COMPARISON OF INSTRUMENTED PILE LOAD TEST RESULTS WITH FINITE ELEMENT SIMULATION

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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CASE STUDY: COMPARISON OF INSTRUMENTED PILE LOAD TEST RESULTS WITH FINITE ELEMENT SIMULATION

ABSTRACT

Bored and cast in situ bored piles are used to support the heavy super structure loads, while transferring them the hard rock layers. Because of that, in order to design single piles or group piles, it is very important to know the carrying capacity characteristics of the pile. To determine the settlement characteristics of the pile head with the load, static pile load tests are playing a significant role. It is really important to know about the skin friction distribution along the pile shaft and the deviation of the applied load in to the friction through the shaft. Such information can be obtained by using the instrumented pile load tests, where strain gauges are installed along the pile length. However the instrumented pile load test is expensive and not always carried out in all pile construction sites, in Sri Lanka. Further, since it is affected by many factors and the processes, the outcome from the instrumented pile load tests is not easy to interpret.

To find out the carrying capacity of the piles, empirical formulae and factors available can be used. However, use of software packages based on finite element analysis to find out the carrying capacity of the pile may provide an excellent opportunity to obtain results easily and quickly, if the accuracy of the results can be established. Because of that, this study was aimed to find out the carrying capacity of cast in situ bored single piles using commonly used finite element software PLAXIS 2D and compare the results with the instrumented pile load test results obtained in the field. Further, the differences and the difficulties of the interpretation of results with their potential reasons were discussed within the study.

Results for two borehole tests and instrumented pile load tests were obtained and compared the real world data with the numerical simulation of such test with same conditions. Input parameters for the Finite element software used were Young's modulus of the soil and rock, poission's ratio and the shear strength parameters of the soil. Young's modulus for the soil layers were calculated from the energy correction method and for rock layers it was calculated using the Hong Kong geo guide lines (Geo,2006) and rock mass rating values. Shear strength parameters for the soil layers were calculated using the borehole data and the method proposed by Bowels. For rock layers it was used the Hoek-Brown formulae, proposed by Hoek and Brown. The best match results with the field data for weathered rocks were given when used twice the Young's modulus for rock layers. For the bored piles socketed in to fresh rock, the best match results with instrumented pile load test results were given when used half the value of the Young's modulus of rock which was found using the Hong Kong geo guide lines (Geo,2006).

Key words;

Bored and Cast in Situ Piles, Instrumented Pile Load Test, PLAXIS 2D, Young's Modulus, Poisson's Ratio, Socketed, Bed Rock, Finite Element Simulation

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LIST OF ABBRIVIATIONS

Abbreviation	Description
2D	Two Dimensional
3D	Three Dimensional
AASHTO	The American Association of State Highway Transportation Officials
CPT	Cone Penetration Test
ESL	Elastic Shortening Line
FEM	Finite Element Model
FoS	Factor of Safety
GIS	Geographical Information System
HC	Highland Complex
ICTAD	Institute for Construction Training and Development
MC	Mohr- Coulomb
PDA	Pile Driving Analyzer
RMR	Rock Mass Rating
RQD	Rock Quality Designation
RSR	Rock Structure Rating
SPT	Standard Penetration Test