EVALUATION OF AGRICULTURAL WASTE MATERIAL AS SOIL STABILIZING AGENT FOR SOFT SOIL

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Dengan hormatnya perkara di atas adalah dirujuk.

Seperti yang tuan/puan sedia maklum, pihak Kementerian Pengajian Tinggi Malaysia telah meluluskan projek seperti tersebut di atas dengan syarat-syarat berikut :

i. Tempoh projek penyelidikan ini ialah 2 tahun, iaitu bermula **1 Januari 2007.**

ii. Kos yang diluluskan ialah sebanyak RM5,000.00 sahaja dan perbelanjaan hendaklah mengikut butiran belanjawan yang telah ditetapkan.

iii. Semua pembelian bahan/peralatan adalah diminta agar tuan/puan mematuhi prosedur perbendaharaan di mana pembelian melebihi RM500.00 hendaklah mengemukakan sebutharga.

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viii. Tuan/puan perlu menandatangani Borang Perjanjian Penyelidikan dengan kadar segera kerana penggunaan geran hanya dibenarkan setelah perjanjian ditandatangani.

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Sekian, harap maklum.

Terima kasih.

'SELAMAT MENJALANKAN PENYELIDIKAN'

Yang benar,

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PERMOHONAN TEMPOH LANJUTAN PROJEK PENYELIDIKAN

Merujuk kepada perkara di atas, pihak RMI telah menerima permohonan tempoh lanjutan projek penyelidikan yang bertajuk **"Evaluation of Agricultural Waste Material as Soil Stabilizing Agent for Soft Soil"** daripada pihak tuan/ puan.

Sukacita dimaklumkan bahawa permohonan tuan/puan untuk melanjutkan tempoh projek penyelidikan adalah diluluskan iaitu dilanjutkan sehingga **30 Jun 2009**.

Pihak RMI berharap projek tersebut dapat disiapkan dalam tempoh yang ditetapkan. Semoga pelanjutan tempoh projek ini dapat membantu pihak tuan/puan untuk menghasilkan projek penyelidikan yang lebih baik.

Sekian, terima kasih.

Yang benar,

PROF. DR. AZNI ZAIN AHMED
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Tuan,

MEMOHON PERTUKARAN KETUA PROJEK BAGI PENYELIDIKAN BERTAJUK: STUDY ON THE PERFORMANCE OF AGRICULTURAL WASTE MATERIAL AS SOIL STABILIZING AGENT FOR SOFT SOIL

Perkara di atas adalah dirujuk.

Sukacita dimaklumkan bahawa permohonan untuk menukar Ketua Projek iaitu **En. Muhammad Sofian Bin Abdullah No K/P 781108-02-5563** untuk menggantikan **Pn. Anas Ibrahim** bagi Projek Penyelidikan ini ***ADALAH DILULUSKAN*** oleh pihak RMI. Sehubungan dengan itu, rekod projek ini akan dikemaskini.

Sekian, semoga projek penyelidikan ini berjalan lancar dan baik.

Sekian, harap maklum.

Yang benar,

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Tarikh : 19 Januari 2009

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PENAMBAHAN AHLI PENYELIDIK: PROJEK PENYELIDIKAN 'EVALUATION OF AGRICULTURAL WASTE MATERIAL AS SOIL STABILIZING AGENT FOR SOFT SOIL'

Perkara di atas adalah dirujuk.

Sukacita dimaklumkan bahawa permohonan tuan/puan untuk menambah seorang lagi ahli penyelidik iaitu **En. Muhammad Hafeez Osman No. Pekerja 218517** adalah ***DILULUSKAN*** oleh pihak RMI.

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Yang benar,

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Tarikh : 10 Jun 2009
No. Fail Projek : 600-IRDC/ST/FRGS.5/3/1186

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Ybhg. Prof.,

LAPORAN AKHIR PENYELIDIKAN 'EVALUATION OF AGRICULTURAL WASTE MATERIAL AS SOIL STABILIZING AGENT FOR SOFT SOIL'

Merujuk kepada perkara di atas, bersama-sama ini disertakan 3 (tiga) naskah Laporan Akhir Penyelidikan bertajuk 'Evaluation Of Agricultural Waste Material As Soil Stabilizing Agent For Soft Soil'.

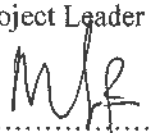
Sekian, terima kasih.

Yang benar,

MUHAMMAD SOFIAN BIN ABDULLAH
Ketua
Projek Penyelidikan

PROJECT TEAM MEMBERS

MUHAMMAD SOFIAN BIN ABDULLAH
Project Leader



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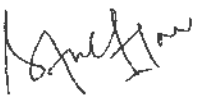

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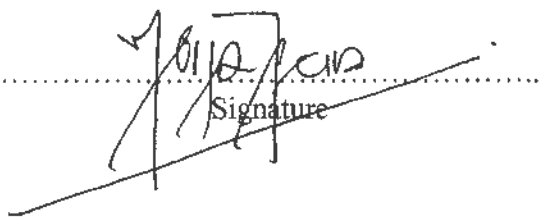

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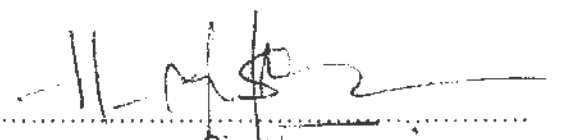

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ABSTRACT

The utilization of agricultural waste (agrowaste) material as stabilize agent in lime stabilization provides a satisfactory solution to some of the environmental concerns and problems associated with the agricultural waste management. Recently, agricultural waste such as rice husk ash (RHA) and are used as a lightweight material for building construction especially for the country that produce a lot of agricultural waste. Lack of research in soil stabilization techniques by using agricultural waste lead an idea on conducting this research. This research focusing on investigating the performance of agricultural waste in soil stabilization. The idea of this research is to improve the shear strength of the silty soil (problematic soil) by adding agricultural waste together with hydrated lime as a stabilizing agent. Three types of agricultural waste were selected namely rice husk ash (RHA), palm oil fuel ash (POFA) and sugarcane baggase ash (SCBA). More than hundreds samples were prepared according to the several mix design. The samples were cured for 7, 14, 28 and 60 days and then tested by using unconfined compressive strength (UCT) as a shear strength test. By the result observation, the agricultural waste had increased the shear strength of the silty soil as the percentage of agricultural waste increased at the longer curing time. As a conclusion, this preliminary test shows that the agricultural waste can be used to stabilized the silty soil and hence reduce the environmental problem.

Keyword: Agricultural waste, Lime, Silty Soil and UCT

CHAPTER ONE

INTRODUCTION

1.1 Background of Research

Malaysia generates a lot of agro waste annually from its plantation crops mainly oil palm, rice, cocoa, coconuts, pineapples and sugar cane which are expected to increase every year. However, systematic management of these wastes has never been given serious attention, although everybody is aware of its consequences to the environment and other economic implications. The agro waste usually will be used as fertilizer or will be disposed without any usage.

Soil stabilization defined as the treatment of a material to improve strength and other physical properties. The stabilization material includes lime, bitumen, polymers and other material can be use to stabilized the problematic soil. Soil stability is closely associated to the structure and mineralogy of the soil particles, soil-water interaction, soil particles ion exchange capacity and the soil inorganic interaction. The objectives of mixing additive with soil are to improve volume stability, strength and stress strain properties. The development of high strength can achieved by reduction of void space, by bonding particles and aggregate together, by maintenance of flocculent structure and by preventing of swelling. Good mixing of stabilizer with soil is the most importance factor affecting the quality of the results. The most commonly used stabilizers are lime and cement. The process occur when the lime added to

stabilize soil, it form a calcium silicate gel which coats and binds soil together and occupies the pores in the soil.

The addition of pozzolanic materials such as rice husk ash (RHA), palm oil fuel ash (POFA) and sugar cane baggase ash (SCBA) to cement-based composites reduces exudation and hydration temperature, potentially improving the performance of the material by increasing stability and cracking resistance (Ganesan, 2007). Furthermore, the pozzolanic reaction as well as pore refinement and filler effect resulting from the addition of pozzolans to cement also improve the durability of the material in the presence of sulfates and prevent the penetration of chloride ions.

In lime stabilization, it is important to create pozzolanic reaction in order to improve the strength of the soil. For silty soils that contain less than 10% clay will need a source of silicates and aluminates to create a bridge between soil particles for the natural cement to form. Since the RHA, POFA and SCBA are pozzolanic material, this research will attempt to investigate the performance of these materials to stabilize the silty soil.

1.2 Research Objective

The objectives of this research are as follows;

1. To evaluate the performance of agrowaste material (RHA, POFA, SCBA) to stabilize silty soil.
2. To determine the optimum lime-agrowaste content to stabilize the silty soil.
3. To study the strength development of treated silty soil.

1.3 Scope of Research

This research is focused on the study of the performance of the agrowaste material with lime as stabilizing agent in silty soil. The silty soil that had been used is getting from Permatang Pauh, Pulau Pinang. Meanwhile, the RHA, POFA and SCBA is getting from the Bumbung Lima, Seberang Perai Utara, Nibong Tebal, Seberang Perai Selatan and Chuping, Perlis respectively. The agrowaste react with lime to create pozzolanic reaction to stabilize the silty soil. More than hundred samples were prepared and curing for 7, 14, 28 and 60 days. Then, unconfined compressive test (UCT) had been conducted on the sample to determine the shear strength of the samples. British Standard is use as reference and guidance.

1.4 Significance of Research

Agriculture helps our country to produce or supply food to us and being one of the biggest economy activities in Malaysia and hence produce a lot of agrowaste that will be disposed without any usage. Therefore, this research will promote the utilization of agrowaste material for the construction purposed and hence reduce the environmental problem. This research also generates a new idea on using a new material to stabilize the silty soil especially for rural road construction.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Stabilized soil is, in general, a composite material that results from combination and optimization of properties in individual constituent materials. Well-established techniques of soil stabilization are often used to obtain geotechnical materials improved through the addition into soil of such cementing agents as Portland cement, lime, asphalt, etc. Replacement of natural soils, aggregates, and cement with solid industrial by-product is highly desirable. In some cases, a by-product is inferior to traditional earthen materials. Due to its lower cost, however, it makes an attractive alternative if adequate performance can be obtained. Often selected materials are added to industrial by-products to generate a material with well-controlled and superior properties (Basha, 2005).

The objective of mixing additives with soil is to improve volume stability, strength and stress strain properties, permeability and durability. The development and high strength and stiffness is achieved by reduction of void space, by bonding particles and aggregates together, by maintenance of flocculent structures and by prevention of swelling. The permeability is altered by modification of pore size and distribution. Good mixing of stabilizer with soil is the most important factor affecting

the quality of results. The two most commonly used stabilizers are cement and lime (Bell, 1994).

2.2 Silty Soil

Silt is produced by the mechanical weathering of rock, as opposed to the chemical weathering that result in clays. This mechanical weathering can be due to grinding by glaciers, abrasion (sandblasting by the wind) as well as water erosion of rocks on the beds of rivers and streams. Silt is sometimes known as 'rock flour' or 'stone dust', especially when produced by glacial action. Mineralogically, silt is composed mainly of quartz and feldspar. Silt has little plasticity; dries quite quickly on the hands and can be dusted off. Silt has a smooth or silky touch, but grittiness can be detected between the teeth. Lumps dry quickly, and when dry have a granular appearance and can be powdered easily (Head, 1992).