PULLOUT CAPACITY OF VERTICAL GROUND ANCHOR IN HOMOGENEOUS SAND

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2011

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THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE OF MASTER OF SCIENCE

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2011

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I hereby declare that the work in this dissertation is my own except for quotations and summaries which I have duly acknowledged.

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DEGREE	:	**MASTER OF SCIENCE (CIVIL ENGINEERING)**
VIVA DATE	:	**14 APRIL 2011**

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Prof. Dr. NSVK. Rao

ACKNOWLEDGEMENT

I would like to express my deepest gratitude to my supervisor Prof. Dr. Ideris Zakaria for his invaluable guidance, help, support and encouragement and above all patience throughout my research. Also my thanks go to Prof. Dr. NSVK Rao as a co-supervisor has also contributed towards the completion of this thesis. I would also like to thank the SKTM for providing the research facilities and to all the technical staff in Laboratory of Geotechnical and Mechanical for supporting in laboratory. Nevertheless, I would love to express my grateful to my family and all my friends for their support and encouragement during the period of study.

Mohd Rafe Bin Abdul Majid
14 April 2011

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LIST OF SYMBOLS

B	Size or Diameter of Anchor, mm
D	Depth of Embedment of Shallow Anchor, mm
H	Depth of Embedment of Deep Anchor, mm
D/B	Depth to Diameter ratio
k	Coefficient of Lateral Earth Pressure
γ	Unit Weight of Sand, mm
η	Porosity of Sand
ϕ	Angle of Internal Friction
α	Apex Angle from the Vertical through the Anchor Edge
P	Pullout Load on Vertical Anchor, kN
P_u	Pullout Capacity of Anchor, kN/m^2
D_r	Relative Density of Sand
e_{max}	Maximum Void Ratio of Sand
e_{min}	Minimum Void Ratio of Sand
δ	Displacement of Vertical Anchor, mm
$\bar{c}$	$D_r \cos \phi$
k_o	$1 - \sin\phi$
M	$1.2[D_r (1 + \cos^2\phi) + (1 + \sin^2\phi)]$
A_s	PL
P	perimeter of pile cross section
L	length of pile embedment
$\bar{A}$	$\frac{\pi}{8}.\gamma.B^2.a$
$\bar{B}$	$\pi.B\,k_1.(\frac{B}{2a})^{k2}.\frac{a^2}{(k_2+1)^2}.\gamma.\sin\varphi$

$\bar{C}$ $\quad \frac{1}{8}\pi.k_1.(\frac{B}{2a})^{k_2}.\frac{B^3}{(k_2+3)^2}.\gamma.\sin\varphi$

$\bar{D}$ $\quad \frac{1}{8}\pi.k_1.(\frac{B}{2a})^{k_2}.\frac{B^3}{a^2}.\gamma.\sin\varphi.(\frac{a^2}{(k_2+1)^2}+\frac{a}{(k_2+3)}.H)$

$\quad -\pi.B.k_1.(\frac{B}{2a})^{k_2}.\gamma.\sin\varphi.(\frac{a^2}{(k_2+1)^2}+\frac{a}{(k_2+1)}.H)$

k_1 $\quad \frac{1}{2}B.k_1(\frac{B}{2a})^{k_2}.\gamma.\sin\varphi$

k_2 $\quad \frac{1}{16}.\frac{B^3}{a^2}.k_1(\frac{B}{2a})^{k_2}.\gamma.\sin\varphi$

a Constant parameter

ABSTRACT

PULLOUT CAPACITY OF VERTICAL GROUND ANCHOR IN HOMOGENEOUS SAND

Vertical ground anchors are commonly used in foundation systems for structures requiring pullout resistance such as transmission towers, structures requiring lateral resistance, such as sheet pile walls. The work described in this research was primarily concerned with the pullout capacity of a vertical ground anchor embedded in dry homogeneous sand. One-laboratory model of anchor test apparatus is fabricated, with dry sand as a medium in sand box to form the homogeneous sand bed. Three models of circular anchors namely 25, 50 and 75 mm diameter and three states of homogeneous sand bed with different unit weights i.e., 15.89, 16.29 and 17.13 kN/m^3, where the relative densities are 29%, 37% and 53% respectively were used in this research. The range of depth/ diameter (D/B) ratios are from 1 to 24 in order to cover shallow and deep anchors with the anchors being subjected to vertical loads under displacement control. A delineation technique is used to define the general failure surface of anchor in the soil mass during pullout. From the test, results show that the behavior and general failure surface of vertical ground anchor in dry homogeneous sand are similar to those reported by previous studies. The predicted formulae of pullout capacity for shallow and deep anchors in dry homogeneous sand are developed using semi-empirical method i.e., prediction of failure surface from pullout test and analytical method. From the comparison, results show that the predicted formula in similar trend with previous studies and experimental test. Overall, the study provides insights about pullout capacity of vertical ground anchor in homogeneous sand. At end of the research finding, suggestions are given for the further works in future.

Keywords: Vertical Pullout capacity, Vertical Ground Anchor, Homogeneous sand, Failure surface