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ORIGINAL ARTICLE

Bearing capacity of sandy soil treated by Kenaf fibre geotextile

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Abstract Bio-based materials are widely used recently in order to introduce a more sustainable construction material. Kenaf is a type of bio-based material that can be easily obtained in a tropical country, which could be a potential material to be utilised as a geotextile material because it has good tensile strength. The geotextile could be used to improve the bearing capacity of a loose soil. This paper presents a series of small-scale physical modelling tests to investigate the bearing capacity performance of Kenaf fibre geotextile laid on and inside the sand layer. A rigid footing was used to replicate a strip footing during the loading test, and sand was prepared based on 50% of relative density in a rigid testing chamber for ground model preparation. In order to treat the soil, Kenaf fibre geotextile was laid at four difference locations which are on the soil surface and underneath the ground model surface at 50, 75 and 100 mm deep. It was found that the usage of the Kenaf fibre geotextile has improved the bearing capacity of the sandy soil up to 414.9% as compared to untreated soil. It was also found that the depth of the Kenaf fibre geotextile treated into the soil also affects the soil performance.

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Introduction

The main function of geotextile is for aggregate separation, soil reinforcement, stabilisation, filtration, drainage and moisture or liquid barriers (Dewey 1993). Bio-based materials such as coir, jute, Kenaf, sugarcane bagasse (Sarby 2007; Subaida et al. 2008; Artidteang et al. 2012; Tanchaisawat et al. 2013; Chaiyaput et al. 2014) are used to develop geotextile layers because of the environmental-friendly behaviour of these bio-based materials. These materials are also cost-effective. Kenaf is a type of bio-based material which is easily obtained in any tropical countries and could be a potential material to be utilised as a geotextile material because it has desirable tensile strength (Yetimoglu and Salbas 2003).

A study has been conducted by Tanchaisawat et al. (2013) to assess the interactions between the woven Kenaf geogrid and compacted sand. A series of pullout and direct shear tests were performed to investigate the interaction coefficient between the geogrid and compacted sand. Numerical simulations were also used to perform the back-calculation from average values of the interaction coefficients. Based on the numerical analysis, the results were found to be similar to the laboratory test results. As a result, they concluded that the axial stiffness of the geogrid and interaction coefficient was found to be important parameters affecting the efficiency of Kenaf geogrid. In addition, they suggested that Kenaf geogrid is suitable to be used as natural fibres for sustainable geosynthetics. Chaiyaput et al. (2014) have carried out a full-scale testing on a soft clay embankment structure treated by the woven Kenaf geosynthetics. The intention of the study was to investigate