THE INSTITUTION OF ENGINEERS, MALAYSIA

Bangunan Ingenieur, Lots 60 & 62, Jalan 52/4, P.O. Box 223, Jalan Sultan, 46720 Petaling Jaya
Tel: 03-7968 4001/4002 Fax: 03-7957 7678 E-mail: sec@iem.org.my
Homepage: http://www.MyIEM.org.my

AGM LECTURE
ON
CENTRIFUGE AND NUMERICAL INVESTIGATION OF PILE PERFORMANCE SUBJECTED TO STRESS RELIEF DUE TO DEEP EXCAVATION

(Organized by Geotechnical Engineering Technical Division)

Date : 09 June 2012 (Saturday)
Time : 9.00 am -10.30am *(Refreshment will be served at 8.30 pm.)*
Venue : Auditorium Tan Sri Prof. Chin Fung Kee, Wisma IEM
Speaker : Prof. Charles Ng

BEM APPROVED
CPD/PDP HOURS: 2
REF: IEM12/HQ/139 /T

SYNOPSIS

Pile foundations are commonly used to support tall buildings with a deep basement in major cities such as London, Hong Kong, Shanghai and Kuala Lumpur. The design of pile foundations is often based on load tests carried out at the ground surface, prior to basement excavation. A sleeve may be used in a load test to eliminate shaft resistance for the entire depth of the planned excavation. In such a conventional load test, however, the effects of stress relief due to basement excavation on pile performance cannot be captured. Systematic research investigating and comparing the capacity and stiffness of piles with and without considering stress relief effects due to excavation simply cannot be found in the literature, and there are no design codes such as EC7 that deal specifically with this type of situation.

In this lecture, centrifuge model tests carried out to investigate the capacity and stiffness of single piles and pile groups with and without considering stress relief effects will be presented and discussed. Two different soil-pile interfaces, namely non-dilatant and dilatant interfaces, representing loose sands/normally consolidated clays and dense sands/over consolidated clays respectively, were studied. Figure 1 shows a typical model package of a 3×3 pile group in sand. During a test, the pile group was subjected to stress relief by an in-flight excavation 20 m deep (prototype). Three piles 1.6 m in diameter and 30 m in length were instrumented to capture their axial loads at eight levels along each shaft. As shown in Figure 2, these instrumented piles were located at the centre, edge and corner within each group. For comparison purposes, in-flight load tests on instrumented single piles with and without considering stress relief effects were also carried out. Furthermore, parametric simulations using the distinct element method (DEM) were carried out to understand and quantify the fundamental mechanisms governing soil-pile interface behaviour and hence the performance of single piles and pile groups. Computed results from the DEM simulations were compared with centrifuge model tests.

It was found that the capacity of a pile in non-dilatant soils was reduced by about 20% when the pile was subjected to an excavation 20 m deep, due to a decrease in shaft resistance, proportional to the effective confining pressure on the pile shaft. For a pile in dilatant soils, on the other hand, strong dilation at the soil-pile interface induced an increase in normal stress acting on the pile shaft. This normal stress increment was 30% even after the pile was subjected to 20 m of stress relief. Semi-empirical equations were proposed to estimate the shaft resistance of piles subjected to stress relief in both non-dilatant and dilatant soils. Design implications to single piles and pile groups will be discussed and presented.

BIODATA

Prof Charles WW Ng, Associate Dean of Engineering at the Hong Kong University of Science and Technology (HKUST) is the first Hong Kong academic to be appointed one of the 12 Board Members of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).

A top academic in geotechnical engineering, Prof Ng obtained his PhD from the University of Bristol in 1992. He was elected an Overseas Fellow at Churchill College, Cambridge, in 2005. He is also a Fellow of the Institution of Civil Engineers, the American Society of Civil Engineers, the Hong Kong Institution of Engineers and the Hong Kong Academy of Engineering Sciences. Recently he was elected Changjiang Scholar (Chair Professor) by the Ministry of Education in China.

Over the years, Prof Ng has delivered numerous keynote speeches and general reports at various major international conferences and symposia. He has also received many international awards in recognition of his significant contributions in the field, including the Henry Adams Award from the Institution of Structural Engineers (UK), the first Tan Swan Beng Award from the Southeast Asian Geotechnical Society, the Mao Yisheng Youth Award from the Chinese Institute of Soil Mechanics and Geotechnical Engineering and the R M Quigley Award from the Canadian Geotechnical Society. Currently Prof Ng is an Associate Editor of the *Canadian Geotechnical Journal*. He has also served on editorial boards of major geotechnical journals worldwide.

Ir. Liew Shaw Shong
Chairman
Geotechnical Engineering Technical Division

Announcement to note:

1. Talk is **STRICTLY** for IEM members only (walk in)
2. Limited seats available on a "first come first served" basis.
3. No telephone and/or fax reservation will be entertained.
4. Latecomers will not be allowed entrance, if the lecture hall is full.
5. Please bring along this flyer and membership card for confirmation of attendance (CPD purpose).

For IEM members, membership cards MUST be presented for identification purpose. Members who fail to show their membership card will be charged a fee of RM20.00.

FUNDS FOR IEM NEW BUILDING

Kindly be informed that IEM will be charging participants RM10.00 administrative fee to talks organised by IEM. The fee would be used for overhead costs, building maintenance expenses as well as to support the purchase of the new building. Students are however exempted. Your understanding is greatly appreciated.

CPD HOURS CONFIRMATION

Name of Member: ..... Signature : .....

M'ship No: ..... Date : .....