Available online at www.sciencedirect.com
SCIENCE DIRECT®
Geotextiles and Geomembranes 23 (2005) 144–173
Geotextiles and Geomembranes
www.elsevier.com/locate/geotexmem

Bearing capacity of square footing on pond ash reinforced with jute-geotextile

Amalendu Ghosh, Ambarish Ghosh*, Ashis Kumar Bera

Bengal Engineering College, a Deemed University, Howrah-711 103, India

Received 6 December 2003; received in revised form 7 May 2004; accepted 15 July 2004
Available online 11 November 2004

Abstract

At present an enormous amount of pond ash is being produced by thermal power plants throughout the world. Storage of pond ash requires vast land area and disposal of ash becomes problematic and also it creates environmental hazards. To mitigate these problems, pond ash has been used in the low-lying areas as structural fills for developing residential and industrial sites. To enhance the bearing capacity of pond ash, it may be reinforced with jute-geotextile, a textile made from jute (natural fibre) for the purpose. In the present study an attempt has been made to study the bearing capacity of square footing on pond ash reinforced with jute-geotextile. The effects of different parameters like number of layers (N) of reinforcement, the depth of the upper most layer of reinforcement from the base of the footing (u), friction ratio (f), i.e. the ratio of the pond ash jute-geotextile interface friction angle (ψ) to the direct shear friction angle of pond ash (ϕ_d) and jute-geotextile sheet length (L_s) on bearing capacity of square footing (q_{rs}) at any settlement resting on pond ash reinforced with jute-geotextile are discussed. A non-linear power model has been developed to estimate q_{rs} based on 1399 experimental data.

Keywords: Bearing capacity; Square footing; Pond ash; Jute-geotextile; Power model; Friction ratio

*Corresponding author.
E-mail addresses: amalendughosh@hotmail.com (A. Ghosh), ghoshambarish@hotmail.com (A. Ghosh), ashis@civil.becs.ac.in (A.K. Bera).

0266-1144/$ - see front matter © 2004 Elsevier Ltd All rights reserved.
doi:10.1016/j.geotexmem.2004.07.002

Nomenclature

B	width of footing
BCR_u	bearing capacity ratio with respect to ultimate load, q_{ru}/q_u
BCR_s	bearing capacity ratio with respect to settlement, q_{rs}/q_s
D_{lr}	depth of last reinforcement layer below the base of the footing at which q_{rs} attains maximum value
E_p	percentage of error, $\left(\frac{q_{rs}-\hat{q}_{rs}}{q_{rs}}\right) \times 100$
f	friction ratio (ψ/ϕ_d)
L_s	length of the reinforcement sheet
N	number of layers of reinforcement
N_{opt}	optimum number of layers of reinforcement
q_u	ultimate bearing capacity of square footing on unreinforced pond ash
q_{ru}	ultimate bearing capacity of square footing on reinforced pond ash
q_s	bearing capacity of square footing on unreinforced pond ash at any settlement
q_{rs}	bearing capacity of square footing on reinforced pond ash at any settlement
$\hat{q}_{rs}$	predicted value of the dependant variable q_{rs}
q_{rsmax}	maximum load intensity on reinforced pond ash at different settlements
S_h	horizontal spacing between two consecutive reinforcement strips
S_v	vertical spacing between two consecutive layers of reinforcement;
u	depth of first layer of reinforcement beneath the footing
ϕ_d	direct shear friction angle of pond ash
ψ	interface friction angle between pond ash and jute-geotextile sheet; and ξ_0, ξ_1, ξ_2, ξ_3, ξ_4, ξ_5 and ξ_6 regression coefficients

1. Introduction

Pond ash, the by-product of thermal power plants is considered as solid waste and its disposal is a major problem from environment point of view and also it requires lot of disposal areas. Utilization of pond ash to the maximum possible extent is a worldwide problem. To solve the problem, pond ash can be used as a structural fill for developing low-lying areas to construct structures on it. There are two types of ash produced by thermal power plants, viz., and bottom ash. These two ash mixed together are transported to the ash pond and this deposit is called pond ash. Improvement of load bearing capacity of shallow foundation on pond ash may be possible by introducing jute-geotextile sheet into the pond ash as reinforcement. The jute-geotextile is manufactured from jute, a natural fibre and it is ecofriendly in nature. Studies on the bearing capacity of shallow foundation on unreinforced fly ash have been reported by DiGioia and Nuzzo (1972), and Kaushik and Ramasamy (1999). Numerous studies on the bearing capacity of shallow foundation on