University of Tabriz

Journal of Civil and Environmental Engineering
Volume 52 (2022), Issue 3 (Autumn), 215-223

EXTENDED ABSTRACT

Numerical Evaluation of Sample Size Effect on the Behavior of Undrained Geotextile-Reinforced Cohesive Soil

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Received: 17 November 2019; **Accepted:** 16 March 2021

Keywords:
Size effect, Reinforced clay, Geotextile, Triaxial test, PLAXIS 2D.

1. Introduction

Present study was carried out to investigate the effects of sample size on the mechanical behavior of geotextile-reinforced clay in the short time using the PLAXIS 2D software. These simulations were modeled for different confining pressures, different diameters and one to four geotextile layers. Two constitutive models including the Mohr-Coloumb model and hardening soil model were used to simulate the behavior of the soil.

2. Methodology

In this study, Plaxis2D software was implemented to model triaxial samples. In order to simulate the static triaxial experiment, due to axial axisymmetric condition the one fourth of sample was model and then the modeling was performed by strain control method in two stages. In the first stage, confining pressure was applied to the upper and right boundary, and in the second stage, with a constant confining pressure, a predetermined displacement, which according to the standard (ASTM D2850) was 15% of the sample height, was applied to the upper boundary of the sample. The bottom and left side of the sample were fixed to model the actual conditions of the sample to establish static equilibrium and axisymmetric condition. The loading and static conditions of the sample are shown in (Fig. 1)

To generate pore water pressure in the modeling of unconsolidated undrained triaxial tests, undrained behavior can be simulated to produce pore water pressure (Noorzad and Mirmoradi, 2010).

3. Results and discussion

3.1. Effect of size on the failure envelope

The effect of sample size for reinforced clay with the Mohr-Columb model is shown Fig. 2. as shown in figure, the effect of sample size increased with increasing number of geotextile layers. In other words, in the same confining pressure, the maximum shear strength value for sample smaller diameter was increased by increasing the number of geotextile layers. For example, the difference between the maximum shear strength of reinforced clay with four layers of type II geotextile and under the confining pressure for two diameters of 38 and 400mm is equal to 128kPa, on the other hand the difference between the maximum strength for samples with one layer of type II geotextile, under the same conditions, is equal to 65kPa.

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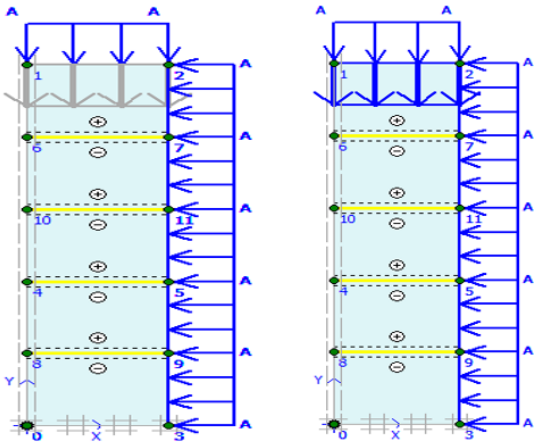

(a) (b)

Fig. 1. Numerical simulation of reinforced clay sample in triaxial test: a) Application of confining pressure, b) Application of shear loading.

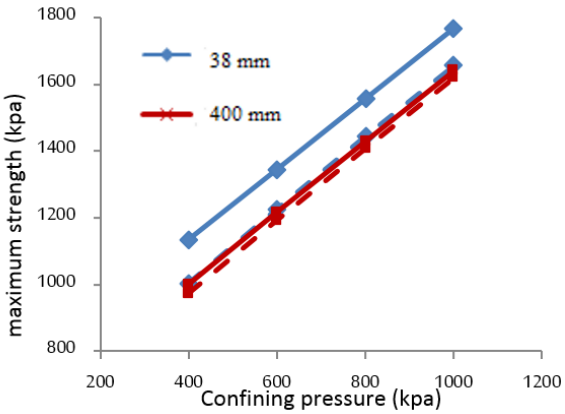

Fig. 2. The size effect on failure envelope of reinforced clay with one to four geotextile layers of type one, the Mohr-Coulomb model. Fill line: for four geotextile layers and dotted line: for one geotextile layer.

3.2. Effect of size on the behavior of reinforced clay samples

Fig. 3 shows the strength of reinforced clay samples with one, two, three and four layers of geotextile with different sample sizes under a pressure of 600kPa. According to Fig. 3, the sample with 38mm diameter showed the highest shear resistance.

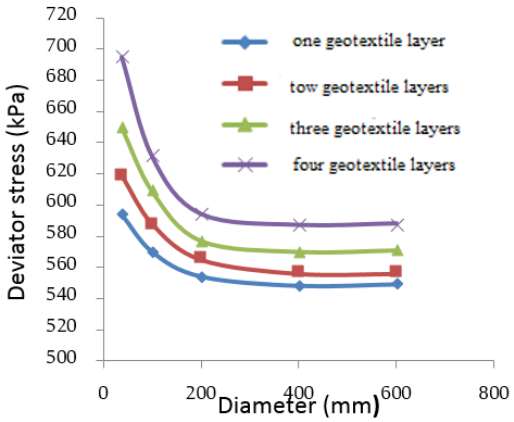

Fig. 3. The size effect of sample on the deviator stress on the number of geotextile layers of type tow under confining pressure of 600kPa, obtained from numerical analysis with hardening model.

The effect of sample size on the soil behavior in samples larger than 400mm in diameter disappears completely therefore diameter of 400mm is introduced as the diameter in which the size effect disappears.

4. Conclusions

The effect of sample size on the maximum strength of reinforced clay is greater for the Mohr coulomb model compared to the hardening model. The effects of sample size on the failure envelope on reinforced clay increased with increasing number of geotextile layers and also decreased with increasing of diameter and it can be ignored for samples with a diameter of 400mm and more. Therefore, a diameter of 400mm is introduced as the diameter in which the size effects disappear in the short term condition, in order to obtain the resistance parameters of the reinforced soil in reality.

5. References

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