



### **Forensic Engineering's Role in Enhancing Offshore Marine Structures Defects and Deterioration**

By Ir. Mohd Izwan Mohd Noor

A committee member of OGMTD. He is an experienced professional engineer known for his exceptional performance in delivering successful and excellent project



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On 11 January 2025, the Oil, Gas, and Mining Technical Division (OGMTD) and Marine Engineering & Naval Architecture Technical Division (MNATD) have successfully organised a webinar talk with topic of Role of Forensic Engineering in Addressing Defects and Deterioration in Offshore Marine Structures, delivered by Ir. Dr. Noor Nabilah Sarbini from Universiti Teknologi Malaysia (UTM). As Head of Department at the Department of Structure and Materials, Faculty of Civil Engineering, she specialised in structural and building condition assessment, forensic engineering, concrete durability, and safety in construction, and actively involved in many consultations works in structural design and forensic engineering investigations.

### **Understanding Forensic Engineering**

All designs that are built and constructed according to standard processes and procedures may still experience defects. Over time, operational conditions and exposure to various external elements will cause defects and deterioration in structures. Forensic engineering introduces the application engineering principles to identify, assess and evaluate the defects and deterioration, this is not new but not widely known. Forensic engineers will be called upon to provide testimony in legal cases or insurance claims, identify liability, improve designs and safety standards recommendations, and prevent future incidents. Offshore marine structures, particularly those involving material failures, are subject to harsh environmental impacts, operational damage, material degradation, and structural fatigue throughout their lifecycle.

The main roles of forensic engineering are:

- Diagnosing failures
- Enhancing material selection
- Introducing design improvements
- Proposing best practice inspection and maintenance
- Providing lessons learned

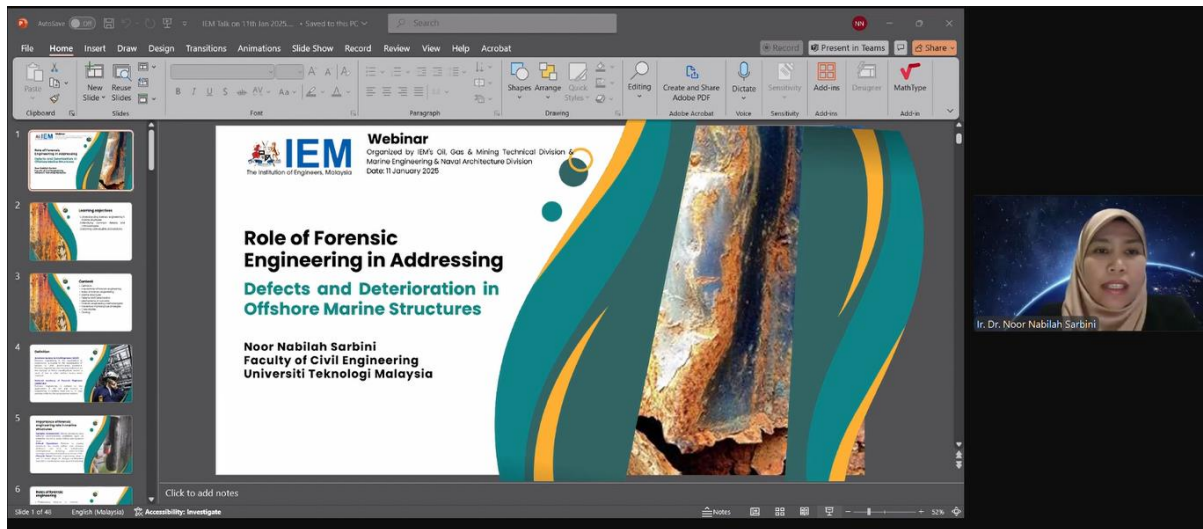
In identifying root cause and diagnosing defects and deterioration, methodologies such as non-destructive testing (NDT) are typically used on operating structures, as opposed to destructive testing, which requires sample collection. Qualitative investigation methods, such as failure analysis and root cause analysis, are

well-established investigation assessment for uncovering underlying issues related to defects and deterioration in the design, construction, commissioning, or operation of offshore marine structures. Case studies of investigation assessment and evaluation should focus on structure failure rather than human error, along with strategies for recommendation implementation and failure prevention.

## Material Failures and Selection

The talk covers material selection, characteristics, and properties of materials, such as quality, strength, and condition, which are critical in forensic engineering. These fundamental concepts of materials are essential for investigating the defects and deterioration. Common materials such as concrete, steel, and aluminium defects and deterioration are briefly presented, as lessons learned and recommending solutions to extend the material lifecycles.

Standards from organisations like the Society of International Gas Tanker and Terminal Operators (SIGTTO) and the International Organisation for Standardisation (ISO), including ISO 14224, are often used as guidelines in investigation assessments and evaluations. Risk matrix is employed in the investigation process, in assess and evaluate risk, failure on demand, probability of failure, and risk conditions. Forensic investigation assessments on structural integrity provide valuable insights into the material lifecycle, risks, and safety of offshore marine structures. This talk will not able to cover all, for in-depth understanding of the theory and methodology of forensic engineers, UTM offers Master's degrees in open and distance learning on professional practices



Picture 1. Ir. Dr. Noor Nabilah Sarbini from Universiti Teknologi Malaysia (UTM) is going through her technical talk materials