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Technical Note

Bearing capacity of embedded strip foundation on geogrid-reinforced sand

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Abstract

Laboratory model test results for the ultimate bearing capacity of a strip foundation supported by multi-layered geogrid-reinforced sand are presented. The depth of embedment of the model foundation, d_f, was varied from zero to B (width of foundation). Only one type of geogrid and one variety of sand at one relative density were used. The ultimate bearing capacity obtained from the model test program has been compared with the theory proposed by Huang and Menq, [1977. Journal of Geotechnical and Geoenvironmental Engineering ASCE 123(1), 30–36]. Based on the present tests, it appears that the theory provides a conservative prediction of the ultimate bearing capacity.

Keywords: Embedment; Geogrid; Sand; Strip; Ultimate bearing capacity

1. Introduction

During the last 20 years or so, results of several studies have been published that relate to the evaluation of the ultimate and allowable bearing capacities of shallow foundations supported by sand reinforced with multi-layered geogrid (e.g., Guido

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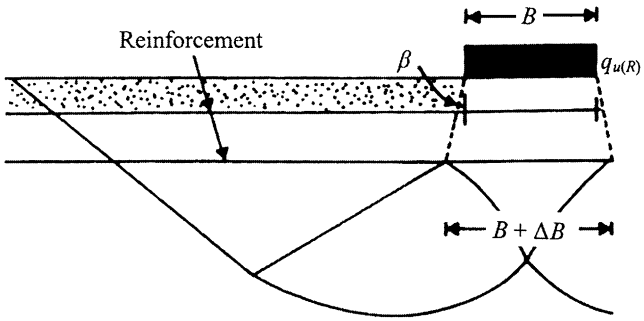

Fig. 1. Wide-slab failure mechanism in reinforced sand supporting a strip foundation. [Note: B = width of foundation; $q_{u(R)}$ = ultimate bearing capacity. For definition of ΔB and β, see Eqs. (9)–(11)].

et al., 1986; Omar et al., 1993; Yetimoglu et al., 1994; Das and Omar, 1994; Khing et al., 1993; Adams and Collin, 1997). All of these studies have been conducted for surface foundation conditions. The effect of the depth of embedment of the foundation, which is the normal situation in all practical cases of construction, has not received proper attention. The purpose of this paper is to report some recent laboratory model test results conducted to evaluate the ultimate bearing capacity of a strip foundation supported by geogrid-reinforced sand. For these tests, the d_f/B value (d_f is the depth of foundation, B is the width of foundation) was varied from zero to one. The experimental results have been compared to the theory developed by Huang and Menq (1997) which is based on the "wide-slab" failure mechanism in soil proposed by Schlosser et al. (1983) as shown in Fig. 1.

2. Geometric parameters

Fig. 2 shows a strip foundation (width B) being supported by sand, which is reinforced with N number of geogrid layers. The vertical spacing between consecutive geogrid layers is h. The top layer of geogrid is located at a depth u measured from the bottom of the foundation. The width of the geogrid reinforcements under the foundation is b. The depth of reinforcement, d, below the bottom of the foundation can be given as

$$d = u + (N - 1)h. \tag{1}$$

The beneficial effect of reinforcement for increasing the ultimate bearing capacity has been generally expressed in the past in terms of a nondimensional quantity called the bearing capacity ratio, BCR or

$$\mathrm{BCR} = \frac{q_{u(R)}}{q_u}, \tag{2}$$

where $q_{u(R)}$ and q_u is the ultimate bearing capacities on reinforced and unreinforced sand, respectively.