The bearing capacity of surface strip foundations on geogrid-reinforced sand and clay – a comparative study

B.M. DAS, E.C. SHIN* and M.T. OMAR*

Office of Academic Affairs and *Department of Civil Engineering and Mechanics, Southern Illinois University, Carbondale, Illinois 62901, USA

Received 5 July 1993

Summary

Laboratory model test results for the ultimate bearing capacity of a strip foundation supported by geogrid-reinforced sand and saturated clay are presented. One type of geogrid only was used for all the tests. On the basis of the model test results, the optimum depth and width of reinforcing layers and the optimum depth of the location of the first layer of the geogrid in sand and saturated clay were determined and compared.

Keywords: Clay; geogrid; reinforcement depth; reinforcement width; sand; ultimate bearing capacity.

Introduction

During the past 15 years or so, several attempts have been made to evaluate the ultimate and allowable bearing capacities of shallow square and strip foundations supported by sand reinforced with various materials such as metal strips (Binquet and Lee, 1975; Fragaszy and Lawton, 1984; Huang and Tatsuoka, 1988, 1990), metal bars (Huang and Tatsuoka, 1990), rope fibres (Akinmusuru and Akinbolade, 1981) and geotextiles (Guido et al., 1985). Similarly, limited information on the topic of the bearing capacity of shallow foundations resting on geosynthetic-reinforced clay can be found in the works of investigators such as Ingold and Miller (1982), Milligan and Love (1984) and Dawson and Lee (1988). Guido et al. (1985) showed that, when flexible materials such as geotextiles are used as a reinforcement in granular soil, the ultimate bearing capacity does increase. However, because of the flexibility of geotextiles, at low settlement levels the allowable bearing capacity either decreases or remains the same. For this reason, a number of studies have been conducted more recently to evaluate the possible increase in the ultimate and allowable bearing capacities of shallow foundations supported by sand with layers of geogrid as the reinforcing material (for example Guido et al., 1986; Khing et al., 1992; Khing et al., 1993; Yeo et al., 1993). All of these studies were conducted using laboratory-model tests whose results are rather encouraging.

0960-3182 © 1994 Chapman & Hall
A review of the existing literature shows that practically no attempt has yet been made to evaluate the bearing capacity of foundations resting on saturated or near-saturated clayey soil reinforced with layers of geogrid. The purpose of this paper is to present the results of a number of laboratory-model tests for the ultimate bearing capacity of shallow strip foundations supported by geogrid-reinforced sand and near-saturated clay and to compare the significant parameters. It is important to point out that the published studies on the subject of the load-bearing capacity of geogrid-reinforced sand were primarily conducted on square model foundations.

**Parameters investigated**

Figure 1 shows a surface strip foundation of width $B$ supported by a soil reinforced with layers of geogrid. There are $N$ geogrid layers. The width of each geogrid layer is equal to $b$. The top layer of the geogrid is located at a depth $u$ below the bottom of the foundation. The vertical distance between each consecutive layer of geogrid is equal to $h$. The extent of the geogrid reinforcement, $d$, measured from the bottom of the foundation is

$$d = u + (N - 1)h$$  \hspace{1cm} (1)

If geogrids are used as the reinforcing material, the ultimate bearing capacity of the