RELATIONSHIP BETWEEN CONE PENETRATION TEST AND UNDRAINED SHEAR STRENGTH OF SOFT SOIL

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To my beloved mother and father

To my family… especially my husband, daughter, son, brother and sister

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ABSTRACT

Undrained shear strength of fine grain soil is one of the most important properties of soil in determining the soil stability especially in foundation design. This study presents the relationship between undrained shear strength and the fall cone parameter by using silly soil experienced an over consolidation ratio equal to two. The study focus to establish the relations between different cone angle of fall cone (β), and the value of Hansbo`s (K) factor which is equal to $(Su\ d^2)/W$) and the relationship between undrained shear strength and water content. A power relation was obtained for the relationship between different cone angle of fall cone (β), and the value of k. The relations obtained in this study can be used to determine the value of liquid limit of fine grain soil by using different weight and cone angles at different depth of penetration of soft soil. Also the relationship between undrained shear strength and value of water content was established, which is indicate that the value of undrained shear strength decrease by increasing the water content of soil.

ABSTRAK

Tanah berbutir halus mempengaruhi kekuatan ricih tanpa saliran yang merupakan salah satu sifat yang paling penting dalam tanah bagi menentukan kestabilan tanah terutamanya. Kajian ini menerangkan tentang hubungan antara kekuatan ricih tanpa saliran dan parameter kejatuhan kon dengan menggunakan tanah biasa dengan nisbah penyatuan sama kepada dua. Fokus kajian ini adalah untuk mewujudkan hubungan antara perbezaan sudut kon jatuh (β), dan nilai faktor Hansbo `s (K) adalah sama dengan $(Su\ d^2)/W$ dan hubungan di antara kekuatan ricih tanpa saliran dan kandungan air. Hubungan yang telah diperolehi adalah antara perbezaan sudut kon jatuh (β) dan nilai k. Hubungan yang diperolehi dalam kajian ini boleh digunakan untuk menentukan nilai had cecair tanah berbutir halus dengan menggunakan berat dan sudut kon yang berbeza pada kedalaman yang berbeza bagi penembusan tanah lembut. Selain itu, hubungan di antara kekuatan ricih tanpa saliran dan nilai kandungan air yang telah dibuktikan menunjukkan bahawa nilai kekuatan ricih tanpa saliran menurun apabila kandungan air dalam tanah meningkat.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

The shear strength of soil is the interior resistance of soil can be present to resist the sliding and failure along any plain inside the soil mass. The shear strength of soils is an important parameter in order to design foundation by referring to bearing capacity of soil, determinate stability of the slopes of dams, embankments, and design for lateral earth pressure on retaining walls.

Several methods have been proposed to determine the shear strength of the soil either in the laboratory scale or on the site such as Triaxial shear strength, direct shear box, Vane shear, and cone penetration tests. In this study the work is focused on the cone penetration and vane shear tests in order to obtain the shear strength of soft soil.

1.2 Background of Study

In situ cone penetration test is a one of the soil investigation test to obtain the undrained shear strength of soil. During the cone penetration test , an electrical cone on the end of a series of rods is pushed into the ground at a constant rate of 2cm/s. Continuous measurements are made to investigate the resistance to penetration of the cone tip (q_c) and the frictional resistance (f_s), or adhesion, on a surface. Measurements can also be made of other soil parameters using more specialized cones such as pore water pressure (piezocone), electrical conductivity, shear wave velocity (seismic cone) and pressure meter cone. Besides that, the value of undrained shear strength affected by many parameter of soil such as moisture content , consolidation ratio , and over burden pressure on the soil .

In this study, a relationship between the undrained shear strength obtained by laboratory vane shear and the fall cone tests under different weight and cone angle was established. The tests was conducted on soil sample experience an over consolidation ratio equal to 2.

1.3 Objectives

i) To establish a relationship between undrained shear strength, cone properties angle and cone penetration rate at constant over consolidation ratio.

ii) To obtain the value of soil undrained shear strength under different value of water content.

1.4 Scope of Study

i) In this study kaolin clay is use as the material to be tested.

ii) In this project the following laboratory tests were conducted.

a) liquid limit test
b) plastic limit test
c) specific gravity test
d) consolidation test
e) water content test
f) fall cone test
g) laboratory vane shear test

iii) Six samples were tested under value of over consolidation ratio which is equal to 2.

iv) The angle of cones used in this study was 30^{o}, 45^{o}, 60^{o}, 90^{o}, 120^{o} and 180^{o} with different weight.

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