



### **Seminar on Jack-in Piles – Good Practices and its Applications** By Ir. Lee Peir Tien

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The Seminar on Jack-in Piles – Good Practices and its Applications was jointly organised by the Geotechnical Engineering Technical Division and Malaysia Geotechnical Society (MGS) on 7<sup>th</sup> January 2016 at Hilton Petaling Jaya. The seminar was delivered by the 4 speakers with different background such as consultant, contractor and academic. A total of 156 participants attended the seminar.

Jack-in pie is a piling method using prestressed spun pile, precast RC piles or H- steel piles jacked into the ground by a hydraulic jacking system working against a set of dead weight. It is a friendly method which is vibration free, air pollution free and low noise level. Malaysia has many years history of utilising jack-in pile. The method began with the installation of small size, low capacity piles and has progressed to bigger size and higher capacity piles of up to 800 tons. While this method has friendly characteristics and other advantages, the usage in built-up city environment need to be assessed and constantly reviewed to ensure safety of pile design, its effectiveness and its impact on surround structures is minimised.

In this seminar, the speakers shared their valuable experience and good practices relevant to jack-in pile with the participants.

The contents of the seminar can be summarised as follows:

- a) Lecture 1 - Design and Execution of Jacke-in Pile in Malaysia by Ir. Chow Chee Meng

Jack-in pile foundation has been successfully adopted in Malaysia since late 1990s and currently, large diameter spun piles of up to 600mm diameter with working load up to 3000kN have been successfully adopted for high-rise buildings of up to 45-storeys high. The speaker summarised some Malaysian experience in design and construction of high capacity jack-in pile systems in different types of ground conditions such as granite, limestone, alluvium and metasedimentary formation. He also presented the comparisons on the performance of the jack-in pile system based on results of fully instrumented test piles.

- b) Lecture 2 – Jack-in Piles: The Way I See It by Er. Prof. Harry Tan Siew Ann

The installation of jack-in piles involved the quasi-static insertion of a solid cylindrical or square pile into the ground by means of large hydraulic pressures equal to at least twice the design working load of the pile. The process is usually undrained

and the surrounding soil immediately around the pile shaft and base is subjected to very high stresses that would produce excess pore pressures, as the soils sheared and deform around the pile. The speaker presented instrumented field tests data from several Singapore sites that shown the pile capacity usually increased significantly beyond three times working load with small displacements of pile head, even though the piles were installed with jack pressures of about twice working load. He then highlighted that the jack-in pile installation can be modelled as an undrained cavity expansion process to produce excess pore pressures around the pile shaft, and examine the parameters that would influence the reconsolidation process and hence the pile shaft capacity with time. He also highlighted the parameters that would influence the gain in pile end bearing capacity with time.

c) Lecture 3 - Some Jack-in Pile Experiences in Singapore by Er. Gwee Boon Hong

The speaker outlined advantages and disadvantages of Jack-in Pile System as shown in below table:-

<b>Advantages</b>	<b>Disadvantages</b>
Environmental Friendly (Low Noise, Negligible vibration and minimal soil disposal)	Soil displacement (Lateral and vertical displacement)
Less possibility of pile damage	Required of large and flat working platform
Able to achieve good verticality	Poor maneuverability of machine
No risk of machine toppling as compared with conventional leader type machines	Maybe not suitable for site with intermittent hard layers and boulders unless pre-boring is adopted.
As piles are jacked to an appropriate maximum jack-in force, hence unnecessary penetration as a result of over-cautious design could be avoided.	High surcharge loading (May induce additional displacement on adjacent structures)

The speaker then highlighted that toe of jack-in pile is governed by total soil resistance and applied jack-in force during installation. Therefore, jack-in pile is commonly terminate in soil with SPT-N>50. However, jack-in pile could even penetrate through soil with SPT-N>100 substantially when adequate jack-in force is applied. Based on case study of instrumented test pile, the speaker verified that piles installed by jack-in force of 1.5 to 2.25 x WL have adequate ultimate pile capacity and it showed similar load-settlement behaviour up to 2x WL.

d) Lecture 4 - Design of Jack-in d Pile and the Role of Field Tests by Er. Dr. Ooi Poh Hai

Er. Dr. Ooi Poh Hai started his presentation by highlighting the differences in pile foundation designs using BS and EC7. Subsequently, Er. Dr. Ooi shared his experiences on jack-in pile via case history as below:

i) For short piles with capacity predominantly derived from end bearing, it is important to monitor the response of installed piles to the installation actions of adjacent piles/pile group. Piles with significant heave/deflection shall be load tested to

verify its performance. Potential contingency/remedial measures and procedures such as re-tappings shall be evaluated at the beginning of the project.

ii) Additional shaft resistance above “actual” cut off level (COL) shall be considered in selecting the maximum jacked force. For similar case with deep cut off level and short effective pile length below COL, pre-boring or toe-pin (below toe of spun piles) could be considered to improve pile capacity.

Before the end of each lecture, the speakers fielded a number of questions from the audience. A forum was carried out after the 4th lecture. During the forum, the speakers expressed their views on jack-in pile good practices and applications and engaged themselves in very enthusiastic discussions with the audience. As a token of appreciation, souvenirs were presented by Geotechnical Engineering Technical Division and Malaysia Geotechnical Society to the speakers. The seminar ended around 5.30 p.m. with applause from the floor.