PREDICTING THE END BEARING CAPACITY OF ROCK-SOCKETED BORED AND CAST IN-SITU PILES IN SRI LANKAN METAMORPHIC ROCK USING ROCK MASS PROPERTIES

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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 the 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. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the Masters thesis under my supervision. I confirm that the declaration made above by the student is true and correct.

Name of Supervisor: Prof. U G A Puswewala

Signature of the Supervisor *UOM Verified Signature* Date: 07/05/2024

DEDICATION

I dedicate this research project report to,

My research project supervisor, Prof. U G A Puswewala

Senior Lecturer and former Head of the Department of Civil Engineering, Open University of Sri Lanka, Eng. M.N.C. Samarawickrama

Former Head of the Department of Civil Engineering, Prof. S A S Kulathilaka,

MSc. research project coordinator, Prof. L.I.N. de Silva and other staff members of the Civil Engineering Department, University of Moratuwa.

To all the students, authorities and researchers who are interested in the field of geotechnical engineering and who are benefited from this research finding

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ABSTRACT

Rock socketed end bearing cast in situ bored (CIB) piles are currently among the most widely used types of deep foundations in Sri Lanka to transfer the superstructure load into the competent bedrock. However, deliberations are going on whether the pile designers maximize the advantage on locally available higher-strength-less deformable metamorphic rock characteristics during the design of CIB piles. In this study, appropriateness of commonly used end bearing capacity estimation methods in the design of rock socketed CIB piles are briefly reviewed and then the results obtained through these methods are compared against the actual end bearing capacity levels obtained from pile static load test data. Locally available static pile load test data do not facilitate direct estimation of actual ultimate end bearing capacity values due to non-continuation of pile load tests beyond the required pile capacity limits caused by practical and economic reasons. Therefore, load-settlement curve extrapolation methods proposed by Chin- Kondner (1978), Brinch Hansen (1963) and Decourt (1999), were used in this study to determine the ultimate carrying capacities of piles. It is found that the ultimate carrying capacity values obtained from Chin- Kondner (1978) and Decourt (1999) methods are in a similar range while values obtained from Brinch Hansen (1963) are far below from other two methods Moreover, the Hong Kong Guidelines (HKG) method which has been developed based on Rock Mass Rating (RMR), seems reasonable to estimate of the allowable end bearing capacity of the bedrock corresponding to a settlement of less than 0.5% of the pile diameter. However, HKG method can be used only in instances where RMR value of rock strata is exceeds 40. In order to facilitate locally available high-strength rock terrain conditions, a more appropriate new empirical relationship between RMR and allowable end bearing capacity of rock socketed pile was introduced and the accuracy of the relationship was verified using limited available instrumented pile load test data. It was further noted that this relationship performs well in rock masses with RMR greater than 20.

Keywords: Cast in situ bored piles, load-settlement curve extrapolation, End bearing capacity, RMR

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LIST OF ABBREVIATIONS

Abbreviation	Description
CIB	Cast In situ Bored
HKG	Hong Kong Guidelines
RMR	Rock Mass Rating
ICTAD	Institute for Construction Training and Development
UCS	Uniaxial Compressive Strength
RQD	Rock Quality Designation
CR	Core Recovery
PDA	Pile Driving Analyzer
CRP	Constant Rate of Penetration
ML	Maintained Load
DVL	Design Verification Load
SWL	Specified Working Load `
RMSE	Root mean Square Error

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