INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

Study on The Soil Stabilization for Soft Soil Bearing Capacity Improvement using Lime Stabilizer

Chai Ming Yu
B.Eng (Hons) in Civil Engineering

Project Supervisor:
(Miss Nurul Ain Binti Ibrahim)

Final Year Project Report

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SUPERVISOR'S DECLARATION

This project report entitled research on the soil improvement of soil at Bandar Seri Damansara for strength improvement is prepared and submitted by Chai Ming Yu I14004702 as partial fulfilment of the requirement for Bachelor of Engineering (HONS) in Civil Engineering, INTI International University.

APPROVED BY DATE

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Supervisor

STUDENT'S DECLARATION

I hereby declare that the final year project is based on my original work except for quotation and citation, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any degree at INTI INTERNATIONAL UNIVERSITY or other institution

Signature .....

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Date .....

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ABSTRACT

Chemical stabilization method has been extensively used for the improvement of the weak soil, in improving the bearing capacity as well as the settlement of the soil. Pleanty of researches regarding the effectiveness of using industrial waste as a chemical stabilizer are also increased rapidly. The aim of this research is to evaluate the engineering properties of the Bandar Seri Damansara weak soil using lime stabilizer at varies stabilizer contents (5%, 10%, 15%,20%). Classification of soil such as Atterberg test, sieve analysis and standard proctor test were carried out to determine the properties, optimum moisture content and maximum dry density of the untreated soil. The basic properties of soil such as Unconfined Compressive Strength (UCS), Direct Shear test and also Consolidation test were used to gauge the behaviour and the performance of the stabilized soil. The carried out tests gave some indication that the unconfined compressive strength and the direct shear test increase with the increase of percentage of lime stabilizer. As a conclusion, the result shows that the stabilized soil sample achieves its optimum strength at 10% of lime stabilizer content. At 15% of lime stabilizer content the strength begin to drop as lime stabilizer is excessive.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Background

There is a lot of engineering consideration to make a project and one of the biggest challenges is the geotechnical problem which is soil condition. High building is rise from the ground, so everything starts in the beginning of a project is all about the soil. One of the geotechnical consideration in design criteria other than the selection of foundation type is the subsoil condition must have a good soil bearing capacity that able to support the structural building without cause excessive settlement to occur.

Construction of building and shops over a soft and weak soil is a very common problem that face by civil engineering project. Soft soil is most likely has high compressible and poor strength characteristic. To construct a building which can perform long-term stability, the subsoil condition is the most important factor to be considered. Soil with low bearing capacity may cause geotechnical problems even during the construction or after the construction for the constructed building such as cracking of the structure due to the settlement of the soil underneath. The settlement of the building constructed is caused by the movement of the soil downward due to the several factors such as change of groundwater level, poor strength of soil, and placement of surcharge on soil for temporary load before the construction. The continuous movement of the soil underneath may cause bigger and serious cracking of the building that may lead to the structural failure. Reduce on the risk of the settlement to occur begins with the determination and recognition of the soil types for the foundation to rest on. It is important to investigate the soil behaviour and potential of geotechnical problem that may occur when being subjected to the structural load. In

engineering building construction, one of the major consideration is always the soil bearing capacity related to the foundation that act as underlying support of the structure.

There are several soil improvement method available in order to improve the engineering properties of soft soil where may lead to the improvement of soil bearing capacity such as by compacting the soil, replace the weak soil with stronger soil, using grouting material and use surcharge in a conjunction with vertical drain. Increasing the depth of foundation also may improve the soil bearing capacity to support the structural load apply. Soil Stabilization method is one of the most common ways to Improve the soil bearing capacity by increase the soil shear strength and reduce the settlement of soil. There has been many previous research that has been done related to the soil stabilization for the bearing capacity improvement using chemical stabilizer such as lime, RHA, fly ash and several others. The main purpose of stabilize the soil with stabilizer is to enhance the engineering properties of the subsoil in order to meet the design requirement of engineering construction. The soil being with treat stabilizer may increase the soil permeability, reduce the settlement, reduce the compressibility of the soil, increase the workability, increase shear strength of soil, increase the soil stiffness, reduce swelling and shrinkage of the soil respectively. Soil improvement using stabilizer is famous because it is an eco-friendly and economic way which provide a significant improvement for the soil.

The research on stabilizer treatment for the soil has proven that the use of different type of stabilizer will improve the soil properties significantly. Furthermore, the percentage of the stabilizer used and the treatments period also provide varies of result. Researchers use a lot of time to find out the best and most economical ways and solution in order to improve the soil bearing capacity. Alhassan (2008) has proven that the use of the rice hush ash (RHA) with mixed with the soil has improve the natural soil. It show the potential of using the RHA as a stabilizer of soil. In the research, it reported that the value of CBR and the unconfined compression value have improved by adding the RHA stabilizer to the soil.

The most common stabilization use for the bearing capacity improvement is the wasted or by product by the industry or manufacture such as fly ash, sawdust and etc. The by product is a secondary product by the industry which might be harmful. Besides, the by product or wasted product also creating depositing problems which means that it create the disposal problem.

Lime stabilizer is also one of the most famous products used to improve the soil properties. Lime stabilizer could change the unusable soil into usable soil. It means that the lime stabilizer might be a very potential material for research on the soil bearing capacity improvement. One of the biggest challenges of the construction sector is to save cost. The research on lime stabilizer improved soil will provide a structural strength that can be sustained the load from the construction, which means that the budget of excavating and disposal of soft soil will decrease significantly.

1.2 Problem Statement

Construction build over a soft ground is a very huge challenge to the field of geotechnical engineering. The problematic soil which is collected from Bandar Seri Damansara is mostly fined grained soil, clay, silt clay and also silt which have very poor properties in strength. Compaction is one of a technique use to improve the strength of the soil. After the compaction soil UCS value usually will increase, However after time has pass, soil will expose to others factor such as moisture which will decrease the UCS value of the soil. The decrease of UCS value means that the soil has loss it bearing capacity. The loss of bearing capacity of soil will definitely affect the performance of the soil. The high compressibility of soil will makes the settlement of buildings and also bearing capacity failure. When a project encounters an unstable ground, it will definitely delay the construction time. The research of soil stabilization for soft soil bearing capacity improvement using lime stabilizer is carry out to improve the soft soil which makes the unusable soil to usable soil instead of dispose away. Lime stabilizer is an economic way to treat the soft soil. Besides, lime stabilizer has the potential of decreasing the swelling and also improve the bearing capacity and strength in long term.

1.3 Objective

The research is conducted in order to understand the property of the soft soil collect from a site from Bandar Seri Damansara as a suitable material to conduct the research on the soft soil improvement by lime stabilizer with the objective as below:

I. To determine the physical properties of soft soil for the soil characterization
II. To determine the optimum percentage of lime stabilizer for the soil bearing capacity improvement.
III. To determine and compare on the settlement of the soil before and after being treated with lime stabilizer

1.4 Scope of Study

To study the properties of the soft soil, the soil sample will be taken from the site on Bandar Seri Damansara. The soil collected from the site is majority contain of clayey and silt. Several tests will be conducted such as direct shear test, moisture content test, standard proctor test, sieve analysis test, Atterberg limit test, unconfined compressive strength. The stabilizer use for the treatment will be lime stabilizer. The purpose of the laboratory test is to understand the properties of soft soil. Besides, laboratory test is conducted to determine the optimum percentage of the lime stabilizer for the soil bearing capacity improvement. Varies percentage of lime stabilizer will be use such as 5%, 10%, 15%, 20%, will be the manipulate factor of the test. The settlement of the soil also will be investigated by using one dimensional odometer test.

1.5 Significance of Study

At the end of the research, the expected finding is the optimum percentage of lime stabilizer to be used as to increase the bearing capacity and to reduce the settlement of soft soil. The load from the structural building must be safely and economically transfer to the foundation and distributed to the soil underneath, this research will help to improve the bearing capacity of the soft soil and can reduce the risk of soil settlement to occur which probably can sustain more loads such as building, house, and it surely will be contribute to the industrial and construction world.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Soft size is defined as soil with poor shear strength, high compressibility and also low permeability. The construction problem is generally the deposit soil is insufficient of bearing capacity, too much settlement, and also instable during excavation. The soil settlement is due to the deformation of the soil by applying stress above it. As settlement of soil happens, the load carrying system will be changed and it will definitely affect the surcharge loading of the soil.

The soil settlement is a result of the low bearing capacity of soft soil. It is obviously show that the soil settlement is the main engineering problem that encounter when a construction is being done above a soft soil area. The consequences of settlement of soil are excessive building distortion and also collapse of buildings. Excessive settlement is also causes the damage of structural to a building frame such as windows and doors. Before any construction of structural, it is necessary to investigate the bearing capacity and also the shear resistance of the soil to safety purpose. Improving settlement is one of the most favourite topics by researcher in geotechnical engineering (Alan J. Lutenegger, 1995).

Soil settlement can be classified to three main type, which are immediate settlement, consolidation settlement and secondary compression. Immediate settlement occurs whit in 7 days after the load has applied. In the other hand consolidation settlement is time dependant, it may takes weeks of months to develop. Secondary compression is also call as creep. It happens under constant effective stress.