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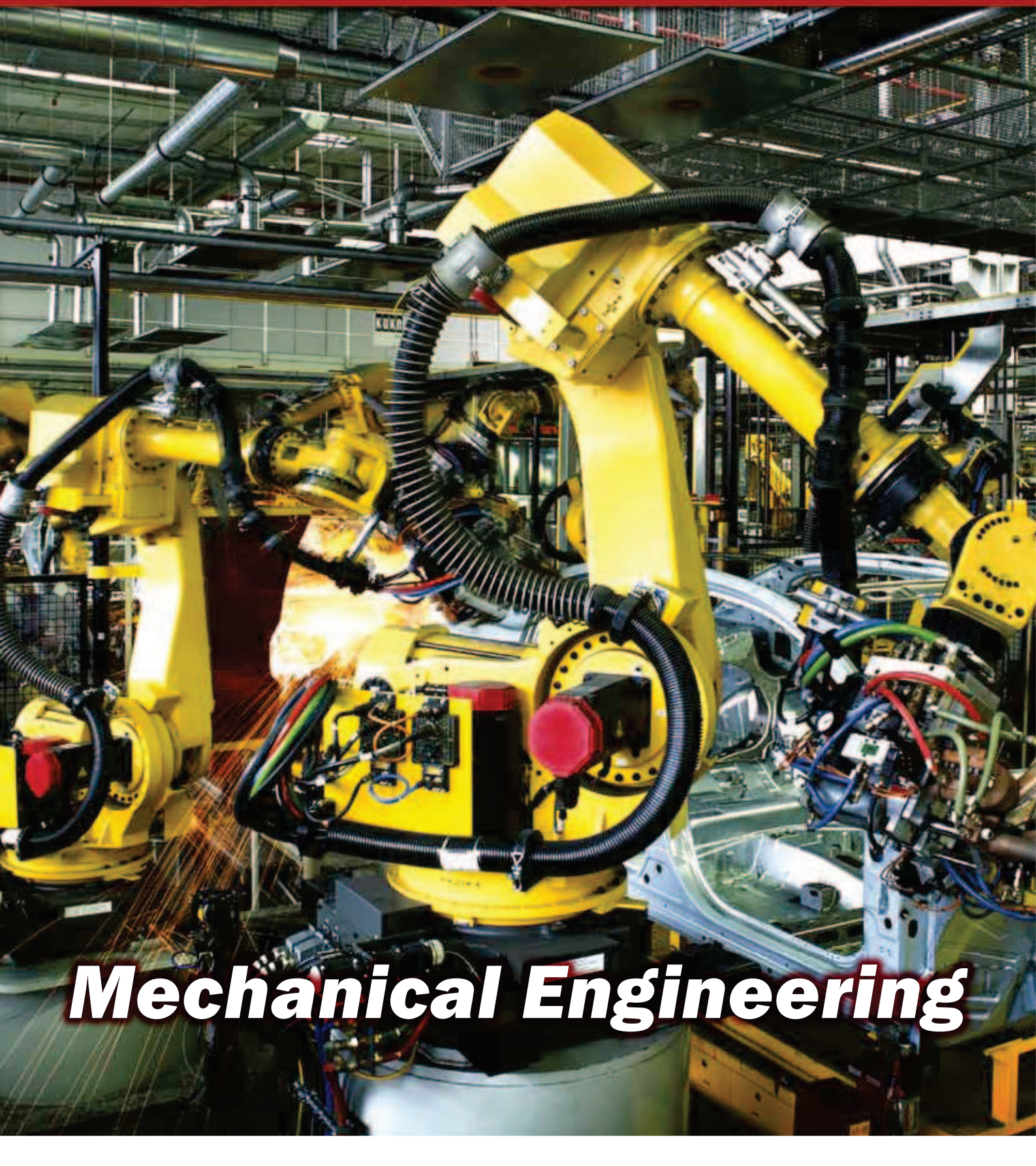

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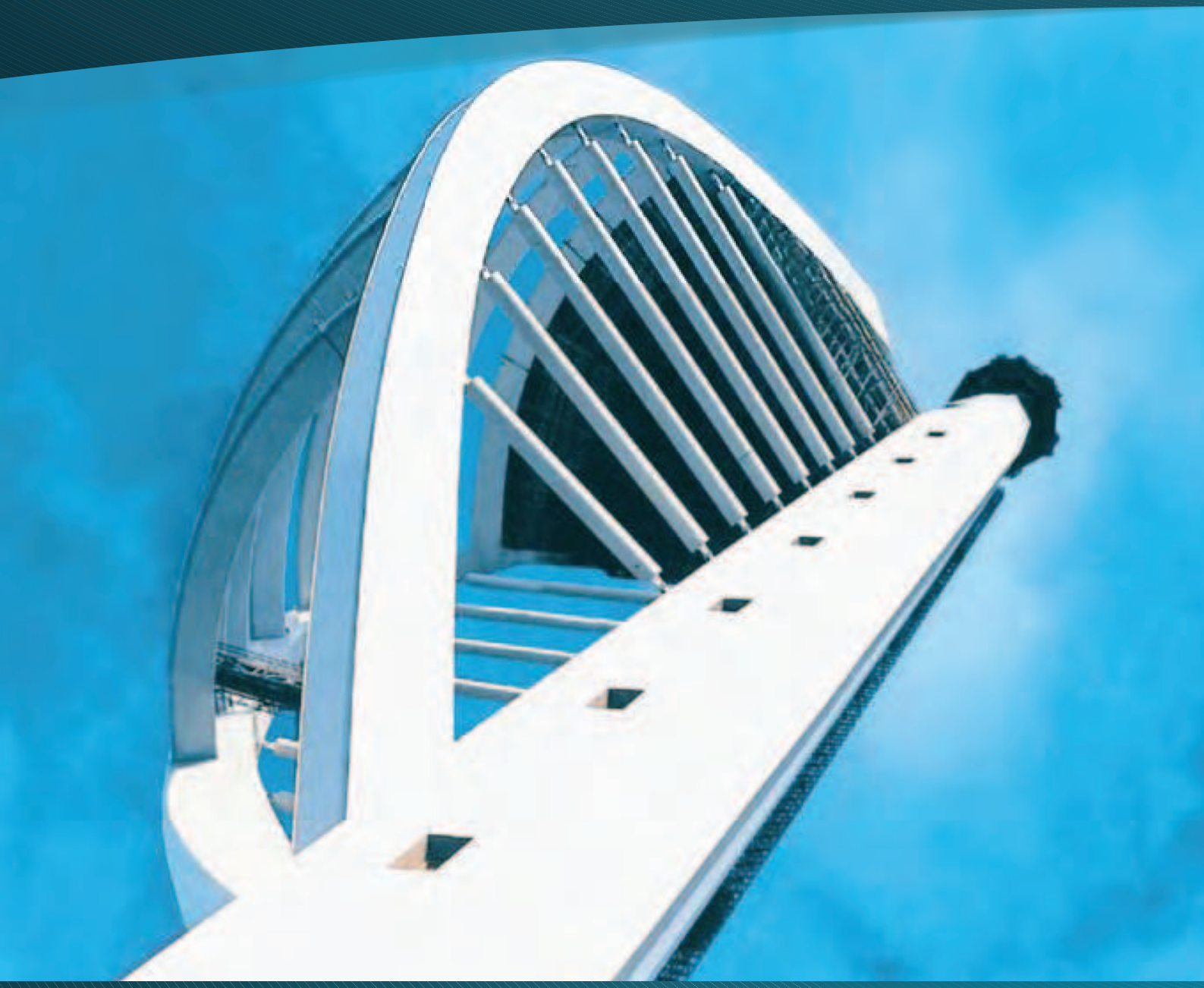

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THEMES – 2013	
July *Electronic Engineering*	**October** *Young Engineers Section*
August *Mentoring Engineers - The Way Forward*	**November** *Oil, Gas & Mining Engineering*
September *Chemical Engineering*	**December** *Facilities Management*

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.

Project Management Technical Division
17th August 2013
9th Annual General Meeting

Civil & Structural Engineering Tecnical Division
20th July 2013
27th Annual General Meeting

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New Challenges for Mechanical Engineers

*by **Ir. Noor Hisham Yahaya***
Organising Chairman,
IEM Annual Dinner 2013

IT is the turn for mechanical engineers to pen some jottings in this month's JURUTERA. As the mechanical engineering field is so wide, I have decided to choose a commonly debated topic, namely the new challenges that mechanical engineers in particular are facing at this point in time.

Investors and property owners alike are increasingly demanding that engineers, especially those belonging to the mechanical discipline, should design and deliver modern, high quality and efficient systems for projects at relatively low cost. Thus, it is not surprising that managing a project is becoming more complex and challenging nowadays, with expectations of "cradle to grave" design solutions that will achieve maximum operational efficiency, economic use of materials, a fair degree of component standardization, cost savings through smart procurement strategies and minimal need for maintenance for maximizing the asset value throughout the life of the asset up to its disposal. With this tall order, it is imperative for the mechanical engineer to be knowledgeable with the whole process of asset life cycle and fully understand the cost associated with this.

The present day mechanical engineer must appreciate and understand cost issues and be "business savvy" in order that life cycle cost benefits may be passed on to the investor or property owner. In managing the cost, the bigger challenge is for the mechanical engineer to ensure that the design, construction, operation and maintenance of the asset will not undermine its functional integrity in the quest for reducing costs. The mechanical engineer must now perform a balancing act between managing the overall project cost and safeguarding the integrity of the asset.

As engineers, we have the responsibility to the public to ensure that all projects are carried out with the highest of integrity while at the same time achieving value for money for the investors or asset owners through asset life cycle costing. ■

IEM DIARY OF EVENTS

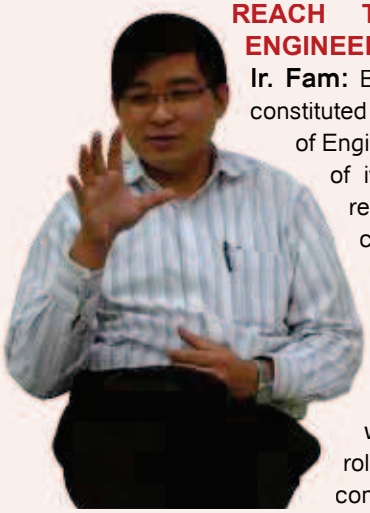
Regional Conference on Liberalisation of Service Sector: A New Era for Engineering & Related Industries
22 - 24 August 2013
Persada Johor International Covention Centre, Johor Bahru
Co-organised : IEM Southern Branch, ASEAN Engineering Register and ASEAN Federation of Engineering Organisations
For details, please contact: Puan Lina at 07-3319705 or iemsouthern@gmail.com

Mechanical Engineering: Its Vital Role and Prospects

by Reika Kua Kee Eng

MECHANICAL engineers have played various significant roles in contributing to not just the industries that heavily rely on their expertise, but also to the society in general. In order to gain an in-depth insight about the various vital roles and prospects of mechanical engineering, JURUTERA conducted an interview session with four key members the Mechanical Engineering Technical Division of IEM, namely Ir. Dr Cheong Thiam Fook, who is the Executive Director of George Kent (Malaysia) Berhad, Ir. Gopal Narian Kutty, the Senior Principal Assistant Director of Mechanical Engineering Branch, Public Works Department Malaysia, Ir. Noor Hisham Yahaya, the Managing Director of Techno Matrix Resources Sdn. Bhd., and Ir. Fam Yew Hin,the Assistant General Manager (Development), Genting Energy.

THERE ARE A NUMBER OF ENGINEERING ORGANISATIONS IN THE COUNTRY SUCH AS IEM, BEM, ETC. HOW DIFFERENT IS THE ROLE OF MECHANICAL ENGINEERING TECHNICAL DIVISION (METD) AND HOW DOES METD PROVIDE A MORE EFFECTIVE BRIDGE TO REACH THE MECHANICAL ENGINEERS IN MALAYSIA?



Ir. Fam: BEM is a statutory body constituted under the Registration of Engineers Act 1967, and one of its main functions is to regulate the professional conduct and practice of registered engineers. On the other hand, IEM is a learned institution (for engineers). Being a technical division within the IEM, METD's roles are to promote continuous learning and improvement among our members, as well as providing a networking platform. For example, METD organises talks, courses, visits, and forum regularly to keep our members continuously updated on the latest technology.

Ir. Gopal: Apart from the aspect of mechanical engineering, another area that we emphasize on is the social contribution of engineers. For instance, a visit to an orphanage or welfare centre. Besides engineering, we also hope our engineers play their role in terms of social responsibility and contribute more to the society at large. We are also trying to encourage more women to join the mechanical engineering field. As compared to 20 years ago, we now have more women mechanical engineers, and it is partly attributed to the awareness programme conducted by METD.

Ir. Hisham: METD is more discipline-based, and caters for the needs of mechanical engineers. In IEM, networking has become an important means of expanding one's contracts. In particular, we are looking into networking among the mechanical engineers within the country as well as within the region. In a broader sense, we are also looking into networking with engineers from other disciplines, not just mechanical engineers, within IEM.

THE WORLD IS MOVING TOWARDS AUTOMATION AND IT, AND THESE AREAS ARE ANTICIPATED TO PLAY AN INCREASING ROLE GLOBALLY. IS MECHANICAL ENGINEERING STILL RELEVANT AND DO YOU FORESEE A CRITICAL ROLE FOR MECHANICAL ENGINEERS IN THE NEAR FUTURE?

Ir. Dr Cheong: If you look at what I refer to as 'Modernisation of manufacturing and the production processes', automation is the great work of mechanical engineers. Robotics and other automated processes are so critical to those engaged in manufacturing and production, such as the automobile industry, and the reality is that without the mechanical engineers, automation and IT would not have progressed as quickly. I believe that mechanical engineers complement the industry by integrating automation and IT knowledge to make manufacturing more efficient, especially in mass production. Automation and IT is complimentary to the mechanical engineering field.

Ir. Hisham: In terms of robotic automation, the basis of the physical activities is essentially derived from the mechanical parts or components. Automation and IT helps enhance the control of these mechanical parts. Hence, the understanding of the mechanical part is crucial in order to basically work on the control part. In brief, they must have an in-depth knowledge of mechanical engineering before they can exercise control over the mechanical parts using automation and IT.

Ir. Gopal: For instance, mechatronics is an inter-disciplinary branch of mechanical engineering. A mechanical engineer would be able to go into a more specific field such as mechatronics, dealing with robotics application and design; however, it could not be the other way round. That is why we often encourage students to choose their discipline wisely by raising their awareness about the differences between the main discipline of engineering and the other sub-disciplinary or inter-disciplinary branches of engineering. It is recommended that they select first to major in the main discipline, a broader branch, before going into a more specific discipline or engineering field. This is also a message to our future mechanical engineers!

MANY COUNTRIES HAVE BEEN PROMOTING RENEWABLE ENERGY AND ENERGY EFFICIENCY. WHAT IS YOUR VIEW ON THE POTENTIAL DEVELOPMENT OF RENEWABLE ENERGY AND ENERGY EFFICIENCY IN MALAYSIA?

Ir. Dr Cheong: Way back in 1981, I had been constantly reading written materials about renewable energy resources. About 30 years later, we are still talking about renewable energy policy in the country. Whether it is energy efficiency or renewable energy, there is a real need for the government to institutionalise these policies, so that the public in general, particularly the citizens of Malaysia, can really move forward with the implementation of energy efficiency policy. The recent implementation of the 1% levy on the electricity bill has caused a lot of uneasiness among consumers and SEDA has to publicly explain to the consumers that this 1% is actually for the development of renewable energy in the country such as the subsidy given to Solar PV and other renewable energy projects in Malaysia. However, Malaysian awareness in these areas is still very low.

Ir. Fam: One of the main hurdles for implementing renewable energy on a larger scale is its high capital cost requirement (as compared to conventional electricity generation). The same is generally true for projects that adopt energy efficient technologies. Therefore, an appropriate incentive scheme is essential to spearhead the development of both renewable energy and energy efficiency.

The Government has enacted the Renewable Energy and the Sustainable Energy Development Authority Act (SEDA) in 2011, which subsequently led to the implementation of the Feed-in-Tariff. As you may have noticed, this scheme has resulted in an increase in investment in renewable energy as it has helped to make the projects commercially viable. However, until these technologies have matured and achieved grid parity, the development of renewable energy will continue to depend on the incentive scheme.

Ir. Gopal: The Government has been offering a lot of incentives to the industry, but the energy cost is still quite high for the private sector and the domestic consumer. Therefore, mechanical engineers play a vital role in ensuring that any product generated not only provides functional efficiency and comfort, but also involves the use of materials that are energy-efficient. Mechanical engineers ought to play their part in ensuring that we use whatever resources we have sparingly to just sufficiently meet our needs now, while also ensuring that we leave some resources behind for our next generation. This is where sustainability comes in. We need to constantly look for more alternative ways to produce energy such as wind, solar, biomass, etc. However, as a matter of fact, the percentage of energy produced from these alternative resources is very small.

Ir. Hisham: Alternative resources are not commercially viable at this moment. Engineers in Malaysia have the capabilities and capacities to look into renewable energy implementation; however, what is lacking here is more of the social and political contribution. The private sector and consumers at large have a similar mindset, that is, they prefer to use power generated through the conventional way which utilises the existing natural resources such as coal and gas, as the energy cost will be much cheaper than those of alternative resources such as solar or wind-powered energy. Until the fossil fuels become more expensive, renewable energy will take a back-seat.

ENVIRONMENTAL POLLUTION HAS BECOME A CONCERN IN THE PROCESS OF DEVELOPMENT. WHAT IS THE POTENTIAL CONTRIBUTION OF MECHANICAL ENGINEERS TOWARDS CREATING A GREENER SOCIETY IN THE COUNTRY?

Ir. Gopal: The private sector and the public in general have to be aware of their responsibilities in terms of energy conservation too, not just the engineers. It means utilising less energy for a constant service. For example, simple gestures such as switching off the lights when not in use would have its effect when everyone does their part. It is beyond our control for others' behaviour, but what mechanical engineers can do is to select energy-sufficient materials so we can have a better air-conditioning system, a better class of motor vehicles, chillers, or any equipment produced that would contribute less to global warming and help reduce pollution. In short, mechanical engineers can only help improve the technology and features, but will not be able to tackle the overall global issue.

Ir. Dr Cheong: We also focus on what we call 'environmental-friendly processes'. Mechanical engineers

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The International Civil Aviation Organisation (ICAO) sets standards for all civil aviation related matters for all member countries in the world. The relevant standards on Obstacle Marking and Beacon lights for tall structures is spelled out in Annex 14 Volume 1, Chapter 6 – Visual Aids for Denoting Obstacles [1]. This documents defines what constitute obstacles to aviation and recommends the measures required to denote the obstacles by marking or lighting the obstacles with appropriate painting or lights to ensure aviation safety.

The Department of Civil Aviation (DCA) Malaysia has published Directives in line with the ICAO recommendations; Airport Standards Directive: ASD401 Control and Denoting Obstacles [2], ASD403 Marking of Obstacles [3] and ASD404 Lighting of Obstacles [4], for reference by all architects, engineers, developers, owners and anyone involved in the construction, operation and maintenance of tall structures that can present an obstacle hazard to a flying aircraft. These documents can be downloaded at DCA website: www.dca.gov.my/Division/Airport_Standard/Airport_Standard_Directive.html

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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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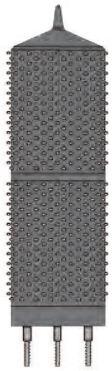

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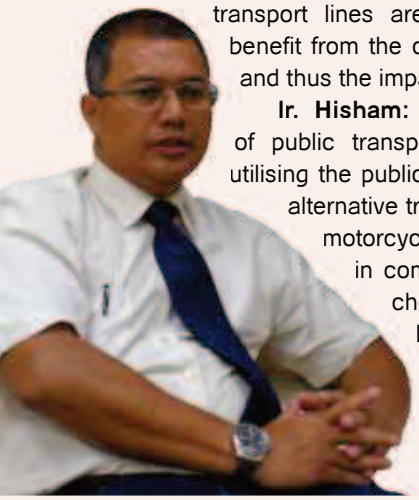
could help by their involvement in planning and designing certain waste treatment systems that would help reduce the waste discharge. Some waste treatment systems can even produce the effect of zero waste discharge. Mechanical engineers play a very crucial role in industries such as transportation and automobile, especially in automobile manufacturing. For example, Volkswagen produces cars that are highly environmental-friendly as it is not only fuel-efficient but also emits zero carbon dioxide. In addition, mechanical engineers also indirectly promote public transportation such as the LRT, Monorail, etc. to help reduce the number of vehicles on the road, and thus help in reducing pollution. In future, when more of these public transport lines are extended, more people can benefit from the convenience of public transport, and thus the impact will be greater.



Ir. Hisham: Looking from the perspective of public transport, why people are not fully utilising the public transport may be because the alternative transportation modes such as the motorcycle or car are relatively cheaper in comparison. Hence, when given a choice, the user would prefer the latter. Not being able to reduce the usage of private vehicles, the mechanical engineers can still contribute by creating a "greener engine" for these vehicles.

Ir. Fam: Fossil fuels are among the most serious sources of environmental pollution. Statistics have revealed that the transport sector, heavy industry as well as power generation are conventionally the major sources of air pollution in modern cities. However, if we take a closer look in recent years, step improvement has been achieved in these sectors through introduction of more efficient engines and generation technologies, enhancement of abatement equipment (to extract and contain the pollutants) as well as implementation of effective maintenance programmes. All of the above will have the participation of mechanical engineers.

THERE HAS GENERALLY BEEN AN INCREASE IN THE NUMBER OF INCIDENTS ON ENGINEERING SAFETY AND QUALITY RECORDED IN RECENT YEARS. HOW CAN MECHANICAL ENGINEERS RENDER A HELPING HAND TO MITIGATE THESE INCIDENTS?

Ir. Hisham: In Malaysia, one of the biggest challenges in terms of safety is related to behavioural safety. For instance, if site workers in Malaysia were told to use scaffolding which did not appear to be safe, they would still climb up without a second thought. However, given the same scenario in other developed countries, the workers would normally refuse to climb up the unsecured scaffolding as it would be a risk to their lives. Another example is the irregular use of safety gear by our local workers although they have been advised to do so. Somehow, the appreciation of the value of life is rather low among the local workers. What mechanical engineers can do is to exercise control and minimise the worker's exposure to risk. Hence, incorporating "engineering controls" in the design is utmost important to ensure that a safe environment or condition is present at all times.

Ir. Gopal: Safety is always a focus of mechanical engineers when it comes to design. However, supervision and enforcement to ensure safety requirements are met is lacking. The safety features or equipment are available but sometimes workers ignore them or just refuse to use them which can put them at higher risk of encountering an accident, which sometimes can be fatal. Authorities such as CIDB which carry out the enforcement of safety are vital. Mechanical engineers may be able to design and build whatever machinery or equipment with all the safety features included, but prompt periodical checks and maintenance are also essential. As there are a number of different parties involved in any form of work requiring stringent safety checks, sometimes human error is just inevitable, although this could be minimised. Safety is a very complicated area to be handled. Thus, every party involved has to be meticulous and thorough.

Ir. Fam: I would say the main causes of workplace accidents can be categorised into two, i.e. design deficiency or human factor. Mechanical engineers are helping, and will continue to help in reducing workplace accidents via constant improvement of equipment and machine design. As for the human factor, mechanical engineers can play a critical role by incorporating safe working procedures at the workplace and ensuring these procedures are adhered to.

THERE ARE CRITICS WHO SAY OUR COUNTRY IS KNOWN FOR ITS FIRST WORLD FACILITIES, BUT THIRD WORLD OPERATION AND MAINTENANCE (O&M) PRACTICES. WHAT IS YOUR VIEW ON THIS STATEMENT?

Ir. Dr Cheong: I do not agree to this statement. In general, I think it is again the behavioural issue where the mentality of having good O&M practices is lacking. Let us look at the property and facility owners around us who tend to utilise all the facilities up to its maximum capacity for the longest time possible, but not giving their facilities proper and timely maintenance. Mechanical engineers are very proud of scheduled maintenance. Certain critical parts that need to be maintained or replaced on a routine basis according to its work span to ensure that they function properly. However, many still fail to understand the importance of scheduled maintenance in reducing the number of accidents and also in ensuring their facilities function smoothly, especially in the production and manufacturing industry.

Ir. Fam: Generally, asset owners should be more willing to embrace proactive maintenance approaches, such as preventive maintenance as well as predictive maintenance.

In most industries, reliability and productivity of capital assets are essential to the financial success of the organisation. Relying on run-to-fail or corrective maintenance could be costly at times.

Ir. Hisham: I think that the statement can partly be attributed to the attitude of the public. A lot of facilities have been vandalised. In terms of continuous maintenance activities, the frequency has to be increased due to vandalism. Vandalism doubles the effort of maintaining such facilities as well as the maintenance cost. Public awareness on costs associated with repair and maintenance works has to be increased. With this awareness, it is hoped that asset owners and the public will contribute towards safeguarding these facilities.

Ir. Gopal: Aside from the human factor, the allocation for maintenance may be low, almost minimum, for both government and the private sector. Hence, such minimal allocation would not be sufficient to cover all aspects of maintenance. Only basic maintenance could be carried out. Unless sufficient allocation is provided, it would be almost impossible to implement maintenance effectively. I presume that people's mindset on O&M will change, but over the course of a very long time.

IN YOUR OPINION, WHAT IS GENERALLY LACKING IN MOST OF THE MECHANICAL ENGINEERS IN MALAYSIA AND HOW CAN THAT BE IMPROVED?

Ir. Fam: When it comes to training and self-development, most mechanical engineers are still pretty much confined to their respective technical fields. I would encourage that fellow mechanical engineers should also get themselves familiar with fundamental financial, commercial and legal knowledge which is essential in today's business environment.

Ir. Dr Cheong: Mechanical engineers should never lose touch of their engineering knowledge even if they might need to work in a multi-tasking environment and perform other non-engineering tasks. The ability to apply relevant mechanical engineering principles as and when required is essential.

Ir. Gopal: Hands-on experience is crucial for mechanical engineers to practise the engineering principles and skills that they have acquired. By merely following theories without practical experience, one cannot become a good mechanical engineer. Both theory and practice are equally important.

Ir. Hisham: I find that mechanical engineers lack in soft skills and multi-disciplinary knowledge. In the present engineering age, presentation skills and commercial knowledge are vital. Having good engineering knowledge means nothing if it cannot be conveyed effectively to others to add commercial value to it.

IN CONCLUSION, WHAT IS YOUR OPINION ABOUT THE MECHANICAL ENGINEERING PROFESSION, HAVING BEEN A PART OF IT THROUGHOUT YOUR ENTIRE CAREER?

Ir. Dr Cheong: My experience in mechanical engineering started from building services engineer to plant engineer and then a consultant in manufacturing. I find it very fulfilling and challenging. But this continues because of my passion to practise as a mechanical engineer. In short, mechanical engineering is a respected profession to be pursued.

Ir. Hisham: I have been practising as a mechanical engineer for over 25 years; the first 15 years, involved in pure engineering practices and the last 10 years venturing into the business sector. Being a businessman, I find that my knowledge in engineering has helped enhance my business portfolio; through analytical thinking, which has assisted me in making better technical and commercial decisions in my business.

Ir. Fam: I have been involved in project development and project management since the start of my career. Being a mechanical engineer, it has allowed me to adapt to various project roles easily by virtue of my engineering background. I would say mechanical engineering offers a wide range of career opportunities as it is one of the broadest engineering disciplines.

Ir. Gopal: I am from the government sector and I have had the opportunity to work in different sectors such as mechanical-related workshops and project management in the Ministry of Defence. Currently, I am involved in projects of the Public Works Department Malaysia. If we look around us, every equipment or system that contributes to the comfort of people is attributed to mechanical engineers (e.g. air-conditioning, lifts, etc.). The future for mechanical engineering is very bright as our country is moving towards becoming a developed nation. In future, facilities or asset management would be one of the major fields, especially in O&M. Hence, mechanical engineers have a very vital role to play in this area. ■

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Progressing Towards a More Dynamic Culture within IEM

by Ir. Choo Kok Beng

"**REFRESH** the existing IEM!" was my very first remarks when I was asked about my future plans for IEM upon taking office as the President of The Institution of Engineers, Malaysia (IEM), for session 2013/2014. In order to achieve this, it is inevitable to have the cooperation from all involved parties including the Council members, leaders and committees of all technical divisions, the IEM Secretariat, IEM branches as well as all members of IEM.

In line with the aspiration to enhance IEM, there are a few vital areas that will need to be given extra thought and attention, namely the culture within IEM, the membership services if provides, the recognition of outstanding and deserving members, and the position of IEM when dealing with issues pertaining to the general public. Indeed, we have plenty of work that needs to be done to enhance all the above-mentioned areas.

However, to start the ball rolling, we ought to first examine the existing culture within IEM that has an immense influence on every aspect of IEM from administration, operation to functionality. How can our existing culture be improved? Progressing towards a more dynamic culture within IEM is the key. By this, I regard IEM members as being part of the system, the problem and the solution, that would act as the driving force in the development of IEM.

Therefore, promoting proactive participation among members in the decision-making process is crucial to enable such a cultural shift to happen. I strongly urge all leaders, from the Council and technical divisions, to the IEM branches and Secretariat, to begin adopting a more dynamic leadership model in terms of managing their respective areas of responsibility, by creating a shift in their current decision-making paradigm.

For instance, if you want more members to engage in more collaborative problem solving, you may need to model this by first implementing it within your own committees respectively. In addition, for leaders to develop and implement their strategies that promote features of a dynamic leadership, they will first have to understand how each member's cultural perception affects their performance and productivity. On top of that, the key members would need to have the necessary instruction, coaching, and performance feedback for a more effective problem-solving process and work collaboration.

In brief, one ought to understand that people do what they do to gain what they desire. Hence, leaders have to explain to the rest of the members how they can benefit from the vision, that is, from their actions to achieve the vision and objectives. Leaders are recommended to model their management style to assist others to gain the knowledge, skills, resources and expectations that are essential to realise the vision. Otherwise, the desired culture shift will be less likely to happen.

Although a culture shift can be kick-started from any level within IEM, I foresee a more effective change if the culture shift is first embraced by the leaders of all technical divisions and branches, as such a shift driven from the top levels of a culture's hierarchy of authority or influence would be executed more easily and with less damage as compared to a culture shift that is initiated by those lacking in support from the culture's official power base.

For a start, the President's Corner is a platform to get my vision for IEM across to all IEM members. In order to 'walk the talk', I shall be actively involved in promoting a shift within IEM towards a more dynamic culture. ■

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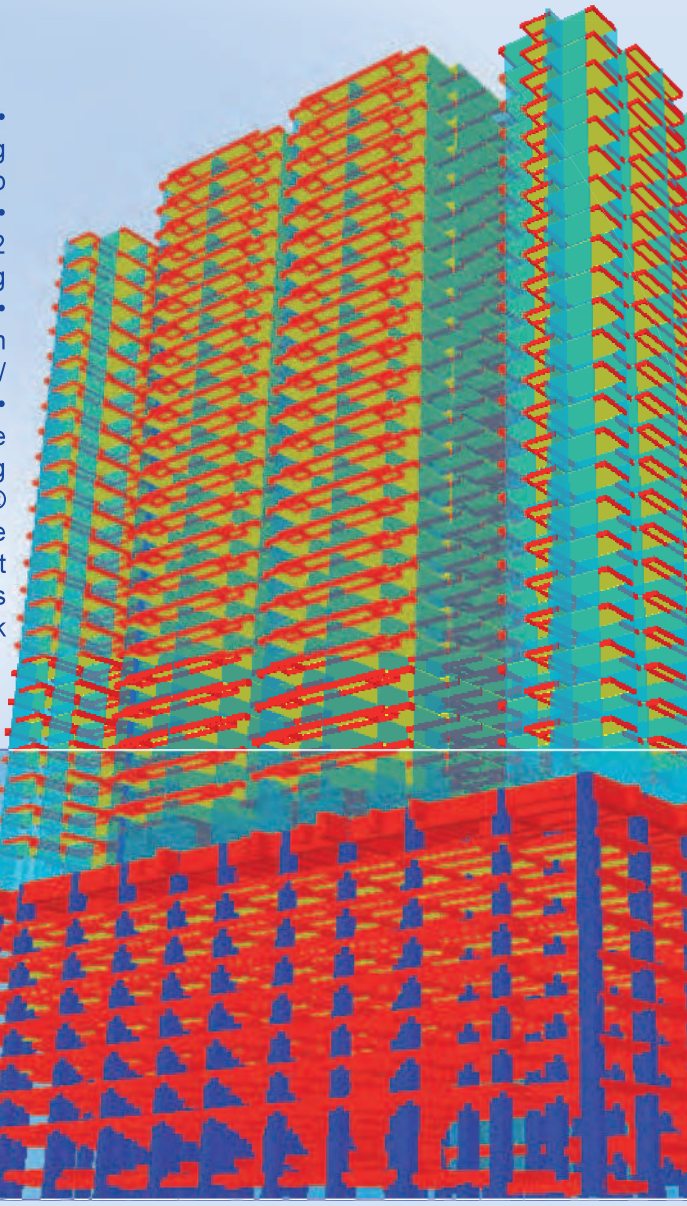

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THE FIRST TWO SESSIONS OF IEM COUNCIL (1958-1960)

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

by Dato' Ir. Pang Leong Hoon

AT the IEM Inaugural Meeting held on 1 August 1958 at No. 23, Perak Road, Kuala Lumpur, nine engineers were elected as the first IEM Council members to organise and manage the functions and activities of the newly born organisation, The Institution of Engineers, Malaysia (IEM). (for details, please refer to 'The Inaugural Meeting' article published in Jurutera, April 2013 issue).

One of the main tasks was to submit its application to the Registrar of Societies, Malaya, to obtain official registration. The IEM was officially registered on 1 May 1959 (Ref: PPM51/59).

Starting from scratch, the Council had worked very hard to lay the foundation of the Institution. During the sessions 1958/1959 and 1959/1960, the Council had held nine meetings to discuss and decide on important matters. Sub-committees were also set up to deal with the various subject matters. Some of the major matters were on:

a. Refinement of the Constitution and the By-laws. The finished copies were printed and distributed to the IEM members;

b. Classification of the branches of engineering;

c. Membership application and approval. Some 13 members were the very first group of engineers who were accepted as Associate Members during the 3rd Council Meeting (bearing the membership No. 001 to No. 013 and two engineers as graduate members). En. Yusof bin Hj Ibrahim, our first IEM President had the honour to be registered under the membership no. 001;

d. Compilation of a list of universities whose degrees would be acceptable by IEM. The list was accepted during the 6th Council Meeting;

e. Nomination and Ballot papers for the election of IEM Council for Sessions 1960/1961 and 1961/1962 were finalised during the 8th Council Meeting held on 15 January 1960; and

f. Decision on the proposed postponement of the Inaugural Dinner to April 1960.

During the two sessions, the Council had approved 27 Associate Members, 30 Graduate Members and six Associates. The cash balance of IEM at the end of the session was RM 1,606.75.

ELECTION TO FILL COUNCIL VACANCIES

Nominations to fill Council vacancies for sessions 1960/1961 and 1961/1962 were invited. This was followed by balloting. The successful candidates as reported at the 9th Council Meeting on 12 February 1960 were:

President	:	Yusoff bin Haji Ibrahim
Vice President	:	Raja Zainal bin Raja Sulaiman
Hon. Secretary	:	Lau Foo Sun
Hon. Treasurer	:	Ow Yong Hong Chiew
Civil Section	:	Tong Kay Chor
Mechanical Section	:	Dalip Singh
Electrical Section	:	Chew Kam Pok
Other Branches No. 1	:	Chin Fung Kee
Other Branches No. 2	:	Chew Kit Lin

The above election results were announced at the Annual General Meeting held on 23 April 1960. ■

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.

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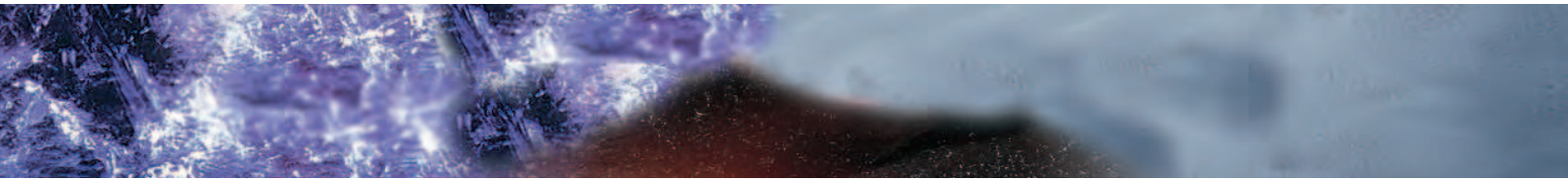

Energy Savings From Axial Fans



by Ir. Dr Kannan M. Munisamy, Ir. Soong Peng Soon and Mr. Ramies Govindasamy

ENERGY consumption has become an important consideration to every individual globally. The word "efficiency" comes to our mind as soon we come across topics related to energy. As the development around us rapidly progresses, the importance of energy efficiency proportionally increases. Efficient energy usage will in the long run reduce the burden on our pockets. The business sector especially will feel and benefit from the vast impacts when efficiency plays its role in saving energy.

In my previous article pertaining to the jet fan and computational fluid dynamics (CFD), there was discussion regarding the replacement of conventional ducting design for ventilation with a Jet Fan system. This replacement represents a positive step in recovering the energy losses in a ducting system and is also shown to be cost-efficient. Often the case is that fan systems directly support production processes. Hence, many fans operate continuously but such long running time will result in significant energy consumption and substantial annual operating costs.

Another investigation has been carried out on the main fans in a ventilation system. Among the many types of fans used, the most common is the axial flow fan. The axial flow fan drives the air through the impeller in approximation of an axial direction. The axial fan utilises blades that force air to move parallel to the shaft around which the blades rotates. Owing to its cost effectiveness and multi-functional nature, the axial fan has been widely adopted in the industrial, commercial, consumer, institutional, and residential applications. In a typical car park ventilation system, these axial flow fans are known as fresh air supply and exhaust fans.

The energy consumption of these fans was investigated at two basement car parks of a 10-storey and 14-storey office building. An enhanced guide vane design was installed downstream of the ventilation main fans for a better efficiency. Economical comparison was made between the existing fan models and the enhanced model with guide vane by measuring the power consumption in KW. The guide vane used in this investigation is of the adjustable type. Table 1 shows the compilation results of the total power consumption (KWh) and the annual electricity costing for the existing fan model on a normal mode of operation. The annual electricity calculation (Eq.1) was done based on a 12-hour, 6 day per week operating duration.

TOTAL ANNUAL ELECTRICAL = COST (RM)

$$(wattmeter\ reading\ 3-phase)x\ (annual\ hours\ of\ op.)\ x\ \left(avg.elect.cost\ in\ \frac{RM}{Kwh}\right)x\ (motor\ load\ factor)$$

(Eq.1)

The guide vane was designed using Computational Fluid Dynamics (CFD) as a tool to determine the flow pattern. Figure 1 below illustrates the two-dimensional cascaded flow simulation of the 30° pitch angled rotor blade velocity distribution. The flow is accelerated after the blade with the momentum of the rotating velocity at the rotor side.

The high velocity region at the trailing edge of the fan blade has been cushioned out with the guide vane and,

Table 1: Comparison of annual electricity cost for the existing fan models

			Axial Fans without Guide Vane		Axial Fans with Guide Vane	
Basement	**Type of Fan**	**Total number of fans**	**Total power consumption (KWh) per year**	**Annual electricity cost (RM)**	**Total power consumption (KWh) per year**	**Annual electricity cost (RM)**
basement 1	supply and exhaust fan	8	80,179.20	25,857.79	73,764.90	23,789.17
basement 2	supply and exhaust fan	12	171,417.60	55,282.18	157,704.20	50,859.60
			Total Cost without vane	81,139.97	Total Cost with vane	74,648.77
Savings for Basements 1 and 2, per year (RM)						**6,491.20**

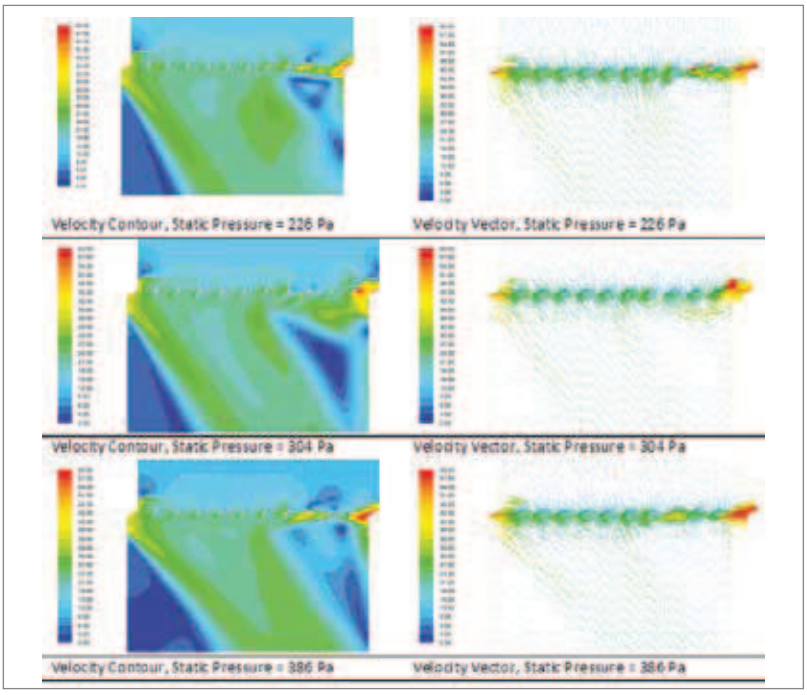

Figure 1: Velocity distribution of cascaded axial fan blade section flow without guide vane (stator) at different back pressure conditions

thus, the streamlining of the flow in the direction of flow is done with reducing swirling. As the guide vane is of a proprietary design, details of it cannot be published.

The experimental analysis was carried out in accordance to AMCA testing procedure. The total efficiency, η_t, for the adjustable guide vane application had increased by 8% as compared to the axial fan without the guide vane. Referring to the AMCA-210 standard, the relationship between power, H and the total fan efficiency η_t is:

$$H \propto \frac{P_t Q K_p}{\eta_t}$$

(Eq. 2)

Where, P_t is total pressure, Q is the air flow rate and K_p is the compressibility coefficient.

From that relationship, the power is proportional to the total efficiency. Therefore, when the total efficiency increases by 8%, the fan power will decrease by 8%. The assumption of an 8% reduction in the power consumed is presented in Table 1. Two basements were considered for the office tower.

The result is shown in Table 1 and indicates that savings of RM 6,491.20 per year can be accrued if adjustable guide vanes are installed for the supply/ exhaust fans.

In summary, the operating cost of large fans is often high enough to justify improving the fan system efficiency which can offer a quick payback. Thus, the application of Computational Fluid Dynamics (CFD) allows a system to be optimised at a much lower cost than the traditional 'cut and dry' method. **n**

Ir. Dr Kannan M. Munisamy graduated from UNITEN in 2000 with Bachelor of Mechanical Engineering (Hons) degree, He later pursued his Masters degree in Cranfield University, Milton Keynes, United Kingdom. He was conferred with a Master of Science degree specialising in Computational Fluid Dynamics. He is currently serving as a senior lecturer in UNITEN.

Ir. Soong Peng Soon graduated from University of Malaya in 1984 in mechanical engineering and worked in various sectors in the ACMV industry. Presently, he is engaged with an ACMV equipment trading company in providing technical support. He also offers his services to other companies, in trouble-shooting, restoration and re-designing of ACMV systems and project management.

Mr. Ramies Govindasamy was conferred with a Bachelor's degree in Electrical and Electronic Engineering in 2010 from Universiti Tenaga Nasional. Since his graduation, he has been working as a research officer with Universiti Tenaga Nasional. His work mostly involves the experimental measurement of axial fan performances and validation with Computational Fluid Dynamics.

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Affinity Laws: Interpretations and Applications for Centrifugal Pumps

by Mr. Kelvin Mohan Thambiduray

1.0 ABSTRACT

Operation of rotating equipment at its best efficiency point (BEP) or close to it is every operator's objective as this leads to less wastage, higher cost savings, less wear in the machine and a bundle of other benefits. However, in common practice, most process data acquired during front-end engineering design (FEED) or conceptual study phases do not accurately tally with actual process conditions during actual plant startup. This of course is due to many uncontrollable or unpredictable conditions and as a result, in most cases, pumps do not operate at rated points. A correction method should be implemented to correct this deviation or to vary pump performance based on process conditions that change over time, permitting peak performance throughout the pumps life cycle. One such method presented here is Affinity Laws, where performance improvements are achieved by toggling with the impeller diameter or rotational speed. This article presents a detailed interpretation of Affinity Laws and their usage for centrifugal pumps, alongside correction methods to mitigate the large inaccuracies that have overshadowed the widespread usage of Affinity Laws. These methods have been evaluated with vendor pump curves with the results presented and discussed.

2.0 INTRODUCTION

Affinity Laws, also known as 'Fan Laws', derive their name from their initial usage to re-rate fans. These laws have proven successful in their application for fans generally in industrial plants, where the fluid medium being dealt with was air (light gas) with a relatively low head rise and volume ratios that are commonly negligible. Their applications in other rotating equipment soon became apparent, as centrifugal pumps and compressors are both ideally governed by similar velocity triangles as fans. Affinity Laws for pumps have often been described in terms of dimensionless numbers, used to predict flow, head and power changes with diameter or speed variation under similar aerodynamic, flow, and geometrical conditions, with a caveat that errors can be in the order of 20% [1].

The objective of this article is to bring awareness and put forward a comprehensive reference to the usage of Affinity Laws for application in re-rating pumps, whether due to changes in process requirements over time or unexpected flow conditions at commissioning. This article discusses methods generally overlooked by the general rotating equipment engineering community. It is worth to note that proper application of this law could provide a scenario allowing the pump to operate closer or at its BEP, providing more efficient operation and in turn cost savings. However, it is outlined without going in-depth into the definition of Euler's rotor dynamics equation (interested readers are directed to (2); (3)).

The problem was tackled by references to multiple literature and analysis of vendor pump curves to validate literature claims along with field experience by industrial experts.

The discussion would also be limited to the following conditions, viz.:

- Pump has no entrained solid or gas [2].
- Scope does not include application to hydromagnetic pumps [2].
- Information presented generally cover medium range specific speed pumps.
- Simultaneous variation of diameter and rotational speed at once is not included in the scope of this article and not recommended [4].
- Viscosity and fluid vaporization are negligible [2].

3.0 BACKGROUND

3.1 Velocity Triangles

Affinity Laws for head relies on Euler's rotor dynamics equation (Equation 1) which is derived from velocity triangles. Noticeable from these triangles as depicted in Figure 1(a) is that as periphery speed, U (also known as tip speed) varies, the absolute fluid exit velocity, V, follows suit linearly. The same observation is noticed for variation in the relative fluid exit velocity, W^1, as illustrated in Figure 1(b).

$$\Delta H = U_2 \cdot C_{u_2} - U_1 \cdot C_{u_1} \qquad \textit{Equation 1}$$

Where;

H = Specific Head, kJ/kg C_u = Meridional velocity, m/s
U = Periphery velocity, m/s

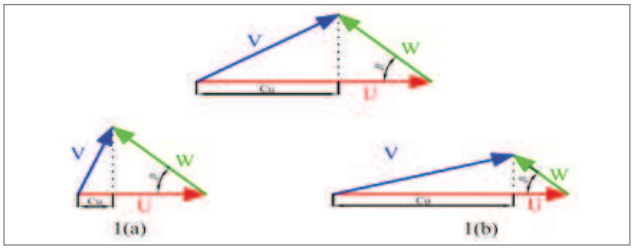

Figure 1: Velocity triangles (a) variation in periphery speed (b) variation relative fluid exit velocity

3.2 Affinity Laws

Affinity Laws are derived from the basis that head and flow rate are both dependent on velocity triangles for geometrically similar impellers, and under ideal conditions (as presented in Figure 1), they react linearly to change either individually or simultaneously.

Fluid flow rate defined by general textbooks suggest the following:

$$Q = UA\begin{cases} A \propto r_2^2 \propto D_2^2 \\ U \propto N \cdot r_2 \propto N \cdot D_2 \end{cases}$$

Equation 2a

$$\therefore Q \propto N \cdot D_2^3$$

Equation 2b

However, empirical data shows that flow rate to be directly proportional to diameter and speed change. The following was proposed by A.J. Stepanoff and suggest [5] its validity for a considerable range of specific speeds[2] .

$$Q \propto N \cdot D_2$$

Equation 2c

Where;

Q= Flow Rate, kg/s A=Impeller exit area, m^2
N = Rotational Speed, rpm D = Impeller diameter, m
r = Impeller radius, m

Head being a function of two velocities as indicated in Equation 1 with velocity being a product of rotational speed and impeller diameter as indicated in Equation 2a then suggest;

$$\Delta H = \Delta(U \cdot C_u)$$

Equation 3a

$$\Delta H \propto (N \cdot D)^2$$

Equation 3b

Power, P being defined as a product of flow and head is then represented by referring to Equations 2c and 3b;

$$P = Q \cdot \Delta H$$

Equation 4a

$$P \propto (N \cdot D_2)^3$$

Equation 4b

Equations 2c, 3b and 4b all represent the general Affinity Laws applicable for pumps[3]. It should be noted that other forms of these laws exist by either holding one of the variables on the right side of these equations constant or implementing correction constants, which would be elaborated further in Section 4 of this article.

4.0 EVALUATION OF FAN LAWS

4.1 Effect of Scaling / Similitude

In order to accurately apply Affinity Laws, Gullich suggested that geometrical and dynamic similarity be maintained; to be more specific, all wetted parts are sealed in the same ratio whilst ensuring constant Euler, Froude and Reynolds number [6]. The effects of Froude[4] and Reynolds[5] number for pumps are however, generally negligible unless detailed loss investigation is required. Jacques and Florjancic both added to these recommendations by implying that Affinity Laws can be applied accurately by maintaining pumps efficiency, specific and suction specific speed [4], [3]. Jacques further suggested that only the same impeller and not one geometrically similar be used for scaling as manufacturing variation on wetted parts surface properties will affect the accuracy of Affinity Laws [4] (refer Section 4.1.1 for further information).

By paraphrase, conservation of fluid impeller exit angle before and after modifications would ensure the accuracy of Affinity Laws. The requirements outlined are to ensure that flow kinematics are maintained which prevents variation in slip. As illustrated beforehand in Section 3.2, observation suggests that variation in impeller outer diameter and rotational speed are major factors which govern corresponding change in the pumps performance. The following sub-sections will elaborate the effect of variation in these parameters on pump performance.

4.1.1 Impeller Diameter Variation

It is common practice with most pump vendors to construct impellers to be slightly larger than theoretically computed, as rated flow within 80% – 110% of BEP is generally acceptable [7]. If required pump performance modifications are carried out by trimming the impeller or throttling the flow. This practice provides a buffer for the minor effects neglected during detailed engineering calculations and also safeguard against under tolerance in contractual terms. Developing an impeller to its exact theoretical calculated size might prove to be detrimental commercially and to the delivery schedule, if the flow properties end up not meeting process requirements and remanufacturing is required.

However, one should take note that throttling the flow would mean the pump is over-sized, leading to detrimental effects, and to name a few:

- Higher manufacturing and operation cost
- Higher energy consumption as the pump would be running on part load (due to reduced pump efficiency)
- Higher maintenance cost and frequency (due to premature wear)
- Possibility of pulsation (if inducers or suction impellers are used to reduce the higher NPSHr of a larger pump)
- Higher possibility of seal failure
- Higher vibrations and noise levels (due to part load operation) [3].

Reducing impeller diameter on the other hand does not significantly cost any of the before mentioned side effects besides the higher capital cost; if performed properly and within the allowable range. Most literatures would suggest the upper limit of the allowable range to be 20% of maximum diameter, whereas some propose it to be up to 30% of maximum impeller diameter. However, in practice it is often trimmed to about 3% – 5%[6] only of maximum impeller diameter. Further impeller trim beyond the allowable range might cause considerable efficiency drop and unstable pump performance due to increase in energy loss to turbulent flow. In addition, if the impeller to casing ratio exceeds the pump design limit, an excessive increment of specific vane loading would occur, resulting in re-circulation flow distribution pattern across the impeller exit to become highly unstable increasing the tendency of back flow in the pump especially in high energy and double suction flow pumps [1].

Also Affinity Laws can be easily applied to estimate the amount of trim required for a desired flow property with a caveat that the results by using this Law does not accurately reflect actual physical data. Reasons for this occurrence are breached to the geometrical similitude, before and after the impeller trim. Factors which contribute to this include failure of geometrical impeller trim to vary proportionally with:

- Impeller surface roughness (commonly negligible with the exception to application of Affinity Law in high head or flow operations (3))
- Impeller width and internal leakage clearances
- Impeller to casing ratio

These mentioned factors cause increase in slip, which evidently changes the angle of relative fluid exit velocity. Due to this, impeller diameters are often trimmed in phases of small increments and re-tested until desired flow conditions are achieved. Each time the impeller is trimmed it would require to be re-balanced which could results in costly modifications.

A silver lining to the setbacks introduced by the usage of Affinity Laws was proposed by Bloch and Budris as illustrated by Figure 2; a correction chart for impeller diameter trim to compensate for hydraulic mismatches and mechanical imperfections [8];[9]. Validity of this chart has been tested with two separate pump vendor performance curves and initial observation shows that improvement of accuracy ranging between 0.2 to approximately 10%. More importantly, usage of the correction factor as indicated in Figure 3 and Figure 4 prevents impeller over cut, which is not correctable unless by change of impeller or variation of rotational speed. The question that lies here is what if the driver is not variable speed, which is the common case in most scenarios where impeller trimming is practiced. Do note however, even with the usage of the correction factor the exact required trim is not indicated with negligible effects, this is especially the case when referring to Figure 3. This is highly likely owed to the high flow of this pump in which the usage of these laws is highly not recommended as addressed later. Note

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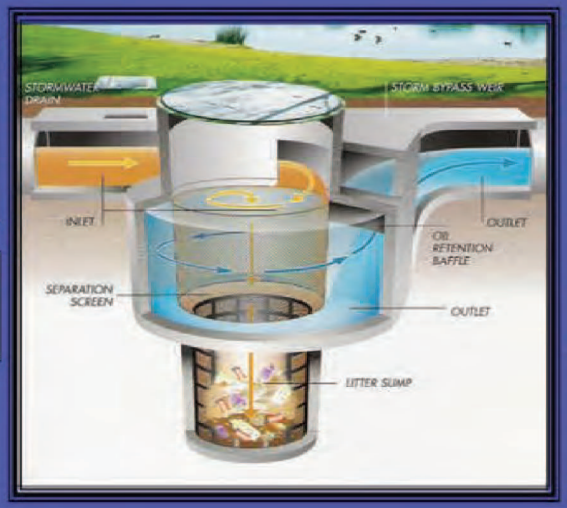

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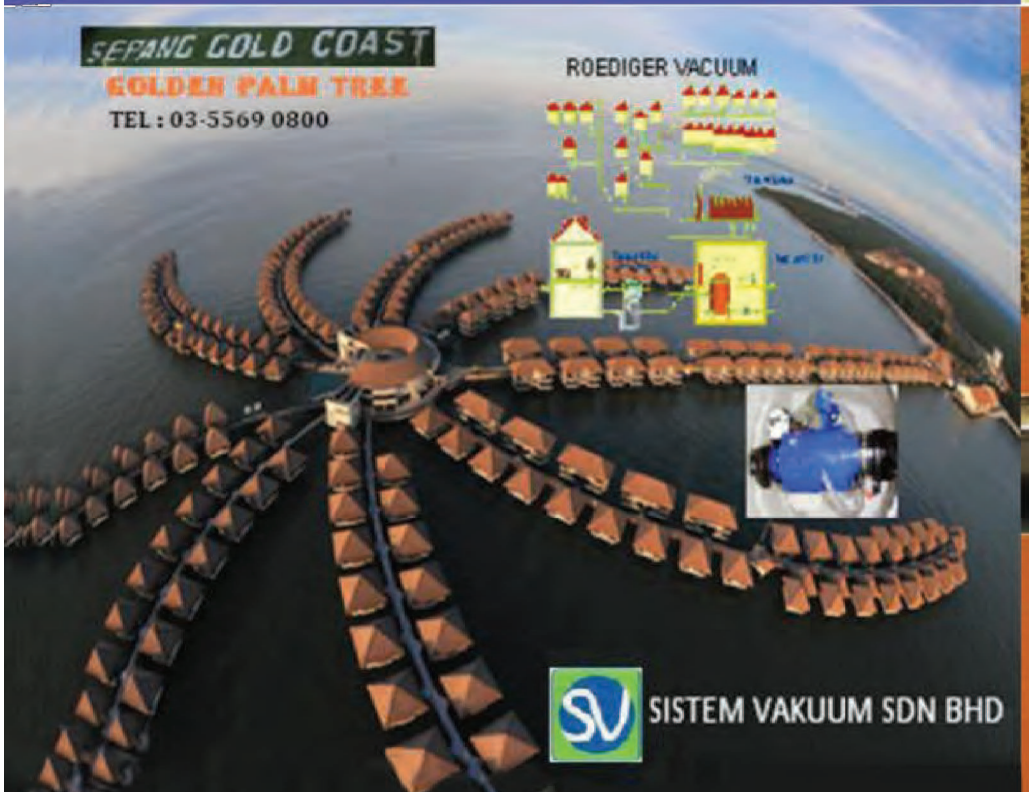

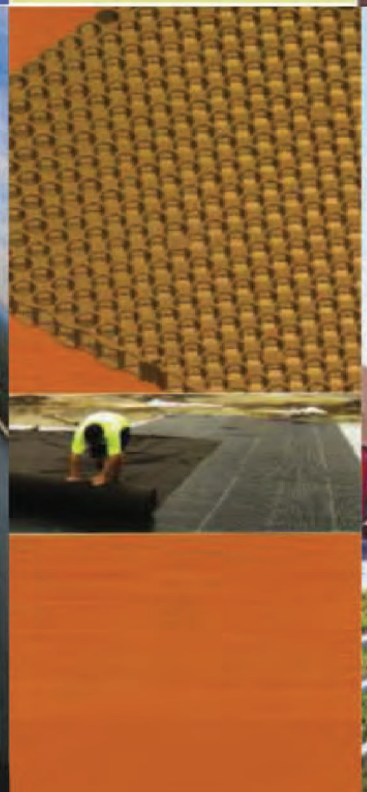

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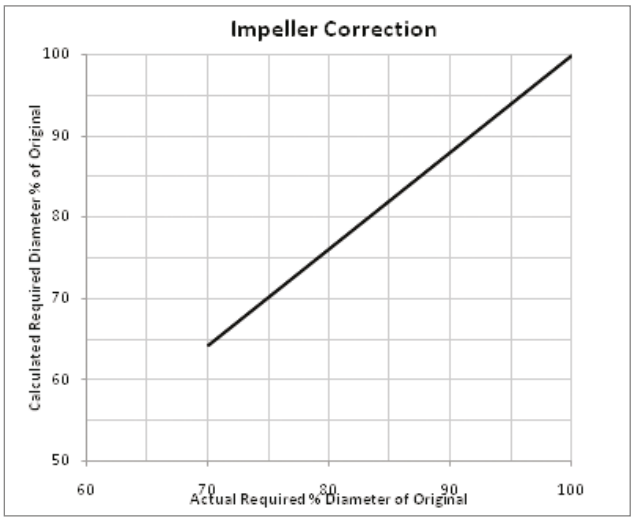

Figure 2: Impeller trim correction [Image adopted from (9); (8)].

however, the mere 0.01% deviation for an approximately 20% maximum impeller diameter trim for pump vendor B as demonstrated on Figure 4, which is likely owed to its moderate flow and head (medium range specific speed). Other methods that may also be applied to make impeller trimming more favourable is trimming of vanes in an oblique cut instead of the entire shroud (for closed impeller designs). This reduces the effect of balancing issues and provides a more uniform exit flow at the impeller exit. However, care also should be taken when performing this to ensure that shroud mechanical strength is not compromised.

It is safe to perform interpolation of actual flow data being utilised (vendor to test and validate impeller with similar specific speed at varying sizes), and extrapolation under any circumstances avoided. If a new impeller is to be purchased to increase head or flow conditions, a complete hydraulic analysis is recommended. The failure of the correction factor when extrapolated is indicated on Figure 3, showing an undersized impeller, which would ultimately lead to dissatisfactory pump performance. Pump underperformance or over sizing is to be expected if the

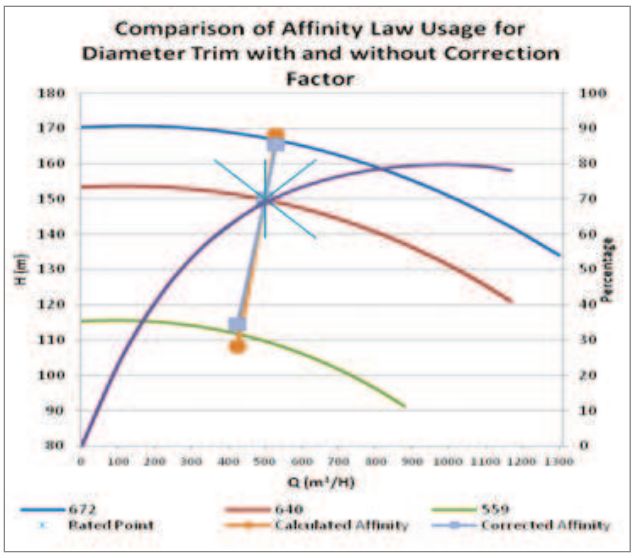

Figure 3: Comparison with and without correction factor proposed on general vendor A pump curve (SI Specific Speed: 762)

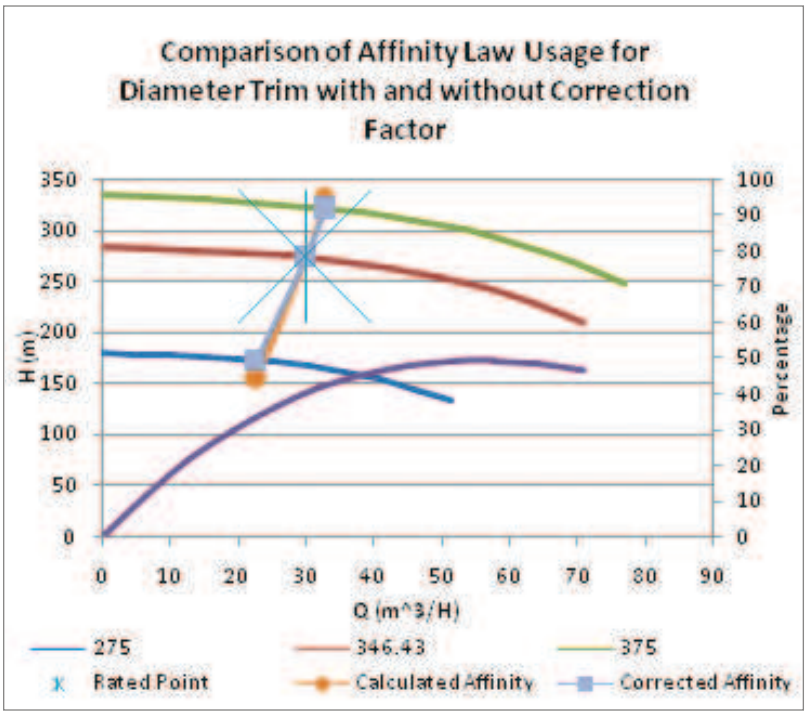

Figure 4: Comparison with and without correction factor proposed on general vendor B pump curve (SI Specific Speed: 287)

process conditions are extrapolated beyond a certain flow threshold.

Another important limitation to consider is the applicable specific speed range which Affinity Laws govern. Pumps with low specific speed are designed to maintain the impeller clearance width for a considerable distance away from the outer diameter; this disrupts the width to diameter ratio which maintains a near constant change as seen in middle range specific speed pumps. High specific speed pumps on the other hand have very short blades. Hence, they are very sensitive to diameter change[5] due to possibility of inadequate vane overlap causing hydraulic problems to arise[9]. Consequently, both these specific speed ranges do not correspond well with Affinity Laws. Mentioned in Section 4.1 that Affinity Laws rely on the pumps efficiency to remain constant before and after the impeller trim, and pump efficiency for system curves with high static head tend to deviate a significant amount for small changes in duty point rendering Affinity Laws highly unreliable in these cases[4].

4.1.2 Impeller Rotational Speed Variation

An efficient way to control pump performance especially in frequently varying process conditions is by changing the impeller rotational speed with variable speed drive system (VSD). Use of VSDs with electric motor drive include variable frequency drive (VFD), hydraulic coupling or 2-step gear box. Where electric motor drive is not used the VSD drive can be variable speed steam turbine, gas turbine, reciprocating engine or even hydraulic power recovery turbine. Note all of these VSD systems have different limitations on allowable speed range which must be taken into account.

Similar to diameter trimming, speed modification does have its limitations too. For one, the larger number of equipment required directly increases capital and maintenance cost, and skid foot print. Limitations concerning to accuracy of Affinity Laws with speed change also exist, as this impacts the fluid velocity, which in turn varies the friction losses due to surface roughness not varying proportionally with speed change. Nevertheless, this impact is commonly negligible with exception given to high head or high flow operations, as friction losses become more predominant in these scenarios[3]. Also as addressed in Section 4.1, for Affinity Laws to be used

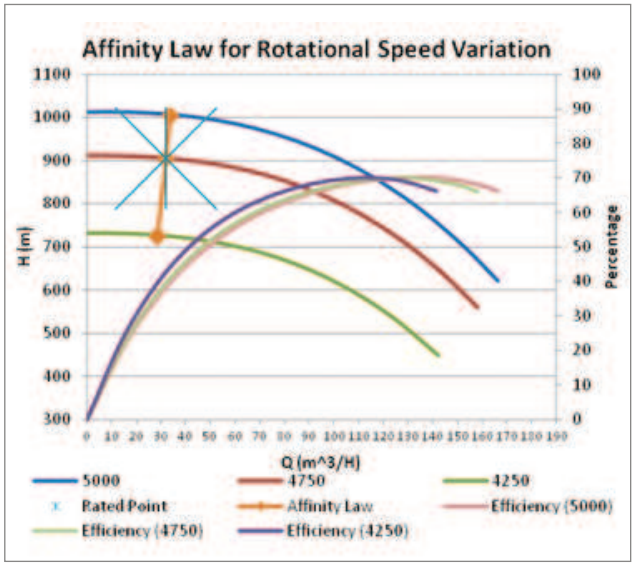

Figure 5: Affinity Laws (Pump vendor A) for rotational speed variation (SI Specific Speed: 178)

accurately, constant pump efficiency is required. This however is not seen in practice, being supported from a large study of commercial pumps by H.H. Anderson suggesting that centrifugal pump efficiency as a function of multiple variables, one of which is rotational speed[2]. Though for small speed changes the effects that cause inaccuracy to Affinity Laws are more than often negligible as illustrated on Figure 5. A pump manufacturer had introduced a method shown in Equation 5 to estimate the new pump efficiency after speed variation [10].

$$\eta_{new} = 1 - (1 - \eta_{old}) \cdot \left(\frac{n_{old}}{n_{new}}\right)^{0.1}$$

Equation 5

Beside accuracy limitations, when Affinity Laws are applied to vary rotational speed, one should be cautious and take mechanical limitations of the pump into consideration, as increasing the rotational speed without a proper rotor dynamic study may cause the shaft to operate dangerously close to its critical speed resulting in excessive noise and vibration, with pump part failures following suit. Increasing the shaft size to counter this effect can be considered with a detailed engineering study, as the shaft size directly affects the rotor dynamics, performance and efficiency of the pump [9]. Prudence should also be taken when the NPSH margin of the pump in operation is very small, as common pump NPSHr curves would show increment of NPSHr as speed is increased[11].

5.0 CONCLUSION

Affinity laws have not always been used in practice owing to the common fallacy of low accuracy predictions and unreliability. This is compounded with competition from present day high speed computational hardware and advancing CFD software with the capability to accurately map new flow conditions for variation of rotational speed and impeller diameter. These factors are main causes as to why not much attention has been paid to Affinity Laws. However, this article brings to light the possibility of these laws being used reliably to estimate expected flow conditions with tolerable accuracy during feasibility stage or even during trouble-shooting, if applied with proper care and the methods outlined. Although further thorough research is strongly suggested before field application of these laws is put into practice. Future works to be considered should include establishing a proven quantitative range for maximum impeller trim, rotational speed variation, applicable specific speeds as well as applicable head and flow. Nevertheless, caution should always be taken especially when trimming impeller diameter, as flow kinematics that prevail at certain flow coefficients are greatly influenced by geometrical properties. ■

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[1]Relative exit fluid velocity is a function of the fluid flow rate, *Q*.

[2]Note that Affinity Laws are not applicable for very low and very high specific speeds as will be discussed further in section 4.
A number of other literatures also support this claim i.e. [9]; [10]; [4].

[3]These equations are also applicable for compressors and fans with caveat that the operating fluid may undergo substantial compression that has to be taken into consideration; as opposed to liquid compression in pumps that is generally negligible (and such will be treated in this article).

[4]Effect of flow resistance does not exceed a threshold that can be considered to cause major influence to flow kinematics.

[5]Flow is generally in turbulent phase along most points in the allowable operating range, flow does not cross Reynolds number threshold to cause significant effect to flow kinematics.

[6]Bloch's observation suggest for up to 5% speed change or impeller diameter trim efficiency remains almost constant, for mid range specific speed pumps.

The author graduated from Curtin University in 2012. He is currently involved in Rotating Equipment Detailed Engineering for a major offshore floating facility under the Rotating Equipment Department of Technip Malaysia.

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Venue: Bangi Golf Resort
Registration and Breakfast: 7.00 am – 7.30 am

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8.00 a.m. (Players must report to their respective tee box at least 15 minutes before tee-off (Shotgun start)

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Product Development Through The Use Of Rapid Prototyping

by Ir. Dr Tan Chee Fai

THE competition and rapid development of the world market is causing the industry to produce more quality innovated products in the shortest time. In the first place, the industry needs to plan and adopt the right strategy in order to reduce the time to market their products. To achieve this, different methods such as Kanban System, Total Design, Lean Manufacturing and Concurrent Engineering are used. To reduce the production time and minimise design error, engineers need to create the rapid models in each development stage.

Rapid prototyping (RP) technology is a means through which the product geometry as modelled in the earlier stages can be directly utilised to obtain the physical shape of a component. This helps explore and prevent the design problems during the manufacturing stage. Rapid prototyping allows real models and tools to be produced directly from the file of computer-aided design (CAD) data [1]. RP is very useful in the early stage of product development as well as in the final stage of product verification. The rapid product can be used for ergonomic evaluation, aesthetic checking, mechanism validation, etc.

The rapid prototyping industry is experiencing impressive growth although it was badly hit by the global manufacturing recession. As RP can support the rapid product development process, the demand of RP is growing [2]. Many RP systems are available in the market; however only a few processes are widely accepted by the industry. Among them, Strereolithography (SLA/SL), Selective Laser Sintering (SLS), Fused Decomposition Modelling (FDM), Laminated Object Manufacturing (LOM), Object Quadra system and Envision Tec Perfactory are some of the widely used systems. Yet most of the present systems have not completely addressed the industry's needs. Machines have limitations in their performances, and dimensional accuracies, surface finish, process speed and material properties have been identified as some of the major limitations [3]. This paper presents the trends, research and development, and applications of RP in recent times.

MAJOR RP APPLICATIONS IN INDUSTRY

Offshore and Abyssal Engineering

Wieneke and Gerber [4] applied RP in offshore and abyssal research. The outcome from the research found that RP has improved and replaced the conventional methods to develop new types of products and procedures. RP therefore has great potential in offshore engineering.

Engineering

The aerospace industry in the United State uses RP technology to manufacture the customized parts for the International Space Station and the space shuttle fleet. RP can also be used to manufacture parts for fighter jet for the military [4].

RP also plays an important role in the automotive industry. RP models are used for design studies (aesthetic evaluation) and physical experimentation (aerodynamic analysis). Functional parts have been used for the motors and assembly experiments [4]. In addition, RP can be developed for tooling within a shorter time such as in F1 racing model development [7].

Architecture

The Rapid Prototyping Group from University of Strathclyde of the United Kingdom has applied RP in the architectural field. The RP was used in visualising the feasibility model, planning model and final project model. The characteristics of architectural models can be described using seven criteria: scale, size, cost, time, materials, complexity and accuracy [5]. The RP technology has also been applied in the continuing construction of Gaudi's Sagrada Familia Church in Barcelona, Spain to integrate with CAD/CAM production [6].

Medical Applications

RP has been used for orthodontics application. Appearance conscious adults can have their teeth straightened without the embarrassment of having a mouth full of metal braces [4]. In addition, RP is also used in the production of crowns, bridges, and other types of dental restorations [7]. RP can also be applied in the hearing aids industry to produce customised hearing aid shells for patients. In addition, RP is also being used to produce custom-fit masks for burn victims. The RP model of a mask will fit perfectly to the patient's face which helps to reduce the formation of scarred tissue.

Arts and Archaeology

RP is being used in the restoration of artefacts. RP can duplicate ancient statues and ornaments which had suffered damage from environmental influences. The original artefacts are scanned to create 3D data, where the damage can then be corrected using the software. In this way, duplicates can be easily created [4].

Sciences

In the field of science, RP is used to model molecular

chains upscale for teaching and learning purposes in the classroom [4].

Currently, RP is not only used by big organisations and educational institutions, it is also affordable and can be used by a small company, college, school or individual. The small firm can use the low-cost RP machine to make a simple part to proof a concept. Next, for colleges and schools, students can learn the RP technology through hands-on projects. For the individual, the low-cost RP machine can be used for various projects or as a product development tool for small scale businesses such as an online business. However, the only drawback is that of the quality of the finished product will not be as good due to the low resolution of the machine. ■

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by Mr. Lim Teck Guan

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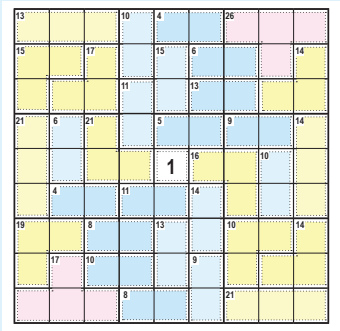
For tips on solving, visit *www.1sudoku.com.my*

(Solution is on page 44 of this issue.)



Civil Engineering Dominates Q1 Construction Activity

According to the Department of Statistics Malaysia, the civil engineering sub-sector contributed the most to construction activity in the first quarter of this year at 38%, followed by non-residential buildings (32%), residential buildings (25.8%) and special trade (4.2%). The total value of construction work done in the first quarter 2013 recorded a decrease of 5.4% quarter-on-quarter to RM21 billion. The percentage change year-on-year however, showed a significant growth of 18.4 per cent. In terms of projects among the states, Selangor recorded the highest value of construction work done at RM4.52 billion or 21.5%. This was followed by Johor at RM3.33 billion (15.9%), the Federal Territory of Kuala Lumpur which recorded RM3.22 billion (15.3%), Sarawak at RM1.95 billion (9.3%) and Sabah posting RM1.33 billion (6.3 per cent). The contribution of these five states accounted for 68.3% of the total value of construction work done. In terms of construction activity by project owners, the private sector continued to dominate, with an increased share from 68.4% in the fourth quarter of 2012, to 69.8% in the first quarter of 2013. – BERNAMA

(Sourced from the Business Times, 9 May 2013)

Cyberjaya Adopts 'Low-Hanging Fruit' Initiatives to Cut Carbon Emissions

Cyberview Sdn. Bhd., the land owner and lead developer of Cyberjaya, will invest RM400,000 this year in "low hanging fruit" initiatives to shrink the smart city's carbon footprint. The company will install solar panels on bus shelters to power the shelter lights at night, put up more GreeNomad vendor kiosks that sport green features and two more 50kg composting machines, said its Acting Managing Director, Izatul Arini, during an awards ceremony honouring companies and other stakeholders in Cyberjaya that have contributed towards greening the township last month. Cyberview via its joint venture company Perdinginan Megajana Sdn. Bhd. is also looking at building a third cooling plant in Cyberjaya. Currently, the two plants that form the district cooling system have a total capacity of 20,000 refrigerant tonnes. Cyberjaya aims to cut its carbon footprint by 21% from a projected 3.2 million tonnes of carbon dioxide in 2020. Cyberview's efforts to reduce carbon emissions include a dedicated bus shuttle system that services an estimated 2,500 passengers daily.

(Sourced from The Edge, 14 May 2013)

Developers urged to adopt Green Initiatives

The Real Estate and Housing Developers' Association (Rehda) youth wing Deputy Chairman, C.S. Tan, urged developers to undertake green initiatives to reduce carbon emissions globally. He called on developers nationwide to increase their knowledge on green initiatives to create sustainable development as the industry contributes about 40% of the global greenhouse gas emissions, which is among the largest greenhouse emitter. He said that there has been a positive response to the Greenre, a measurement tool which assesses the performance of real estates and developers, since it was launched last month. The tool will be used to study the entire construction process, from the conceptualisation and design stage, to construction as well as post - completion stage.

(Sourced from The Sun Daily, 13 May 2013)

New York City Relies on Automation Technologies to Face Challenges of Urbanisation

The operating complexities of the two enormous square sunken pools located at the National September 11 Memorial and Museum, where the two towers of the World Trade Centre used to stand, require a master control system with a sophisticated architecture and onboard central processing units. Delta Fountains collaborated with Siemens Industry for this project and their solution was the Siemens Simatic S7-300 master controller that provides local control for the motorised pumps that keep each pool's water moving at 135,000 litres per minute and filtered at 27,000 litres per minute. The Variable frequency drives (VFDs) also reduce energy consumption and carbon emissions over time because they can continuously drive the 16 pump motors in each pool at optimal speeds, ensuring a sustainable solution while reducing maintenance costs.

With the master controller, the engineers can take real-time inputs from sensors just about anywhere in the pools and plumbing that measure temperature, pressure, chemistry, wind and much more, then, use the data to automate the controls and keep the water and systems in balance. The Siemens automation and control components are based on Totally Integrated Automation, which enables adaptability and flexibility of technology solutions. The automation solution allows daily operations to be controlled remotely from 1,600 km away at their base in Jacksonville, Florida, allowing Delta Fountain engineers to avoid the additional costs of living in New York.

(Sourced from The Star, 14 May 2013)

O&G Sector to see RM15 Billion Worth of Acquisitions in 2013

Merger and acquisition (M&A) activities remain on the cards of local oil and gas (O&G) players, with about RM10 billion to RM15 billion worth of acquisitions expected this year, said tax experts. Deloitte Southeast Asia M&A tax leader and country energy and resources leader, Steven Yap said that factors driving acquisitions are growing demand, replacing existing resources for expansion and worldwide M&A trend. He cited national oil firm Petroliam Nasional Bhd. (Petronas) which has been actively seeking to acquire foreign oil and gas assets and had recently planned a US$850 million acquisition of Brazil's Tubarao Martelo oil field from OGX Petroleo e Gas participacoes SA. Many more companies will be pursuing M&A activities globally for the obvious benefit of access to capital, improved profitability and sharing of technology and risk. Yap described the outlook for the O&G sector as "attractive" and there will be a lot of exploration activities with new discovery.

(Sourced from The Sun Daily, 15 May 2013)

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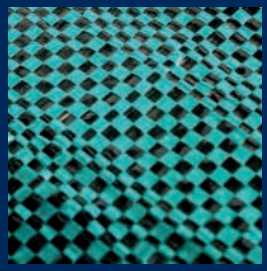

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7th International Conference on Cooling and Heating Technologies in 2014 (ICCHT 2014)

Ir. Dr Tan Chee Fai

MECHANICAL ENGINEERING TECHNICAL DIVISION

THE Institution of Engineers, Malaysia (IEM) has won a bid to become the organiser of the 7th International Conference on Cooling & Heating Technologies in 2014 (ICCHT-2014), which will be held in Malaysia. IEM was invited by American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Singapore Chapter to participate and bid for the ICCHT-2014. Mechanical Engineering Technical Division (METD) was given the task by IEM to be in charge of the bidding of ICCHT-2014. After several preparatory meetings, METD had decided to send a delegation to bid for the organisation of 7th ICCHT during the 6th ICCHT in Xi'an, China, between 9 and 12 November 2012.

The proposal from METD was supported by IEM and for the ICCHT-2014, METD has decided to work with IEM Training Centre (IEM-TC). After some preparations and discussions, the delegates from METD and IEM-TC flew to Xi'an, China, to meet the ICCHT main committee and to present the proposal. The delegation team was represented by Ir. Noor Hisham Yahaya (Team Leader), Ir. Fam Yew Hin, Ir. Luk Chau Beng, Ir. Gopal Narian Kutty, Ir. Yim Hong Wa (representative from IEM-TC), and Ir. Dr Tan Chee Fai. There were two intensive discussion sessions and a presentation during the 6th International Conference on Cooling & Heating Technologies (ICCHT-2012). Finally, the main ICCHT committee approved METD's proposal and awarded the organising right of 7th ICCHT to the Institution of Engineers, Malaysia.

The ICCHT was formed by a group of researchers from four countries, namely Professor Maogang He (Xi'an Jiatong University, China), Professor Aryandi Suwono (Institut Teknologi Bandung, Indonesia), Professor Hanshik Chung (Gyeingsang National University, Korea), Professor Shengqiang Shen (Dalian University of Technology, China), and Professor S.H. Winoto (National University of Singapore, Singapore). Their main research interest are cooling and heating technologies such as HVAC system, heat transfer, renewable energy and refrigeration engineering.

The 1st International Conference on Cooling & Heating Technologies was held in Hanoi Vietnam (January 2005, whereas the subsequent conferences were held in Dalian, China (July 2006); Tokyo, Japan (July 2007); Jinhae, Korea (October 2008) and Bandung, Indonesia (December 2010). The previous ICCHTs had gathered more than 100 cooling and heating researchers from different countries such as China, Japan, Korea, Singapore and Indonesia. The 7th International Conference on Cooling & Heating Technologies will be organised in Kuala Lumpur from 4 November to 6 November 2014. ■

Figure 1: Ir. Noor Hisham presenting the IEM proposal during the bidding process to the ICCHT main committee

Figure 2: Ir. Fam Yew Hin addressing questions raised by the ICCHT main committee

Figure 3: The delegation team from IEM and IEM-TC

Figure 4: A group photo taken in front of the conference venue in Xi'an, China

Figure 5: The delegation team cycling around the Xi'an City Wall

Ir. Dr Tan Chee Fai is a committee member of the Mechanical Engineering Technical Division and a Senior Lecturer, Department of Design & Innovation, Faculty of Mechanical Engineering, Universiti Teknikal Malaysia, Melaka.

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(January 2010 IEM Front Cover Caption)

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Retreat and Brainstorming Workshop

MECHANICAL ENGINEERING TECHNICAL DIVISION

by Ir. Chok Yuk Yun

THE annual Retreat and Brainstorming Workshop of the Mechanical Engineering Technical Division (METD) for Session 2012/13 was held on 15 December 2012 at Raintree Club, Ampang. The main objectives of the retreat session were to assist the new committee members to familiarise themselves with the policies and procedures of The Institution of Engineers, Malaysia (IEM) as well as to develop the divisional action plan for year 2013.

The very first retreat session of METD was mooted back in year 2005, as the committee members felt that the monthly meeting in the evening was too short and not conducive enough for the committee to chart out the annual plan and activities. Since then, the retreat session has become an annual event for METD, and it has been proven that such event is of great help in generating new ideas as well as putting together an effective annual plan for the new term.

As a result, several new activities (in addition to the regular talks, courses and visits) have been successfully rolled out to promote networking among its members as well as to share knowledge or technology updates. It may also be worth mentioning that as a result from such systematic planning, METD has won the IEM Presidential Award of Excellence for six consecutive years.

The retreat session for 2012/2013 was well attended by the METD Committee Members. The session started at 8.30 a.m. with a welcoming speech given by the Chairman Ir. Noor Hisham. In his welcoming speech, Ir. Hisham explained the main purposes and objectives of the retreat session as well as the key areas of focus for 2013 to the attendees.

The retreat session was then handed over to the Deputy Chairman, Ir. Fam Yew Hin, who acted as the session facilitator. He presented the general policies and procedures for organising activities in IEM and elaborated on the proposed direction of the technical division in the key areas of focus. The attendees were then divided into four different groups, each of which was assigned to handle a specific area of focus respectively.

Lively discussions were held to brainstorm and propose activities for year 2013. Subsequently, a 'challenge session' was held where respective group representatives were given the opportunity to present their proposals to all the attendees for constructive comments and debate.

As in previous years, the retreat ended with the finalisation of a comprehensive action plan for the coming term, comprising both new and regular activities. Let us all hope that 2013 will be another interesting year for METD and its members! ■

Ir. Chok Yuk Yun possesses a Bachelor's degree in Mechanical Engineering from University of Wales, Swansea, United Kingdom (2001) and a Master is in Business Admisnistration (MBA) from University of Malaya (UM) (2008). Currently he is a Process Safety Engineer in Talisman Malaysia Limited, with the main responsibility of providing support to the company's operations and facilities engineering team in safety related tasks. He is a Committee Member of the IEM Mechanical Engineering Technical Division for the 2012/2013 session.

Application of Plastic Pipes in the Plumbing Industry

BUILDING SERVICES TECHNICAL DIVISION

by Ir. Gary Lim Eng Hwa and Ir. Ung Ah Hock

THE one-day course content consists of the application of all types of plastic pipes and tour of the manufacturing process of ABS pipe. It was conducted at the training room of Azeeta Pipe System Sdn. Bhd. on 11 September 2012 and was attended by 15 participants who were involved in the plumbing industry. All meals of the day were sponsored by Azeeta Pipe System Sdn. Bhd.

Ir. Ung Ah Hock started the morning session highlighting some of the actual site problems, particularly those related to installations. Various photographs were shown to bring to light a range of shortcomings of installations found in the industry which would cause pipe to burst or crack resulting in water damage even during the project's liability period, where maintenance often gets the blame for such damage. A properly designed plastic piping system operating within its parameters is said to be able to last for 50 years.

The participants toured the manufacturing plant and were shown the various quality assurance steps taken at different stages to ensure that the finished pipe complies with MS 1419 Specifications and Installation Guides of ABS Pressure Piping System.

A number of participants tried out the joining of ABS pipes using solvent cement and were amazed that the joint could withstand the impact and hydrostatic test pressure as high as 48 bars!

The afternoon session was conducted by Ir. Gary Lim Eng Hwa who elaborated on the Fundamentals of Fluid Laws covering Continuity Equation and Bernoulli's Theorem, both of which are essential in sizing the pump and pipe size. To determine the frictional loss in a pipe, Ir. Gary advocated the use of Hazen-William's formula. The term 'Net Positive Suction Head Available and Required' was explained through the use of an example so that the participants could better understand these two key terms, especially in a situation when a pump is subject to negative suction.

The relevant SPAN draft Uniform Technical Guidelines were also presented during the course as they would be the criteria for the future design of internal plumbing systems, once the guidelines are published by SPAN.

A list of all the plastic pipes used in the plumbing industry was compiled with the corresponding MS colour to enable the participants to easily identify the different type of plastics at a project site.

A case study was carried out to compare the frictional losses of the various types of pipe including metal pipes so that the differences could be highlighted. Participants were reminded that whilst the internal diameter of a galvanized pipe is greater than its nominal diameter, the internal diameter of a plastic pipe may differ significantly especially for higher pressure rated pipes. Major plumbing problems would arise if pipe size is not adjusted for this factor.

Water hammer in a pipe line is a major problem in plumbing installations and should be addressed in the design stage with the use of larger pipe size, incorporating Variable Speed Drive, Surge Tanks, Water Hammer arrestor or slow closing valves.

We are indeed grateful to the Management of Azeeta Pipe System Sdn. Bhd. for offering the training venue and also for the meals provided. ■

Ir. Gary Lim Eng Hwa is a co-opted member of the Building Services Technical Division and a past Council member. Since his retirement, Ir. Gary regularly conducts courses pertaining to fire engineering and plumbing engineering at IEM.

Ir. Ung Ah Hock is a committee member of the Building Services Technical Division and is also the Founder and Managing Director of Azeeta Pipe System Sdn. Bhd. He possesses more than 15 years of experience in the manufacture and installation of thermoplastic piping systems.

Improving IEM's Links with Relevant Ministries

SMART PARTNERSHIP WITH MINISTRY OF HOUSING AND LOCAL GOVERNMENT

IN line with the Institution's objectives to strengthen its association with the relevant government ministries that involve engineering activities such as the Ministry of Housing and Local Government, the Ministry of Transport, the Ministry of Health, the Ministry of International Trade and Industry and the Ministry of Tourism, IEM Deputy President Ir. Choo Kok Beng and IEM Council Members - Ir. Yap Soon Hoe and Ir. Yam Teong Sian - had an informal discussion with the Minister of Housing and Local Government, YB. Dato' Wira Chor Chee Heung on 25th February 2013, arranged with the assistance of the Special Advisor to the Minister, Ir Fong Tian Yong.

Dato' Wira Chor said he was aware of the tremendous technical expertise and resources available at IEM and the Technological Association of Malaysia (TAM) which can be drawn on by the Government for the Economic Transformation Plan (ETP) and Vision 2020. It was agreed that a smart partnership between IEM, TAM, similar allied professions and the Government can make a tremendous impact on providing a better life for all in the future. The Institution intends to continue with such meetings to chart the way forward. ■

The Engineering Club Outreach

YOUNG ENGINEERS SECTION

by Sdri. Chai Kah Sin

THE 'Engineering Club Outreach' was successfully organised on 13 & 14 October 2012 through the joint-effort of the Student Section of the Institution of Engineers, Malaysia (IEM) and a team of Universiti Teknologi Petronas (UTP) students. The objective of the event is to establish the first high school Engineering Club in Malaysia. The Engineering Club was launched in Sekolah Menengah Teknikal Kuala Lumpur (SMTKL) by IEM during the closing ceremony of Engineering Invention and Innovation Exhibition (EINIX) 2012 which was an event held to promote the Engineering Profession to the public through the exhibition of inventions and products of the undergraduates from local universities.

The idea of launching this club in schools is to increase the engagement and involvement of students in hands-on activities as currently activities organised by schools are considerably insufficient for students to utilise the knowledge gained. The Engineering Club helps expose students to more challenges and provides them the opportunity to gain practical experience through thought provoking games and activities related to engineering. In the course of time, the students will be adequately trained for their future and will be able to contribute significantly to our country's development as part of the efforts to achieve Vision 2020.

This Engineering Club is the very first Engineering Club established in secondary schools in Malaysia with the aim to expose the students to the field of engineering. On 13 October 2012, a talk on the introduction of engineering was given by Engr. Mah Way Sheng, the Chairman of Young Engineers Section, The Institution of Engineers, Malaysia (IEM-YES).

The event continued with the selection of committee members of the Engineering Club among students of SMTKL. Students who were regarded to possess leadership qualities were nominated and voted by the students from SMTKL. The Annual General Meeting involving the Chairman of IEM-UTP Student Section, Sdr. Muhammad Nasrullah bin Annuar and the newly-elected committee members was held to discuss about the management of the newly-established Engineering Club.

To spice up the event, a robotic class was held on the first night of the event. The class was conducted by the members of Petrobots, Universiti Teknologi Petronas, and the purpose of the class was to educate students on the basic knowledge of robotics. The group of students who won the game had the opportunity to present a short sketch during the closing ceremony of Engineering Club Outreach.

On the second day of the event, the committee members of the Engineering Club Outreach had conducted ECOLYMPIC 2012, which was a competition to interact with the students from SMTKL. ECOLYMPIC 2012 is an acronym for "Engineering Club Olympics". The ECOLYMPIC 2012 comprised three different Science-related games, especially Physics. In "Airborne Deployment", participants were required to design and construct a parachute whereas in "Seconds from Disaster", they had to construct a bridge using the materials provided within the given time. Apart from that, the game entitled, "Encapsulated Impact Resistor" required the participants to utilise the given materials to build an egg pod which can withstand the impact of the fall when the egg is released from an elevated area.

Medals and prizes were presented to the champion, first runner-up and second runner-up for each game and the team "Tribal" won the overall championship. Besides the participants of the games and activities, the closing ceremony of Engineering Club Outreach was attended by Ir. Choo Kok Beng, the Deputy President of IEM, Engr. Mah Way Sheng, Chairman of Young Engineers Section, IEM, Mr. Yap Tho Huat, Senior Assistant Co-Curriculum Department of SMTKL, Sdr. Muhammad Nasrullah Annuar, Chairman of IEM-UTP Student Section, and Sdr. Abdul Sharib Mohamed, Vice Chairman of IEM-UTP Student Section.

According to Ir. Choo Kok Beng, SMTKL was the first school in Malaysia which had been selected to launch an Engineering Club. Ir. Choo also urged other universities to organise more relevant events to benefit the students. He also expressed his warmest gratitude to the teachers, committees of UTP and the students from SMTKL for the success of this event.

Launching of Engineering Clubs in schools is definitely an excellent programme as it not only offer students better exposure to the world of engineering, but also helps them to acquire practical knowledge and skills. All in all, students are encouraged to take the initiative and participate in activities organised by similar clubs or associations such as the Engineering Club in order to equip themselves for the future. ■

Sdri. Chai Kah Sin is currently pursuing Chemical Engineering in Universiti Teknologi PETRONAS in the First Year Second Semester, and is the secretary of IEM-UTP Student Section.

Government Transformation Programme's Corporate Integrity Pledge

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

CORPORATE INTEGRITY SYSTEM

The signing of the Corporate Integrity Pledge (CIP) is only the first step for business entities as they will then have to take several steps to ensure that they comply with the pledge. The first stage is a self-assessment process where companies will develop an assessment and improvement plan to strengthen their own integrity system. The plan will then be implemented where the establishment of the appropriate infrastructure and training for staff take place. Finally, the companies will include these anti-corruption elements in their audits, as well as highlighting them in their annual reports.

CORPORATE LIABILITY

Work on the Corporate Integrity System Malaysia (CISM) will continue by encouraging more companies to sign the CIP as a tool to develop their own anti-corruption programmes. There are also plans to introduce a corporate liability provision into the MACC Act which will make companies liable for the corrupt acts of their employees. Currently, the MACC Act does not have any special provisions for corporate liability, and thus, only individuals are charged for corrupt practices even when such action was carried out on behalf of a company.

United Nations Convention Against Corruption (UNCAC) as well as Organization for Economic Co-operation and Development (OECD) recommend the liability to be extended to the corporate body as it can be a powerful legislative tool to deter corruption. Ultimately, the initiative is aimed at motivating companies to implement the measures contained within the corporate integrity system. ■

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.

IEM – IET Electrical Conference (IIEC 2013)

19 – 21 November 2013

Theme : Sustainable Development Through Innovations in Energy Management and Technology
Venue : Palace of The Golden Horses, Kuala Lumpur
Organised by : Electrical Engineering Technical Division, IEM and The Institution of Engineering & Technology (IET) - Malaysia

Talk on Diaphragm Wall Technique and Construction in Difficult Ground Conditions

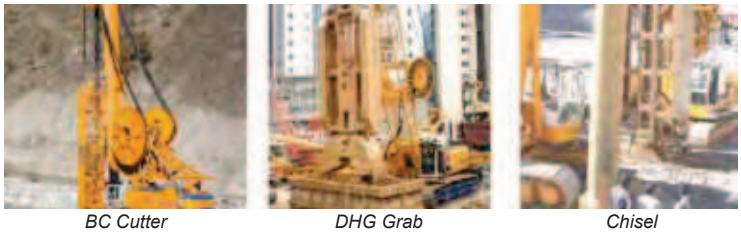
GEOTECHNICAL ENGINEERING TECHNICAL DIVISION

by Ir. Lee Peir Tien

THE evening talk on Diaphragm Wall Technique and Construction in Difficult Ground Conditions was organised by the Geotechnical Engineering Technical Division on 28 September 2012 at the Tan Sri Prof. Chin Fung Kee Auditorium, Wisma IEM. The talk was delivered by Mr. Author BI. The talk was attended by 69 participants.

The speaker started his talk with the definition of various difficult ground conditions (e.g. rock, layers with stones, boulders and inclined rock surface) and the associated problems. Subsequently, he introduced some techniques of excavation, such as, the BC cutter, DHG hydraulic grab and chisel as shown in Figure 1, and highlighted the advantages and disadvantages of each technique. For example, DHG hydraulic grab provides high performance in "normal" soil conditions but would face difficulty when excavation is carried out in hard soil such as those with SPTN>100. He then mentioned that it is through the combination of all techniques that success could be achieved in a project.

The formation of an effective water barrier within the soil and rock formations beneath dams is still one of the most important tasks in dam construction. The oldest method of providing a barrier beneath dams which is still widely used even today is the grout injection technique. The impermeability of such grout curtains is governed by the spacing of the grout holes. They will soon reach their economical and technical limitations in alluvial soils especially when they are mixed with stones and cobble. As such, there is also an increasing demand for the use of the diaphragm wall technique as a permanent water barrier below the dam structure especially in heterogeneous soil conditions with high permeability. Under such conditions, where an added advantage would be its capability to socket the cut-off wall into bedrock.



BC Cutter | DHG Grab | Chisel

Figure 1: Excavation Techniques in Difficult Ground Condition.

The speaker also shared with the audience four historical cases where a diaphragm wall had been successfully constructed at site as a cut-off wall for dams. Figure 2 shows the adoption of diaphragm wall as cut-off wall for a dam.

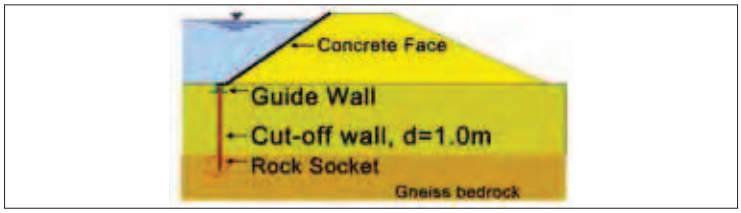


Figure 2: Adoption of Diaphragm as Cut-off Wall in a dam project

At the end of the talk, the speaker was fielded a number of questions from the audience. Lastly, a token of appreciation was presented to the speaker. The talk ended with a big round of applause from the floor. ■

Ir. Lee Peir Tien is currently a Committee Member of IEM Geotechnical Engineering Technical Division (GETD) and he is also an Associate Director of G&P Geotechnics Sdn. Bhd.

TEMUDUGA PROFESIONAL

Tarikh: 8 Mei 2013

Kepada Semua Ahli,

SENARAI CALON-CALON YANG LAYAK MENDUDUKI TEMUDUGA PROFESIONAL TAHUN 2013

Berikut adalah senarai calon yang layak untuk menduduki Temuduga Profesional bagi tahun 2013.

Mengikut Undang-Undang Kecil IEM, Seksyen 3.9, nama-nama seperti tersenarai berikut diterbitkan sebagai calon-calon yang layak untuk menjadi Ahli Institusi, dengan syarat bahawa mereka lulus Temuduga Profesional tahun 2013.

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

Ir. Prof Dr Jeffrey Chiang Choong Luin
Setiausaha Kehormat
Institusi Jurutera Malaysia
Session 2013/2014

PERMOHONAN BARU

Name	Qualifications
KEJURUTERAAN KIMIA	
AHMAD FATANI BIN ABDUL RAHMAN	BSc (MISSOURI (CHEMICAL, 1996) ME (UNITEN) (MANAGEMENT, 2006)
KEJURUTERAAN AWAM	
ASMANINI BINTI ISMAIL	BE HONS (UTM) (CIVIL, 2002)
CHAN TUCK LEONG	BE HONS (LOUGHBOROUGH) (CIVIL,1998) PhD (LOUGHBOROUGH) (WATER, 2004)
HAFIZ BIN MD. ZAKI	BE HONS (UiTM) (CIVIL, 2004)
MARIMUTHU A/L MUNIANDY	BE HONS (UKM) (CIVIL, 1998)
RIDWAN BIN UDIN	BE HONS (UPM) (CIVIL, 2001)
TEOH PEI LIM	BE HONS (UM) (CIVIL, 2005)
AZIZUL AZHAM BIN MOHD NADZRI	BE HONS (UTM) (CIVIL, 2002)
JOHNNY MALCOM ANAK EDWARD DUOD	BE HONS (UiTM) (CIVIL, 2001)
WAN MOHD FIRDAUS BIN WAN OMAR	BE HONS (UNISEL) (CIVIL,2008)
MOHD. SALIM BIN ABD. WAHID	BE HONS (UiTM) (CIVIL,2004)
KEJURUTERAAN ELEKTRIK	
CHUNG NYET MI @ REBECCA CHUNG	BE HONS (WALES) (ELECTRICAL & ELECTRONIC, 1993)
KEJURUTERAAN ELEKTRONIK	
ROSNAZRI BIN ALI	BE (RMIT) (ELECTRICAL, 1988) MSc (USM) (ELECTRICAL & ELECTRONIC, 2007)
KEJURUTERAAN INSTRUMENTASI DAN KAWALAN	
ANITA BINTI MARZUKI	BE HONS (UTM) (ELECTRICAL, 1997) MSc (UiTM) (TELECOMMUNICATION & INFORMATION ENG, 2011)
KEJURUTERAAN MEKANIKAL	
MOHD KAMAL BIN MISDAR	BE HONS (LONDON) (MECHANICAL, 2001)
MOHD SHUKRI BIN YOB	BE HONS (UTM) (MECHANICAL, 2007) ME (UKM) (MECHANICAL, 2010)
RIZAUDDIN BIN RAMLI	BE (KYOTO) (MECHANICAL,1997) ME (GIFU) (MECHANICAL, 2005) PhD (GIFU) (MECHANICAL, 2008)
KEJURUTERAAN PERLOMBONGAN	
OH TEIK SOO	BSc (LONDON) (MINING, 1977)

PEMINDAHAN AHLI

No. Ahli	Nama	Kelayakan
KEJURUTERAAN KIMIA		
45790	LEE WEI CHOEW	BE HONS (UTM) (CHEMICAL, 2005)
KEJURUTERAAN AWAM		
49595	CHEK SOON WEI	BE HONS (UKM) (CIVIL & STRUCTURAL, 2007)
37943	LOKMAN BIN AMIR HAMZAH	BE HONS (UITM) (CIVIL, 2007)
21645	MOHD KHAIRULFADHLAN BIN MOHD DZURRI	BE HONS (UTM) (CIVIL, 2004)
26490	SITI AIANE BT MD YUNOS	BE HONS (UTM) (CIVIL, 2000)
58649	TAN HOW CHIN	BE HONS (CURTIN) (CIVIL & CONSTRUCTION, 2008)
54504	TAY CHOON GUAN	BE HONS (HERTFORDSHIRE) (CIVIL, 2000)
5242	MOHD ZAHARI BIN MANSOR	BE HONS (LIVERPOOL) (CIVIL, 1978)
KEJURUTERAAN ELEKTRIK		
53752	MOHAMAD ZAKRI BIN ABDUL TALIB	BE HONS (UTM) (ELECTRICAL, 2006)
18354	NAZMAN IDIS BIN MOHD AMAN	BE HONS (UTM) (ELECTRICAL, 2001)
KEJURUTERAAN BAHAN		
56600	MILKCUES JASPER	BE HONS (USM) (MATERIALS, 1999)
37287	SRIMALA A/P SREEKANTAN	BE HONS (USM) (MATERIALS, 1999) MSC (USM) (MATERIALS, 2001) PHD (USM) (MATERIALS, 2006)
KEJURUTERAAN MEKANIKAL		
17040	AMIR HAMZAH BIN JA'AFAR	BE HONS (UITM) (MECHANICAL, 1997)
38070	ARDY SUHAIDY BIN MUSTAPHA	BE HONS (UM) (MECHANICAL, 2004)
41310	EMI HAFIZZUL BIN JAMALUDDIN	BE HONS (UTM) (MECHANICAL, 2006)
14938	WONG YII HUI	BSC (SOUTH DAKOTA STATE) (MECHANICAL, 1985) MSC (SOUTH DAKOTA STATE) (MECHANICAL, 1987)

PERMOHONAN BARU / PEMINDAHAN AHLI

Persidangan Majlis IEM yang ke-**387** pada **20 April 2013** telah meluluskan sebanyak **503** ahli untuk permohonan baru dan permindahan ahli. Berikut adalah senarai ahli mengikut disiplin kejuruteraan:

DISIPLIN	GRED KEAHLIAN							
	FELO	AHLI	SISWAZAH	"INCORPORATED"	"AFFILIATE"	"ASSOCIATE"	SISWA	JUMLAH
Aeronautikal								
Aeroangkasa			2					**2**
Pertanian			1					**1**
Automotif								
Biokimia								
Bioperubatan								
Bioteknologi								
Perkhidmatan Bangunan								
CAD/CAM								
Kimia		1	12				13	**26**
Awam	1	15	55				62	**133**
Komunikasi								
Komputer			4					**4**
Sistem Komputer								
Komputer & Komunikasi								
Pembinaan								
Sistem Kawalan								
Elektrikal & Elektronik							1	**1**
Elektrikal		7	34				43	**84**
Elektronik		1	22				78	**101**
Elektronik & Kawalan Instrumentasi								
Elektromekanikal								
Tenaga								
Alam Sekitar			1				19	**20**
Proses & Makanan								
Geoteknik								
Lebuhraya		1						**1**
Industri			1					**1**
Sistem Maklumat								
Teknologi Maklumat								
Instrumentasi								
Kawalan & Instrumentasi			1					**1**
Pembuatan							5	**5**
Sistem Pembuatan								
Marin		1						**1**
Bahan		1	1					**2**
Metallurgi								
Mekanikal		7	43	1			58	**109**
Mekatronik			1				4	**5**
Mikroelektronik								
Mineral								
Sumber Mineral								
Perlombongan								
Arkitek Naval								
Petroleum		1	2					**3**
Polimer								
Pengeluaran								
Struktur							1	**1**
Telekomunikasi							1	**1**
Sumber Air		1						**1**
JUMLAH	**1**	**36**	**180**	**1**			**285**	**503**

Senarai nama ahli dan kelayakan adalah seperti di bawah. Institusi mengucapkan tahniah kepada ahli yang telah berjaya.

Ir. Prof Dr Jeffrey Chiang Choong Luin
Setiausaha Kehormat
Institusi Jurutera Malaysia

KEAHLIAN

Nota: *Ini adalah sambungan senarai nama daripada isu Mei 2013 yang diterbitkan di muka surat 55.*

No. Ahli	Nama	Kelayakan
KEJURUTERAAN KIMIA		
58085	MOHD UZAINI BIN MOHD ARIFF	B.E.HONS.(MALAYA) (CHEMICAL, 2006)
58635	NATALIE LOUISE SHIM FRANCIS	B.E.HONS.(MALAYA) (CHEMICAL,11)
58670	RABIATUL AZLIN BINTI MOHAMAD SUPUAN	B.E.HONS.(UITM) (CHEMICAL,07)
58709	RAZUANA BINTI RAHIM	M.E.(UM)(SAFETY,HEALTH & ENVIRONMENT,09) B.E.HONS.(MALAYA) (CHEMICAL,07)
58676	SAIFUL AZWAN BIN AZIZAN	B.E.HONS.(UTM)(CHEMICAL,10)
58043	SHAHRIZAL HISHAM BIN ASRI	B.E.HONS.(UTM) (CHEMICAL-GAS,2004)
58052	THINAKARAN A/L VADIVELOO	B.E.HONS.(UMS) (CHEMICAL,2007)
58044	WONG MING WEI, FRANCIS	B.E.HONS.(CURTIN) (CHEMICAL,2008)
KEJURUTERAAN AWAM		
58087	ABDUL HAFIZ BIN MAT ALIF	B.E.HONS.(UITM) (CIVIL,2012)
58666	ABDULLAH HALIMI BIN AZIZ ZUDDIN	B.E.HONS.(UPM)(CIVIL,08)
58652	AHMAD SABARE BIN JAMALUDIN	B.E.HONS.(UTM)(CIVIL,02)
58115	AINA YAZWIN BINTI MOHAMAD KHAIRI	B.E.HONS.(MELBOURNE) (CIVIL,2007)
58106	'AINAA HAZWANY BINTI AMRAN	B.E.HONS.(UTM) (CIVIL,2011)
58046	AIZAT BIN ALIAS	B.E.HONS.(UTM) (CIVIL,2008)
58048	ARZANIZAM BIN MOHAMMAD	B.E.HONS.(UTM) (CIVIL,1996)
58677	AZLINA BINTI ISMAIL	B.E.HONS.(UITM)(CIVIL,06)
58657	AZRUL HAFIZAL BIN MAHADI	B.E.HONS.(UTM)(CIVIL,07)
58013	CHAU SHEN YUAN	B.E.HONS.(UTAR) (CIVIL,2010)
58020	CHIA WEI ZHONG	B.E.HONS.(ADELAIDE) (CIVIL & ENVIRONMENTAL,2012)
58723	CHUAH POOI YEE	B.E.HONS.(UPM)(CIVIL,09)
58681	EDDY BIN MISRUM	B.E.HONS.(UMP)(CIVIL,11)
58690	FADHLI SHAZLAN BIN ABDUL RAHMAN	M.E.(UMIST)(CIVIL,04)
58053	FAUZAN IRWADY BIN AHMAD TAJIDIN	B.E.HONS.(UTM) (CIVIL,2012)
58112	FLORENCE SINDUN ANAK DENIS GASAN	B.E.HONS.(UNIMAS) (CIVIL,2009)
58014	GOH WAI KHUEN	B.E.HONS.(SWINBURNE) (CIVIL,2008)
58022	HASRUL NIZAM BIN AHMAD	B.E.HONS.(UKM) (CIVIL & STRUCTURAL,2001)
58109	HAZRUL AIZAT BIN MOHAMMAD	B.E.HONS.(UTM) (CIVIL,2005)
58631	HOW WIL MIN	B.E.(MONASH)(CIVIL,07)
58089	KAMAL ZAHIDDIN BIN KAMARUDIN	B.E.HONS.(UITM) (CIVIL,2011)
58110	KHAIRULLIZAM BIN ABU	B.E.HONS.(UTM) (CIVIL,2005)
58679	KHOR WEI HUAT	B.E.HONS.(USM)(CIVIL,10)
58695	LAI SOO CHIN	B.E.HONS.(KUITTHO)(CIVIL,06)
58716	LAU CHEE HOE	B.E.HONS.(KLIUC)(CIVIL,09)
58648	LEE HOOI CHIE	B.E.HONS.(UTM)(CIVIL,11)
58108	LEE SIAW YIAN	B.E.HONS.(UNISEL) (CIVIL,2007)
58669	LIM EN KAI	B.E.HONS.(UKM)(CIVIL,09)
58018	LIM MENG TECK, TONY	B.E.HONS.(UMS) (CIVIL,2012)
58015	LING ZING TIENG	B.E.HONS.(UNIMAS) (CIVIL,2011)
58632	MARILYN JILIKO	B.E.HONS.(UITM)(CIVIL,09)
58672	MOHAMAD FIRDAUS BIN ABU BAKAR	B.E.HONS.(UTM)(CIVIL,08)
58054	MOHAMAD NIIZAR BIN ABDURAHMAN	B.E.HONS.(KUITTHO) (CIVIL,2003)
58678	MOHAMMAD AMIRULKHAIRI BIN ZUBIR	B.E.HONS.(UKM)(CIVIL,07)
58049	MOHAMMAD FADHLI BIN AHMAD	ADV.DIP.(ITM) (CIVIL,1994)
58698	MOHAMMAD NORFAIZAL BIN SHAHARIR	M.SC.(IMPERIAL COLL) (SOIL MECHANICS & ENVIRONMENTAL GEOTECHNICS,10) B.E.HONS.(ROYAL MELBOURNE)(CIVIL,07)
58006	MOHD AZFAEZUL BIN MOHAMED AZMI	B.E.HONS.(MALAYA) (CIVIL,2008)
58091	MOHD KHAIRIL ANUAR BIN MOHAMAD	B.E.HONS.(UITM) (CIVIL,2005)
58088	MOHD KHAIRUL ANWAR BIN MOHD SHARIP	B.E.HONS.(UITM) (CIVIL,2011)
58692	MOHD KHAIRUN HAFIZ BIN BAHARUDIN	B.E.HONS.(UMP)(CIVIL,09)
58055	MOHD SHALAHUDDIN BIN ADNAN	B.E.HONS.(USM) (CIVIL,2006)
58047	MUHAMAD SYAMSUL BIN CHE SU	B.E.HONS.(KUITTHO) (CIVIL,2006)
58671	MUHAMMAD HELMI BIN RAMLI	B.E.HONS.(UTM)(CIVIL,09)
58016	NAZMI DHIYAUDDIN BIN CHE JAMALUDIN	B.E.HONS.(UTM) (CIVIL,2009)
58105	NOOR SABRINA BINTI ZAHARUDIN	B.E.HONS.(UTP) (CIVIL,2007)
58017	NOORHANA BINTI NOORDIN	B.E.HONS.(MALAYA) (CIVIL,2003)
58643	NOR AZLIN BINTI JOHARI	B.E.HONS.(UTM)(CIVIL,06)
58654	NORFAIZAH BTE MD ZIN	B.E.HONS.(MALAYA)(CIVIL,02)
58050	NORSHAFIK BIN SHAHAR	B.E.HONS.(UTM) (CIVIL,2011)
58023	RAHIMAH BINTI AHMAD	B.E.HONS.(UITM) (CIVIL,2004)
58093	RUSDI BIN RUSLI	B.E.HONS.(USM) (CIVIL,2002)
58019	SIM TZE WOON, JEFFREY	B.E.HONS.(SWINBURNE) (CIVIL,2011)
58649	TAN HOW CHIN	B.E.HONS.(CURTIN)(CIVIL,08)
58739	TIONG VUI YEN	M.E.HONS.(BIRMINGHAM) (CIVIL,10)
58650	TIU SOO PHUI	B.E.HONS.(MALAYA)(CIVIL,08)
58624	WAN AISHAH BINTI WAN HASHIM	B.E.HONS.(KUITTHO)(CIVIL,06)
58021	WAN MUSTAFA BIN WAN ALI	B.E.HONS.(USM) (CIVIL,2001)
58005	WAN ROHANINA BINTI WAN IBRAHIM	B.E.HONS.(UITM) (CIVIL,2005)
58051	WONG MING EN	B.E.HONS.(KLIUC) (CIVIL,2009)
58668	ZAINI BIN ABD KARIM	B.E.HONS.(UITM)(CIVIL,02)
58004	ZAINI BIN IBRAHIM	B.E.HONS.(UTM) (CIVIL,2012)
KEJURUTERAAN KOMPUTER & TELEKOMUNIKASI		
58039	SITI KHAIRUNNIZA BEJO	B.E.HONS.(UPM) (COMPUTER SYSTEM & COMMUNICATIONS,2002)
KEJURUTERAAN ELETRIK		
58008	ABDILLAH BIN MOHAMED	B.E.HONS.(UTM) (ELECTRICAL,2006)
58080	ABDUL RAHMAN BIN HASSAN	B.SC.(ALBERTA) (ELECTRICAL,2011)
58704	ABU THALHAH BIN MOHD LAZIM	B.E.HONS.(MALAYA) (ELECTRICAL,07)
58094	AHMAD BIN ISMAIL	B.E.HONS.(UMS) (ELECTRICAL & ELECTRONIC,2002)
58684	AIDALINA BINTI MAHMUD	B.E.HONS.(KUTKEM) (ELECTRICAL,06)
58722	ALIAS BIN KHAMIS	M.SC.(UPM) (ELECTRICAL POWER,07) B.E.HONS.(UITM) (ELECTRICAL,03)
58113	AZRAN AZHIM BIN NOOR AZMI	B.E.(TOKUSHIMA) (ELECTRICAL & ELECTRONIC,2003)
58097	CHAN YI VON	B.SC.(WESTERN MICHIGAN) (ELECTRICAL,2012)
58740	CHIN KOK WEI	B.E.HONS.(HERTFORDSHIRE) (ELECTRICAL,02)
58101	CHONG SUNG HUI, DANIEL	B.E.HONS.(UTAR) (ELECTRICAL & ELECTRONIC,2012)
58636	DONNY PIUS	B.E.HONS.(UMS) (ELECTRICAL,05)
58060	FAIZAL BIN MOHD ARIFIN	B.E.HONS.(UTM) (ELECTRICAL,2006)
58638	HIEW ZHI CHEUN	B.E.HONS.(UMS) (ELECTRICAL,06)
58065	IDRIS BIN MOHD NOOR	B.E.HONS.(UTM) (ELECTRICAL,2000)
58680	JACKSON JUSTIN	B.E.HONS.(UMS) (ELECTRICAL,06)
57998	KHOR JEEN GHEE	B.E.HONS.(LEICESTER) (ELECTRICAL & ELECTRONIC,1996)
58655	LEONG TZIN SIANG	B.E.HONS.(MONASH) (ELECTRICAL,10)
58736	MOHAMAD HANIF BIN ISMAIL	B.E.HONS.(UTM) (ELECTRICAL,04)
58647	MOHAMAD HASRUZAIRIN BIN MOHD HASHIM	B.E.HONS.(UTM) (ELECTRICAL,10)
58642	MOHAMAD HELMEE BIN MOHD RORTI	B.E.HONS.(UITM) (ELECTRICAL,08)
58056	MOHAMAD NAWAWI BIN ISMAIL	B.E.HONS.(UTM) (ELECTRICAL,2010)
58646	MOHD FAHMI BIN ABDUL HALIM	B.E.HONS.(UITM) (ELECTRICAL,10)
58715	MOHD HANIF BIN ZAHARI @ JOHARI	B.E.HONS.(UTEM) (ELECTRICAL,11)
58011	MOHD KHAIRIL AKMAL BIN AHMAD	B.E.HONS.(UITM) (ELECTRICAL,2011)
58674	MOHD ZAIM BIN MOHD NAZARI	B.E.HONS.(UTM) (ELECTRICAL,09)
57996	MOHD. FARIDZI BIN JAMIL ABD. NAZIR	B.E.HONS.(UTEM) (ELECTRICAL,2011)
58007	MUHAMAD SAFUAN BIN ISHAK	B.E.HONS.(UTM) (ELECTRICAL,2008)
58697	MUHAMMAD ZAIDI BIN MAHMOOD	B.E.HONS.(UTM) (ELECTRICAL,12)
58660	NABILAH BINTI ABDUL RASHID	B.E.HONS.(MALAYA) (ELECTRICAL,09)
58712	NASROL FIRDAUS BIN ABDUL WAHAB	B.E.HONS.(UKM) (ELECTRICAL,07)
58721	NASRUNG BIN NURBA	B.E.HONS.(UMP) (ELECTRICAL,09)
58062	NG THAI LIM	B.E.HONS.(UTAR) (ELECTRICAL & ELECTRONIC,2009)
58683	NORHAZIRAH BINTI JAAFAR	B.E.HONS.(UTEM) (ELECTRICAL,11)
58735	OW KEE TEIK	B.E.HONS.(UNITEN) (ELECTRICAL,12)
58708	RAMESH KUMAR A/L SIVALINGAM	B.E.HONS.(GLASGOW) (ELECTRICAL,99)
58634	RIDWAN BIN MOKHTAR	B.E.HONS.(UITM) (ELECTRICAL,11)
58092	SALLEH MURSHIDI BIN BASHARUDIN	B.E.HONS.(KUITTHO) (ELECTRICAL,2005)
58734	SATHYAN A/L ANBALAKAN	B.E.HONS.(UTM) (ELECTRICAL,08)
58626	SHARIMAN EFFENDI BIN SHARANI	B.SC.(HANYANG) (ELECTRICAL,08)
58688	SIAU JIN HUEI	B.E.HONS.(UTAR) (ELECTRONIC,08)
58694	SITI AMANIAH BINTI MOHD CHACHULI	M.E.(UM)(INDUSTRIAL ELECTRONICS &CONTTROL,12) B.E.HONS.(UKM) (ELECTRICAL,08)
58001	SITI BAHGIA BINTI ARIFFIN	B.E.HONS.(UTP) (ELECTRICAL & ELECTRONIC,2006)
58059	SITI NORJANNA BINTI JAMARI	B.E.HONS.(UKM) (ELECTRICAL & ELECTRONIC,2007)
58058	STENDLEY ANAK BUSAN	B.E.HONS.(UITM) (ELECTRICAL,2009)
57994	SYAHIRAH BINTI MOHD SAHAR	B.SC.(KOREA UNI) (ELECTRICAL,2009)
58641	SYED SHAHRIN JAMALULLAIL BIN SYED AHMAD	B.E.HONS.(UTM) (ELECTRICAL,12)
58682	TAN HAK VUI, MALEK	B.E.HONS.(UMS) (ELECTRICAL,08)
58063	TAN WEE SER	B.E.HONS.(UNITEN) (ELECTRICAL & ELECRONIC,2010)
58009	TEH KHEE LEONG	B.E.HONS.(UTAR) (ELECTRICAL & ELECTRONIC,2011)
58057	WAN YUSRIZAL BIN WAN YUSOFF	B.E.HONS.(UTM) (ELECTRICAL & ELECTRONIC,2006)
58064	WIDIASTUTY BINTI JONNAIDY JUSI	B.E.HONS.(UNITEN) (ELECTRICAL & ELECRONIC,2007)
58012	WONG HOWE NGIING	M.E.HONS.(LEEDS) (ELECTRONIC & ELECTRICAL,2011)
58010	YUSUF BIN MOHD SALLEH	B.E.HONS.(UTM) (ELECTRICAL,2009)
58637	ZENO PAULUS	B.E.HONS.(KUTKEM) (ELECTRICAL,06)

58061	ZULKIFLI BIN MOHD ALI	B.E.HONS.(UNITEN) (ELECTRICAL & ELECRONIC,2008)

KEJURUTERAAN ELEKTRONIK

58667	AFIZIE BIN RADZALI	B.E.HONS.(UITM) (ELECTRICAL,10)
58627	CHAN KOK LOONG	B.E.HONS.(UCSI) (ELECTRONIC,11)
58098	CHONG CHI CHUNG	B.E.HONS.(MMU) (ELECTRONICS-TELECOMMUNICATIONS,2002)
58000	FARAH DIANA BINTI MAHAD	B.E.HONS.(UTM) (ELECTRICAL-TELECOMMUNICATIONS,2009)
58639	HO FENG NAM, FELIX	B.E.HONS.(KUTKEM) (ELECTRONIC,06)
58116	HODA REZAIE HASAN	M.E.(UTM) (ELECT-ELECTRONIC & TELECOMM, 11) BE (AZAD UNI, IRAN) (ELECTRICAL, 07)
58675	HUDA ADIBAH BINTI MOHD RAMLI	M.SC.(UTM)(COMPUTER SCIENCE,12) B.E.HONS.(UITM)(COMPUTER & INFORMATION,03)
58633	MOHD AIZAT BIN SALIM	B.E.HONS.(UTM) (ELECTRONIC,09)
58724	MOHD FIRDHAUS BIN RAMDAN	B.E.HONS.(UTHM) (ELECTRICAL,10)
58081	MOHD KHAIRUL MUZHAFAR BIN MD NOOR	B.E.HONS.(UTHM) (ELECTRICAL,2010)
58706	MOHD PAWZI BIN HJ MOHD SADRI	B.SC.HONS.(UTM) (ELECTRICAL,98)
58066	MOHD ZULFAHMI BIN HARUN	B.E.HONS.(UTM) (ELECTRICAL & ELECTRONIC,2012)
58703	NORBAYAH BINTI YUSOP	M.SC.(UITM) (TELECOMMUNICATION & INFORMATION,12) B.E.HONS.(UTEM) (ELECTRONIC,07)
58082	NOREHA ABDUL MALIK	B.E.HONS.(UTM) (ELECTRICAL-MEDICAL ELECTRONICS,2001)
58104	NURUL FADZLIN HASBULLAH	B.E.HONS.(CARDIFF) (ELECTRICAL & ELECTRONIC,2001)
58090	NURUL HUDA BINTI ABD RAHMAN	M.E.(SURREY) (ELECTRONIC,2008)
58084	SOFYANSHAH BIN JUBLEE	B.E.HONS.(USM) (ELECTRONIC,2005)
58037	TIE SIANG FUI	B.E.HONS.(UTM) (ELECTRICAL & ELECTRONIC,2011)
58079	TIEN KOK LANG	B.E.HONS.(HERTFORDSHIRE) (ELECTRICAL & ELECTRONIC,1997)
58651	YAZMIN BINTI MOHD YUSOFF	B.E.HONS.(MMU) (ELECTRONIC,09)
58083	ZAINAL ABIDIN BIN OTHMAN	B.E.HONS.(SUSSEX) (ELECTRONIC,1990)
58731	ZUBAIR BIN JUZAR	B.E.HONS.(MONASH) (ELECTRICAL & COMPUTER SYSTEMS,12)

KEJURUTERAAN INDUSTRI

58673	AHMAD KHADRI BIN ABDUL RAZAK	M.E.(UKM)(MECHANICAL,12) B.SC.(PITTSBURGH) (INDUSTRIAL,96)

KEJURUTERAAN KAWALAN & INSTRUMENTASI

58095	YAZID BIN ABDUL MALIK	B.E.HONS.(KUITTHO) (ELECTRICAL,2006)

KEJURUTERAAN PEMBUATAN

57999	HERUL AZRUL BIN SHAF'I	B.E.HONS.(UTEM) (MANUFACTURING PROSESSES,2010)
58700	MOHD ZAIM BIN MOHD ZUKERI	M.E.(UTHM)(MECHANICAL,11) B.E.HONS.(UNIMAP) (MECHANICAL,09)
58003	MOHD ZULHELMI BIN ABDULLAH	B.E.HONS.(UIAM) (MANUFACTURING,2008)
58686	NG TAN CHING	B.E.HONS.(UTEM) (MANUFACTURING,09)
58042	OOI MING ERH	B.E.HONS.(MALAYA) (MANUFACTURING,2011)

KEJURUTERAAN BAHAN

58036	AHMAD FITRIE BIN MOHD ITHNIN	B.E.HONS.(UIAM) (MATERIALS,2012)
58693	WAN MOHD SYAHRIR BIN WAN MOHAMAD	B.E.HONS.(USM) (MATERIALS,07)

KEJURUTERAAN MEKANIKAL

58696	ADAM VOO BIN ABDULLAH	B.SC.(OKLAHOMA) (MECHANICAL,00)
58073	AIZUDDIN BIN ABDUL HALIM	B.E.HONS.(UPNM) (MECHANICAL,2011)
58625	ALIRNUS BIN CHE MAT	B.E.(TAKUSHOKU) (MECHANICAL,06)
58729	ATIKAH BINTI HAJI AWANG	B.E.HONS.(UNITEN) (MECHANICAL,00)
58100	BAIZURA BINTI ZUBIR @ ZUBAIR	B.E.HONS.(USM) (MECHANICAL,2001)
58031	CHEE WOON HO	M.E.HONS.(NOTTINGHAM) (MECHANICAL,2012)
58691	CHIA WAN HOONG	B.E.HONS.(UTAR) (MECHANICAL,10)
58032	CHONG WOON PHIN	B.E.HONS.(UNITEN) (MECHANICAL,2012)
58640	CHOR JIA HAO	B.E.HONS.(UTAR) (MECHANICAL,10)
58707	CHUA JUN YEE	M.E.HONS.(IMPERIAL COLL) (MECHANICAL,11)
58645	GEOJU GNANADHAS	B.E.HONS.(UMS) (MECHANICAL,12)
58732	GOH CHUEN SENG	B.E.HONS.(QUEENSLAND) (MECHANICAL,08)
57997	GOH WAE FAE, IGNATIUS	B.SC.HONS.(NORTHERN ARIZONA) (MECHANICAL,2012)
58711	GUNASILAN A/L MANAR	M.SC.(ISAE)(AEROSPACE MECHANICS & AVIONICS,10) B.E.HONS.(UTM) (MECHANICAL,07)
58028	HAFIZZUDIN BIN KASIM	B.E.HONS.(UNITEN) (MECHANICAL,2012)
58102	KASDI ANAK PULAI	B.E.HONS.(UTM) (MECHANICAL-MARINE TECHNOLOGY,2002)
57993	KHAIRUDDIN BIN MOHD ROSLI	B.E.HONS.(KUITTHO) (MECHANICAL,2005)
58107	KHOO YIN CHENG, ADELINE	B.E.HONS.(UNITEN) (MECHANICAL,2010)
58111	KOAY TZE HOW	B.SC.(MISSOURI) (MECHANICAL,2004)
58024	LEE CHOON CHOW, KELVIN	B.E.HONS.(MMU) (MECHANICAL,2011)
58689	LEE JIAN JONG	B.E.HONS.(UTAR) (MECHANICAL,11)
58653	LEONG YAN FOON	B.E.HONS.(MONASH) (MECHANICAL,11)
57995	LIM GUAT KOOI	B.E.HONS.(UKM) (MECHANICAL,2005)
58658	LUM WAI LEONG	B.SC.(CALIFORNIA STATE) (MECHANICAL,07)
58710	MAXMILLAN BOB JR	B.E.HONS.(UTM) (MECHANICAL,06)
58665	MD FIKRI BIN ABDULLAH	B.E.HONS.(PORTSMOUTH) (MECHANICAL,97)
58714	MOHAMAD IZZAT BIN MOHAMAD YUDEN	B.E.HONS.(UMP) (MECHANICAL,09)
58071	MOHAMMAD THAQEEF BIN NOOR HISHAM	B.E.(WOLLONGONG) (MECHANICAL,2012)
58699	MOHD AZHARI BIN MOHD RODZI	B.SC.(RENSSELAER POLY) (MECHANICAL,12)
58070	MOHD FAROUK EZMAN BIN MOHD ZUBIR	B.E.HONS.(USM) (MECHANICAL,2002)
58656	MOHD HAFIZ BIN ABDULLAH	B.E.HONS.(MALAYA) (MECHANICAL,10)
58663	MOHD HASHIM BIN ABD RAZAK	B.SC.HONS.(UTM) (MECHANICAL,98)
58002	MOHD HASRAT BIN SABIRAN	B.E.HONS.(UTM) (MECHANICAL-MARINE TECHNOLOGY,2011)
58727	MOHD IFSYAM HAZWAN BIN MOHD IBRAHIM	B.E.HONS.(UTM) (MECHANICAL,10)
58725	MOHD IKHWAN BIN SAMSUDDIN	B.E.HONS.(UITM) (MECHANICAL,08)
58720	MOHD IZWAN BIN NORDIN	B.E.HONS.(MALAYA) (MECHANICAL,11)
58662	MOHD NAIM BIN AWANG	B.E.HONS.(UTM) (MECHANICAL,06)
58628	MOHD NASIR BIN JAMALUDIN	B.E.(GANNON) (MECHANICAL,89)
58099	MOHD NASRUDDIN BIN AB MUAID	B.E.HONS.(USM) (MECHANICAL,2001)
58026	MOHD NAZMIN BIN MASLAN	B.E.HONS.(UTP) (MECHANICAL,2010)
58027	MOHD RIDHUAN BIN ISMAIL	B.E.HONS.(KUITTHO) (MECHANICAL,2006)
58702	MOHD RIZAL ABDUL RASHID	B.E.HONS.(UNIMAS) (MECHANICAL,03)
58029	MOHD SIDDIQ BIN ABDUL RAHIM	B.E.HONS.(UITM) (MECHANICAL,2011)
58069	MOHD TAUFIK BIN ARSHAD	M.E.HONS.(LOUGHBOROUGH) (MECHANICAL,2008)
58067	MOHD ZIKRI BIN AHMAD ABUSTAMAN	B.E.HONS.(UTP) (MECHANICAL,2009)
58033	MUHAMAD HELMI BIN JASAN AHPANDI	B.E.HONS.(UPNM) (MECHANICAL,2012)
58738	MUHAMMAD BAHEEJ BIN MAZLI	B.E.HONS.(MALAYA) (MECHANICAL,12)
58072	MUSLI BIN MOHAMMAD	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL,2002)
58078	NG KIM HAI	B.E.HONS.(UPM) (MECHANICAL,2004)
58664	NOR ASHIMY BIN MOHD NASIR	B.E.HONS.(KUITTHO) (MECHANICAL,04)
58068	NOREFFENDY TAMALDIN	B.SC.(HARTFORD) (MECHANICAL,1998)
58629	NUR AKMAL HAKIM BIN JASNI	B.E.HONS.(UTHM) (MECHANICAL,10)
58096	ONG PEI PEI	B.E.HONS.(UPM) (MECHANICAL,2011)
58701	PAN KHEE KEONG	B.E.HONS.(LIVERPOOL JOHN MOORES)(MECHANICAL,99)
58737	RIO ANAK JALIT	B.E.HONS.(UTHM) (MECHANICAL,12)
58114	SAFWAN BIN DON	B.E.HONS.(MALAYA) (MECHANICAL,2010)
58025	SIDHARTH PILLAI A/L MURALEDHARAN	B.E.HONS.(MONASH) (MECHANICAL,2012)
58086	SIK CHIN KHUEN	B.E.HONS.(UTAR) (MECHANICAL,2011)
58687	SIVAPRAKASH A/L MUNIANDI	B.E.HONS.(UNITEN) (MECHANICAL,04)
58030	SUHAIRI BIN ISMAIL	B.E.HONS.(UTM) (MECHANICAL,2003)
58077	SYAHRIL ANUAR BIN MD REJAB	B.E.HONS.(UTM) (MECHANICAL-INDUSTRIAL,2000)
58074	SYAZLAN BIN MOHD HISYAM	B.E.HONS.(UTHM) (MECHANICAL,2008)
58076	SYED AHMAD ZAKI BIN SAID MADEEN	B.E.HONS.(UNITEN) (MECHANICAL,2008)
58075	SYLVESTER GINDAN	B.SC.HONS.(UTM) (MECHANICAL,2001)
58630	TAN PINH KYEOW	B.E.(TASMANIA) (MECHANICAL,09)
58659	TAN WAI HONG	B.E.HONS.(UTAR) (MECHANICAL,11)
58719	TUN IZUDDIN ROHIMI BIN ARIFFIN	B.E.HONS.(UNISEL) (MECHANICAL,12)
58730	WAN ABDULLAH BIN WAN MUSTAFA	B.E.HONS.(UTM) (MECHANICAL,12)
58713	WAN KHAIRUL SHAHRIZAD BIN WAN SHAMSUDIN	B.E.HONS.(UTM) (MECHANICAL,08)
58685	WONG KAM VENG, WILFRED	B.E.HONS.(WESTERN AUSTRALIA)(MECHANICAL,12)
58726	ZAIRILAFDI BIN ZAMRI	B.E.HONS.(UPM) (MECHANICAL,05)
58661	ZAKIMAN BIN ZALI	M.E. (UKM) (MANUFACTURING SYSTEMS,10) B.E.HONS.(UTM) (MECHANICAL,00)

KEJURUTERAAN MEKATRONIK

58040	MOHD ZOOLFADLI BIN MD SALLEH	B.E.HONS.(UIAM) (MECHATRONICS,2009)
58103	SALMIAH BINTI AHMAD	B.E.HONS.(UIAM) (MECHATRONICS,2001)

KEJURUTERAAN METALUGI

58733	PREMA A/P SIVANATHAN	B.E.HONS.(UNIMAP) (METALLURGY,12)

KEJURUTERAAN STRUKTURAL

58644	MUTHUKUMARAN PARANJOTHY	M.E.HONS.(SHEFFIELD) (STRUCTURAL,12)

DANA BANGUNAN

Pengumuman yang ke 62

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

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NO.	MEM. NO.	DETAILS
1	08692	MOHD SABRI BIN ZAKARIA
2	09988	KOSHY NAINAN S/O THOOMPUNKAL KOSHY NAINAN
3	39230	AZWANIZAM BIN CHE ABD RAHMAN
4	45265	MUKHLIS CHUA @ CHUA CHING KOK
5	11930	PANG SU SIONG
6	04871	HEW WAI THO
7	25093	WONG KIE HIEN
8	01950	DR. KUAK YONG CHEW
9	05491	ABDUL NASSER BIN ABDUL WAHAB
10	03530	LEE CHONG TEIK
11	09016	MUSA BIN OMAR
12	10290	BAHARI BIN MOHAMED
13	12893	LEONG YEE LUNG
14	04593	LAU ENG LIM
15	09881	SDR. WONG HOCK CHUAN
16	13655	NGU PIEW CHOO
17	54220	NG YOKE FEI
18	16323	MOHAMED AZMI BIN ABDUL KARIM
19	06722	TIONG HUO CHIONG
20	04006	CHIM SIEW CHOON
21	39142	YULNAIKEY BIN MOHD YUSOFF
22	52475	KHOR LOONG HUAT
23	13434	DATO' TEO CHIANG KOK
24	24713	SHIA SIN SAN
25	21162	CHEW TAT SEN
26	05727	TAN SIEW KHENG
27	09362	AHMAD ASRI BIN ABDUL HAMID
28	11937	DATO' LEW CHIN HOI
29	00042	TAN YORK HING
30	04183	CHENG KIN MING
31	07657	TAN KOK HENG
32	10509	GNANANANTHAM KANDIAH
33	01465	DATO' CHUA SOON POH
34	02428	DATO' HAMZAH BIN HASAN
35	08253	TAN CHUNG KEN
36	09654	RAJASEGARAN S/O PALANISAMY
37	05709	SDR. NIK AB RAHIM BIN NIK ISMAIL
38	10449	LIEW KIM MING, JUSTIN
39	04077	TEH GEK HUAT
40	04937	YUSOF HOLMES BIN ABDULLAH
41	11620	KASIM BIN GANI
42	13996	SDR. KUHANESWARAN A/L S. GANESHWARAN
43	17049	NOOR AZAM BIN MD SAAD
44	25658	LIEW VOON HING
45	29666	TEH ENG HUAT
46	39965	DOO TAI WUI
47	02820	TAN LEK LEK
48	00684	DATO' YU WEN CHIEH
49	10340	WONG SHU VUI, ANTHONY
50	08592	CHIEW HUEY SHENG
51	01156	CHOW CHEW HOONG
52	09624	TIU JON HUI
53	02224	SELVARATNAM S/O SINNADURAI
54	13475	MOHAMAD SHARIF BIN MOK SOM
55	14400	TEO JIN ANN
56	13453	TEOH KENG ENG
57	34326	GAN SIEW CHEOK
58	47102	LEE MENG TZE
59	03773	TEH KIAK SENG
60	03457	HARBANS SINGH S/O KISHAN SINGH
61	37011	PRAKASH A/L THIRUNAVAKARASU
62	12697	AHMAD NORNADZMI BIN DZULKARNAIN
63	12994	SUZANA BTE DAUT
64	06216	LOKE HOON BOO
65	02404	CHAN YOON FATT
66	34426	ZULKARNAIN BIN MOHD YUSOF
67	14451	ANIPAH BTE ANSARI
68	06424	WONG, RORY KIM
69	04210	LIM KWEE TIONG
70	13552	ABI SOFIAN BIN ABDUL HAMID
71	23964	MU MUNG SIUNG
72	07514	GAN POH KHEE
73	18751	ABDUL AZIZ BIN AHMAD
74	42013	MOHD REDZUAN BIN ISMAIL
75	10132	CHONG CHOO LING
76	19621	CHONG LEH KHENG
77	13911	NG KIM CHU
78	36364	HARTINI BINTI ALI
79	05685	LAU KIN SWA
80	08983	SAW POI TEE
81	12572	KHUSAIRI BIN WAHIJAN
82	25505	MOHAMMAD ATIQURRAHMAN BIN KHAIDZIR
83	09157	ACADEMICIAN DATO' IR. PROF. DR CHUAH HEAN TEIK

Note: *This is a continuation of the name list in May Issue.*

Pengumuman yang ke 63

SENARAI PENDERMA KEPADA WISMA DANA BANGUNAN IEM

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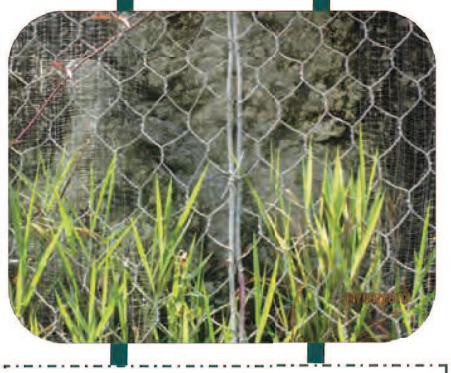
NO.	MEM. NO.	DETAILS
1	47623	ABU HANIFAH BIN HAJI ABDULLAH
2	19186	ADRIAN NORBERT LEE
3	13471	AHMAD KAMIL BIN ARSHAD
4	39140	AHMAD ZAKI BIN MOHD HASSAN
5	04812	ARIFFIN LEE BIN ABDULLAH @ LEE KIM SENG, FRANCIS
6	52373	AZRIN BIN ABU KASIM
7	17003	BOON HIN NAN
8	39077	CHAIRIL BAHARI BIN IBRAHIM
9	22916	CHAN CHEE KIT
10	03762	CHAN SWEE LOON
11	24819	CHAN WAN HOE
12	10012	CHANAN SINGH A/L SANTA SINGH
13	16716	CHANG HENG YONG
14	03838	CHEAH BOON HWA
15	02166	CHEN CHIN PENG
16	06022	CHEN KEUN HOONG
17	01332	CHEN SENG CHONG
18	36878	CHIA CHE HIENG
19	03950	CHIN NYOK KIEN
20	13505	CHUA BOON HWEE
21	24198	CHUAH CHIN SENG
22	44154	CHUE SZE LYN
23	27544	DATO' ABU BAKAR BIN AHMAD
24	02107	DATO' MOHD NOOR BIN SALLEH
25	27553	DURAIDA BINTI SALLEH
26	32678	HJ. WAN SALLEHUDDIN BIN WAN ZAKIUDDIN
27	01501	INDERJIT SINGH PURBA
28	01896	JAYASEKAR S/O RENGANATHAN
29	07160	KOH JIT HUAT
30	02382	LEE HEUK PING
31	06166	LEE KIUN HONG
32	01955	LEE MUN WOH
33	12608	LENG BOON HOCK
34	12626	LEONG MUN YEAN
35	27611	LIEW TURK MING, RYAN
36	43531	LIM CHIN GUAN
37	07013	LIM CHING SOON
38	03549	LIM KIUN PHOK
39	09131	LING JIN KII, JOSEPH
40	50235	LUDHSIAH BINTI MUHAMAD SAIRI
41	04621	MAH GUAN PANG
42	56815	MAHYAN BIN ESA
43	13027	MO CHEE LIM
44	01793	MOHAMAD AFIFI BIN ABDUL MUKTI
45	08536	MOHAMED AMIN BIN KASIM
46	33724	MOHD AZMER BIN MD ZAINOL
47	20097	MOHD FAUZI BIN SHAFIE
48	52484	MOHD NAIM BIN HASHIM
49	19471	MOHD. ASRI BIN SIDEK
50	13665	MOHD. PAKHARI BIN CHIK
51	20285	MOHD. RIADHI BIN HASHIM
52	12703	MOHD. ZAMZAM BIN JAAFAR
53	43851	MUHAINI BINTI RAFI'I
54	24076	MUHAMMAD RIDHWAN BIN ALI
55	03684	NG KAM WENG
56	05043	NG YONG KONG
57	15066	NIK SOH BIN NIK MAT
58	28999	NURUL HUDA BIN ROMLI
59	09852	ONG LYE SIONG
60	02063	ONG TEE JOHN
61	02063	ONG TEE JOHN
62	23886	PALANISAMY A/L THANJAGOUNDAN
63	14396	PHUA FOO YONG
64	27139	QUEK SWEE JIN
65	00661	RASATHURAI CHELLIAH
66	19110	RASHID BIN DAUD
67	14979	RAYMON MANGALARAJ
68	05722	RAZALI BIN MUDA
69	38325	ROSEMAN BIN MAT JIDIN @ JIDIN
70	13400	SEET JEN PING
71	13151	SHARIFAH AZLINA BT. RAJA KAMAL PASMAH
72	09828	SOHAIMI BIN SAMAD
73	12186	SUHANA BTE ABDUL MAJID
74	12755	SYED ABU HANIFAH BIN SYED ALWI
75	03312	TAN CHEONG PENG
76	22237	TAN ENG HENG
77	01798	TAN HOON KAI
78	11806	TEO CHENG KHIANG
79	37614	TILAKASIRI A/L SIMON
80	32613	TIONG KAI SONG
81	24542	V. PARANJOTI A/L VEERAPPAN
82	43962	VOON FOOK HIN
83	14844	WAN BAINILLAH BIN WAN SENIK
84	24257	WONG KIM HOU
85	13493	WOO SOO MING
86	24712	YAP MENG SOON, TONY

Solution for 1Sudoku published on page 29 of this issue.

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

MACCAFERRI



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