بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

Sûrat Al-Isrâ'
(The Journey by Night) XVII

سُورَةُ الإِسْرَاءِ

In the Name of Allâh
the Most Gracious, the Most Merciful.

بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

وَيَسْـَٔلُونَكَ عَنِ ٱلرُّوحِ ۖ قُلِ ٱلرُّوحُ مِنْ أَمْرِ رَبِّى وَمَآ أُوتِيتُم مِّنَ ٱلْعِلْمِ إِلَّا قَلِيلًا ﴿٨٥﴾

85. And they ask you (O Muhammad صلى الله عليه وسلم) concerning the *Rûh* (the Spirit); Say: "The *Rûh* (the Spirit) is one of the things, the knowledge of which is only with my Lord. And of knowledge, you (mankind) have been given only a little."

مَا شَاءَ اللَّهُ لَا قُوَّةَ إِلَّا بِاللَّهِ

Ain Shams University
Faculty of Engineering
Department of Structural Engineering

Evaluation of Ultimate Capacity and Serviceability Performance of Single Piles under Axial Compressive Loading

A Thesis Submitted in Partial Fulfillment of the Requirements of
the Degree of Master of Science in Structural Engineering

by
Mohamed Sobhy El Sayed El Kharashy

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Cairo - 2018

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STATEMENT

This thesis is submitted as partial fulfillment of M.Sc. degree in Structural Engineering, Faculty of Engineering, Ain Shams University.

The work included in this thesis was carried out by the author during the Period from 1st Oct 2013 to …….. 2018, and no part of it has been submitted for a degree or qualification at any other scientific entity.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Cairo – 2018

Evaluation of Ultimate Capacity and Serviceability Performance of Single Piles under Axial Compressive Loading

Mohamed Sobhy El Sayed El Kharashy

Abstract

It is common practice for geotechnical engineers to evaluate pile load capacities using pile load tests. In many practical applications, the measured load-settlement curve represents only parts of pile total resistance by applying insufficient loading levels. That's from reasons why most of the conducted pile load test results cannot be used in a reliable way to estimate the pile capacity. However, these results can be helpful to verify the pile-soil stiffness parameter as a single pile through back analysis techniques in terms of further variable and effective parameters.

In the presented research, evaluation and analyses of bearing capacity for about 23 pile load tests in soils, in different countries, were carried out. Different techniques to estimate pile capacity from load-settlement measurements were conducted. Accordingly, the accuracy of the extrapolation technique using mainly the general hyperbolic method was studied. Then, the results have been compared with Egyptian Code and further International Codes. New computer application is programmed to practice the intensive calculations. Using about 94 additional pile load tests, new empirical equations are formulated to estimate the pile serviceability performance. Where, Randolph's approaches are selected to back analyze piles' load-settlement performance under working loads to estimate single pile stiffness, considering their rigidity. The results of the conducted analyses are presented and discussed in the present thesis.

Keywords :
normal soil, pile design, pile capacity extrapolation, compression pile load test, pile serviceability performance

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Glossary And Acronyms

Letters: Indication

LS: Load Settlement Curve

PLT: Pile Load Test

LL: Load Level

P = Q: Axial Load Applied on Pile Top

S: Settlement of Pile Top

$\sigma_{y:}$ vertical stress due to axial load (P) applied to pile head

$w_{s:}$ Settlement of pile shaft

P_{PLT}: Load Level in Pile Load Test

$P_{(plt,\ max)}$: Maximum Load Level in Pile Load Test

W_{PLT}: Settlement at Pile Head in Pile Load Test

A_s: Area of pile shaft (m^2)

A_b: Area of pile base (m^2)

D: diameter of drilled shaft (mm)

SPT: Standard Penetration Test

N: no. of blows from SPT

N_{av}: number of blows from SPT (as an average along pile depth in soil)

COHLS%: Cohesionless percentage considering all thicknesses of soil layers along pile depth

COHS%: Cohesive percentage considering all thicknesses of soil layers along pile depth

CPT: Mean Cone Resistance

$c_u = S_u$: Undrained Cohesion or Undranied Shear Strength (MPa)

f_{cu}: Concrete Compressive Strength

P_a: atmospheric pressure (= 0.101 MPa = 101 KPa)

P_{slip}: Start of Slip Load

$Q_{tu} = Q_u$: Total Ultimate Resistance

Q_{fu}: Ultimate Friction Capacity