

MUD FLOOD AS A SUITABLE MATERIAL FOR SUBGRADE LAYER OF
LOW TRAFFIC VOLUME

NURUL AIN BINTI IBRAHIM

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DEDICATION

For my beloved

Dad: Ibrahim Bin Mamat, Mom: Che Habshah Binti Ismail

Siblings: Muhammad Anis Hafizan, Muhammad Hafis, Muhammad Dudha,
Muhammad Shahiran, Nur Fatin Munirah, Muhammad Naquiuddin and Muhammad
Alif Daniel

Partners: Azizi Ahmad Fadzil and Nur Zamira Abd Wahab

Thanks for your support, understanding and concern.

I will love you all

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ABSTRACT

This paper describes a research carried out to identify the basic properties of mud flood soil and the efficiency of SH-85 stabilizer to improve the unconfined compressive strength of the soil. Based on the soil classification test conducted, mud flood soil can be classified as a fine grained soil and grouped as sandy lean clay. Unconfined Compressive Strength (UCS) test were carried out on untreated and treated soils sample with respect to different curing periods of 3 days, and 7 days. Based on the UCS analysis, 10% of SH-85 stabilized with 7days cured sample was the optimum dosage to achieve the minimum required strength of 0.8MPa as a suitable material for subgrade layer of low traffic volume. FESEM and EDAX analysis were carried out on the optimum strength of mud flood sample to investigate the microstructure of the soil. The result indicates that formation of new cementitious products filled the pore space in the soil structure after the sample being treated with 10% of SH-85 stabilizer (optimum dosage). These chemical reaction takes place on the mud flood sample improved the soil strength.

ABSTRAK

Kertas ini menerangkan kajian telah dijalankan untuk mengenal pasti perlakuan asas tanah banjir lumpur dan keberkesanan pemangkin SH-85 dalam meningkatkan kekuatan mampatan tak terkurung ke atas tanah tersebut. Berdasarkan ujian klasifikasi tanah yang dijalankan, tanah banjir lumpur boleh diklasifikasikan sebagai tanah halus secara terperinci dan dikumpulkan sebagai tanah liat yang berpasir. Ujian kekuatan mampatan tak terkurung telah dijalankan ke atas tanah yang dirawat dan tanah yang tidak dirawat, bersamaan dengan masa pengawetan yang berbeza selama 3 hari dan 7 hari. Berdasarkan analisis UCS, 10% daripada SH-85 distabilkan dengan sampel yang telah diawet selama 7 hari adalah dos yang optimum untuk mencapai kekuatan paling minima yang diperlukan iaitu 0.8 Mpa sebagai bahan yang sesuai untuk lapisan subgred daripada jumlah trafik rendah. Analisis FESEM dan EDAX telah dijalankan ke atas sampel tanah yang kekuatannya paling optima untuk menyiasat mengenai struktur mikro tanah tersebut. Keputusannya menunjukkan penghasilan produk bersimen yang baru telah memenuhi ruang liang dalam struktur tanah setelah tanah itu distabilkan kekuatannya dengan 10% daripada SH-85(optima dos). Reaksi kimia yang bertindak ke atas tanah banjir lumpur ini telah meningkatkan kekuatan tanah itu.

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LIST OF SYMBOLS AND ABBREVIATION

Cc	=	Compression Index
CL	=	Sandy Lean Clay
Cr	=	Recompressive Index
ho	=	Initial Head
hi	=	Final Head
k	=	Coefficient of Permeability
kPa	=	KiloPascal
MPa	=	MegaPascal
mm	=	Millimetres
min	=	Minutes
ρ	=	Density
μm	=	Micrometer
σ	=	stress of material
ε	=	strain of material
FESEM	=	Field Emission Scanning Electron Microscopy
EDAX	=	Energy Dispersive X-Ray Spectrometer
UCS	=	Unconfined Compressive Strength
LL	=	Liquid Limit
PL	=	Plastic Limit

CHAPTER 1

INTRODUCTION

1.1 Background

The successful construction of highways depends on the road structure that capable of carrying the imposed traffic loads. One of the most important layers is subgrade, which the actual foundation of road. However, soft subgrade becomes problems to the transportation engineer in designing pavement since it has low density and affect the life of pavement. Since the removed and replaced of the weak soil with stronger granular material need high cost plus time consuming, the best technique for improving engineering properties of soft soils is by using stabilization techniques. In general, soft subgrades are identified by their in-situ density and California Bearing Ratio (CBR) value. For low volume traffic road, stabilized soft subgrade materials must have UCS of at least 0.8 Mpa for pavement layer based on Malaysia Public Work Department (PWD) specification for low volume roads (JKR, 2012).

Malaysia has experienced severe and life-threatening flood disaster especially at east Malaysia during heavy rains season. Several thickness of mud formed from the flooding phenomena after the reduction of water level. The mud flood was disposed without proper management and being wasted. This mud soil might be

useful after undergo stabilization process that increases their engineering properties. Perhaps, stabilized mud soil can be used as subgrade materials for low volume traffic road.

This study is conducted to access the geotechnical, microstructural, physical and mechanical characteristics of mud flood soil from flooding area at Kuala Krai, Kelantan. In addition, some geotechnical parameters such as grain size distribution and Atterberg's limits were determined. The testing results will be used to characterise the type of mud flood soil. The main aim of this study is to enhance this type of material which could be used as a suitable low traffic volume subgrade road material taking into account of its best physical and mechanical characteristics.

In general, soft subgrades are identified by their in-situ density and CBR value. For low volume traffic road, stabilized soft subgrade materials must have a minimum CBR of 80% and UCS of at least 0.8Mpa for pavement layer based on Malaysia Public Work Department (PWD) specification for low volume roads (JKR, 2012).

1.2 Problem Statement

High-quality materials required for the pavement design to fulfill minimum construction standard. Unfortunately, quality soil materials such as aggregates are scarce even in many areas of the world and the use of these non-renewable resources seem unsustainable. This situation force the engineers to seek an alternative techniques such as soil stabilization to treated a soft and expansive soil. On the other hand, mud flood that formed from flood disposal waste material do not has proper management thus that mud soil become wasted. So, the characteristic of mud flood and the effect of chemical stabilizer being study as to increase the strength of

problematic soil thus study the possibility to use this type of soil as a suitable material for subgrade.

1.3 Objective

The research study is conducted in order to acquire understanding on properties of mud flood as a suitable material for subgrade layer. The objective of this study are as below:

- i. To determine the basic properties and soil classification of mud flood.
- ii. To obtain the optimum percentage of specified stabilizer (SH-85) to achieve targeted strength of low traffic volume road.
- iii. To investigate the microstructure properties of treated and untreated mud flood.

1.4 Scope of study

In order to achieve the objectives of the study, several experimental works was carried out. Soil sample of mud flood were obtained from the flooding area at Kuala Krai, Kelantan. Mud flood undergo some testing such as sieve analysis test, Atterberg limit test, hydrometer test, permeability test, specific gravity, oedometer test, and Unconfined Compressive Strength (UCS) test in order to determine the basic properties of the sample. Stabilizer selected which is SH-85 was introduced into the soil sample to increase the strength properties of the soil. Varies percentage of stabilizer were added into mud flood soil sample so that the targeted compressive strength for low traffic volume subgrade purposes can be achieved. The

microstructure between treated and untreated mud flood were also investigated during this study.

1.5 Significance of study

At the end of the study, this research shall contribute to the advancement of knowledge on the reuse of waste material from flood deposited. Results obtained from the study also can be used as a guideline for engineers, as the properties and strength of flood deposited material can be change to suit a material for low traffic volume subgrade roads by an addition of stabilize agent.

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