NUMERICAL MODELLING OF ROCK SOCKETED PILES

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MEng in Geotechnical Engineering

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DECLARATION

This thesis is a report of research carried out in the Department of Civil Engineering, of University of Moratuwa, between January 2000 and December 2001. Except where references are made to other work, the contents of this thesis are original and have been carried out by the undersigned. The work has not been submitted in part or whole to any other University or an institution for a higher degree.

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ABSTRACT

The two basic types of pile foundations are skin friction piles and end- bearing piles. Friction piles resist the applied vertical load by utilising the shear stresses developed along the pile-soil interface, with the end-bearing at the tip of pile contributing a small proportion of the total pile resistance. End-bearing piles resist the applied vertical loads mainly by end-bearing generated at the tip of pile.

There are many instances where end-bearing piles / piers are constructed with their tip located inside a cavity made in rock strata: such piles are referred to as rock-socketed piles. The resistance developed by rock-socketed piles and piers is partially due to the shearing stresses generated at the pile rock interface on the wall of the rock cavity and partially due to the end bearing at the tip of the pile. The load that can be carried by the rock socket is usually underestimated in the design practice due the lack of guidance in relevant codes.

This thesis presents the findings of the research focused on computational modeling of rock socketed piles conducted to investigate the behavior of such piles.

Axisymmetric finite element analyses were conducted to determine the percentages of load resisted by interface shear along the socket wall and end-bearing at pile tip, for various socket length/pile diameter ratios. Different interface conditions were modelled by varying cohesion and friction parameters input to the interface element, as well as by assuming perfect connection between pile and rock material.

The finite element results obtained are compared with some available field test data to verify the models. Finally a field test procedure is suggested for deriving load carrying capacity of the socket.

Findings and further expansion of this research program would be of immense benefit to state and private organisations involved in deep foundation design and construction. It will highlight whether the use of rock-socketed piles can be economically advantageous over the simple end bearing piles with no sockets, and indicate optimum geometries of rock sockets.

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