LABORATORY MODEL TEST ON IMPROVED SOIL USING LIME-COLUMN

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ABSTRACT

The lime-column technique has been applied successfully in recent years to improve the physical and mechanical properties of the soils. This technique increases soil bearing capacity and reduces soil settlement owing to improving of soil strength and stiffness. This paper presents the preliminary results of the laboratory model test of lime-column technique on soft clay soil to investigate load-settlement characteristic in laboratory. The lime-column was designed as single column with 50 mm in diameter (D), and 100 mm of depth. The laboratory tests carried out was one dimensional consolidation and small plate loading test. The test results show that before installation of the lime-column, based on the load-settlement curve, the mode of failure was likely defined as general shear failure. The bearing capacity of the soft soil increased from 0.23 kN to 5.2 kN, it was about more than 20 times increasing, after the lime-column was installed. Whole results indicated that lime-column technique is a valuable method to enhance soil bearing capacity and reduce soil settlement.

Keywords: lime-column, deformation, soft soil, bearing capacity

INTRODUCTION

Lime and cement treatment has been extensively used in the field of highways, railroads and airports construction purposes resulting in increased bearing capacity of soft subgrade, enabling an improvement the mechanical properties of the bearing layers. The use of lime or cement stabilization has been extended to greater depth in which lime or cement columns act as a type of soil reinforcement. The layers of lime or cement stabilized soils can also function as rigid crust which is useful in spreading the applied loads to the subsoil. The lime or cement column is a variant of deep mixing method. The Deep Mixing Method (DMM) is common technique for an in situ soil treatment technology whereby the soil is blended with cementitious and/or other materials. These materials are widely referred to as "binders" and can be introduced in dry or slurry form. They are injected through hollow, rotated mixing shafts tipped with some type of cutting tool (Terashi, 1997). The lime-column method was formed by injecting the dry or wet lime under preferable pressure into soil in-situ. The dry mixing is commonly applied for clays, and wet mixing is suitable for sands layers (Rogers and Glendinning, 1997). The lime-column technique has been applied successfully in recent years to improve the physical and mechanical properties of the soils. This technique would increase soil bearing capacity and reduces soil settlement owing to improving of soil strength and stiffness. Hence, this technique was preferable for soft soil improvement (Broms and Boman, 1975). A study carried out by Baker (2000) on full-scale model showed that the stiffness of the improved soil using lime-column increased more significantly than that of lime-cement column. Several researchers (e.g. Shen et al., 2003; Tonoz et al., 2003; Budi, 2003) studied separately the strength of the soil surrounding the lime-column. They reported that the soil strength increased near the column to a distance up to 2 to 3 times