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Stabilization of Expansive Soils Using Polypropylene Fiber

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Abstract

Current research main aim is to study the effect of adding polypropylene fiber (PPF) on the behavior of expansive soil to reduce the swelling as percentage (0.5, 1 and 2%) of the weight of dry soil. Expansive soil used in this research was prepared artificially by mixing Ca-based bentonite from geological survey and mining company with sandy soil brought from Karbala city as percentage 80% bentonite to 20% sand of dry weight. Multiple laboratory tests have been carried are (Unconfined Compression Test, One-Dimensional Consolidation Test, Swelling Test, Sieve Analysis and Cycle Swell Shrink Test). A conventional odometer cell was modified to allow the study of swell- shrink cycle test to be carried out under controlled temperatures and surcharge pressure. The results showed that the increase in percentage of (PPF) led to decrease the swelling and to increase the unconfined compression strength. The wetting and drying results of (PPF) showed that with continuous cycles the effect of (PPF) keeps on reducing the swelling and the 2% of (PPF) produces less ratio of swell - shrink, which has obtained higher than 57 % in the improvement factor of swell and shrink.

Keywords: Expansive Soils; Polypropylene Fiber; Wetting and Drying Cycles; Bentonite.

1. Introduction

Expansive soil usually refers to those clay minerals that have contradictory behavior (swell and shrink) due to changes in moisture content over time [1]. The montmorillonite clay mineral contributes mainly to this behavior. In Iraq and other countries the expansive soil contributes to many problems which observed on the structures that are established on the expansive soil. With increasing and decreasing of soil water content the soils will swell and shrink [2]. The environmental change around structures usually results in severe risk subsequent after they are built, the prediction of the heave of the light structure has likely received more attention than any other analyses associated with the expansive soil. So, it is important to study the properties of these soils and how to treat them to overcome these problems. The goal of most related work was to identify the swelling potential and swelling pressure that the soil may exhibit under an extreme condition of complete flooding. In the field the state of moisture change that may occur is cycles of wetting and drying which leads to cycles of swelling and shrinkage of the soil [3].

Residential buildings construction and other structures like highways, airports, bridges and seaports on expansive soil in high risk situation, as these soils are subjected to the cycle of drying and wetting resulting in shrinkage and swelling under structures foundation leading to crack into the structural. The damage average yearly cost to structures because of shrinkage and swelling estimated 400 £ million in the UK, 15 $ billion in the United States, and many billions dollars worldwide [4].

Therefore, the expansive soils require an amendment to meet the pre-design criteria of the application. Stabilization

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