in Building Structural Design to Mitigate Disaster" was organised by the Civil & Structural Engineering Technical Division of The Institution of Engineers, Malaysia (IEM) on the 29 and 30 May 2012 at Hotel Armada, Petaling Jaya, Selangor. A total of 89 participants had attended the course.

A total of eight technical sessions were conducted by three experts from Monash University and University of Melbourne, Australia:

i. Lessons Learnt from Past Events
ii. Structural Design for Fire Resistance (I)
iii. Structural Design for Fire Resistance (II)
iv. Structural Design for Impact Actions (I)
v. Structural Design for Impact Actions (II)
vi. Blast Actions (I)
vii. Blast Actions (II)
viii. Structural Design for Impact Actions (III).

FIRE DESIGN

The subject of Fire Design according to the Eurocodes was delivered by Prof. Bill Wong from the University of Melbourne, Australia. He provided illustrations of various examples of disaster such as fire, structural failure of buildings and bridges, as well as their consequences. According to Eurocodes, Fire Design is meant to minimise the loss of lives and property should a fire occur in buildings. The current fire design is based on a Performance Based Approach, a methodology of design that is totally new in structural design philosophy. For example, the column is designed for the ultimate limit state in selection of materials, size and reinforcement to support the ultimate load. In cases where the column will require say about 80% of the capacity for service load, the remaining will be utilised for fire design. Such methodology is defined as Performance Based Approach.

Prof. Bill Wong also illustrated the methods used in Eurocodes for design of structural concrete and steel sections against fire. An Excel programme for designing a steel section was distributed to the participants without any charge. It was amazing to hear that the Windsor Tower fire in Spain 2005 did not cause structural collapse, even though the fire had burned the building continuously for 18 hours. He also illustrated the unfortunate case of the World Trade Centre collapse due to fire in the 'September 11 attack' (911) by terrorists, where an aircraft hit the said building.

EXPLOSION

The subject of explosion was delivered by Dr Tuan Ngo, a senior from the University of Melbourne, Australia. He introduced the subject by illustrating the effects of explosion created by terrorists all over the world. For example: Ronan Point (1968); St Mary Axe, London (10 April 1992); Bishopgate, London (24 April 1993); Oklohoma City (19 April 1995); Manchester (15 June 1996); Khobar Tower (25 June 1996); and the Australian Embassy bombing in Jakarta (2004).

He also illustrated how blasting propagates and its effects on buildings, especially the façade. Dr Tuan Ngo also provided some methods of design that would help resist blast forces. However, human beings would have no chance of surviving a blast because of the extreme pressures.

IMPACT

The subject of Impact loading was delivered by Prof. Nelson Lam from the University of Melbourne, Australia. He is no stranger to IEM members as he has conducted many short courses pertaining to Earthquake Engineering. He illustrated the effect of impact load on a structure for both horizontal and vertical structural members. Various configurations of structural members were illustrated such as simply supported, fixed end propped cantilever and cantilever. Impact of objects on slabs was also demonstrated.

The most important aspect of his presentation was his intention to unify the method of design to that of other structural dynamic problems, especially those unified to the method used in earthquake resistance design for buildings where the response spectrum is used. This will be a great simplification to the design of structure as no new code will be required for impact loading. The existing seismic code would be sufficient. ■

Ir. Mun Kwai Peng operates a company specializing in the use of stresswave measurement to perform dynamic load test on piles. He is a member of PPC, EC0, EC1, EC2, EC3, EC7, EC8 and Malaysian Wind Code committee. He is also the IEM SWO (Standard Writing Organisation) coordinator.

Ir. M.C. Hee is the Chairman of the Earthquake Technical Committee (WG1), IEM and a Structural Consulting Engineer and Principal of M C Hee & Associates, Malaysia.

CONTRIBUTIONS TO WISMA IEM BUILDING FUND

RM 2,120,511.20 from IEM Members and Committees

RM 641,502.00 from Private Organisations

TOTAL RM 2,762,013.20

(ANOTHER RM 9,387,986.80 IS NEEDED)

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

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

(The donation list to the Wisma IEM Building Fund is published on page 51)

Courtesy Visit of the IChemE for Potential Collaboration

CHEMICAL ENGINEERING TECHNICAL DIVISION

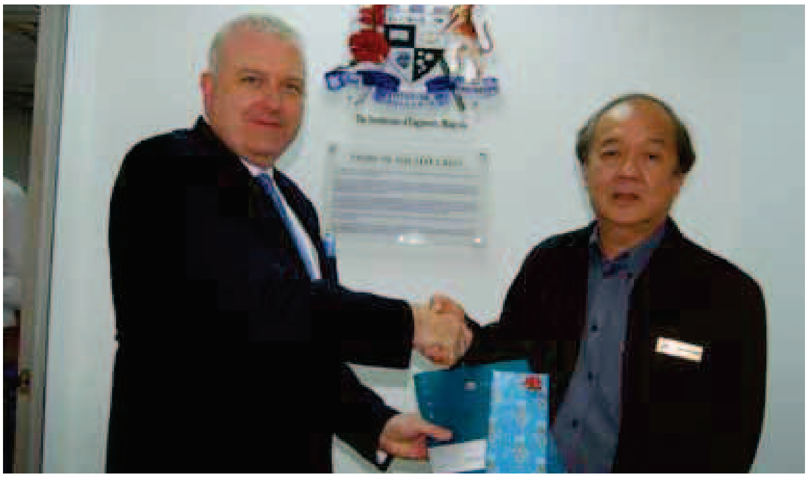
by Ir. Prof. Dr Dominic Foo Chwan Yee

IEM hosted a courtesy visit by a delegation from the Institution of Chemical Engineers, UK (IChemE) on 3 October 2012 at Wisma IEM. IEM was represented by Deputy President, Ir. Choo Kok Beng, Executive Director, Ir. Cheang Kok-Meng, as well as representatives from the Chemical Engineering Technical Division (CETD), namely the CETD Chairman, Ir. Prof. Dr Dominic Foo Chwan Yee (then Deputy Chairman) and CETD Secretary/Treasurer, Ir. Thayananthan Balakrishnan (then Committee Member). The IChemE was represented by its Deputy CEO, Mr. Justin Blades; Chairman of IChemE Malaysia Branch, Ir. Prof. Dr Abdul Wahab Mohammad, and the Southeast Asia Regional Manager, Mr. Mohan Balasingam. The purpose of the visit was to identify the areas of interest for potential collaboration between these two organisations in the near future.

To kick start the discussion, Ir. Cheang Kok-Meng had first introduced the background of IEM to IChemE. Then, he gave a more thorough overview about IEM, such as its

From left: CETD Chairman Ir. Prof. Dr Dominic Foo Chwan Yee; IChemE Regional Manager (SEA), Mr. Mohan Balasingam; CETD Secretary/Treasurer, Ir. Thayananthan Balakrishnan; IChemE Deputy CEO, Mr. Justin Blades; IChemE Malaysian Branch Chairman, Prof. Ir. Dr Abdul Wahab Mohammad; IEM Deputy President, Ir. Choo Kok Beng; and IEM Executive Director, Ir. Cheang Kok Meng posing together after the IEM-IChemE meeting

IChemE Malaysian Branch Chairman, Prof. Ir. Dr Abdul Wahab Mohammad, elaborating the agenda and purpose of the visit to IEM representatives in the meeting



IEM Deputy President Ir. Choo Kok Beng presenting a token of appreciation to IChemE Deputy CEO, Mr. Justin Blades

current membership which had reached 23,000 throughout Malaysia, with its 18 Technical Divisions and three Special Interest Groups, covering the four major (i.e. civil, mechanical, electrical and chemical) and minor engineering disciplines.

According to Mr. Justin Blades, IChemE is an international body representing chemical engineers worldwide with a total membership of 35,000 across 120 countries. He also explained that the branch in Malaysia had recorded the strongest membership growth in the past few years.

The two organisations have reached an agreement that it was timely to work together for the benefit of their members. Both Ir. Choo Kok Beng and Mr. Justin Blades have also agreed that an area of mutual benefit was the corporate membership of both parties, which needed to be explored in detail with the formation of a special committee. Ir. Prof. Dr Dominic Foo also suggested that various activities could be jointly organised between CETD and the IChemE. The visit concluded with a proposal to sign a Memorandum of Agreement between IEM and IChemE in the near future. ■

Ir. Prof. Dr Dominic Foo Chwan Yee is currently the chairman of IEM Chemical Engineering Technical Division (CETD). He is the Founding Director of the Centre of Excellence for Green Technologies, University of Nottingham Malaysia Campus. Dominic won the 2009 Innovator of the Year of IChemE, 2010 Young Engineer Award of IEM, and also the recent Outstanding Young Malaysian Award 2012.

IEM-Korean Concrete Institute (KCI) Dialogue Meeting

CIVIL AND STRUCTURAL ENGINEERING TECHNICAL DIVISION

by Ir. Assoc. Prof. Dr Low Kaw Sai

THE IEM-Korean Concrete Institute (KCI) Dialogue Meeting hosted by the Civil & Structural Engineering Technical Division of The Institution of Engineers, Malaysia (IEM) was held on 20 July 2012 at Wisma IEM, Petaling Jaya.

The IEM delegation which consisted of six members was headed by the Vice President, Dato' Ir. Lim Chow Hock, together with four secretariat staff. The Korean Concrete Institute (KCI) team was represented by nine delegates led by Prof. Jongsun Sim, the President of KCI. Out of the nine members whom were present, four of them were from KCI itself and the rest were chosen from the concrete-related industries in Korea.

Prof. Jongsun Sim and Dato' Ir. Lim Chow Hock in action

Soon after the arrival of the KCI delegates at 1.30 p.m., the event started by Dato' Ir. Lim Chow Hock welcoming the KCI delegates to IEM. This was followed by a mutual introduction amongst members from the two institutions beginning from by Dato' Ir. Lim, followed by the IEM delegates and secretariat staff, and subsequently, the KCI members led by Prof. Jongsun Sim and the rest of his delegation.

Dato' Ir. Lim went on to thank the KCI delegation for initiating this dialogue meeting. He mentioned that as an institution in Malaysia that represents and is constantly looking after the interest of engineers in this country, IEM welcomed this commendable move by KCI and believed that it would foster a closer working relationship between the two institutions.

After delivering his short speech, Dato' Ir. Lim then handed the session over to the Executive Director of IEM, Ir. Cheang Kok Meng for a presentation on IEM. This presentation aimed to instill a clearer picture of IEM as a professional institution in Malaysia to the KCI members.

In return and upon the invitation of Dato' Ir. Lim, the head of the KCI delegation, Prof. Jongsun Sim, too gave a presentation on KCI and its activities. He then informed the participants that KCI actually consists of professionals drawn from various concrete related fields. Subsequently, he went on to explain about the structure, activities, membership and other details of his organisation.

On the subject of collaboration and joint activities, both IEM and KCI had signed a Memorandum of Understanding (MoU) on 14 November 2011. This MoU is for three years, with automatic renewal for another three years. Based on this document, the two institutions have agreed to collaborate on activities for the benefit of their members. For example, KCI would conduct evening talks at IEM premises, engage in the mutual exchange of publications and journals with IEM and hold other similar activities.

Before the meeting ended, Dato' Ir. Lim Chow Hock informed KCI member of a few events of IEM which included 'The Asia-Pacific Conference 2012 (APC2012) entitled, *"Cradle to Cradle Structures in Transport Engineering"* (10 September 2012), Engineering Week 2012, and the Engineering Invention and Innovation Expo (EINIX). The latter was to promote the engineering profession to the public via exhibition of creative inventions and innovative products of undergraduates from the local universities in Malaysia. KCI was warmly encouraged to participate in such activities and other future events of IEM.

The meeting ended with a note of thanks to the Chairperson. This was soon followed by a brief group photography session and an exchange of souvenirs before

A group photo taken after the dialogue session

the meeting was adjourned and later reconvened as the 'Afternoon Forum' at Wisma IEM, an event that was open to both IEM members and invited guests.

The 'Afternoon Forum' started off with a 15-minute presentation given by a committee member of the Civil and Structural Engineering Technical Division of IEM on *"Concrete Engineering Practice and Seismic Design Standards Development in Malaysia"*. This was followed by five consecutive presentations delivered by five different KCI delegates on various concrete-related subjects or fields. Including the time for questions and answers (Q&A), each of these five presentations lasted for about 30 minutes. Judging from the good response as well as the active interaction between the speakers and the participants, especially during the Q&A session, it was fair to conclude that it had been a meaningful event with most, if not all, of its objectives being achieved.

The dialogue meeting concluded as members from both institutions adjourned for dinner at a nearby restaurant where a more casual and cordial atmosphere prevailed and helped to foster closer friendship among the delegates. ■

Ir. Assoc. Prof. Dr Low Kaw Sai is currently the Deputy Chairman of the Civil & Structural Engineering Technical Division, IEM.

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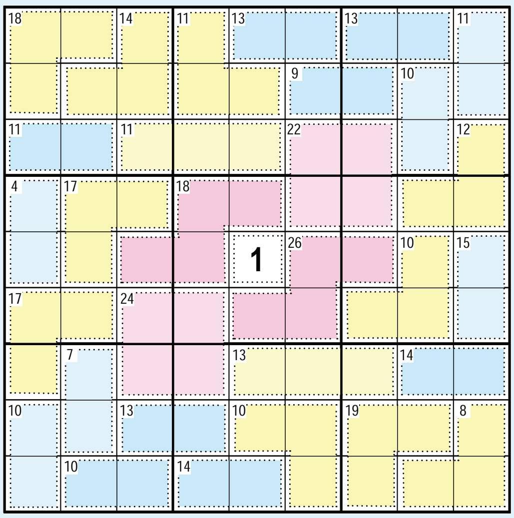
by Mr. Lim Teck Guan

Fill in the remaining 80 squares with single digits 1-9 such that there is no repeat of the digit in every Row, Column and Block of nine squares. The number at the top left hand corner of the dotted cage indicates the total for the digits that the cage encompasses.

For tips on solving, visit *www.1sudoku.com.my*

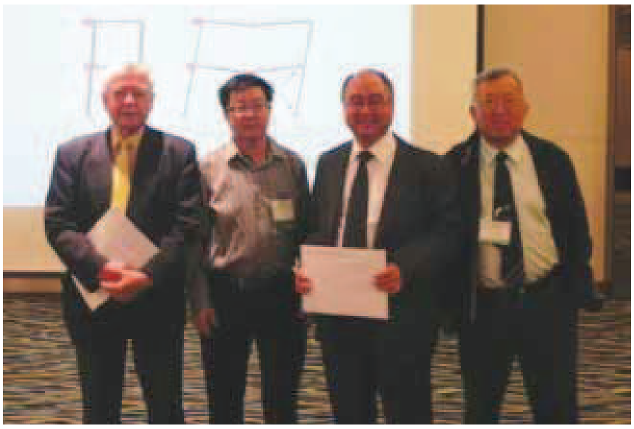
(Solution is on page 46 of this issue.)



Sequel to a Two-Day Course on Analysis and Design to EC8 Demystified

CIVIL AND STRUCTURAL ENGINEERING TECHNICAL DIVISION

by Ir. Ong Sang Woh



(From left to right) Ir. MC Hee, Ir. Ong Sang Woh, Assoc. Prof. Dr Nelson Lam and Ir. Mun Kwai Peng

THE 'Two-Day Course on Analysis and Design to EC8 Demystified' is the sequel to the EC8 Demystified course held earlier on 2 and 3 November 2011. This follow-up course was organised by the Civil & Structural Engineering Technical Division of The Institution of Engineers, Malaysia (IEM). The event was held on 5 and 6 November 2012 at Armada Hotel, Petaling Jaya. It was attended by 60 participants.

The first speaker, Associate Professor Dr Nelson Lam began by presenting an overview of the fundamentals of Earthquake Basics and Seismic Design with emphasis on the earthquake loading model proposed for Peninsular Malaysia. Other topics presented during the course were the Concepts & Computational Principles of Dynamic Analyses, Deformation Modelling of Reinforced Concrete and push-over analysis.

Associate Professor Dr Nelson Lam from the University of Melbourne, Australia is an internationally recognised expert in earthquake engineering and structural dynamics who has served as member of the sub-committee for developing the new standard for Earthquake Actions in Australia. He has published 200 technical articles with regards to earthquake engineering and structural dynamics in journals worldwide.

The second speaker Ir. M C Hee presented his lecture on Operating Dynamic Analyses of Buildings, Design of RC Buildings for Ductility Class Medium Classification and Operating Push-Over Analyses of Buildings.

Ir. M.C. Hee is a practicing Structural Consulting Engineer and a Principal of M C Hee & Associates. His expertise is in the design and construction of high-rise buildings particularly in value engineering and alternative design as well as the promotion of strut and tie applications in structural engineering. He is an active member of the technical committee drafting the Malaysian National Annex of Eurocode 8.

The following is a listing of the major topics (i.e. first 3 topics presented by Associate Professor Dr Nelson Lam) covered on the first day of the course:

i. Earthquake Basics and Introduction to Seismic Design

The fundamentals of seismic activity of the World, presence of high stresses in the earth crust (hypocentre and epicentre) and fault lines as planes of weakness, Elastic Rebound Theory, map of Tectonic Plates and seismicity from Offshore of Peninsular Malaysia were explained. The earthquake ground motions in relation to peak ground acceleration (PGA), peak ground velocity (PGV) and peak ground displacement (PGD) together with the pulse wave duration, natural period of vibration, effects of damping and the acceleration time-history affecting the response of the structure were also emphasised. The response spectrum representing seismic action and the Aseismic Design of Structures with reference to Eurocode 8 for 'No Collapse Requirement and Damage Limitation/Continuous Functionality Requirements' were highlighted.

ii. Earthquake Loading Models Proposed for Peninsular Malaysia

The different forms of response spectra in the acceleration, velocity and displacement formats with respect to time and the inter-relationship formula were shown. These response spectrum models recently developed by the speakers were presented for the prediction of long distance earthquake generated from the offshore of Sumatra and projected local earthquakes generated from within Peninsular Malaysia.

iii. Concepts and Computational Principles of Dynamic Analysis

The response simulations of single-degree-of-freedom systems by Central Difference Method, the Principles of Modal Superposition & Dynamic Equilibrium Basics for frames under 1st, 2nd and 3rd mode responses and the Eigensolutions by Mode Shape Iteration Method for multi-storey buildings and their co-relationship matrix were covered in detail. The storey displacements, drifts, inertia forces, base shear and effective modal mass together with the Modal Combination were demonstrated with spreadsheet work examples.

iv. Operating Dynamic Analysis of Buildings for Design Office Applications using Simplified-Unified Approach

The speaker Ir. M.C. Hee introduced the simplified-unified approach to reinforced concrete section analysis and design. Flexural and ductility design concepts and formulae, the moment-curvature relationship and the modal response spectrum method analysis to framed-shear-wall buildings were explained. Also, design using Midas-Gen software was demonstrated with interpretation of the results.

Both speakers covered the following topics on the second day of the course:

i. Design of Reinforced Concrete Buildings of DCM Classification

Ir. M.C. Hee went through the EC8 definition and detailing of various structural elements such as beam, column, wall and ductile wall, structural systems and local ductility with reference to Capacity Design for strong column-weak beam concept. The P-Delta effects on secondary column, joints detailing, geometric constraints for walls and an example of capacity design were illustrated using both hand and computer methods.

ii. Concepts and Principles of Deformation Modelling of Reinforced Concrete

Associate Professor Dr Nelson Lam introduced the fundamental concept of deformation modeling and its adaptation to displacement-based seismic design of structures. The concepts of estimating drift and ultimate drift at yield by hand calculations, deformation modeling by fibre analysis and the method of estimating the beneficial effects of confinement were explained. The estimation of deflection for reinforced concrete elements in both the pre-yield (cracked) and post-yield conditions (at the plastic hinges) were also presented with worked examples.

iii. Concepts and Computational Principles of Push-Over Analysis

The Capacity Spectrum Method and the use of the Accelerated-Displacement Response Spectrum (ADRS) Diagram involving the Push-Over Analysis can be an effective method in predicting the seismic performance of low-medium rise buildings. This method was illustrated by example of single and two-storey moment frame buildings basing on linear elastic behaviour and also for framed structure after formation of plastic hinges. The application of matrix computation and the list of detailed considerations for push-over analysis were highlighted.

iv. **Operating Push-Over Analysis of Buildings for Design Office Applications**
The operational details of push-over analysis by hand computation was shown based on practical case studies of buildings. Also, computer simulations using Midas-Gen software were demonstrated for comparison and the results were interpreted.

Overall, participants were introduced to the fundamentals of Seismicity on earthquake ground motions (PGA, PGV, PGD and intensities), natural periods and damping, response to a single pulse, and response spectrum. The Capacity Spectrum Method involving the push-over analysis for predicting the seismic performance of low-medium rise buildings was introduced. Examples of hand and computer modelling of building structures to EC 8 were also discussed.

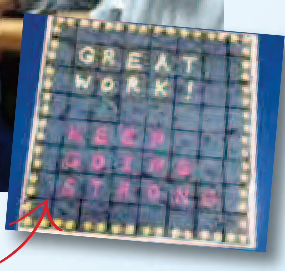
Finally, before the two-day course was concluded, a token of appreciation was presented to each of the speakers, namely Associate Professor Dr Nelson Lam and Ir. M.C. Hee. ■

Ir. Ong Sang Woh is currently the Chairman of the Civil & Structural Engineering Technical Division, IEM.

IEM SNAPSHOTS

Two social events were recently organised to celebrate Chinese New Year – the year of the snake! The first event was a luncheon hosted by the Hon. Secretary, Ir. Prof. Dr Jeffrey Chiang Choong Luin for the IEM Secretariat on 21 February 2013.

The second event was a dinner hosted by the Young Engineers Section for the IEM Council, Executive Committee and Secretariat on 26 February 2013.

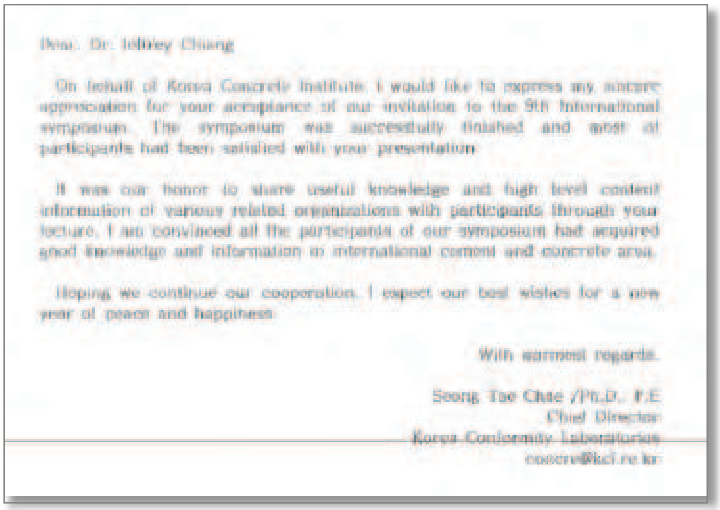


Chocolate cake courtesy of the Deputy President, Ir. Choo Kok Beng

The 9th International Symposium on Advancement on Cement and Concrete Industries

AT the 9th International Symposium on Advancement on Cement and Concrete Industries held on 19 November 2012 in Seoul, South Korea, Ir. Prof. Dr Jeffrey Chiang Choong Luin, Hon. Secretary of IEM was invited to deliver a presentation entitled, *"Current Practice in Cement and Concrete Industries in Malaysia: From the Perspective of IEM"*. The event was organised by the Korea Concrete Institute (KCI).

Reproduced below is a photograph of the event together with an acknowledgement note from KCI. ■



Dear Dr. Jeffrey Chiang

On behalf of Korea Concrete Institute, I would like to express my sincere appreciation for your acceptance of our invitation to the 9th International symposium. The symposium was successfully finished and most of participants had been satisfied with your presentation.

It was our honor to share useful knowledge and high level content information of various related organizations with participants through your lecture. I am convinced all the participants of our symposium had acquired good knowledge and information in international cement and concrete area.

Hoping we continue our cooperation, I expect our best wishes for a new year of peace and happiness.

With warmest regards,

Seong Tae Chae /Ph.D., P.E
Chief Director
Korea Conformity Laboratories
concre@kci.re.kr

Government Transformation Programme's Corporate Integrity Pledge

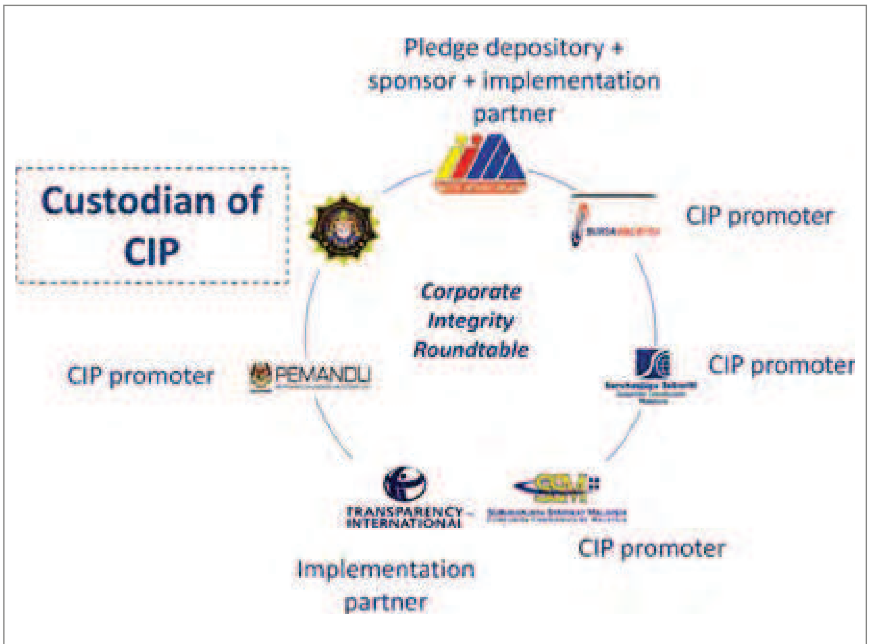
by Anti-Corruption NKRA, PEMANDU and Mechanical Engineering Technical Division

AS an initiative under the Government Transformation Programme, the Corporate Integrity Pledge (CIP) is a document that allows a company to make a commitment to uphold the Anti-Corruption Principles for Corporations in Malaysia.

By signing the pledge, a company is making a unilateral declaration that it will not commit corrupt acts, will work toward creating a business environment that is free from corruption and will uphold the Anti-Corruption Principles for Corporations in Malaysia in the conduct of its business and in its interaction with its business partners and the Government.

The effect of entering into the pledge is two-fold. Firstly, a company can use this Pledge to set itself apart from its peers by demonstrating to its stakeholders that its business operations do not include any hidden risks or costs that are associated with corrupt activities. By signing the pledge, the company can be listed in the register of signatories that is posted on the website of the Malaysian Integrity Institute (IIM). Secondly, a company will be making a clear stand of how it operates, and this will serve as a guidance to the company in its business interactions, should it be faced with the possibility of condoning any payments or other activities that would amount to corruption.

This Pledge is not issued by any regulator or authority but is a result of collaboration between the Malaysian Anti-Corruption Commission (MACC), Bursa Malaysia Berhad, the Companies Commission of Malaysia (SSM), the Malaysian Institute of Integrity (IIM), Securities Commission Malaysia (SC), Transparency International Malaysia and the Performance Management and Delivery Unit (PEMANDU), Prime Minister's Office. ■



PROFILE OF INCOMING IEM PRESIDENT FOR SESSION 2013/2014 – IR. CHOO KOK BENG

Ir. Choo Kok Beng pursued his career in Civil Engineering after his graduation from the University of Aberdeen, Scotland in 1977. He is the Managing Director of the Vertitech Group which specialises in building and structure auditing and rehabilitation.

Ir. Choo is the present Deputy President of the Institution of Engineers, Malaysia (IEM). He has been actively involved in the Institution since 1984 and has held several significant posts including its Honorary Secretary (1997-1999) and Honorary Treasurer (1996-1997). He will soon be taking office as the President of IEM for Session 2013/2014.

He is also a Fellow of the Technological Association of Malaysia (TAM), The Institution of Engineers, Malaysia (IEM), The Institution of Engineers Australia, Hon. Fellow of ASEAN Federation of Engineering Organisations (AFEO), Founding Fellow and Secretary-General of the Asean Academy of Engineering and Technology (AAET), a registered Professional Engineer in Malaysia, APEC, the International Engineers Register and a Chartered Engineer in Australia.

Above all, Ir. Choo has distinguished himself as the founder of the ASEAN Engineers Register (AER) that facilitates the mobility of engineering services within the ASEAN region. He has served as the AER's Head Commissioner from year 2000 to 2003 and was re-appointed for session 2010-2012. He was the Chief Secretary of AFEO for the 2003/2004 session, where IEM was entrusted the role of Engineer Registrar for the ASEAN region.

Over the years, Ir. Choo has been presented with many awards for his outstanding services and contributions. He was awarded the 'Outstanding Service Award' by the Minister of Works Malaysia for his contribution towards the engineering profession while serving as a member in the Board of Engineers, Malaysia (BEM) in 2001. Subsequently, he was awarded the '1st Class Friendship Medal' by the Royal Cambodian Government in 2002. In addition, in December 2010, Ir. Choo received another award during the 28th Conference of AFEO, namely the 'ASEAN Outstanding Engineering Achievement Award for the Year of 2010'.

In terms of his personal life, Ir. Choo Kok Beng is happily married with two lovely children and is blessed with four granddaughters.

The Great Sahara Desert

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

THE great Sahara Desert was on my list of places to visit before I leave this world, and when my wife and I together with a friend of ours were travelling in Algeria and Tunisia for 1½ months in November and December 2012, we had the good fortune of being able to spend half a month exploring a sizeable part of the great desert that makes up the bulk of Algeria's territory.

The Sahara has an area of over 9.4 million km², about the size of USA. It covers much of Morocco, Western Sahara, Mauritania, Senegal, Mali, Algeria, Niger, Tunisia, Libya, Egypt, Chad and Sudan. The name given to this vast area, i.e. Sahara, comes from the colloquial Arabic word for desert.

Algeria is a North African country located on the southern shores of the Mediterranean Sea. With an area of 2,381,741 km², it is the largest country in Africa after the secession of South Sudan from Sudan and is more than 7 times the size of Malaysia. However, about 80% of its territory is part of the great Sahara Desert which is understandably very sparsely populated, and so this large country only has a population of 37 million people.

After spending about one week exploring the cities and Roman archaeological sites in the northern part of the country, we left Tlemcen for Taghit which is about 680 km to the south. We soon entered the great desert with vast plains of little vegetation on both sides of the road. Taghit itself is a pretty oasis town set in a broad valley with giant sand dunes to its south.

As we continued our journey to Timimoun and then to Ghardaia, we encountered more and more giant sand dunes and were thoroughly amazed and mesmerized by those spectacular sculptures of sand which are the result of the forces of nature.

Sand dunes are what most people will expect to see in a desert, but in the great Sahara Desert, sand seas constitute less than 20% of the total area and sand dunes make up only a small part of the sand seas. The desert is principally rocky in nature and can take several landforms such as stone plateaux, gravel plains, dry valleys, and salt flats.

When we were in Tamanrasset deep in the Sahara and about 300 km north of Algeria's southern border, we spent 3 days doing the so-called Assekrem Circuit in the surrounding desert, seeing nothing but spectacular rock formations and rock-strewn plains.

We then flew to Djanet in the east and spent about 5 days in the Tassili n'Ajjer National Park in south-east Algeria. This national park is a UNESCO world heritage site and is noted for its prehistoric rock art and other ancient archaeological sites, dating from Neolithic times when the local climate was wetter, with savannah rather than desert. The art depicts herds of cattle, large wild animals like crocodiles, lions and giraffe, and human activities such as hunting and dancing.

We travelled by 4WD in the desert about 120 km from the village of Djanet and got as close as 20 km from the Libyan border. We had a Tuareg guide, Ali, and a Tuareg driver named Hamdani. The Tuareg are a Berber group who live in the Sahara regions of Africa. They followed a traditional lifestyle of camel nomadism until fairly recently. We camped at four different locations in the desert, seeing many rock pictograms and petroglyphs in addition to interesting rock formations and spectacular sand dunes. Hamdani was a good cook and Ali, besides being our guide-cum-comedian, pitched our tents and boiled tea (of which the first cup was usually very bitter while the second cup very sweet) for us after every meal. We had a great time in the great Sahara Desert. I consider my Sahara experience as the best part of this trip. ■

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.

Date: 11 March 2013

To All Members,

CANDIDATES APPROVED TO SIT FOR YEAR 2013 PROFESSIONAL INTERVIEW

The following candidates have been approved to sit for the Professional Interview for 2013.

In accordance with Bylaws 3.9, the undermentioned names are published as having applied for membership of the Institution, subject to passing the year 2013 Professional Interview.

If any Corporate Member of the Institution has any reason as to why any of the candidates is not a fit and proper person for election, he should communicate in writing to the Honorary Secretary. Such communication should be lodged **A MONTH** from the date of publication.

Ir. Prof. Dr Jeffrey Chiang Choong Luin
Honorary Secretary,
The Institution of Engineers, Malaysia
Session 2012/2013

NEW APPLICANTS

Name	Qualifications
CIVIL ENGINEERING	
DZULKIFLE BIN SULONG	BSc (MARQUETTE) (CIVIL, 88)
ELECTRICAL ENGINEERING	
MOHD RAZAIFULIZAN BIN MOHD RUSOFF	BE HONS (UNITEN) (ELECTRICAL POWER, 07)
SHAHRUL HISHAM BIN SAMSUDIN	BE HONS (UiTM) (ELECTRICAL, 06)
ELECTRONIC ENGINEERING	
TAN SENG LOON, RAYMOND	BE HONS (MMU) (ELECTRONICS, 06)
MECHANICAL ENGINEERING	
AZIZI BIN AHAMAD	BE HONS (UTM) (MECHANICAL, 05)
AZMI BIN SULAIMAN	BE HONS (UTM) (MECHANICAL, 97)
CHONG KOK HUA	BSc (WICHITA STATE) (MECHANICAL, 96)
FOO POH LOON	BE HONS (WESTMINSTER) (MECHANICAL, 97)
LING TUONG THAI	BE HONS (UTM) (MECHANICAL, 03) ME (UTM) (MECHANICAL, 06)
MUHAMAD BIN MURRAD	BE HONS (UTM) (MECHANICAL, 1995) ME (UTM) (MECHANICAL, 2002)
NORIAH BINTI YUSOFF	BE HONS (UTM) (MACHINE, 89) MSc (UiTM) (MECHANICAL, 08)
PETROLEUM ENGINEERING	
MOHD ZUBIR BIN MAT DAHAN	BE HONS (UTM) (PETROLEUM, 02)

TRANSFER APPLICANTS

M'ship No.	Name	Qualifications
CHEMICAL ENGINEERING		
49890	CHAI SIEW WUN	BE HONS (USM) (CHEMICAL, 04)
CIVIL ENGINEERING		
46763	DOREEN SIEW LEN BINTI ALOYSIUS	BE HONS (UiTM) (CIVIL, 07)
20120	HIEW VUN HENG	BE HONS (UMIST)(CIVIL, 97) MSC (LONDON) (STRUCTURAL, 99)
48868	LIM GEE ZHIONG	BE HONS (UNIMAS) (CIVIL)
26507	LIM LEE WEE	BE HONS (UTM) (CIVIL-CONSTRUCTION MANAGEMENT, 03)
49220	MOHD IZWAN BIN MOHD NOOR	BE HONS (UM) (CIVIL, 04)
46764	NAIZIMIN HISHAM BIN RAMLI	BE HONS (UTM) (CIVIL, 07)
35601	TAN SU LEAN	BE HONS (UTM) (CIVIL, 05)
18658	TIONG TOH OH	BSC (OKLAHOMA) (CIVIL, 1984)
ELECTRICAL ENGINEERING		
49268	WAN HOONG MING	BE HONS (TASMANIA) (ELECTRICAL POWER, 2008)
ELECTRONIC ENGINEERING		
21231	TAN SHIEW SUN	PART II (IEM/BEM) (ELECTRONIC, 00)

Solution for 1Sudoku published on page 39 of this issue.

6	3	1	2	4	9	5	8	7
9	5	8	6	3	7	2	1	4
7	4	2	1	8	5	6	9	3
1	9	6	7	2	8	3	4	5
3	2	5	4	1	6	8	7	9
4	8	7	5	9	3	1	2	6
5	1	9	3	7	2	4	6	8
8	6	4	9	5	1	7	3	2
2	7	3	8	6	4	9	5	1

IEM SPECIALIST REGISTER FORM

The IEM Fire Advisory Board on Fire Protection Service (FAB) under the IEM Standing Committee on Professional Practice is compiling a list of names of practicing professional engineers who are registered as Corporate Members of IEM. Hence, engineers who wish to have their names recorded with the FIRE AUTHORITY, are requested to be first registered with IEM through a SPECIALIST REGISTER FORM (page 52).

The IEM SPECIALIST REGISTER FORM is enclosed in the ***JURUTERA Bulletin*** to facilitate the practising engineers in filling up the form and returning the same to the FAB for compilation, before the compiled list is forwarded to the FIRE AUTHORITY for their updating.

The IEM SPECIALIST FORM will also be posted on the IEM Web Portal for easy downloading. Should any member have any queries regarding the IEM SPECIALIST REGISTER FORM, kindly forward your questions to FAB for assistance.

Ir. Thin Choon Chai
Chairman,
IEM Fire Advisory Board on Fire Protection Services

***Note:** This is a continuation of the list which was first published on page 55 of the March 2013 issue.*

TRANSFER TO THE GRADE OF GRADUATE

AEROSPACE ENGINEERING

M'ship No.	Name	Qualifications
31150	LIM CHIN SAN, KEVIN	B.E.HONS.(UPM) (AEROSPACE, 10)

CHEMICAL ENGINEERING

M'ship No.	Name	Qualifications
26543	CHEW FEW NE	B.E.HONS.(UPM) (CHEMICAL, 07)
44028	GOH WAI BOON	B.E.HONS.(UTP) (CHEMICAL, 12)
48580	LING TEEN, MICHELLE	B.E.HONS.(CURTIN) (CHEMICAL, 12)
35971	MOHD KHAIREE NAEEM BIN ABDUL RAUB	B.E.HONS.(UTM) (CHEMICAL, 10)
41440	TAN SZE LENG	B.E.HONS.(UPM) (CHEMICAL, 12)
37711	WAH KENG SERN	B.E.HONS.(UKM) (CHEMICAL, 09)

CIVIL ENGINEERING

M'ship No.	Name	Qualifications
19379	ANAS BIN IDRIS	B.E.HONS.(UTM) (CIVIL, 00)
33012	BEE CHIOU LING	B.E.HONS.(UTM) (CIVIL, 10)
28415	CHAE TYNG FENG	B.E.HONS.(USM) (CIVIL, 07)
41643	CHE KU MOHD FAIZ BIN CHE KU DIN	B.E.HONS.(UTHM) (CIVIL, 12)
42402	CHONG CHOOI YENG	B.E.HONS.(UNIMAS) (CIVIL, 10)
32756	CHONG NYEN HING	B.E.HONS.(KLIUC) (CIVIL, 12)
29537	CHOW TZE LIANG	B.E.HONS.(UNITEN) (CIVIL, 11)
28947	HO KAH LUN	B.E.HONS.(UPM) (CIVIL, 07)
42355	HOO MEI HUA	B.E.HONS.(UMS) (CIVIL, 11)
41608	IRAWAN BIN LATIP	B.E.HONS.(UTHM) (CIVIL, 12)
39653	IZZAH NAQIBAH BINTI MOHD ARIFF	B.E.HONS.(UTHM) (CIVIL, 12)
26635	JALINA BINTI KASSIM	B.E.HONS. (UTM) (CIVIL, 06) MSC (UTM) (CIVIL, 08)
20974	LAI JIN YU	B.E.HONS. (UTM) (CIVIL, 01) ME (UTM) (CIVIL, 03)
42742	LEE CHIN FOO	B.E.HONS.(UTHM) (CIVIL, 12)
40537	LEW SHONG WAI	B.E.HONS.(UTM) (CIVIL, 12)
33530	MASHITAH BINTI MIAU TAHAR	B.E.HONS.(UiTM) (CIVIL, 09)
44715	MATHILDA TUPANG MONTEGRAI	B.E.HONS.(SWINBURNE) (CIVIL, 12)
38926	MELVIN SAMUEL A/L PAKINATHAN	B.E.HONS.(UTHM) (CIVIL, 11)
38593	MOGANRAJ A/L SUBRAMANIAM	B.E.HONS.(UTHM) (CIVIL, 12)
41635	MOHAMAD ANUAR BIN PADELI	B.E.HONS.(UTHM) (CIVIL, 12)
27283	MOHAMAD QUAZEE BIN MOHAMAD ZAILON	B.E.HONS.(USM) (CIVIL, 06)
49362	MOHD HAMBALI BIN MOHAMMAD ZUBIR	B.E.HONS.(KLIUC) (CIVIL, 11)
40496	MOHD NAZRUL BIN ADNAN	B.E.HONS.(UTM) (CIVIL, 12)
41633	MOHD. AFINDY BIN ABD. KADIR	B.E.HONS.(UTHM) (CIVIL, 12)
50078	MUHAMAD HAFIZ BIN OTHMAN	B.E.HONS.(KLIUC) (CIVIL, 12)
41588	MUHAMMAD ABDULLAH BIN YAAKUB	B.E.HONS.(UTHM) (CIVIL, 12)
37160	MUHAMMAD NOR BIN KUSIN	B.E.HONS.(UTHM) (CIVIL, 11)
38947	MUHD ALIFF BIN MUHAMMAD SUHAIMI	B.E.HONS.(UTP) (CIVIL, 10)
37121	NG TEE WUI, DENNIS	B.E.HONS.(UTHM) (CIVIL, 11)
28338	NOOR ADLIN ZURINA BINTI ZULKUFLY	B.E.HONS.(UTM) (CIVIL, 09)
54153	NOOR MAISARA BTE JAIS	B.E.HONS.(UTHM) (CIVIL, 12)
47036	NUR SYAFIRA BINTI A. RAZAK @ AZIZ	B.E.HONS.(UTHM) (CIVIL, 12)
54152	NURUL AISYAH BINTI AHMAD	B.E.HONS.(UTHM) (CIVIL, 12)
39674	RAJA PUTRI ZARIFH ANA BINTI RAJA SOH	B.E.HONS.(UTHM) (CIVIL, 12)
31242	RAJA SHAHROM NIZAM SHAH BIN RAJA SHOIB	B.E.HONS.(MALAYA) (CIVIL, 09)
17840	RUDY TAWIE ANAK JOSEPH SIPI	B.E.HONS.(UiTM) (CIVIL, 00) M.SC.(HERIOT-WATT) (STRUCTURAL, 01) P.HD.(KAIST) (CIVIL & ENVIRONMENTAL, 11)
40286	SAFWAN FIRDAUS BIN ABD RANI	B.E.HONS.(UTM) (CIVIL, 11)
47904	SOH HOONG THAI	B.E.HONS.(NOTTINGHAM) (CIVIL, 12)
42749	TANG KIM CHUAN	B.E.HONS.(UTHM) (CIVIL, 12)
42743	TANG SUI LING	B.E.HONS.(UTHM) (CIVIL, 11)
42372	TANG ZI SHENG	B.E.HONS.(UMS) (CIVIL, 11)
54176	UMI NADRAH BINTI ARIS	B.E.HONS.(UTHM) (CIVIL, 12)
41955	UTAYA KUMAR A/L VEELMURUGAN	B.E.HONS.(UTHM) (CIVIL, 12)
42300	WAI LIANG CHIET	B.E.HONS.(UMS) (CIVIL, 11)
43699	WEE YIAN LIN, ANDREA	B.E.HONS.(SWINBURNE) (CIVIL, 12)
49814	YASMINE BINTI SUHAIMI	B.E.HONS.(UTHM) (CIVIL, 12)
47453	ZAKI BIN MOHAMED	B.E.HONS.(UTHM) (CIVIL, 12)

ELECTRICAL ENGINEERING

M'ship No.	Name	Qualifications
48774	ABU HURAIRAH BIN ZAINUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49780	ASFARINA BINTI ABU BAKAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49821	AZLAN AZUAN BIN NORPIAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49727	BASRI BIN BAHARI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48626	ENGKU MOHD NASRI BIN ENGKU MAT NASIR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49771	FATEHAH BT MOHAMAD AMIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48302	FAZARUDIN BIN A. WAHAB	B.E.HONS.(UiTM) (ELECTRICAL, 11)
48688	GOBI A/L ARUMUGHAM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48729	HAFIZAH BINTI NOR AZMUDDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48728	HAIRIEROSNIZA BINTI ROSDI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49839	HUZAIMAH BINTI MOHAMED	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49844	IZATTI BINTI MD AMIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49750	JAMES ALI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49752	JULIZA EZAIDA BINTI JUMELAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49694	KEE SEOK HOE	B.E.HONS.(UTHM) (ELECTRICAL, 12)
43863	KOK YEN CHUNG	M.E.HONS. (SOUTHAMPTON) (ELECTRICAL, 12)
48838	MOHAMAD FAIZ BIN MOHD RASOL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
29270	MOHD AZRAIE BIN SUARIN	B.E.HONS.(UMP) (ELECTRICAL, 08)
49850	MOHD AZRI BIN KHALIB	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48811	MOHD FADZLI BIN MOHD DIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49696	MOHD FAKHRUL SHAHIRIN BIN MOHAMMAD ZAKI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
34127	MOHD HAFIZ BIN AZMI	B.E.HONS.(UiTM) (ELECTRICAL, 09)
49744	MOHD HISHAM BIN HARUN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49742	MOHD ZUHAILI BIN ZULFINAINI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49753	MOHD. HASRULSANI BIN MD. SENIMAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49692	MOHD. NAZMI BIN MANAP	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49761	MOHD. RIDZUAN BIN HASSAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49755	MOHD. SYAHIR BIN MUHAMED YAACOB	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48800	MUHAMAD AZAHAR BIN JAAFAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48823	MUHAMAD MATTA BIN MD. ESA	B.E.HONS.(UTHM) (ELECTRICAL, 11)
49175	MUHAMMAD ASRAF BIN NOR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49716	MUHAMMAD AZZIM BIN MOHAMED SAHARIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49760	MUHAMMAD FAIZAL B. MOHD RAIS	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49730	MUHAMMAD NOOR AKHIR BIN TAHRIR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49743	MUHAMMAD SUHAIZAN BIN MAHAMAD ZIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48609	MUHAMMAD ZULFAHMI BIN MD SAFAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
50247	NAIMAH BALQISH BT. SHARI SHAWARUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
47763	NG BOON JOO	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49739	NIK MOHD HAFIZU BIN NIK IBRAHIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49754	NOOR AZUAN BIN RAMELI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49810	NOR HIDAYAH BINTI MIDON	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49774	NOR HIDAYAH BT. YAZIZ	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49729	NORHAZIRA BINTI ZAMRI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49778	NORLIYANA NADIAH BINTI ADNAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48608	NUR AIN BINTI ABDUL WAHIT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48744	NUR FAREEZA EKMA BINTI MUSTAFAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49765	NUR HIDAYAH BT. ABDUL AZIZ	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49715	NUR IKHMAR @ NAJMEEN BINTI AYOB	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49728	NUR RASHIQAH BINTI SUHAILI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49855	NURDIANA BT. KHAIRAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49824	NURFASIHAH BINTI ADNAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48745	NURUL FATHIA BINTI MOHAMAND NOOR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49769	NURUL FITRI BINTI MARSOM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
42759	NURUL HUDA BINTI AHMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49748	NURULAINI BINTI MOHAMED JARIS	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49724	RADEN EMIYANTI BINTI RADIN A. OTHMAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
40165	SEOW CASEY	B.E.HONS.(UTM) (ELECTRICAL, 12)
49854	SHARIFAH AMIRAH BT. AMIR SHARIFFUDDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49718	SIM SY YI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49723	SITI NASIKIN BINTI MOHAMMAD SETH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49811	SITI NAZIEMA BINTI ALI HASSAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
20220	TAN KHENG BOON	B.E.HONS.(UTM) (ELECTRICAL, 01)
48630	TENGKU MARISSA BINTI TENGKU AHMAD	B.E.HONS.(UTHM) (ELECTRICAL, 11)
49847	TERENCE CHURCHILL AK. JANANG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
30702	THIVAGARAN A/L GOPALLAH	B.E.HONS.(UTM) (ELECTRICAL, 09)
31819	UTHAYA KUMARAN A/L DEVARAJ	B.E.HONS.(USM) (ELECTRICAL, 11)
36195	VOON YANN PENG	B.E.HONS.(UTM) (ELECTRICAL, 12)
38514	WAHIDAH BINTI KARI	B.E.HONS.(UTM) (ELECTRICAL, 10)
48682	WAN MUNIRAH BINTI WAN NAZULAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49836	WAN NA A/P EH TEM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
49763	ZULAIKA BTE KAMIL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
48620	ZULKARNAIN BIN ZAINOL ABIDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)

ELECTRONIC ENGINEERING

M'ship No.	Name	Qualifications
45139	MOHD ALWI BIN MOHD NADZIR	B.E.HONS.(UTP) (ELECTRONIC, 11)

ENVIRONMENTAL ENGINEERING

M'ship No.	Name	Qualifications
28599	TANG KIN HENG	B.E.HONS.(MALAYA) (ENVIRONMENTAL, 07)

MEMBERSHIP

TRANSFER TO THE GRADE OF GRADUATE

FOOD & PROCESS ENGINEERING

M'ship No.	Name	Qualifications
27315	SHOW PAU LOKE	B.E.HONS.(UPM) (FOOD & PROCESS, 10)

MATERIALS ENGINEERING

M'ship No.	Name	Qualifications
40703	FAROUQ BIN AHMAT	B.E.HONS.(UIAM) (MATERIALS, 12)
32241	KAMILA BINTI AB. HAMID	B.E.HONS.(UIAM) (MATERIALS, 10)

MECHANICAL ENGINEERING

M'ship No.	Name	Qualifications
28175	AHMAD FADHIL BIN SAARANI	B.E.HONS.(UTM) (MECHANICAL, 09)
28659	ALHAFIZ BIN FAUZAN	B.E.HONS.(UTM) (MECHANICAL, 09)
28165	AZRUL BIN ARIFIN	B.E.HONS.(UTM) (MECHANICAL, 09)
42750	CHEN SIOW WIE	B.E.HONS.(UTHM) (MECHANICAL, 12)
32258	FADHILAH BINTI SHIKH ANUAR	B.E.HONS.(UNITEN) (MECHANICAL, 08)
38263	GEGE NURFAIZEE BIN FADZIL	B.E.HONS.(UiTM) (MECHANICAL, 10)
48561	KELVIN MOHAN THAMBIDURAY	B.E.HONS.(CURTIN) (MECHANICAL, 12)
40807	KRISHNATH TANGARAGEE	B.E.HONS.(UNITEN) (MECHANICAL, 10)
42293	LING LIH JIE, JESTER	B.E.HONS.(UMS) (MECHANICAL, 11)
32371	MOHAMAD ASYRAF BIN OTHOMAN	B.E.HONS.(UTM) (MECHANICAL, 10)
33115	MOHAMAD SHUKRI BIN MERAN	B.E.HONS.(UTHM) (MECHANICAL, 10)
39710	MOHD AFIQ BIN JANTAN	B.E.HONS.(UTHM) (MECHANICAL, 11)
28649	MOHD HAIRUL AMINUDDIN BIN CHE MOOD	B.E.HONS.(UTM) (MECHANICAL, 09)
32426	MOHD KHAIRUL SYAHRIN BIN ZAKARIA	B.E.HONS.(UTM) (MECHANICAL, 09)
49196	MOHD NUREDLEEE BIN MOHD KAMAL GHAZALEE	B.E.HONS.(UNITEN) (MECHANICAL, 12)
30406	MUHAMAD IZUAN BIN OTHMAN	B.E.HONS.(UiTM) (MECHANICAL, 10)
42361	ONG HAI YEW	B.E.HONS.(UMS) (MECHANICAL, 11)
39696	PUAN HUEY KIM	B.E.HONS.(UTHM) (MECHANICAL, 12)
32774	RIDWAN SAPUTRA BIN NURSAL	B.E.HONS.(UTM) (MECHANICAL, 10)
42753	ROSLI BIN MOHD. HASHIM	B.E.HONS.(UTHM) (MECHANICAL, 12)
27341	SIVABALAN A/L TANAPALA	B.E.HONS.(UTHM) (MECHANICAL, 07)
50048	YAP SIEW HUI	B.E.HONS.(UNITEN) (MECHANICAL, 12)

ADMISSION TO THE GRADE OF GRADUATE

AERONAUTICAL ENGINEERING

M'ship No.	Name	Qualifications
57509	RIDZUAN SANI BIN MOHD MUSTAFA	B.E.HONS.(UPM) (AERONAUTICAL, 03)

AEROSPACE ENGINEERING

M'ship No.	Name	Qualifications
56480	ABDULL KARIM BIN ASHARI	M.E.HONS. (SOUTHAMPTON) (AEROSPACE, 08)
56598	AZLIZA BINTI EMBONG	B.E.HONS.(USM) (AEROSPACE, 02)
57028	GUZTYNE BALANG JUAN	B.E.HONS.(USM) (AEROSPACE, 05)
56599	HO HANN WOEI	B.E.HONS.(USM) (AEROSPACE, 09) M.SC.(DELFT) (AEROSPACE, 12)
56457	LEE CHIH FANG	B.E.HONS.(USM) (AEROSPACE, 10)
57027	LIOW SHI WEI	B.SC.(EMBRY-RIDDLE AERONAUTICAL UNI) (AEROSPACE, 08)
57026	MAK SIN NEE	B.SC.(OKLAHOMA) (AEROSPACE, 04)
57029	SITI HAZIRAH BINTI OTHMAN	B.E.HONS.(UIAM) (AEROSPACE, 10)

AGRICULTURAL ENGINEERING

M'ship No.	Name	Qualifications
56458	MOHD SHAFIQ BIN IDRIS	B.E.HONS.(UPM) (AGRICULTURAL, 06)

BIOCHEMICAL ENGINEERING

M'ship No.	Name	Qualifications
57573	DAUD BIN ADAM	B.E.HONS.(UIAM) (BIOCHEMICAL, 10)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
57527	PEER MOHAMED	B.E.HONS.(UIAM) (BIOCHEMICAL, 10)

BIO-MEDICAL ENGINEERING

M'ship No.	Name	Qualifications
57033	SIAH CHEE SHING	B.E.HONS.(MALAYA) (BIO-MEDICAL, 11)

CHEMICAL ENGINEERING

M'ship No.	Name	Qualifications
56462	AZIATUL NIZA BINTI SADIKIN	B.E.HONS.(USM) (CHEMICAL, 00) M.SC.(LOUGHBOROUGH) (CHEMICAL, 03)
56461	HASRINAH BINTI HASBULLAH	B.E.HONS.(UTM) (CHEMICAL, 02) M.E.(UTM) (CHEMICAL, 07) P.HD.(IMPERIAL) (CHEMICAL, 12)
57035	JEFRI BIN JAAPAR	B.E.HONS.(UTM) (CHEMICAL, 99)
57034	LIM TEE YEN	B.E.HONS.(MONASH) (CHEMICAL, 10)
56628	MOHD KHAIRUL AFIZAN BIN HARUN	B.E.HONS.(UMP) (CHEMICAL, 09)
56511	NGO CHEE LOON, VINCENT	B.E.HONS.(UTM) (CHEMICAL, 07)
56627	NOR YULIANA BINTI YUHANA	B.E.(SHEFFIELD) (CHEMICAL, 99) M.E.(MCGILL) (CHEMICAL, 02) P.HD. (UKM) (MATERIALS, 12)
56463	NORAZANA BINTI IBRAHIM	B.E.HONS.(UTM) (CHEMICAL, 02) M.E.(UTM) (CHEMICAL, 07)
56626	NUR AIN BINTI MOHD ZAINUDDIN	B.E.HONS.(UiTM) (CHEMICAL, 12)
56460	ROSHAFIMA BINTI RASIT ALI	B.E.HONS.(UTM) (CHEMICAL, 00) M.E.(UTM) (POLYMER, 04)
56510	TOH SU LIAN	B.E.HONS.(UKM) (CHEMICAL, 08)
56459	UMI AISAH BINTI ASLI	B.E.HONS.(UTM) (CHEMICAL, 00) M.SC.(WALES) (CHEMICAL, 05) P.HD. (BATH) (CHEMICAL, 11)
56512	ZURAIDAH BINTI ZUHARI	B.E.HONS.(UiTM) (CHEMICAL, 10)

CIVIL ENGINEERING

M'ship No.	Name	Qualifications
56129	ABDUL MUHAIMIN BIN IBRAHIM	B.E.HONS.(UTHM) (CIVIL, 12)
56130	AHMAD AZRI BIN ALIAS	B.E.HONS.(UTHM) (CIVIL, 12)
57086	AHMAD KAMIL BIN MD HANAPIAH	B.E.HONS.(UTM) (CIVIL, 01)
56131	AHMAD MAHFUZ BIN SAAD	B.E.HONS.(UTHM) (CIVIL, 12)
57564	AHMAD YAZID BIN ZULKIFLI	B.E.HONS.(UTP) (CIVIL, 08)
56552	AIMAN SYAHIRAN BIN BUANG	B.E.HONS.(UiTM) (CIVIL, 11)
56132	AKHIRUL NAZIROH BT DIN	B.E.HONS.(UTHM) (CIVIL, 12)
56133	AKMALIZA SURYANI BINTI MUSA	B.E.HONS.(UTHM) (CIVIL, 12)
56134	AMIRA BINTI AZHAR	B.E.HONS.(UTHM) (CIVIL, 12)
56550	ANANTHA SARAVANA A/L MUTUSAMY	B.E.HONS.(KLIUC) (CIVIL, 11)
56135	ARMIN BIN MOHD. NATSIR	B.E.HONS.(UTHM) (CIVIL, 12)
57069	ARTHUR RAY ANAK JENTRY	B.E.HONS.(USM) (CIVIL, 07)
56136	ASRIF BIN AB SHUKOR	B.E.HONS.(UTHM) (CIVIL, 12)
56556	AZHANI BINTI ZUKRI	B.E.HONS. (UTM) (CIVIL, 07) M.E.(UTM) (CIVIL, 10)
57554	BADRUL NIZAM BIN ITHNIN	B.E.HONS.(UTM) (CIVIL, 09)
57088	BERTRAM ANAK THOMAS	B.E.HONS.(UNIMAS) (CIVIL, 06)
56471	BONG BOK ENG	B.E.HONS.(UTM) (CIVIL, 05)
56137	BONG HAN LIUNG	B.E.HONS.(UTHM) (CIVIL, 12)
56465	CHAN SIOK CHENG, JUDITH MARIA	B.E.HONS.(UNIMAS) (CIVIL, 10)
57071	CHAW SIEW HWA	B.E.HONS.(LEEDS) (CIVIL, 01)
56138	CHIN KENG YEN	B.E.HONS.(UTHM) (CIVIL, 12)
56562	CHOO MUN FEI	B.E.HONS.(UPM) (CIVIL, 07)
57080	CHUA DER SHIAW	B.E.HONS. (PORTSMOUTH) (CIVIL, 10) MSC (PORTSMOUTH) (CIVIL, 11)
56139	DIYANA BINTI MOHAMED AMIR	B.E.HONS.(UTHM) (CIVIL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
57077	ELLYA HAYATI BINTI OMAR	B.E.HONS.(UTM) (CIVIL, 09)
57523	EMMANUEL LAURENTIUS LAI	B.E.HONS.(SWINBURNE) (CIVIL, 11)
57524	ERIENA BINTI ABAS	B.E.HONS.(UiTM) (CIVIL, 07)
57539	EZLIN BINTI ABD HALIM	M.E.(MANCHESTER) (CIVIL, 09)
56140	EZUAN BIN SUHAILI	B.E.HONS.(UTHM) (CIVIL, 12)
56141	FADILAH BTE YUSOF	B.E.HONS.(UTHM) (CIVIL, 12)
56602	FADLIANA BINTI BORHANUDIN	B.E.HONS.(UITM) (CIVIL, 09)
56142	FARAH BINTI OSMAN	B.E.HONS.(UTHM) (CIVIL, 12)
56143	FARZANA BINTI ASMAAI	B.E.HONS.(UTHM) (CIVIL, 12)
56473	FIFIE HANIEZAH BINTI HAMDAN	B.E.HONS.(UTM) (CIVIL, 11)
57529	FIRDAUS BIN PARI	B.E.HONS.(MALAYA) (CIVIL, 06)
56547	FUNG SHAW SHEN	B.E.HONS.(CURTIN) (CIVIL, 09)
57092	GOH KAU SOON	B.E.HONS.(UTHM) (CIVIL, 09)
56144	GOH LI LIAN	B.E.HONS.(UTHM) (CIVIL, 12)
57074	GOO KENG JIN	B.E.HONS.(UKM) (CIVIL, 05)
56145	HAFIZAN BIN MOHD SALLEH	B.E.HONS.(UTHM) (CIVIL, 12)
56146	HAMIZAH BINTI ABDUL WAHAB	B.E.HONS.(UTHM) (CIVIL, 12)
56147	HELMI AZWAN BIN RUSLAN	B.E.HONS.(UTHM) (CIVIL, 12)
56148	HIHASNAINI BINTI BATTIAR	B.E.HONS.(UTHM) (CIVIL, 12)
57541	HONG FANG SHEN, ALEX	B.E.(ADELAIDE) (CIVIL, 03)
56149	HUSSIN BIN MUSTAFA HAMIZAN	B.E.HONS.(UTHM) (CIVIL, 12)
56150	INNI KAUTHAR BIN MOHD SABRI	B.E.HONS.(UTHM) (CIVIL, 12)
57127	IZZUL BIN RAMLI	B.E.HONS.(UTM) (CIVIL, 11)
57537	JESSIE LEE	B.E.HONS.(NOTTINGHAM) (CIVIL, 07)
56467	KHAIRUL ANUAR BIN AHMAD AFFANDI	B.E.HONS.(NEW SOUTH WALES) (CIVIL, 11)
56153	KHAYRUL APRI AMSO BIN SUIS	B.E.HONS.(UTHM) (CIVIL, 12)
56469	KOK WAI HANG	M.E.HONS.(UCL) (CIVIL, 10)
57079	KUMARAN A/L KUMARAWEH	B.E.HONS.(UTM) (CIVIL, 06)
56548	LAU WENG KIT	B.E.HONS.(UTHM) (CIVIL, 08)
57094	LAU YEO SHIN	B.APP.SC.(BRITISH COLUMBIA) (CIVIL, 12)
56154	LEE CHONG JENG	B.E.HONS.(UTHM) (CIVIL, 12)
57520	LEE TECK WEI	B.E.HONS.(UTAR) (CIVIL, 11)
56560	LEE YEN LONG	B.E.HONS.(WALES) (CIVIL, 02)
57569	LEE YUNN ZYE	B.E.HONS.(UNIMAS) (CIVIL, 09)
56155	LIM YONG SIANG	B.E.HONS.(UTHM) (CIVIL, 12)
56151	LING TECK HOCK, JOSEPH	B.E.HONS.(UTHM) (CIVIL, 12)
56156	LIONG LOONG HING	B.E.HONS.(UTHM) (CIVIL, 12)
56466	LUQMAN BIN ISMAIL	B.E.HONS.(UNITEN) (CIVIL, 07)
56157	MA KANG CHEN	B.E.HONS.(UTHM) (CIVIL, 12)
56158	MARINA BINTI MAZLAN	B.E.HONS.(UTHM) (CIVIL, 12)
57022	MARINA PATRICK	B.E.HONS.(UNIMAS) (CIVIL, 08)
57089	MEOR BURHAN SHUHDY BIN MIOR KHAIRUDIN	B.E.HONS.(USM) (CIVIL, 01)
57076	MOHAMAD ATIQULLAH BIN ZAKARIA	B.E.HONS.(UITM) (CIVIL, 09)
57083	MOHAMAD NAIEM BIN MOHAMAD KASIM	B.E.HONS.(KLIUC) (CIVIL, 10)
57084	MOHAMAD SOUFI BIN ABDUL HAMID	B.E.HONS.(UTM) (CIVIL, 87)
56159	MOHAMED ASHRAF BIN SHAIK MOHAMED	B.E.HONS.(UTHM) (CIVIL, 12)
57570	MOHD FAISAL BIN MOHD AZLAN	B.E.HONS.(UNISEL) (CIVIL, 07)
56160	MOHD FAIZULLAH BIN MOHAMED	B.E.HONS.(UTHM) (CIVIL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56161	MOHD FIRDAUZ BIN MOHD ADNAN	B.E.HONS.(UTHM) (CIVIL, 12)
57511	MOHD HAFIS BIN MOHD HASHIM	B.E.HONS.(UTHM) (CIVIL, 12)
57091	MOHD HAFIZ ARIF BIN ZAKARIA	B.E.HONS.(UiTM) (CIVIL, 11)
57126	MOHD HAFIZUDIN BIN HASNAN	B.E.HONS.(UITM) (CIVIL, 09)
56162	MOHD IZZAT BIN A.GHANI	B.E.HONS.(UTHM) (CIVIL, 12)
56163	MOHD KAMAL IZWAN BIN ZULKIFLI	B.E.HONS.(UTHM) (CIVIL, 12)
56464	MOHD NOR HAMIM BIN SAMSUN BAHARUN	B.E.HONS.(UNITEN) (CIVIL, 07)
56164	MOHD RIDHWAN BIN RUSLAN	B.E.HONS.(UTHM) (CIVIL, 12)
56436	MOHD SAIFUL ANUAR B A.GHANI	B.E.HONS.(UTHM) (CIVIL, 12)
57082	MOHD ZAMZAMI BIN RAIZAM	B.E.HONS.(UiTM) (CIVIL, 11)
56165	MUHAMAD ABDUL HAKIM BIN NASURUDIN	B.E.HONS.(UTHM) (CIVIL, 12)
56166	MUHAMAD AIMAN BIN IDRIS	B.E.HONS.(UTHM) (CIVIL, 12)
57560	MUHAMAD IQMAL BIN MUHAMAD SHAH	B.E.HONS.(UMP) (CIVIL, 11)
56167	MUHAMAD TARMIZI BIN HUSSIN	B.E.HONS.(UTHM) (CIVIL, 12)
57068	MUHAMMAD AZRY BIN SHAHARY	M.E.HONS.(NOTTINGHAM) (CIVIL, 11)
56555	MUHAMMAD FAIZ BIN ABD RAHMAN	B.E.HONS.(UTM) (CIVIL, 11)
56168	MUHAMMAD IKMAL HISHAM BIN ABDUL HAMID	B.E.HONS.(UTHM) (CIVIL, 12)
57542	MUHAMMAD SHAHIR BIN ISMAIL	B.E.HONS.(UiTM) (CIVIL, 12)
56563	MUHD YUSRIZAN B. MOHD YUSOF	B.E.HONS.(UPM) (CIVIL, 02)
56564	NASRUL IZZAD BIN IDERIS	B.E.HONS.(UTP) (CIVIL, 10)
57522	NG ZHEN YEN	B.E.HONS.(UTM) (CIVIL, 11)
57534	NIK ZAINAB BINTI NIK AZIZAN	B.E.HONS.(UTM) (CIVIL, 09)
57510	NOOR AFFIDA RAFFIKA BINTI MOHAMAD NAZARI	B.E.HONS.(UTHM) (CIVIL, 12)
56169	NOOR NAIMAH BINTI AB NASER	B.E.HONS.(UTHM) (CIVIL, 12)
56170	NOOR SANAA BINTI MOHD BUNYAMI	B.E.HONS.(UTHM) (CIVIL, 12)
57095	NOOR SHAZLINA BINTI AHMAD	B.E.HONS.(UMS) (CIVIL, 06)
56171	NOR AIMA SYAZWANI BINTI HARON	B.E.HONS.(UTHM) (CIVIL, 12)
56172	NOR AIN FAZLINA BINTI SAARI	B.E.HONS.(UTHM) (CIVIL, 12)
56173	NOR ASHIKIN BINTI KHOLIB	B.E.HONS.(UTHM) (CIVIL, 12)
56174	NOR HAFIZAN BIN ABD WAHAB	B.E.HONS.(UTHM) (CIVIL, 12)
56175	NOR HASLINDAH BINTI RAZALI	B.E.HONS.(UTHM) (CIVIL, 12)
57070	NOR SAHARA BINTI JONIT	B.E.HONS.(UiTM) (CIVIL, 12)
56176	NOR SYAZANA BINTI MOHD AMINUDDIN	B.E.HONS.(UTHM) (CIVIL, 12)
56177	NORASMA BINTI MOHAMAD	B.E.HONS.(UTHM) (CIVIL, 12)
56178	NORAZIANA BINTI KASIRAN	B.E.HONS.(UTHM) (CIVIL, 12)
57530	NORAZURA BINTI MUHAMAD BUNNORI	B.E.HONS.(UKM) (CIVIL, 99) MSC (USM) (STRUCTURAL, 02)
56179	NORBAIZURA A/P NGAH	B.E.HONS.(UTHM) (CIVIL, 12)
56180	NORHASZURAH BINTI MALEKAL	B.E.HONS.(UTHM) (CIVIL, 12)
56181	NORLIYANA BINTI MOHD NOOR	B.E.HONS.(UTHM) (CIVIL, 12)
56182	NORNADIA BINTI JAAFAR	B.E.HONS.(UTHM) (CIVIL, 12)
56183	NUR AIDAH BINTI HASSAN	B.E.HONS.(UTHM) (CIVIL, 12)
56184	NUR AISHAH BINTI SULAIMAN	B.E.HONS.(UTHM) (CIVIL, 12)
56185	NUR ERENNA BINTI ABD AZIZ	B.E.HONS.(UTHM) (CIVIL, 12)
56186	NUR FARHANA BINTI MOHD ZAHARON	B.E.HONS.(UTHM) (CIVIL, 12)
56187	NUR FARHANA BT YAHYA	B.E.HONS.(UTHM) (CIVIL, 12)
56188	NUR HAMEEDAH BT HJ ABDUL HALEEM	B.E.HONS.(UTHM) (CIVIL, 12)
56189	NUR HAMIZAH BT AB AZIZ	B.E.HONS.(UTHM) (CIVIL, 12)
56190	NUR MALYANAH BINTI MD ZIN	B.E.HONS.(UTHM) (CIVIL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56191	NUR SYAZWANI BT ABDULLAH	B.E.HONS.(UTHM) (CIVIL, 12)
56192	NUR ZALIKHA BINTI SAHARUDIN	B.E.HONS.(UTHM) (CIVIL, 12)
57561	NURBAITI HAZLINI BINTI ZAKARIA	B.E.HONS.(UMP) (CIVIL, 10)
56193	NUR-EFIZAN BINTI ISA	B.E.HONS.(UTHM) (CIVIL, 12)
56194	NURUL HAZIRAH BT MOHD FADZIL	B.E.HONS.(UTHM) (CIVIL, 12)
56195	NURUL HUSNA BT ABD HALIM	B.E.HONS.(UTHM) (CIVIL, 12)
56196	NURUL NAKHIAH BINTI WAHID	B.E.HONS.(UTHM) (CIVIL, 12)
56197	NURUL SYAKEERA BINTI NORDIN	B.E.HONS.(UTHM) (CIVIL, 12)
56551	ONG REN YIH	B.E.HONS.(UMS) (CIVIL, 09)
57547	OOI CHEE KWANG	B.E.HONS.(USM) (CIVIL, 01)
56437	OOI PEI GUNG	B.E.HONS.(UTHM) (CIVIL, 12)
56198	PARAN ANAK GANI	B.E.HONS.(UTHM) (CIVIL, 12)
57073	PARANITHARAN A/L ELLAN	B.E.HONS.(UTHM) (CIVIL, 03)
57130	POH WEE HOON	B.E.HONS.(MALAYA) (CIVIL, 12)
57090	PUTERI NADIA MOHD AZALI	B.E.HONS.(UiTM) (CIVIL, 11)
56199	QAIRUNIZA BINTI ROSLAN	B.E.HONS.(UTHM) (CIVIL, 12)
57528	RADEN MAIZATUL AIMI BINTI MOHD AZAM	B.E.HONS.(UiTM) (CIVIL, 09)
56549	RAJA RUSDY IRWAN BIN RAJA HUSSIN	B.E.HONS.(UPM) (CIVIL, 06)
57098	RAMES KUMAR A/L SHANMUGAM	B.E.HONS.(UTHM) (CIVIL, 11)
56557	RAZALI BIN KASSIM	B.E.HONS.(UTM) (CIVIL, 07)
56470	REGINALD GOLOD	B.E.HONS.(UPM) (CIVIL, 00)
56545	ROSAFIZI BIN MOKHTAR	B.E.HONS.(USM) (CIVIL, 02)
56468	SAAPILIN MD. YASSIN	B.E.HONS.(WALES) (CIVIL, 98)
56200	SAHIRMA BINTI MAHAT	B.E.HONS.(UTHM) (CIVIL, 12)
56201	SAIDATHUL UMMAH BINTI ABD RAHIM	B.E.HONS.(UTHM) (CIVIL, 12)
57093	SAM GUO RONG	B.E.HONS.(UTHM) (CIVIL, 10)
56554	SAUFIYAN SAURI B. MD RAMLI	B.E.HONS.(UiTM) (CIVIL, 12)
56202	SHAHARATULAINI BINTI MUSTAFA	B.E.HONS.(UTHM) (CIVIL, 12)
56546	SHAMREE BIN AHMAD	B.E.HONS.(UTM) (CIVIL, 08)
56604	SHARMEELEE A/P SUBRAMANIAM	B.E.(KARTANAKA) (CIVIL, 98) M.E.(NATIONAL UNI. OF SINGAPORE) (CIVIL, 03)
56438	SHARMILA BINTI AYUB	B.E.HONS.(UTHM) (CIVIL, 12)
57078	SHUKRI BIN ISHAK	B.E.HONS.(UPM) (CIVIL, 98)
56603	SIM BOON SEONG	B.E.HONS.(NOTTINGHAM) (CIVIL, 00)
57072	SIT WAN KEAT	M.E.HONS.(BIRMINGHAM) (CIVIL, 10)
56203	SITI NOR FAIZAH BINTI KAMARUDDIN	B.E.HONS.(UTHM) (CIVIL, 12)
56204	SITI NORAMYRA BINTI ABDUL RAHIM	B.E.HONS.(UTHM) (CIVIL, 12)
56205	SITI NORAZAMI BINTI ALI	B.E.HONS.(UTHM) (CIVIL, 12)
56206	SITI NURFAIZAH BINTI RUSMAN	B.E.HONS.(UTHM) (CIVIL, 12)
57543	SITI NURUL AINI BINTI ZOLKEFLE	B.E.HONS.(UiTM) (CIVIL, 12)
56207	SITI NURUL EDAYU BINTI AHMAD JAKI	B.E.HONS.(UTHM) (CIVIL, 12)
56208	SITI ZUBAIDAH BINTI MOKTAR	B.E.HONS.(UTHM) (CIVIL, 12)
57544	SOFRIE MIRAJ BIN SHAUFI MIRAJ	B.E.HONS.(UiTM) (CIVIL, 11)
56209	SOON SIAU WEN	B.E.HONS.(UTHM) (CIVIL, 12)
57531	STEVEN NGUI	B.E.HONS.(UTP) (CIVIL, 12) ME (UTM) (CIVIL, 10)
56210	SUFIAN BIN HJ OSMAN	B.E.HONS.(UTHM) (CIVIL, 12)
56561	SUHAILA BT. MADZLAN	B.E.HONS.(UiTM) (CIVIL, 12)
57550	SYAMSULBAHRI BIN ISMAIL	B.E.HONS.(UTM) (CIVIL, 03)
56211	SYARIFAH NURULNAIM BINTI SYED IDRUS	B.E.HONS.(UTHM) (CIVIL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
57521	TAN AIK HENG	B.E.HONS.(UNISEL) (CIVIL, 12)
57545	TAN KIAT BOON	B.E.HONS.(KLIUC) (CIVIL, 11)
57075	TAN KOK FAN	B.E.HONS.(UNITEN) (CIVIL, 07)
56212	TAN LEE SIANG	B.E.HONS.(UTHM) (CIVIL, 12)
56559	TEH MAISARA BINTI MOHD HASSAN	B.E.HONS.(UTHM) (CIVIL, 09) M.SC. (UiTM) (CIVIL, 11)
56152	TEO SUET HUI, JOYCE	B.E.HONS.(UTHM) (CIVIL, 12)
57081	THAM WENG KEET	B.SC.HONS.(STATE UNI OF NEW YORK) (CIVIL, 07)
57087	WAN KHAIRUL ANUAR BIN WAN KASSIM	B.E.HONS.(UTM) (CIVIL, 99)
56553	WAN MOHD AZRI BIN WAN MOHD ZUBIR	B.E.HONS.(UiTM) (CIVIL, 10) M.SC.(UITM) (CIVIL, 11)
56213	WAN NORSHAREEDA BINTI WAN MOHD YUSOFF	B.E.HONS.(UTHM) (CIVIL, 12)
56558	WAN ZAIDI BIN WAN MAHAMOOD	B.E.HONS.(UTM) (CIVIL, 11)
57085	WAZARIAH BINTI WAHAB	B.E.HONS.(UTM) (CIVIL, 02)
57097	YEOH EEFFIE	B.E.HONS.(NOTTINGHAM) (CIVIL, 09)
56214	YUSNOREZANI BINTI YUSOFF	B.E.HONS.(UTHM) (CIVIL, 12)
56215	ZUL ZHAFRI B ROSLAN	B.E.HONS.(UTHM) (CIVIL, 12)

CIVIL ENGINEERING

M'ship No.	Name	Qualifications
56526	SYAFIQ FIRDAUS BIN AZMI	B.E.HONS.(UIAM) (COMMUNICATION, 09)

COMPUTER ENGINEERING

M'ship No.	Name	Qualifications
57551	CHUAH JOON HUANG	B.E. HONS. (UTM) (COMPUTER, 99) ME (NUS) (2002) MPHIL (CAMBRIDGE) (2008)
56508	MARNI AZIRA BINTI MARKOM	B.E.HONS.(KUKUM) (COMPUTER, 06)
56601	MOHD ZAKWAN BIN MOHD KHALID	B.E.HONS.(UTM) (COMPUTER, 08)

ELECTRICAL ENGINEERING

M'ship No.	Name	Qualifications
56216	ABDUL RAHIM BIN SALEHUDDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56217	ACHMED AZIZIE BIN MARZUKI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56218	ADEL YAHYA ISA ASHYAP	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56492	AHMAD AIZZUDDIN BIN ZAINON	B.E.HONS.(MALAYA) (ELECTRICAL, 05)
56496	AHMAD FARIZ BIN HASAN	B.E.HONS.(UTM) (ELECTRICAL, 07) M.E.(UTM) (ELECTRICAL, 12)
56219	AINANI HASYYATI ABDUL RAHIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56220	ALI AHMAD BIN MASTAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56572	ALI EMRAN BIN NGATENAN @ ADNAN	B.E.HONS.(UITM) (ELECTRICAL, 06)
56221	ALIAA DINA BINTI ABU BAKAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56222	AMIRA BINTI ZULKAPLI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56439	AMIRUL ASYRAF BIN ABDUL MANAP	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56223	AMITHA RAJ A/L SELVARAJU	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56224	ASMUNI BIN HARON	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56625	AZIZUL HAFSYAM BIN ISHAK	B.E.HONS.(UTM) (ELECTRICAL, 07)
56225	AZMAN BIN WAHAB	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57051	AZMAN BIN ZAINUDDIN	B.E.HONS.(UNITEN) (ELECTRONICS, 08)
56524	AZRUL FIRDAUS BIN MOHD	B.E.HONS.(UTM) (ELECTRICAL, 07)
56522	BEH YEIN YEN	B.E.HONS.(SHEFFIELD) (ELECTRICAL, 05)
56226	BUDIAZMAN BIN ASMADI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57563	CHE YUSWADI BIN CHE YUSOFF	B.E.HONS.(UKM) (ELECTRICAL, 06)
56227	CHEE SU THIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56228	CHIAU CHOON JIAT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56243	CHIN CHIEN CHUO, JEREMY	B.E.HONS.(UTHM) (ELECTRICAL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56229	CHONG SZE FAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56230	CHOONG FEI YOONG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56231	DENNIS ANAK LEE	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57048	DESMOND JESUDOSS A/L NELSON	B.E.HONS.(UNITEN) (ELECTRICAL, 10)
56591	DZULHIZZAM BIN DULAIDI	B.E.HONS.(UPM) (ELECTRICAL, 07)
57046	ELYA BINTI MOHD NOR	B.E.HONS.(UTP) (ELECTRONICS, 03)
56232	ERNI MULIATY BINTI ISMAIL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56233	EUGENE MAI CHOY HONG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56592	EZAD RAZIF BIN AHMAT ROZALI	B.E.HONS.(MALAYA) (ELECTRICAL, 05)
56234	EZATULHERNI BINTI MAZALAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57064	FAIRUZ BIN WAHAB	B.E.HONS.(UiTM) (ELECTRICAL, 09)
56235	FREDDIE HO KANG NENG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56491	GOPI A/L SUBRAMANIAM	B.E.HONS.(UNITEN) (ELECTRICAL, 09)
56236	HAFIZAH BINTI MUHAMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56237	HARINDRAN A/L PARAMESWARAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57058	HARKISHEN SINGH A/L JASBIR SINGH	B.E.HONS. (NORTHUMBRIA) (ELECTRICAL, 06) ME (UM) (ELECTRICAL, 10)
56622	HIJRIL ASWAD BIN WAHID	B.E.HONS.(UPNM) (ELECTRICAL, 11)
57055	HU KOK HAU	B.E.HONS.(MMU) (ELECTRICAL, 11)
56520	IKHWAN BIN SULAIMAN	B.E.HONS.(UNITEN) (ELECTRICAL, 09)
56238	ILEYATI BINTI MOHD YUSOFF	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56239	IRNIE BINTI AZIZ	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56240	IZAN ROZAIMIE BINTI MOHAMED IBRAHIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57061	JA'AFAR SIDEK BIN BUDIN	B.E.HONS.(UTM) (ELECTRICAL, 12)
56241	JAYARAMNI A/L RAJU	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56242	JAYNE ANAK JUKING	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56244	JUWAIRIAH BINTI MOHD JANGGI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56440	KENNEDY ANAK MENSAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57059	KHADIJAH BINTI MOHD NOOR	B.E.HONS.(UTHM) (ELECTRICAL, 11)
56245	LAM KOK KHEONG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56494	LEE JUN JIA	B.E.HONS.(UTP) (ELECTRICAL, 10)
57546	LEE KWANG JUI, GORDON	B.E.HONS.(CURTIN) (ELECTRICAL, 05)
56246	LEONARD LAI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57052	LIEW SENG JOO	B.E.HONS.(USM) (ELECTRICAL, 09)
56247	LIM HUEY SIA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57021	LIM YANN SIANG	B.E.HONS.(UNITEN) (ELECTRONIC, 11)
57526	LIOE DE XING	B.E.HONS.(UPM) (ELECTRICAL, 09)
56248	LOW JIA WEI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56441	MAHDIR BIN MAHMOOD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56249	MAIZUL HAFFIN BIN ZULKARNAIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56250	MARK ANAK SELAT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56525	MARLENNY BINTI ALWI	B.E.HONS.(UNITEN) (ELECTRICAL, 10)
56251	MARNIE BINTI ZAKARIA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56497	MELATY BINTI AMIRRUDDIN	B.E.HONS.(UTP) (ELECTRICAL, 09)
56252	MOHAMAD AZMIL BIN MOHD ZAINUN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57556	MOHAMAD HANIZAM BIN MAHMOOD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56253	MOHAMAD IZUAN BIN KAMARUZAMEND	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56499	MOHAMAD SAFRI BIN MOHD. DALI	B.E.HONS.(LEEDS METROPOLITAN) (ELECTRICAL, 97)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56254	MOHAMMED KHAIRULLAH BIN RAZALLI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56255	MOHD ADIB BIN PAUZI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56256	MOHD AMIRUDIN BIN ROSLI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56257	MOHD ASHIQ KAMARIL BIN YUSOFF	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56258	MOHD ASYRAF BIN DAIPI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56259	MOHD AZUHAR BIN MUSTAPHA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56260	MOHD FADZLI BIN MAT ARIFFIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56261	MOHD FADZLIE BIN AHMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56262	MOHD FAHMI BIN ISMAIL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56263	MOHD FAIZAL BIN MOHD KHALID	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57049	MOHD FALAAH BIN ABD MANAP	B.E.HONS.(MALAYA) (ELECTRICAL, 07)
56264	MOHD FARID BIN MOHD DAUD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57060	MOHD FAUZI BIN ABDULLAH	B.E.HONS.(UTM) (ELECTRICAL, 04)
56521	MOHD HAZIRIE BIN MOHD SHAMSUDDIN	B.E.HONS.(UKM) (ELECTRICAL, 07)
56265	MOHD IHSAN BIN RAMLAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56266	MOHD ILHAM BIN MAHADAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56267	MOHD IMAN SYAZWAN BIN MUKHATAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56573	MOHD ISMAIL BIN JUSOH	B.E.HONS.(UiTM) (ELECTRICAL, 04)
56268	MOHD IZWAN BIN ISMAIL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57557	MOHD KHAIRUDDIN BIN MAT YAMIN	B.E.HONS.(UTHM) (ELECTRICAL, 10)
56575	MOHD KHAIRUL ADZHAR BIN UMAR	B.E.HONS.(UTM) (ELECTRICAL, 05)
56269	MOHD SAFUWAN BIN MOHD JASNI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56270	MOHD SAZWAN B ABDULLAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56271	MOHD SHAHRULAMIN BIN HAMZAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56487	MOHD SHAIFUL KHAIRI BIN IHSAN	B.E.HONS.(UTM) (ELECTRICAL, 06)
56272	MOHD SYAFIQ AKMAL BIN MOHD AINI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56273	MOHD SYAFIQ BIN MAHMOOD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56495	MOHD SYAFREN EFFENDY BIN MOHD YUSOFF	B.E.HONS.(UNIMAP) (ELECTRICAL, 07)
56274	MOHD TAUFIK BIN MD JAIS	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56486	MOHD ZAIDDY BIN MAT RAJALI	B.E.HONS.(UNITEN) (ELECTRICAL, 07)
56275	MOHD ZAIDI BIN ZAINAL ABIDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57050	MOHD. ZUHIR BIN HAMZAH	B.E.HONS.(UMS) (ELECTRONICS, 11)
56485	MUHAMAD ADZHIM BIN NORZAIMI	B.E.HONS.(UNITEN) (ELECTRICAL, 08)
56579	MUHAMAD KHALID BIN ABDULLAH	B.E.HONS.(UTM) (ELECTRICAL, 04)
57571	MUHAMAD MUSHIDI BIN MUSTAPA	B.E.HONS.(UiTM) (ELECTRICAL, 07)
57062	MUHAMAD NORHAFIZI BIN ZAINAL ABIDIN	B.E.HONS.(UTM) (ELECTRICAL, 12)
57056	MUHAMAD SYAZWAN BIN MOHD SALLEH	B.E.HONS.(UTM) (ELECTRICAL, 08)
57054	MUHAMAD TAUFIQ BIN RAMLY	B.E.HONS.(UiTM) (ELECTRICAL, 10)
56586	MUHAMAD YUSUF BIN ZULKEFLY	B.E.HONS.(UTM) (ELECTRICAL, 06)
56276	MUHAMAD ZAHARI BIN TASLIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56277	MUHAMMAD AMIIN BIN AB RAHIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56278	MUHAMMAD DANIAL BIN AMINUDDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56442	MUHAMMAD FADDIL BIN AHMAD REBUDI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57568	MUHAMMAD FADHLY BIN ASLAI	B.E.HONS.(UNITEN) (ELECTRICAL, 10)
56279	MUHAMMAD FAKHRUL AFIQ BIN ABDULLAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57065	MUHAMMAD FIKRY BIN ABDULLAH	B.E.HONS.(UiTM) (ELECTRICAL, 09)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56280	MUHAMMAD HASBULLAH B. SELAMAT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56578	MUHAMMAD NAZMI BIN MUHAMMAD SOFI	B.E.HONS.(UiTM) (ELECTRICAL, 06)
56281	MUHAMMAD NIDZAMUDDIN BIN ZAINAL ABIDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57063	MUHAMMAD RIDZUAN BIN IDRIS	B.E.HONS.(UTHM) (ELECTRICAL, 10)
56282	MUHAMMAD SYUKRI BIN MANSOR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56283	MUHD AZIZI BIN HAMIDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56284	MUHD FAIZ AKMAL BIN AHMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56285	MUHD NURHISHAM BIN SOKRI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57516	MURALIRAJAN A/L K. YELLUMALAI	B.E.HONS.(UNITEN) (ELECTRICAL, 08)
56286	NARA SIMAN SUBRAMANIAM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56287	NAZEERUL HAZIQ BIN AMIRUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57057	NEKMAT BIN MD LAZI	B.E.HONS.(UTM) (ELECTRICAL, 09)
56443	NOOR HAFIZAH BINTI CHE MANAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56488	NOOR SHAFAWATI BINTI MOHD BADARI	B.E.HONS.(UTM) (ELECTRICAL, 07)
56288	NOORAIN BT MOHD JOHARY	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57567	NOORSHARIN BIN MOHAMED NAWAWI	B.E.HONS.(UMS) (ELECTRICAL, 00)
56289	NOR ZAIMAH BINTI SURIA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56290	NORAZILA BINTI MANSOR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56291	NOREFARIZA BINTI ROSLI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56444	NORFARAHIN BINTI MAHMOD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56581	NORHAMIMI BINTI HAMDAN	B.E.HONS.(UTM) (ELECTRICAL, 02)
56292	NORHIDAYAH BINTI YAHAYA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56293	NORHUSNA BINTI MOHAMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56294	NORLINNOR BINTI BAHARUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56295	NORUMMIRAH BINTI ABDULLAH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56296	NUR AQILAH BINTI MOHAMAD AMIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56297	NUR ASHIKEEN BT ABD RAHIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56298	NUR ATIQAH BT AHMAD	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56299	NUR AZEAN BINTI AZLAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56300	NUR AZURA BINTI MAMAT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56490	NUR HIDAYAH BINTI SALLEH	B.E.HONS.(UNITEN) (ELECTRICAL, 08)
56301	NUR HIDAYAH BINTI YAHYA	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56302	NURAINI BINTI AB RAHIM	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56303	NURHAFIZAH BINTI ISMAIL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57548	NURUL AZWANI BINTI MAHBOB	B.E.HONS.(UTM) (ELECTRICAL, 05)
56304	NURUL FADILA BT SAMSUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56305	NURUL SUHAILAH BINTI KIMSIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56306	NURUL WAHIDAH BINTI SHAFEE	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56307	NURULFARAHIDA BINTI NORAZAHAR	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56523	ONG CHOON TAT, ERIC	B.E.HONS.(UNITEN) (ELECTRICAL, 11)
57513	ONG WOON LEONG	B.E.HONS.(UMS) (ELECTRICAL, 12)
56308	ONG YI VERN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56309	OOI ZHI JIANG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56489	PURUSOTHEMEN A/L MAHALINGGAM	B.E.HONS.(UNITEN) (ELECTRICAL, 09)
56310	PUVANENDRAN A/L RENGASAMY	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57067	RAFIDAH BINTI AB RAHMAN	B.E.HONS.(UTHM) (ELECTRICAL, 04)
57066	RAFIZAH BINTI AB RAHMAN	B.E.HONS.(UTHM) (ELECRRICAL, 04)
56311	RAHAYU BINTI JAMALUDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56312	ROSLIZA BINTI MOHAMAD ZIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56313	SADEQ ALI QASEM MOHAMMED	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56314	SANMARKAM A/L DHANA SIGH	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56632	SATHIS KUMAR THASNAMOORTHI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56315	SATHYBABU PAIDUTHALY	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56317	SH. NAZATUL NURHAKIMI BT SYED MHD SHAHRUDDIN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56316	SHAHRUL ATIQAH BINTI ABDUL RAZAK	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56623	SHAMSUL BIN ABDULLAH	B.E.HONS.(WARWICK) (ELECTRICAL, 97)
56519	SHANJAY KUMAR A/L A. KRISHNASAMY	B.SC.(PURDUE) (ELECTRICAL, 99)
56619	SITI AISYAH BINTI HARUN	B.E.HONS.(UTHM) (ELECTRICAL, 10)
56318	SITI ASMA BINTI ZAKIRIA	B.E.HONS.(UTHM) (ELECTRICAL, 12)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56319	SITI AZULAINEY BT MHD ASLAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56320	SITI FARHANAH BINTI ZULKIFLI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57053	SITI HAJAR BINTI MOHD NORDIN	B.E.HONS.(UNITEN) (ELECTRICAL, 11)
56321	SITI NOR AKMALIZA BINTI LUTFI	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56322	SITI NURHAFIZAH BINTI ANUAL	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56323	SITI SUWARNI BINTI AWANG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57532	SITI ZALEHA BINTI ACHA	B.E.HONS.(UNIMAS) (ELECTRICAL, 05)
56498	SOO TUNG SEUNG, JONATHAN	B.E.HONS.(AUCKLAND) (ELECTRICAL, 09)
56324	SUHALINA BINTI SELAMAT	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57047	SYAIRAH BINTI ABDUL GHANI	B.E.HONS.(UTP) (ELECTRONICS, 08)
56621	SYANITA BINTI ZUR	B.E.HONS.(UNITEN) (ELECTRICAL, 08)

ADMISSION TO THE GRADE OF GRADUATE

M'ship No.	Name	Qualifications
56325	SYLVESTER TIMOTHY JAMES	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56326	TAN CHIN CHUAN	B.E.HONS.(UTHM) (ELECTRICAL, 12)
56327	TAN MIN HORNG	B.E.HONS.(UTHM) (ELECTRICAL, 12)
57517	TEOH CHOON MING	B.E.HONS.(UMS) (ELECTRICAL, 11)
56493	TONG YEAH FONG	B.E.HONS.(MALAYA) (ELECTRICAL, 06)
56328	UK RAAI A/P CHEN	B.E.HONS.(UTHM) (ELECTRICAL, 12)

***Note:** Remaining list of the "ADMISSION TO THE GRADE OF GRADUATE", "ADMISSION TO THE GRADE OF INCORPORATED MEMBER" and "ADMISSION TO THE GRADE OF ASSOCIATE MEMBER" would be published in the May 2013 issue. For the list of approved "ADMISSION TO THE GRADE OF STUDENT", please refer to IEM web portal at http://www.myiem.org.my.*

60th Announcement

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3	22477	KHAIRUL AMIN BIN NAIM
4	21423	WOO CHUNG HING
5	46788	MOHD ADLI BIN ADANAN
6	33933	DONALD ERIC CHUCHONG
7	49441	ZULZAMRI BIN KOSNAN
8	13875	TANG WA
9	41210	RAMASAMY CHETTEAR A/L PERIASAMY
10	18296	LIEW PAK WAI
11	21881	AHMAD NAZRY BIN SARNI
12	04626	TAN LIAN SOON
13	29833	NG ZY YI
14	20010	NG KHAI SOON
15	33903	VOON HIAN YA, MILDRED
16	43736	CHOW WOON CHEK
17	55987	MOHD. ADZHAR BIN KAMAL
18	30572	SAW CHUN LIN
19	25559	MOHD. HARDY BIN LAIDIN @ SAIDIN
20	29743	HO POOI KWAN
21	16515	MASITAH BINTI HASAN
22	04961	ASOK KUMAR S/O HARILAL HIRA PATEL
23	07242	TAN SEE CHEE
24	43722	NOR SAZLINA BINTI ISMAIL
25	19235	MOHD. RAZNAN BIN HASSAN
26	38687	MOHD TARMIZI BIN ABDUL HAMID
27	43735	ZULKIFLI BIN AHMAD AHTAR
28	06440	LINGANATHAN S/O V THILLAINATHAN
29	24856	MAZLAN BIN YUSOFF
30	56125	ZURAIKHA BINTI SAMSUDDIN
31	08013	GOH KAR BUNG
32	03665	TEOH HAN ENG
33	02171	AL'AZMY BIN AHMAD
34	04692	CHAN SIEW KEAT
35	25392	GAN SHIAU HUI
36	04243	CHE ARIFFIN BIN HASSAN
37	12556	JUHARI BIN HUSIN
38	16069	HUSAINI BIN HUSIN
39	48045	MOHD FAIZAL BIN JALIL
40	15356	CHOW CHEE HENG
41	15607	FOO SAIK CHENG
42	05380	LIM SIANG CHAI, DONALD
43	00818	LOH CHOW KHUAN
44	02548	TEO HOCK YEOW
45	01998	LEE LAM
46	05132	ZULKIFLY BIN MADON
47	13524	JUNAIDI BIN MUSLIM
48	05943	WANG CHUNG TA
49	10983	LAI HOCK YEE
50	03016	ANG LEE HUAT
51	04611	OOI TEONG CHEAU
52	13486	AZMAN BIN ABDULLAH
53	08637	CHONG SWEE CHOON
54	02772	LEE KIM CHAI
55	05802	BAHARAM BIN MOHD.
56	18080	HAMIDON BIN YUSOF
57	01450	WONG KIM YEN
58	48104	NOR HAZRIL BIN MOHD NOOR
59	07078	LOO YEOW CHUEN
60	02143	LEE SOO SIN
61	11125	HALINA BTE ABD. HADI
62	13796	ONG CHOOI HUAT
63	07017	LING LAI KIONG
64	02290	LAU KA TING
65	15970	ABDUL RAZAK BIN MAT YUNUS
66	19172	ABDUL RAZAK BIN JAMIN
67	07838	ASOKAN A/L SELVAGANAPATHY
68	54109	KHOH SOO BENG
69	16674	TAN KOK HWA
70	03650	CHUA LEE BOON
71	31733	MOHD AZMI BIN JUSOH
72	47097	MUHAMAD YUSUF BIN HASAN
73	22505	ENG KOK SONG
74	33980	ARLEENEANSHAM @ LEE KIM SENG
75	13912	NG KOON SENG
76	14537	SEE CHENG SENG
77	21748	TEH HUCK NGI
78	36342	MOHAMAD SORBANI BIN HAMZAH
79	56807	HUAN YEW JIN
80	18841	ANG WEE BAN
81	27472	ABDUL RASHID BIN HUSSAIN
82	29023	IMRAN AZIM BIN AZHARUDDIN
83	13827	A. RASHID BIN OMAR
84	18262	FAISAL BIN ABDUL HALIM
85	09010	LEONG SANG KHIM
86	11358	LEE MENG CHIAT
87	03451	NG CHEU KUAN
88	08385	DHILEEPAN RAMAN NAIR
89	17129	BADHRULHISHAM BIN ABDUL AZIZ
90	29647	SYAHRULNIZAM BIN MOHAMMAD
91	08211	MANSOR BIN MAZLAN
92	13409	LEONG SOW KHEAN
93	10247	OTHMAN BIN A. KARIM
94	17362	KAMSANI BIN JOHAN
95	05369	MOHD. ZAMIN BIN KAMARUZAMAN
96	21285	NG WENG LIANG
97	04907	KHALID BIN HAMZAH
98	38744	ABDUL ZAIRUL BIN ABD RAHIM
99	03436	CHEW TAT JIN
100	37987	ZUHAIRI BIN JUSOH
101	37038	CHAN YEW FAH
102	09360	HANAFI BIN NASIR
103	04825	CHUA SONG YANG
104	15235	ROSLAN BIN MOHD. YUNUS
105	26586	CHEE JEN YIH
106	09686	MOHAMAD BIN ABD. SAMAD
107	01836	LEE MEAU KON
108	01835	KHAW EAN KEE
109	03031	SU AH KAU
110	28253	WAN AZIZUL AZRI BIN WAN ABDUL AZIZ
111	38286	ADENAN BIN RASHID
112	14527	TE KIM BOON
113	15325	HAN SUNG TING
114	17560	WONG SU KEN
115	29793	NURULWAHIDA BINTI MOHD JAMMAL
116	06100	CHEONG THIAM FOOK
117	28958	TAN CHEE WEI
118	08818	LIM CHOR PIN
119	25634	DAVID ROBERT PARKS
120	07129	MOHD JAMMAL BIN MOHD SATAP
121	00086	LIM CHOO BOON
122	00670	MOHAMED KHALID BIN DIN
123	13648	MOHAMAD AZMI BIN JOHARI
124	02072	POO HAI LEONG
125	14350	AZHAR BIN AHAMAD
126	37023	SHOFI BIN AHMAD
127	05492	FUAD BIN ABAS
128	02677	CHAN BUA WAH
129	12175	TEH MING HU
130	01994	LOH ENG WAH
131	23101	KUEK HANN YIH, KELVIN
132	09122	TAN SENG THIAN
133	09817	SULAIMAN BIN MOHAMAD TAIB
134	11026	ABDULLAH BIN OTHMAN
135	05018	TAN GIM FOO
136	11135	FOO TIAN HUEI
137	03273	SYED ZAIN AL-KUDCY BIN DATO' SYED MAHMOOD
138	43805	SHIRIDHARAN A/L GANESAN MUTHI
139	20703	MD. MAZMI BIN MD. HADZIR
140	09702	POH RUNNY
141	13914	WONG LEAN HUAT
142	10801	BOEY WEI LUN
143	13636	KAMAL BHAREEN BIN EMBONG
144	51712	ROSHASMAWI BIN ABDUL WAHAB
145	25872	CHEONG CHUN SIONG
146	17613	SILAHUDDIN BIN SAIBANI
147	05485	LOKE PAK CHEONG
148	06397	NG KOK HWA
149	06161	RAJASKANDA S/O THAMOTHARAM
150	05585	ONG ANG KOOI
151	18344	KAMAL NASHARUDDIN BIN MUSTAPHA
152	04531	YONG YEW WEI
153	10675	LIM THUAN SWEE
154	17604	LIM MING SIN
155	36923	SAMUEL BIN EDWARD ATIT
156	16364	CHERYL CECILIA SAROL UDARBE
157	26772	SURAYA BINTI AB RAZAK
158	25664	LIM CHAIN CHUAN
159	41027	SITI RAFIDAH BINTI MOSLIM
160	35538	MURALI A/L KANNIPAN
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163	52451	MOHAMAD ZAKI BIN MAJID
164	11275	MOHD. HARIS BIN ABAS
165	24199	NG EAK TONG
166	13780	MOHD REDZUAN BIN MOHD RAMLI
167	13760	LEONG YEOW KEE
168	26404	TAN SENG GUAN
169	19650	MOHAMED HANIFFA HJ. ABDUL HAMID
170	16967	ZAIDI BIN MD. ZAIN
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172	03073	QUAH SING HOCK
173	16835	CHOO BENG LYE
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175	16217	MUHAMMAD ASHRI BIN MUSTAPHA
176	16258	LIEW AUN LEONG, DAVID
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178	03314	ACHUTHAN KUTTY G. KRISHNAN
179	15381	MOHD SHOKRI BIN DAUD
180	34351	FAUZI BIN AHMAD
181	39193	YEOH YAP ZHENG
182	30791	MUSFA BIN MOHAMAD
183	08672	LIM KONG JOO
184	04577	LEE CHENG SIONG
185	07826	LAU LEE YENG
186	21575	NGIM CHIN KIM
187	26740	MHD. SHUKREE BIN SHAHABUDIN
188	24544	NOOR MOHD HELMI BIN NONG HADZMI
189	18436	WONG KIM HUNG
190	20413	MADHU SOOTHANAN A/L VELAYUTHAM
191	18274	KONG YEOW LIONG, PAUL
192	07039	WONG YII HENG
193	02609	TAN KOK YEE
194	09696	HO SAY HAI
195	15107	YIP SHUI CHEONG
196	10752	CHEONG CHEE MING
197	17883	NOOR SAMSUDIN BIN KANDAR
198	21884	LOO LEE WEN
199	13792	KUEK AH CHEW @ KOK AH CHIEW
200	15850	JAWHARDEEN BIN HAJI ABDUL KADER

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NAME: *(please underline the surname)* ______

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P.ENG NO: ______ DATE: ______

NOTE: *Kindly attach a photocopy of your MEMBERSHIP CARD to this Form*

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ECP NAME: ______ TELEPHONE: ______

ADDRESS: ______ FAX: ______

______ MOBILE: ______

______ EMAIL: ______

______

______

POSTCODE: ______ STATE: ______

3. ACADEMIC QUALIFICATIONS

FIRST DEGREE /
UNIVERSITY /
DISCIPLINE: ______ DATE OF GRADUATION: ______

POST GRADUATE DEGREE /
UNIVERSITY /
DISCIPLINE: ______ DATE OF GRADUATION: ______

OTHER PROFESSIONAL AFFILIATION / REGISTRATION: ______

4. PRE-SUBMISSION REGISTRATION *(select only 1 preferred category for registration purpose)*

Please tick: (✓) ☐ Civil *(Passive Fire Protection)* ☐ Mechanical *(Active Fire Protection)*

Period of Experience	Position of Responsibility	Months	Nature of projects, its significance, your functions, responsibilities, achievements, practical innovations, original application of theory
	Total number of Months		

5. DECLARATION

All statements of facts in my report and as summarised in the tables of this Registration Form are true.

Signature: ______ Date: ______

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