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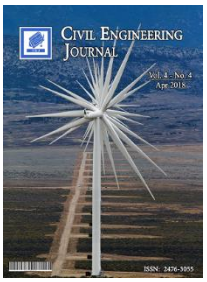

Evaluation of Softening of Clayey Soil Stabilized with Sewage Sludge Ash and Lime

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Abstract

Production of sewage sludge have raised increasing concerns due to negative environmental effect. Sewage Sludge Ash (SSA) is used as a new type of additive for clay. Laboratory tests were performed on clay samples to study the mechanism of sewage sludge ash (SSA) and Hydrated Lime (HL) soil stabilization. Different SSA contents (0, 5, 10, 15%) and hydrated lime (0, 1, 3 and 5%) were added to the soil samples. 288 samples were prepared, and unconfined compressive strength tests were carried out. The samples were tested under optimum water content and also saturated conditions with three replications. The results of the coefficient of softening indicated that by adding SSA and hydrated lime to clay soil simultaneously, the stabilized clay soils can be applied in the moist and saturated condition. According to the results, the samples of SSA contents 0% with hydrated lime 5% and SSA contents 10% with hydrated lime 5% can be placed in the vicinity of moisture.

Keywords: Soil Stabilization; Sewage Sludge Ash; Hydrated Lime; Unconfined Compressive Strength; Coefficient of Softening; Water Absorption.

1. Introduction

Soft clay soil is one of the problematic soils covering considerable parts of the earth including many low-land and coastal regions where many urban and industrial hubs are located and are frequently encountered in civil engineering projects. Some of the major behavioral and strength problems associated with these types of soils are low strength, excessive settlements, expansive, collapsible, liquefiable, soluble, dispersive, silty fine sands, highly organic weak soils, high plasticity, swelling, dispersivity, erodibility, high compressibility and sensitivity to environmental conditions. Generally, problematic soils such as soft clay soils were improved in order to improve their behavioral and strength properties [1, 2]. The methods of stabilization can be divided into ground improvement techniques, chemical, mechanical and biological techniques or a combination of them [3-5]. Chemical stabilization includes the addition of different natural and synthetic additives such as lime, cement, fly ash and different modern technologies such as nanoparticles to the soil [3, 5, 6]. One of the major techniques used to overcome the problems created by soft soils is the mixing with a cementitious binder. Traditionally, these binders are cement and/or lime, which 'glue' the soil particles together mainly through chemical and not physical reactions. Both binders share the fact that their reactions with water depend largely on their specific surface. Moreover, although the type of reaction is different for lime and cement, the final product is very much alike, based on calcium and silica compounds [7]. On the other hand, production of sewage sludge have raised increasing concerns due to negative environmental effect. So the management of sludge produced in

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