STRENGTH STABILIZATION OF PEAT SOIL USING ORDINARY PORTLAND CEMENT (OPC)

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STRENGTH STABILIZATION OF PEAT SOIL USING ORDINARY PORTLAND CEMENT (OPC)

MARLENE INSIN ANAK JACK

A report submitted in partial fulfilment of the
requirements for the award of the degree of
B. Eng (Hons.) Civil Engineering

Faculty of Civil Engineering and Earth Resources
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LIST OF SYMBOLS

S_u	Shear strength
K_o	Pressure coefficient
qu	Unconfined Compressive Strength
Gs	Specific gravity
e_o	Initial void ratio
E	Strain
Σ	Stress

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ABSTRACT

This article describes a laboratory study on stabilizing peat soil using Ordinary Portland Cement (OPC) to improve its strength. Peat soil commonly occur as extremely soft, wet, unconsolidated surficial deposits that are the major parts of the wetland systems. These problematic soils are well known for its high compressibility and low in shear strength. Therefore this soil were stabilized in order to solve the major problem that always encountered by the civil engineer in Malaysia. Various percentages of OPC which is 4, 6, and 8% were added to peat soil at optimum moisture content and the sample was cured for 7, 14 and 28 days before conducting Unconfined Compressive Strength test. The Unconfined Compressive Strength test show that the strength of the peat soil will increase as the percentage of the stabilizer increases.

ABSTRAK

Thesis ini adalah mengenai kajian makmal untuk menguatkan tanah gambut dengan menggunakan Portland Simen Biasa (PSB) bagi meningkatkan kekuatan tanah gambut. Pada kebiasaannya tanah gambut merupakan tanah yang sangat lembut, basah, dan selalu didapati di permukaan tanah tak terkukuh adalah merupakan bahagian terbesar di system kawasan ‘wetland’. Tanah yang mempunyai banyak masalah ini telah distabilkan supaya dapat menyelesaikan masalah yang sering dihadapi oleh jurutera awam di Malaysia. Pelbagai peratusan PSB akan digunakan iatu 4,6 dan 8% untuk dicampurkan ke dalam tanah gambut pada kandungan lembapan yang optimum dan sampel juga telah dimatangkan selama 7,14 dan 28 hari sebelum menjalankan eksperimen Kekuatan Mampatan Takterkurung. Eksperimen Kekuatan Mampatan Takterkurung akan menunjukkan kekuatan tanah gambut akan meningkat sekiranya peratusan penstabil juga meningkat.

CHAPTER 1

INTRODUCTION

1.1 Background of the Problem

Soil may contain organic matters which are essential remains of plants. These soils called organic soil once their organic content exceeds 20% of their dry mass. Organic soils would turn be termed ‘peat’, once their organic content exceeds 75%. In Malaysia, the area that covered with peat soil is about 3 million hectares or 8% of the total land in Malaysia. Peat and organic soils were extremely soft and unconsolidated surficial deposits constituting the subsurface of wetland systems. The peat soil also can be found stratified in other surficial deposits in areas that have undergone paleo-environmental changes. General construction problems in this deposit were insufficient bearing capacity, excessive post construction settlement and instability on excavation and embankment forming.

Peat soil also well known to deform and fail under a light surcharge load and it was characterized with low shear strength. Generally any ground that subjected to additional loads which exceed its previous load condition or level, geotechnical requirements for design on that ground are to be established. These requirements included a set of standard laboratory tests and also some foundation design calculations in order to find the allowable bearing capacity.

Different approaches were used for the improvement of peat soil. Soil stabilization such as compaction and soil mixing with the addition of chemicals was

to modify the soil condition so that construction can be done easily without any risk. Most common way for soft or peat soil treatment was by excavating the soft or peat soil and replacing it with good granular or sandy soil but this way of soil treatment was not encouraged because of the uneconomical design. If the construction of the heavy loaded buildings was made on a soft peat soil layers, piled foundations can be used to transfer the loading to the rock. But if lightly loaded buildings or a road are to be constructed, it is not economical to construct the structures on a piled foundation. The method of pre-consolidation by preloading was the most widely used method by the engineers to improve the soil. But the one of the disadvantage of preloading method was it required a long period of time to done.

Soil stabilization was very important to strengthen the peat soil. Therefore, it was more economical to improve the strength and stiffness of the soil so that the structures can be built on top of soft soil. Soil stabilization by using chemical admixtures involves the treatment of the structures and fabric of the soil. The chemical reaction that occurs within the soil will results in changes in moisture content, shear strength, compressibility, pH values and other physical, chemical and engineering properties of the soil. The chemical stabilizer could accelerate the bonding in the soil but the bonding and the rate of the bonding depends on the type of stabilizer used.

1.2 Statement of Problem

These problematic soils were well known for their high compressibility and low shear strength (Huat, 2004). Normally, the construction and buildings were avoided on these soils. Usually it was very hard to access to the peat soils as the water table was often at, near or above the ground surface. From the perspective of engineering, the choices to construct on this type of soil normally had been avoided due to its consolidation settlement.

Challenges faced by those responsible for construction on peat and organic soils include:

- Limited accessibility and difficult traffic ability
- Expectation of very large settlements over an extended time period

- Possibility of stability problems

As the peat soil was easily to deform and fail under a light surcharge load, and also commonly known low shear strength, low compressibility, and high water content. Thus, it was not suitable for construction area due to its consolidation settlement.

1.3 Objectives and aims

Based on the high strength characteristic of peat in the evaluation of the soil when it applies with load, the objectives set for this study were as followed:

Overall Objective

This study was aimed to evaluate the strength of Pekan, Pahang Peat Soil which was stabilized with Ordinary Portland Cement (OPC) as an admixtures.

Specific Aims

1. To determine the physical and chemical behavior of unstabilized peat soil at Pekan.

2. To evaluate the strength and the effectiveness of the stabilizers (OPC) mixed with peat soil.

1.4 Scope of the Study

This research was carried out according to the scope of study that was specified. The scope focuses on the effectiveness towards the peat soil used different percentages of OPC which were 4, 6 and 8%. The curing period used were different which were 7, 14 and 28 days. Several laboratory tests had been carried out to determine the physical and chemical properties of soil.

The Unconfined Compression Strength (UCS) method was used to test the strength of the peat soil with different amount of OPC. If the UCS value is increasing by adding the OPC to the soil there is effectiveness in increasing the soil strength and