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Research Article

Measurement of Peat Soil Shear Strength Using Wenner Four-Point Probes and Vane Shear Strength Methods

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The general objective of this research was to measure the peat soil shear strength using Wenner four-point probes and vane shear strength methods. Specifically, the objective of this study was two-fold, namely, (a) investigating the relationship between laboratory soil resistivity and undrained shear strength and (b) determineing the relationship between in-situ soil resistivity and undrained shear strength. Data were randomly collected over six locations in Meranek, Sarawak, for in-situ test and three repetitions for each data were set based on three parameters. The selected parameters were soil density, moisture content, and salinity for both laboratory and in-situ test using Wenner four-point probes and vane shear method. The soil resistivity and vane shear strength readings for laboratory test were correlated with soil salinity, moisture content, and density. The R^2 values showed a good correlation for soil salinity (R^2 =0.8468) and density (R^2 =0.9475), respectively. However, a weak correlation of R^2 =0.1205 was observed for soil moisture. The R^2 value for in-situ correlation between soil resistivity and three parameters (soil salinity, moisture content, and density) was R^2 =0.8916. It can be concluded that the peat soil shear strengths of the study area using Wenner four-point probes from in-situ were (4.38 ohm.m) and laboratory was (2.47 ohm.m) and when using the vane shear strength method, in-situ was (23 kPA) and laboratory was (5 kPA). This study implies that the peat soil of the study area can be categorized as texture (soft loamy soil) and it is suitable for agriculture instead of construction. The relationship established between Wenner four-point probes and vane shear method can be beneficial for ground engineering design to enhance investigation on site suitability. Future work on DUALEM-421 technique should be emphasised for better subsurface exploration accuracy and resolve peat depth for an in-situ test.

1. Introduction

Field of civil engineering specifically the engineering properties of geomaterials is very crucial since most of tunnels, bridges, and dams are built with a mixed of soils or rocks in it. The most important aspects for the geotechnical engineers to investigate are the strength and the stress-deformation behaviour as well as the fluid flow properties of earth materials; the geotechnical discipline was based on this common framework [1]. There are three categories of common techniques to determine these engineering properties, such as in-situ test, geophysical methods, and laboratory. Geophysical methods were developed because of their accuracy to specify soil properties based on quantification [2].

The laboratory tests have the advantages to measure directly the specified engineering properties under controlled environment and different situation. The samples taken were frequently disturbed during the sampling and drilling processes, which may deviate the actual values of its engineering properties [3]. There are lots of electrical potentials and fields that were often simultaneously observed in natural soil, thus, making it possible to determine which formation correlate with which mechanism [4]. Electrical resistivity and conductivity of soils have been conducted in many research studies and can be divided into three different groups. The first group include laboratory studies of electrical dielectric and conductivity by applying electromagnetic waves at constant