

# The 54th Rankine Lecture 2014 “Interactions in Offshore Foundation Design”: A Rerun

GEOTECHNICAL ENGINEERING TECHNICAL DIVISION



reported by Engr. Dr  
Gue Chang Shin

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It was a great honour for the Geotechnical Engineering Technical Division (GETD) of IEM, to invite Prof. Guy Housby of University of Oxford, for a rerun of the 54th Rankine Lecture on “Interactions In Offshore Foundation Design” at the Tan Sri Prof. Chin Fung Kee Auditorium, Wisma IEM on 4 December 2014.

The Rankine Lecture is considered one of the most prestigious geotechnical lectures in the world. It commemorates Prof. W.J.M. Rankine, best known for his theory for earth pressure on retaining walls. The lecture, chaired by the technical division Chairman, Ir. Yee Thien Seng, was divided into three parts:

- Part 1: Installation of jack-up units
- Part 2: Performance of jack-up units
- Part 3: Foundations for offshore wind turbines

In Part 1, Prof. Housby introduced various jack-up operations used in the offshore industry. He explained that in terms of analysis and design, the foundation of a jack-up installation such as spudcan penetration can be viewed as a bearing capacity issue. He then illustrated on the use of probabilistic calculations to deal with typical problems faced by engineers, such as soil variability, and demonstrated probabilistic calculations can narrow down a range of soil profiles obtained through laboratory and field tests, to arrive at a best estimate of soil profile for design.

The main message in Part 1 is for engineers to learn more about statistics as soil mechanics calls out for the application of statistics and



Photo 1: Screw piles

probability and geotechnical engineers should not shy away from this subject.

In Part 2, Prof. Housby highlighted the interactions with structural engineers such as choosing a pinned or fixed support in the analyses of jack-up foundations. The importance and benefits of “fixity” in structural response and the application of plasticity theory in analyses were discussed.

The main message in Part 2 emphasised the communication between structural and geotechnical engineers. Prof. Housby quipped that structural engineers would typically ask for spring properties at the bottom of the jack-up legs for soil-structure interaction analysis whilst the geotechnical engineers will say that the issue is more complicated than springs! He

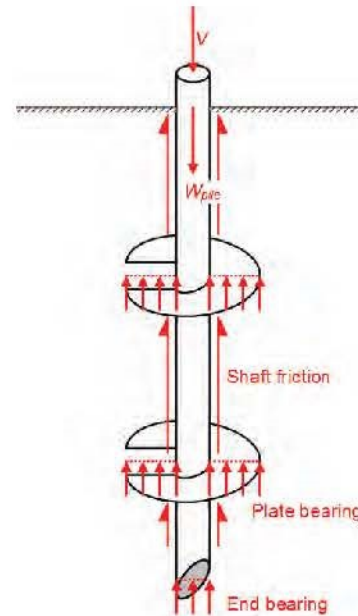


Photo 2: Capacity of a screw pile

concluded that the framework of plasticity theory is the common language between geotechnical and structural engineers.

The final part of the lecture was on foundations for offshore wind turbines. Prof. Housby brought the attention of the audience to renewable energy, particularly on the challenges and solutions for offshore wind turbines.

The offshore wind industry is going into deeper waters and using larger turbines. The lecture covered the conventional, unconventional and completely novel foundation solutions for offshore wind turbines. Monopiles are considered the conventional solution, where cyclic loading has to be considered in design.

While unconventional solutions, such as suction caisson, are used because of the advantage of cheaper installation equipment, the challenge lies in determining the tensile capacity. Prof. Housby then introduced the novel concept of screw piles (Photos 1 & 2) which can be installed by twisting motion.

The concept of screw piles could provide the solution as wind farms start to be developed in deeper water, where screw piles are robust and simple. However, the challenge lies with scaling up existing screw piles by many folds and the need to develop the equipment to install them. Prof. Housby metaphorised that screw piles essentially need the world's "biggest screwdriver". He then revealed that screw piles were used as the foundation for the Maplin Sands Lighthouse back in 1838!

The main message in Part 3 is that geotechnical engineers need to seek alternative and innovative solutions to meet the foundation demands of the next generation of the offshore wind industry.

Finally, Prof. Housby concluded the lecture by stressing that geotechnical engineers should embrace themselves with statistics and the importance of both the physical interactions of the foundations and the professional interactions between geotechnical and structural engineers



Photo 3: Ir. Liew Shaw Shong presenting a memento of appreciation to Prof. Guy Housby

as well as the use of plasticity theory to communicate geotechnical knowledge.

He encouraged the audience to engage with the energy debate. With that, Prof. Housby brilliantly linked all three parts of the lecture to the title of the talk, "Interactions In Offshore Foundation Design". The talk ended with a round of applause from the audience. Then the technical division Advisor, Ir. Liew Shaw Shong, presented a memento of appreciation to Prof. Guy Housby (Photo 3). ■

## ERRATA

Errata on Forum Report for the Technical Visit to Pahang River Mouth Improvement Project in Pekan, Pahang published in JURUTERA March 2015 page 39. We wish to inform that the correct name and company information are as follows:

**Ir. Lim Foo Hoat**  
**Angkasa Consulting Services Sdn. Bhd.**

The error is much regretted.

## IEM DIARY OF EVENTS

**Title: Talk on Re-Engineering Our 'Limiting Beliefs', Bringing NLP Into The Matrix Of Our Mind**

**28 May 2015**

Organised by : IEM Women Engineer Section  
 Time : 5.30 p.m. – 7.30 p.m.  
 CPD/PDP : 2

**Title: 26th Annual General Meeting of Geotechnical Engineering Technical Division, IEM**

**30 May 2015**

Organised by : Geotechnical Engineering Technical Division  
 Time : 11.00 a.m. – 1.00 p.m.  
 CPD/PDP : 2

*Kindly note that the scheduled events below are subject to change. Please visit the IEM website at [www.myiem.org.my](http://www.myiem.org.my) for more information on the upcoming events.*