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Abstract

NUMERICAL SIMULATION OF FOUNDATIONS ON SOIL
WITH SINGLE REINFORCEMENT

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Previous experimental studies in the literature have been successfully proven that it is very cost-effective to place horizontal geosynthetics reinforcement layers beneath the shallow spread foundation to improve the bearing capacity of the ground. The current study is to investigate, with numerically modeling, the response of the mechanisms of foundation sitting on uniform layer of soil, reinforced with a layer of horizontal reinforcement under monotonic loading.

The substantial improvement of the soil structure after inclusion of reinforcement is demonstrated through the numerical simulation results by employing Duncan hyperbolic and Three Surface Kinematics Hardening model. The selection of the appropriate model between the two numerical models to simulate geosynthetic reinforced foundation was by comparing the laboratory element tests and strip footing model tests in the literature. The results showed that Duncan Hyperbolic model seems to predict the response of the reinforced foundation better than the Three Surface Kinematics Hardening model under the current configurations of study.

In this study, finite element models under plane strain condition were established to investigate several parameters, influencing the behavior of reinforced foundations. Parametric studies including: i) Depth of the first reinforcement layer below the foundation, u ; ii) Width of the geotextile reinforcement, b_{GT} ; iii) Stiffness of the geotextile, J_{GT} ; iv) Soil-reinforcement interface friction angle, $\phi_{interface}$; v) Soil friction angle, ϕ_f ; vi) Width of foundation, B .

From the numerical simulation results, the inclusion of reinforcement between the soil layers would not significantly vary the normal stress distributions. However, the reinforcement would alter the shear stress distributions compared to unreinforced case. Thus, it is believed that shear stress mechanism is the major causes of the improvement of the reinforced foundations under the current study. Also, from the maximum shear strain field generated from the finite element analyses, a clearer picture of the formation of the reinforced foundation failure mechanism was observed.

All the above mentioned parameters (depth, length/width and stiffness of the reinforcement, etc.) were found to have different degree of influence on the response of the reinforced soil foundation (RSF) with single layer of reinforcement.