



Effect of Fibers on Shear Strength of Clayey Soil

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Abstract

Soft soils are well known for their low strength and high compressibility. Several techniques such as reinforcement are usually used for increasing the strength and reducing deformation characteristics of this kind of soil. This paper presents the results of an experimental study on the influence of short, discrete and random fibers on the shear strength of a clayey soil. A series of triaxial compression tests were conducted in a conventional triaxial cell on samples of compacted clay and compacted mixed clay with discrete randomly distributed synthetic fiber. Comparison of the results show that the strength of clay soil increased with increasing the proportion of fibers.

Key words: clayey soil, fiber, shear strength

1. Introduction

Reinforcement of soils is a reliable and effective technique for enhancing the stability and strength of soils. Reinforcement of clayey soils with reeds, straw and other natural fibers has been practised from before the time of the Pharaohs. Some of these methods are still in use in the construction of low cost buildings.

Soil reinforcement with short discrete, randomly oriented fibers is getting attention from many researchers around the world. Among them, Anderland and Khattak (1979) studied the effect on mechanical behaviour of adding pulp to kaolin clay; up to 40% pulp was added. They reported an increase in both strength and ductility with fiber content. Maher and Ho (1995) who investigated the engineering properties of kaolinite-fiber soil composite reached similar conclusions. Although the applications are different in the above studies, the fiber size and quantity are very important factors in governing the behaviour of the composite. Hoare (1977) and Gray and Al-Refeai (1986) carried out triaxial compression tests on dry sand reinforced with randomly distributed, discrete fibers. The test results indicated that presence of fiber increased both the ultimate strength and stiffness of reinforced sand with an increase in fiber content up to 2%.

Donald H .Gary .et.al (1983) carried out a set of experiments on the reinforced sand and showed that shear strength increases as a result of fiber reinforcement and increasing the length of the fiber, increased the shear strength of the fiber-sand composite but only up to a point.

One of the researches that are conducted recently is exploring on behaviour of footing on reinforced soil. For example Gupta (2004) conducted plate load tests on the footing of size 150mm×150mm on the randomly distributed fiber soils (RDFS) to study the pressure settlement behaviour and bearing capacity of the RDFS. From the pressure settlement curves at different fiber content it was found that the settlement of the unreinforced is more than that of the reinforced sand and the settlement reduces with the increase in the fiber content.

Another usage of reinforced soil is reducing lateral earth pressure on a rigid retaining wall with reinforced backfill.

It appears that finer natural fibers could have a beneficial effect on strength of clay and sandy soil.

This paper describes an investigation into the effect of increasing the proportion of fibers on the density and strength of kaolin.