MODELLING THE FIELD APPLICATION OF ELECTRO-OSMOTIC CONSOLIDATION TO IMPROVE ENGINEERING PROPERTIES OF SOFT PEATY CLAYS

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DECLARATION

The work included in this thesis in part or whole has not been submitted for any other academic qualification at any institution.

UOM Verified Signature

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Abstract

In Sri Lanka, there are large areas underlain by soft peaty clays in and around Colombo and its suburbs. Soft peaty clay deposits are highly compressible and have very low shear strength. High primary and secondary consolidation settlement problems are associated with the low shear strength. Due to scarcity of land with good subsoil condition, Geotechnical engineers are compelled to use these grounds for new development works. Therefore, it is needed to improve the properties of peaty clay deposits before doing any construction works on them. As such, there is a need to find cost effective and efficient ground improvement techniques. The potential of electro-osmotic consolidation as a technique for improvement of Sri Lankan peaty clay was studied in this project. There are records in literature to indicate that this technique was successful with soft inorganic clays. But there are no records of the use of the method in organic soils. Sri Lankan peaty clays have very low organic contents in the range of 20% to 30%. The effectiveness of electro-osmotic consolidation technique with Sri Lankan peaty clay was studied at the University of Moratuwa first by performing a series of one dimensional electro-osmotic consolidation tests and the method was found to be quite successful.

In the field, electro-osmotic consolidation is done by driving parallel lines of electrodes, and by applying direct current potential difference and pumping from the cathode. This configuration cannot be considered as one-dimensional and this would be essentially three-dimensional. In this research, the field arrangement of electro-osmotic consolidation was closely simulated in a model tank filled with remoulded peaty clay and a series of tests were performed with the objective of understanding the aspects of electro-osmotic consolidation technique under three dimensional conditions.

Specimens were taken from the remoulded peat mass after it was subjected to consolidation tests and shear strength tests. For comparison purposes, tests were done on untreated peaty clay remoulded in the same manner.

The level of improvement achieved in compressibility characteristics in three-dimensional condition is less than that achieved with one-dimensional condition. But it shows a preconsolidation effect especially near anodes. A significant reduction in water content and significant increase in shear strength were observed near anode compared to near the cathode. pH tests confirm that electro-chemical changes take place in the soil. pH values increased at cathode and decreased at anode. Electro-osmosis treatment has caused an increase in the liquid limit. The coefficient of electro-osmotic permeability of Sri Lankan peaty clay found to be in the range of $1*10^{-9}$ to $1*10^{-8}$ m^2/sec.-V, which was within the range suggested by Mitchell (1991) for fine-grained soils.