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Three-Dimensional Experimental Evaluation of Footings' Behavior Located on Geocell-Reinforced Slopes

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Abstract

Generally, soil-strengthening methods aim at increasing the bearing capacity, reducing the settlement and lateral deformation and improving the soil stability. Among different methods of soil improvement, the use of polymeric and geosynthetic materials has been increased in recent decades. One of the types of geosynthetics is geocell. Geocells exhibits good performance in terms of increasing the bearing capacity compared to planar reinforcements due to its three-dimensional cell structure and procurement of the necessary enclosure for the infill soil. In this research, in order to study the bearing capacity of geocell-reinforced slopes, a physical model of a small-scale square footing lying on reinforced soil was used. Geocells with various depths of placement, numbers of reinforcements and vertical gaps to each other were investigated. Loading on the footing was applied and the stress-settlement curve was plotted. Results of loading on the unreinforced slope show that with an increase in the distance of loading to the edge of the slope, enhancement in bearing capacity and decrease in the failure of the edge and surface of the slope footing will be observed. In the one-layer reinforcement of the slope, the bearing capacity of the footing was enhanced by decrement of the geocell depth to 0.25 of footing's width. Furthermore, in the one-layer reinforcement, failure in the surface at the edge of the slope had occurred even at the optimum depth of the geocell embedment. In the two-layer reinforcement scenario, the maximum load carrying of the foundation was recorded by placing the second geocell layer under the first layer of reinforcement in a vertical gap equal to the optimum placing depth of the single-layer reinforcement.

Key words: geocell, slope, square footing, bearing capacity

1. Introduction

The extensive use of geosynthetics over the last decades, in particular as reinforcing elements is primarily due to their durability and reasonable price compared to other soil improvement methods. Geosynthetics are used to reinforce road and embankment