

RELATIONSHIP BETWEEN UNDRAINED SHEAR STRENGTH (S_u) AND CONSOLIDATION RATIO FOR MARINE SOFT CLAY

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Abstract

Clay soil is known to create many problems in civil engineering works specifically from the design, construction and maintenance stages. Special consideration should be taken especially in the design of infrastructures on clay soil. Over consolidation ratio (OCR) and the undrained shear strength (S_u) of clay soil is very important in the field of Geotechnical engineering as it can be used to estimate the behavior of clay. In this study, a relationship between undrained shear strength and over consolidation ratio (OCR) parameters was found to establish a non-linear correlation formula. Laboratory experiment was done by taking undisturbed samples at different depths of 0.5 m from 1.0m to 3.5m below ground level. The samples were then tested under the odometer and vane shear test to obtain the OCR values and the undrained shear strength (S_u) respectively. It was found that the OCR and shear strength values are inversely proportional at similar depths and at the same undrained conditions. The OCR value however, decreases when the soil strength increases. An acceptable correlation was obtained from the relationships where the R^2 values were very close to 1.0 using polynomial equations. The comparison between the experimental result and previous researchers produced a non-linear correlation that shows a similar pattern with this study.

Keywords: *Clay, Over-consolidation ratio, Undrained shear strength*

INTRODUCTION

Marine clay soil presents several challenges for Geotechnical Engineers as they pose problems related to stability and settlements. The characteristics of soft clay are high compressibility, low strength and low permeability. As a comparison to other types of soils, the strength development of soft clay is time dependent. General construction problems in this deposit are insufficient bearing capacity, excessive post construction settlement and instability on excavation and embankment forming. The behaviour of soft clay can be classified according to the over consolidation ratio (OCR) of the soil. The formation of clay soil defines the OCR values and it can be described as the ratio of previous maximal pre-consolidation pressure (σ_c) and current effective stress (σ_v) (Urbaitis et al., 2016). The OCR values of the soil can be used to determine its past condition where vital information can be obtained in predicting settlements. OCR is also essential in geotechnical design to indicate soil strains under construction (Szymanski et al., 2006). Based on the stress magnitude and stress history, OCR values can be used to classify clay soils if there are nonconsolidated ($OCR < 1.0$), normally consolidated (1.0–1.5), overconsolidated (1.5–10.0) and highly overconsolidated ($OCR > 10.0$) (Urbaitis et al., 2016).

Due to the difference in current and past stress conditions, the undrained shear strength of the soil too will be different for soils having different OCR values. Hence, the