INFLUENCE OF MATRIC SUCTION ON PULLOUT RESISTANCE OF SOIL NAILS

Paranthaman Rajeevkaran

178048G

Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

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DECLARATION

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ABSTRACT

Soil nailing is a widely used slope stabilisation technique using the passive intrusions-soil nails. Soil nail is a reinforcement bar encased within a grouted borehole without any pre-tensioning. When the soil mass attempts to move down, a tensile forces mobilized in the intercepted nails will enhance the shear resistance by increasing the normal stress along the potential failure surface while reducing the shear stress to be mobilized for equilibrium. This enhances the factor of safety.

The tensile force developed on reinforced bar depends on tensile capacity of the bar and pull-out resistance at the soil-grout interface. The contribution of matric suction in pull-out capacity of soil nails is often neglected in conventional design formulae to make it conservative. But most of the soil nails are installed in unsaturated region of soil and significant matric suctions would prevail.

This paper investigates the influence of matric suction on pull-out resistance of soil nails. To ensure uniform conditions the nails were installed in a soil mass compacted under controlled laboratory condition in a test box with dimensions of 1.30 m × 1.08 m × 0.90 m. In this study, four soil nails were installed at an inclination of 5^0 to the horizontal. The pull-out capacity of soil nails measured under different matric suctions and overburden pressures were compared with the values estimated using the design formulae. The matric suctions varied by controlled wetting were monitored by tensiometers. A good agreement is found between the estimated and measured pull-out capacities and the influence of matric suction on the pull-out resistance was found to be very significant. The numerical analysis performed with Plaxis 2D justified the results obtained.

Keywords: Pull-out resistance, tensiometer, soil nail, matric suction, unsaturated soil, Plaxis 2D

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Abbreviations	Description
FSR	Force Sensitive Resistor
FHWA	Federal Highway Administration
CDG	Completely Decomposed Granite
GFRP	Glass Fibre Reinforced Polymer
FEM	Finite Element Model
VP	Vertical Pressure
SWCC	Soil Water Characteristic Curve
MEMs	Micro Electro Mechanical Systems
ASTM	American Society for Testing and Materials
DL	Design Load
GWT	Ground Water Table
USCS	Unified Soil Classification System