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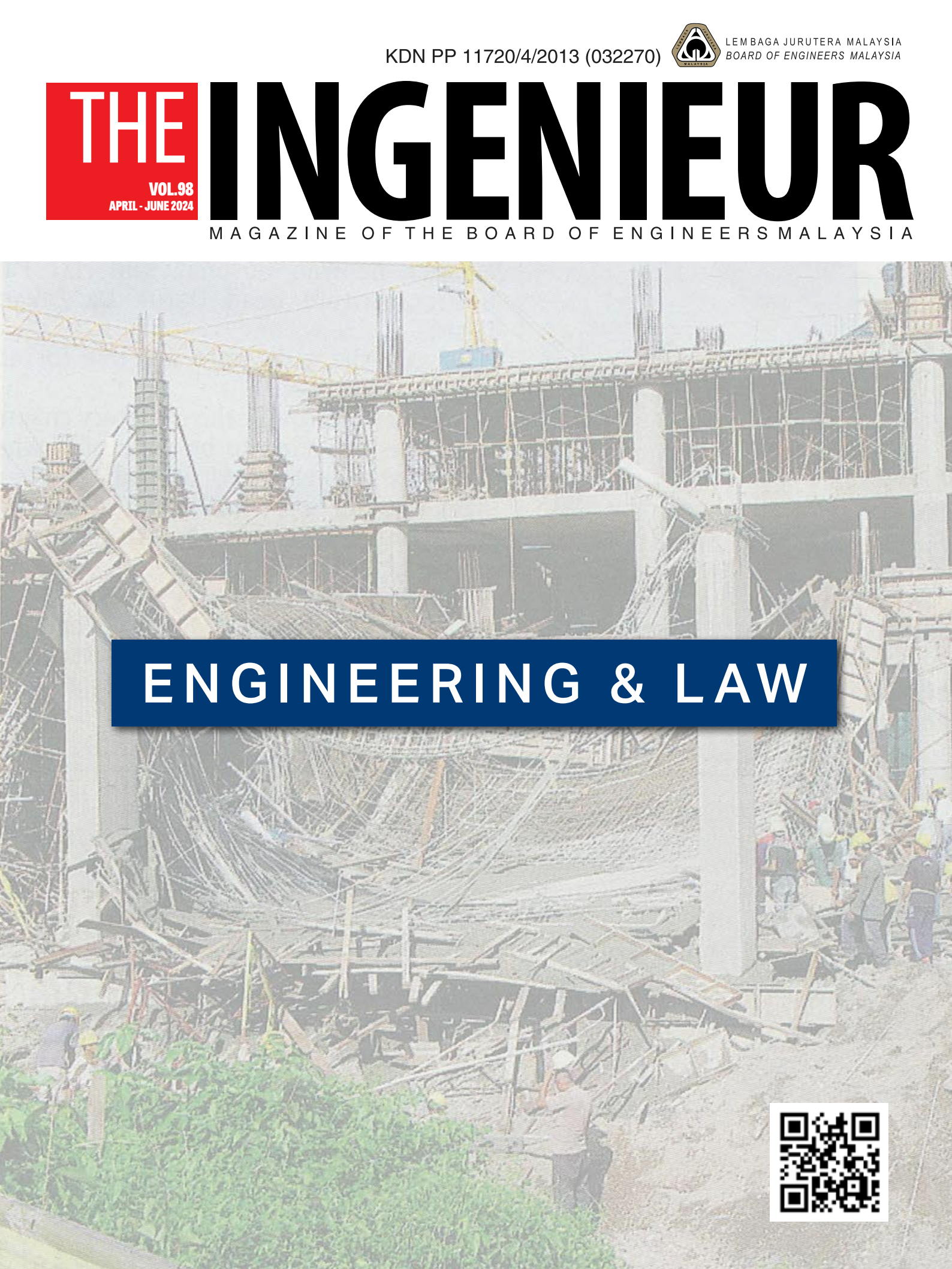


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BOARD OF ENGINEERS MALAYSIA

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ENGINEERING & LAW



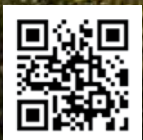
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wind and water to light up homes and brighten lives.
Hand in hand with Mother Earth, we strive to unlock an
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THE INGENIEUR MAGAZINE IS FULLY ONLINE



THE INGENIEUR is fully online starting from Volume 96, October-December 2023 issue. This initiative is part of BEM's plan to move all its services to be fully online and as part of its efforts towards reducing carbon emissions. Nevertheless, BEM will print 400 hard copies only for PE & PEPC who still wish to receive the print magazine on first come first serve basis. However, they are required to pay postage cost of RM5.00/issue (RM20.00 for 4 issues). Please apply to receive the hard copy of THE INGENIEUR magazine through:

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Registration of Road Safety Auditor (RSA)

Pursuant to the Board's decision on 6th June 2023, the registration of Road Safety Auditor (RSA) will be placed under the purview of BEM with effect from 1st August 2023. All existing RSA registered with Jabatan Kerja Raya (JKR) prior to this date will be offered to be transferred to BEM's Register as their saving rights. This saving rights will expire by 31st December 2023.

All new applications to be registered as RSA will henceforth required to be submitted to BEM.

For further details please contact: pe@bem.org.my





Engineering and Law

Engineering is a profession deeply embedded in technical expertise and innovative problem-solving tasks. However, it operates within a complex legal framework that governs its practice, ensuring that the interests of public safety, welfare, and environmental protection are safeguarded. The intersection of engineering works and legal liability is multi-faceted involving professional ethics, regulatory compliance and the management of risks associated with engineering projects.

The numerous construction site incidents particularly those involving temporary works warrants attention by the whole technical team from the designers, supervisors, superintending officer, engineers for temporary works, checkers, clients and contractors. The implication of legal responsibility among these stakeholders is often not given due attention until incidents happen making it difficult to ascertain respective responsibility and liability.

Malaysia has witnessed several notable cases involving engineers who have been found guilty of professional misconduct or contractual liability. These cases highlight the importance of adhering to professional standards, ethical guidelines and contractual obligations within the engineering profession.

The article on 'Professional Conduct of Engineers, Legally Speaking' provides a good account of the process and manner BEM handles the cases of complaints through the Investigation Committee, Disciplinary Committee and Appeal Board. It is important to understand that BEM regulates the professional conduct of engineers whilst the courts regulate the way in which BEM regulates the professional conduct of engineers.

Professional engineering consultants are also entangled in contractual disputes. Professional consultants in addition to fulfilling their contractual duties are also bound by a duty of care in tort towards their employer which may lead to legal action in negligence suits. The article on 'Liability of Professional Consultant in a Construction Project' explains in detail the legal implication with illustrations on cases.

In this litigious world, I would advise engineers, particularly engineering consultants, to be more aware of the legal implications, in particular their responsibilities and liabilities in the context of works that they carry out.

Datuk Ir. Ahmad Redza bin Ghulam Rasool
President, BEM



CALL FOR ARTICLES

The Ingenieur is published quarterly by the Board of Engineers Malaysia. The following are the themes for the coming issues.

- Vol. 99 July-Sept 2024
Agriculture Engineering
- Vol. 100 Oct-Dec 2024
VOLUME 100 - The Centennial
- Vol 101 January-March 2025
Waste Management

Articles and other contributions relevant to the themes are welcomed, but the decision to publish rests with the Editorial Board.

Advertising inquiries are also welcomed. Please refer to the BEM advertisement on Page 41 for the latest rate card and booking form.

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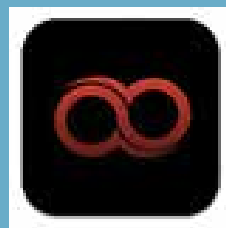


*The Ingenieur Vol. 97
January-March 2024*



*The Ingenieur Vol. 98
April-June 2024*

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Ir. Dr Lai Khin Wee – BEM Most Prominent Young Engineering Leader 2022

The Board of Engineers Malaysia (BEM)'s Most Prominent Young Engineering Leader 2022, Ir. Dr Lai Khin Wee has made outstanding contributions in engineering research in the biomedical field. He heads the Advanced Analytic Research Group at Medical Imaging Laboratory, at Universiti Malaya (UM)'s Faculty of Engineering. His research efforts have garnered him 17 patents for various biomedical devices and he has made inroads into commercialisation. Besides research excellence, he devotes time to his other passion to teach post-graduate engineering students as Associate Professor and Head of Department (Biomedical Engineering) in UM.

The 39-year-old Ir. Dr Lai hails from Kuching, Sarawak. In an interview with *The Ingenieur*, he says that invaluable guidance from mentors and peers have contributed to his success. Personally, he attributes it to hard work, self-motivation and embracing challenges. Two unexpected education opportunities also paved the way.

He first chose to study electrical and electronics engineering at Universiti Teknologi Malaysia (UTM), Johor but half-way through the Bachelor Degree course, a new faculty called Biomedical Engineering opened. He and his classmates were offered to be the pioneer batch and they took the opportunity. So started his journey in this field. He views biomedical engineering as a multi-disciplinary field which covers mechanical engineering and electrical & electronic engineering plus medical knowledge on human physiology relating to medical devices like CT Scans and X-ray machines.

The second unexpected opportunity was a scholarship to do his PhD (Biomedical Engineering) in Germany in 2010, one year after his Bachelor of Engineering degree. "The sheer surprise of receiving this scholarship highlighted important lessons: always be prepared for the



Ir. Dr Lai Khin Wee

unexpected and just do it," he recalls. It appeared to be serendipity as he could take up his study from Bachelor degree to PhD with *Technische Universitat ilmenau* (Germany) and UTM under a DAAD PhD Sandwich Programme.

"Recognising the potential life-changing impact of this opportunity, I embraced the challenge, prepped myself in a month and embarked on this incredible journey. The journey to Germany was more than a geographical transition; it was a leap of faith," he recalls. He came back empowered to embark on an engineering career. Over the years, he built many professional credentials locally and abroad. Among these are Professional Engineer PEPC with BEM, ACPE (Malaysia), Chartered Professional Engineer CPEng., Engineers Australia NER, APEC Engineer IntPE (Australia), Chartered Engineer CEng and MIET, UK Engineering Council.

What drove Ir. Dr Lai to research work was his childhood ambition to be an inventor who

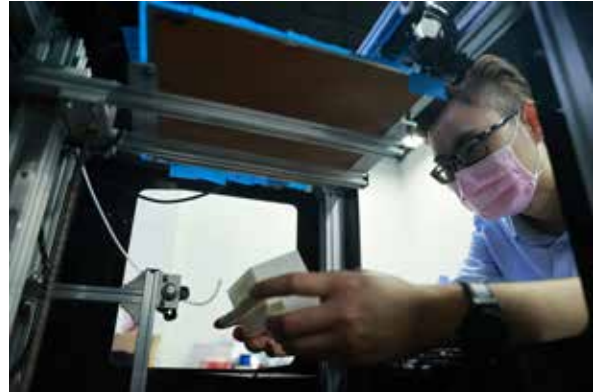
can make Malaysia a better place. His research interests revolve around the establishment of new medical imaging and bioinstrumentation solutions to enable automated, intuitive and non-invasive properties in early detection and classification of diseases.

Ir. Dr Lai and his team carried out research work on many health issues such as sleep quality, blood circulation, osteoarthritis and cardiovascular diseases. Among the devices he came up with are IOT Enabled Scoliosis Diagnosis Digital Device, OsteoKneeclass and Low Cost Powered Upper Limb Prosthesis. His inventions have been recognised with many international and national awards. For instance, Ir. Dr Lai was awarded an ACU Fellowship by the Association of Commonwealth Universities by UK in 2021 for his research on the risk of hospital readmission among recovered COVID-19 patients.

In 2019, he coveted the Best Inventive Award for Scoltech by IET International Aceic 2019: International Automation & Control Enhancing Innovation. *The Ingenieur Vol 95* featured this invention of a non-invasive scoliosis assessment device. He progressed to commercialisation becoming the Chief Technical Officer and founder for Biosight Sdn Bhd, which markets this device. The company is supported by UMxcelerate (UMX) under the UM Innovation Incubator Complex.

After securing 17 patents for various inventions, Ir. Dr Lai asserts that it is not easy to spearhead R & D in universities and later commercialise inventions due to financing and career development constraints. He explains that local universities do not have separate tracks for career advancement, where professors can choose to focus purely on research or teaching. Teaching and student supervision take priority presently among lecturers in Malaysia.

Besides impressive research work, Ir. Dr Lai finds teaching very rewarding. He supervises 55 post graduate students. 'The exchange of knowledge and experiences in guiding them has been a reciprocal process, shaping their academic journey and my own educational philosophy. It's a testament o the symbiotic relationship that exists in mentorship – a continuous cycle of learning and growth," he acknowledges. He notes that his goal in teaching is to empower students to become leaders in their chosen field, emphasising critical



Ir. Lai busy in a research project

thinking, creativity, teamwork and communication skills.

With advancements in IOT, Machine Learning and Artificial Intelligence, he believes there will be a lot of productivity improvement in medical devices that will help doctors in diagnosis and treatment. Concurrently, biomedical engineers will be needed to operate and maintain modern devices. Medical tourism in Malaysia will be an added boost. Ir. Dr Lai also sees potential in developing locally-made biomedical equipment as many of the high-tech ones are currently manufactured abroad. When repairs are needed, replacement of parts is time consuming and expensive.

Ir. Dr Lai believes he is living his purpose in both teaching and spearheading research. He intends to use his engineering training to help young engineers. "Wearing the hat of success, I am now driven by a profound motivation to pay it forward. I am eager to guide and support young individuals who share the same aspirations that fuelled my journey. My hope is to provide them with the support and mentorship that was instrumental in my own success, helping them navigate their paths to achievement.", he explains. As both educator and leader, he wants to bridge the gap between academic knowledge and practical applications.

Ir. Dr Lai's message to aspiring engineers - "Be consistent and confident, no matter what happens. Be present in every moment of your life. Seize all the opportunities and just do it. Profound transformations may occur when one embraces the unexpected and acts decisively to pursue opportunities." - *Inforeach*

Professional Conduct of Engineers, Legally Speaking

By **Richard Kok**
Lee Sherzanne
Messrs Richard Kok

Registered engineers or engineering consultancy practices are regulated by the Board of Engineers Malaysia (“the Board” or “BEM”) under their registration with the Board which is a legal entity created by the Registration of Engineers Act 1967 (“REA” or “the Act”).

Under REA, a registered engineer means a Graduate Engineer, a Professional Engineer, a Professional Engineer with Practising Certificate or an Accredited Checker.

Inevitably, trust is placed upon the Board by the public as well as members of the profession to regulate the conduct and ethics of the engineering profession and to determine disputes and complaints relating to the professional conduct of persons or practices registered with the Board, as well as to take appropriate actions against misconduct, misfeasance or incompetence. These duties and powers are enshrined in the Act and are further elaborated in the Registration of Engineers Regulations 1990 (“RER” or “the Regulations”) which also provides a Code of Conduct under Part IV of the Regulations. In addition to that, the Board issued Circular No. 001 providing a further Code of Conduct supplementing the rather brief Part IV of the Regulations (collectively referred to as “the Code”).

The Code provides, generally, that a registered engineer shall conduct himself honourably, responsibly, ethically, and lawfully, and shall discharge his duties with complete fidelity to



“The Board regulates the professional conduct of engineers whilst the courts regulate the way in which the Board regulates the professional conduct of engineers.

his client. The Act also recognises a wide range of circumstances constituting misconduct, from the more specific situations of the conviction of any offence or non-compliance with the law and specific acts of dishonesty or fraud to more indeterminate acts, such as the failure to discharge one's professional duties with due skill, care and diligence, and, conduct found, in the Board's opinion, to be *"infamous or disgraceful"*.

Notwithstanding the subjectivity of such obligations or circumstances that should be avoided, one may ask: How strictly are the rules under the Act, the Regulations and the Code enforced under the law? Or rather, how does the Board determine whether a registered person has conducted himself in accordance with the law and what role do the Malaysian courts play? As with any public body with a disciplinary function, the answer is simply that the Board regulates the professional conduct of engineers whilst the courts regulate the way in which the Board regulates the professional conduct of engineers. In other words, the courts act as the regulator of the regulators.

The Role of the Board: The Disciplinarian

The Board is empowered under Section 4(f) of the Act *"to determine and regulate the conduct and ethics of the engineering profession"*. Under Section 4(e) of the Act, the Board is also *"to hear and determine disputes relating to professional conduct or ethics of registered Persons or to appoint a committee or arbitrator or arbitrators to hear and determine such disputes"*. Subsequently, under Part IIIA of the Act, at Sections 14A to 14C, the Board is to appoint a Disciplinary Committee (DC) to *"conduct hearings of any misconduct or complaint against any registered Person referred to it by the Investigating Committee"*. The DC has powers under Section 15 of the Act to cancel or suspend the registration of a registered engineer or practice, to impose a fine, and to issue written warnings, if it finds them guilty of misconduct or falling into one of the circumstances stipulated under Section 15 of the Act that render them unfit to practise.

The Regulations provide for how the Board deals with a complaint from the time it is received

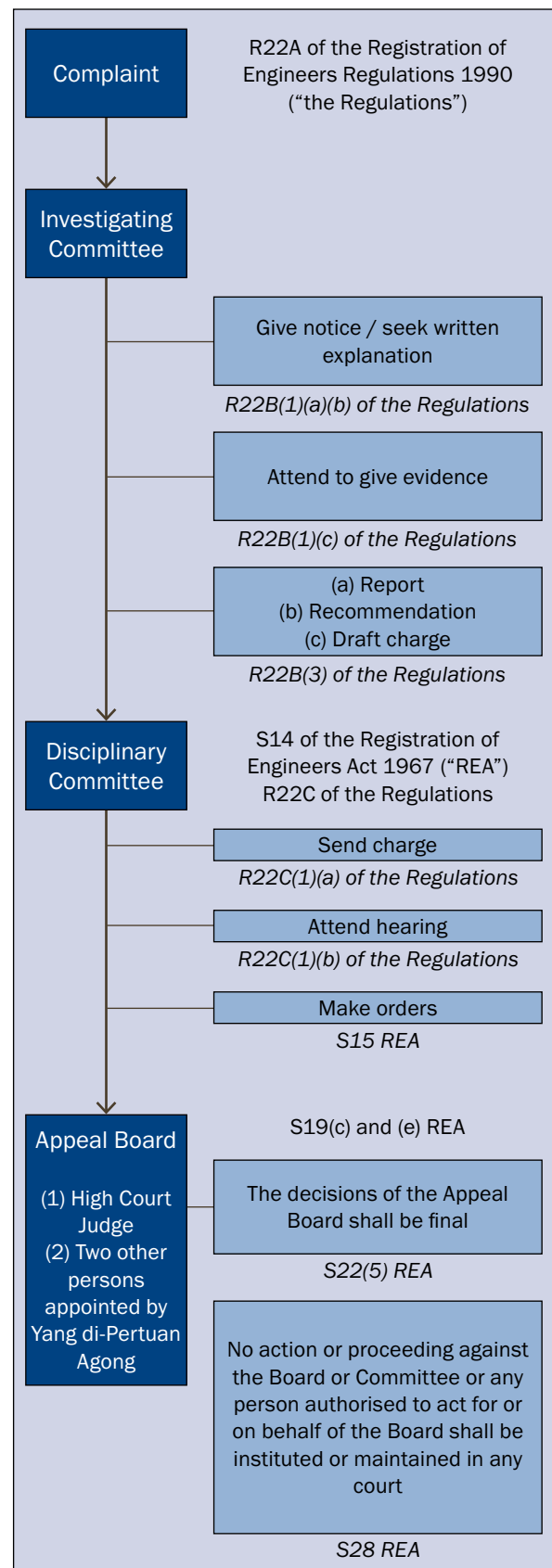


Diagram 1 – BEM's Disciplinary Process

until it reaches the DC, although, strictly, the Act does not require a complaint or complainant for the Board to exercise its disciplinary powers (*Lembaga Jurutera Malaysia v Leong Pui Kun* [2009] 2 MLJ 36) as such requirement would limit the Board's regulatory powers. The journey of a complaint is markedly set out in the Regulations and the Act.

It begins with the Board determining whether "*it is satisfied that there may be sufficient grounds for the complaint*" before appointing an Investigating Committee (IC) to investigate the complaint. The IC then submits a report, its recommendations and a draft charge if it "*is satisfied that there are grounds for the complaint*". The DC sends the charge and conducts a hearing, giving the impugned engineer an opportunity to be heard before making an order to cancel or suspend one's registration, to fine and/or to issue a reprimand. Thereafter, such a decision by the DC may be appealed to the Appeal Board (AB) whose decision shall be final and non-appealable.

Put very simply, a complaint goes through the Board, the IC, the DC, and the AB, assuming the Board finds grounds for the complaint or the alleged misconduct. Otherwise, the complaint or alleged issue may be dismissed at an early stage. The exact procedures taken by each committee or board appointed are at their discretion as long as they do not contradict the Act or the Regulations.

The wide discretion given to the Board by the enabling legislation in determining its procedures is in line with the fact that it is the best authority to carry out the functions it was created to do (*Keith Sellar v Lee Kwang And Tennakoon v Lee Kwang* [1980] 1 LNS 36). However, the power or discretion is not unfettered and must be exercised reasonably.

The Role of the Court: The Overseer

It may be observed that a public or disciplinary body is not always right or properly exercising its powers. Being a legal entity which may sue as well as be sued, the Board's decisions can be challenged in court under a process called judicial review, a process under which public actions are reviewed by the judiciary, i.e., the courts. The impugned decision may be quashed by the court

and the case may be ordered to be redetermined by the public authority if the judicial review is successful. A declaratory order may also be sought. These reliefs are not exhaustive.

This is the only way to 'appeal' against a decision of the Board, in a limited sense, as Section 22(5) of the Act provides that the decision of the AB shall be final and Section 28 of the Act provides that no court action can be taken against the Board, IC, DC, or AB for any such decision, act or omission taken in good faith in discharging their functions, power or duties under the Act or Regulations.

The law also does not generally allow any party to make an application for relief against a public authority concerning an infringed public law right except by way of judicial review (*Robert Cheah Foong Chiew v Lembaga Jurutera Malaysia* [2009] 1 MLJ 676). The provision of judicial review protects the public as well as the public authorities themselves – the public, by leaving an avenue for decisions of public bodies to be challenged when they are ordinarily non-appealable, and the public authorities, by restricting ordinary legal actions and limiting the scope of review of the authorities' actions to prevent an influx of claims ensuing from the mere exercise of statutory public duties. One should take care not to use the wrong procedures lest his case be deemed an abuse of the court's process and be struck out. Otherwise, a judicial review is available to an aggrieved engineer or practice due to a decision of the Board.

The bar to a successful judicial review application is, however, high. The law of judicial review is governed by Order 53 of the Rules of Court 2012 which imposes stringent conditions. The Board's procedures or processes in determining a dispute or complaint relating to the professional conduct of a registered person or practice which ultimately leads to the making of any decision, action or omission may be subject to judicial review by a party who can show that he is adversely affected by the Board's decision, action or omission in relation to the exercise of the public duty or function under the laws. Such decision, action or omission must be final and conclusive.

A registered engineer whose license to practise has been cancelled by the Board pursuant to a finding of professional misconduct may show that he is adversely affected by such

“The courts may only review a decision on four grounds – illegality, procedural impropriety, unreasonableness, and proportionality.

a decision to cancel his registration as his legal rights are directly affected and he is deprived of the benefit he was permitted to enjoy as a result of that decision (*Members of the Commission of Enquiry on the Video Clip Recording of Images of A Person Purported to be an Advocate and Solicitor Speaking on Telephone on Matters of Appointment of Judges v Tun Dato' Seri Ahmad Fairuz bin Dato' Sheikh Abdul Halim* [2011] 6 MLJ 490).

The Board's disciplinary process or procedure which has not been concluded or exhausted cannot ordinarily be challenged unless the aggrieved party can show that the decision is conclusive of any matter gravely affecting his rights. Otherwise, the courts would be undermining the powers and duties of the Board and the constituted committees which are conferred under the Act and Regulations as well as the domestic remedies available to any unsatisfied party. Theoretically, it may be the case that a judicial review application can only be brought after a decision is made by the AB. However, in practical terms, an engineer who is adversely affected by a decision of the DC may bring a judicial review application before the AB returns a verdict if he can show that the DC's order to suspend or cancel his registration has taken effect. The three-month timeline under Order 53 rule 3(6) of the Rules of Court 2012 to make an application from “*when the grounds of application first arose or when the decision is first communicated*” may also render it necessary for one to file the judicial review application sooner than later.

The courts may only review a decision on four grounds – illegality, procedural impropriety, unreasonableness, and proportionality. In simpler terms, where there is an abuse of power or unfair

treatment by the decision-making authority or where the decision would not be made by a reasonable authority having properly considered the facts and evidence, then there is ground for the court to interfere. Things may have been made a little murkier now that the courts seem to be moving in the direction of considering errors on the merits to justify a review when historically they would only consider fundamental procedural errors.

Having said that, the courts generally do not interfere with the exercise of discretion by public authorities given the powers conferred on them. The purpose of the powers being conferred by statute to the Board would be defeated if the courts frequently assumed the Board's duties. In this sense, the courts' roles as overseer of the Board's powers and duties and reviewer of the Board's administrative determinations are limited.

Conclusion

The Board functions as a regulator of the professional conduct of registered engineers or engineering consultancy practices whilst the Malaysian courts play the role of an overseer to ensure the Board does not exercise its discretion arbitrarily. The Board's complaint or dispute handling process is stipulated in the Act or Regulations guided by the Code which is to be observed by registered engineers or engineering consultancy practices. The Board's discretion as to its procedures is balanced by the court's ability to review the Board's decisions. Such division of powers entails as well as enhances the specialisation of functions intended by our laws and the laws governing engineers. ■

Liability of Professional Consultants in a Construction Project

By Lam Wai Loon
Amy Hiew Kar Yi
Partner, Harold & Lam Partnership

Ooi Hui Ying
Senior Associate, Harold & Lam Partnership

Although construction claims disputes commonly involve disagreements between employers, contractors, and various parties in the construction contracting chain, it is important to note that professional consultants, such as architects, engineers, and quantity surveyors, may also find themselves entangled in disputes related to their fees and the consultancy services they offer for the projects they participate in.

Professional consultants are usually engaged by the employer at the very early stage of a project, even before the actual implementation of physical works at the project site. Their services in a typical construction project would include the preparation and submission of plans and drawings, providing advice in connection with any feasibility study, planning, survey, design, construction, commissioning, operation, maintenance, and management of the project construction works, and providing advice on costs and budgeting.

In a construction project, professional consultants hold a crucial position. They are tasked with executing their responsibilities with professionalism, independence, and impartiality. Should these consultants fail to meet their contractual or professional duties, or engage in fraudulent behaviours, they may face claims from the employers and potentially even the contractors, especially if these actions result in losses for the employers or contractors.

This article will delve into the issue of the liability of professional consultants in a construction project, shedding light on the stance taken by Malaysian Courts regarding this issue.

Liability of Professional Consultants in Contract and/or Tort

A professional consultant may be liable to his employer in contract or tort of negligence, or even both. In cases where a contractual relationship exists between the employer and the consultant, there is deemed reliance by the employer on the consultant's expertise and diligence in fulfilling their obligations as outlined in the consultancy contract. Beyond the contractual duties, professional consultants also owe a tortious duty of care to the employer, necessitating the use of reasonable skill and care in executing their professional responsibilities in a project.

In a standard construction project, professional consultants are typically appointed directly by the employer. In addition to the express terms of appointment set out in the construction consultancy contract, there is an implied term that the professional consultant will perform their duties with reasonable skill and care. Further, a construction consultancy contract would typically set out the repercussions or remedies available to the employer in the event of the consultant's breach of contract. These specified consequences



In a standard construction project, professional consultants are typically appointed directly by the employer.

or remedies may include the employer's contractual entitlement to pursue compensatory damages, request specific performance, or seek the rescission of the consultancy contract.

In addition to fulfilling their contractual duties, a professional consultant is also bound by a duty of care in tort towards their employer. The standard of care for a professional consultant is that of a professional having or holding himself out as having the skill or ability in question. An action in negligence can be pursued against a professional consultant if it can be proven that the professional consultant had breached their duty of care, resulting in loss or damage to the employer and provided that the loss or damage is not too remote. As we will demonstrate in the case laws below, it may be found that a professional consultant also owes a tortious duty of care to other persons who are reasonably within his contemplation to be closely and directly affected by his action or omission.

Positions Taken by the Malaysian Courts on Liability of Professional Consultants

There are various instances in a construction project where professional consultants could be exposed to potential claims against them, whether by the employer or the contractor, due to their breach of duty in contract or in tort arising from the provision of their professional services.

In the case of *Pembinaan BLT Sdn Bhd v Nazarin (NBM) Sdn Bhd & Ors* [2021] MLJU 1254, it was held by the High Court that in a situation where there is a contract between the parties but the contractual terms did not specifically stipulate the specific contractual duty to carry out a certain task, the consultants would still be liable to the employer if the consultant had in the course of performance of his professional services assumed responsibility for those actions within their expertise which have been relied upon by the employer.

In *PB Malaysia Sdn Bhd v Samudra (M) Sdn Bhd* [2009] 7 MLJ 681, the defendant, a developer, appointed the plaintiff, a consultant engineer, for their project in the district of Gombak to design, advise on and supervise permanent work to be constructed or installed per the relevant contract. Due to outstanding consultancy fees which were not paid by the developer, the consultant engineer commenced an action against the developer. In its defence and counterclaim, the developer contended that the engineer had been negligent in carrying out its duties as the consultant engineer to, amongst others, supervise and offer solutions in relation to sewerage problems. It was held by the High Court that the consulting engineer owes no duty to the developer to advise, supervise or offer solutions in relation to the sewerage problem, as it relates to temporary works.

Consultant's Duty of Care towards Third Parties

In *Steven Phoa Cheng Loon v Highland Properties Sdn Bhd* [2000] 4 MLJ 200, a building named the Highland Towers which consisted of three blocks of 12-storey apartments, was constructed in front of a steep hill with a stream. In 1993, one of the blocks collapsed, and the residents from the remaining two blocks were ordered to evacuate. In 2000, the residents of the building brought an action against ten defendants which included, among others, the developer, the architect, the engineer of the building, and the local authority. The High Court held that the architect and engineer for the project, amongst other defendants, were held to be liable for breach of duty of care owed to the residents and were liable for compensation. On the issue of design, it was held by the High Court that whilst there was no contractual relationship between the architect and the purchasers, an architect was capable of being held liable to anyone who was sufficiently proximate and whom the architect could foresee that his act and/or omission would cause damage to that person. The High Court's decision was then upheld by the Court of Appeal.

In *Lok Kok Beng & Anor v Loh Chiak Eong & Anor* [2015] 4 MLJ 734, 50 purchasers had entered into their respective sale and purchase agreements to purchase units of industrial buildings from the developer of a special industrial building project. There was a term in the SPAs that the purchasers would obtain vacant possession of the units purchased within 24 months from the date of the approval of the building plan. The purchasers filed an action in negligence against the project manager and the project architect for the financial loss they had suffered due to the late delivery of vacant possession of their industrial units. It was the purchasers' case against the project architect that as the professional consultant, it had acted negligently in the preparation of the original layout plan resulting in its amendment, and also negligent in the supervision of the works and the certification of completed works, thereby causing a delay of eight years for the completion of the industrial buildings. The Federal Court held that it was unforeseeable that the architect's action and/or omission would lead the purchasers to suffer consequential financial loss, and the purchasers' claims were disallowed.

In the case of *Corsa Tech Sdn. Bhd. v YTB Impressions Sdn. Bhd. & Ors* [2021] MLJU 2210, the first defendant company was the employer of a construction project in Malacca City. The Plaintiff was a contractor appointed by the first defendant for the design, fabrication, construction and installation of the entrance statement. The third defendant was appointed by the first defendant as the quantity surveyor in the project. The Plaintiff brought an action against the third defendant and alleged that the third defendant was negligent in revising its valuation and failing to value the Plaintiff's progress claims within a reasonable time. The High Court held that there were cogent policy reasons to negate the duty of care against a quantity surveyor towards a contractor, because:

- a. The quantity surveyor was appointed by the employer, and not the contractor;
- b. Imposing a duty of care of consultants towards a contractor might adversely affect the independence of the consultants in the performance of their duties;
- c. It might hinder, if not jeopardise, the smooth running and success of the project. This would be unjust to the employer and does not augur well for the construction industry as a whole; and
- d. No injustice would be caused to a contractor if the court did not recognise the existence of a duty of care owed by a consultant to a contractor in a project because the contractor should have a valid cause of action against the employer based on the agreement arising from any negligent action or omission on the part of the employer's consultant.

In the case of *L3 Architects Sdn Bhd v PCP Construction Sdn Bhd and another appeal* [2019] MLJU 972, the main contractor brought an action against the architect for incorrect certification of works done. It was held by the High Court that as the arbitration agreement between the main contractor and the employer served as an adequate machinery for the main contractor to pursue its grievances against the employer for issues such as wrongful certification, it would not be reasonable in the circumstances to impose a duty of care on the consultant. However, it must be highlighted that the High Court also held that there are certain exceptional cases where

the professional consultant could be liable to the contractor, namely, where the professional consultant has acted fraudulently or colluded with the employer to cause loss and damage to the contract, or the professional consultant has in the course of administering the contract deliberately misapplied the contract, or the professional consultant has committed misrepresentation which resulted in loss to the contractor.

In *MRCB Builders Sdn Bhd (formerly known as Gelanggang Harapan Construction Sdn Bhd) v Liang United Engineering Studio* [2022] MLJU 3359, the High Court had to decide whether the professional consultant appointed by the employer to design the Contiguous Bored Piled Wall (CBP) walls owes a duty of care to the subcontractor. It was held by the High Court that as there was no contract between the subcontractor and the professional consultant, the professional consultant did not owe a duty of care to the subcontractor with regard to the damaged CBP walls.

Conclusion

As demonstrated in the case authorities above, it can be seen that in addition to fulfilling their contractual duties, a professional consultant is also bound by a duty of care in tort towards their employer. An action in negligence can be pursued against a professional consultant if it can be proven that the professional consultant had breached their duty of care, resulting in loss or damage to the employer, and provided that the loss or damage is not too remote.

On the other hand, though not completely impossible, it would be an uphill task for third parties to bring an action against a professional consultant under tort of negligence. This is especially applicable in cases where the third parties have a remedy against the employer under the construction project. ■

TAKE A FRESH LOOK AT SEWAGE TREATMENT PLANT



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- ✓ Capital & Operation Cost
- ✓ Odor Level
- ✓ Minimal Maintenance
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GREEN Technology

- ✓ Uses Natural Conditions and Organisms
- ✓ Use Only Biological Processes, No Chemical Processes
- ✓ Does Not Involve High Electricity Consumption
- ✓ Consume Low Energy During Treatment Process
- ✓ Restore Water Through Re-Usability
- ✓ Eco-Friendly Treatment System



AICR Extended Industrial Waste Treatment

The system could be extended for treatment of various types of industrial wastes

- » Food/Seafood
- » Soft Drinks Manufacturing
- » Food/Seafood Processing
- » Hardware Accessories
- » Textile Dye Based
- » Palm Oil Mills
- » Leachate
- » Slaughter House
- » Hospital Waste/Effluents
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New Set Of OSH Regulations for the Construction Industry

By **Ir. Dr Mohd Fairuz Ab Rahman**
Mohd Fiqri Mohd Hanafi
Dr Mohamad Syamir Senin
Ir. Dr Noor Nabilah Sarbini

Department of Occupational Safety and Health

The Guidelines on Occupational Safety and Health for Construction Industry (Management), popularly known as OSHCIM, introduces new approaches to the management of occupational safety and health (OSH) for construction projects. Since its inception as a voluntary compliance in 2017, the Department of Occupational Safety and Health (DOSH) has made it no secret that the contents of the guidelines will be embedded into a new set of OSH regulations for the construction industry in Malaysia. These new regulations will be mandatory requirements, replacing the Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) Regulations or BOWECS that have been enforced since 1986.

Brief History of BOWECS

BOWECS at the time of their enactment were the 'first of the kind' specific OSH regulations for construction sites. These regulations primarily focused on the safety aspects of temporary structures, work equipment and work activity commonly used in construction sites. BOWECS sets out in prescriptive detail precisely what employers or contractors must do in specific situations. For example, in Regulation 116, where

trenches to be excavated exceed 4m in depth, pilings, shoring and bracing must be constructed in accordance with the design and drawings of a Professional Engineer (PEPC). In effect, this approach takes away the onus on employers to carry out risk assessment and determine the most suitable and adequate measures to control the risk.

While a prescriptive approach is preferred due to its clarity and clear expectation on what should be done in a particular situation, it does not cover every eventuality found on construction sites. As industry practices are evolving, new construction methods and technologies have emerged and thus the prescriptive nature of BOWECS renders it ineffective to address these changes. In addition, BOWECS does not provide a comprehensive framework for managing OSH in construction projects. It lacks specific requirements on risk assessment, planning, co-ordination, co-operation and appointment, which are critical in OSH management, especially for construction projects.

OSHCIM in a new set of OSH Regulations

The Occupational Safety and Health (Construction Work Design and Management) Regulations or CWDM is a new set of OSH regulations for the



OSAH Regulations have more complete health and welfare aspects

construction industry in Malaysia. CWDM is more complete as it covers health and welfare, as well as safety. It is designed to improve OSH in construction projects, rather than prescribe specific control measures for risks in construction sites. CWDM will also ensure that occupational risks throughout the project's lifecycle are effectively managed. These risks include foreseeable risks during the operation and maintenance of a building or structure.

As in OSHCIM, CWDM places legal duties on the client, designer and contractor involved in a construction project to plan, manage, monitor and co-ordinate OSH during the project. It aims to reduce accidents and ensure that construction work is carried out safely and efficiently. The

OSHCIM Guidelines that were published in 2017 will be revised and will serve as a practical guide to CWDM.

Effects of CWDM on engineers

The importance of engineers in OSH has been recognised in BOWECS and many other regulations under the Factories and Machinery Act 1967. This is seen in many requirements, particularly in regulations, whereby the design and specification of several temporary structures are required to be prepared by PEPC. The role of engineers can also be found in the design, manufacture and operation of machinery such as the steam engineer, the

designer of boiler and pressure vessels, and the lift and crane competent persons.

The engineer who in his professional work carries out the design of a plant¹ has general duties in the Occupational Safety and Health Act (OSHA). CWDM prescribes specific duties to the client, designer and contractor organisation in which the engineer may be employed. Therefore, any engineer working in the construction industry will be affected by CWDM. To comply with CWDM, an engineer should:

Understand their duty: The engineer must familiarise himself with his specific responsibilities under CWDM. An engineer may fall into the category of a “designer” or “contractor” depending on his role in the project. The engineer is also employed by the “client” organisation to co-ordinate and monitor projects. The Board of Engineers (BEM) has conducted many seminars and workshops on OSHCIM since 2019. Since 2020, there have been three training providers recognised by DOSH to conduct OSHCIM Professional courses. By attending these courses, participants will learn:

- (i) duties of every duty holder in OSHCIM; and
- (ii) design risk assessment procedures and the application of the general principles of prevention.

Co-operate, communicate and co-ordinate: Collaborate with other professionals involved in the project, including other designers (architects or engineers), contractors, and the client, to ensure that OSH management is integrated into the overall project management, from its inception to completion. Developing a good relationship with the project team members will assist the engineer (as designer or contractor in CWDM) in managing OSH risks and resolving issues. An engineer should communicate with the client to understand the client’s needs. The engineer should also encourage the client to hold regular meetings. Involving the client and contractor in meetings should improve co-operation, communication and co-ordination, especially when making decisions.

Assess design risk: As a designer or contractor in CWDM, the engineer must identify and assess potential risks associated with his design or construction work. He must develop

and implement risk mitigation measures by taking into account the general principles of prevention. The principles provide a framework whereby any potential OSH risk in design is considered. The engineer is expected to do what is practical at the time the design is prepared, taking into account the current industry practice and knowledge. Any risk that cannot be addressed by the engineer at the stage of his design should be reviewed later on, during subsequent design processes. As a designer, the engineer must take into account the requirements for cleaning, maintenance and access to the completed structure. It is important to discuss this with people who will operate and maintain the completed structure.

Provide information: As a designer or contractor in CWDM, the engineer must provide the necessary OSH information to other project duty holders, including the principal designer and principal contractor. This may include design-related risk assessments and information about the safe sequence of construction methods. The level of detail required on OSH information about risks should be proportionate to the risks involved, the scale of the project and the competency of people who will use that information.

The engineer must understand the specific requirements and duties associated with his role in a construction project. This will ensure that he fulfils them and complies with CWDM. If there are any uncertainties or need for further guidance, the engineer may contact DOSH through the authors or e-mail projkkp@mohr.gov.my.

Roles of Engineers in Work at Height Regulations

Within the OSHA, another new set of regulations, the Work at Height Regulations or WAH, will be introduced. WAH and the construction industry cannot be separated primarily because construction activities involve tasks performed above ground level. The erection of high-rise structures, installation or maintenance of building components, roofing and façade works all require workers to operate at various heights throughout the construction process. The use of scaffolding,

1 Plant includes any machinery, equipment, appliance, implement or tool.

elevated platforms, ladders and tower cranes further emphasise the inherent connection between construction work and tasks conducted at elevation.

The risk of falls is heightened in construction due to the dynamic and varied nature of the work, making safety measures for work at height a critical focus. WAH strongly emphasises that employers manage these risks, aligning with the industry's need to ensure the well-being of workers in elevated work environments. Given the engineer's background in technical expertise and enhanced with OSH knowledge, he is well-suited to help address the unique challenges associated with work at height in the construction industry and implement effective safety protocols.

WAH underscores a strategic hierarchy to prioritising worker safety. The primary emphasis is on avoiding work at height whenever practical. When work at height cannot be avoided, WAH requires preventing falls by utilising existing workplace structures. Collective protection measures, such as guardrails, parapets and safety nets, take precedence as effective safeguards against falls. In instances where collective measures are impractical, the use of personal protective equipment (PPE) becomes a critical line of defence.

WAH then stresses a collective approach to minimise both the distance and consequences of potential falls through meticulous planning and risk assessments. This hierarchical framework ensures a technically systematic and integrated strategy, reflecting the engineer's role to help ensure OSH is cared for throughout the construction industry.

WAH explicitly assigns responsibility to the PEPC when scaffolds are used as a working platform. As in BOWECS, the design and drawing of all scaffolds will be done by PEPC. He is expected to provide notes of calculations, encompassing the contemplated structural arrangements, or when the assembly deviates from a generally recognised standard configuration or manufacturer's instruction. The stipulation that strength and stability calculations for scaffolds should be carried out by PEPC underscores the

critical role engineers play in ensuring the safety and structural integrity of scaffolding systems. PEPC must refer to the current BS EN 12811-1 Temporary works equipment — Part 1: Scaffolds — Performance requirements and general design and TG20 Design Guide — Technical guidance on the use of BS EN 12811-1 or other equivalent design standards.

Summary

In the intricate landscape of the construction industry, engineers play a pivotal role in both CWDM and WAH, contributing significantly to project safety and efficiency. In the context of CWDM, engineers are instrumental in integrating OSH considerations into the design and planning phases of construction projects. Their expertise ensures that structures are not only functional but also inherently safe, setting the groundwork for a comprehensive and proactive approach to risk management throughout the project lifecycle.

Simultaneously, in the area of WAH, engineers bring their technical acumen to bear on creating safe environments for tasks performed at height. From designing stable platforms to selecting and testing safe work equipment, engineers play a key role in mitigating the risks associated with working at elevation. Their involvement spans from conducting risk assessment and providing information to on-going monitoring and co-ordinating works, emphasising a commitment to creating places of work where the well-being of workers engaged in height-related activities is paramount.

CWDM and WAH are the quantum leap in OSH legislation in the construction industry in Malaysia. At the heart of it are engineers with their role extending beyond technical proficiency; it encompasses a dedication to fostering a culture of safety and collaboration. As stewards of design and safety, engineers are at the forefront of creating construction environments that prioritise both efficiency and the welfare of those who contribute to the built landscape. ■

Enforcing Mediation Settlement Agreements in Practice: Pitfalls and Possible Solutions

By **Ir. Harbans Singh K.S**

Notwithstanding the many benefits of mediation extolled by the proponents of this mode of alternate dispute resolution, it is undeniable that in practice there is much concern and scepticism by practitioners and parties alike vis-à-vis proven shortcomings which mar its effectiveness. While this short article does not permit a detailed discussion on all of the said shortcomings, nevertheless it is pertinent to address one of the most notable drawbacks of mediation which may most likely be encountered during the mediation of construction disputes, this being the enforceability of settlement agreements reached by the parties at the end of the mediation process.

Many a party has complained that since the results of the mediation process are not guaranteed by the courts, be they local (for domestic disputes) or foreign (for international disputes), the enforceability of settlement agreements is adversely compromised and the entire mediation process rendered an exercise in futility. This is often the case when one of the parties refuses to honour the results reached through the mediation process, thus leaving the other party with limited options to proceed further after expending considerable effort, time and costs. The question is: is this true across the spectrum of all the different types of mediation, or is it confined to only a particular type of mediation?

It is undeniable that the issue of the enforceability of the results of the mediation

process is of little or no concern to the parties in court-based mediations (CBM) which comprise principally judge-led mediations (JLM) and court-annexed mediations (CAM). For JLM, the judge who acts as the mediator will record the result of the mediation process as a consent judgement on the terms agreed to by the parties (provided these are lawful and enforceable), which consent judgement will be enforced by the courts. For the latter, i.e. CAM, if the mediation process is successful, the result of the process will be formalised in a settlement agreement which will be referred to the relevant court to record as a consent judgement (also provided the terms of the settlement agreement are lawful and capable of being enforced); the said consent judgement being thereafter also enforceable by the courts.

The above is reflected in Section 14(2) of the Mediation Act 2012 (Act 749) which states “.....If proceedings have been commenced in court, the settlement agreement may be recorded before the court as a consent judgement or judgement of the court”. Essentially for CBMs, be they JLMs or CAMs, the results of the mediation process are guaranteed by the courts which ensures enforceability. Owing to this positive attribute, in practice, only CBMs have produced effective and enforceable decisions, which bears testimony to the rapid expansion of CBMs in this country.

The above positive enforceability attribute for the CBMs are sadly not reflected in the other types of mediations, be they of the “ad hoc”,

“institutional”, or “contractual” types. Neither does any provision of the Mediation Act 2012 (“MA 2012”) furnish any assistance for the enforceability by the courts of settlement agreements reached through such types of mediations which are on par with Section 14(2) MA 2012 for CBMs. All that the MA 2012 vide Sections 13(1) to (3) states is that upon the conclusion of the mediation and the reaching of an agreement by the parties regarding a dispute, the parties shall enter into a settlement agreement which shall be in writing, signed by the parties and authenticated by the mediator. Once the above is satisfactorily undertaken, then, by virtue of Section 14(1), the settlement agreement shall be binding on the parties.

In practice, many a time, difficulties in the enforcement of such settlement agreements often arise notwithstanding the fact that these are recognised as “binding” under Section 14(1) of the MA 2012. The said difficulties may be due to a number of reasons, such as, where a party has a change of mind or an after-thought or has realised that it does not have the means to comply or external pressure from third parties bear on the party not to comply with the terms of the settlement agreement. These may lead a party to not honour the settlement agreement and/or breach its material terms. Under such circumstances, the only legal option available to the other party would be to commence an action against the non-compliant party in court for the breach of the terms of the settlement agreement, thereby rendering the entire mediation process futile and a sheer waste of effort, time and expense. Another significant setback often faced in international mediations is that there is a lack of cross-border enforceability of the settlement agreements, unlike arbitrations under the New York Convention 1958 (NYC).

For non-CBMs, the situation vis-à-vis the enforceability of settlement agreements, especially in the face of non-compliance and/or breaches of the material terms of the said agreement, seems dire. Repeated efforts have been made by the local mediation community to engage with and educate parties, in particular, the “dominant” or “powerful” ones, to honour settlement agreements so as to give effect to “win-win” solutions based on “common interests” instead of a “zero-sum game” premised on

merely a “rights-based” approach which seems to be prevalent at this time. Notwithstanding the above, these efforts have shown little success in the face of a lack of interest and commitment on the part of the “dominant/powerful” parties who have exhibited a general reluctance to change their positions or mitigate the adverse culture of non-compliance. Under such circumstances, over and above such efforts, more immediate and effective approaches need to be formulated and implemented to ensure that the mediation process will be effective and, more importantly, that settlement agreements reached can be readily and effectively enforced. The good news is that there appears to be some light at the end of the tunnel.

In the case of the cross-border enforcement of international settlement agreements of a commercial nature resulting from mediations, this can be effected by the competent authority of a party state of the Singapore Convention on Mediation 2019 (SCM) under the rules of procedure and the conditions set out in the SCM. Although Malaysia is a signatory to the SCM, it has still not been ratified by Malaysia. It is earnestly hoped that ratification will be undertaken in the near future to ensure that local disputants can enjoy the benefits proffered by the SCM which encompass principally settlement agreements resulting from mediations undertaken both locally as well as internationally that could be enforced cross-border so long as these settlement agreements fall under Art. 1(1) of the SCM and are not excluded vide Art. 1(3)(b) and/or Art. 5(1) of the SCM.

A further recent development has been the introduction on the local scene of the Med-Arb procedure for which there are rules provided by the Asian International Arbitration Centre (AIAC) and Borneo International Centre for Arbitration (BICAM). Under this procedure, a dispute is referred by the disputants to mediation first, and if the parties are able to achieve a settlement, the settlement agreement is recorded as a consent award. As a consent award, the settlement agreement achieves the status of an arbitration award which makes it enforceable by the local courts under the Arbitration Act 2005, or cross-border in countries which are signatories to the NYC. For parties to take advantage of the Med-

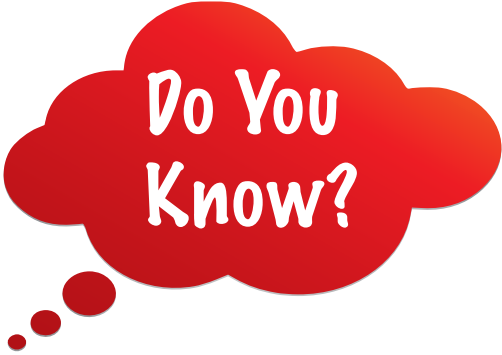


Principal aim of mediation is achieving a "win-win" result based on common interest

Arb dispute resolution mechanism, they must incorporate into their contract/agreement a suitably worded express provision to this effect—typical standard clauses made available by the AIAC and BICAM in their respective Mediation Rules which can be adopted (with or without necessary amendments) by the parties.

In conclusion, it can be said that the difficulty in enforcing a settlement agreement in the face of breaches of the same by a dilatory or non-compliant party is a common problem encountered in practice for mediations undertaken outside the jurisdiction of the courts. This has been, and continues to be, one of the main drawbacks which dissuades many disputants from resorting to mediating their disputes. Other than educating and/or persuading potential non-compliant parties, such as the more “powerful” or “dominant” ones, to give effect to the principal aim of mediation in achieving a “win-win” result which is based on “common interests”, there is nothing much which can be done at the moment. Some relief has been proffered by the SCM for cross-border enforcement of settlement agreements of a commercial nature. However,

such agreements must fall within the ambit of the SCM and the signatory states, which at the moment are confined to merely 56 countries (of which only 11 have ratified the SCM and which does not include Malaysia yet). A novel option of adopting the Med-Arb procedure is available to parties for their adoption as currently being allowed for under the AIAC and BICAM Mediation Rules where there is a possibility of the settlement agreement to be recorded and thereupon enforceable as an arbitration award in the local courts or cross-border in countries which are the signatories to the NYC. Although appearing attractive, it is a hybrid dispute resolution procedure which is inevitably costlier and, time-wise, longer. A better solution would be to amend the Mediation Act 2012 to allow for all settlement agreements (and not only the court-based ones as currently provided for under Section 14(2)) to be recorded as consent judgements and thereupon enforced by the courts. This would certainly bring the results of mediation to be on par with arbitration and statutory adjudication under CIPAA 2012 (Act 746), thereby making it more attractive to disputants. ■



Do You Know?

Engineering & Law

By Pang Soo Mooi

Engineering and law are two distinct fields that require different skill sets and knowledge. However, there are often intersections between the two, particularly in areas where engineering and legal principles overlap.

This intersection ensures that engineers can navigate the legal landscape effectively, maintain ethical standards, and protect themselves and their organisations from legal liabilities.

Incorporating legal knowledge into engineering practice is essential for managing risks, ensuring compliance, and upholding ethical standards. Engineers should seek to gain a basic understanding of relevant legal principles and, when necessary, collaborate with legal professionals to navigate complex legal issues. This interdisciplinary approach enhances the overall effectiveness and integrity of engineering projects and practices.

Ancient Punishment for Engineering Failures

In ancient China and Japan, the roles and responsibilities of engineers (often referred to as artisans, builders, or craftsmen) were significant due to the large-scale and often monumental nature of their projects. Failure in engineering

projects could lead to severe consequences, including harsh punishments. Here are some details about how accountability was enforced in these cultures:

Ancient China

In ancient China, engineers and builders were often employed directly by the imperial court for large-scale projects such as the construction of palaces, canals, and the Great Wall. The Chinese emperors placed immense importance on these projects, as they were seen as symbols of their power and capability.

Failure to meet the emperor's expectations could result in severe punishments. Historical records indicate that builders and engineers who failed in their duties, resulting in structural failures or construction delays, could face execution or exile.

The legal codes during various dynasties, such as the Tang and Qing Dynasties, often included specific provisions for the punishment of officials and workers responsible for construction failures. These legal frameworks ensured that there was a clear system of accountability for engineering failures.

For example, during the Tang Dynasty (618–907 AD), the “Tang Code” provided detailed regulations and punishments for negligence in public works. This included fines, demotion, corporal punishment, or even execution depending on the severity of the failure and its impact on public safety and resources.

Ancient Japan

In feudal Japan, particularly during the Heian (794–1185) and subsequent periods, the construction of castles, temples, and other significant structures was often overseen by master builders and craftsmen who were accountable to the *daimyo* (feudal lords) or the shogun.

Similar to China, failure to successfully complete a project could lead to severe consequences, including loss of status, property, or even life. The importance of honour in Japanese culture meant that failure could also lead to acts of ritual suicide (*seppuku*) to atone for perceived dishonour or failure.

During the Edo Period (1603–1868), the Tokugawa shogunate established strict regulations

for public works and construction projects. The failure of engineering projects, especially those involving critical infrastructure like bridges and castles, often resulted in severe penalties for the responsible parties, including fines, demotion, or execution.

Ancient Rome

Roman architect and engineer Vitruvius (Vitruvius Standard) documented that engineers and architects were held personally responsible for the quality and safety of their structures. If a building they designed or constructed collapsed and caused injury or death, they could face severe penalties, including death.

Medieval Europe

In medieval times, engineers and builders were often members of guilds. These guilds had strict rules and codes of conduct. Failure to adhere to these standards could result in fines, expulsion from the guild, or even corporal punishment.

Ancient India

According to the *Manusmriti* (an ancient legal text), artisans and engineers who caused the collapse of a building could face financial penalties or corporal punishment. The severity of the punishment often depended on the extent of the damage and harm caused.

Ancient Mesopotamia

Code of Hammurabi: One of the oldest known legal codes, the Code of Hammurabi, included specific provisions for builders. If a house collapsed and caused the death of the owner, the builder could be put to death. If the collapse caused the death of the owner's child, the builder's child could be executed. These laws were intended to ensure that builders took their responsibilities seriously.

Ancient Egypt

Pharaonic Accountability: Engineers and architects working on the monumental projects of ancient Egypt, such as pyramids and temples, were held in high regard but also faced severe consequences for failure. If a project did not meet the required standards or resulted in significant issues, the penalties could range from financial retribution to corporal punishment.

Key International Bodies on Dispute Resolution on Engineering Works

Several International Bodies deal with dispute resolution in engineering, construction, and manufacturing projects. These organisations provide frameworks and mechanisms for resolving disputes that arise from contractual disagreements, project delays, and other issues. International dispute resolution bodies play a crucial role in resolving conflicts in engineering, construction, and manufacturing projects. By providing neutral and structured frameworks for arbitration and mediation, these organisations help parties reach fair and enforceable settlements, thereby maintaining stability and encouraging investment in international projects.

Here are some key international bodies and notable cases:

International Court of Arbitration: Provides arbitration services to resolve international commercial disputes, including those in engineering and construction.

Notable Case: A dispute between a multinational construction company and a Middle Eastern Government regarding the construction of an airport terminal was resolved through ICC arbitration. The case involved claims of delays and cost overruns, and the arbitrators awarded damages to the contractor.

London Court of International Arbitration (LCIA): Provides arbitration and mediation services for international commercial disputes, including those in engineering and construction.

Notable Case: A dispute between a European engineering firm and an African Government over a dam construction project was resolved by the LCIA. The arbitration focused on issues of project delay and additional costs, leading to a settlement that compensated the engineering firm.

International Centre for Settlement of Investment Disputes (ICSID): As part of the World Bank Group, ICSID handles investment disputes between international investors and states.

Notable Case: Salini Costruttori S.p.A. and Italstrade S.p.A. v. Kingdom of Morocco: The case involved an Italian construction company and the Moroccan Government regarding a highway project. The dispute centered on issues of delay

and additional costs, and the ICSID tribunal awarded compensation to the contractor.

Dispute Resolution Board Foundation (DRBF): Promotes the use of Dispute Resolution Boards (DRBs) in construction projects to resolve disputes during the execution of the project, aiming to prevent them from escalating to arbitration or litigation.

Notable Case: A large infrastructure project in Southeast Asia used a DRB to address a series of disputes over project specifications and payment schedules, resulting in resolutions that allowed the project to continue without significant delays.

United Nations Commission on International Trade Law (UNCITRAL): Develops frameworks and model laws for international commercial arbitration and mediation, such as the UNCITRAL Arbitration Rules and the Model Law on International Commercial Arbitration.

Notable Case: UNCITRAL rules were used in a dispute between a Middle Eastern construction firm and a European equipment supplier. The arbitration, conducted under UNCITRAL rules, resolved issues related to defective equipment and breach of contract, leading to an award in favour of the construction firm.

Overseas court cases where engineers were held accountable for their actions or omissions.

These cases illustrate the various dimensions of engineers' liability overseas focusing on negligence, professional duty of care, and adherence to safety and design standards. Engineers are consistently held to high standards to protect public safety and ensure the integrity of their professional work.

East River Steamship Corp. v. Transamerica Delaval Inc.(1986)

The US Supreme Court held that under maritime law, a manufacturer (including engineers involved in design) is not liable in tort for purely economic losses caused by a defective product. This case highlighted the limitation of liability for engineers concerning economic loss in the absence of personal injury or property damage.

Kansas City v. Ernst & Young (1993)

This case involved the liability of engineers and other professionals in their capacity as service providers. The court ruled that professionals, including engineers, can be held liable for negligence in their services if it can be proven that they failed to adhere to the standard of care expected in their profession.

Queen v. Cognos Inc.(1993)

Canadian Supreme Court case where the engineer was found liable for negligent misrepresentation. The engineer had provided incorrect information which was relied upon, leading to financial losses. The case underlines the importance of accuracy and honesty in the information provided by engineers.

Bilt-Rite Contractors, Inc. v. The Architectural Studio (2005)

The Pennsylvania Supreme Court ruled that design professionals, including engineers, could be held liable for economic losses suffered by a contractor due to reliance on negligent misrepresentations in design documents. This case extended engineers' liability to third parties who rely on their professional work.

United States v. Spearin (1918)

This landmark case established the "Spearin Doctrine," which states that if a contractor follows the plans and specifications provided by the owner (and often prepared by the owner's engineers), the contractor is not liable for the consequences of any defects in those plans. Engineers can be held liable if the plans they prepare are defective.

Balfour Beatty Construction v. RML (1991)

The court found an engineering firm liable for failing to properly supervise and inspect the construction work, leading to a structural failure. This case emphasises the duty of care engineers owe in supervisory roles.

Donoghue v. Stevenson (1932)

Although not specific to engineering, this case established the modern concept of negligence, which applies to engineers. It set the precedent that engineers owe a duty of care to those who

could be foreseeably harmed by their actions or omissions.

Moorhead Construction Co. v. City of Grand Forks (1993)

The North Dakota Supreme Court held that engineers could be held liable for professional negligence if they fail to meet the standard of care required in their field, resulting in harm to their clients or third parties.

Boyle v. United Technologies Corp. (1988)

This case involved the Government contractor defense, which can shield engineers from liability if they can show that the design was approved by the Government, conformed to the Government specifications, and the engineer warned the government about known dangers.

Indian Oil Corporation Ltd. v. NEPC India Ltd. (2006)

The Supreme Court of India dealt with the liability of engineers in providing inaccurate information about the safety of fuel tank installations. The engineers involved were found liable for professional negligence as their incorrect assessment led to a significant fire hazard.

Islamabad High Court Bar Association v. Federation of Pakistan

This case involved the collapse of a building due to poor engineering practices. The court held the engineers responsible for the structural failure, emphasising the critical nature of adhering to building codes and professional standards in engineering practice.

Engineers and Law

Engineers should have a solid understanding of several key legal matters to effectively deliver their professional services. This knowledge helps them navigate the complex legal landscape of the construction industry, manage risks, and ensure compliance with various regulations. Here are the primary legal areas engineers should be familiar with:

Contract Law

Engineers must be able to read, understand, and interpret the terms and conditions of contracts. This includes knowing the obligations, rights, and responsibilities of all parties involved. Engineers should know how to negotiate terms and conditions to ensure fair and favourable agreements. They should also be familiar with drafting contracts to avoid ambiguities and potential disputes. Understanding what constitutes a breach of contract and the legal remedies available is crucial. This includes knowing how to address issues like delays, non-performance, and sub-standard work.

Professional Liability and Negligence

- Engineers must be aware of the duty of care they owe to their clients and the public. This involves performing their duties with the requisite skill, knowledge, and diligence expected of a professional engineer.
- Engineers should understand what constitutes negligence and the potential legal consequences. This includes knowing how to mitigate risks and avoid negligent behaviour in their work.

Regulatory Compliance

- *Building Codes and Standards:* Engineers must be familiar with local, state, and national building codes and standards. Compliance with these regulations is essential to avoid legal penalties and ensure the safety and integrity of their projects.
- *Environmental Regulations:* Understanding environmental laws and regulations, such as those related to pollution control, waste management, and environmental impact assessments, is critical for sustainable and legally compliant project execution.

Intellectual Property

- *Patents:* Engineers should know how to protect their inventions through patents and understand the process of applying for and maintaining a patent.
- *Copyrights and Trademarks:* Understanding how to protect software, designs, and

branding is important. Engineers should also be aware of how to avoid infringing on the IP rights of others.

- *Confidentiality Agreements:* Engineers should be familiar with non-disclosure agreements (NDAs) to protect proprietary information and trade secrets during collaborations and partnerships.

Health and Safety Laws

- *Occupational Health and Safety:* Engineers must ensure that their work complies with health and safety regulations to protect workers and the public. This includes understanding the requirements for safe design, construction practices, and workplace conditions.
- *Risk Management:* Knowledge of risk management practices and safety protocols is essential to prevent accidents and mitigate hazards on construction sites.

Dispute Resolution

- Engineers should understand the various mechanisms for dispute resolution, including negotiation, mediation, arbitration, and litigation. Knowing the advantages and disadvantages of each method helps in selecting the most appropriate approach for resolving conflicts. Familiarity with dispute resolution clauses in contracts is important for knowing how disputes will be handled if they arise.

Insurance

- *Professional Indemnity Insurance:* Engineers should obtain professional indemnity insurance to protect against claims of negligence or errors in their work. Understanding the coverage, exclusions, and claims process is crucial.

Ethics and Professional Conduct

- *Code of Ethics:* Engineers should adhere to the ethical standards and codes of conduct established by professional bodies.

Engineers should have a solid understanding of several key legal matters to effectively deliver their professional services.

- *Conflict of Interest:* Understanding and managing conflicts of interest is essential to maintain professional integrity and avoid legal issues.

Employment Law

- *Employer-Employee Relationships:* Engineers in managerial roles should understand employment laws related to hiring, firing, workplace discrimination, and employee rights.
- *Contractor and Sub-contractor Agreements:* Knowing the legal aspects of working with contractors and sub-contractors, including payment terms, scope of work, and dispute resolution, is important.

Project Management and Documentation

- *Record Keeping:* Engineers should maintain thorough and accurate documentation of their work, including design calculations, project communications, and changes to the scope of work. Proper documentation can be crucial in defending against claims of negligence or breach of contract.
- *Project Management Principles:* Understanding project management principles and best practices helps ensure projects are completed on time, within budget, and to the required standards, thereby minimising legal risks. ■

Risk Assessment in New OSHA Legislation

By Ir. Teo Eu Jin

As an Engineer our job scope is enormous and mostly involves decision making to a certain degree. Hence, it is pivotal for us to adhere to the rules and guidelines always. Moreover, the “Board of Engineers Malaysia Code of Conduct of Registered Person” do emphasise the compliance to the law or regulation whereby any violation needs to be reported to the Employer or appropriate professional bodies, including public authorities (if relevant). A quick glance in “Board of Engineers Malaysia, BEM” webpage under legislation section, there are many associated Acts and Regulation available ranging from “Registration of Engineers Act 1967 (Rev. 2015)”, “Uniform Building By - Laws” to “Gas Supply Act 1993”.

On top of the mentioned local law, there are other related legislation that we Engineers need to be aware notable from the “Department of Occupational Safety and Health, DOSH”. In this article, I highlight the new “Occupational Safety and Health (Amendment) Act 2022” which will basically consolidate both existing “Occupational Safety and Health Act 1994” and “Factories and Machinery Act 1967”. Indeed, there are new sections introduced in this latest piece of legislation. For example, “Appointment of licensed person”, “Duties of principle”, “Rights of employee”, “Occupational safety and health coordinator” and “Occupational safety and health training course” just to name a few.

The purpose of this article is to articulate the “Risk Assessment” clause on Safety and Health in the new Occupational Safety and Health Act (OSHA). Even though risk assessment is common to most industrial player in Malaysia, there are some parties that may be new to it, especially Small and Medium Enterprises (SME). Generally, risk exist in all workplaces, just that the level of risk

exposure differs depending on the job nature and industry. Therefore, both employer and employee need to work together to identify the risk and subsequently take necessary mitigation. There are a few effective risk assessment methods such as “Job Safety Analysis” (JSA) and “Hazard Identification, Risk Assessment and Risk Control” (HIRARC) that will be discussed further.

Duty to conduct and implement risk assessment

Section 18a.

- (1) Every employer, self-employed person or principal shall conduct a risk assessment in relation to the safety and health risk posed to any person who may be affected by his undertaking at the place of work.
- (2) Where a risk assessment indicates that risk control is required to eliminate or reduce the safety and health risk, the employer, self-employed person or principal shall implement such control.
- (3) For the purposes of this section, “risk assessment” means the process of evaluating the risks to safety and health arising from hazards at work and determining the appropriate measures for risk control.”.

Source: Occupational Safety and Health (Amendment) Act 2022

Table 1: Introduction of Risk Assessment in Occupational Safety and Health (Amendment) Act 2022

Job Safety Analysis (JSA) which sometimes called Job Hazard Analysis (JHA) uses simple

LIKELIHOOD	EXAMPLE	RATING
Most Likely	The most likely result of the hazard / event being realized	5
Possible	Has a good chance of occurring and is not unusual	4
Conceivable	Might occur at some time in the future	3
Remote	Has not been known to occur after many years	2
Inconceivable	Is practically impossible and has never occurred	1
Remarks: Likelihood is an event likely to occur within the specific period or in specified circumstances.		

Table 2: Indicate Likelihood with Assigned Value

Source: Guidelines for HIRARC, 2008, Department of Occupational Safety and Health, Ministry of Human Resource

LIKELIHOOD	EXAMPLE	RATING
Catastrophic	Numerous fatalities, irrecoverable property damage	5
Fatal	Approximately one single fatality, major property damage	4
Serious	Non-fatal injury, permanent disability	3
Minor	Disabling but not permanent injury	2
Negligible	Minor abrasion, bruises, cut, first aid type injury	1
Remarks: Severity is outcome from an event such as severity of injury or health of people, or damage to property, or insult to environment, or any combination of those caused by the event.		

Table 3: Indicate Severity with Assigned Value

Source: Guidelines for HIRARC, 2008, Department of Occupational Safety and Health, Ministry of Human Resource

	Severity (S)					Remark on Risk Level:
Likelihood (L)	1	2	3	4	5	
5	5	10	15	20	25	High  Medium  Low 
4	4	8	12	16	20	
3	3	6	9	12	15	
2	2	4	6	8	10	
1	1	2	3	4	5	

Table 4: Example of Risk Matrix

Source: Guidelines for HIRARC, 2008, Department of Occupational Safety and Health, Ministry of Human Resource

1. Hazard Identification				2. Risk Analysis				3. Risk Control	
No.	Work Activity	Hazard	Which can cause/effect	Existing Risk Control (if any)	Likelihood	Severity	Risk	Recommended Control Measures	PIC (Due date/status)
1	Loading the machine with wood	Cutting blades	Cuts / first aid type injury	Safe work practice	4	1	4 (Low)	Use leather hand glove	Andy (26 July 2007) / completed
2	Operating the machine	Unguarded machine	Hand get caught into rotating parts / amputation	Safe work practice, daily pre-use check and regular maintenance	4	3	12 (Medium)	To Fix L-guard	Chia (26 Ogos 2007) / In progress
		Flying fragments	Serious cuts & eye injuries by flying fragments of blades that break during cutting	Warning signs; Training, Safety goggles	4	3	12 (Medium)	Use stronger blades; To Fix L-guard install	Mute (26 Ogos 2007) / completed
3	Unloading cut wood	Heavy load	Muscular strain / back pain	Manual lifting procedure	3	1	3 (Low)	Use mechanical lifter	Ali (20 Ogos 2007) / KIV
4	Repair and maintenance of the machine	Unguarded machine; unsafe work practise	Serious cuts from blade & getting caught in rotating parts if machine is accidentally started	Cover 'on button' Safe work practice	4	4	16 (High)	To make delay start button	Ahmad (18 Ogos 2007) / completed

Table 5: Example of HIRARC

Source: Guidelines for HIRARC, 2008, Department of Occupational Safety and Health, Ministry of Human Resource

methodology to capture the risk at work and take necessary action to manage them. It starts by listing down the steps of a specific job, evaluate the safety and health risk for each step, and determine the preventive measure to manage the risks. Moreover, one can strategically utilize the “Hierarchy of Control” which comprise of “Elimination”, “Substitution”, “Engineering Control”, “Administrative Control” or “PPE” concept to address any potential concern. It is crucial to take note that JSA should involve the workers executing the job and conduct thorough discussion as they are the ones directly exposed to the hazard.

Basically, HIRARC uses similar concept as JSA with additional qualitative risk assessment element. Each safety and health risk will be evaluated on the likelihood to occur and severity using the specific formula “Risk = Likelihood x Severity”. Both “Likelihood” and “Severity” will have pre-assigned rating, allowing one to determine the risk level (High, Medium, or Low). With the Risk level understood, the team can implement the control measures and prioritize them accordingly. It is wise to repeat the HIRARC on the same job after a certain period even with the control measures implemented, as the team can identify new risk if the situation changes. Clearly, HIRARC is a better approach than JSA, nonetheless it all depends on organisational due diligence.

The amendments introduced by the “Occupational Safety and Health (Amendment) Act 2022” and the “Factories and Machinery (Repeal) Act 2022” which were gazetted by Parliament on March 16, 2022 are yet to be enforced. Nonetheless, it is wise for employers to play proactive role and be prepared for the upcoming changes.

In conclusion, laws are developed by the Government to protect fellow citizens. The amendments introduced by the “Occupational Safety and Health (Amendment) Act 2022” and the “Factories and Machinery (Repeal) Act 2022” which were gazetted by Parliament on March 16, 2022 are yet to be enforced. Nonetheless, it is wise for employers to play proactive role and be prepared for the upcoming changes. This new OSHA may subsequently influence the revision of other affiliated written law such as Regulation, Order, Guidelines that are under DOSH custodian. Furthermore, risk assessment is not limited to JSA and HIRARC, there are other approaches like “Hazard and Operability study (HAZOP)” which ought to be considered if relevant to the workplace and we Engineers can act as a bridge to close any existing gap. ■

REFERENCE

Board of Engineers Malaysia Code of Conduct of Registered Person, Circular No. 001, Rev.0.

Laws of Malaysia, Act A1648, Occupational Safety and Health (Amendment) Act 2022

Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC), 2008, Department of Occupational Safety and Health, Ministry of Human Resource (JKKP DP 127/789/4-47 ISBN 978-983-2014-62-1).

THE INGENIEUR (Vol. 96), Magazine of the Board of Engineers Malaysia, “New OSHA (Amendment 2022) – A Paradigm Shift for Occupational Safety”, by Ir. Ts. Wong Chee Fui.

https://thesun.my/home_news/amendments-to-m-sian-occupational-safety-and-health-laws-JG9778694

www.ehs.harvard.edu/sites/ehs.harvard.edu/files/job_safety_analysis_fact_sheet.pdf

APPENDIX

(A) Hierarchy of Control	(B) Common Types of Legislation
<pre> graph TD A[Elimination] --- B[Substitution] B --- C[Engineering Control] C --- D[Administrative Control] D --- E[Personal Protective Equipment PPE] </pre>	<pre> graph TD A[Act] --- B[Regulation / Order] B --- C[Codes of Practice] C --- D[Guidelines] </pre> By Parliament By Ministry

A Case Study in Fraudulent Trading

By **Richard Kok**
Messrs Richard Kok Advocates & Solicitors



How does one prove that a business was being carried on to defraud its creditors or for a fraudulent purpose? What has to be shown in order to find a person or several parties liable for carrying on the business in such a manner? What losses and to what extent can a plaintiff recover from a judgment finding fraudulent trading? A recent High Court case in *KHH (Puchong) Hardware Sdn Bhd v Chong Chee Onn & Ors* reported at [2022] MLJU 66 considered a claim under Section 540 of the Companies Act 2016 for fraudulent trading brought by a company against seven related individuals and corporate entities. The judgment explores the manner in which the business of CHSSB, the sixth defendant, was being carried on and whether it was carried on to defraud its creditors or for a fraudulent purpose. The other consideration is whether the first to fourth Defendants are persons who are knowing parties to the carrying on of the business. The learned Judicial Commissioner Ong Chee

Kwan allowed the claim against the first to fourth Defendants, who were family members, and held them jointly and severally liable to pay a debt owed by the company controlled by some of them to the Plaintiff.

Brief Facts

The Plaintiff was a company selling steel products. The first to fourth Defendants were family members. The first Defendant is CCO. The second Defendant, CCH, is CCO's younger brother. His wife is the fourth Defendant, LMY. The third Defendant, CYY, is the first and second Defendants' younger sister. The sixth Defendant is CHSSB. CHSSB's directors and shareholders are CCH and LMY. Initially CCH alone was operating CHSSB's account but subsequently, LMY and CYY were made joint signatories to the RHB Account. CYY was the sole director and shareholder of the seventh Defendant, CF2 SB.

The Plaintiff traded with companies managed by the Defendants. The Plaintiff sold to CHSSB whose directors and shareholders were CCH and LMY. CCH's older brother, CCO, was the salesman and the Plaintiff's point of contact who ordered steel products from the Plaintiff for CHSSB and several other entities. The claim was for outstanding debts owed by CHSSB to the Plaintiff for the sales of steel products.

The dispute began with a dishonoured cheque from CHSSB given by CCO to the Plaintiff. The post-dated cheque was given so that CCO could order more goods from the Plaintiff despite having already accumulated a rather substantive debt. As the date of the cheque lapsed, CCO requested the Plaintiff not to bank in the cheque. About four months later, the Plaintiff presented the cheque for payment only to have it bounced. CHSSB's bank account was closed. Before it closed CYY incorporated CF2 SB to carry out a similar business to CHSSB.

From this encounter sprung the Plaintiff's suspicions and through a discovery application, the Plaintiff obtained information and documents relating to CHSSB's bank account. It was found that monies had been withdrawn via cash cheques to CCH in the period CHSSB's debt to the Plaintiff increased. Substantial sums were withdrawn right after CHSSB received payments from clients. It was also found that CHSSB had not filed its audited financial statements and had not paid income tax and goods and services tax for several years. After the closure of the bank account, CHSSB directed its clients to pay to another company owned by WML and it was inferred that CHSSB's machineries were transferred to CF2 SB.

Section 540 of the Companies Act 2016

Like the law of lifting the corporate veil, Section 540 of the Companies Act 2016 affords creditors of a company a remedy personally against directors or persons knowingly assisting them, that is, fraudulent trading. To succeed in a claim for fraudulent trading, the three elements that must be established and proven are:

1. The plaintiff is a 'creditor' for the purposes of sSection 540.

2. The business of the company has been carried out with the intent to defraud creditors or for any fraudulent purpose.
3. The parties being sued were knowingly a party to the carrying on of the business in that manner.

Once the elements are established, Section 540 allows the Court to declare any person to be personally responsible, without any limitation of liability, for all or any of the debts or other liabilities of the company.

The word "creditor" is interpreted in the widest sense. It includes anyone who has a monetary claim against the company and can enforce its claim by an action of debt. "*Carrying on of the business*" is not limited to the ordinary course of business that the company usually engages in but includes any dealing by the company or its alter ego such as its directors and shareholders. The most contentious part of Section 540 is in the meaning of "*intent to defraud creditors*" or "*for any fraudulent purpose*". Fraud can be proven in many ways and is often inferred from the facts including the surrounding circumstances and the defendant's conduct. Dishonesty is an essential ingredient of "*intent to defraud*". Much depends on the strength of the evidence but there need not be many creditors or transactions or a complex scheme. A single act to defraud suffices. Finally, "*knowingly a party*" is also construed widely to include outsiders who could not be said to have carried on the business but nonetheless in some way participated in the fraudulent acts.

Decision of the High Court

The High Court found that the three elements of fraudulent trading are made out against the first to fourth Defendants, that is, CCO, CCH, CYY and LMY. There is no dispute as to the first element. The Court found overwhelming evidence against them in relation to the second and third elements. Accordingly, the Court ordered the first to fourth Defendants to be jointly and severally liable to pay the Plaintiff, which means that the said sum could be claimed against any one or all of them.

This case demonstrates how a claim of fraudulent trading may be proven through diligent study and creative analysis.

Dishonest Intent

With regards to dishonest intent, the Plaintiff's case hinges primarily on the large cash withdrawals from CHSSB's bank account during the material period. The Defendants on the other hand were of the view that the Plaintiff could not prove that they were done to defraud the Plaintiff or for any fraudulent purpose. The Defendants maintained that its debts to the Plaintiff were not due and it was able to meet its payment obligations.

The Court rejected the Defendants' arguments and found that the systematic cash withdrawals by CCH from CHSSB during the period CHSSB's debts to the Plaintiff increased were not for legitimate purposes at all in the interest of CHSSB and were questionable, resulting in CHSSB being dependent on cash injections each time debts had to be paid by the company. This showed that CHSSB's business was being carried on in a manner where CHSSB would pay the Plaintiff only intermittently and in sums less than what were due so as to lure the Plaintiff to continue supplying goods.

The Court was convinced that CCO and CCH must have been aware that the post-dated cheque would be dishonoured because the cash withdrawals intensified around the time the cheque was issued and CHSSB already had two dishonoured cheques by the date of the cheque. There were cash cheques issued to CCO signed by CCH, LMY and CYY when CCO told the Plaintiff not to bank in the post-dated cheque. Dishonest intent was further shown by the fact that CHSSB ceased operations and moved to a bigger and newer factory to continue business under a different company owned by WML and took active steps to divert CHSSB's customers and payments to the new entity and its business to other companies also managed by the Defendants.

Moreover, the Court held that CHSSB was being operated without any intention for its continuous survival based on the non-existence of audited accounts and tax payments amongst

other corporate obligations, which led to the compelling inference that CHSSB's business was being carried on with intent to defraud its creditors and/or for a fraudulent purpose.

Knowing Parties

In considering the liabilities of CCO, CCH, CYY and LMY, the Court found that there was no doubt that CCH as a director of CHSSB was directly involved in the carrying on of CHSSB's business in a fraudulent manner and that the preponderance of evidence was against CCO's contention that he was merely a salesman given that he was intimately involved in the business' transactions and manoeuvres. On the other hand, although CYY and LMY both have other full-time jobs, the Court found that they were both aware as to how the business of CHSSB was being carried on by CCH and CCO at least regarding the cash withdrawals and were actively participating in the fraudulent activities by, amongst others, setting up other entities to divert CHSSB's business.

Conclusion

The High Court's analysis and judgment in the instant case were premised upon inferences made by putting together the facts and evidence surrounding the parties and by weighing the strength of the parties' submissions. After all, fraudulent acts are often consciously concealed and can only be inferred by putting facts together and finding the most believable story. This case demonstrates how a claim of fraudulent trading may be proven through diligent study and creative analysis. Fraud often leaves marks.

On another note, this case serves as a reminder that companies and the people behind them may not escape liability simply by denying and presenting an empty defence.

Richard Kok successfully represented the Plaintiff in this suit. ■

Leveraging Legislation in High-end Medical Device Delivery for Radiology

By Ir. Ts. Dr Mohd Effendi bin Amran
Senior Principal Assistant Director
Engineering Service Division
Ministry of Health Malaysia

Practising engineers must be flexible, aware of applicable laws, rules, and guidelines, able to retrieve specifications and other important data, and focus on compliance throughout the entire engineering and development process. Particularly when it comes to the procurement and installation of medical devices, healthcare engineers should always be alert to established laws and regulations, together with amendments that relate to the healthcare sector. In the case of radiology, there are several legal requirements concerning the devices, systems, and department facility's compliance that necessitate engineers to be in the co-supervision.

Radiology is the area of medicine that uses radiation, high-frequency sound waves, or extremely strong magnetic fields to create images of the body that are used for diagnosing diseases and treatment. In Malaysia, including Sabah and Sarawak, the radiology department is usually designed to cater to all clinical disciplines and subspecialties for all inpatients, outpatients, emergency services, and other Ministry of Health (MOH) hospitals and clinics in the vicinity of the hospital. Along with the Radiology Information System (RIS) and the necessary digital devices and computers for image capture, processing, post-processing, reporting, printing, distribution, and storage/archiving, it is also completely IT-equipped. Furthermore, in compliance with the Hospital Information System (HIS), the

aforementioned system is fully integrated with the main hospital IT network and PACS in the Radiology Department. Additionally, the department serves as a mastery programme for medical imaging and diagnostics as well as a training ground and attachment training centre for other radiologists, medical officers, radiographers, trainees in radiology, and trainees in other clinical and allied disciplines.

Medical imaging is the art and science of producing visual depictions of an organ or tissue's function inside the body for clinical studies and medical intervention. It plays a crucial role in modern medicine, allowing healthcare professionals to visualise and analyse the internal structures and functions of the human body without invasive procedures. Besides, medical imaging is essential for diagnosing and monitoring various medical conditions, guiding treatment plans, and facilitating surgical interventions. Advances in technology continue to enhance the capabilities of medical imaging, leading to more accurate and non-invasive diagnostic procedures.

In a nutshell, the discipline of medical imaging is adaptive and diverse, with uses beyond clinical diagnosis. It is a vital instrument in modern healthcare and other fields, having an impact on a wide range of scientific, research, and industrial sectors. Hence, to meet the functional needs, a modern radiology department must be well-equipped with the necessary high-end,

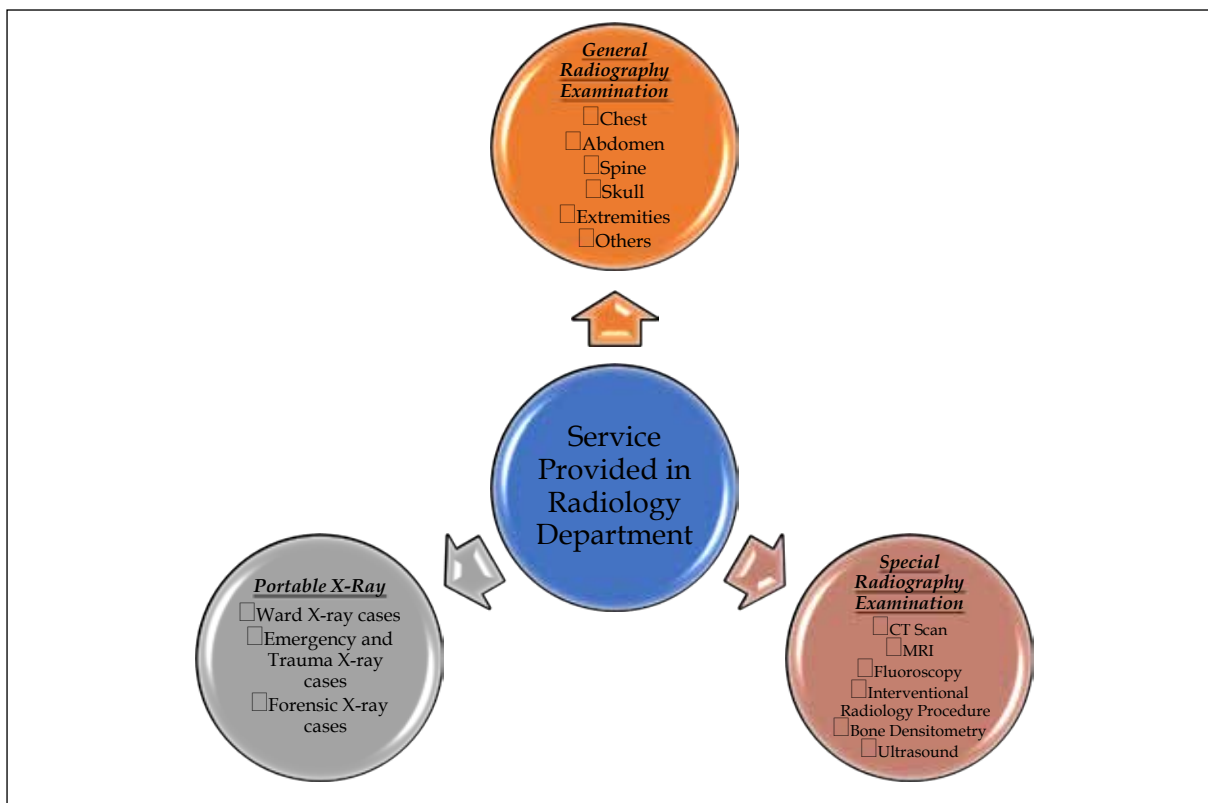


Figure 1: Typical services provided in the Radiology Department

state-of-the-art devices. Examples of such devices include mobile radiography, Direct Digital Radiography (DDR), Computed Tomography (CT) scanner, Magnetic Resonance Imaging (MRI), Ultrasound, Angiography, Fluoroscopy, Bone Densitometry, reporting, digitalising and scanning/printing equipment for appropriate services, as summarised in Figure 1. However, the key success factors underlying this department's operations rely on the effective organisation of device delivery and installation, which is co-supervised by Healthcare Engineers through the evaluation of numerous legitimate requirements.

LEVERAGING LEGISLATION IN MEDICAL DEVICE PROCUREMENT AND PLACEMENT FOR THE RADIOLOGY DEPARTMENT

The MOH is committed to ensuring that state-of-the-art devices are always at their best

performance, either through good maintenance or the acquisition of new installations (replacement or additional modalities). The questions that may arise are, "Is the procurement and placement of high-end medical devices just a straightforward process?" "Who are the hidden figures behind this entire process?" "Are medical officers or other clinical support professions alone in the procurement and installation process?"

In fact, many figures are involved in this journey – radiologists, engineers, physicists, medical officers, administrators, etc. However, in most cases, the overall delivery of high-end devices is subject to a "Customised Healthcare Engineering Policy" by the MOH Engineering Division, the Division appointed as the co-implementor and technical advisor. The final acceptance and application by the end-user will then take place accordingly.

To customise this policy, the identified principles of the Act, Regulations, Circulars, Standards, and Guidelines hierarchy are

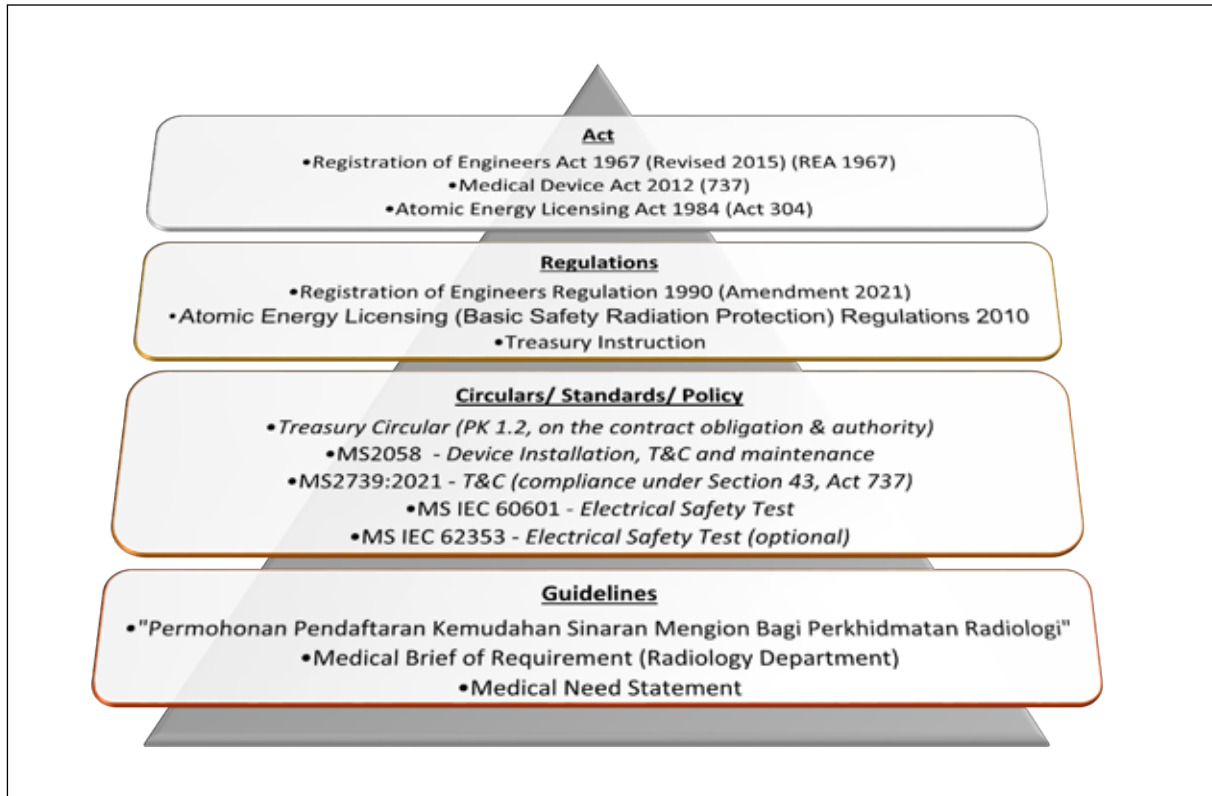


Figure 2: The legal framework by hierarchy for similar kinds of projects

streamlined with the entire engineering boundary to become a legal framework hierarchy, as shown in Figure 2.

In normal practice, the supply, installation, and commissioning of high-end medical devices are under the purview of the engineering process. This includes the pre-construction phase, which involves preparing technical specifications and scope, site briefing, technical assessments, engineering system assessments, and other related tasks, as well as the construction phase, which involves technical and site meetings/inspections, and testing and commissioning on the medical device and engineering systems.

To be realistic, acquiring high-end medical devices requires more than just plug and play; they also require careful consideration of the provision of advanced engineering systems and infrastructure. Figure 3 illustrates some of the procedures carried out by the MOH engineering team, which are also governed by the Registration of Engineers Act 1967 (Revised 2015) (REA 1967), Treasury Instructions, and Treasury Circulars. As

seen in Figure 2, they also must conform with other legal, scientific, and other requirements that are stated in their own legislation.

1. The Registration of Engineers Act 1967 (Revised 2015) (REA 1967)

To justify the need for the engineer's accountability in the above scenario, we can refer to REA 1967 under Section 7(2) and a circular from the Board of Engineers Malaysia (BEM) (ref: BEM/ACT/02-03 dated November 21, 2022), which provide the restriction on mandatory registration, particularly for Graduate Engineers (GE), Engineering Technologists (ET), and Inspectors of Works (IoW), to practise or take up employment in professional engineering services. In this sense, it is mandatory to register as a graduate engineer if the person wants to take up such employment per Section 7(2)(a):

"a Graduate Engineer who is registered with the Board may, subject to section

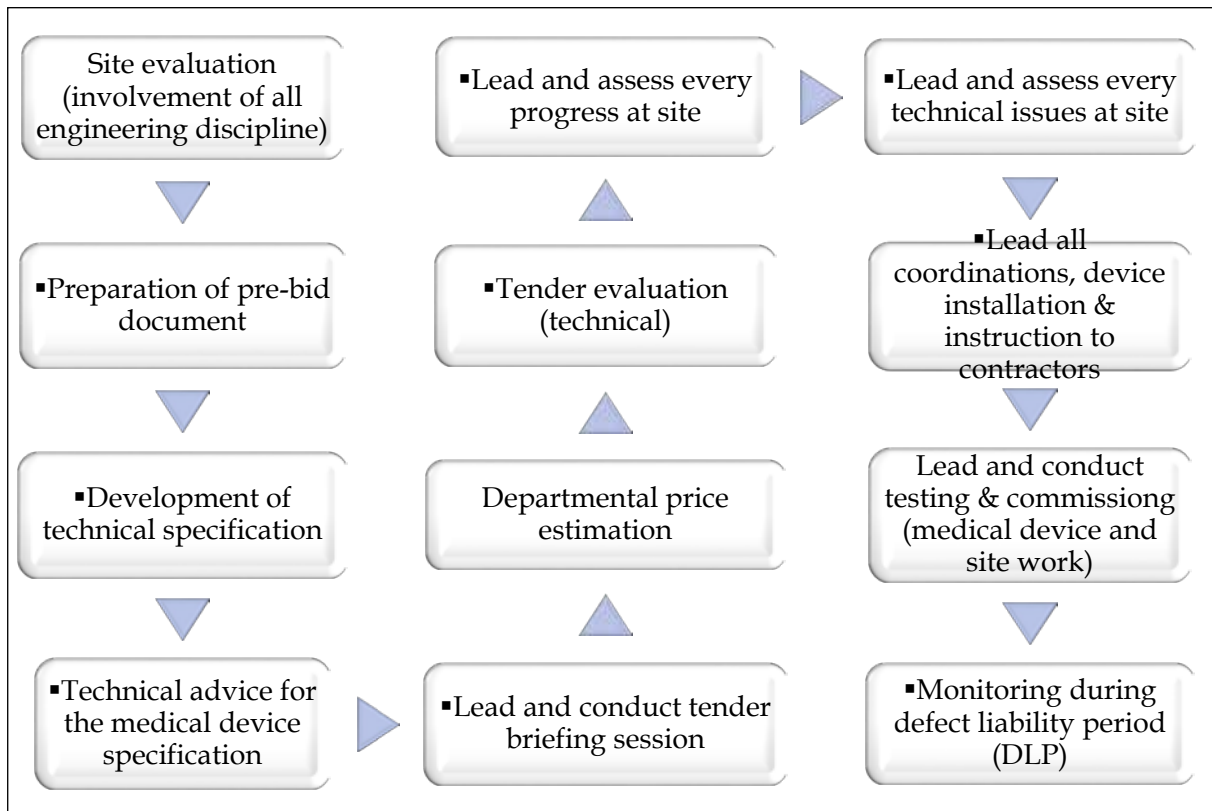


Figure 3: Some of the engineering processes conducted by the MOH engineering team governed under the Treasury Instruction, Treasury Circular and REA 1967

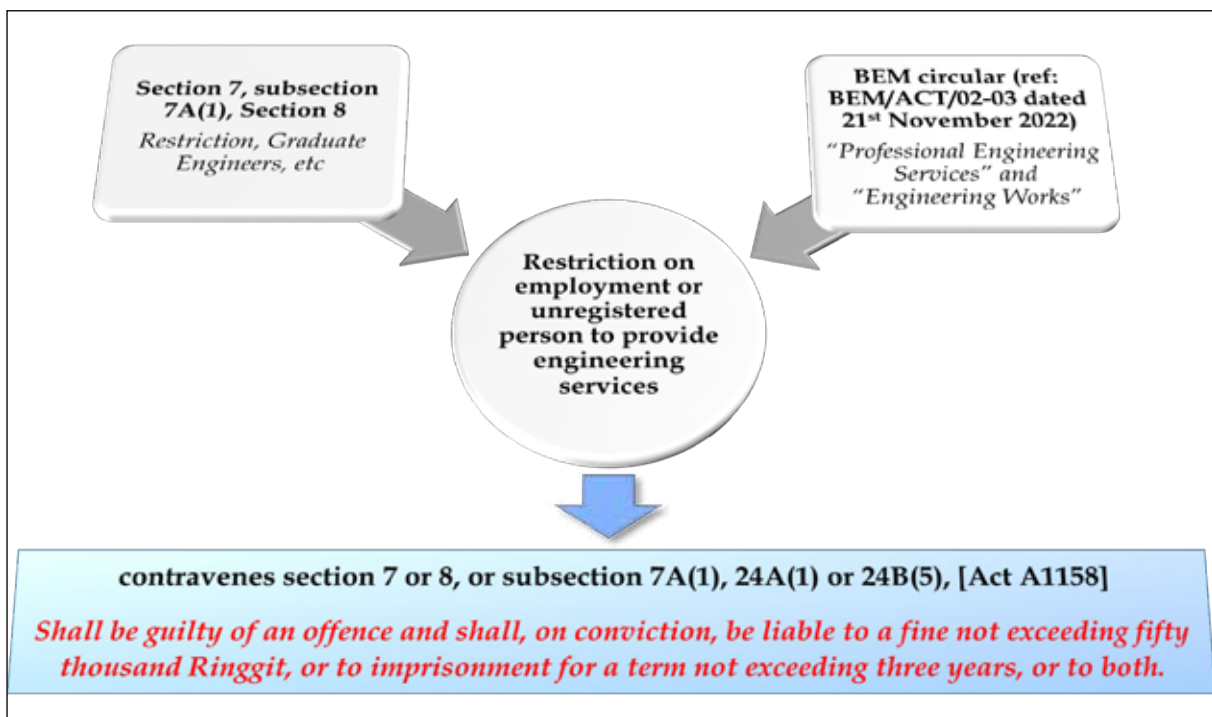


Figure 4: Legislation on restriction in conducting engineering services

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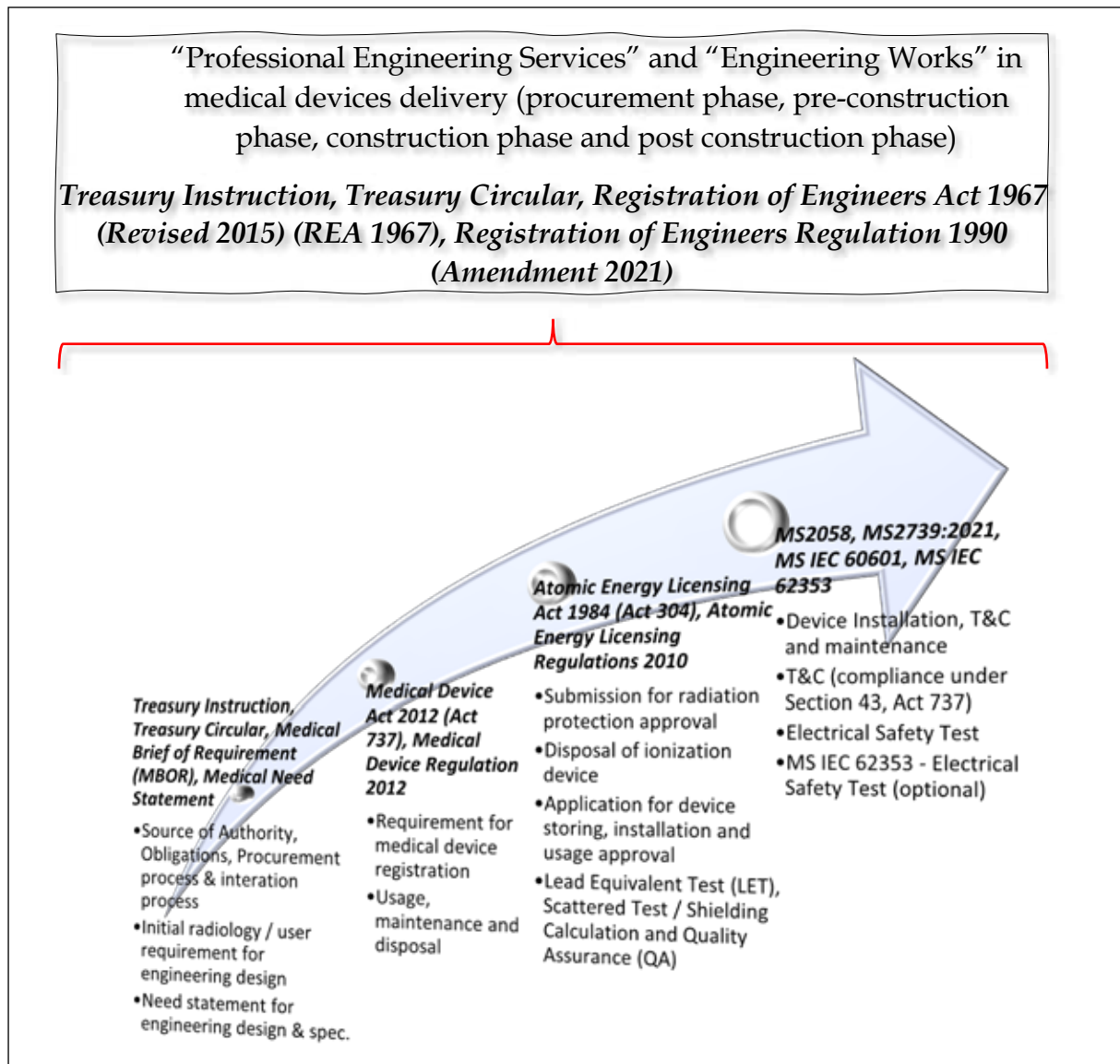


Figure 5: Typical sequence of legitimate requirements for the overall “Professional Engineering Services” and “Engineering Works” milestone

8, take up employment which requires him to perform professional engineering services;”.

GE is a person registered under Section 10(1) of the REA 1967 (Revised 2015). Additionally, REA 1967 defines “Professional Engineering Services” and “Engineering Works” as follows:

“Professional engineering services” means engineering services and advice in connection with any feasibility study, planning, survey, design, construction, operation, maintenance and management of engineering works or projects and

includes any other engineering services approved by the Board;

“Engineering works” means all works which include any publicly or privately owned public utilities, buildings, machines, equipment, processes, works or projects that require the application of engineering principles and data;

Those contravening the above Section 7 of the REA 1967, upon conviction, shall be liable to penalties under Section 24.

Thus, due to the nature of the work which necessitates extensive technical supervision by

the engineering team, the first requirement is to obtain a clear “source of authority” and clear “obligations” in the contract in compliance with the Treasury Instruction (*Arahan Perbendaharaan*) and Treasury Circular (*Pekeliling Perbendaharaan Malaysia*).

Besides, the complexity of the diagnostic provision in the radiology department demands the need to understand the various legitimate requirements, as summarised in Figure 2. This also obliges the segmentation of legislation for each specific necessity that corresponds with accountability and professionalism specified in the “Professional Engineering Services” and “Engineering Works” milestones. Figure 5 depicts some of the crisscrossing of legitimate requirements with respect to the above entire milestone from day one until the completion:

2. Medical Device Act 2012 (Act 737)

Alongside the device delivery milestone, it has to be noted that Section 5(1) of the Medical Device Act 2012 (Act 737) requires a medical device to be

registered under the Act before it can be imported, exported or placed in the market. For that reason, an application for medical device registration must be submitted in conformity with Act 737’s requirements and the procedure established by the Authority in Medical Device Regulation 2012.

Besides, this also applies to medical device usage, disposal and maintenance under their respective Sections. The medical device term covers any product used in healthcare for the diagnosis, prevention, monitoring or treatment of illness or handicap but excludes drugs. The complete definition of medical device is given in Section 2 of Act 737. The identified Sections under this Act which relate to the project milestone are as shown in Figure 6.

3. Atomic Energy Licensing Act 1984 (Act 304)

Ionising radiation is used widely in the radiology department, both for diagnosis and treatment. While being tremendously useful, they can be hazardous to patients, staff and members of the public, if not well

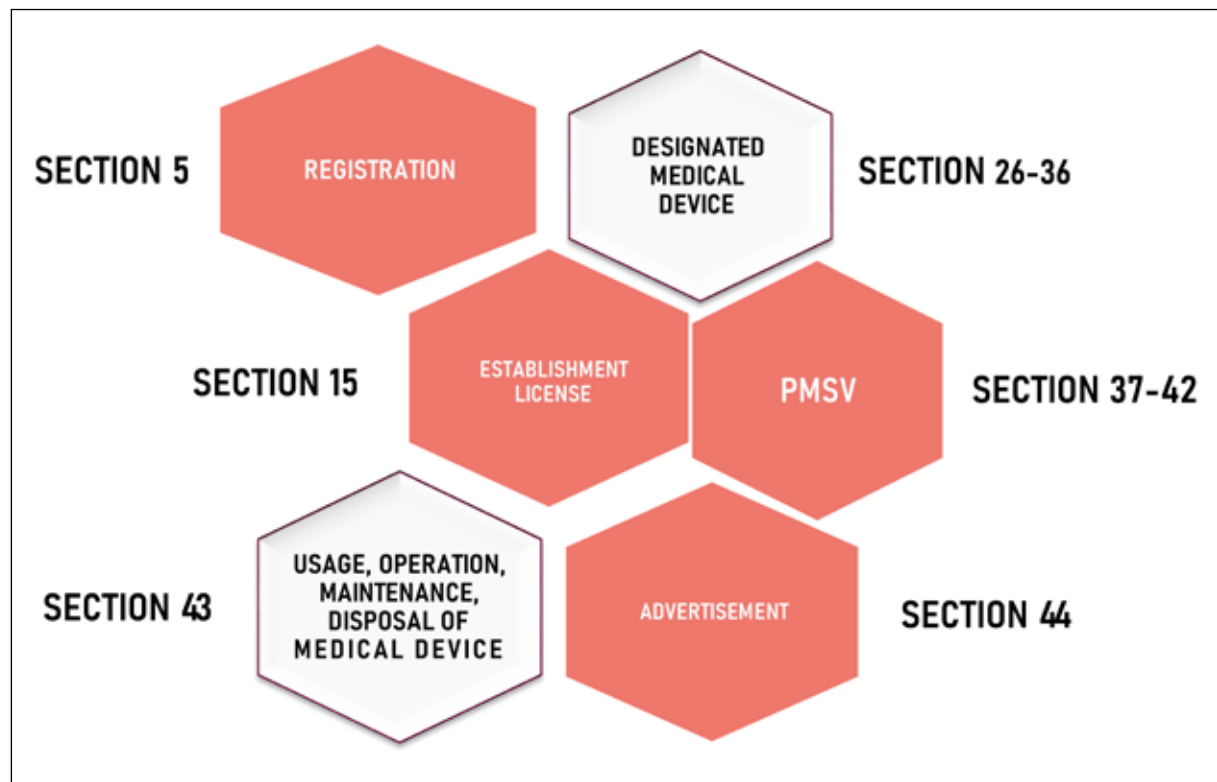


Figure 6: Sections under Act 737 that impose in the device delivery milestone

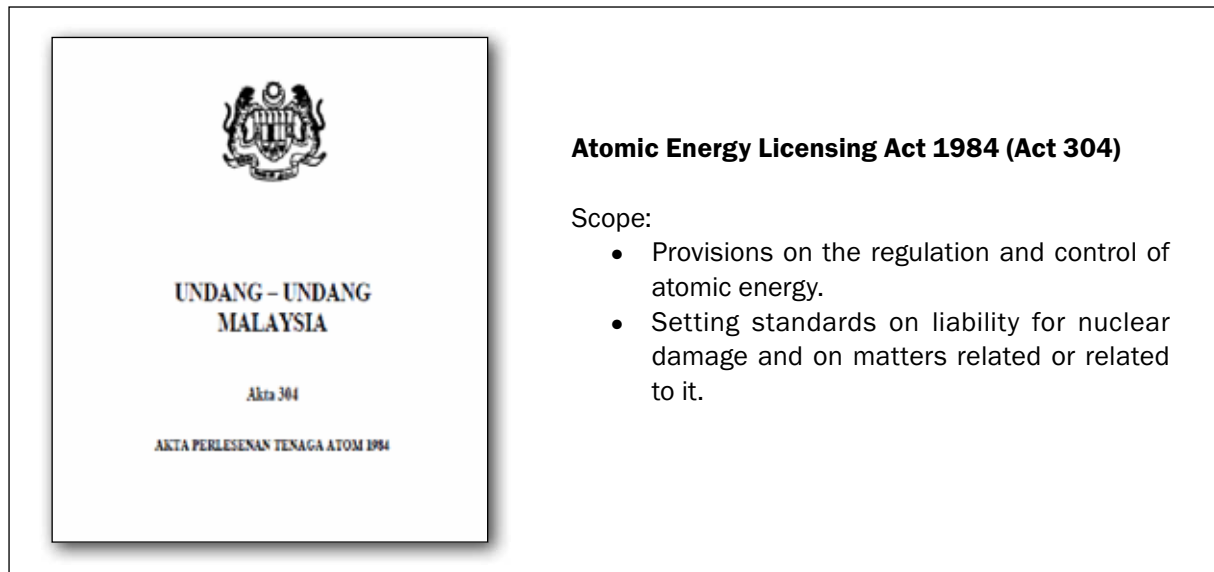


Figure 7: Scope of Atomic Energy Licensing Act 1984 (Act 304)

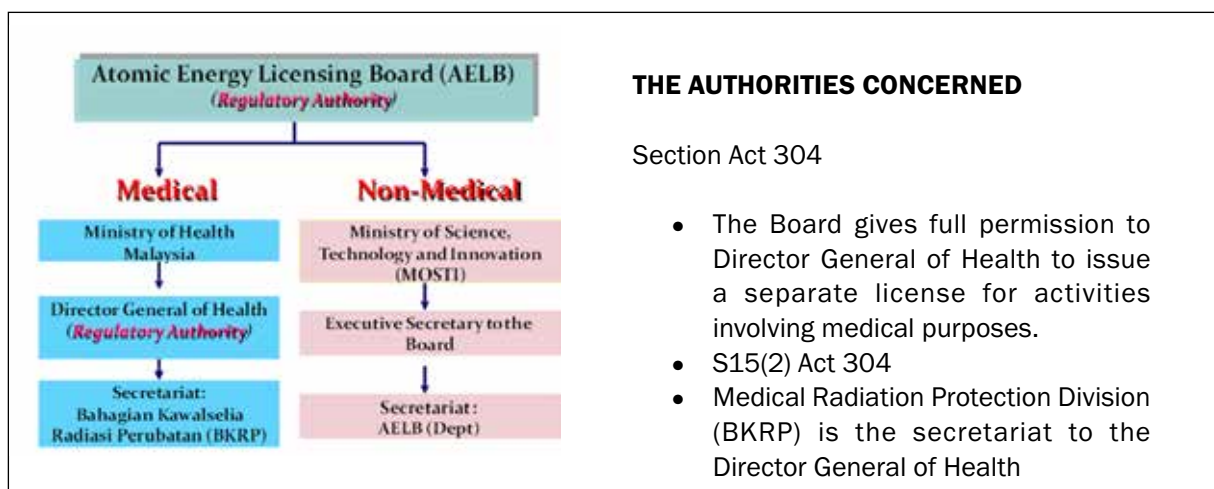


Figure 8: The source of authority to the designated Department/Division

managed. This can also directly affect susceptible individuals as well as their descendants. Radiation can affect body cells, increasing the risk of cancer or harmful genetic mutations that can be passed on to future generations.

If the dose is high enough to cause significant tissue damage, it can lead to death within weeks of exposure to the radiation. Therefore, all healthcare facilities utilising ionising radiation (such as the radiology department) shall adhere to current legislation and regulations under the Atomic Energy Licensing Act 1984 (Act 304).

The main objective of this legislation is to ensure safety and radiation protection at an

optimal level and that all sources of ionising radiation are safe to use for diagnostic and therapeutic purposes. In addition, the objectives of radiation protection are:

- Reduce the health effects of radiation.
- The biological effects of radiation are classified into “Deterministic Effects” and “Stochastic Effects”.

Figure 8 summarises the Authorised Department/Division responsible for enforcing compliance under Act 304 for radiology and other clinical departments. Frequently, the engineering team ensures that the process (i.e., the design, submission, and approval by the Authorised

Division, as shown in Figure 9) is defined within the milestone before the device delivery phase.

personnel and accepted in accordance with the manufacturer's specification, purchase agreement and statutory requirement.

4. MS 2739:2021 – Requirements for installation, testing and commissioning (T&C) and acceptance of medical device (Code of Practice)

This Malaysian Standard (MS) applies to medical devices placed for use in any healthcare facility or any other facility or residential premises which require installation, testing and commissioning (T&C) and acceptance, excluding implantable medical devices. This standard is intended to:

- Provide guidance to comply with the requirements under Section 43, Usage, operation and maintenance of medical device in the Medical Device Act 2012 (Act 737);
- Provide guidance on the procedures for the installation, T&C and acceptance of medical devices in any healthcare facility, aesthetic settings, and premises for wellness programs and related services; and
- Ensure the medical device is appropriately installed, tested and commissioned by the equipment specialists or competent

5. MS IEC 60601 and MS IEC 62353 on Electrical Safety Test (EST)

Based on the typical life cycle of a medical device, the region of electrical safety test in T&C is specified as whether to utilise the MS IEC 60601 or MS IEC 62353 version. Figure 11 summarises the differences between them in terms of reference selection;

6. MS2058:2018 – Code of Practice for good engineering maintenance management of active medical devices (Second Revision)

Please refer to Figure 12: Area of MS2058:2018

Engineering administration and control

Given all of the legal conditions listed above, the supervision of project milestones is administered and controlled by an identified protocol as outlined

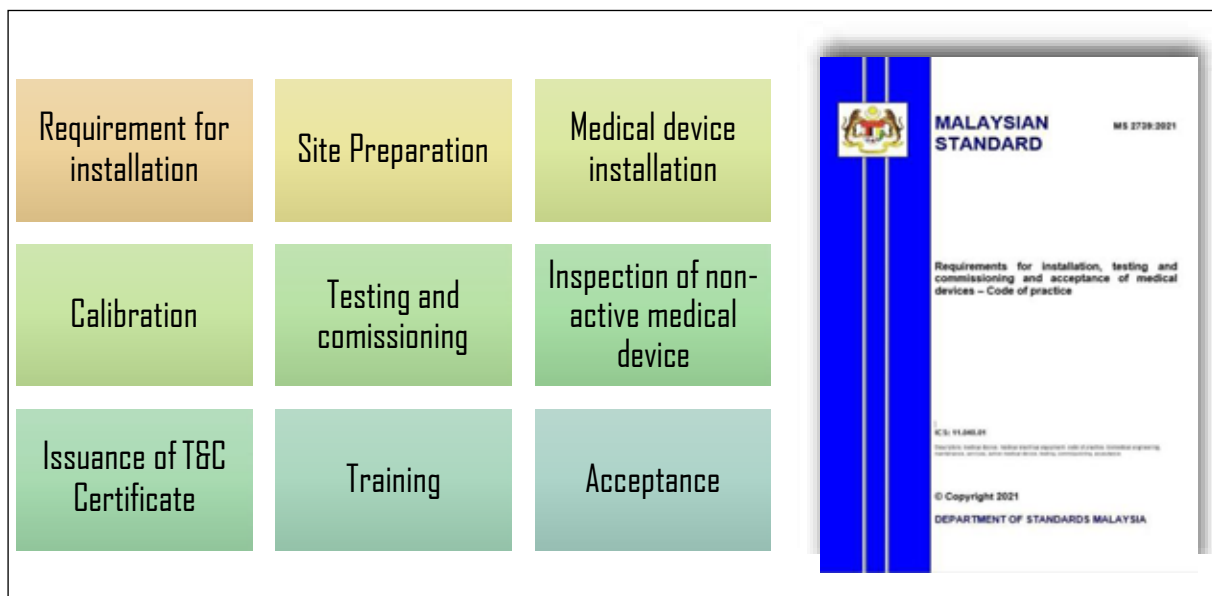


Figure 10: The scope of MS 2739:2021

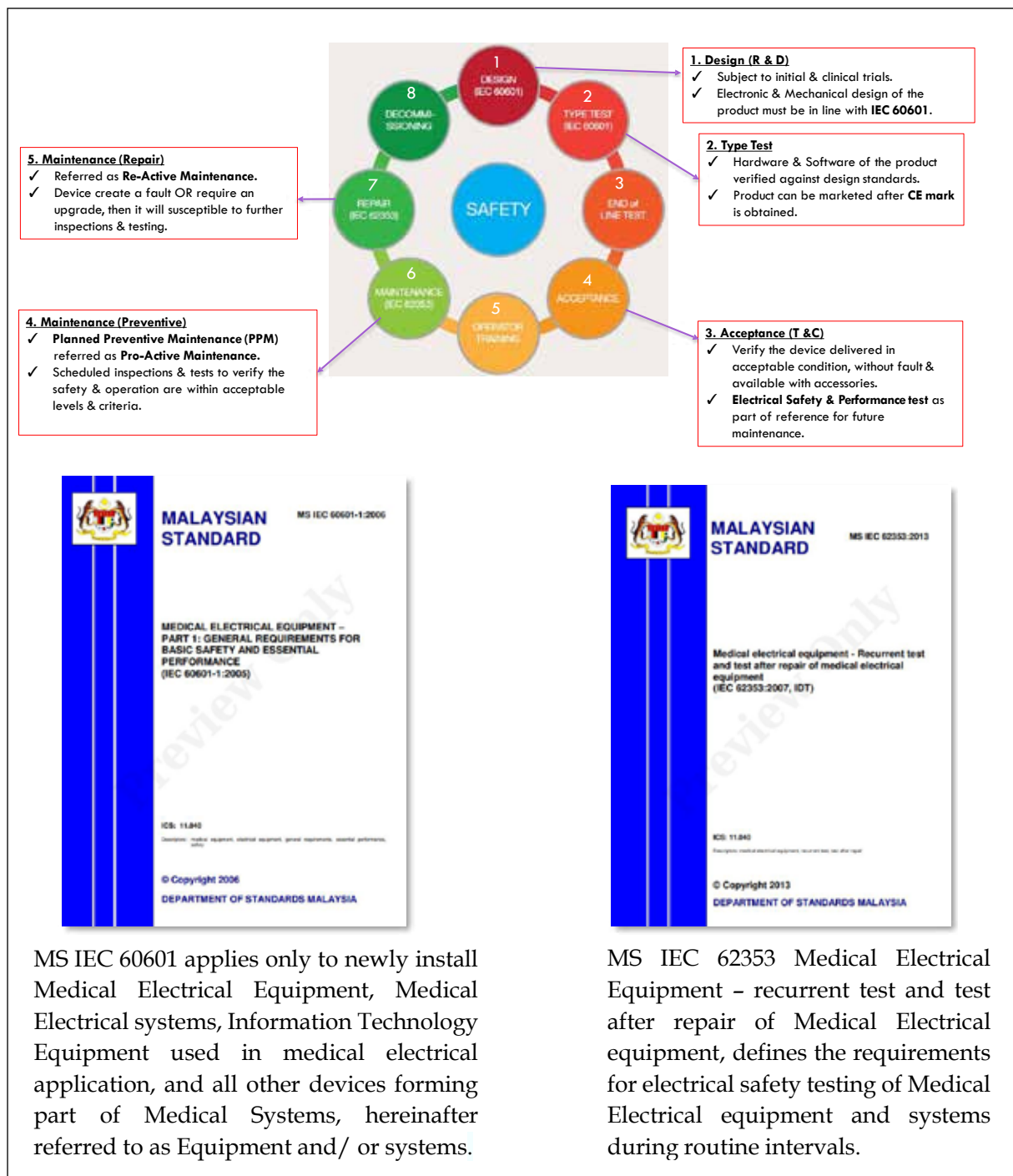


Figure 11: Area of MS IEC 60601 and MS IEC 62353 on EST

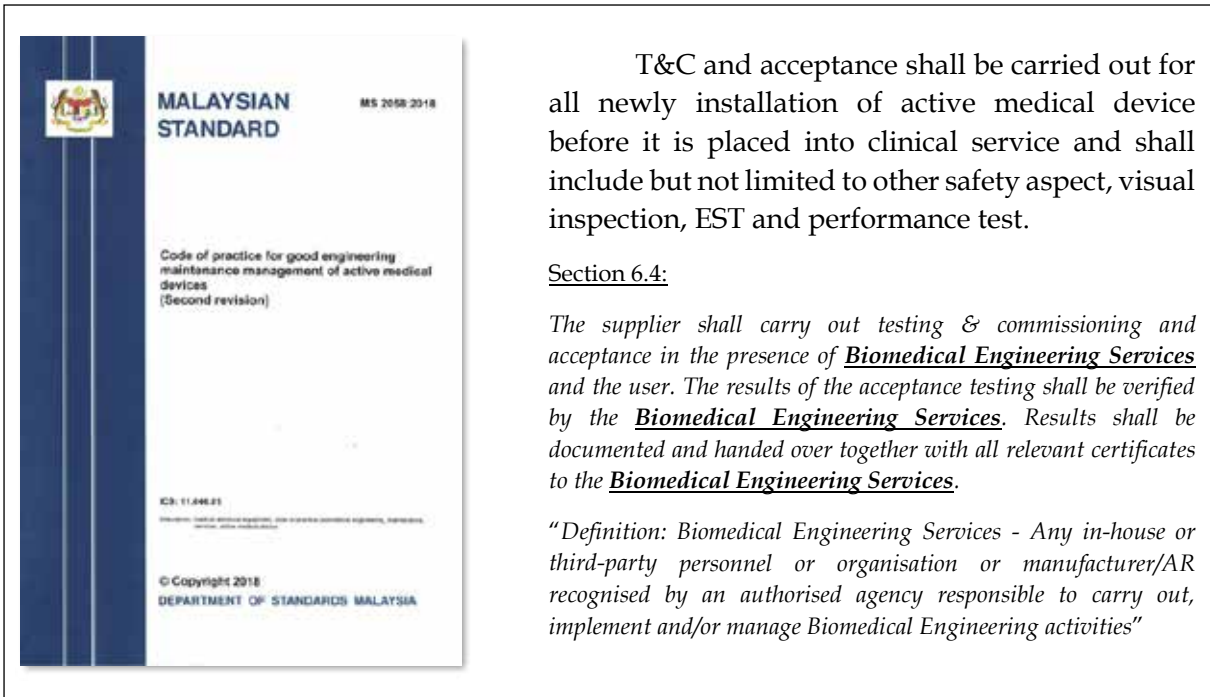


Figure 12: Area of MS2058:2018

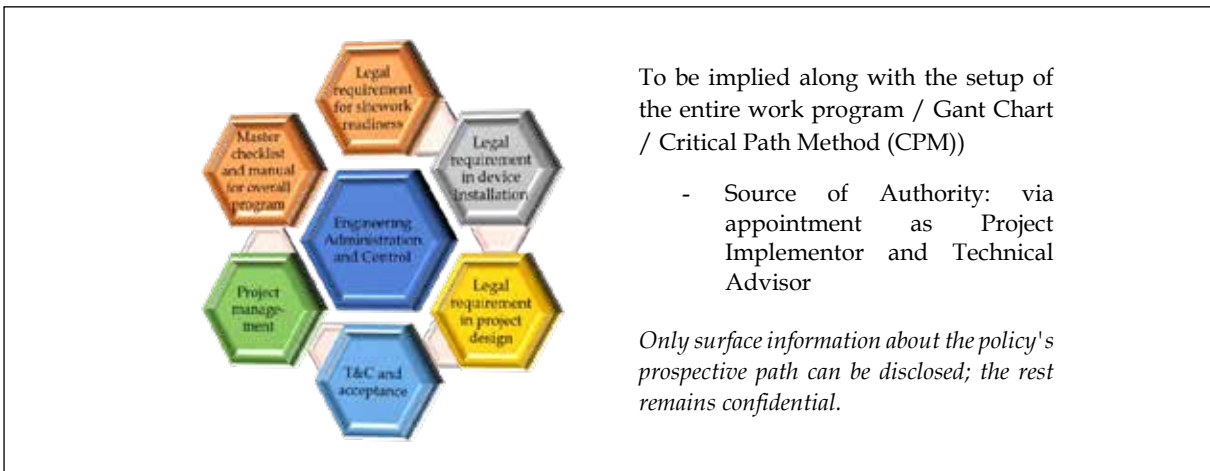
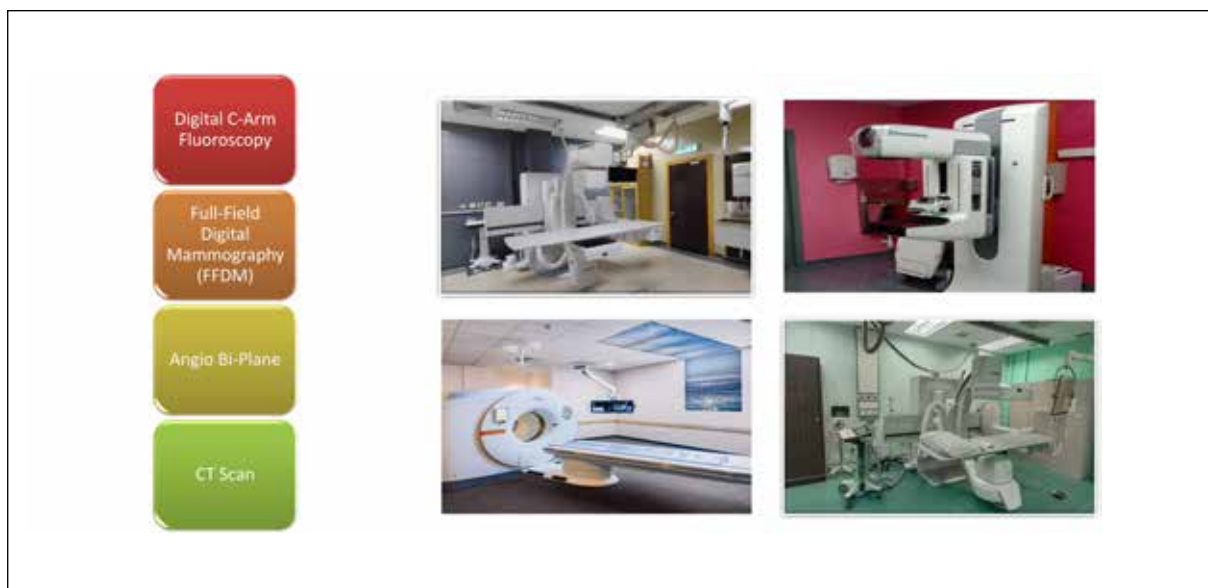


Figure 13: Framework of the engineering administration and control



MOH engineering team who procured some high-end medical devices for radiology

in the established healthcare engineering policy (refer to Figure 13).

Project Outcome & Conclusion

Engineering is always governed by laws for a wide range of circumstances, including the installation of medical devices. It must also abide by the relevant laws and regulations as it is subject to Government and public trust. The qualifications and experience of this profession are regulated by an Engineering Board (BEM), and engineers are subject to disciplinary measures for professional

misconduct or negligence, such as fines or suspension of license.

The delivery of high-end devices for the radiology department commonly accelerates in response to the increased demand for the needs of the patients. Nonetheless, the intricacies of the entire procedure remain unchanged, and it is impossible to compromise the legal requirements. Healthcare engineers are no longer “the hidden figures”; instead, they play a crucial role in radiology by preserving the professionalism and accountability of “Professional Engineering Services” and “Engineering Works” for the betterment of healthcare services. ■

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Highlights of Legislation Regarding Offshore Oil & Gas Subsea Pipeline Inspection and Repair

By **Nanthan Sivalingam**
Pipeline Engineer

Ir. Teo Eu Jin
Innovation & Repair Lead

The transfer of liquid or gas medium from one point to another can be achieved either via a piping system or a pipeline system. So, what is the difference between these two systems? A piping system is a complex network of relatively smaller pipes, fittings, and valves within the defined plant boundaries (inside the plant itself) which is normally above ground level, whereas a pipeline system is a series of relatively larger pipes over long distances beyond the plant boundaries (outside the plant), which can be aboveground, underground, or underwater. Basically, a pipeline system is for transporting liquid or gas medium from one platform to another.

The Offshore Oil and Gas Industry uses both piping and pipeline systems inside and outside the platform respectively. Moreover, the pipeline will be located underwater (subsea) at offshore platform due to the nature of the set-up. Nevertheless, how does one ensure the pipeline system can safely keep the product in the pipe? A leaking pipeline will ultimately lead to safety, health, and environmental concerns. Therefore, proper Engineering Design, Construction and Maintenance is essential to address this concern. Fortunately, all pipelines in Malaysia fall under the custody of the Department of Occupational Safety and Health (DOSH) and regulated in accordance with our national law (see Table 1).

Petroleum (Safety Measures) Act 1984, Part V Transportation of Petroleum by Pipelines

Section 16. Authorisation of pipeline works

It shall not be lawful for any person to undertake any pipeline works to be executed in or on land, on the surface of or underwater, onshore or offshore except under authorisation granted by the Minister, or otherwise than along the route delineated on the map annexed to the authorisation or within such limits of lateral deviation from the route as may be prescribed in the authorisation, or by a person other than the one named in the authorisation.

The Minister shall have power to grant or to refuse an application for pipeline works authorisation under subsection (1).

Remarks:

On top of that, there is another regulation under this Act by the title of "Petroleum (Safety Measures) (Transportation of Petroleum by Pipelines) Regulation 1985" that addresses the pipeline aspect of Design, Permission for Installation, Permission for Operating, Inspection and Modification.

Table 1: National Law capturing Pipeline Work

Sample Pipeline Leak Incident



In January 2022, a beach located in Eastern Thailand was contaminated with crude oil due to a pipeline leak in the Gulf of Thailand. The oil spillage into the ocean was estimated to be 50,000 litres. Fortunately, the situation was brought under control by the relevant parties within a short period of time leading to minimum impact on the environment.

Source: www.straitstimes.com/asia/se-asia/thai-beach-declared-disaster-area-after-oil-spill

Table 2: Oil Spill Incident in Thailand

Historical Oil Spill Incidents

There have been multiple incidents of crude oil spillage into our environment ranging from The Amoco Cadiz Oil Spill (1978) in France, the Kolva River Spill (1994) in Russia to the infamous Deepwater Horizon Oil Spill (2010) in USA. Among the examples mentioned, the Kolva River Spill was related to poor pipeline maintenance. Instead of looking into an oil spill occurrence at a faraway nation, let us zoom in to an oil spill event that took place in our neighbouring country Thailand. Any oil spill incident will have a detrimental impact on the environment, and incur financial losses to the stakeholders.

Looking at the highlighted oil spill incidences, are we prepared for a similar incident locally? The reply is YES. Indeed, oil spillage is an unintentional and undesirable event, and we ought to be prepared for the worst-case scenario via a proper Damage Control strategy. In Malaysia, the Department of Environment is responsible for the overall Oil Spill Response in collaboration with the Marine Department in an operation role. If the effect spreads beyond local boundaries, then there will be involvement from other associated stakeholders such as Ministry of Foreign Affairs per the “National Oil Spill Contingency Plan”. Also, the clean-up response can be categorised into Tier 1 (Asset Owner), Tier 2 (State), and Tier 3 (Regional).

Inspection (part of Maintenance)

There is a famous saying, “A Stitch in Time Saves Nine”, meaning if we sort out a problem early it

may save a lot of extra work later. This is how inspection comes into the picture in which the owner performs due diligence to ensure that the pipeline is fit-for-service. Basically, a pipeline needs to be inspected externally and internally. Subsea pipeline external inspection is achieved via Remote Operated Vehicles or ROV (maybe with divers in some cases) launched from a vessel. ROVs attached with the right equipment can perform many tasks, ranging from Visual Inspection, record Pipeline Position, evaluate Seabed Profile with respect to pipeline (span), check Corrosion Protection (CP) value, and understand CP Field Coverage Gradient.

Internal inspection of pipelines is challenging regardless of onshore or offshore location, as the team needs to check the conditions inside the pipe. The most efficient way presently is via Intelligent Pigging (IP). It is important to bear in mind that IP can pass through a specific design diameter without any obstruction. Thus, it is crucial for the owner to maintain the internal cleanliness of the pipeline regularly. This goal is achieved by using maintenance pigging (e.g., Bi-Directional, BiDi Pigs either in the form of Disc, Brush, or Foam) to remove light deposits from the internal pipe wall surface. Also, gauging survey is done to detect any geometrical restriction prior to the deployment of IP to ensure obstruction-free conditions inside the pipeline.

The main difference between IP and Maintenance Pig is the many sensors attached to the IP which comes in multiple modules or sections, together with the recording system. Also, IPs primarily use specific sensors to check for

metal loss and internal pipeline corrosion. At the same time, IPs may be able to provide geometrical information or pick-up physical defects, allowing owners to obtain preliminary information for assessment together with the distance recording log. Based on the IP result, the owner can determine Fit-for-Service (FFS) of the said pipeline.

Repair Approach

In general, offshore pipelines for the oil and gas industry can be split into Sweet Service and Sour Service whereby the medium inside the pipeline is without hydrogen sulfide or H_2S (or relatively low) and with H_2S content respectively. Most of our subsea pipelines in Malaysia are considered Sweet Service. With this kind of characteristic, the mode of our pipeline leaking scenario will theoretically be due to severe corrosion or mechanical damage. Although the Kolva River Spill (1994) was a result of severe corrosion, pipeline leak from this factor can be minimised provided sufficient maintenance and inspection are conducted by the pipeline owner, including timely action taken when abnormalities are detected.

Remarks:

- The presence of Sour Service (H_2S) in the process fluid may lead to Sulfide Stress Cracking (SSC) on Carbon Steel material. Thus, appropriate material selection and testing is required to prevent this situation.
- Rule of thumb, Engineers can determine whether the existing pipeline is still compatible by comparing the maximum operating pressure (P_{max}) which shall be greater than the calculated Safe Operating Pressure (P_s). Below shows the formula for P_s per ASME B31G (2012), Sec 1.5:
- $P_s = [2 \times \text{Material Yield Strength} \times \text{Wall thickness}] / [\text{Outer Diameter} \times \text{Design Safety Factor}]$

Hence, the focus on this section will be on offshore pipeline leak caused by Mechanical Damage. One may wonder how a pipeline in the middle of the sea experience Mechanical Damage. While the probability may be low, it could happen with dropped objects during lifting activities or even hit by shipping anchor. Depending on the degree of damage, the pipeline may leak

immediately, or it may give way at a later stage, or even be still fit-for-use. Regardless of the outcome, it is crucial for pipeline owners in Malaysia to immediately notify the Department of Safety and Health (DOSH) once they are aware of any dangerous occurrence related to their pipeline per regulation illustrated in Table 3.

Petroleum (Safety Measures) (Transportation of Petroleum by Pipelines) Regulation 1985

Regulation 13 Dangerous Occurrence

1. The owner, operator or contractor of a pipeline or his authorised representative shall immediately notify the Approving Authority.
2. An owner or operator of a pipeline shall, as soon as he becomes aware of any defect in the pipeline or any circumstance which would affect the safety of the pipeline:
 - a. rectify the defect or circumstance so as to ensure the safety of the pipeline.
 - b. cease to operate the pipeline if the defect or circumstance cannot be made good or removed and inform the Approving Authority.

Table 3: National Law Regarding Dangerous Occurrence on Pipeline

So, what is the strategic approach in handling a Mechanically Damaged Subsea Pipeline? If leaking is observed, the response will be to depressurise the pipeline and activate the oil spill response before executing any repair. For damage that does not result in leakage, we can refer to common First Aid response analogy on a fractured bone or dislocated joint, whereby the initial step is to demobilise the injured area. Similarly for pipeline, if the damaged section is static, we can just leave it. However, if there is potential movement it is best to install "Concrete Mattress" on both the upstream and downstream locations. This is to prevent further motion as the Stress Concentration point in cyclic motion is a root cause for material failure (break).

Once the damaged section is secured, we need to continue with cleaning and examination to determine the degree of damage. In the medical discipline, doctors will use X-ray. For an offshore pipeline, cleaning can be done using high pressure water jets and grit blasting (include seabed excavation). Furthermore, engineers can technically inspect the pipeline using standard

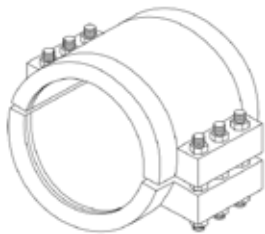
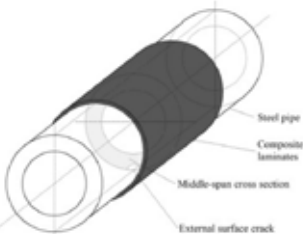
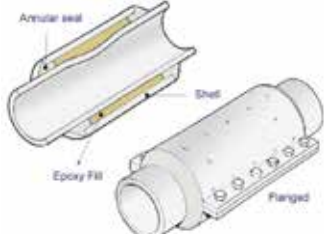
Mechanical Clamp	Composite Wrap	Grout Filled Sleeve
 Source: Reference 4	 Source: Reference 5	 Source: Reference 6
Leak Containment solution. It can also be Material Strengthening if the clamp cavity is filled-up with an epoxy-like substance.	Material Strengthening and Leak Containment. Flexible approach as the wrap can take the shape of the pipeline together with the dent profile.	The diameter of the sleeve is larger than the pipeline with the gap filled with an epoxy-like substance for Material Strengthening purposes.
Remarks: - Mechanical Clamp can be designed for Pressure Leak Test after installation depending on stakeholder requirement. - Sometimes “Grout Filled Sleeve” can be designed for leak containment, based on Contractor ability and Stakeholder requirement. - For mitigation purposes, technical personnel may refer to ASME B31.4 (2019) Clause 451.6 “Pipeline Integrity Assessments and Repairs” or ASME B31.8 (2018) Clause 851.4 “Repair Procedure for Steel Pipeline” to determine the industrial recommended repair method. - Some Industrial Codes do have restrictions on wrap. For instance, ASME B31.8-2018 Clause 851.4.2 does not accept non-metallic composite wrap repairs on injurious dents or mechanical damage unless proven through reliable engineering tests and analysis. - On some occasions, Mechanical Clamp or Grout Filled Sleeve can be placed on top of a composite wrap, meaning 2 mitigations in place. - The so-call Material Strengthening theory works by transferring the stress from the pipeline body to the clamp/wrap/sleeve provided there is proper surface contact and a well-distributed compression medium such as epoxy exists in between the materials. - Some Industrial Codes mention dents that exceed 6% of the nominal pipe diameter are considered injurious and require examination, such as ASME B31.4 (2019) Clause 451.6.2.4 (d) and ASME B31.8 (2018) Clause 851.4.1 (d). However, it depends on pipeline owner’s discretion.		

Table 4: Typical Subsea Pipeline Repair for relatively mild Mechanical Damage

underwater Non-Destructive Examination (NDE) methods on both external surfaces (e.g. Visual Inspection, Magnetic Particle Inspection, Alternating Current Field Measurement) and internal segments (e.g. Single Probe Ultrasonic Testing or Phase Array Ultrasonic Testing). Additionally, outer dent profiles can be measured for FEA confirmation.

After securing the damaged section and examination, the professional member can then prescribe the appropriate action to be taken on the damaged section. There are different ways to mitigate a Mechanical Damaged pipeline with the

intention of Material Strengthening (prevent leak) and/or Leak Containment, for example, “Clamp”, “Wrap”, and “Sleeve”, with each having their own unique properties on leak mitigation. Pipeline Clamp has tighter dimensional tolerance to attain proper sealing mechanism, and therefore there is a need to confirm measurement upfront. Alternatively, if the pipeline damage is severe, the owner can opt for “Sectional Replacement” whereby the affected portion is cut out and replaced.

In some cases, the removal of subsea pipeline defects via grinding or de-burring may be permissible provided there are engineering

Sample Industrial Code on Removal of Pipeline Defect via Grinding	
ASME B31.8 (2019) Clause 851.4.2 Permanent Field Repairs of Injurious Dents and Mechanical Damage (3) External mechanical damage, including cracks, may be repaired by grinding out the damage, provided any associated indentation of the pipe does not exceed a depth of 4% of the nominal pipe diameter. Grinding is permitted to a depth of 10% of the nominal pipe wall with no limit on length. Grinding shall produce a smooth contour in the pipe wall. The remaining wall thickness shall be verified using ultrasonic testing. After grinding, the surface shall be inspected for cracks using a non-destructive surface examination method capable of detecting cracks, and the surface shall be inspected with a suitable etchant.	(a) For pipelines operating at or above 30% SMYS, grinding is permitted to a depth greater than 10% up to a maximum of 40% of the pipe wall, with metal removal confined to a length given by the following equation: $L = 1.12 \left\{ (Dt) \left[\left(\frac{a/t}{1.1a/t - 0.11} \right)^2 - 1 \right] \right\}^{1/2}$ Whereby “a” = measured maximum depth of ground area, in. (mm); “D” = nominal outside diameter of the pipe, in. (mm); “L” = maximum allowable longitudinal extent of the ground area, in. (mm); “t” = nominal wall thickness of pipe, in. (mm)

Table 5: Sample Clause in Industrial Standard that mentioned Grinding on Pipeline.

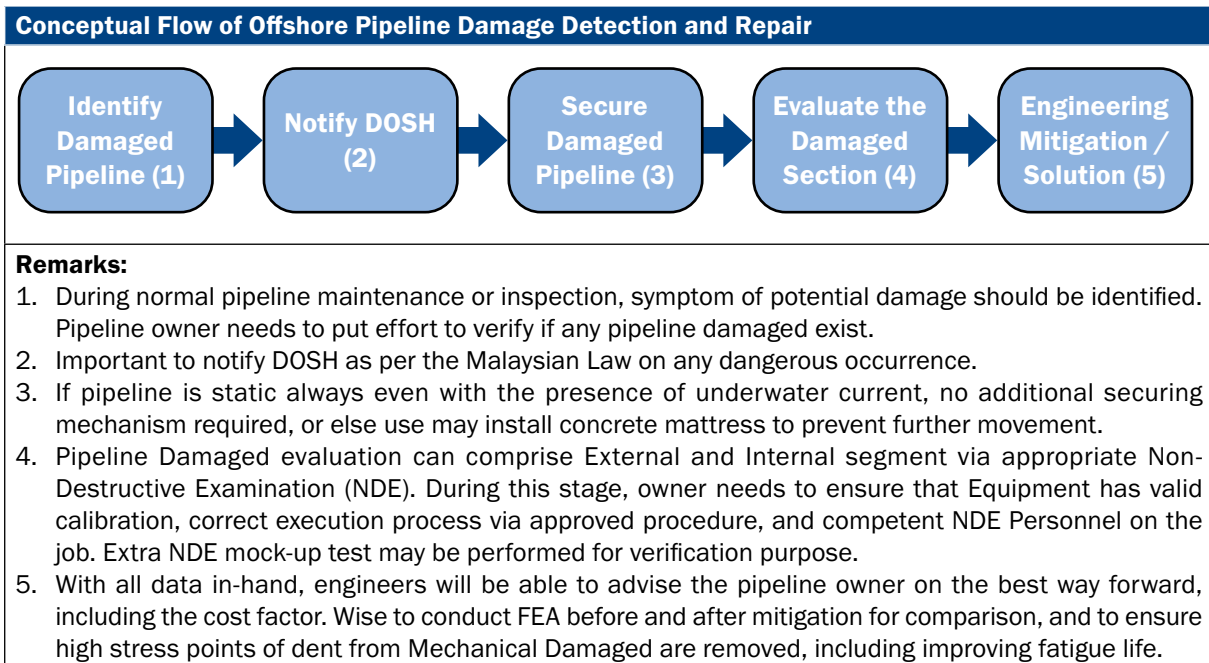


Table 6: Example of Flow Chart on Subsea Pipeline Damage Response

justifications, sufficient emergency safeguards in place, and approval from the pipeline owner. Though this approach is rarely practised locally, the industrial code does include this option. For example, ASME B31.8 clause 851.4.2 do highlight the allowable wall thickness removal by grinding, including calculation as illustrated in Table 5. During material removal activity, it is vital

to regularly verify the pipeline metal thickness to ensure the required wall thickness exists. This can be done by using underwater Ultrasonic Testing devices via zero angle probe. Also, a diver can verify defect removal via MPI.

“Fatigue”, which is a failure mechanism that occurs on material below the tensile strength that is subjected to dynamic and fluctuating stresses

Figure 1: Common Bi-Directional (BiDi) Disc Pigs

Without Brush (left) and With Brush (right)



Source: www.tdwilliamson.com/sites/default/files/2021-11/BiDirectionAll%20Pig%26SeriesIV-Nov2021-Combined-Webonly.pdf

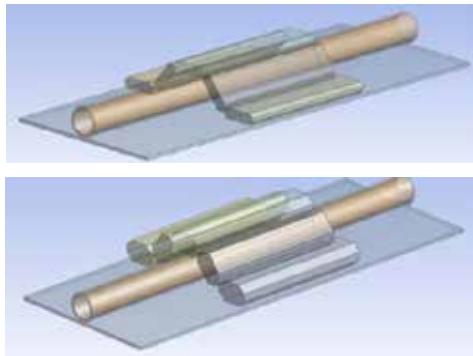
Figure 2: Sample Intelligent Pig (IP)

(Eddy Current for geometrical record & Magnetic Flux Leakage, MFL for metal lost detection)



Source: "Design & Development of Pipeline Inspection Gauge (PIC)", 5th IUGRC International Undergraduate Research Conference Military Technical College, Cairo, Egypt, Aug 2021, by Assistant Professor Naguib Saleh.

Figure 3: Sample of Concrete Mattress



Source: "Subsea Pipeline Protection Design Subjected to Dropped Anchor Using Concrete Mattress", International Journal of GEOMATE, Aug 2019, by Ricky Lukman Tawekal & Julio De Velas.

Figure 4: Sample Gauge Plate used for Survey

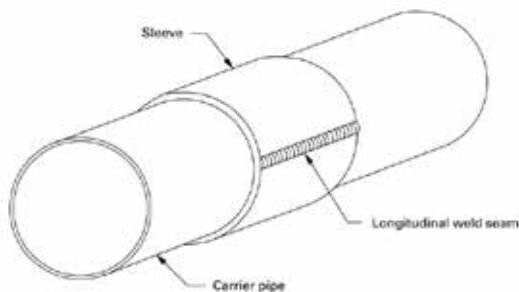
(The present of dents indicate obstruction inside the pipe during Pipeline Gauging)



Source: www.inlineservices.com/News/gauge-plates-and-pipeline-gauging/

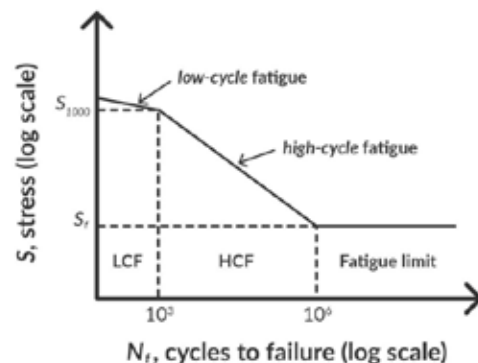
Figure 5: Sample Welded Pipe Sleeve Diagram

(Not commonly used in subsea pipeline repair)



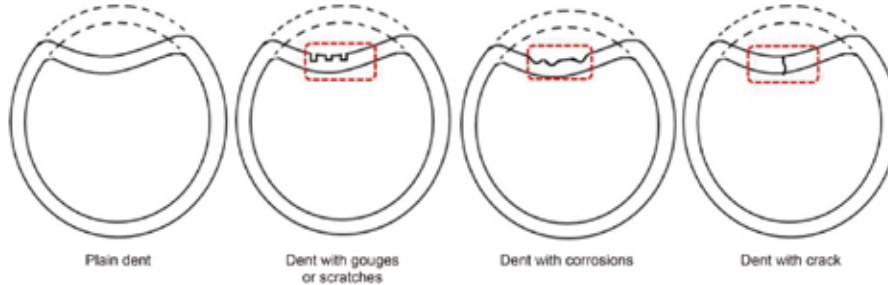
Source: ASME PCC-2 (2015), Part 2, Article 2.6 Full Encirclement Steel Reinforcing Sleeves for Piping, Type B Sleeve

Figure 6: Sample Fatigue S-N Curve



Source: www.simscale.com/docs/simwiki/fea-finite-element-analysis/what-is-fatigue-analysis/

Figure 7: Example of Pipeline Dent Affiliated Defects



Source: "Standards and methods for dent assessment and failure prediction of pipelines: A critical review", KeAi, Petroleum Science 2022, by Jian Zhao, Yun-Rong Lv & Y. Frank Cheng

from cyclic loading, may exist on the dented pipeline. The exposure of cyclic loading may eventually cause cracks that propagate and result in pipeline leakages. Thus, the objective of repair is to prolong the pipeline service lifespan by improving fatigue life, either via stress concentration removal or enforcing material strength. There is no ideal solution as mechanical damage mitigation is on a case-by-case basis. It all depends on the Best Practicable Means in evaluating the severity of the hazard, understanding the risk, and mitigating the situation using a suitable method, taking into account the overall cost.

Conclusion

Offshore Pipeline damage is unprecedented and usually relatively costly in terms of inspection and repair. Nonetheless, all pipeline owners in Malaysia need to demonstrate due diligence in maintaining their own assets appropriately. Furthermore, there are many advanced pipelines-associated technology in the market which oil and gas industry players can explore, for example, underwater autonomous devices that can perform 3D profile scans, inspections and wrapping in a single machine. In the future, there is the potential to move into deep water where human execution could potentially be limited and technology would then be the most practical solution. ■

Note: All photos and formula in this article are meant for sharing and educational purpose.

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Legislation & Industrial Standards Overview: Metal 3D Printing in the Oil & Gas Sector

By **Ts. Khaizuran Izzat Bin Khairuddin**
Integrity Engineer

Ir. Teo Eu Jin
Innovation & Repair Lead

There is an increased trend and interest in metal 3D printing among industrial players. With the advancement in science and technology, the material range for 3D printing has expanded, making it more attractive. In theory, 3D printing can transform a digital 3D software model into a 3D solid object via an additive manufacturing process by creating the product layer-by-layer sequentially. This method differs from the conventional subtractive manufacturing process that cuts a larger block of material into the final product. Furthermore, this new technology is gradually expanding into the oil and gas industry.

So, how does one ensure that metal 3D printing products are safe to use in the Malaysian Oil and Gas Industry? Firstly, for local usage we need to refer to legislation, especially in OSHA (refer Table 1). Secondly, there are relevant Oil and Gas industrial standards that spell out metal 3D printing or Additive Manufacturing requirements, such as API 20S “Additively Manufactured Metallic Components for Use in the Petroleum and Natural Gas Industries” and DNV-ST-B203 “Additive Manufacturing of Metallic Parts”. The ultimate objective of all these legislation and industrial standards is to ensure the final product is fit-for-use and uphold safety standards. For simplicity, API 20S will be illustrated in this article.

Basically, various products will have different critical criteria defined by material specification, grade, and the engineering usage context determined by the end user. Henceforth, API

LAWS OF MALAYSIA ACT 514, OCCUPATIONAL SAFETY AND HEALTH ACT 1994 (OSHA)

Section 20: General duties of manufacturers, etc. as regards plant for use at work.

- (1) It shall be the duty of a person who designs, manufactures, imports or supplies any plant for use at work:
- (a) to ensure, so far as is practicable, that the plant is so designed and constructed as to be safe and without risks to health when properly used;
 - (b) to carry out or arrange for the carrying out of such testing and examination as may be necessary for the performance of the duty imposed on him by paragraph (a); and
 - (c) to take such steps as are necessary to secure that there will be available in connection with the use of the plant at work adequate information about the use for which it is designed and has been tested, and about any condition necessary to ensure that, when put to that use, it will be safe and without risks to health.

Per definition, “Plant” includes any machinery, equipment, appliance, implement or tool, any component thereof and anything fitted, connected or appurtenant thereto.

Table 1: OSHA Requirements for Manufacturers
Source: Laws of Malaysia Act 514, Occupational Safety & Health Act 1994 (OSHA)

20S highlights the Additive Manufacturing Specification Level (AMSL) which dictates the degree of testing needed to proof the process and provide confidence to the stakeholders. The AMSL testing (comprising both Destructive and Non-Destructive Tests) differs in accordance with 3D printing manufacturing processes such as “Powder Bed Fusion (Laser Beam, LB or Electron Beam, EB)”, “Directed Energy Deposition (Wire and Blown Metal Powder)”, and “Binder Jetting”. Currently, metal 3D printing produced from “Powder Bed Fusion” is more common than other processes in the local market; thus it will be discussed further in this article. The goal for metal 3D printing testing is to prove that the product material characteristic is equivalent to that from conventional manufacturing processes (for safety and quality purposes).

Key Notes:

- Both standards API 20S and DNV-ST-B203 differ to a certain extent, but nonetheless the basic principles are almost the same.
- Additive Manufacturer Quality Management System (QMS) together with associated processes can be established in parallel with ISO 9001 for company implementation.

In order to produce a successful product, there are three vital elements that needs to be carefully considered: “Equipment”, “Process”, and “People” whereby the first two elements fall under the Printing Equipment Qualification in API 20S. All advanced machines require both hardware and software to co-function to be effective, including Additive Manufacturing (3D Printing). Hence, the manufacturer needs to possess a proper “Preventative Maintenance Plan” and “Digital Product Definition”. The maintenance plan shall cover the requirements on equipment calibration, inspection, servicing, and cleaning frequency, including the supply system for power and gas. Proper recording needs to be preserved for audit purposes.

The “Process” itself in Additive Manufacturing (AM) is another critical aspect for metal 3D printing. There should be a QA strategy approach in terms of the manufacturing flow process and consumable handling, including the consumable

criteria. The “First Article” which can be considered as a pilot/test run meant for verification is to proof the process prior to the subsequent production phase. Howbeit, any failure in the required first article testing and any changes to the “Essential AM Variable” will require another first article sample run. As mentioned, the degree of first article testing is per AMSL. Also, engineers can include additional tests according to ASTM material properties and customer requirement.

Human intervention is generally the last line of defense to prevent any bad products and should not be underestimated by any parties. Competency of personnel (in terms of Education, Training, Skills, and Experience) is highlighted in API 20S on the AM Operator, NDE technician and QC Inspector. On top of that, the employer needs to put proper company procedures, work instructions and necessary recording in place. For example, manpower: product involvement starts from the initial design stage, metal printing phase, and final product quality inspection before release to end user. Thus, there are many opportunities to improve and control the AM process. Clearly, the human factor is vital to the success on the overall product.

In API 20S, Section 7 mentioned the “Production Component Quality Control Requirements”, which means batch testing in layman language. Basically, a few samples will be randomly chosen from the whole production lot for testing and evaluation purposes. Similar to the first article sample run, both Destructive and Non-Destructive Tests exist, but generally in lesser quantities. Normally, all quality control activities shall be governed by the additive manufacturer’s documented procedures (QC Procedure), which would include appropriate methodology and acceptance criteria. The objective of these controls is to thoroughly scrutinise the product from the aspect of Quality and Safety prior to moving to the next stage.

In conclusion, there are advantages in 3D printing for metal products compared to the conventional subtractive manufacturing, such as the relative speed in the production of complex shaped parts, customised products and low material waste, just to mentioned a few. Nonetheless, some of the downsides are the higher production costs due to the equipment and raw material (metal powder), and the limitation

of the size of parts produced by the build volume of the machine itself. Regardless of the pros and cons, it is crucial for owners to ensure the product from AM is fit-for-purpose in terms of material characteristic by sufficient verification and data evaluation. Metal AM is relatively new in Malaysia, therefore there are many opportunities available for local players. ■

REFERENCE

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American Petroleum Institute, API 20S “Additively Manufactured Metallic Components for Use in the Petroleum and Natural Gas Industries”, 1st edition, Oct 2021.

“Quality & Safety in Welding Procedures with Metal 3D Printing Perspective”, Board of Engineers

Malaysia, THE INGENIEUR VOL 96 (Oct-Dec 2023), by Ir. Teo Eu Jin.

Remarks:

The minimum documentation and retention period of most of the AM document per API 20S is 10 years following the date of manufacture.

Legends:

3D = Three Dimensional; AM = Additive Manufacturing; AMSL = Additive Manufacturing Specification Level; ASTM = American Society for Testing and Materials; API = American Petroleum Institute; DPD = Digital Product Definition; MPS = Manufacturing Process Specification; NDE = Non-Destructive Examination; OSHA = Occupational Safety & Health Act; QA = Quality Assurance; QC = Quality Control; QMS = Quality Management System

Appendix A: Example of QAQC Strategic Concept

	Parameter	AMSL 1	AMSL 2	AMSL 3	Material Standard (E.g., ASTM)	Customer In- House Standard / Requirement
Test Specimens	Chemical analysis (see 4.6.4.2)	Feedstock certificate only	Required	Required		
	Tensile testing (see 4.6.4.3)	1 specimen in 1 orientation (1 in Z) (1 total)	1 specimen in 2 orientations (1 in Z and 1 at 90° to Z) (2 total)	2 specimens in 2 orientations (2 in Z, 2 at 90° to Z) (4 total)		
	Impact testing (see 4.6.4.4)	—	1 set in the Z orientation, 1 set 90° degrees from Z	1 set in the Z orientation, 1 set 90° degrees from Z		
	Hardness testing (see 4.6.4.5)	—	Required	Required		
	Microstructure analysis (see 4.6.4.6)	—	2 orientations (1 perpendicular to Z and 1 parallel to Z)	2 orientations (1 perpendicular to Z and 1 parallel to Z)		
	Density testing (see 4.6.4.7)	—	Required	Required		
Component in the final condition	Visual inspection (see 4.6.5.1)	Required	Required	Required		
	Volumetric NDE (see 4.6.5.3)	—	Required	Required		
	Surface NDE (see 4.6.5.2)	Required	Required	Required		
	Hardness testing (see 4.6.4.5)	Required	Required	Required		
	Dimensional inspection (see 4.6.6)	Required	Required	Required		
Integrated substrates	Visual inspection for cleanliness on base material (pre-build) (see 4.6.5.1)	Required	Required	Required		
	Surface NDE on base material (pre- build) (see 4.6.5.2)	—	—	Required		

Source: API Standard 20S, 1st Edition 2021, Powder Bed Fusion (LB and EB) – 1st Article

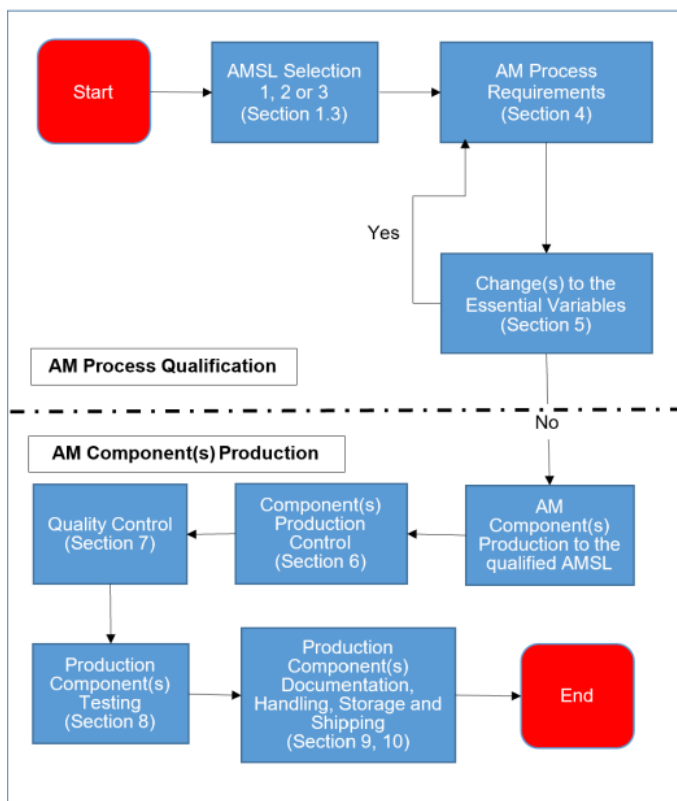
Note: Sufficient comparison needs to be conducted across the relevant Industrial Standard, Codes, and In-house requirements to produce a comprehensive test plan for the AM metal product.

Appendix B: Sample Powder Bed Fusion (PBF) & directed energy deposition (DED) Essential Variables

Parameter	Applicable AMSL	
	Powder Bed Fusion (LB and EB)	DED (Wire/Blown Metal Powder)
Specified feedstock chemistry	1, 2, 3	1, 2, 3
Specified powder morphology, flowability, and particle size distribution	2, 3	2, 3
Specified wire diameter and type	—	2, 3
Specified post-processing heat treatment and other thermal processes	1, 2, 3	1, 2, 3
Specified shield gas composition	1, 2, 3	1, 2, 3
AM machine manufacturer and model number	1, 2, 3	1, 2, 3
Name and revision number of the DPD	1, 2, 3	1, 2, 3
Build platform material	1, 2, 3	1, 2, 3
AM machine unique ID	3	—

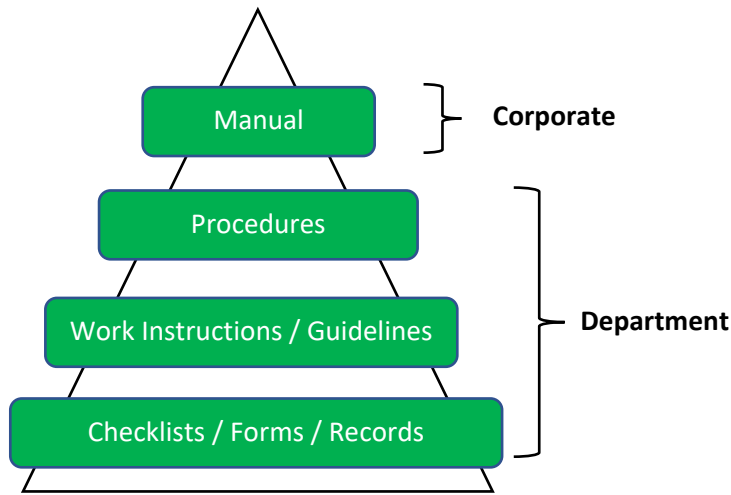
Source: API Standard 20S, 1st Edition 2021

Appendix C: Qualification Process Flowchart per API 20S



Source: API Standard 20S, 1st Edition 2021

Appendix D: Sample QMS Documentation



Note: Usually these documents are co-related.

Appendix E: Summary of API 20S

AM Metal Printing Equipment Qualification (Procedures & Record)		
Equipment	Process	People
Hardware Preventive Maintenance Plan which covers equipment servicing and calibration for the facilities involved in MPS but not limited to: 3D Printing Machine Post-build Processing Facilities such as Stress Relief, Heat Treatment, Hot Isostatic Pressing (HIP), Curing, De-powdering, De-binding / Sintering, etc. Software Procedure to develop and maintain the Digital Product Definition (DPD) file, which includes the digital data required for AM components. For instance, CAD files (e.g., STL, STEP), equipment settings, software used and version.	QMS Strategy (QA&QC) This section highlights the documentation for the MPS, and emphasize on AM consumable or feedstock (powder / wire / binder) AMSL requirement, storage, change plan, reuse, shielding gas, etc. First Article (Pilot Run) This first article shall be manufactured with the same DPD and MPS as the production components and meeting to the necessary testing (per App. A). <i>[Note: Manufacturing Process Specification (MPS) comprises of printing strategy, pre-build check, post-processing activities, Quality Control inspection, and documentation requirements]</i>	Human Competency This column touches on personnel training and competency requirements in the form of Education, Training, Skills, and Experience for: AM Operator NDE technician QC Inspector <i>[Note: Usually there will be a need for Vendors to submit the associated documentation to the customer for approval / acknowledgement]</i>
<i>Note:</i> Company may consolidate both DPD and MPS in the Inspection and Test Plan (ITP) to document and outline the quality inspection, test, and survey of the product or process to meet the needed criteria.		

Appropriate Form G to be Used in Support of CCC as Prescribed under UBBL

BEM noticed that the standard Form G used by Majlis Daerah Sabak Bernam (MDSB) bears its letterhead and logo. BEM had consulted with Jabatan Kerajaan Tempatan (JKT) with reference to the prescribed standard form in the UBBL. JKT in its letter cautioned MDSB that Form F and Form G used for the issuance of CCC should follow the gazetted UBBL, in this case Undang-Undang Kecil Bangunan Seragam Selangor (Pindaan) 2007.

The JKT letter to MDSB is appended herewith for reference.

	JABATAN KERAJAAN TEMPATAN KEMENTERIAN PEMBANGUNAN KERAJAAN TEMPATAN <i>(Ministry of Local Government Development)</i> Aras 26-29, No. 51, Persiaran Perdana, Presint 4 Pusat Pentadbiran Kerajaan Persekutuan 62100 Putrajaya, MALAYSIA	Tel : +(6)03 - 8891 3000 Faks : +(6)03 - 8891 3090
		Ruj. Kami : JKT.T.800-2/1 Klt(1) Tarikh : 10 November 2023
Yang Dipertua Majlis Daerah Sabak Bernam Sungai Besar 45400 SELANGOR		
Tuan,		
ADUAN LJM : PENGGUNAAN BORANG G BAGI PENGEMUKAAN SIJIL PERAKUAN SIAP DAN PEMATUHAN (CCC)		
Dengan segala hormatnya saya diarah merujuk perkara di atas dan surat dari Lembaga Jurutera Malaysia (LJM) rujukan BEM/PPC/05-254 bertarikh 13 Oktober 2023 adalah berkaitan.		
2. Jabatan Kerajaan Tempatan (JKT) telah menerima satu aduan daripada pihak LJM berkaitan penggunaan Borang G dengan kepala surat Majlis Daerah Sabak Bernam (MDSB). Jabatan ini juga telah membuat semakan menerusi laman web MDSB pada ruangan e-borang terdapat borang G yang boleh dimuat turun dan pihak Jabatan mendapati borang-borang G tersebut menggunakan kepala surat MDSB.		

3. Untuk makluman pihak tuan, terdapat elemen yang tidak selaras dengan peruntukan undang-undang serta tidak menepati aspirasi CCC iaitu mempertingkatkan aspek *self-regulation* di kalangan para profesional. Sistem Perakuan Siap dan Pematuhan (*Certificate of Completion and Compliance – CCC*) dikuatkuasakan antara lain bertujuan untuk mempertingkatkan profesionalisme di kalangan para profesional melalui pendekatan *self-certification* dan *self-regulation* ini. Tanggungjawab untuk menandatangani Borang G1- Borang G21 adalah dipertanggungjawabkan sepenuhnya kepada sama ada Kontraktor atau Kontraktor Tred dan para profesional untuk menyempurnakannya.

4. Sehubungan dengan itu, mohon penyelarasan segera dilakukan terhadap pengeluaran borang-borang G di Majlis pihak tuan berdasar pewartaan Undang-Undang Kecil Bangunan Seragam Selangor (Pindaan) 2007 pada 12 April 2007 yang bernombor warta Sel.PU.9.

5. Adalah diharapkan agar pihak tuan dapat memastikan status pelaksanaan CCC ini dilaksanakan mengikut garis panduan yang telah ditetapkan oleh Kementerian agar pelaksanaannya teratur dan mematuhi peruntukan perundangan.

Sekian, terima kasih.

"MALAYSIA MADANI"
"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,



(Ar. MOHAMAD NAZLI BIN RAMLI)
Pengarah
Bahagian Perunding Kawalan Pemajuan
b/p.: Ketua Pengarah
Jabatan Kerajaan Tempatan
Kementerian Pembangunan Kerajaan Tempatan

SALINAN KEPADA :

Edaran Luaran :

- i) YBhg. Dato' KP/JKT
- ii) YBr. TKP(T) / JKT

Edaran Luaran :

- i) Presiden
Lembaga Jurutera Malaysia (LJM)
Tingkat 17, Blok F, Ibu Pejabat JKR
Jalan Sultan Salahuddin
50582 KUALA LUMPUR
Tel : 03 – 2698 2413
Faks : 03 – 2692 5017

Fire Protection Code

Service Apartment Purpose Group under UBBL 1984: 2021 Amendments

By **Ir. Au Chong Hun**
Managing Director
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This article discusses the rationale behind the introduction of Service Apartment Purpose Group and the Provision of Residential Sprinklers in the UBBL 1984: 2021 Amendments.

Under Malaysian building regulations and practice, the term 'Service Apartment' can be subject to different definitions. For instance, it can refer to serviced-multi-room-suites which are operated like hotels, or it can refer to residential apartments built on land with commercial titles.

From a legislative perspective, the original UBBL 1984 under Purpose Group III only had sub-groups hotel, hostel or flat. Each sub-group would have different passive and active fire protection requirements. In the late 90s and early 2000s, most BOMBA officers would understand and categorise "service apartment" as "hotel". This confusion was understandable mainly due to the word "service". Much effort was expended to convince BOMBA that the "service apartment" is first and foremost "not serviced".

However, from the fire engineering perspective, the determination of fire provisions should rightly be based on the design of the building and not the type of land title. If the building is designed and will be operated as a hotel, then the protection systems required should be that of a hotel. But if a building is designed and operated as an apartment, then building the same building on commercial land or otherwise should not increase or decrease its fire risk.

As such, it would be overkill to interpret and apply the UBBL requirements of a hotel to an apartment. Do we really require sprinkler protection for a five-storey apartment block because the total number of "rooms" exceeds 50 (assuming one apartment has three bedrooms)? Do we calculate the travel distance from the furthest room door of the apartment unit or from the main door of the unit? Should we be installing public address (PA) speakers in every room of the apartment?

That was the gist of the prevailing issues which led to the historic first BOMBA circular on this subject on November 11, 2005 following the BOMBA-Professional dialogue of October 18, 2005. Basically, this first circular acknowledged that although the land title is commercial, some service apartments were intended to be built purely as residential apartments. It was agreed that the fire protection system would be determined based on the design and usage of the building. To appeal against the imposition of hotel requirements, evidence of building design and usage, including evidence of Sales and Purchase agreements (of at least 50% of the total units), would need to be submitted as substantiation.

Since then, the service apartment genre has flourished and matured. Less and less service apartments were designed as "purely residential" as one would on a residential title. Many developments started to incorporate commercial



With or without the hotel vs home debate, we still need to address the fire risks associated with high-rise residential.

podium elements. The era of SOHO, SOGO, SOFO and the like began to take root with some even going as far as converting entire blocks of completed service apartments into short-term stay units upon completion.

On May 30, 2014, BOMBA rescinded the original circular and stated that service apartments can no longer be considered residential. This left a gap in practice and legislation.

From another point of view, one can say that the industry has finally reached the realisation that this whole episode is not merely a matter of black or white, hotel or home, but rather we are experiencing a unique class of urban living phenomena which needs to be considered as a class of its own. The time has come for our fire protection legislation to be updated to meet the needs of protecting the community.

On another front, professionals have, for a long time, rallied for residential sprinklers, especially for high-rises. Local statistics have shown that our commercial buildings are relatively safer due to sprinkler protection and regular Fire Certificate inspections. As apartment towers are getting taller, fire is best fought from within and automatically. With or without the hotel vs home debate, we still need to address the fire risks associated with high-rise residential.

History has shown that many fire legislations were conceived after major fire catastrophes. The original UBBL may have been kickstarted by the Campbell Complex fire but nothing is stopping us from getting ahead of the curve and eliminating foreseeable risk beforehand.

It is commendable that the UBBL Amendments working group took the approach to introduce a new sub-group of Serviced Apartments under Purpose Group III. Not only was Service Apartment introduced in the Tenth Schedule, but the other Schedules of the UBBL were also updated to reflect the requirement for Service Apartment. At the same time, residential sprinkler protection was also introduced for residential apartments exceeding 120m in height.

In the conventional LPC sprinkler design tradition, any building exceeding 45m warrants two stages of the sprinkler system and is thus categorised as a high-rise. 90m is more or less the limit for two stages of the sprinkler system. A 120m height would have required two stages of the Wet Riser system based on UBBL 1984. Therefore, 120m is sort of stretching the high-rise limit on many fronts in terms of existing legislation.

In the author's opinion, the process of deliberating the need for sprinkler protection for high-rise residential has provided an important perspective in the process of harmonising the fire engineering versus land title debate. One can find such an example of reasoning in the BOMBA circular dated November 29, 2021, which allowed sprinkler exemptions until the 120m limit — matching the residential apartment limit. We should expect the gaps to close in the future.

Meanwhile, let's welcome Service Apartment to the UBBL! ■

‘R&D Tree’ Concept in Knowledge Management in Engineering Consultancy Practices

By Ir. Dr Tan Yean Chin

Engineering consultancy firms are regulated by the Board of Engineers (BEM) as mandated in the Registration of Engineers Act (REA). Sections 7A and 7B of REA state that the various types of engineering consultancy firms, which must be registered under BEM, are known as Engineering Consultancy Practices (ECP).

The day-to-day work of a Professional Engineer with Practising Certificate (PEPC) and the processes of engineering work in ECPs generally cover the following four key components:

- a) **Planning:** Conceptualising and determining engineering systems to be adopted, gathering initial facts, and identifying engineering parameters.
- b) **Analysis:** Conducting engineering calculations and analyses, whether manually, using spreadsheets, or engineering software.
- c) **Design:** Translating analysis results into engineering drawings and specifications that adhere to applicable engineering standards and best practices.
- d) **Supervision and Inspection:** Ensuring that engineering construction, based on endorsed drawings and specifications, is supervised and inspected by a Professional Engineer with Practising Certificate (PEPC) or his representatives registered with BEM (e.g., PEPC, Professional Engineer, Graduate Engineer, or Inspectors of Work).

The performance of engineering consulting firms and their PEPCs significantly impact public safety and interests. To address the challenges

posed by the ever-evolving construction industry and ensure their long-term survivability, the ECP management should consider the following key questions:

1. **Consistent Safety and Technical Suitability:** How can ECPs consistently produce safe and technically suitable deliverables that won't fail due to design errors?
2. **Efficiency:** What strategies can streamline the engineering process within ECPs, minimising time and resource requirements while maintaining quality?
3. **Knowledge Retention:** How can ECPs effectively preserve knowledge and experiences acquired from previous projects, particularly during transitions or retirement of key personnel?
4. **Effective Implementation:** What methods can effectively incorporate retained knowledge and experiences into day-to-day ECP operations?
5. **Effective Training:** How can young engineers be trained effectively and aligned with company culture and practices?

One practical and achievable approach to address the questions raised above is through in-house research and development (R&D) combined with a robust and regimented knowledge management culture. In this article, the author proposes a concept called ‘R&D Tree’ to effectively enhance knowledge management (KM) within the engineering consulting firm and fulfil their set objectives.

Knowledge Management and R&D Processes within ECP

In the context of ECPs, effective knowledge management involves several key steps:

1. **Identification and Creation:** Identifying relevant engineering knowledge and creating new insights are essential. This includes capturing knowledge from projects and experienced professionals and converting them into explicit, shareable content which we will refer to as 'R&D Product'. Any engineering process which the engineers in the firm feel is needed but still not available will be created in-house through the R&D process to create the R&D Product for the firm's knowledge management system.
2. **Organisation and Storage:** Systematically structuring engineering knowledge into categories related to specific engineering works ensures easy retrieval and accessibility. For geotechnical engineering, the categories are: retaining walls, slopes, basement excavation, tunnels, deep foundation, shallow foundation, reclamation, etc. A centralised repository should have clear categories for easy retrieval, accessibility and usage. The firm needs to create a user-friendly software interface in a Cloud Website or Intranet to encourage engineers' usage.
3. **Sharing and Utilisation:** Foster collaboration by encouraging knowledge sharing among team members. Conducting regular knowledge-sharing sessions (through colloquiums or in-house training), documentation, and cross-functional discussions will contribute to better decision-making and innovation. Top management commitment is crucial, as it involves human resource investment and cost.
4. **Workflow Improvement:** Leverage collective engineering knowledge accumulated throughout the years and use proper categorisation and storage to streamline engineering design processes (e.g., design manuals, methodologies, checklists, etc). Through learning from past experiences and best practices easily

accessible, both young and experienced engineers can optimise work processes, reduce inefficiencies and maintain good quality work.

5. **Quality Control and Error Prevention:** Effective knowledge management helps identify potential pitfalls and areas for improvement. By learning from past mistakes and implementing preventive measures, organisations can enhance overall performance. The standardised workflows within the knowledge management system can also be used for internal design checks and review processes carried out by a Senior Engineer and PEPC to improve quality and prevent mistakes. The use of knowledge management also reduces reliance on individual memory which may not be consistent.

Why is Research and Development (R&D) important for a successful knowledge management system within an ECP?

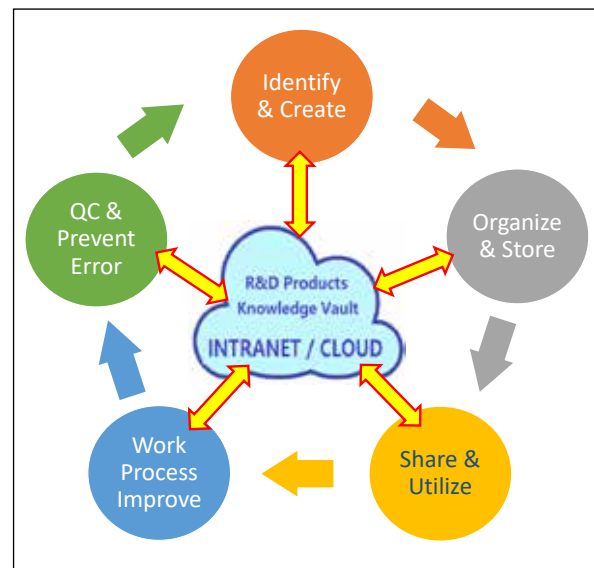


Figure 1: Knowledge Management Key Steps

- R&D develops resources into 'R&D Products' (e.g. analyses and design methodology, checklists, manuals, methodologies, spreadsheets and computer programs) that can be utilised for the work of an engineering consultancy in servicing a project.

- Enhancement of efficiency to develop the project by improving, standardising and automating processes that eliminate manual tasks and minimise redundancies leading to innovations to suit the project's nature.
- Identify the lessons learnt in past project experiences and update the R&D products in a timely manner.
- Contribution to differentiation:
 - i. Innovation and new product development
 - ii. Advanced technology and intellectual property
 - iii. Quality improvement
 - iv. Customisation and personalisation
 - v. Efficiency and cost savings
 - vi. Thought leadership and industry recognition

The R&D Process of an ECP requires commitment from management and the formation of an in-house committee that meets every month to propose new topics, assign work, monitor progress, check the output for correctness, approve completed R&D Products, upload to the knowledge vault in the Cloud or Intranet, improve and update R&D Products, and maintain the system in a good condition for users.

The “95/5” Rule and the Importance of a Reliable System in ECP

The “95/5” rule refers to the Pareto Principle, also known originally as the “80/20” rule which states that approximately 80% of the effects come from 20% of causes. This concept is mentioned here as it highlights the unequal distribution of inputs and outcomes that apply to the process of engineering works carried out by ECPs. The “95/5” rule from a problem-solving standpoint means that 95% of the problems can be due to and effectively prevented or mitigated by making significant changes to only 5% of the work processes and the people implementing them. The rule suggests that systemic factors (the system itself) are the main contributors while individual actions play a much smaller role. In summary, to achieve consistent safety and technical suitability in all works carried out by ECPs, a reliable system which strikes a balance and considers both systemic improvements and

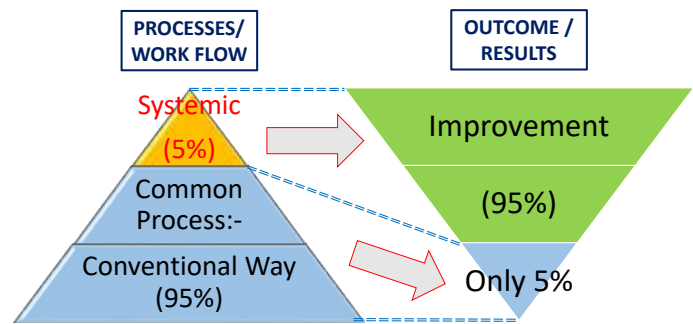


Figure 2: Application of “95/5” Rule to Improve 5% of System for 95% Overall Improvement of the Engineering Process.

also individual behaviours has to be created based on the management of accumulated knowledge to address the five key questions highlighted above.

Based on the above criteria, the author proposes two major systemic improvements for ECPs:

- A) R&D Tree:** The Research and Development Tree (R&D Tree) is the knowledge vault of all engineering processes that can be easily used as a reference or followed by all engineers working in the company for day-to-day engineering works, for checking to ensure safety and technical suitability, and for training and learning. This is a major part of knowledge management on engineering works necessary for all ECPs.
- B) Operating Flow Chart (OFC):** OFC is proposed for all major operations of the Company in administration, human resources, accounting, claims and payment processes, ISO, engineering check and review processes and documentation, and tender and contract management. The concept of OFC, despite its importance, will not be discussed in this article.

R&D Tree Concept

The R&D Tree is a knowledge management concept developed by the author in 2018. It aims to create a comprehensive repository—a knowledge vault—for an organisation’s Research and Development (R&D) initiatives. This repository houses essential resources and standard office documents related to engineering

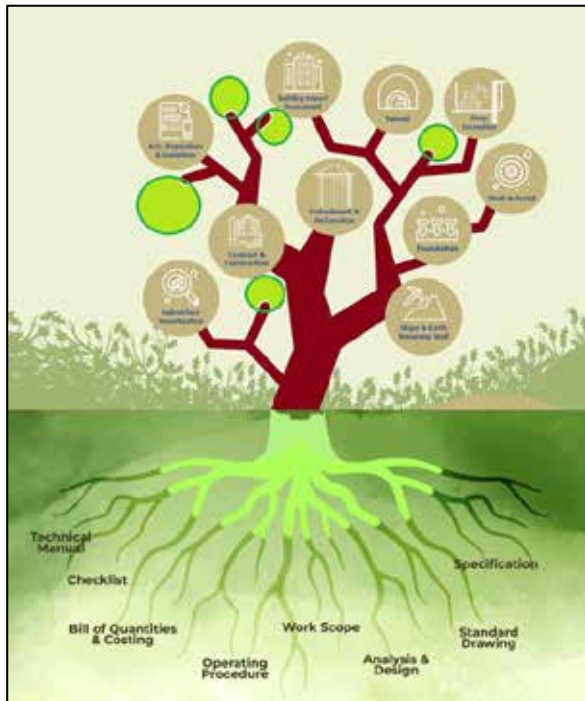


Figure 3: R&D Tree for Knowledge Management in Geotechnical Engineering (abstracted from G&P 25th Anniversary Booklet and Video, 2024)

works. Figure 3 illustrates the R&D Tree concept specifically for geotechnical engineering. The R&D Tree concept can also be adopted by other engineering disciplines. The term ‘Tree’ is used because the R&D process involves a cyclical pattern of identifying, developing, using, and improving R&D products, much like the growth and renewal of a real tree in nature.

The key components of the R&D Tree Concept in relation to a real tree in nature are:

- **Roots (Foundational Knowledge)**
 - The foundational knowledge base includes principles, theories, and best practices.
 - Roots represent the fundamental understanding of engineering disciplines.
- **Trunk (Structured Knowledge)**
 - The trunk symbolises structured knowledge repositories.
 - It includes databases, documentation, lessons learned, and project histories.
- **Branches (Specialised Categories)**
 - Each branch represents a specialised category (For geotechnical engineering, they are retaining walls, slopes, basement excavation, tunnel, deep foundation, shallow foundation, reclamation, etc).
- **Leaves (Innovation and Research)**
 - Leaves signify the on-going research, innovation, and development that will add to the R&D Tree, just like the photosynthesis and nutrients from the water that leaves use to produce food for growth.

This innovative platform of a knowledge vault developed through the R&D Tree concept serves as a centralised hub, allowing seamless access

A Tree	R&D Tree Concept
Roots absorb water and nutrients from soil.	Based on current available and commonly practice engineering processes to carry out a project until R&D Products are available in the knowledge vault.
Leaves use photosynthesis and nutrients from the water to produce its own food	Lessons learned from Projects carried out will be developed into R&D Products (e.g. new analysis and design procedures, spreadsheets, methodologies, improved specifications, checklist for planning, analysis and design, construction supervision, etc).
The Tree grows properly becoming taller with stronger roots.	Through in-house R&D, more R&D Products are produced, growing the comprehensiveness of the knowledge vault. The Consultancy Firm also grows stronger with higher engineering capacity and quality of works.
Bigger and stronger tree can absorb more water and nutrients to grow.	With more R&D products added to the knowledge vault, engineers can work more effectively, ensuring quality and preventing failures due to design errors.

Table 1: Similarities of a tree with the R&D Tree Concept



Figure 4: Example of Cloud Website for knowledge management and operation (from G&P Professionals Group Cloud)

to crucial information, data, and insights that fuel the pursuit of excellence and drive innovation within the firm. Within this vault, there will be a wealth of R&D products, ranging from cutting-edge technological advancements to experimental breakthroughs, all carefully curated and organised to facilitate collaboration and foster creativity among the talented teams in the firm. The knowledge vault offers a wealth of knowledge to inspire and propel projects carried out by the firm forward and improve the competitiveness of the firm in terms of engineering know-how and the latest developments in engineering.

The proposed R&D Tree concept aims to enhance knowledge management within engineering consulting firms and align with their objectives.

In addition, the knowledge vault also houses a comprehensive collection of office standard documents that are related and can be used or referred to when carrying out engineering works. These encompass a wide range of materials, including corporate policies, operating flow charts (OFC), procedures, best practices, and guidelines that promote consistency, efficiency, and compliance throughout the whole firm. Having access to this invaluable repository ensures that everyone operates with a unified approach and adheres to the highest standards of quality and professionalism. At the heart of the firm, the Knowledge Vault embodies the commitment to continuous learning, exploration, and the pursuit of excellence.

Figure 4 shows an example of a Cloud website that is only accessible by the in-house staff for knowledge management and operation.

Conclusion

To address the challenges posed by the ever-evolving construction industry and ensure long-term firm survivability, engineering consultancy firms should implement an effective approach that leverages in-house research and development (R&D) alongside a rigorous knowledge management culture. The proposed R&D Tree concept aims to enhance knowledge management within engineering consulting firms and align with their objectives. ■

Note: As the Author is a PEPC in the Civil discipline and an Accredited Checker in the Geotechnical discipline, the examples presented in this article will focus primarily on these areas.

Smart Engineering Innovations towards Business Success

By Dato' Ir. Dr Eric Goh, FASc
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Ts. Poo Teng Soo
Director - Alexcus Engineering

Smart engineering innovations and industrial work practices need to be efficient and practical to produce positive outcomes aimed towards business success in the respective holistic industrial operations. The objective of strategic engineering innovations is to produce optimum benefits and production outputs using the existing budget and, if possible, without incurring any extra financial investments. Cost-effective smart engineering should thus focus on the best, most efficient, accurate and effective technologies and techniques to eventually further increase the overall profits and good governance practices for the ever-dynamic sustainable industrial sectors worldwide.

The engineering profession has always been acknowledged worldwide as the foundation in the design, construction and manufacture of various innovative structures, infrastructures and amenities for the sustainability of society enrichment and progress. The engineering profession is thus the vital catalyst and component of any country worldwide striving for industrialised and developed nation status. With the new exciting era of 'Cyber Physical Systems' (Industry 4.0), top-trending smart technologies, globalisation and the present economic challenges a reality, engineering professionals need to acquire the latest effective skills in state-of-the-art engineering knowledge, sustainable industrial business success

practices, environmental-friendly technology and economical means to carry out best practices in the industry to stay competitive.

The 'Blue Ocean' Strategy developed by eminent international experts Professor Chan Kim and Professor Renée Mauborgne in 2005 from the *Institut Européen d'Administration des Affaires* (INSEAD, France) is useful as a catalyst for the industrial sector to progress in this globalised and technology-savvy era. Some of the key principles towards using this unique 'Blue Ocean' Strategy to progress the engineering-centred industry from 'good' to 'great' include:

- ability to create uncontested new market opportunities by reconstructing existing market boundaries,
- focusing on the big picture,
- reaching beyond existing market demand, and
- getting the strategic sequence right.

'Blue Ocean' manufactured goods include all the value-added products not yet in existence today, complemented by market demands that can strategically be created rather than fought over. There is thus ample opportunity for growth which can be both profitable and rapid. 'Blue Ocean' is thus an analogy to describe the wider, deeper economic potential of the market space for new unique industrial techniques and products that is not yet explored or tapped for further enhancement.

INNOVATIVE SMART ENGINEERING

The definitive results of successful innovative cost-effective smart engineering are:

- ability to produce good results without costing a lot of money,
- focus on the best, most efficient, accurate and optimal schemes,
- outcome helpful in cost-saving initiatives for industrial operations, and
- capacity to obtain the ultimate outcome in the increase of profits.

Highlights of the top-trending smart engineering innovations in the respective industrial sectors aimed towards further sustainable, society enhancement and business success worldwide include:

Iconic Smart Medical Health Engineering



The World Health Organisation (WHO) noted that every year around one million citizens worldwide are waiting for a kidney transplant. Although about 130,000 kidney organ transplants are successfully carried out every year, all the noble global medical efforts just meet 10% of the annual demand for kidney transplants worldwide. Owing to the global organ shortage scenario, thousands of critically-ill patients around the world are left waiting indefinitely for compatible donors. Likewise, approximately 22.6 million patients worldwide annually require neurosurgical interventions to treat unfortunate damage to their peripheral nervous systems. Imagine the direct crystal-clear benefits from society-centred engineering research if, instead of waiting for an organ compatible match, the health centre can successfully use an engineering designed 3D-bioprinting technology

to fabricate a new well-matched organ made from the patient's own cells. Organ bioprinting, similar to classic 3D printing, uses 'bio-ink' which contains living stem cells instead of plastic or metal being the printing material. Though significant progress has been made in printing skin tissues and cartilage, the next phase for medical society-centred engineering research worldwide is in the successful printing of fully functional complex organs with integrated nerve cells, such as eyes, lungs, hearts and livers. The World Health Organisation reports that every year about 15 million people worldwide suffer from cardiac arrest/heart attack. The victims' odds of survival are presently set at a depressing rate of 8%. The main reason for this sad statistic is the long response time of about an average of ten minutes for Emergency Response Teams to reach the respective victims, while brain death or fatalities occur within four to six minutes. Motivating engineering research into the development of efficient Emergency First Aid Drones can definitely save lives since these light-weight drones (4 kg) with speeds of up to 100 km/h can easily manoeuvre over difficult terrains, overcome traffic jams and reach tight spots in crowded areas within a one-minute time frame from a distance of 3 km away within a 12 km² zone. Deployment of these life-saving drones in strategic locations can give the unfortunate victim suffering from a heart attack an 80% positive chance of survival. The Ambulance Drone is another novel technology to rapidly transport victims from difficult-to-assess accident and disaster zones quickly to the medical centre for treatment. Millions of patients around the world and their families would be most grateful and relieved if these proposed top-priority community-centred medical engineering research projects achieve more health successes in the near future.

Drone/Unmanned Aerial Vehicle (UAV) Engineering

Some of the major benefits of using this engineering marvel for any industrial sector projects include more than 99% results accuracy, 85% faster time to complete task and five times cheaper for overall



project implementation. Imagine a technology able to successfully complete a two-hectare aerial survey in six minutes with high resolution data outputs or even producing an accurate digital site volume model with 3 cm site accuracy. This unique feat is made possible using Unmanned Aerial Vehicle (UAV) technology, popularly known as 'Drones', which are able to accomplish these demanding tasks effectively. The specifications of drone technology are progressively improving and rapidly complemented by a reduction in pricing. We are confident that geo-referenced aerial surveys can effectively be used to increase industrial site surveys, mineral productivity or even shorten the time for accurate environmental assessment from the present time period of project execution of weeks to merely hours at any potential or remote industrial site worldwide.

Remote Transport Fleet and Production Management



The aim of an effective remote fleet management is to provide real-time detailed asset information for

any selected industrial site operation so that a top management overview can be strategically carried out instantaneously on the operating efficiency of all the equipment used at the respective sites worldwide from the head office of any multinational



corporation. Equipment productivity is defined as the monitoring of their on-going production complemented with the management of their corresponding jobsite efficiency. The productivity solution enables top management to control the manufacturing process in real-time to meet the specifications as required by the client via the usage of Industry 4.0 high-precision technology to increase the accuracy and efficiency in the manufacturing process.

Energy Efficiency Engineering Technology



A secure, reliable and sturdy energy supply is a national priority for all countries around the world. With the exponential population growth of the global community complemented by the respective increase in industrialisation programmes, the escalating demand for energy will correspondingly intensify. Though the majority of the global population are presently connected with adequate electricity supply for daily usage, the

International Energy Agency (IEA) noted that due to the challenges of the Covid-19 pandemic, 660 million of the world community will still not have access to electricity amenities in 2030. Access to a dependable and continuous energy or electricity supply is essential for functioning economies around the world. The ready availability of electrical supply is important as an economic indicator for the alleviation of poverty, economic growth and elevation of living standards. Since energy sources and facilities for power generation are usually fixed, intelligent engineering solutions need to be found to improve energy efficiency, optimisation of energy usage and effective implementation of power distribution network systems. Owing to the need for strategic availability of ready power or electricity supply to households and the industrial sector, society-centred engineering projects could focus on the introduction of smarter and more sustainable electronic gadgets to optimise the efficiency of energy usage. The national power grid needs to be fail-safe to ensure the continuity and quality of energy to important economic industrial sectors as well as homes. Energy efficiency engineering projects centred on community development should also be accorded high-priority status worldwide. Efficient management of power/ electricity production and effective power network distribution will definitely reduce energy wastage and factory downtime due to power failures, enabling more communities and industrial sectors around the world to progress economically.



Innovative Real-time Equipment Training Simulators

This innovative real-life training simulator concept is most advantageous when imparting experience to new equipment operators. Operators undergoing this ingenious training programme experience an accurate representation of the work site with the installation of sensory perception and motion feedback mechanisms to reflect scenarios such as working in uneven ground terrains. The training programme carried out is dynamic and the task scenarios created are based on the actual work experience of senior equipment operators. Task performance can also be assessed and analysed in real time during the respective training sessions.



Food Security Engineering

Global food security, as defined by the United Nations, is the availability of adequate world food supplies to ensure that everyone worldwide, at all times, has access to food for a healthy lifestyle.



Source: modified from Tetra Pak

Thus, the key to food security is the continuous and systematic access to sufficient quality and quantity food for the global population. A 2022 World Bank analysis report noted that due to the impacts of Covid-19 pandemic many countries are facing widespread increases in global food insecurity, disruption of food supply chains, increase in transportation costs and the shocking increase in food prices to near all-time highs. Owing to Covid-19 uncertainties, the outlook for global food security is of significant concern for many countries worldwide. It was noted that although digital transformation has gradually been implemented in the food processing industry, the unfortunate occurrence of the Covid-19 pandemic has dramatically accelerated the rate of change.

The application of smart solutions and innovative Industry 4.0 technologies to adapt to the new work pandemic SOPs whilst optimising production costs is the logical way to go for this essential industrial sector to survive in these challenging times. Owing to the critical needs worldwide, community-centred engineering research should thus be accorded high priority in addressing issues on sustainable food security which includes efficient food processing, identification of alternative food supplies and the improvement of viable agri-food supply chain setups.

Highlights on the positive benefits of Industry 4.0 community development-centred research applications towards sustainable food security include improved production,

monitoring, traceability, task automation, predictive maintenance, quality control, consumer preferences projection, real-time customer demands and strategic rapid management decision-making on overall business setup.

Other advantages of innovative cyber-physical (Industry 4.0) systems research include the minimisation of unintentional wastage due to food rejects during production complemented by the identification of alternative and safe food products which meet the nutritional needs of the global population. These much-anticipated engineering innovations would be most useful, not only in Malaysia but worldwide, to successfully enhance food security to an efficient and sustainable level.

Waste Management Engineering

Waste generation has been increasing dramatically around the world. The World Bank reported that a shocking 2.01 billion tonnes of municipal solid waste are generated by the global community every year; which works out to $\frac{3}{4}$ kg per person worldwide. With an expected exponential surge in population growth, the projected global increase in waste generation is expected to increase by 70% to 3.4 billion tonnes by 2050.

Landfill sites for the storage of waste are becoming scarce. The good news is that with continuous progress in waste management technology research, each tonne of recycled paper represents a savings of 64% in energy savings, a



Source: modified from *The Architectural Designs*

reduction of 58% water used, and a decrease of 27kg of air polluted emissions generated in the paper production process.

Overall, construction costs for a recycled paper production mill are cheaper by 50-80% compared to a traditional paper mill using new timber pulp.

Similarly, in recycling one glass bottle compared to making a new glass bottle from silica raw material, the energy saved can light up a 100W bulb for four hours, emit 20% less air polluted material and also results in a reduction of 50% less water pollution.

It was also noted that the saved energy from the recycling of 1kg of steel can run a 60W light bulb for two days. Thus, in one year the recycling of steel in some countries can provide power/light to 18 million needy community households.

Engineering focus on the design of smart waste management technology is useful to communities all around the world. Some of the proposed engineering technologies include effective waste storage complemented by efficient disposal scheduling setups, automatic sorting of waste types (plastic, paper or glass) using sensors, and real-time on-line monitoring network of all the potential waste and waste-type generated so that rapid decision-making can be carried out on the best means for their disposal.

The design of economic environmental-friendly disposal systems for electronic wastes or even novel food waste management solution technologies would also be valuable.

CONCLUSION

Since effective sustainable economic development is an important topic worldwide, extensive progress of engineering innovations under Industry 4.0 by equipment manufacturers are all geared towards systematic management, efficient increased production complemented by further overall society enhancement. Owing to the continuous national development of a majority of countries worldwide, we are very confident the engineering-centred dynamic industry will continuously be vibrant right into the next millennium and beyond.

Some of the ingenious engineering foresights envisaged for the industrial sector in the dynamic era of Industry 4.0 and top-trending technologies are: virtual industrial design, interactive production control, and urban design.

The aim of smart engineering innovations via Industry 4.0 is to successfully assist in optimising the benefits and production outputs using the existing allocated budget and if possible, without incurring any additional investments. Smart engineering innovations and work practices can thus strategically focus on the best, most efficient, accurate and effective techniques to eventually further successfully increase overall company profitability and foster good governance practices for the ever-progressive sustainable industrial sector right through to the next millennium. ■

International Dispute Resolution Organisations

By Lim Tau Wee

In the construction industry, international dispute resolution organisations play a crucial role in resolving conflicts efficiently and fairly. The history and development of international dispute resolution organisations are intertwined with the evolution of global trade, investment, and the complexities of international relationships.

The key international dispute resolution organisations that specialise in the construction industry, including their structures and specialities, are as follows:

International Chamber of Commerce (ICC)

The ICC International Court of Arbitration, with its headquarters in Paris, France, is part of the International Chamber of Commerce. ICC was established in 1923 to resolve international commercial disputes. It has a Secretariat and several arbitral tribunals. The ICC is renowned for its global reach and expertise in handling complex international construction disputes. The ICC Arbitration Rules are highly respected, and the institution offers a robust framework for arbitration and dispute resolution.

London Court of International Arbitration (LCIA)

The LCIA was established in 1892 in London, UK. As one of the oldest arbitration institutions providing services globally, it operates through an international court and a secretariat, with panels of arbitrators who are experts in various fields, including construction. Known for its efficiency and impartiality, the LCIA provides arbitration, mediation, and other alternative dispute resolution (ADR) services. It has specific expertise in construction disputes, offering streamlined procedures and experienced arbitrators.

International Centre for Settlement of Investment Disputes (ICSID)

ICSID was established in 1966 under the Washington Convention (1965). As part of the World Bank Group, ICSID consists of an Administrative Council and a Secretariat. It maintains a list of arbitrators and conciliators. ICSID specialises in resolving disputes between international investors and states, often involving large construction and infrastructure projects. It provides arbitration and conciliation services under the ICSID Convention.

American Arbitration Association (AAA) / International Centre for Dispute Resolution (ICDR)

ICDR, with its headquarters in New York City, US, was established in 1996 as the international arm of the AAA. The AAA is a non-profit organisation with a national panel of arbitrators and mediators. The ICDR is its international arm, focusing on cross-border disputes. Together, they offer a range of dispute resolution services, including arbitration and mediation. They are known for their extensive resources, specialised rules for construction disputes, and a global network of experts.

Dispute Resolution Board Foundation (DRBF)

The DRBF, with its headquarters in Seattle, Washington, US, was established in 1996. It is a non-profit organisation that promotes the use of Dispute Resolution Boards (DRBs) in construction projects. It provides guidelines, training, and resources. DRBF specialises in preventing and resolving disputes on construction projects through DRBs, which are

established at the start of a project to handle issues as they arise, fostering a collaborative approach.

Singapore International Arbitration Centre (SIAC)

SIAC was established in 1991 in Singapore and developed rapidly into a leading arbitration hub in Asia.

It operates through a court of arbitration, a secretariat, and panels of arbitrators. It has specific rules and procedures for arbitration.

SIAC is a leading institution in Asia, known for its expertise in construction disputes. It offers efficient, cost-effective arbitration services with experienced arbitrators and tailored rules for complex construction cases.

Hong Kong International Arbitration Centre (HKIAC)

HKIAC was established in 1985 in Hong Kong as a leading arbitration institution in Asia. It includes an arbitration centre with a secretariat, an advisory board, and panels of arbitrators and mediators. HKIAC provides comprehensive dispute resolution services, including arbitration, mediation, and adjudication, with a strong focus on construction and infrastructure disputes. It is known for its flexible procedures and bilingual capabilities.

Dubai International Arbitration Centre (DIAC)

DIAC was established in 1994 in Dubai, UAE to promote arbitration in the Middle East.

It operates within the Dubai Chamber of Commerce and Industry and has an arbitration court and a secretariat. DIAC specialises in resolving disputes in the Middle East, particularly in construction. It offers arbitration, mediation, and conciliation services with a focus on regional practices and laws.

Chartered Institute of Arbitrators (CIArb)

CIArb was established in 1915 in the UK as a professional membership organisation with branches worldwide. It offers training, certification, and panels of arbitrators and mediators. CIArb

focuses on education and training in arbitration and ADR. It provides specialised dispute resolution services, including arbitration and mediation for construction disputes, supported by a network of certified professionals.

Fédération Internationale des Ingénieurs-Conseils (FIDIC)

FIDIC was established in 1913. It is an international federation of national associations of consulting engineers. It has various committees and working groups. FIDIC is known for its standard form contracts widely used globally in construction. It offers dispute resolution services through its Contracts Committee, including Dispute Adjudication Boards (DABs) and expert determination.

Society of Construction Law (SCL)

SCL is a professional organisation with a membership structure, including various regional chapters. SCL focuses on promoting knowledge and understanding of construction law. It offers guidelines, resources, and support for resolving construction disputes, emphasising education and best practices in dispute resolution.

Cairo Regional Centre for International Commercial Arbitration (CRCICA)

The CRCICA was established in 1979 under the auspices of the Asian-African Legal Consultative Organisation (AALCO). It has an independent Board of Trustees responsible for its strategic direction and oversight. CRCICA is known for its arbitration services, governed by the CRCICA Arbitration Rules, which are based on the UNCITRAL Arbitration Rules. These rules provide a flexible and efficient framework for resolving international commercial disputes, including those in the construction sector.

CRCICA has developed significant expertise in resolving construction disputes, benefiting from its location in a region that has extensive construction and infrastructure development. It provides specialised panels and tailored procedures to address the unique challenges in construction disputes. ■

Johor Bahru in 1960

By Cheo Hong Keyong



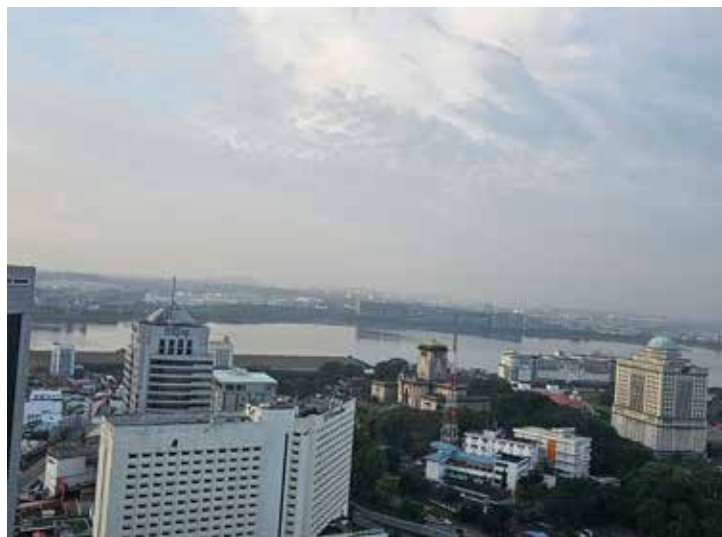
View of Johor Bahru in 1960 from Bukit Timbalan, showing the Causeway, Custom Complex at entrance to the Causeway, pre-war shophouses and a few Government buildings at the front end. (Photo courtesy of Jabatan Penerangan Malaysia).

In 1960, Johor Bahru, the capital city of the state of Johor was a burgeoning urban center with a unique blend of colonial and traditional Malay influences.

The area around the Causeway and the Custom Complex as shown in the photo background was already bustling and dynamic, reflecting both the city's historical significance and daily activities of the time.

Johor's proximity to Singapore made Johor Bahru an important trading hub, with goods and people frequently moving between the two cities.

Across the Straits of Johor, the Woodlands area in Singapore was still a wooded area with a Malaysian Naval Base stationed there. ■



View of Johor Bahru in 2024. The Causeway is to the left.

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