



INFLUENCE OF FIBER REINFORCEMENT ON TRIAXIAL SHEAR BEHAVIOR OF CEMENTED SANDY SOILS

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Abstract

A number of triaxial tests were conducted for evaluation of randomly distributed fiber reinforcement effects on the behavior of cemented sand. Cemented samples were prepared by addition of Portland cement up to 3% by weight and were cured for about seven days after mixture. Polypropylene fibers with a length of 12 mm were added and mixed in three different weight percentages of 0%, 0.5%, 1%. Specimens were compacted in relative densities of 50% and 70%. Consolidated drained compression triaxial tests were performed under confinements of 100, 300 and 500 kPa. Tests results indicated that addition of polypropylene fiber to cemented sandy soils increases peak and residual strength. However, ultimate dilation decreases with enhancement of fiber content in cemented soil.

Keywords: Fiber, Cemented sand, triaxial test, shear strength, volume change behavior.

1. INTRODUCTION

Shear strength characteristics of artificially cemented sandy soils has been studied in the past by many researchers, such as Saxena et al. (1978), Clough et al. (1981), Leroueil and Vaughan (1990), Airey (1993) and Coop and Atkinson (1993) and Hamidi and Haeri (2005). Also, experimental studies on influence of reinforcement on shear strength of uncemented and cemented sands using fiber inclusions have also been reported by different researchers, e.g., Gray and Alrefeai 1986; Gray & Maher, 1989, Maher and Gray 1990; Al-Refaei, 1991, Maher and Ho 1993; Omine et al. 1996, Consoli et al., 1998, 2002, 2003. The results showed that fiber-reinforced soil is a potentially composite material which can be advantageously employed in improvement of the structural behavior of soils. One of the main advantages of randomly distributed fibers is the maintenance of strength isotropy and the absence of potential planes of weakness that can develop parallel to the oriented reinforcement. The fiber reinforcement causes significant improvement in shear strength of sand. More importantly it exhibits greater extensibility and small loss of post-peak strength (i.e. greater ductility in the composite material) as compared to sand alone or to sand reinforced with high modulus inclusions. However, more research is necessary to evaluate the influence of fiber reinforcement on the mechanical behavior of cemented soils.

2. EXPERIMENTAL STUDIES

A number of 18 conventional triaxial compression tests were carried out in this research on fiber-reinforced cemented sand. Fiber contents were selected as 0%, 0.5% and 1% and cement content was 3% by weight of dry sand. Specimens prepared in two different relative densities of 50% and 70% at confining pressures ranging from 100 to 500 kPa. Fibers with length of 12 mm and diameter of 0.023 mm were used in sample preparation process.

2.1 MATERIALS

2.1.1 SOIL

The soil used in the present study obtained from Babolsar shores near Caspian Sea in Mazandaran province, Iran. Specific Gravity of Solids G_s is 2.74, with a Uniformity Coefficient C_u and Curvature Coefficient C_c of 1.75 and 0.89 respectively. The minimum and maximum void ratios of soil were determined as 0.5 and 0.75 respectively. Grain size distribution curve of base soil is shown in Fig. 1.