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INGENIEUR PENANG

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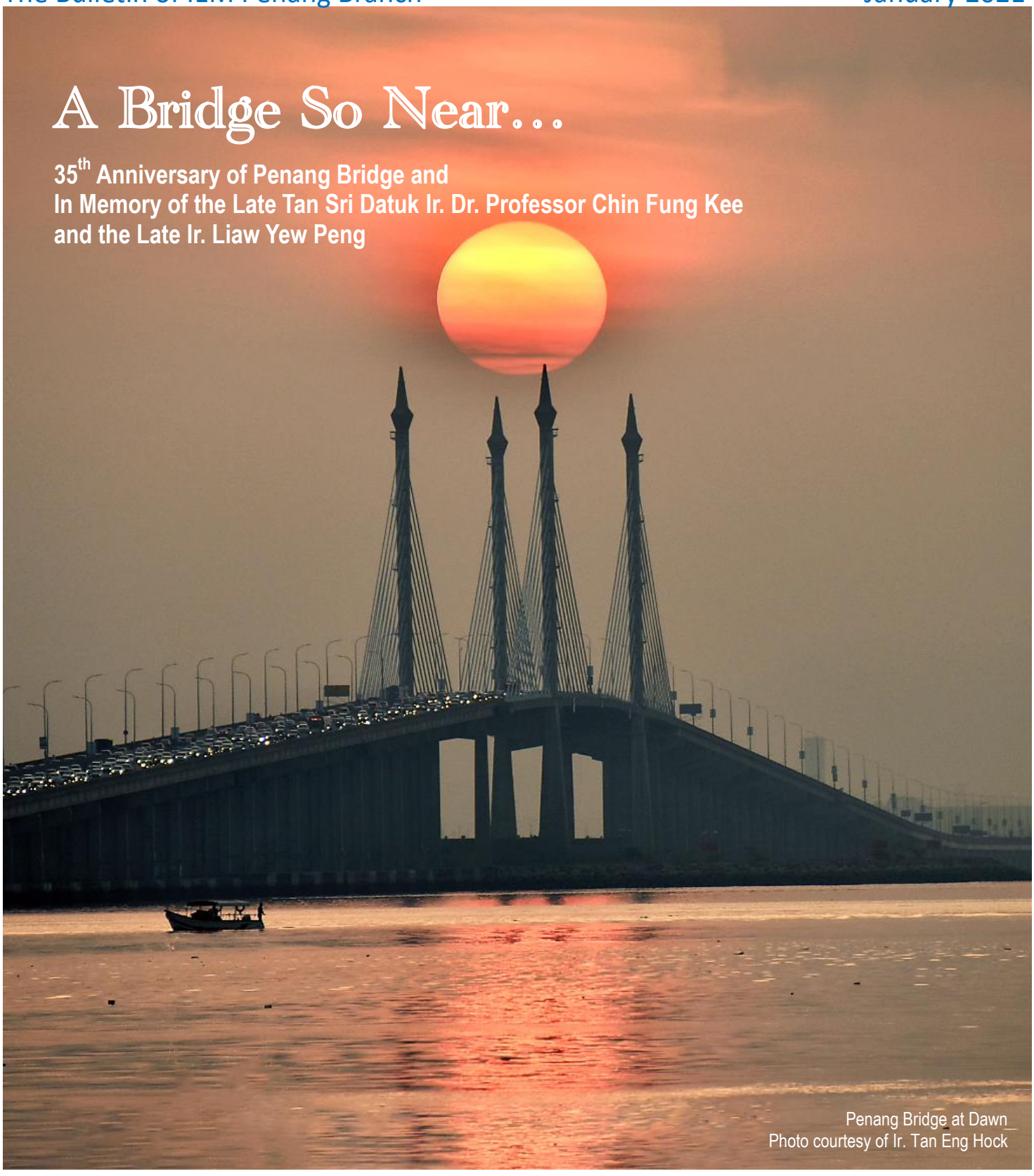
January 2021

COMPLIMENTARY ISSUE

A Bridge So Near...

**35th Anniversary of Penang Bridge and
In Memory of the Late Tan Sri Datuk Ir. Dr. Professor Chin Fung Kee
and the Late Ir. Liaw Yew Peng**



Penang Bridge at Dawn
Photo courtesy of Ir. Tan Eng Hock

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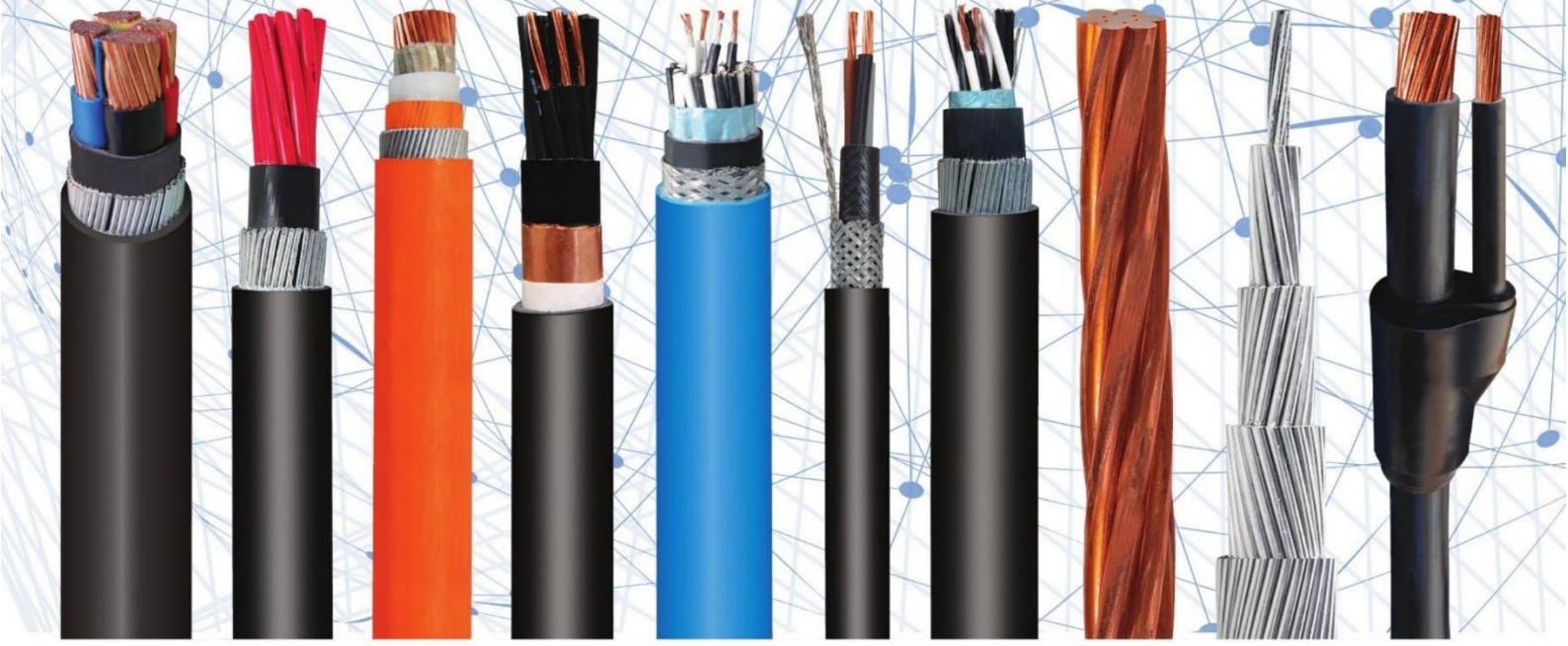

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IEM Penang Branch
1-4-02 E-Gate, Lebuh Tunku Kudin 2,
11700 Gelugor, Pulau Pinang.
Tel : +604-606 5998 / +604-606 5998
Mobile: +6018 - 462 7577
Website : http//www.iempenang.org
http://www.facebook.com/iempenang
Email : iempenangbranch@gmail.com

CHAIRMAN'S CORNER

Ir. Yau Ann Nian

It is time again for IEM Penang Branch to publish another edition of the Ingenieur Penang, the third issue since the inaugural issue was published in August 2019.

In memory of the late Tan Sri Datuk Ir. Dr. Professor Chin Fung Kee's 100th birthday which coincides with the 35th anniversary of the opening of the Penang Bridge, the Branch Committee has decided to have the editorial team of Ingenieur Penang to consider dedicating a section of this issue to remember Professor Chin and refreshing some quick facts on Penang Bridge, the first bridge connecting the mainland peninsular and the island. In this issue, tribute is also extended to the late Ir Liaw Yew Peng who was the past chairman of IEM Northern Branch (1993-1994) and had contributed much to IEM Penang. Ir. Liaw was closely associated with the construction of the Penang Bridge in the 80s. I wish to thank our fellow engineers and friends who had spent their valuable time talking to our editorial team, providing valuable information, and writing articles about Professor Chin and Ir Liaw for Ingenieur Penang, especially to Dato' Seri Ir. Dr. Lee Yow Ching, Ir. Dr. Ooi Teik Onn and Ir. Ng Sin Chie.

Special thanks and kudos to editorial team of Ingenieur Penang on their marvellous effort and hard work to make this issue of Ingenieur Penang another success. I wish to also thank our members who continue to support this news bulletin through contributing their interesting and valuable articles.

2020 has certainly been a very special year. It is also a challenging year to many of us. The entire global economy has to cope with a unique yet unfortunate Covid-19 pandemic. Our branch committee members, the various subcommittees, event organisation teams, invited seminar speakers, our members and guests have given their relentless support to make IEM Penang sustainable and wonderful, amid this difficult period. I truly appreciate your contribution. I wish all of you good health and safe, and I hope that 2021 will bring you and your families a lot more happiness and prosperities.

Take care and stay safe!

EDITORIAL NOTES

The myth of 2020 has finally come and gone! So, we are not yet a developed nation. It did not turn out the way we were once told. Instead, we were raged by the unfortunate COVID-19 pandemic, amongst others. The past one year had seen our nation combating the pandemic in full force. One MCO after another, albeit different names. The purpose was the same and the message was clear, until it came a time when safety and economy biting against each other. The politicians were busy as usual, the people were enduring. The front liners are the ones to be saluted. One single common awareness is to strictly adhere to the SOP and hopefully to pull through this tough period no matter how, be it by ourselves or together. We shall remember 2020 for a long time, we shall follow the SOP and we shall prevail.

During this difficult period, IEM Penang Branch was able to continue serving its members by organizing some 50 activities and events and garnered some 107 CPD hours. Most of the activities had to be conducted via online platforms, while a few were able to be conducted on actual ground, with full compliance with the SOP. The Branch Committee, YES (Young Engineers Section), WE (Women Engineers) and eETD (Electronic Engineering Technical Division) continued to put in their best efforts. Congratulations to these committed working committees!

Ingenieur Penang has come a long way since its inaugural issue in August 2019. For this issue, besides the usual landscape, we have dedicated a special section to remembering a great engineer of our nation, the late Tan Sri Datuk Ir. Dr. Professor Chin Fung Kee. This is commensurate with his 100th birthday this year (2020) and coincides with the 35th anniversary of the opening of the Penang Bridge. Professor Chin was famously associated with the design and construction of the Penang Bridge. We also see fit to pay tribute to the late Ir. Liaw Yew Peng who was a past chairman of IEM Northern Branch and a front-line engineer during the construction of Penang Bridge in the 80's. To complement the above, we also had an exclusive interview with Dato' Seri Ir. Dr. Lee Yow Ching, a retired prominent senior engineer and a past chairman of IEM Northern Branch, as well as a close acquaintance of Professor Chin.

For most of the Penangites, Penang Bridge somehow remains their preferred choice for crossing the channel between the mainland and the island, be it logistic wise or for some passionate or economic reasons. The bridge was opened in 1985 to the pride of the nation, for being the longest bridge in S.E.A. at that time. It was the first road bridge connecting the mainland and Penang island. The bridge has since become a landmark tourist attraction as well as boosted the economy of Penang State through improved logistic and connectivity. Many of us have fond memories of making spontaneous stops while crossing the bridge in those days to take iconic pictures, and of laughing over Lat's cartoon which saw the then prime minister driving a Proton Saga rounding the bridge from sunrise to sunset! For the Penang engineers, the bridge is never too far; the bridge is so near, and so are the memories of Professor Chin and Ir. Liaw.

The Editorial Team

REMEMBERING PROFESSOR CHIN FUNG KEE

Ir. Dr. Ooi Teik Aun

Tan Sri Datuk Ir. Dr. Professor Chin Fung Kee was born son of the late Mr. Chin Siew Woon and the late Madam Chang Nyuk Khim in Nibong Tebal, Province Wellesley, Penang in 1920. He was the third generation of Chinese descendant from Taishan, Guangdong Province in China. The family was in the Goldsmith business.

Professor Chin completed his secondary education at the High School, Bukit Mertajam, and was awarded a Straits Settlement Scholarship to study at Raffles College, Singapore where he obtained a First-Class Diploma in Arts. He then won a Queen's Scholarship in 1949 to study Civil Engineering at the Queen's University in Belfast. At Belfast, he won the Foundation Scholarship in Civil Engineering and the Belfast Association of Engineers Prize. In 1952, he graduated with First Class Honours in Engineering and proceeded to complete his master's degree at the same University while working as an assistant lecturer. In 1984, he was conferred a Doctor of Science degree by his Alma Mater for his independent research over the years during his working life. He was forced to submit his thesis to his Alma Mater because he was urged to do so! He was also awarded an Honorary Doctor of Science degree by the University of Singapore in 1975 and the University of Glasgow in 1986.

Professor Chin returned to Malaya in 1954 after completing his master's degree and served as an engineer in the Drainage and Irrigation Department as his first job in Malaya, before he joined the University of Malaya in Singapore in 1955 first as a lecturer, followed by a senior lecturer, and finally a professor. He was once Acting Vice Chancellor for seven years, and for a period he was simultaneously the Professor and Dean of Engineering, Deputy and Acting Vice-Chancellor in the University of Malaya. He was also the main person behind the establishment of the Faculty of Engineering when the University of Malaya moved to Kuala Lumpur in 1958, at Pantai Valley.

Prof Chin retired as Emeritus Professor in 1973, having trained countless engineering talents for Malaysia. He was the Defector Project Director in the Planning, Design and Construction of many buildings including the International Award-winning Faculty of Medicine when he was the acting Vice-Chancellor in the University of Malaya. During the tenure with the Faculty of Engineering, Professor Chin, through the collective effort of both staff and students, produced the first batch of five graduates in 1958 and built up in a short period of a few years, an engineering degree which attained international recognition. A pass in engineering degree from the University of Malaya then was readily accepted by the British, Australian, and American Universities for Postgraduate studies which normally required a good honours degree. Such were the great achievements of Professor Chin whilst he was with the University of Malaya!

After retiring from the academy, Professor Chin joined Jurutera Konsultant (SEA) Sdn Bhd as one of the Directors in the same year. He was responsible for the design and construction of many bridges, high-rise buildings, land reclamations, and structures on the soft ground including the Penang Bridge. As a practicing consultant, Professor Chin was an outstanding engineer in Structural, Hydraulic and Geotechnical engineering, and has been remembered for his leading role in the design and construction of the first Penang Cable-Stay Bridge and the KOMTAR foundation rectification works in Penang, amongst others.

Professor Chin was the Project Director for the Planning, Design and Construction of the Penang Bridge. He has published a book entitled "The Penang Bridge - Planning, Design and Construction". In the Penang bridge project, he introduced innovative design features to achieve considerable savings in cost and time. The Penang Bridge was designed for seismic loading! In particular, special natural rubber bearings were designed as isolators and manufactured for the project. This has given rise to a new industry for Malaysia and to market the use of natural rubber bearings in seismic design of earthquake resisting foundations for buildings and bridges worldwide.

In the 1970s Professor Chin developed the concept of the inverse slope method for the prediction of pile ultimate carrying capacity without testing the pile to failure. This method has gained both local as well as international acceptance and has been acknowledged as "The Chin Method". The diagnosis of pile condition in the ground was developed by Professor Chin when he was involved in the rectification of the KOMTAR foundation as an independent consultant in 1977. This method of diagnosis of piles has also been widely practiced by the construction industry.

Professor Chin devoted much of his time and efforts to carrying out research in respect to the needs of and the problems faced by the Construction Industry during his time. He was Chairman of the governing Council of the National Institute for Scientific and Industrial Research of Malaysia; Member of Three Royal Commissions; Member of the National UNESCO Commission, Malaysia and Member of the Coordinating Advisory Committee, Malaysia Rubber Research and Development Board. In 1988, The National Council of Scientific Research and Development Malaysia awarded him the National Science Award. He has published more than 70 papers in learned journals covering a wide range of subjects in structural, hydraulic, and geotechnical engineering.

In recognition of the enormous contributions, Professor Chin was conferred the Johan Mangku Negara in 1967 and the Panglima Setia Mahkota which carries the title of Tan Sri in 1980 and the Darjah Yang Mulia Pangkuan Negeri Pulau Pinang which carries the title Datuk in 1985. His success earned him widespread reputation and recognition. He was the Country Representative for Malaysia for The Institution of Civil Engineers (ICE), United Kingdom, and an Honorary Fellow of both The Institution of Civil Engineers and The Institution of Engineers, Malaysia of which he was a founder Council member in 1959 and a President from 1966 – 1968. He was also President of The Southeast Asian Geotechnical Society from 1973 – 1975 and the Vice President for Asia of the International Society for Soil Mechanics and Foundation Engineering in 1981 – 1985. He was Chairman of the Commonwealth Engineer's Council in 1973 – 1977.

Professor Chin passed away on 29 August 1990 after a short illness. In memory of Prof Chin's outstanding achievements and contributions, the Southeast Asian Geotechnical Society (SEAGS) established a Professor Chin Fung Kee Lecture to be delivered at every Society Conference held once in every three years hosted by Member Nation of the Association of Geotechnical Societies in Southeast Asia (AGSSEA). An annual Professor Chin Fung Memorial Lecture series was also set up and conducted by The Institution of Engineers, Malaysia and funded by the Engineering Alumni Association of the University of Malaya since 1991. Professor Chin has made important contributions in the fields of Engineering, Science and Education in Malaysia. It is therefore intended that the invited Lecturer will be an eminent person from similar fields of interest as Professor Chin.

It is worthy to mention that Chan See Shu Yuen Temple (陈氏书院) in Kuala Lumpur also decided to include 陈宏基 (Chin Fung Kee, 1920-1990) into their Hall of Fame. The temple was built in 1897-1906 and is more than one hundred years old.

Professor Chin was a man of great humility and has been a role model, a teacher, and a friend to many who had been fortunate to know him and worked with him. He was a man of principle and integrity who has dedicated his life to excellence and service to engineering and education and society at large. He will be remembered as one of the great engineers of the last century who has excelled in engineering practice, research, and education.

Prof. Chin Fung Kee

Award presentation ceremony of the American Consulting Engineers Council Grand Award for Penang Bridge in 1986. On the right is Professor Chin Fung Kee

MY MEMORIES OF PENANG BRIDGE AND Ir. LIAW YEW PENG

by Ir. Ng Sin Chie

I joined Jurutera Konsultant (SEA) as graduate resident engineer for Penang Bridge Project, Package 5-Cable Stayed Main Span in 1983. That was when and where I first met Ir. Liaw Yew Peng, who was the Deputy Chief Resident Engineer for the whole Penang Bridge Project. The Chief Resident Engineer then was Engineer James Lichy from Howard, Needles, Tammen & Bergendoff (HNTB), the design consultant for the Cable-Stayed Main Spans of Penang Bridge Project.

On my first day in Penang Bridge Project, I was given a lengthy lecture by Ir. Liaw first thing in the morning, before being sent to report for duty to the Resident Engineer of Package 5 – Cable-Stayed Main Span. Thereafter, I quickly learned that Ir. Liaw was indeed being referred to as "Liaw Cik" amongst all his subordinates in Penang Bridge Project. This was probably due to his always serious and no-nonsense characters. "Liaw Cik" in Penang Hokkien Dialects means Uncle Liaw - a name which in my opinion suited him the most, especially for his serious character and seldom smile outlook. Unless otherwise, we were shying away from seeing him. We normally checked with his secretary if he was in a good mood prior to seeing him. Otherwise, we may be caught in the wrong timing and receive another round of long and serious lecture from Ir. Liaw.

Ir. Ng (left) & Ir. Liaw (right) met at IEM Secretariat.

After the completion of the Penang Bridge Project, Penang Bridgers did organise some gatherings once in a while. I did meet up Ir. Liaw in some of these gatherings which I have attended. However, the short gathering did not allow much conversation and communication to take place between us then. I bound into Ir. Liaw again sometime after 2004 when I joined the working committees of IEM Penang Branch. We were together on numerous occasions during IEM's functions and activities. Thereafter, he even appointed me to be his second interviewer and together we have conducted several professional interviews. I have visited Ir. Liaw at his resident in Bukit Gelugor on many occasions. We used to have long chats and we also went out for several lunches /dinners together too. It was really amazing that the living room of Ir. Liaw's house was fully packed and stacked with books, contract documents, drawings etc. He has habitually kept good care of all documents and drawings from all his past projects. On one occasion, he even proudly announced that he still has a complete set of contract documents, drawings, design calculations, work progress records and claim records for the Penang Bridge Project. That is amazing!

Interestingly, to date there are still many articles, write-ups and reports on the construction of Penang Bridge which could be found on the internet. Though there were many interesting happenings during the construction period of which we did recall and talk about it jestingly whenever we met. Penang Bridge Project has always remained a popular topic of our conversations. Surely, Ir. Liaw was very proud of the successful completion of the Penang Bridge Project, well within the budgeted cost. Of course, disappointments too arose due to some aspects which were beyond his control. Foremost, he was totally shattered and saddened over the execution of two major alteration/expansion projects to the completed Penang Bridge, i.e., the Penang Bridge Widening Project and the Penang Bridge Cable Replacement Project.

Penang Bridge Widening Project began in January 2008 and was completed in late 2009. The entire bridge was widened to Eight lanes inclusive of the 2m wide motorcycle lanes at each carriageway. Hence, an additional 3.5m lane plus a 2m motorcycle lane were added to each carriageway. The approach spans and the Main Cable-stayed span were somehow already constructed and completed with six lanes earlier. As such, there were no widening works carried out to these spans.

As the resident staff of Penang Bridge Project, we did not involve in the design of the bridge at all. Somehow, we were told that the entire Penang bridge was indeed designed for 6 lanes with similar width to the cable stayed main span. The piled foundations, pile caps, pier and crosshead beam have all been designed and constructed to support future expansion to 6 lanes dual carriageway with width similar to the cable-stayed main span. The required prestressing ducts have been pre-installed at the crosshead beam at all the piers. Hence, the crosshead beam could be extended by prestressing for future expansion. By extending the cross beam, the new girders could then be

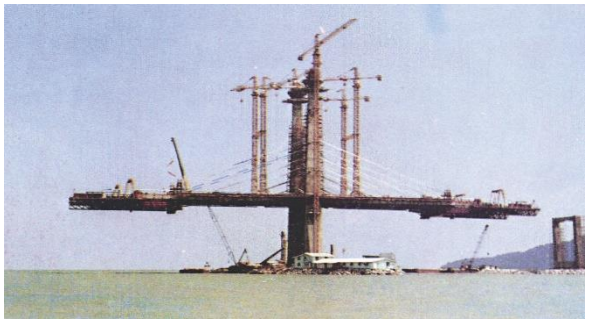
rested on it and a new deck could be constructed for the additional lane on each carriageway.

I took the opportunity to refer this matter to Ir. Liaw and seek his opinion on the bridge widening project. Ir. Liaw confirmed that the entire bridge was designed for six lanes plus the hard shoulder in each direction, with a width similar to the constructed cable-stayed main span. However, the extra motorcycle lanes in each direction were not allowed for in the original design. Ir. Liaw was saddened over the decision to provide the little extra width for the motorcycle lane which had resulted in this expansive and challenging bridge widening project. It involved the construction of new decks, piers, and deep-piled foundations in close proximity to the existing structure, with extensive use of heavy plant and machinery mounted on marine barges. While safeguarding the existing bridge structure during works, the operational flow of traffic was maintained at all times. During the design and construction stage of the widening project, surely costly due consideration would have to be given to address the possible differential settlement of the old and new deck of Penang Bridge.

The Penang Bridge Cable replacement project was another disappointment to the engineering fraternity generally with many rumblings heard within the circles. Ir. Liaw too was very firm with his opinion that the original Dywidag threaded bars cables stay system at the main span was adequately designed and extensively tested before installation. It is supposed to have a long life span of over 100 years. Recalling from the press report then, it was initially called for the replacement of the 2 short cables nearest to the towers due to defects found at the deck anchoring point. Subsequently, it was reported that some Dywidag High Yield bars inside the steel pipe casings were found to be failed at the couplers due to fatigue damage. Many other bars were also found to be significantly over-stressed according to current standards then. This had led to the replacement of all cables in Penang Bridge which was only 25 years in service then. The cable replacement project was undertaken by a French company, Freyssinet.

The original cables were fabricated and installed under very stringent conditions. The outer steel tube casings were pre-welded to the required length at the yard. All welding works were sent for radiographic testing to check and detect discontinuities in the internal structure of welds. The Dywidag High Yield Bars were pre-jointed with couplers at the yard to required lengths, and pre-tensile tested to confirm its suitability. These cables were then transferred to the main span and lifted to the position by pontoon cranes during erection. Cables were pre-anchored at the deck end and stressing of the bars was carried out at the tower end under stringent control conditions, i.e., limiting the temperature variation and ensuring no disturbances caused by other construction activities. Hence, the stressing was executed during late hours in the evening and continued through before work resumed in the morning with pre-fixed incremental stress values and to pre-determine sequent on the bars. The stresses on every bar were recorded and telex to the HNTB office in Seattle, the US upon completion of each night's work. A new set of pre-fixed values and sequence of bars stressing would then be provided by HNTB the next day for reiterated stressing works on the bars the following night. The whole process was repeated with incremental values until all bars were being stressed to the required predetermined values.

Comparingly, the replacement of the new cable system by Freyssinet was more challenging and difficult as it was installed under loading conditions. The bridge remained open to traffic at all times during construction. Moving traffic surely generates some vibrations and causes some form of variation and fluctuation to the stressing values. Ir. Liaw adamantly insisted that these replacement works may have caused more damages to the bridge and good. He was of the opinion that if the cables have failed as claimed, the original contractor who has constructed the bridge, the consultant who has designed the bridge, and the specialist who has supplied the cable system, should have been recalled investigating and answer for it. ■



Balanced Cantilever Construction of Cable Stayed Main Span

Quick Facts of Penang Bridge:
Inaugurated: 14 September 1985.
Connecting: Seberang Perai -- George Town.
Main bridge: Cable-stayed bridge with beam and slab deck.
Approach: Beam and slab deck bridge.
Total length: 13.5km.
Length over water: 8.4km
Vehicle lanes: 6 + 2 motorcycle lanes, dual carriageway
Main navigation span: 107.5 m + 225 m +107.5 m
Current status: Second longest in Malaysia; Fifth longest in S.E.A. by total length

Exclusive Interview

DATO' SERI Ir. Dr. LEE YOW CHING

Complementing the Cover Feature for this issue is an exclusive interview with Dato' Seri Ir. Dr. Lee Yow Ching, the former Deputy Chairman and General Manager of Penang Water Authority or Pihak Berkuasa Air Pulau Pinang (PBA). Dato' Seri is also a close acquaintance of Professor Chin Fung Kee despite their age difference. Ir. Ng Sin Chie, Dato' Ir. Dr. Goh Teik Cheong, Ir Tiu Jon Hui, Ir Heng Lee Sun and Mr. Sim Kai Sheng from IEM Penang Branch talked to Dato' Seri Ir. Dr. Lee during a luncheon on 17 December 2020.

Ingenieur Penang: Dato' Seri, thank you for accepting our request for this exclusive interview. You have spent your entire career in the government sector in Penang before retiring, beginning as an engineer in the city council, and the rest of your career with the Penang Water Authority (PBA). How would you sum up your experience and achievement from the perspective of a civil engineer?

Dato' Seri: Thank you very much for this opportunity to talk to you. Graduating from Universiity of New South Wales, Australia in Civil Engineering, I first served in the City Engineer's Department, the City Council of George Town, Penang in 1965 and, after a year and so, was transferred to the City Water Department (CWD). T that time the CWD was responsible for water supply to Penang Island excluding Balik Pulau and Penang Hill as well as Seberang Perai, which were taken care of by the Public Works Department (PWD). When Penang Water Authority or Pihak Berkuasa Air Pulau Pinang (PBA) was established in 1973 to manage the water supply for the whole Penang State I was appointed successively Senior Executive Engineer, Chief Executive Engineer and eventually, Deputy Chairman and General Manager. When I reached the then retirement age of 55 in 1995, my service was extended. In 1999, PBA was corporatised (and subsequently privatised in 2002 by listing in the Kuala Lumpur Stock Exchange) to become Penang Water Supply Corporation or Perbadanan Bekalan Air Pulau Pinang (PBAPP), I was appointed Director of Penang Water Department, a regulatory body for PBAPP. My service was extended by the State Government for about 9 years, before concluding my career as a water engineer in 2004, at the age of about 64 and ended my engineering career as a public servant. It had been a very absorbing time and I feel fortunate to have had that opportunity to go through those many and varied working experiences.

Ingenieur Penang: Wow! With about 39 years as water engineer, you must be the longest-serving water engineer in the government sector!

Dato' Seri: I am glad to have been able to devote almost my entire working life to the development of Penang water supply.

Despite limited resources, the Penang water supply system has been well managed and is able to cope with the demand. It should be emphasised that two outstanding water engineers, Ir. Goh Heng Chong and his successor, Dato' Ir. Kam U-Tee played vital roles in the development of Penang water supply. They were focussed, creative and good in management and innovation. With clear vision, persistent effort, and teamwork to improve water system and management practices, both of them laid a very solid foundation and put PBA in good stead to achieve notable success and win accolades both locally and internationally. Recognised as one of the leading water supply organisations in Malaysia, PBA supplies the cheapest water with the widest coverage, lowest Non-Revenue Water (NRW) and highest revenue collection efficiency.

Three generations of Penang water engineers.
Kam U-Tee (left), Goh Heng Chong (centre), and Lee Yow Ching (right) at Teluk Bahang Dam in 2002.

PBA had a good tradition of self-reliance and applying technology appropriate to local conditions Design of new treatment plants, water distribution systems, upgrading of existing treatment plants, laying, and repairing water mains etc were carried out departmentally.

I am indeed fortunate to inherit the good work of my predecessors. "Not aiming to get credits, but rather trying to avoid making mistakes" (不求有功，但求无过), I attempted to maintain the good work and tradition and pass on to the future generations.

I have witnessed the three developmental stages of Penang water supply from CWD and PWD Water Section to PBA and eventually to privatised PBAPP.

I was involved with many development projects. A major project implemented during the period when I was Deputy Chairman and General Manager of PBA was Teluk Bahang Water Supply Project. I also initiated the implementation of Mengkuang Dam Expansion Project.

Before my retirement, a National Water Resources Study has identified Perak River Transfer Scheme that will benefit Penang, Perak and Kedah. This project together with other development projects will ensure that Penang will have adequate water supply up to the year 2050. Penang is surrounded by sea. Desalination of sea water which is a drought proof source of water is expected to feature in future Penang water supply system.

Ingenieur Penang: Dato' Seri, you are a civil engineer by profession and you also hold a Doctor of Business Administration (DBA). You had also completed courses on local government administration and finance management. Do all these additional non-engineering academic qualifications help you in your career?

Dato' Seri: Certainly. I have benefitted from these courses, particularly the DBA which I obtained in 2004. This DBA course offered by University of South Australia is a combination of course work and research program for professionals. It emphasises interdisciplinary understanding and appreciation of knowledge. This course has widened my scope of knowledge and research methodology. It enabled me to reflect on my past experiences and enhances my passion to do research, publish articles and books.

Subsequent to my getting the DBA, I was appointed as a supervisor of an engineering research student from Universiti Sains Malaysia. To date, I have written more than a hundred Chinese and English articles and classical Chinese poems. I co-authored with Datin Paduka Tan Siok Choo a bilingual book: "环壁生辉 – 敦陈修信祖居文物巡览 Within the Walls of Tun Tan Siew Sin's Ancestral Home". This book showcases the Chinese artefact found within the walls of a 200-year-old ancestral home and underscores the overwhelming Chinese ambience of the Malacca Babas' lifestyle.

Ingenieur Penang: Dato' Seri, what are the major challenges and obstacles that you have faced when you were with PBA?

Dato' Seri: Every problem is an obstacle. The challenge is to overcome the obstacle.

Malaysia is blessed with abundance of water resources, but Penang is a" water stressed" state as the available water within Penang Island is inadequate. This is our major obstacle. Our major challenge is to consistently adhere to our goal under all conditions – To produce at all times and as economically as possible a clear and potable drinking water in sufficient quantities to meet the needs of Penang. We must expand the capacity of waterworks to ensure that supply is always ahead of demand and to supply water at the lowest cost possible consistent with the need to obtain sufficient income to cover recurrent costs and the need to sustain development.

In line with this I would like to quote what Dato' Ir. Kam once said: "Running a water authority can be likened to walking up an escalator traveling down in the opposite direction". As supply needs to always be ahead of demand, we always need to run up faster than what brings us down.

For me, running a water authority is like riding a bicycle. We have to keep riding. The moment we stop, we may be able to hold on balancing for a while, but not for too long, we will eventually fall.

These analogies have helped us to a certain extent to remind us where we are and what we should be doing. With the correct mindsets, we have been able to help Penang achieve what it is today. The supply of adequate water plays an important role in sustaining economic growth in Penang. A well-managed water supply system will ensure that water will not become a constraining factor in the development of Penang.

Ingenieur Penang: Dato' Seri, Muda River Water Scheme, Mengkuang Pumped Storage Scheme and Teluk Bahang Water Supply Project are among some of the notable PBA projects. Can you share with us what you know about these projects?

Dato' Seri: 1. Muda River Water Scheme is a milestone project, the biggest and most important in Penang. The completion of this project in 1973 marked the integration of two water supply systems in Penang Island and Seberang Perai and the establishment of PBA to manage water supply of Penang State.

Water from Muda River is pumped and conveyed by an unlined earth canal to Sungai Dua Water Treatment Plant in Seberang Perai Utara, from which treated water is supplied to Seberang Perai and to Penang Island through submarine pipelines.

It should be mentioned that the centre line of the Muda River is the State boundary between Kedah and Penang. Penang is drawing water within Penang State. This scheme although initially was meant to provide water supply for Penang has benefitted agriculture and water supply sectors of both Kedah and Penang as the barrage with the gates closed prevents saline intrusion and conserves more water for all users during dry seasons.

This scheme plays an important role in the industrialisation program of Penang State introduced in the early 1970s. PBA was able to reschedule the construction program of the scheme to enable Sungai Dua Water Treatment Plant to be partially commissioned to ensure adequate water supply was available to meet the demand. The scheme has been progressively enlarged in many stages and is now supplying about 80% of the demand in Penang

Sungai Dua Water Treatment Plant (courtesy of PBAPP)

2. Mengkuang Pumped Storage Scheme, completed in 1985, was implemented to provide strategic reserve to augment the output of the Muda scheme as the flow in Muda River during dry season is inadequate to meet the requirements of all users. The scheme includes Mengkuang Dam, a combined gravity and boosted conveying pipeline and pumping system. Water from Kulim River and subsequently Muda River is pumped to Mengkuang Dam for storage and released during dry seasons (hence the name pumped storage scheme). Under the Mengkuang Dam Expansion Project the capacity and hence the yield of the dam was recently expanded with the increase of the height and the length of the earth embankment. This dam is the biggest and the last dam constructed in Penang as no suitable dam site is now available. Future water supply project will involve inter-state water transfer.

Mengkuang Dam (courtesy of PBAPP)

3. Teluk Bahang Water Supply Project was mooted in the 1960s, after the completion of the Air Itam Dam and land was acquired for the project. However, this project was held in abeyance as the Muda Scheme can provide much more water to satisfy the needs of whole state.

This is the last sizeable water project in Penang island. It was completed in 2000 to increase storage and provide water for emergency use during periods of drought. The project comprises Teluk Bahang Dam, Batu Ferringhi Water Treatment Plant, water tunnel, pumping stations and pipelines together with upgrading of existing Guillemard Water Treatment Plant. It was a "Government to Government" project and was the first water supply project undertaken in Malaysia by a company from China.
Both China and Malaysia consider this project to be of great importance as it is a significant symbol of close relation and cooperation between the two countries.

TeluK Bahang Dam (courtesy of PBAPP)

Ingenieur Penang: Dato' Seri, we know that you are very knowledgeable. Besides engineering, can you share with us some of your thoughts on topics such as the Belt and Road Initiation and its connection with Malaysia?

Dato' Seri: I am certainly not very knowledgeable. I am just interested in some non- engineering subjects as I believe we should not confine our knowledge to our own fields only.

As we are aware, the Belt and Road Initiative (BRI), initially known in English as One Belt One Road, is a global infrastructure development program adopted by China with the objective of connecting Asia with Africa and Europe via land and maritime networks to improve regional integration, increase trade and stimulate economic growth.

Malaysia is the first country in Asean to establish diplomatic relationship with China and China's biggest trade partner in Asean. Malaysia can play an important role to promote BRI in the following fields: economic co-operation, infrastructure development, two-way trades, two-way investments, financial cooperation as well as tourism, education, and culture exchanges.

The BRI aims to "enhance connectivity in the five major priority areas of policy, infrastructure, trade, finance and people-to-people ties"（政策沟通，设施联通，贸易畅通，资金融通 与 民心相通）.

In my opinion, the concept of people-to-people interaction is a very important element in the BRI. This concept is particularly applicable to engineering projects. It is the synergy and networking involving all parties in a project implementation, where good relationships between all stakeholders – clients, consultants, contractors and the authorities – are the key to the success of a project team. The success of Teluk Bahang Water Scheme, designed and constructed by a Chinese company, is a good example of strong connectivity between two countries that fostered effective collaboration

China is known to be a world leader in infrastructure development, having completed a lot of outstanding and awesome engineering projects. The IEM, our consultants and contractors should have close cooperation and interaction with the Chinese counterparts to enhance our engineering practices. Our members may also venture to China for career advancement.

Ingenieur Penang: As a Past Chairman of IEM Northern Branch (now IEM Penang Branch), do you have some advice for the current generation of IEM Penang?

Dato' Seri: I rather not say advice, but I would like to give a few suggestions:

1. Engineer should adopt an attitude and approach to thinking to seek out change, rather than to adapt to change. This mind set embraces critical questioning, innovation and continuous improvement and seeking out new opportunities. This is a way of approaching situations

where we feel empowered, motivated, and capable of not only seeing problems, solutions and opportunities, but to come up with ideas to do something about them. We need to think anything is possible and have the tenacity to accomplish it.

2. We must always keep track of what we do. All achievements shall be recorded to enable all those legacies to serve as guides and references for our future generations. Engineers are generally considered as "backroom persons" The general public does not realise and appreciate our responsibilities and contributions. Our past performances should be properly recorded. In 2010, our Penang Branch produced a book, "Northern Builders – Memoirs of Past Chairmen" highlighting the experiences and achievements of our past chairmen. This is a commendable effort. Let us continue to publish books to record our contributions and engineering achievements so that all legacies can be passed down without being forgotten.

Tan Sri Prof. Ir Chin Fung Kee mentioned that his book, "The Penang Bridge -- Planning, Design and Construction", was written with the aim of emulating the departmental paper of the Drainage and Irrigation Department on the design and construction of projects by engineers serving their pupillage. These papers outlined "the basis of design, progressive stages of construction, the factors important in quality control, anticipated problems in construction and criteria for rejecting unacceptable work". They also included footnotes "suggesting improvements to the original design and detailing in the light of site conditions, from those who had executed the construction". I earnestly hope that records similar to such invaluable papers should be kept by every engineer not only for his or her benefit but also for the engineering profession.

Lee (left) with Prof. Chin (right) and friends at Guillemard Service Reservoir in 1985

3. Practising engineers should aim to publish articles. "Publish or perish", engineers in academic circles must publish research papers, otherwise their careers may be in jeopardy. But it may be very difficult for practising engineers to produce research papers. They can contribute articles to IEM Journals, JURUTERA and Ingenieur Penang or other similar publications to share their experiences with others.

4. We should always make sure our time is gainfully occupied. Focus on doing things we are supposed to do and always try to do well. However, we need not only confine ourselves to technical matters. Participating in community services and social activities also gives us added advantages that we may not realise. Throughout my careers and retirement, I have been playing active roles in such activities, serving as president/chairman in many clubs and organisations, such as the IEM, Northern Branch, Australian and New Zealand Graduates' Association of Malaysia, Penang Branch, the Hakka association, the Penang Swimming Club, Penang Amateur Swimming Association, Rotary Club of Penang, Chinese poetry society etc.

It is said that our future is what we make of it. I wish all my fellow engineers every success in their endeavours. ■

The Ingenieur Penang interviewing team with Dato' Seri Ir. Dr. Lee Yow Ching. From left: Ir. Ng, Dato' Ir. Dr. Goh, Dato' Seri Lee, Ir. Heng, Ir. Tiu and Mr. Sim Kai Sheng.

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A BRIEF PERSPECTIVE ON FOUNDATION UNDERPINNING AND STRUCTURAL STRENGTHENING FOR EXISTING INDUSTRIAL BUILDING STRUCTURES

by Ir. Catherine Sim Siew Ping & Dato' Ir. Dr. Goh Teik Cheong

In structural engineering, sometimes there exists an inevitable need for retrofitting or strengthening of existing building structures. Building structures are not only constantly being exposed to a variety of loading conditions and degrading environmental actions but also to the continuous demands of the industry in the face of technology advancement. Existing factories experience changes in process equipment in the form of more massive loadings to meet the latest industrial requirements.

Selection of the right techniques, materials and procedures for the strengthening and underpinning of the existing building structures and foundations posed a major challenge to the engineers. This is so to avoid potential structural failure, reduce safety risks, upgrade the existing capacity, and further enhance the durability of the structures.

Thus, in-depth understanding of the issues at hand, inspections, desk-studies, analyses, design options that come with cost evaluations and constructability, construction, safety management and monitoring are deemed a prerequisite as far as structural strengthening and foundation underpinning are concerned. All of which have to be conducted in phases to ensure the implementation of a systematic procedure for the works.

This article attempts to put forth procedural recommendations that encompass site inspection, appraisal of the existing structures, site investigations, verifying assumptions on existing structural capacity, structural analyses, various design options, cost considerations, construction methods, safety managements, projects scheduling and monitoring works among other. The procedural recommendations are simplified in Fig.1.

An initial desk study is usually conducted with the sole objective to produce a customised engineering solution to the issue. The efforts expanded on this included soil investigation reports, desk study on available drawings and site verifications. Structural finite element analyses and foundation analyses need to be performed to simulate the new dead and imposed loads of the new equipment, the implication to the existing superstructure and sub-structure, which includes the foundation.

In industrial plants, very often new pieces of equipment such as scrubbers, chillers, or production equipment are added to the production areas. Sometimes, the new equipment is heavy, thus impose massive load on the existing foundation and making it necessary to increase the existing foundation capacities by way of the underpinning technique that encompasses safe temporary works and protecting the existing structure. Generally, this entails shutting down the affected plant that may incur a cost of several hundred thousand Ringgit to millions per day. Hence, a real need to develop new practical and innovative underpinning techniques to construct the foundation with minimum or without interruption to production.

Typical methods employed for foundation underpinning works include installing micropiles, small drive-in piles, jack-in piles and grouting. Methods selection eventually will depend on design, soil conditions, accessibility of installation machines, cost and time schedule. As found in most cases, the accessibility of installation machines and the cost are the main criteria.

For structural strengthening works, the common methods adopted include carbon fibre reinforcement polymer, additional steel plate, additional supporting members and increase in reinforced concrete sectional members

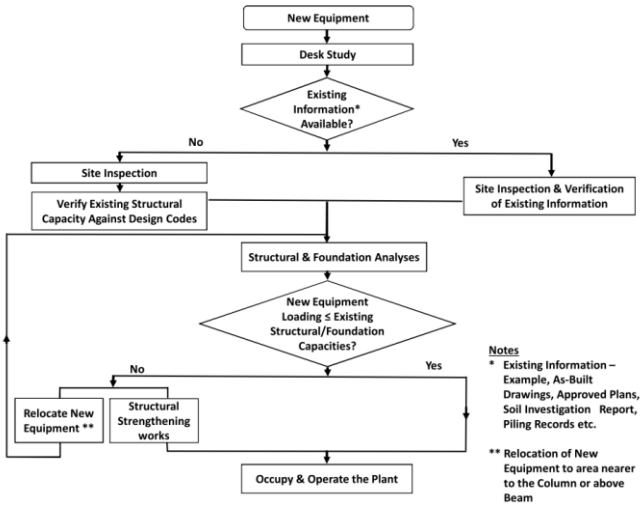


Fig. 1: Procedural recommendation.

At times, industrial plant owners may not safe-keep the structural as-built drawings. This would lead to challenges for the structural engineers to determine the existing structural capacity. Under such circumstances, certain assumptions or engineering judgement would be needed. If an existing warehouse or general manufacturing facility requires to be retrofitted to a new semiconductor

production, the structural loading requirements will be different. Similarly, conversion of an office area to the production area. The structural engineer has to study and analyse, based on available information and existing site conditions. Reference is made to as-built drawings or previous design codes used. Assumptions and later verifications may be necessary. The experiences and judgements of the engineer are important. Lessons that we learnt along the path is, archiving of documents is paramount important especially when it involves a change of use of the facility, retrofitting, refurbishment, addition or alteration of existing structures.

Common challenges throughout the process of analyses and design of the structural strengthening and foundation underpinning works includes:

- Underpinning works have to be executed in a life plant where daily operations are on-going continuously without any interruption to production. All utility piping, life cabling, process tanks and equipment remaining in operational mode (Fig. 2 and Fig. 3).
- Height constraint between the floor levels, including existing structural beam and slab.
- Congestion of the area and limitation of working space with existing equipment within close proximity which is operational during physical underpinning works execution.
- Consideration, not only to localised strengthening structures but also to the existing building especially at the inter-connecting structures.
- A temporary protection is required to be made to the existing environment especially when dealing with life plant where we need comply with Good Manufacturing Practice (GMP) controlled, Hazard Analysis and Critical Control Points (HACCP), Safe Quality Food (SQF) and Global Food Safety Initiatives (GFSI) requirements.
- Vibration sensitivity to the existing life plant which is fully operational during this construction period.
- Interfacing between existing ground floor elements such as beam and slab with the new pile cap has to be designed and constructed either integrated or isolated. Fig. 4 shows an integrated structure.
- In order to check the pile integrity and verify the driven pile capacity against the pile design load, a dynamic pile load test can be used.

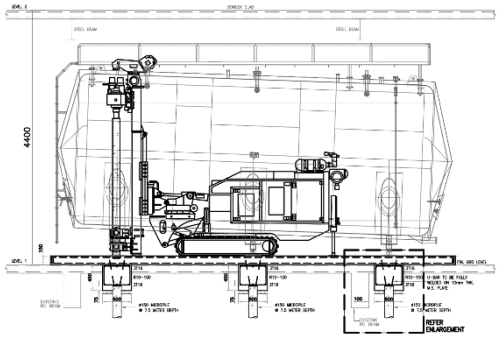


Fig. 2: Foundation underpinning works within limited height clearance.

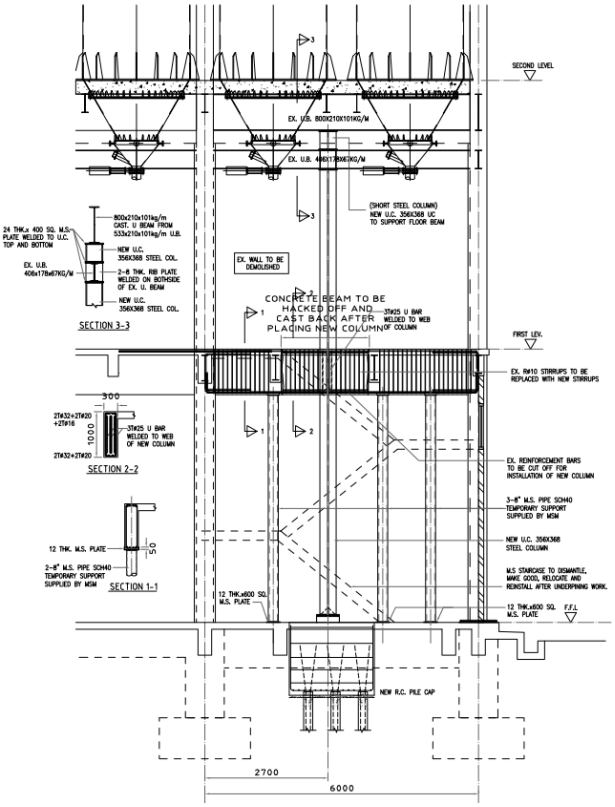


Fig. 3: Foundation underpinning and structural strengthening work for new production equipment in an industrial plant.

Fig. 4: Foundation Underpinning and Structural Strengthening works at life plant.

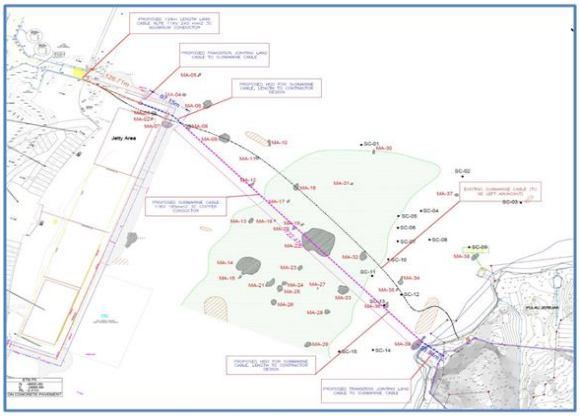
In conclusion, undeniably, foundation underpinning and structural strengthening works are complicated, time-consuming and demanding, not to mention costly when compared to greenfield works. The methods of construction are limited and usually governed by space constraints at the site. Hence, close attention on all details of existing structures is an absolute necessity in order to ensure the successful construction of the design.

SUBMARINE CABLE WORKS

by Ir. Paul Phor Chi Wei

Lately, due to sea reclamation project, I have the rare opportunity to involve in submarine cable replacement works from Bayan Baru shore to Pulau Jerejak. The total length of the submarine cable to cross the sea area is approximately 1.0KM. We have engaged a specialist contractor to undertake the submarine cable replacement works.

Among the scope of works, the marine route survey caught the most attention. The principal objective of the marine survey is to collect relevant information such as water depth, seabed surface, nature of sea bed soil, sub-bottom sediments and obstacles and etc. The due process is critical to identify the most suitable route for the submarine power cable. From experience, marine route survey and submarine cable installation are conducted during fine weather window period from March to June, before monsoon season comes after July, and monsoon season at year-end.



Seabed Detection

From the marine survey data obtained, the submarine cable route is finalised based on the shortest, safest, most economical, and practical route and alignment to minimize the conflicts with environmental constraints, economic issues and feasibility of the cable installation. That determines the submarine cable length to be manufactured including the spare cable from the finalised selected route. It is estimated 1.0km cable length of submarine cable, 185mm2copper with XLPE insulation, armoured wired, PP Yarns Outer serving layer with 24 core fibre optic cable installation works will cost approximately RM5 million ringgit Malaysia and it takes 6 months to procure and complete the installation.

Transferring and storage of submarine cable are very challenging. Upon loading the submarine cable at the port, it has to transfer into the cable vessel on a barge. Visual checking and testing shall be conducted at all times during the transferring. It involves sophisticated equipment e.g. cable engine, cable gantry, cable guides, cable rollers, cable chute and etc. Prior to sailing to the site, proper voyage plans shall be done, and all meteorological data and weather reports shall be studied carefully for a safe voyage.

Submarine cable laying barge equipped with cable handling, laying, and burying equipment. The barge plays a very critical role to install the submarine cable. Cable laying barge layout is designed in such a way that it has to balance the cables weight and tension when launching the cable into the seabed. Trenching onshore preferable by open-cut excavation toward the sea and install with HDPE pipes at 1.0m depth. The submarine cable will be pulled through these pipes for connections at the substation. For seabed trenching, the plough is designed with a high-pressure water jet to cut a trench, which is able to bury the submarine to a depth of 1.5m. The impact of cable carrying capacity is approximately 50% for lying depth of 1.5m versus surface lying. Unfortunately, the threat to the cables by trawling gear and anchors is high in that area and repairs of the cable is very costly. Cable route clearance is done by towing a specially made steel grapnel along the planned route for 10m on each side of the central cable route. Thus, the seabed surface and subsurface is clear before the submarine power cable is installed. The divers role is to check the physical depth of the cable buried.

Deployment Procedure

Sample of Water Jet Plough

It is a wonderful experience to realize the technical aspects of submarine cable installation work. The work is still ongoing, but I foresee the next phases of work will be even more interesting and challenging.

THE DIFFERENCE BETWEEN DESIGN, BID & BUILD AND DESIGN & BUILD CONTRACT AND ITS ADVANTAGES & DISADVANTAGES




by Dato' Ir. Lim Kok Khong *Ir. Khor Wei Huat* *Ir. Law Chun Teik* *Chan May May*

Abstract

The Owner should adopt design, bid & build, or design & build to deliver projects always is a question related to fundamental decisions in the procurement process. This article reveals the difference between design, bid & build and design & build contracts and its advantages & disadvantages for deliveries of common construction projects.

Design, Bid & Build

The Design, Bid & Build delivery method is commonly used to obtain the lowest construction cost from builders selected from a set of bidders or builders that are pre-qualified by a team of relevant and independent consultants hired by the Owner or investor.

All bidders will be submitting their offer based on a set of documents generated from understanding the Owner's requirements and objectives. These documents shall comprise of:-

i) Bid form
ii) Terms and conditions
iii) Scope of Works
iv) Construction drawings
v) Construction materials & technical specifications
vi) Construction Schedule
vii) Price break down
viii) Other relevant information

This set of documents will also clearly define builders and Owner's responsibility, liability, accountability, entitlement, and compensation claimable from each party. A penalty will be imposed on the party that fails to perform what it had agreed to.

Bidders can be a set of companies recommended by the independent consultants hired by the Owner or Owner's representative. Bidders are normally identified after going through a pre-qualification process to ensure all bidders are relevant in meeting the relevant statutory requirements, licensing, and project criteria.

After all the offers have been received from the bidders within the tender period, the independent consultants will review the offers, conduct tender interviews, and seek clarifications to ensure offers and The owner's expectations are calibrated prior to making a recommendation to the Owner which bidder should be awarded the project contract.

After the contract has been awarded to the successful bidder, the construction process will begin, and the builder is fully responsible for the following in relation to the entire site: -

i) Relevant permits
ii) Health and Safety
iii) Quality of works (QA/QC)
iv) Schedule
v) Cost control
vi) All relevant submittals and approvals
vii) Full delivery and handing over upon completion of construction, testing and commissioning

Design & Build

Design & Build Contract is a method to deliver a project in which both the design and construction services are single services from one company (Design & Build). This is to minimize the risks for the Owner and to reduce the delivery schedule by overlapping the design phase and construction of a project. The Design & Build Contract is often a general builder with a team of design professional

architects and engineers hired and typically retained directly by the builder.

In the Design & Build contract, a set of performance-based specifications are given to the bidders to quote which comprise of the followings:-

i) Project objectives
ii) Terms and conditions
iii) Conceptual building layouts
iv) Building's dimensions
v) Building utilities' requirements
vi) Process utilities' requirements
vii) Floor loadings and any other specific requirements
viii) Project schedule
ix) Other relevant information

Under the Design & Build Contract, the builder is not only responsible for the construction but also the design, compliance in meeting the Owner's objectives and all relevant authorities' requirements, permit, constructability, and functionality of the project.

The advantages of Design, Bid & Build contract are:-

i) Project deliverables are well defined.
ii) Construction drawings and specifications are all made available to bidders for the tender.
iii) All contractual parties' responsibilities and entitlement are defined.
iv) The consultant and builder have their own respective contract with the Owner. This allows the consultant to play the role as a moderator should there be any dispute between the Owner and the builder before the problem escalates to mediation, arbitration, or litigation.
v) The Owner can have the consultant or a team of professional architects and engineers working together with them to prequalify the bidders to ensure all bidders are qualified and with the relevant experience.
vi) Having gone through the process with a set of bidding materials allows the Owner to have the lowest construction price offered for a similar scope of works.
vii) With all the design parameters, detail designs, construction drawings and specifications made available to the bidders, the possibility of cost variation is minimized and with this, it will allow better cost control.

The disadvantages of Design, Bid & Build Contract:-

i) The project deliverables have to be very well defined. Failing which, will result in a discrepancy between the parties and result in high variations in cost.
ii) Owner's scope of works developed by their architects and engineers have to be very comprehensive and seamless between different disciplines (architecture, civil, structural, mechanical & electrical works)
iii) Builders will bid in accordance with the scope of works specified in the Construction drawings and meet the specifications. Any variation of scope from the original bidding documents will result in re-negotiation of cost and extension of time although quite often a schedule of rates should have been agreed upon prior to the contract being signed off.
iv) In order to have a very accurate and firm project cost, the design and construction drawings as well as the specifications have to be very accurate and to do this, it will normally take a longer time as several design reviews are recommended.
v) No incentive for bidders to highlight mistakes and or omissions by the design consultants as all the bidders will be judged or evaluated based on the lowest bid.
vi) There are circumstances where the lowest bidder or awarded bidder will only highlight the mistake after they have been awarded and have mobilized. With this, the builder is entitled to issue a change order where both additional cost and time are claimable.
vii) Since the project consultant or professional architects and engineers and builders are hired by the Owner separately, all parties will have the tendency to protect their own interests instead of working as one team.

SUNPOWER – Industrial project accomplished under design, bid and build basis

The advantages of Design & Build Contract are:-

i) The Owner is only required to define a list of deliverables and project specifications to the bidders and awarded builder based on its: -
   a) Project objectives
   b) Performance specification
   c) Project schedule
ii) All risks resulting from any miscommunication between the design architect and engineers and builder are migrated from the owner to the builder.

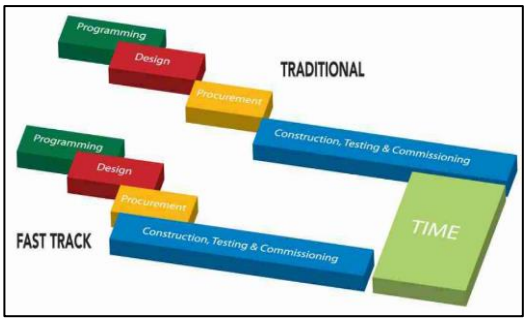
iii) Shortens the overall project schedule as the tendering process will normally take about four to six weeks or longer depending on the complexity of the project.

iv) The bidders are given the incentives to introduce some of the latest technology and experiences as well as local knowledge that they may have in order to offer their best price.

v) Since the design architect or engineer and builder are from the same entity, the opportunity of having any change order due to design mistake or omission will be avoided.

vi) Similarly, for schedule delays resulting from design mistakes or design errors, the risk is with the builder.

vii) Owner is not liable for any dispute between the design consultant, architect or engineers and builder.



The disadvantages of Design & Build Contract:-

i) The Owner may need to incur additional cost to hire another team of personnel to protect its interest in the area of: -
   a) Quality.
   b) Ensure project performance specifications are met.

   This is to ensure the builders do not take advantage by compromising the specifications that are open to delivering the lowest or cheapest cost building. This additional cost is necessary also to ensure the Owner's requirements are met.

ii) The Owner may face challenges in evaluating the bids submitted by the builders because some builders may have submitted an offer that is very low in terms of initial cost or first cost but very high operating cost or very high maintenance cost and short life cycle depending on the brand and/or manufacturer of equipment offered.

iii) The Owner will have a very minimum say in the project and the designers are not acting for the Owner but for the builder.

iv) Under the Design & Build Contract, it eliminates the checks and balances when the designer and builder are not separately hired.

v) In the Design & Build Contract, the Owner potentially may face challenges in having the consultant, design architect or engineers and builder recognizing each other's mistakes and also in having them to act independently.

vi) Unlike the Design, Bid & Build Contract, the designer will normally closely monitor and examine the builder's performance to ensure they meet specifications and evaluate their status of work prior to issuing certificates of payments.

Design & build of a manufacturing plant at Iskandar Senai Industrial Park, Johor.

In summary, under Design, Bid & Build Contract, the Owner hires the consultant and builder separately and for the Design & Build Contract, the Owner will only hire one company under the contract. There are advantages and disadvantages of adopting Design, Bid & Build and Design & Build Contract and it all depends on the selection criteria, i.e., whether the schedule and cost are the main criteria. The traditional approach where the Design, Bid & Build Contract is commonly adopted, the offers by the bidders are usually more competitive as all bidders are bidding based on a similar and very comprehensive set of documents produced after a detailed design process. However, this usually will require a longer project schedule as compared to a Design & Build Contract when the project can be fast-tracked because the builder can be on board before the construction drawings and specifications are completed and sometimes even before the design has even begun. This is because all that is required is only the performance specifications. However, the Design & Build Contract may not provide an opportunity to allow the Owner to compare the bids received on an apple-to-apple basis. ■

Engineering: Harnessing the Power of Language

by Lee Bee Choo

English language remains the undisputed lingua franca of all domains, irrespective of disciplines and this includes engineering. An engineer that is handicapped language wise is disadvantaged professionally. As a matter of fact, the disadvantages do not wait to emerge only when one enters the working world but starts to unfold in Engineering school itself. Sheppard's (2003) depiction of an engineer's scope is expressly appropriate: Engineers "scope, generate, evaluate and realize ideas." Within this range, language plays an undeniable mammoth and significant role that typically applies to engineering students as well.

Academically, no doubt engineering is a technical discipline. However, a substandard command of the English language is likely to leave one grappling with lectures and tutorials, laboratory work and reports, project documentations and papers which are predominantly in English. In addition, the Internet is by far the current leading information provider although there may be cases where credibility and reliability of the web sources are debatable. Having said that, the Internet remains the preferred choice of many for both information and news, to the extent that this technology is claimed to have reshaped the worldwide educational landscape in terms of facilitating and enhancing academic learning (Apuke and Lyendo, 2017; Manasijević et al., 2016; Lyendo and Halil, 2015). It is arguably the most popular source of information and the English language is the principal language used. Thus, can you picture how compromised is a student with low proficiency in the language in his studies?

Moreover, a weak command of the language will not only effectively undermine learners' comprehension of study materials but will also enfeeble their deeper understanding of underlying engineering concepts, deemed so vital in their applications to resolve real-world issues constructively. Nowadays, it may not be so startling to chance upon professionals in the engineering field that are dealing with technical matters somewhat ineffectively due to skimpy understanding of engineering concepts, possibly due to low proficiency in a certain language, i.e. English. Take for example, a case with a Counterintuitive Approach that involved stud bolts on ASME B16.5 DN350 CL600 flanges in an industrial plant whereby 1-1/4'' stud studs were to replace 1-3/8'' stud bolts temporarily due to shortage of the latter **(**Artamonov, 2019**).** Where there is consistency in materials and surface treatment, the torque required to tension the bolt in order to reach the required compression force is in tandem with the stud's diameter. However, the 1-1/4'' studs were tightened 1.1 (138/114) times of 1-3/8'' studs torque as instructed by a maintenance engineer instead of being tightened to 1.1 times less torque than 1-3/8'' studs, a figure easily derived from basic physics formulas for frictional force, Ff=μFN and force-torque relationship, T=Fd.

Consequently, higher education institutions have also proactively strived to empower engineering students through communication skills, a vital employability skill that reverts back to the person's English language proficiency (Zainuddin, et. al., 2019). Apparently, effective communication skill is identified as a significant gap between academic programmes and industry skill requirements. It has been lamented often enough that Malaysian graduates are not able to communicate nor write reports effectively in English despite learning the language formally via our education system from primary to tertiary (Lee, Ambigapathy and Souba, 2020). Hence, to plug the gap, undergraduates enrolled in public universities are required to take and pass a minimum number of units of English language courses in order to graduate.

Efforts to prop up and enhance communication skills at tertiary levels have further extended to encompass qualified engineers since communication is also viewed as a critical part of engineering practice. Engineers too acknowledged the significance of possessing competent communication skills of which language represents the building blocks. A study conducted by Dowling (2013) on 250 experienced engineers showed that among 63 competencies listed in the survey, 6 communication competencies were ranked in the top ten competencies of which 4 were rated critical (5 on a five-point scale) by more than 50% of the participants in the study.

Thus, the PCR (Purpose-Communication-Response) Communication Model with a 10-step checklist was created to assist those in the engineering field in understanding the communication process and planning them (Dowling, Carew and Hadgraft, 2013). The PCR Communication Model remains a useful framework not only for professionals to explore and analyse complex engineering communications such as contracts for a large project or detailed construction plans but also as a tool to develop effective communication packages that include business letters and project reports.

Therefore, to qualified engineers who require in-depth understanding of the communication process for overall effective communication or engineering students who are aiming to be employed upon graduating, in possession of a decent level of proficiency in the English language is not mere convenience, but a prerequisite.

WATER REUSE:

A SUSTAINABLE WATER RESOURCE AND CHALLENGES FOR ITS DEVELOPMENT

by Dr. Kourosh Bedzadian *Ir. Dr. Leo Choe Peng*

Due to the ever-increasing pressure on many urban water systems (UWS) as a result of limited water resources and increasing urban water demands combined with climate change and infrastructure ageing, finding new sustainable water resources is one of the biggest challenges for water authorities. This pressure can further increase when combined with lack of sustainable water management leading to inequitable access to potable water, poor sanitation, vulnerability to any short-term environmental shocks and unsustainable for long-term environmental change.

Out of several intervention options to overcome the above challenges, water reuse is considered as a favourite option that can benefit both water supply systems by reducing water demands and sewer systems by alleviating surface runoff or sanitary sewage discharge into overwhelming sewer networks and thus mitigating urban flood risk (Behzadian and Kapelan 2015). Development of water reuse in many occasions can be argued as a sustainable and resilient option for water resources compared to other interventions such as developing new traditional water resources already used by other sectors.

Development of common water reuse options such as rainwater water harvesting, and greywater/wastewater recycling is available at both decentralised (such as household or catchments) and centralised scale (wastewater treatment works). This can be planned and developed in most components of urban water cycle as shown in Fig. 1. As well as water conservation due to reduced water withdrawals from resources, water reuse can have other benefits such as reducing energy consumption for transportation in both water supply and sewer systems; and reducing contamination being discharged into receiving water bodies.

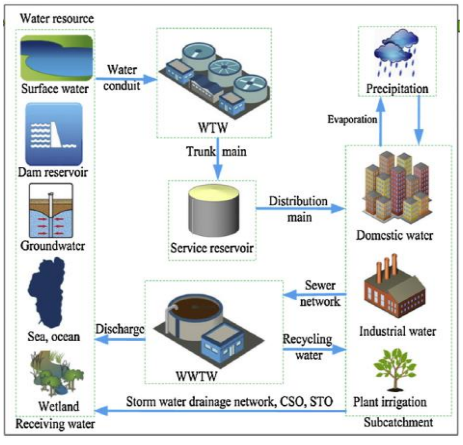


Fig. 1: Urban water cycle

Water reuse scheme as a non-traditional water resource is gaining more attention worldwide as a supplementary or alternative option for consumers. Although there are multiple plans to adopt water reuse schemes in many regions and countries such as California in the US and Singapore (Vesey 2016), the growth rate of using this scheme is currently slow at a worldwide scale. The obstacles for wide application of these technologies can be envisaged through a set of four principal components for sustainable development of these schemes as shown in Fig. 2. Normally, a reconciliation between all four components is needed to ensure the infrastructure and platform are properly available for fully uptake by communities and support of stakeholders.

Fig. 2: Key features of water reuse development

This needs to address the complexity of socio-technical and socio-economic systems of urban water management and investigate the obstacles that hinder uptake of water reuse interventions at various scales from the three angles of policy making, community acceptance and technological developments. A successful plan for water reuse development needs to identify the mutual interactional technologies. The connection of these interactions will also be identified with social (e.g. cultural and traditional aspects) and economic (e.g. affordability) considerations of

the communities for taking up water reuse schemes. This can demonstrate the potential for behaviour change in the communities. In addition, the connection of the above interactions with urban planning and household development needs to be investigated to identify the potential of these changes for future planning either through household retrofitting or new development of household construction projects. The identified commonalities and differences in multiple applications of these schemes can help decision makers better classify potential interventions and scenarios in the decision-making framework and share the successful knowledge and skills to develop potentially good alternatives for water reuse strategies. Within the policy-making perspective, a wide range of national policies, standards and regulations, regional and local resources and facilities affecting the case studies should be analysed. This will be combined with gaining knowledge in local communities by analysing the social, cultural, and religious behaviour for dealing with the existing challenges and barriers for taking up new water reuse technologies. Technological advancement in terms of affordable and low-tech water reuse equipment and strategy should be analysed to identify potential innovative and sustainable solutions fit for the purpose of holistically addressing the identified challenges and hence result in community resilience. All these requirements should also be justified through the improved performance of urban water systems and hence an integrated and holistic approach for system performance is required that quantify sustainability-based performance indicators when these technologies are placed within the urban water systems. Once all these components are established and embraced by all stakeholders and consumers, we should be able to see fast growth and uptake of these schemes in the communities.

References:

Behzadian, K. and Kapelan, Z., 2015. Modelling metabolism-based performance of an urban water system using WaterMet2. Resources, Conservation and Recycling, 99, pp.84-99.

Vesey J 2016. Water Reuse: A Critical Step on the Path to a Secure Water Future, IWA publishing

IEM SECRETARIAT

by Ir. Tan Eng Hock

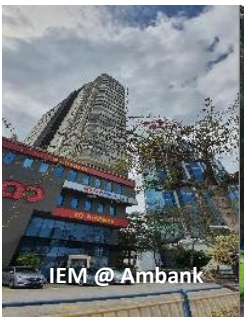
Since graduation
IEM Secretariat always is a place where occasionally must check in…
It is not only a location for the registration of Continuous Professional Development activities
But also a purposeful future pathway for all the Engineers in achieving their targeted accomplishments
Where providing an agile platform to qualitatively improve and enhance their knowledge

In my memory since the first day of career life
IEM Secretariat was initially situated on the ground floor of a nostalgic Building at Macalister Road
I gain my countless and precious factual information here
I enjoy the ambience of the neighbourhood encompassing this building

I can't recall
when It was moved to the fifth floor of Ambank Building
A place where you can attend seminars and other comprehensive activities comfortably
A place where you can enjoy the vast sea view beside the busy life of surroundings

By compromising some mutually agreed terms and conditions among IEM and Purchaser
of our office
IEM Secretariat was offered to move out to another permanent office
A place call E-gate
From Level 4 where it is located
We still continue rejoicing the Penang Bridge sea view and the dazzled traffic flow to and fro between Island and mainland
We still continue developing and contributing our learning to our nation selflessly

IEM Secretariat
A place with plenty of activities which you must actively involve and participate...


IEM @ Ambank


IEM @ Macalister Road


IEM@E-Gate

MODELING OF SLOPE STABILITY WITH SEISMIC & DYNAMIC EFFECTS AND THE RELATED GROUND ANCHORAGES

by Ir. Chua Beng Seong

BACKGROUND INFORMATION

This is a case study involving alteration to an existing slope and the effect on its stability taking into consideration the seismic and dynamic effects as per the client's briefs.

The client purchased an adjacent empty plot of land with the intention to merge with the existing unit (with basement level) into one common pretentious villa. Due to the new brief requirement, the basement level for the new building will have to be recessed further into the existing slope by another 2.5m, thus altering the Factor of Safety (FS) for slope stability under the Limit Equilibrium to an unfavourable condition.

2.0 EXISTING GEOTECHNICAL PROFILE

Fig. 1.0 shows the existing slope profile where the slopes can be categorized into (a) Slope-1: 40-degree, (b) Slope-2: 30-degree and (c) Slope-3: 10-degree. Under the Hill Slope Classification for Design Purpose, Slopes-1, 2 & 3 are classified as Class 4A, Class 3A & Class 1 respectively.

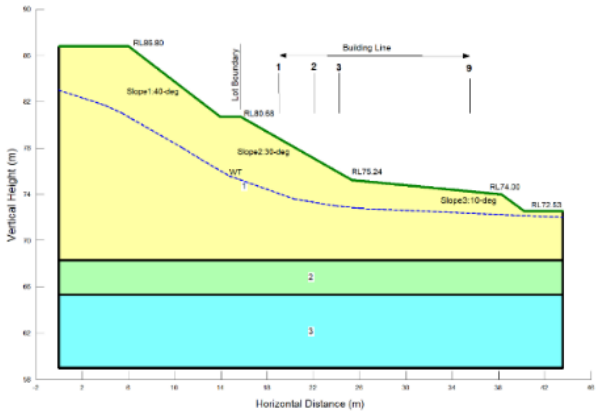


Fig.1.0: Existing Slope Profile

For the purpose of slope modelling and analysis, the effective strength soil parameters from Mohr-Coulomb model (interpolated from the SI bore-Logs) are divided into 3 main profiles:

Layer 1: Medium Stiff Sandy SILT:
Y_b= 18.0kN/m^3, C'= 8.0kPa, θ'= 34°, SPT N/300=16
Layer 2: Stiff Sandy SILT:
Y_b= 19.0kN/m^3, C'= 10.0kPa, θ'= 36°, SPT N/300=20
Layer 3: Very Stiff Sandy SILT:
Y_b= 20.0kN/m^3, C'=18.0kPa, θ'= 45, SPT N/300>45

3.0 BASIS OF MODELING & DESIGN

a. Slope stability and strengthening analysis shall be modelled via the numerical modelling software "Geo-Slope/W";
b. Bishop's simplified factor of safety method shall be adopted based on normal interslice forces, but ignore interslice shear forces.
c. The seismic load due to the Peak Ground Acceleration, PGA = 0.08g for the KL zone shall be adopted to MS EN1998-1:2015 (National Annex: 2017 Table N.A.1) & EC8-Part 1/ EN1998-1: 2004;
d. Strengthening of slopes via bored-and-grouted soil nails /Type A (Equivalent) Ground Anchorage shall be designed to BS8081:1989 (Ground Anchorages).

4.0 NEW BUILDING

For the design of the new building with the basement footprint now extending another 2.5m into the slope, the detailed staged construction sequence will have to be modelled and checked for both the temporary (local) and permanent (global) states. This article extracts and highlights only Stage 3 with seismic analysis results.

Fig. 2.0 shows the new building modelled under **Stage 3**: Preparation of Retaining Wall and Foundation at **Gridline 2** (New Recess Line). The local Factor of Safety (FS) for moment limit equilibrium is 1.06 (<1.20) which now falls below the required minimum FS margin. Fig. 3.0 shows the global Factor of Safety (FS) for moment limit equilibrium has now lowered to 1.29 (<1.40) which also falls below the required minimum FS margin. Slope strengthening is therefore required.

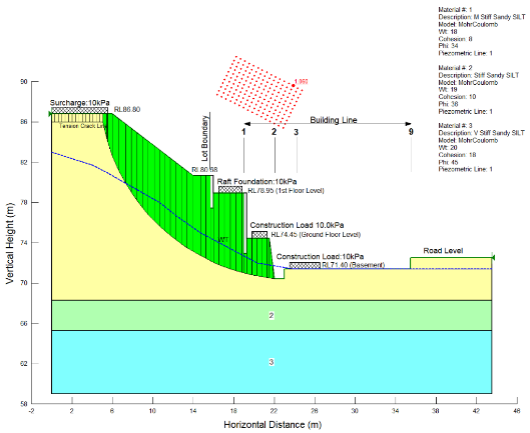


Fig. 2.0: Local Analysis

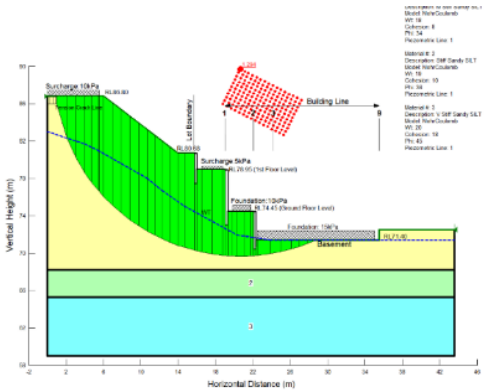


Fig. 3.0: Global Analysis

5.0 SEISMIC & DYNAMIC STABILITY

Fig. 4.0 shows the new building modelled under **Stage 3**: Completion of Retaining Wall and Foundation at **Gridline 2** (New Recess Line) with the introduction of Soil Nailings SN#1, SN#2 & SN#3. The Global Factor of Safety (FS) for moment limit equilibrium with the soil nails fully mobilized, has now increased from 1.29 to 1.56 (>1.40). Fig. 5.0 shows the Seismic Pseudo-static Analysis to PGA=0.08g. The Global Factor of Safety (FS) for moment limit equilibrium has now lowered from 1.56 to 1.38 (>1.10) but still satisfies the required minimum FS margin.

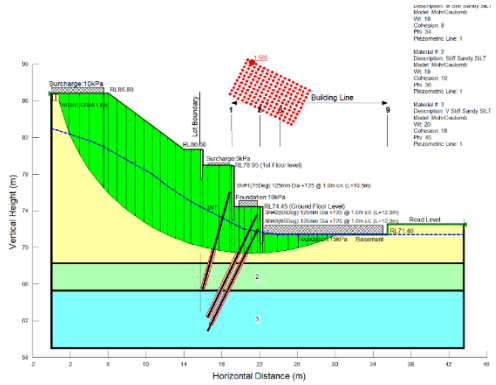


Fig. 4.0: Global Analysis with Soil Nails

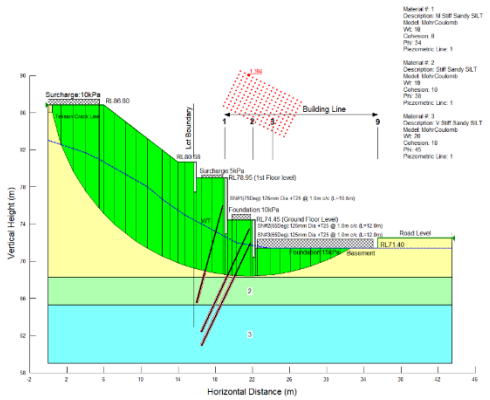


Fig. 5.0: Seismic Pseudo-Static Analysis with Soil Nails

6.0 PSEUDO-STATIC SEISMIC LIMIT EQUILIBRIUM

Dynamic effects of the slopes due to seismic loading can be considered in two ways, namely (a) Pseudo-Static analysis (b) Finite Element dynamic stresses with pore water pressure modelling. In this article only Pseudo-Static modelling will be presented. As in the case of Limit Equilibrium Fundamentals, a limit equilibrium formulation in Pseudo-Static analysis finds those forces acting on slice so that the slice is in force equilibrium and so that the factor of safety is the same for every slice. If a dynamic force is applied to a slice, the slice forces will be re-adjusted, which will include a re-adjustment of the base shear strength.

A Pseudo-Static analysis represents the effects of earthquake shaking by accelerations that create inertial forces. These forces act in the horizontal and vertical directions at the centroid of each slice. The design seismic inertia forces $\mathbf{F_H}$ and $\mathbf{F_V}$ acting on the ground mass, for the horizontal and vertical directions respectively shall be taken as:

EC8/EN 1998-5 :2004: Part 5

$\mathbf{F_H = 0.5\ \alpha \cdot S \cdot W}$ - Eqn. (4.1)

$\mathbf{F_V = \pm 0.5 F_H}$ if the ratio $\mathbf{a_{vg}/a_g}$ is greater than 0.6 - Eqn. (4.2)

$\mathbf{F_V = \pm 0.33 F_H}$ if the ratio $\mathbf{a_{vg}/a_g}$ is not greater than 0.6 - Eqn. (4.3)

where

$\boldsymbol{\alpha}$ is the ratio of the design ground acceleration on type A ground, $\mathbf{a_g}$, to the acceleration of gravity **g**;

$\mathbf{a_{vg}}$ is the design ground acceleration in the vertical direction.

$\mathbf{a_g}$ is the design ground acceleration for type A ground.

S is the soil parameter of EC8/EN 1998-1 :2004; - Cl. 3.2.2.2

W is the weight of the sliding mass.

Additionally, a topographic amplification factor $\mathbf{S_T}$ for $\mathbf{a_g}$ shall be taken into account according to: - Cl. 4.1.3.2 (2)/ Annex A

Therefore, based on MS EN1998-1:2015 (National Annex: 2017 Table N.A.1) and EC8-Part 5/ EN1998-5: 2004,

$\mathbf{a_g}$ = 0.08g (for KL Zone)

$\boldsymbol{\alpha}$= 0.08

S = 1.4 (Ground Type B: Table N.A.1 of MS EN1998-1:2015)

$\mathbf{S_T}$ = 1.2

$\mathbf{F_H = 0.5 \cdot \alpha \cdot S \cdot S_T \cdot W = 0.5 \cdot 0.08 \cdot 1.4 \cdot 1.2\ W = \underline{0.067W}}$

$\mathbf{F_V = \pm 0.33 F_H = 0.33 \cdot 0.067\ W = \underline{0.022W}}$

7.0 CONCLUDING REMARKS

The case study shows how the stability of the slope under seismic conditions can be effectively modelled using a similar concept of limit equilibrium fundamental. The case study shows that the stability of the slope under seismic consideration has resulted in a lower FS by 11.54%.

Due to space constraints, the following topics which have been left out, must be equally emphasized:

- The Seepage effect during construction due to the water table that is higher than the basement.
- The effect of Ground Deformation due to the strip foundation and seismic loadings.
- The design of the facing plate which should be of sufficient size to ensure that local bearing capacity failure does not occur.

WOMEN ENGINEERS, LEADERSHIP FOR FUTURE

by Ir. Heng Lee Sun

*"**Leadership** is about making others better as a result of your presence and making sure that impact lasts in your absence." Quote from Sheryl Sandberg,* the Chief Operating Officer (COO) of Facebook and the founder of LeanIn.Org. In 2012, she was named in the Time 100, an annual list of the most influential people in the world.

The visibility of female role models plays a significant role in inspiring other women to pursue similar careers, as well as proving that success in this male-dominant industry is achievable. Everyone is facing a unique set of challenges in this world and being a woman in this industry sometimes has its difficulties. As professionals, women not only have to deal with double standards in businesses dominated by men, but they have to balance both work and home obligations. In fact, recent research from the World Economic Forum found that women work an hour more than men a day, when totalling paid and unpaid labour.

As Women Engineer, while you cannot always change your industry, you can change your mind and learn the courage to lead and become the role model for younger women need.

IEM Penang Branch WE Committee:
Back row from left: Ir. Yeap NG, Ir. Lim SR, Ir. Ooi CH, Ir. Dr. Leo CP
Middle row sitting left: Ir. Tean SN, sitting right: Ir. Tan YM
Front row from left: Ms. Tan HS, Ir. Heng LS, Ir. Catherine Sim SP, Ir. Than SW.

Be Brave to define your personal ambition, purpose, and goals for.
Be Determine for the decision to connect the challenges and to create the best idea for a solution.
Be Resilient to manage relentless change in organisation and becoming invincible.
Be Extraordinary to step up to lead, to step beyond the comfort zones, and to achieve a better future.
Embrace Change to shape the future, Women Engineers, WE Lead.

Ir. Heng Lee Sun is the current Vice Chairman of IEM Penang Branch

IEM Membership Updates (March 2020 to October 2020):

Membership No.	Fullname	Grade	Discipline
66827	LEONG CHORNG YI	MEMBER	CIVIL
70485	CHUA EU LIANG	MEMBER	MECHANICAL
112504	KHOR HSAO PINK	COMPANION	CIVIL
70410	KAAJENNTHIRAN A/L SEPULOH MANIAM	MEMBER	MECHANICAL
15421	YAU ANN NIAN	FELLOW	CIVIL
20911	LAU TZE LIANG	MEMBER	CIVIL
26486	HENG LEE SUN	FELLOW	CIVIL
45915	WONG KOK NIAN	MEMBER	ELECTRICAL
50212	SANTHIYA A/P RAMASAMY	MEMBER	ELECTRICAL
50882	OOI TZE HOONG	MEMBER	MECHANICAL
52845	CHEAH SHENG HONG	MEMBER	CIVIL
77459	TAN KIM SEAH	MEMBER	MATERIALS
80547	AMIR ANWAR BIN SHABUDIN	MEMBER	ELECTRICAL
86891	KHAW YAO SHUN	MEMBER	MECHANICAL
90012	LIM WOOI KEONG	MEMBER	CIVIL
112737	MOHD HANAPIAH BIN ABDULLAH	MEMBER	ELECTRONIC

BUILDING WITH THE MOUNTAIN

Technical Talk by Dr. Peter A. Wyss

Reported by Ir. Bernard Lim

Langkawi Skybridge

There are a lot of apprehensions when it comes to building on slopes and mountainous terrain. In certain places there are limitations and even prohibition for varied reasons. So how will you be able to overcome such challenges?

We have our speaker, Dr Peter A. Wyss who grew up in the highly mountainous country of Switzerland where he experienced building villages, and even part of agglomerations of steep terrain have become the bread and butter for the construction industry.

Dr. Wyss

Dr Peter Wyss was the chief planner of the Gunung Machinchang Masterplan and the designer of the iconic Langkawi cable card and Skybridge.

In this talk, Dr Wyss share with us some of the pertinent design and construction points when building on steep terrain, including sharing of movie clips on the Langkawi project. The Skybridge is located at the Machinchang Mountain. It is a difficult terrain.

The Machinchang Formation, found in the northwestern region of Langkawi, is a unique mountain environment dominated by barren rocky peaks and vertical cliffs made from yellowish, moderate-to-thickly bedded sandstone, interspersed with hits of interbedded dark-to-light grey shale and mudstone.

It is indeed an eye opener when the speaker shares his motto when implementing project, which is "thinking beyond the obvious".

The talk was held at Bayview Hotel, Georgetown, Penang on 9 May 2020 with well over 70 participants. It was well received with lots of interaction between participants and speaker. The hall arrangement followed the SOP to ensure social distancing.

Some of the participants with the speaker Dr. Wyss (4th from right)

Ir. Bernard Lim is the current Vice Chairman of the IEM Penang Branch

URBAN PLANNING & INFRASTRUCTURES DEVELOPMENT

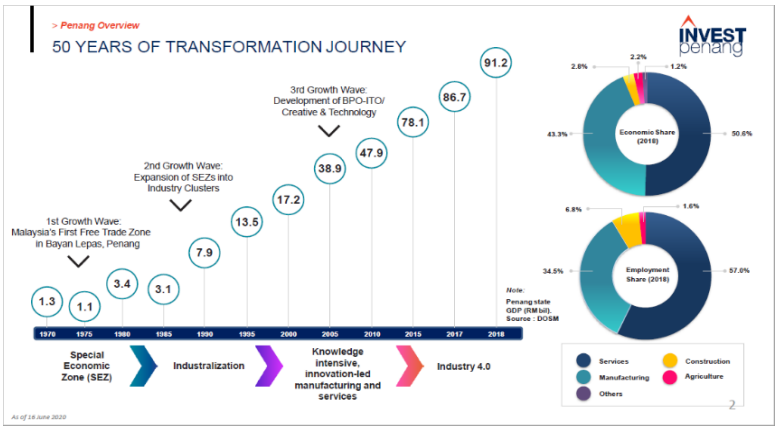
Where we were, now and heading to, from industrialization points of view & economically

Talk by Dato Seri Lee Kah Choon, City Bayview Hotel, Penang, 18 July 2020 *Reported by Ir. Bernard Lim*

We have the honour of having Dato' Seri Lee Kah Choon, currently the Chairman of Malaysia Debt Ventures Bhd, Malaysia's leading technology financier under the Ministry of Finance presenting a talk on urban planning & infrastructures development. Dato' Seri is also the Special Investment Advisor to the Chief Ministry of Penang.

Penang's industry success is the presence of robust ecosystem with proven track record to evolve and stay focused on the state-of-the-art manufacturing and technologies.

Over the 50 years Penang has been transform into one of the Asia's manufacturing super hubs with over 300 multinational corporation, MNC. The arrival of 8 Samurai in 1970s has spawn the establishments of MNCs in Penang and it bodes well for the State's manufacturing industry in moving up the value chain. Following such trajectory, the State is now a regional hub for E&E, equipment, and medical device industries. Concerted urban planning and accessible infrastructure are imperative in Penang's transformation journey, alongside with the comprehensive



supply chain and a well-nurtured talent pool. The urban

Dato' Ir. Lim Kok Khong (left) and Ir. Bernard Lim (right) presenting appreciation certificate to Dato' Seri Lee Kah Choon (centre) after the talk.

planning and infrastructure development of Batu Kawan will be an interesting case study. Speaker shared the plan for Batu Kawan and the way towards the future. Following the proven track record in creating state-of-the-art manufacturing and technologies, Batu Kawan will have 5 objectives in its ecosystem:

1. Strong industrial base
2. Affordable housing
3. High-End Residences

4. Emerging supporting cluster in education
5. New retail & recreational facilities

Other initiatives by the state of Penang are:

i. Batu Kawan as an Eco-City.
ii. Penang Smart City

The talk was moderated by Dato' Ir. Lim Kok Khong. There were over 60 participants attended the talk.

ROUND TABLE DISCUSSION ON IMPLEMENTATION OF RENEWABLE ENERGY (RE) AND ENERGY EFFICIENCY (EE) IN PENANG

by Ir. Khaw Yao Shun

Instead of viewing renewable energy (RE) and energy efficiency (EE) as just goals, let us first ask ourselves what is the motive for implementing RE and EE in Penang? Why is there a need for the existence of RE and EE and how do they relate to our everyday life? Coiled in the late 20th century, these two terms are often associated with efforts of reducing carbon footprints on the earth. Both RE and EE are distinctive yet correlated. RE is on the macro scale. It is about utilising energy that is clean and unlimited where it is easily replenished. The energy should be abundant and leave no carbon trace behind. However, the exploration of the energy itself must also be clean and not at the expense of nature. One of the renewable energies is solar energy which is plentiful in Malaysia. It is a good practice to install solar panels on the rooftop of buildings to harness solar energy. Malaysia is advancing with the introduction of NEM (Net Energy Metering). The concept is to pay users the amount of energy equivalent to how much they have produced using the solar panel. It also further attracts users with the introduction of incentives like Green Investment Tax Allowance (GITA), and other tax waivers. Nevertheless, it is wise to think of how much roof space has to be sacrificed in order to install a determined number of solar panels as well as how much energy can be produced on the number of solar panels installed. The capital cost must be justified with the operational earnings or else it will not be viable from a business point of view and is not sustainable in a market sense.

On the other hand, EE is on a micro-scale. It is more about the habitual and mentality of the user. Essentially, it revolves around how a building utilises less energy to maintain operations at the same level, thereby leaving less carbon footprint from the energy of hydrocarbon. EE can be easily achieved via good engineering design and prudent consumption habits.

Note that a high EE building may not necessarily leave lesser carbon footprint as compared to a low EE building that derives its energy from RE. However, it is relatively easier for EE to be implemented by the general public. Therefore, EE contributes the most points to the Green Building Index (GBI).

Under the Penang 2030, all new developments with GBI Gold certified from 2020 onwards are listed under the category "Invest in the built environment to improve resilience – Implement climate change adaptation plans". It is opined that by fulfilling the GBI requirement, RE and EE, which are requirements included in the index, would have already been implemented in Penang indirectly.

The article is representing opinion conveyed in "Perbincangan Tenaga Diperbaharui (RE) dan Kecekapan Tenaga (EE) Pulau Pinang" which was held on 25 September 2020 at KOMTAR, chaired by YB Zairil Khir Johari, Exco Kerja Raya, Utility dan Tebatan Banjir.

IEM PENANG

MALAYSIA DAY CYCLING

Queensbay Mall to Karpal Singh Drive

Date : 16th September 2020 (Wednesday)
Time : 0615hrs-0800hrs
No. of Participants : 15
Reported by:

Ir. Wong Kok Nian

Lim Wei Hong

Group Photo near the Penang Bridge

In conjunction with Malaysia Day, the first cycling event of 2020 had been organized by the Young Engineer's Section of the Institution of Engineers, Malaysia (Penang Branch). This event was organized to celebrate Malaysia Day as well as to raise the awareness of health among engineers. The route taken is the dedicated bicycle lane connecting the east coast of Penang Island.

At approximately 0615hrs, participants gathered at Queensbay Mall Link Bike Station. They then rented bicycles from the Link Bike station before riding to Karpal Singh Drive. It took approximately 1 hour for all participants to reach the destination, which is approximately 10 km in distance. Along the way, the scenery by the sea along the bicycle lane is beautiful and all participants stopped under the Penang Bridge to take some photographs. After breakfast near Karpal Singh Drive, half of the team return to the starting point using the original route.

This event was led by IEM Penang YES Committee Mr Lim Wei Hong, and with great honour participated together with IEM Penang Executive Committee Dato' Ir. Dr. Goh Teik Chong, Ir. Bernard Lim, Ir. Chan Wah Cheong, and other 14 IEM YES Members.

MY IRONMAN JOURNEY

by Ir. Bernard Lim

Ir. Bernard Lim at finishing line of

My Ironman journey started back in 2016. I had always been running marathons to keep myself healthy. I was overweight, 120kg and when I started running, I managed to reduce my weight down to 80kg. I used to cycle and swam back in my school days, but I had never thought that I will participate in such a multi-sports event like Ironman.

I was encouraged by my friend Mei Chee Seong to join a group of athletics that has been participating in multi-sports known as AM.i.3. This is really a great team of friends that pushes one to excel.

Training for an ironman event took lots of my time. I usually do averagely a total of 50KM running, 200KM bike and 3-4KM swim weekly, which took approximately 12-15hrs per week. Running is easy for me as I had already been running marathons or Ultramarathons all this while. My toughest discipline is cycling and therefore, I spend most of my weekends cycling.

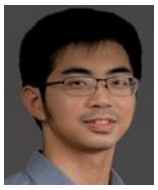
My first Ironman (226KM) event was on 11 Nov 2017 in Langkawi, Kedah. I trained for almost 8 months for the event and went to the actual site for training twice before the event. Unfortunately, as it was getting close to the event, I had an accident and fell from my bike on 29 Oct 2017 which was about two weeks before the Ironman Langkawi 2017. It was a bad fall while going downhill on my bike training at Sumpitan, Lenggong. I fractured my sternum from the fall but fortunately, there were no broken ribs or broken collar bone. Doctors advised me not to participate in the upcoming Ironman event. However, as I have put in so many training hours to prepare myself for the event, I decided to go ahead with the challenge, promising to stop if I deem unfit to continue.

Group photo with family members

Completing the Ironman Langkawi 2017 was really one of my greatest achievement. I completed it almost to the cut off time with a time of 16 hours 18.22 mins. Subsequently after the race in 2017, I went on to participate in the following year Langkawi Ironman 2018 but this time I was better prepared, and I came in with a time of 15 hours 6.25 mins.

Things that I have learned from Ironman challenges are determination, focus and never give up. Once I have put my mind on a task, I will work on it, take it one day at a time. The Ironman journey has been a great experience for me; outside of my day to day live as an engineer.

MUSIC & MATHEMATICS



by Ir. Ooi Zi Xun

According to Oxford Learner's Dictionaries, music is defined as sounds that are arranged in a way that is pleasant or exciting to listen to. People sing music or play it on instruments. The word music comes from the Greek word (mousike), which means "(art) of the Muses". In Ancient Greece the Muses included the goddesses of music, poetry, art, and dance. Someone who makes music is known as a musician. Music is sound that is arranged by rhythm, melody, harmony and can be characterised as such:

1. Pitch – high and low notes
2. Rhythm – beat / how sound and silences are being arranged.
3. Dynamics – arrangement of soft and loud
4. Timbre – the distinctive quality of sound, i.e., gentle, warm, dark, hazy, etc.

Frequencies of Music Notes

After explaining the fundamental of music, have you ever imagined that music can be presented in mathematical equations? And did you recall studying the physics of sound and wave during high school? You will be surprised by reading the following paragraphs.

Photo 1 below shows a keyboard / piano black & white key with corresponding frequency. So, what are your guess on the relationship between music and mathematics?

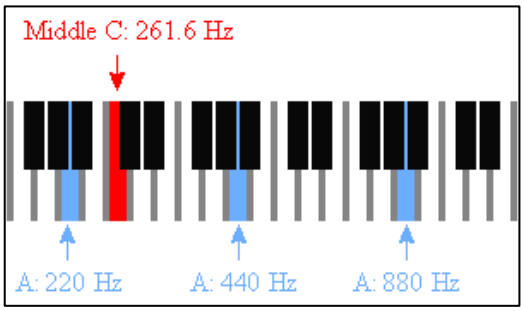
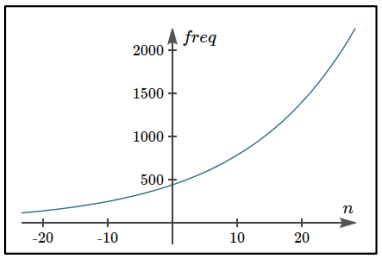


Photo 1: Keyboard / Piano black & white key and its frequencies

Yes, my fellow engineers, you are right! Music is made up of sound and thus musical frequency can be formulated as such:

Frequency, v = 440 x $2^{n/12}$, for n = -21, -19, ……, 27

The relationship between note and frequency is shown in graph 1.



Graph 1: Note frequencies (exponential curve)

A sine wave with frequency *v* in Hertz, peak amplitude *c* and phase ϕ will correspond to a sine wave of the form:

$$c\sin(2\pi vt + \phi)$$

For example, in photo 2, modern concert pitch places the note A above middle C, at *v* = 440 Hz.

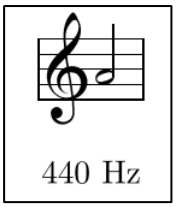


Photo 2: Modern concert pitch A

So, this would be represented by a wave of the form:

$$c\sin(880\pi t + \phi)$$

Examples of Relationship between Music and Mathematics

1. Notes, intervals, scales, harmony (consonance and dissonance), tuning, and temperaments are related to proportions and numerical relations, integers, and logarithms.
2. Mathematical concepts are present in melody and rhythm; musical notation includes concepts of time (length of notes, bar lines, and time signatures), rhythm (beat and the grouping of notes in tempos), pitch (clefs, staff, and frequency of the sound), and dynamics (signs of graduation of intensity), all in the circle of musical space (geometry of music). These elements are related to certain arithmetical operations (division, multiplication, addition, and logarithmic function), trigonometry, and geometry.
3. Mathematical patterns and motifs (types of symmetries) have been employed in musical compositions by a number of composers within geometrical ideas. Some examples are the motet *Non vos relinquam orphanos* by Byrd, fugues by J. S. Bach, and *Le coulis cendre* from the *Catalogue d'oiseaux* by Messiaen, etc.
4. The mathematical concepts of the "Fibonacci sequence" and the "Golder Section" theory may be found in musical compositions, such as piano sonatas by Mozart. Thus, music is connected to several different areas of mathematics, i.e., arithmetic, geometry, and trigonometry.

Benefits of Learning Music

1. Enhanced memory: According to Laurel Trainor, who directs the Institute for Music and the Mind at McMaster University in Ontario, Canada. Her research indicates that musical training seems to modify the brain's auditory cortex. She suggests that playing music in concert with others requires a particularly high level of attention and memory, perhaps leading to greater effects.
2. Improved literacy: Learn to play an instrument helps children develop "neurophysiological distinction" between certain sounds. Because the mechanisms for processing sound and speech are similar, this can lead to improving literacy as well.
3. Better cognitive learning, particularly in logical reasoning, spatial reasoning, and spatial reasoning: Playing a melody involves reconstructing a spatial-temporal pattern in which the elements are not puzzle pieces but notes of high and low pitches of long and short duration. The understanding of fractions and rations confirms the role of spatial-temporal reasoning in a number of mathematical operations.
4. Higher IQs: According to a 2006 study published in the Journal of Educational Psychology, music lessons appear to improve children's IQ and academic performance. The 2006 study found that for children, music lessons were positively correlated with higher school grades and higher scores on achievement tests. It also found that musical instruction was a predictor of higher IQs in young adulthood as well as higher high school grades.

Conclusion

Music has a power that's practically immeasurable. It transcends time and language, expresses and influences our emotions, educates and entertains, and so much more. Scientists are also beginning to understand the impact music has on our brains. Essentially, the effect is massive, and it has a particularly strong influence on the brains of children. I hope that this article triggers fellow engineers' interest & knowledge about music from the perspective of science, mathematics, and engineering.

SNailKitchen

by Ir. Tean Sze Nee

Almond Cookies

Recipe:

Ingredient A:
Almond powder 120g
Flour 180 g
Fine sugar 120g
Salt to taste
Baking powder 1 tsp
Baking Soda Powder 1 tsp
Corn oil 120g

Ingredient B:
Egg yolk 1 nos (for decoration purpose)

Steps:

1) Mix well for ingredient A
2) Split and roll into small balls (6-7g)
3) With brush, paint the egg yolk on top the balls
4) Preheat the oven 180c and bake the cookies for 20 minutes till the top color turned golden brown.

Chocolate Banana Cereal Muffin

Recipe:

Ingredient A: Butter in room temperature 150g, Fine sugar 70g
Ingredient B: Egg 2 nos
I*ngredient C:* Low protein flour 150g, Coco powder 15g
Instant cereal 3 tbsp, Baking soda powder 4g
Ingredient D: Milk 45g, Chocolate beans 20g
Ingredient E: Banana 2 nos cut into pieces

Steps:

Add Ingredient B) slowly into ingredient A) and mix well.

1. Add Ingredient C into 1 and mix well.
2. Mix ingredient D into 2 and mix well with hand mixer.
3. Add 3 into cups (70% full)
4. Add banana into the center of cups.
5. Preheat the oven 180°C and bake the cups for 25 minutes

IEM-USM × GAMUDA

STUDENT ENGAGEMENT AND NETWORKING SESSION

by Gary Ng Lit Phin, IEM-USM Student Section

Despite the outbreak of Covid-19, IEM-USM Student Section has continued its activity for the student community of Universiti Sains Malaysia. The student engagement and networking session has been conducted with GAMUDA Berhad on the 2nd of December 2020, through a virtual platform. This webinar session entitled "Everyday Life of a Gamuda Engineer" has attracted participation from nearly 90 students from Universiti Sains Malaysia.

The organizing committee had invited two distinguished speakers from Gamuda Berhad. They are Mr. Keith Gabriel Gan and Mr. Foo Han Piew. Mr. Keith graduated with a Bachelor of Human Resources Management. He is a Talent Acquisition & Employer Branding Executive of Gamuda Berhad. He manages end-to-end recruitment exercises including sourcing, interviewing, and hiring of fresh and senior recruits, and also establishes Gamuda's brands with several reputable universities including Universiti Sains Malaysia. The other speaker is Mr. Foo who is also an alumnus from Universiti Sains Malaysia in Civil Engineering. He is currently an assistant manager in Gamuda Construction Training Unit (CTU). He was involved in the Electrified Double Track and Line 1 (Sg Buloh – Kajang).

During the talk, Mr. Keith introduced the background, core business and management policy of Gamuda Berhad. Gamuda Berhad mainly focuses on engineering construction, property development and infrastructure concessions which improve the living quality of our country. Mr. Keith has highly inspired the participants with the quote 'We are working as a team but not individual, so every decision we made must consider the team and the members behind us with no one left alone'. The participants have gained an insight into Gamuda Berhad.

After that, Mr. Foo introduced his working life after graduating from Universiti Sains Malaysia in story form. From the story of Mr. Foo, participants learnt that everything starts up hard and tough but do not give up when facing any challenges as these challenges are precious experience for future life. A Chinese idiom states that your hard work will be paid off and everything will become better after overcoming times of hardships. Last but not least, Mr. Foo and Mr. Keith told the participants that each of them has their special traits and personality, and the most important thing is to have a strong heart, clear mind, and good attitude in the engineering world.

Participants have gained early exposure to future working life through this engagement session. The session has benefited participants with valuable knowledge and skillsets as an engineer. Participants have also been aware of the importance of technology in the engineering field.

Webinar session between USM students and Gamuda

IEM PENANG BRANCH ACADEMIC AWARD

The IEM Penang Branch Executive Committee on 20 October 2020 had the monthly committee meeting and decided to approve the Institution of Higher Learning (IHL)'s request for Book Prize with certification for the approved engineering programmes with the following conditions: -

- The IHL must have established an IHL-IEM student section. Currently in Penang, Universiti Sains Malaysia (USM) and Universiti Teknologi MARA cawangan Pulau Pinang (UiTM) have IEM student sections. USM has 11 engineering programmes and UiTM cawangan Pulau Pinang has 4 engineering programmes.
- The engineering programmes must be an accredited Bachelor of Engineering Degree by Engineering Accreditation Council (EAC) of Malaysia.
- The Book Prize is a cash prize of RM300 for each of the best student from the above 15 Engineering Programmes, with IEM Penang Branch Certificate.
- The Book Prize will be awarded to only the best First Year Student of each Engineering Programme. The student will be graded based on their year one Cumulative Grade Point Average (CGPA) results. If more than 1 student received the same top CGPA results, the IHL will choose the best among them based on their extra-curricular activities.
- The IHL has to send the recommended list of student names with their Identity Card Number and their results to the Chairman of IEM Penang Branch for approval prior to 30th October 2021.
- The awards will be presented in one of the events organized by the IHL or IEM Student Section. The awards are likely to be presented during the fourth quarter of the year.
- These awards will be considered from year-to-year basis subject to application by IHL and approval by IEM Penang Branch.

(For more details, please refer to IEM Penang Branch Secretariat)

WITH BEST COMPLIMENTS FROM:

SOIL MECHANIC SDN BHD

No. 7, Lorong Talang Satu, Prai Garden, 13600 Prai, Penang, Malaysia
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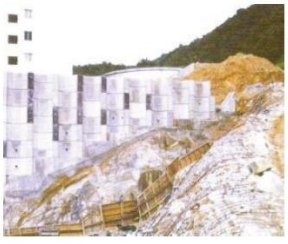

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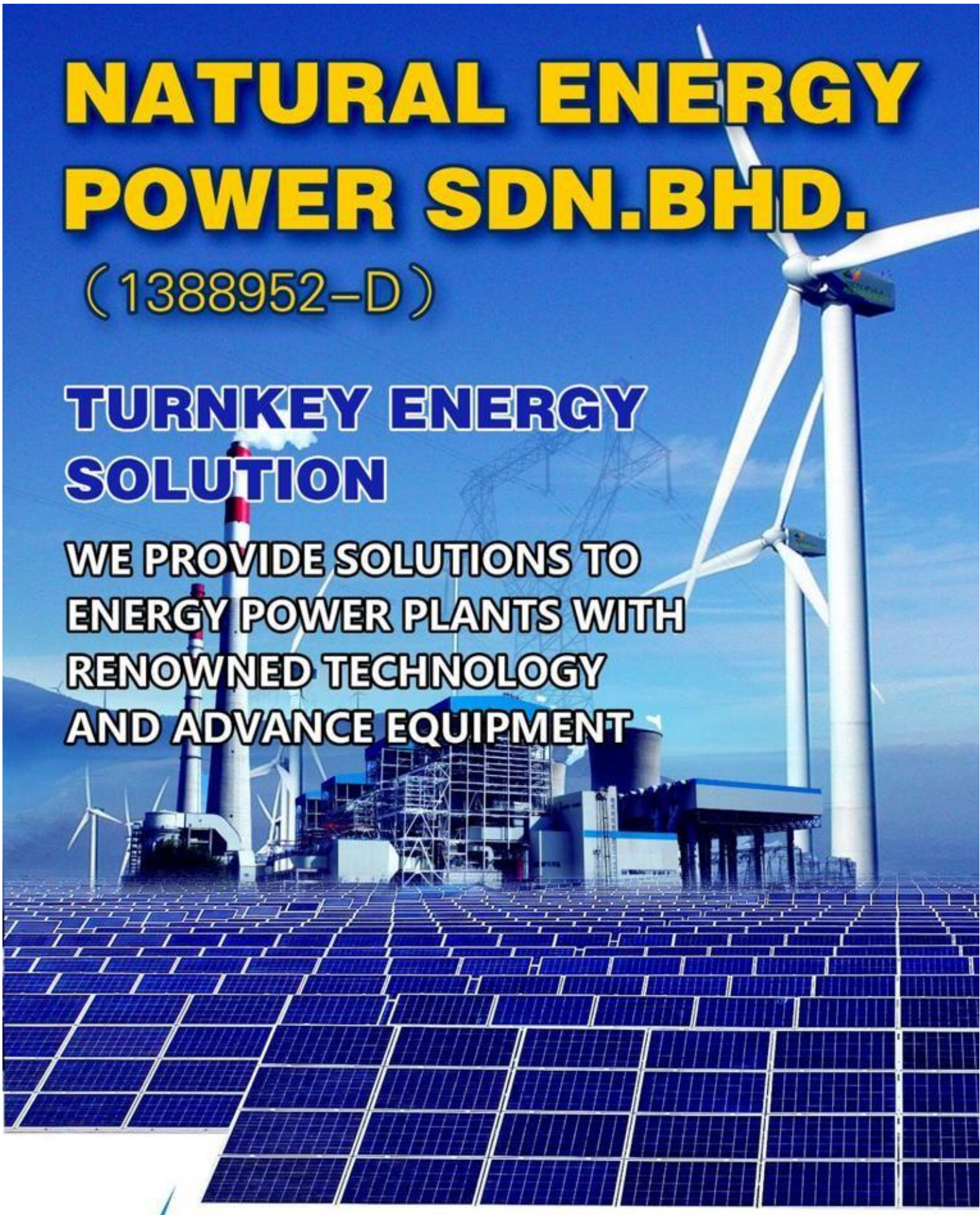

ADDRESS: 32, JALAN ELEKTRON U16/61 SEKSYEN U16,
DENAI ALAM 40160 SHAH ALAM SELANGOR MALAYSIA
EMAIL: NATURALEPOWER@GMAIL.COM