

MEMBERSHIP

To All Members,

Date: 9 October 2006

CANDIDATES APPROVED TO SIT FOR YEAR 2006 PROFESSIONAL INTERVIEW

The following candidates have been approved to sit for the Professional Interview for 2006.

In accordance with Bylaws 3.7, the undermentioned names are published as having applied for membership of the Institution, subject to passing the year 2006 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 Hon. Secretary. Such communication should be lodged a month from the date of publication.

Engr. Oon Chee Kheng, E.L.E.M., P.Eng.
Honorary Secretary, IEM

TRANSFER APPLICANTS		
Membership No	Name	Qualifications
CIVIL ENGINEERING		
21864	ABD. KADIR BIN NIK ABDULLAH	BE (HONS) (USM) (CIVIL, 98)
13813	CHEN SIN KHONG	BE (HONS) (UPM) (CIVIL, 95)
20985	GAN SHWU JIUAN	BE (HONS) (UTM) (CIVIL, 01)
21838	KONG CHEE KEN	BE (HONS) (DUNDEE) (CIVIL, 99)
19903	TAN WEE PENG	BE (HONS) (UTM) (CIVIL, 01)
ELECTRICAL ENGINEERING		
23052	LIM SOON WAH	BE (HONS) (USM) (ELECT. POWER ENG, 02)
26473	ZAMRI BIN HASSAN	BE (HONS) (UTM) (ELECT, 00)
MECHANICAL ENGINEERING		
19472	CHENG YEONG CHANG	BE (HONS) (UTM) (MECH, 96) PhD (NANYANG) (06)
19620	HAMBALI BIN CHIK	BSc (TENNESSEE) (MECH, 94)
14445	JAYASEELAN S/O P. NADARAJAH	BE (HONS) (MALAYA) (MECH, 03)
19054	KONG SHIAN BIAU	BE (HONS) (SHEFFIELD HALLAM) (MECH, 97)
17366	MOHD AZLAN BIN ABAS	BSc (WESTERN MICHIGAN) (MECH, 95)
25612	NORASMARINA MASROM	BE (HONS) (UTM) (MECH, 02)
23182	SIA KIONG WAR	BSc (HONS) (UTM-ITTHO) (MECH, 98)
23945	SIVANANTHAN JOTHEE SUBRAMANIAM	BSc (SOUTH ALABAMA) (MECH, 00) MSc (SOUTH ALABAMA) (MECH, 01)
6148	WONG SIN MIN	BE (HONS) (UM) (MECH, 85)
PETROLEUM ENGINEERING		
23251	TAN LIT HERNG	BE (HONS) (UTM) (PETROLEUM, 96)

NEW APPLICANTS	
Name	Qualifications
CIVIL ENGINEERING	
MD SHAHRUDIN BIN MUHAYAT	BE (HONS) (MIDDLESEX POLY) (CIVIL, 98) (CNAAC)
ELECTRICAL ENGINEERING	
DZULFIDA BIN RAZAK	BE (HONS) (UTM) (ELECT, 02)
MECHANICAL ENGINEERING	
AZMER BIN SHAMSUDDIN	BSc (MICHIGAN) (MECH, 86)

ANNOUNCEMENT**Sponsorship of Twenty (20) IEM Young Engineers for the 2006 International Energy Conference for Sustainable Asia**

Vertitech (M) Sdn. Bhd. has agreed to sponsor the registration fees for twenty Young Engineer Members of IEM (39 years and below) to the above event, held on the 26 - 28 November 2006 at the Sunway Pyramid Convention Centre. IEM wishes to express our gratitude and thanks to Vertitech (M) Sdn. Bhd. for their kind support. Please contact IEM for more details on the sponsorship.

ANNOUNCEMENT



IEM DIARY OF EVENTS

For further enquiries on the events below, please contact IEM Secretariat at 03-7968 4001/2 or visit IEM Homepage at <http://www.iem.org.my>

EVENTS AND ACTIVITIES FOR NOV 2006

Chemical Engineering Technical Division 4 NOVEMBER 2006

Time : 9.00 a.m. - 11.00 a.m.

Talk on How Web-Based Software Applies to Process Relief Safety Management (PRSM)

Project Management Technical Division 11 NOVEMBER 2006

Time: 9.30 a.m. - 11.30 a.m.

"A Snapshot of a Typical Project Schedule Management Methodology"

Speaker: Engr. Faizal Abdullah Sanusi

13 - 14 NOVEMBER 2006

Time: 9.00 a.m. - 5.00 p.m.

Essentials of Project Management – Theory and Practice Introducing Microsoft Project Tool"

Session 1: Project Management Principles

Venue: Armada Hotel, Petaling Jaya

15 NOVEMBER 2006

Session 2: Basic Microsoft Project Tool Practical

Venue: Cosmopoint Corporate Training Centre, Crystal Plaza, Petaling Jaya

21 NOVEMBER 2006

Time: 5.30 p.m. - 7.30 p.m.

Lectures on Arbitration – Lecture No. 6: "Preliminary Meeting and Interlocutories"

Speaker: Engr. Dr Wong Fook Keong

Information Technology Special Interest Group

13 NOVEMBER 2006

Time: 5.30 p.m. - 7.30 p.m.

Talk on "Document Engineering"

Speaker: Engr. K. K. Aw

Engineering Education Technical Division 14 NOVEMBER 2006

Time: 5.30 p.m. - 7.30 p.m.

Talk on "Environmental, Safety and Health Management System in the Property Development Sector"

Speaker: Engr. Hasnida binti Abdul Manan

Tunnelling and Underground Space Technical Division

16 NOVEMBER 2006

Time: 8.00 a.m. - 1.00 p.m.

Half-Day Seminar on the Construction of Pantai Trunk Sewer

Mechanical Engineering Technical Division

17 NOVEMBER 2006

Time: 2.15 p.m. - 9.30 p.m.

"Groovy Friday" – Half-Day Technical Course on Mechanical Coupling Technologies for Modern Buildings and Construction Piping Works

Speaker: Engr. Ho Hok Kim

20 NOVEMBER 2006

Time: 5.30 p.m. - 7.00 p.m.

Talk on "Automobile - Driver and Vehicle Primary Safety"

Speaker: Engr. Ho Hok Kim

Electrical Engineering Technical Division 21 NOVEMBER 2006

Time: 9.00 a.m. - 2.00 p.m.

Technical Visit to Telekom Operation Centre

Venue: Cyberjaya

24 NOVEMBER 2006

Time: 5.30 p.m. - 7.00 p.m.

Talk on "Power Factor Correction, Its Principle and Operation"

Speaker: Engr. Chan Yaw Sang

Building Services Technical Division 23 NOVEMBER 2006

Time: 9.00 a.m. - 5.00 p.m.

Critical Thinking and Writing for Engineers

Speaker: Mr. G. Sivalingam

FINAL ANNOUNCEMENT

29 NOVEMBER - 2 DECEMBER 2006

24th Conference of ASEAN Federation of Engineering Organisation (CAFEO 24) on Branding of ASEAN Professional Engineering Services and Education for Global Mobility

Sunway Lagoon Resort Hotel, Petaling Jaya

Website : <http://www.aseanengineers.com/> CAFE024

EVENTS AND ACTIVITIES FOR 2007

8 - 11 MAY 2007

16th Southeast Asian Geotechnical Conference (SEAGC 2007)

Venue : Sheraton Subang Hotel and Towers, Subang Jaya

E-mail : 16seagc@iem.org.my

Website : <http://www.16seagc.com>

(Second Bulletin: Call for Papers and Invitation to Register)

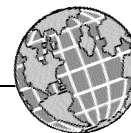
1 - 5 AUGUST 2007

3rd World Engineering Congress (WEC)

Venue : Penang

ANNUAL DINNER AND AGM OF BRANCHES YEAR 2006		
AGM and Annual Dinner	Penang Branch	22 Nov 06
Annual Dinner	Sabah Branch	9 Dec 06
AGM and Annual Dinner	Kedah/Perlis Branch	Dec 06
AGM and Annual Dinner	Sarawak Branch	Dec 06
AGM and Annual Dinner	Terengganu Branch	Dec 06
AGM and Annual Dinner	Melaka Branch	Dec 06
AGM and Annual Dinner	Eastern Branch	TBA

CONFERENCE & SEMINAR



MALAYSIA

14 November 2006

SEMINAR ON ENERGY EFFICIENCY AND CONVERSATION: "LESSONS LEARN'T, CHALLENGES FACED AND WHAT'S NEXT?"

Venue : Renaissance Hotel, Kuala Lumpur

Organiser: PTM, MEPA, KTAK, UNDP, GEF

Tel: 03-8943 4300

Fax: 03-8945 1121 / 8941 1121

Website : www.ptm.org.my

(Invitation to Register)

4 December 2006

SYMPOSIUM ON ENVIRONMENTAL GOVERNANCE – AUDITOR'S ROLE IN PROMOTING ENVIRONMENTAL GOVERNANCE

Venue : Akademi Audit Negara, Mukim Labu, Seremban

Organiser: Jabatan Audit Negara

Tel: 03-8889 9000

Fax: 03-8889 1607

Website : www.audit.gov.my

(Invitation to Register)

18 - 19 July 2007

CONFERENCE ON AUTOMATION AND COMPUTER NETWORKS (CACN 2007) – "EFFICIENCY THROUGH AUTOMATION AND DATA NETWORKS"

Venue : Kuala Lumpur Convention Centre, KL

Organiser: TEEAM

Tel: 03-9221 4417 / 9221 2091

Fax: 03-9221 8212

E-Mail: teeam@po.jaring.my

Website : www.teeam.com

(Call for Papers – by 30 December 2006)

18 - 21 July 2007

THE 7TH INTERNATIONAL EXHIBITION OF TRANSMISSION AND DISTRIBUTION AND ELECTRICAL ENGINEERING (ASEAN ELENEC 2007): POWERING FUTURE TRENDS AND TODAY'S SOLUTIONS

Venue : Kuala Lumpur Convention Centre, KL

Organiser: TNB

Tel: 03-4041 0311

Fax: 03-4043 7241

Website : www.aseanelenex.com

(Invitation to Register)

SINGAPORE

8 - 10 November 2006

ISRM INTERNATIONAL SYMPOSIUM 2006 – 4TH ASIAN ROCK MECHANICS SYMPOSIUM: ROCK MECHANICS IN UNDERGROUND CONSTRUCTION

Venue : Meritus Mandarin Hotel, Singapore

Organiser : Tunneling and Underground Construction Society of Singapore, PTRC

Tel: (65) 6221 2310

Fax: (65) 6221 2670

E-mail : info@arms2006.org

(Invitation to Register)

BAHRAIN

27 - 29 November 2006

8TH INTERNATIONAL CONCRETE CONFERENCE AND EXHIBITION: CONCRETE IN HOT AND AGGRESSIVE ENVIRONMENTS

Venue : Gulf Hotel, Kingdom of Bahrain

Organiser : Bahrain Society of Engineers

Tel: +973 17 727100

Fax: +973 17 729819

E-mail : bseng@batelco.com.bh

Website : www.engineer-bh.com/icce

(Invitation to Register)

SAUDI ARABIA

7 - 11 April 2007

PROJECT MANAGEMENT CONFERENCE AND EXPO: FUTURE TRENDS IN PROJECT MANAGEMENT

Venue : King Fahd Cultural Centre, Riyadh, Saudi Arabia

Organiser: Saudi Council of Engineers

E-mail : masser@saudieng.org

Website : www.saudieng.org/pm

(Call for Papers - by 8 November 2006)

HONG KONG

29 - 31 May 2007

INTERNATIONAL CONFERENCE ON CLIMATE CHANGE

Venue : Hong Kong Convention and Exhibition Centre, HK

Organiser : HKIE, CIWEN HK, ICE HKA, IMechE HK

Tel: (852) 2895 4446

Fax: (852) 2203 4133

E-mail : conf3@hkcie.org.hk

Website : www.hkie.org.hk/ICCC2007

(Call for Papers - before 20 November 2006)

ANNOUNCEMENT

COLUMNISTS WANTED

We would like to invite Members and Readers to contribute as Columnists. Please write to the Chief editor with a short proposal and provide him with a portfolio of the articles, or e-mail to pub@iem.org.my. IEM is looking for articles, write-ups or editorials on any issues related to Engineering and touches on the life of Engineers.

ANNOUNCEMENT

To all advertisers,

Please be informed that the existing agreement between IEM and the publisher, Dimension Publishing Sdn. Bhd. would be expiring June 2007. Re-registration for renewal to be finalised latest by March 2007. All members and advertisers please take note.

Thank you.

CONDOLENCES

With deep sadness, we announce the demise of the following members and wish to extend our condolences to their families. The Institution would like to thank them for their past support and contribution.

<u>Membership No.</u>	<u>Name</u>
F01845	Engr. Mohd. Zain bin Hj. Yusuf
M13272	Engr. Wong, Chee Keong, Joe



PERSATUAN GEOLOGI MALAYSIA GEOLOGICAL SOCIETY OF MALAYSIA

c/o Department of Geology, University of Malaya, 50603 Kuala Lumpur, Malaysia
Tel: (603) 7957 7036 Fax: (603) 7956 3900 E-mail: geologi@po.jaring.my

(IN COLLABORATION WITH IEM AND IGM)

TO ALL MEMBERS OF GSM and IGM,

MALAM HULU KELANG

13 December 2006, Wednesday

Department of Geology, University Malaya, Kuala Lumpur

- 5.00 - 5.30 p.m.: Tea
 5.30 - 6.00 p.m.: Is the Ground at Hulu Kelang Unstable?
 Engr. Dr Gue S.S. (Gue and Partners)
 6.00 - 6.30 p.m.: Tanah Runtuh Kg. Pasir, Hulu Kelang
 Yunus A.R. et al. (JMG)
 6.30 - 7.00 p.m.: Q & A

All members and friends are cordially invited to this event.

Assoc. Prof. Tan Boon Kong
 Chairman
 Working Group on Engineering Geology and
 Hydrogeology



IEM TRAINING CENTRE SDN. BHD. (127273-K)

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TENTATIVE 2006 PLANNER

NOVEMBER 2006		
COURSE TITLE	DATES	VENUE
BEM Mandatory Course – Safety and Health At Work	7 and 8 Nov	IEM TC
Contract Administration for Site Personnel	7 and 8 Nov	Dungun
Essentials of Project Management – Theory and Practical	7 - 9 Nov	Penang
BEM Mandatory Course - Code of Ethics/Regulations	14 and 15 Nov	IEM TC
Claims in Engineering and Construction Contracts	21 and 22 Nov	Kuching
BEM Mandatory Course – Code of Ethics/Regulations	23 and 24 Nov	Kuching
BEM Mandatory Course – Engineering Management Practice	28 and 29 Nov	IEM TC
DECEMBER 2006		
COURSE TITLE	DATES	VENUE
BEM Mandatory Course – Safety and Health at Work	4 and 5 Dec	IEM TC
Claims in Engineering and Construction Contracts	5 and 6 Dec	Penang
BEM Mandatory Course – Engineering Management Practice	7 and 8 Dec	Penang
BEM Mandatory Course – Code of Ethics/Regulations	13 and 14 Dec	IEM TC
BEM Mandatory Course – Engineering Management Practice	19 and 20 Dec	IEM TC

REPORT

Report on the 16th Professor Chin Memorial Lecture

By : Engr. Dr Ooi Teik Aun, F.I.E.M., P. Eng.

The Malaysian engineers once again gathered at the IEM lecture hall on 16 September 2006 to remember the late Tan Sri Professor Chin Fung Kee who passed away in 1990. The Professor Chin Memorial Lecture Series was instituted in Malaysia in order to commemorate the achievements and contributions to the engineering profession by the late Tan Sri Professor Chin Fung Kee.

The Lecture Series was jointly established by The Institution of Engineers Malaysia and the Engineering Alumni Association of the University of Malaya. This is a very prestigious lecture and each year imminent Speakers from Malaysia and abroad are invited for the occasion.

Prof. Chin made significant contributions in the field of engineering education and practice both in Malaysia and the international arena. The late Prof. Chin has been a teacher, a mentor and a friend to many.

This is the sixteenth lecture and we are very fortunate today to have Assoc. Prof. K. Arichandran, former Dean of Faculty of Engineering, University of Malaya and presently Assoc. Professor at the School of

Electrical and Electronic Engineering, Nanyang Technological University, Singapore to deliver the lecture on *"Enigma of Space and the Rationale for Space Exploration"*

Professor K. Arichandran is a born Malaysian. For Prof Arichandran, it is home coming. We are proud to welcome him home. The lecture, though a very specialised topic such as Space Engineering Technology, attracted some 70 participants. There were active discussions from the floor after the lecture. The lecture started at 1.00 p.m. and finished at 3.20 p.m.

The lecture is very appropriate as two Malaysian astronauts are joining the Russian crews to explore outer space next year.

The perspective on space and in particular extra terrestrial or outer space has varied from ancient times. At one time it was held as a mystery to be feared. In some religions it is thought as the location for after-life. In recent times scientific inquiry and the marvels of space engineering have helped to clarify the mystery. But more work remains to clarify the enigma of Space.

Scientific enquiry based on observation, hypothesis and theory poses the questions.

Space experiments with sophisticated instruments placed both in outer space and on Earth help to validate hypotheses and the theories. Latterly the placing of such experiments away from the Earth and its atmosphere has become more beneficial and vital. It has become a need.

As part of this need, Man has gone to the Moon.. sScientific probes have been landed on Mars and the International space station orbits the Earth. These and similar effort requires the training of space scientists, engineers, astronauts. It takes time, manpower and money. The quantum is large and perhaps a significant portion of the GDP of any country.

Why this endeavour should be undertaken was explored in the lecture. A survey of the major ideas on the science of space as well as the engineering aspects of space exploration was outlined.

The question of when the sun will vanish into a dark hole was raised and the audiences were comforted knowing that it will not happen in his or his grand children's time. ■

Tunneling and Underground Space Technical Division

Technical Visit To BISHAN CCL3 Station, Singapore

By : Engr. Neo Boon Kheng, M.I.E.M., P.Eng.

On 13 August 2006, a technical visit to Bishan CCL Station was jointly organised by Tunneling and Underground Space Technical Division (TUSTD) and IEM Southern Branch. There were 60 participants attended the one day visit. The visit was lead by Engr. Neo Boon Kheng, Committee Member of TUSTD.

A BRIEF OUTLINE ON CIRCLE LINE STAGE 3 (CCL3)

The Circle Line (CCL) will be medium capacity rail transit system from the city towards Upper Paya Lebar and on via Bartley road to Marymount Road and termination at Harbour Front Station. The CCL is being constructed in stages. CCL3 comprises 5 stations and connecting tunnels, and joining Stage 2 to the East of Bartley Station in a section of cut and cover tunnel and Stage 4 at the southern end wall of Marymount Station. The 5 stations are

located over a route length of approximately 5.7 km, Bartley (BLY), Serangoon (SER), Lorong Chuan (LRC), Bishan (BSH) and Marymount (MRM). BLY, LRC and BSH are Civil Defence shelters.

CCL3 Bishan Interchange Station is located in the heart of Bishan estate, Bishan Place. It is sited next to the existing North South Line (NSL) Bishan Station and Bishan sub-regional centre where Junction 8 Shopping complex and Bus Interchange is located.

The CCL3 Bishan Interchange Station forms an important interchange with the North South Line (NSL) Bishan Station, linking to the North East Line (NEL) and East West Line (EWL) through paid and free areas. The CCL Bishan Station, together with the existing NSL Bishan station will be an intensively used interchange facility. Passenger flow shall be optimised, with travel distances and changes in direction for commuters kept to a minimum.

The CCL3 Bishan Station comprises of 2 underground levels, which linked to the NSL Bishan Station via paid pedestrian subways. Entrance 1 outlet at Junction 8 development shall be linked via 1st basement which is specially designed to provide an animated space that maximises headroom.

Entrance 2 outlets shall be integrated with the Bishan Bus Interchange to almagate rail and bus.

Extensive Addition and Alteration (A&A) works shall be done to the Bishan Station. Design of temporary works for the side platform and roof shall take into considerations the close proximity to the Junction 8 and the existing station. This is due to all direct and unobstructed commuter/pedestrian flow to the existing NSL BSH and Junction 8 entrance shall be maintained throughout the project. ■



EMC, Signal Reference Planes, and 'Noise' Management for Data Centers and Mission Critical Facilities

By: *Engr. Satha A. Maniam, M.I.E.M., P.Eng.*

BACKGROUND

The presentation was organised by the IEM Oil, Gas and Mining Technical Division on 26 July 2006 with an attendance of 64 participants.

The presentation used extensive animation and graphics to explain the issues described below and went on to show the concepts in implementing them properly.

The focus of this presentation was limited to Ground 'Noise'; its sources, its impact, and its management. However it is important that the full spectrum of EMC (as mentioned in the 'INTRODUCTION' below) be cohesively integrated.

INTRODUCTION

EMC, or Electro-Magnetic-Compatibility covers a broad spectrum of electrical engineering and includes Lightning and Surge Protection, Grounding and Bonding, Power Quality, Electro-Static-Discharge, 'Noise' Management, 'Clean Earths', 'Technical Earths', 'Functional Earths', Signal Reference Planes, RFI and Shielding amongst others.

EM Compatibility

A product and its associated equipment often carry their individual 'CE' certification. However it is essential that the system and the installation too be compliant from an EMC stand-point. This would typically comprise the equipment themselves, the power supply distribution system, the grounding systems, the data and signal sub-systems, and even the topology of the cabling. Furthermore it is essential that the complete facility or system be compliant in respect of the expected EM Environment in Malaysia!

Typical Mission Critical Facilities

Quite often, an Electrical Designers perspective for Data Centers, would be in respect of Redundancy in Power Supply ie. dual power feeds, dual UPS; Power Quality; a well Graded Protection System; 'Star-Point Grounding'; 'Clean Earths'; '1 Ohm Grounding'; etc.

However, when one looks at it from an EMC perspective, there are many shortcomings and further critical refinements, that need to be considered. A few of these issues are listed here.

'Electrical Ground Noise'

Where does it come from? Is it to do with Power Quality? Where does the Noise want to go to? Where does low frequency Noise come from? Where does high frequency Noise come from? How does it enter the grounding system? How does it affect equipment? How do I manage it?

'Clean Earth'

Confusion again! Do I need a 'Clean Earth'? What really is a 'Clean Earth'? Is it a separate earth? Is it 'Star Point Grounding'? What is a 'Technical' or 'System' Earth? Can I or should I bond the 'Clean Earth' to the electrical earth?

Signal Reference Grids / Planes

Signal Reference Grids are very suited for the management of Noise in large Data Centers. Well designed facilities will have them. However as the issue of Noise and its management is not well understood, the application of SRGs are seldom considered.

Cable Layout and Topology

Scant attention is paid to the topological layout of the power, data, and grounding conductors. This is often left to the installers who have no idea, and who just install 'the stuff' as they have been doing in the past.

Quality of Racks

If you take a Rack from the 70's or 80's, you will observe the build quality in respect of the intent of grounding. Today's equipment racks fall far short in this respect.

Impedance of Conductors

Protective conductors are installed as normal, and serve their intended purpose.

Functional grounding conductors however are often left out (!), and even if

installed, are still based on long spiraled grounding leads! Seldom is there any consideration for the impedance of these functional grounding conductors.

Isolation Transformers

Isolation Transformers, when applied correctly are very effective in the management of Ground 'Noise'. However the basis for this solution is not understood by many. This results in the incorrect management of the Neutral, which in turn negates the fundamental purpose of utilising the isolation transformer for ground 'Noise' management in the first place.

Additional 'Food for Thought'

UPS have isolation transformers in the output side. Now, how should we be grounding the neutral of the Isolation Transformer?

Bonding

This is often overlooked in facilities, e.g. trunking is not bonded properly all the way through to the DB; earth leads are bolted onto epoxy frames of DBs. These practices fall far short in respect of EMC needs.

Supervision of Facility During Construction

The requirements of Mission Critical Facilities (Data Centers being one of them), requires very stringent and experienced supervision to ensure that the facility is done right. In fact it is essential that the supervision be done by one who is familiar with the subtle nuances of EMC.

Post Construction Change Control

Once a facility is built and handed-over, it undergoes changes during its life-cycle. This may be an ID fit-out, or an expansion. We need to appreciate that a Mission Critical Facility is different, and strict change-control is required to ensure that changes implemented do not compromise the EMC needs of the facility. ■

One Day Course On “Street Lighting Design”

By : Engr. Lee Kok Chong

On 7 June 2006, the IEM Electrical Engineering Technical Division and Graduate & Student Section jointly organised a one day “Street Lighting Design” seminar together with Straits Design Sdn. Bhd. The speaker, Mr. Yap Ching Kiat, who is the Technical Advisor of Straits Design, has given seminars on public lighting systems regularly. He is a member of SIRIM’s Technical Committee on Lighting, Lamps and Accessories. He is also a key member of SIRIM’s Work Group, set up to draft Malaysian Standards on street lighting.

Generally, the seminar covered principle of street lighting, photometric units, road surface reflection properties, international recommendations, quality criteria for road lighting, design procedures and testing requirements.

1) Principle of Street Lighting

The principle of street lighting is to permit road users to move about with the greatest possible safety and comfort at night and any object which is dangerous should be seen clearly in time.

Consequently, the question of whether an obstacle is visible or not is related to the luminance contrast between the obstacle and its background.

Luminance Contrast

$$C = (L_o - L_b) / L_b$$

Where L_o = object luminance
 L_b = background luminance

If the obstacle is darker than its background, then it will be seen in silhouette and the contrast will be negative i.e. $C < 0$.

If the obstacle is brighter than its background, then it will be seen in reversed silhouette and the contrast will be positive i.e. $C > 0$.

Threshold Contrast C_{th} is the minimum luminance contrast needed for vision. It decreases when the background luminance L_b increases.

2) Photometric Units

Lighting criteria for motor and pedestrian traffic are normally based on these concepts:-

- Illuminance, E
- Luminance, L

Illuminance is the quantity of light or luminous flux falling on a unit surface.

Illuminance

$$E \text{ (lux)} = \frac{\text{luminous flux on a surface (lumen)}}{\text{Area of the surface (m}^2\text{)}}$$

Luminance is the concept for the luminous intensity emitted per unit of area of a surface in a specific direction. As such, with the same illuminance, surfaces with different reflecting properties will have different luminance.

Luminance

$$L \text{ (cd/m}^2\text{)} = \frac{\text{Illuminance (lux)} \times \text{Road Surface Reflecting Property}}{\pi}$$

For example:-

Clear road surface

$E = 40 \text{ lux}$

Road Surface Reflecting Property = 0.8

$\pi = 3.14$

$$L = 40 \times 0.8 / 3.14 \\ = 10 \text{ cd/m}^2$$

Dark road surface

$E = 40 \text{ lux}$

Road Surface Reflecting Property = 0.04

$\pi = 3.14$

$$L = 40 \times 0.04 / 3.14 \\ = 0.50 \text{ cd/m}^2$$

3) International Recommendations

The followings are some international standards used for road lighting design:-

- CIE 115 – Recommendations for the lighting of roads for motor and pedestrian traffic (1995)
- CIE 30.2 – Calculation and measurement of luminance and illuminance in road lighting (1982)
- CIE 140 – Road lighting calculations (2000)

- CIE 88 – Guide for the lighting of road tunnels and underpass (1990)
- CIE 31 – Glare and uniformity in road lighting installations (1976)

4) Quality Criteria for Road Lighting

The followings are quality criteria that are commonly used for road lighting design:-

- Average Luminance (L)
- Uniformity (U_o , U_L)
- Glare Restriction (TI, G)
- Surround Ratio (SR)
- Optical Guidance

Table 1 to Table 6 lists all necessary data for road lighting design, which is based on CIE Standards.

5) Design Procedures

Generally, the following procedures can be served as a guide for road lighting design:-

- Step 1 - Preliminary data collection
- Step 2 - Practical rules of installation
- Step 3 - Computer calculation

5.1) Step 1 - Preliminary data collection

- To define lighting class and requirements based on the type of road (please refer to Table 1 to Table 6 for details)
 - Motor Traffic (M Class – Luminance Based)
 - Conflict Areas (C Class – Illuminance Based)
 - Pedestrian Traffic (P Class – Illuminance Based)
- To check the cross section of the road
 - For single carriageway, to check it is 1 way or 2 ways traffic
 - For dual carriageway, to check the width of central median
 - To check the number of lanes per carriageway and lane width
- To check the type of road surface
- To check the lamp lumen maintenance factor and luminaire

Table 1: Lighting Requirements for Different Road Types

Lighting Class	L (cd/m ²) Minimum Maintained	U _o Minimum	UL Minimum	TI (%) Maximum Initial	SR Minimum
M1	2	0.4	0.7	10	0.5
M2	1.5	0.4	0.7	10	0.5
M3	1	0.4	0.5	10	0.5
M4	0.75	0.4	NR	15	NR
M5	0.5	0.4	NR	15	NR

Table 2: Lighting Classes for Different Road Types

Description of Road	Lighting Class
High speed roads with separate carriageways, free of crossings at grade and with complete access control, motorways, express roads. Traffic density and complexity of road layout: High Medium Low	M1 M2 M3
High speed roads, dual carriageway roads. Traffic control and separation of different types of road users: Poor Good	M1 M2
Important urban traffic routes, radial roads, district distributor roads. Traffic control and separation of different types of road users: Poor Good	M2 M3
Connecting less important roads, local distributor roads, and residential major access roads. Roads which provide direct access to property and lead to connecting roads. Traffic control and separation of different types of road user: Poor Good	M4 M5

Table 3: Lighting Classes in Conflict Areas

Conflict Area	Illuminance Lighting Class
Underpass	C(N) = M(N)
Junction, gores, ramps, weaving section, areas with restricted lane width.	C(N) = M(N-1)
Railroad crossing: Simple Complex	C(N) = M(N) C(N) = M(N-1)
Roundabouts with no signals: Complex or large Medium complexity Simple or small	C1 C2 C3
Queuing areas: Complex or large Medium complexity Small or simple	C1 C3 C5

Table 4: Lighting Requirements for Conflict Areas

Lighting Class	E (lux) Over Whole of Used Surface Minimum Maintained	U _e (E) Uniformity of Illuminance Minimum
C0	50	0.40
C1	30	0.40
C2	20	0.40
C3	15	0.40
C4	10	0.40
C5	7.5	0.40

Table 5: Lighting Requirements for Pedestrian Traffic

Lighting Class	Horizontal Illuminance (lux) On Whole of Used Surface Maintained	
	Average	Minimum
P1	20	7.5
P2	10	3
P3	7.5	1.5
P4	5	1
P5	3	0.6
P6	1.5	0.2
P7	Not Applicable	Not Applicable

Table 6: Lighting Classes for Different Road Types in Pedestrian Traffic

Description of Road	Lighting Class
High prestige roads	P1
Heavy night time use by pedestrians or pedals cyclists	P2
Moderate night time use by pedal cyclists or pedestrians	P3
Minor night time use by pedal cyclists or pedestrians solely associated with adjacent properties	P4
Minor night time use by pedal cyclists or pedestrians solely associated with adjacent properties Important to preserve village or architectural environment	P5
Very minor night time use by pedal cyclists or pedestrians solely associated with adjacent properties Important to preserve village or architectural character of environment	P6
Roads where only visual guidance provided by the direct light from the luminaires is required	P7

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maintenance factor. For luminaire maintenance factor, it varies according to the intervals between cleaning, the amount of atmospheric pollution and the quality of the sealing of the optical system. Table 7 can be used as a guide for luminaire maintenance factor:

Type of Luminaires	S/H
HPSV	~ 4.0
HPMV	~ 3.5
LPS	~ 3 to 3.5

- d) To determine the power of light source. To minimise glare, it is recommended that a limit is set on

Table 7: Luminaire Maintenance Factor

Cleaning Interval	Ingress Protection								
	IP 2X			IP 5X			IP 6X		
	Pollution Category			Pollution Category			Pollution Category		
Months	High	Medium	Low	High	Medium	Low	High	Medium	Low
12	0.53	0.62	0.82	0.89	0.90	0.92	0.91	0.92	0.93
18	0.48	0.58	0.80	0.87	0.88	0.91	0.90	0.91	0.92
24	0.45	0.56	0.79	0.84	0.86	0.90	0.88	0.89	0.91
36	0.42	0.53	0.78	0.76	0.82	0.88	0.83	0.87	0.90

5.2) Step 2 – Practical Rules of Installation

- a) Generally, road lightings for single and dual carriageway are arranged as follow:-

- Single carriageway – single sided, staggered or opposite
- Dual carriageway – twin central or opposite

- b) To determine the height of road lighting pole based on the following formula:-

$$H_{\min} = f(W_E)$$

H_{\min} = minimum mounting height

W_E = width of carriageway + set back, or width of carriageway - overhang

- To ensure an adequate overall uniformity, the following table can be served as a guide:

Type of Luminaires	H_{\min}
HPSV	$\geq 0.8 \times W_E$
HPMV	$\geq 1.0 \times W_E$
LPS	$\geq 1.2 \times W_E$

- c) To determine the spacing to height ratio
- To ensure a sufficient longitudinal uniformity (i.e. UL > 70%), the following ratios for spacing to mounting height should be observed:

the power of the light source according to the mounting height. For road lighting using HPSV lantern, the followings can be served as a guide:

HPSV Lamp Power	Recommended Mounting Height
50W-70W	5m - 6m
100W-150W	7m - 9m
250W	10m - 12m
400W	12m - 15m
600W	15m - 18m

5.3) Step 3 – Computer Calculation

- a) Computer calculation is the tool to evaluate lighting designs.
- b) Computer calculations shall based on the following international standards:
- CIE 30.2 (1982)
 - CIE 140 (2000)
 - EN 13201-3:2003
 - IESNA (Illuminating Engineering Society of North America)
- c) Very often, concentration is given to the lighting quality of the design i.e.
- Lave or Eave Pl qualify these terms
 - U_o Is this for uniformity?
 - UL Is this for uniformity?
 - TI Is this for glare reduction?

6) Testing Requirements

In accordance to IEC 60598, the following tests are required for a lantern:

- Electrical Tests
 - Insulation class
 - Earthing
 - Insulation resistance
 - Electric strength
 - Leakage current
- Tightness test – testing on the ingress of dust, solid objects and moisture
- Endurance Test – testing under conditions representing cyclic heating and cooling in service, and the luminaire shall not become unsafe or fail prematurely.
- Thermal Test – testing based on 1.10 times of the rated voltage with lamp removed, and the result shall not exceed the values given in the standard.
- Mechanical Test – this test is to ensure luminaire should have adequate mechanical strength after such rough handling as may be expected in normal use.
- Static Load Test – this test is to ensure all connections shall be designed to withstand the relevant wind speeds on the projected surface of the assembly without undue deflection.
- Resistance to Corrosion – this test is to ensure rusting of which might cause the luminaire to become unsafe shall be adequately protected against rusting.

Finally, all road lightings that are installed at site are subject to site acceptance test. BS EN 13201-4:2003 can be used as a guide for testing of road lighting performance. Generally, photometric measurement is most commonly used method to determine the performance of the lantern installed. Photometric measurement can be conducted by using Luxmeter to measure the luminance (L) and illuminance (E) level. ■