COMPARISON OF INSTRUMENTED PILE LOAD TEST RESULTS WITH FINITE ELEMENT SIMULATION

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Engineering in Foundation Engineering and Earth Retaining Systems

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September 2020
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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ACKNOWLEDGEMENT

At the outset, I would like to express my sincere and heartfelt gratitude to my research supervisors, Professor Saman Thilakasiri and Dr. L.I.N. De Silva for the continuous support to my study with guidance, motivation and immense knowledge. Without their dedicated supervision and continual guidance, this thesis would not be successfully completed within the time frame. Their dynamism, vision, sincerity and motivation have deeply inspired me. They have taught me the methodology to carry out the research and to present the research works as clearly as possible. It was a great privilege and honor to work and study under their guidance. I am extremely grateful for what they have offered me. During this period, they basically allowed this research to be my own work while steering me towards the right direction whenever they thought that I needed.

My sincere thank also goes to Dr. Evert Hoek, who has given access to me to more than 50 of his most significant publications, together with a 16 chapter eBook entitled practical rock engineering and 6 professionally made videos on rock engineering, after requesting through a small message via research gate.

It is my duty to pay gratitude to Dr. Janaka Liyanagama, the Dean of the Faculty of Engineering and Technology, CINEC Campus Malabe for providing me the unconditional support by releasing me whenever I asked and motivating me all the time to complete this task.

In addition, I would like to declare my sincere thankfulness to all teachers served in or visited to Geotechnical Engineering Unit, department of Civil Engineering including Professor U. G. A. Puswewala, Professor S.A.S. Kulathilake, Professor H. Saman Thilakasiri, Dr. Udeni P. Nawagamuwa, Dr. L.I.N. De Silva, Dr. Nadeej Priyankara, Dr. J. S. M. Fowze etc, for not only their contribution to improve my knowledge, but also for their guidance on my carrier development.

Moreover, I would like to pay my gratitude to University of Moratuwa for providing me an opportunity to follow this Master degree and to the management of CINEC including Prof. N. Rajkumar and Prof. Nalaka Jayakody for relieving me to attend lectures on Fridays. Further, I extend my sincere gratitude to all my friends who given me assistance and encouragement for completion of this thesis.
I am extremely grateful to my loving mother and father for their dedications, encouragement and blessing for not only this work but also for my whole life to make me who I am today. Further, my gratitude goes to my loving son Setheesha for bearing all the stress I had while work on this thesis and to my loving husband Maduranga for giving me his fullest support and all the encouragement and motivation to complete this study.

Finally, my thanks go to all those who have supported me to complete the research work directly or indirectly.
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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<tr>
<td>2D</td>
<td>Two Dimensional</td>
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<td>3D</td>
<td>Three Dimensional</td>
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<td>AASHTO</td>
<td>The American Association of State Highway Transportation Officials</td>
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<td>CPT</td>
<td>Cone Penetration Test</td>
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<td>ESL</td>
<td>Elastic Shortening Line</td>
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<td>FEM</td>
<td>Finite Element Model</td>
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<td>Factor of Safety</td>
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