The influence of Geocell Geometry on Reinforced Soil Bearing Capacity

N. Valinezhad[1], M. Ghazavi[2]
1- PhD candidate, K. N. Toosi University of Technology
2- Professor, K. N. Toosi University of Technology, Department of Civil Engineering

nsvalinezhad@gmail.com

Abstract
Geocell reinforced soil is a cellular mattress with an almost honeycombed configuration. The Geocell reinforcement not only increase the soil bearing capacity but also reduce its settlement. There is little information on interaction effects of its geometry parameters. This paper discusses the trends of footing behavior in terms of Bearing Capacity Ratio (BCR). Several different configurations of geocell were examined. The obtained results show a slight interaction between the length of the Geocell layer and the required cover layer thickness. The most significant parameter is find to be the Geocell height. Although the optimum dimension for the height, length and aperture size of the cells is obtained.
Keywords: Geocell, Reinforcement, Bearing Capacity, Sand.

1. INTRODUCTION

One of the most effective approaches to reduce footing load effects transmitted to the soft underlying soils is to improve its stiffness. Among various available methods, the latest invention to enhance the stiffness is to maintain the confinement of the overlying layers using Geocell [J. S. Vinod et al., 2011]. Geocells originally were developed by the U.S. Army COE to improve vehicular mobility over loose sandy subgrade (Webster and Alford 1978). Geocell is a term used for cells with honeycomb configuration in which the soil would be encapsulated. The three dimensional structure of the pockets cause interconnection effects which produce a wide cushion and also prevents lateral spreading of the infill soil by additional confinement. So, by using the Geocells, the confined soil can carry the footing loads thorough the tension strength of Geocell polymeric cell walls and the resulted mattress spread the loads over a wider flat. This phenomena leads to an improvement in the foundation overall efficiency. There are several investigations in which the Geocell reinforcement beneficence is reported [Krishnaswamy et al., 2000; Dash et al., 2003, 2004; Latha et al., 2006; Sireesh et al., 2009; MoghaddasTafreshi and Dawson, 2010, 2012; Yang et al., 2012; Leshnisky and Ling, 2013]. A conventional triaxial apparatus has been used widely to investigate the shear strength of sand reinforced by single and multiple geocell arrangements (Rajagopal et al. 1999; Mengelt et al. 2006; Tafreshi and Dawson 2010; Biswas et al. 2013). The improved performance of sand reinforced by geocells was attributed to the apparent cohesion between the granular material and the geocell strips (Bathurst and Karpurapu 1993). The role of cyclic loads under triaxial conditions has been investigated to examine how reinforced granular media behave under various geotechnical and pavement applications (Tseng and Lytton 1989; Cowland and Wong 1993; Sekine et al. 1994; Haque et al. 2004; Kwon and Tutumluer 2009; Palmeira and Antunes 2010; Al-Qadi et al. 2012; Yang et al. 2012; Leshchinsky and Ling 2013; Indraratna and Nimbalkar 2013; Santos et al. 2013). However, only limited studies have investigated the behavior of granular material under a plane-strain environment that is applicable for rail tracks (Peters et al. 1988; Radampola 2006; Radampola et al. 2008; Wanatowski et al. 2008; Choudhury 2009).The purpose of the present study is to analyze, by the aid of Design Of Experiment, the influencing parameters of geocell reinforced sand under strip footing and in turn of interaction effects between geometry parameters. A series of model tests on strip footing supported on geocell reinforced sand bed are carried out. The four influencing parameters varied for the statistical analysis are cover layer thickness, u, Geocell height, h, cell aperture size, d, and length, b, of geocell layer. The parameters are defined in a dimensionless form by dividing to footing width, B.