



The effect of anchors pre-stressing forces on reinforced excavated wall

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Abstract

The effect of pre-stressing the anchors in composite soil nailing with pre-stressed anchors, has been investigated on dry sand using particle image velocimetry (PIV) method. A small-scale model of reinforced excavated wall with composite soil nailing using pre-stressed anchors was prepared. After each step of excavating and loading the footing, digital photographs were taken. Using image processing on sequences of digital images, soil deformation and effect of pre-stressing were observed. Diagram of footing settlement against pressure and horizontal displacement of facing versus its height for different pre-stressing of anchors, have been plotted. The results show that increasing the pre-stressing, decrease the horizontal displacement of facing and increase bearing capacity of footing. Also it can be seen that maximum horizontal displacement of facing occurs in lower part of facing; however it occurs in top of reinforced wall with nailing.

Keywords: composite soil nailing with pre-stressed anchor, bearing capacity, strip footing, physical model test, PIV

1. INTRODUCTION

Soil nailing is one of the most important methods for reinforcement of excavated wall whose application has been increased in recent decades. Theory of soil nailing has been advanced in Austrian Tunneling Method for first time and then Germany, France and U.S started studying the behavior of this system [1]. These reinforcing elements produce shear stress around nails surface and tensile force in them and increase the shear strength of soil [2].

Different shapes for slip surface of trenches have been suggested. For example, Germany method considered the equilibrium of forces by two-part wedge for a slip surface. Also translational slip, single wedge, log-spiral, circular slip, parabolic, etc. have been suggested; however safety factor of them doesn't vary too much [3].

Application of composite soil nailing has been increased in recent years that include composite soil nailing with mini piles, composite soil nailing with pre-stressed anchors, etc. Composite soil nailing with pre-stressed anchors because of its reasonable cost, without a need for heavy and complicated machineries is suitable for applying in different conditions.

Hao et al [4] have studied the parameter sensitivity in composite soil nailing with pre-stressed anchors and have shown that sensitivity of affecting factors on maximum displacement of excavation side, in decreasing order is the pre-stressing of anchor cable, soil friction angle, soil cohesive strength, soil nail spacing, soil nail length and soil nail diameter.

Wang et al [5] also have proved that maximum horizontal displacement of foundation pit has been occurred in lower heights.

Ahmadi and Hajjalilue Bonab [6] have shown that reinforcing the soil increases bearing capacity of footing by increasing the number of geotextiles and reduces the displacement of wall. These studies proved the efficiency of reinforcement in system.

In the present study, experimental procedure was taken to behavior of supported excavated wall with composite soil nailing using pre-stressed anchors under strip footing loading is explored. Failure mechanism is determined by the PIV method helped to compare the changes in bearing capacity and horizontal displacement of facing in each test.