UNIVERSITI TEKNOLOGI MARA

PERFORMANCE OF FLOATING SEMI RIGID PULVERIZED FLY ASH STONE COLUMN

NAZARUDDIN BIN ABDUL TAHA

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ABSTRACT

Stone column is among the method commonly used in ground improvement work. Simplicity on installation, cheapest cost and its effectiveness on ground improvement. In this study, Pulverized Fly Ash (PFA) applied as additive material to solve the bulging problem of stone column. Sample of PFA have been used taken from power plant Sultan Salahuddin Abdul Aziz Shah and considered as Class F PFA. In the beginning of study, ten configurations of mixture material (PFA, cement and sand) was proposed to identify the optimum of PFA content. The configurations grouped in two cement content, 10% and 5%. Unconfined Compression Test (UCT) and modified big shear box were conducted to study the behaviour of each configuration before tested on plate load test. From the result obtained found that sample of 70%PFA SC was the highest compressive strength. Meanwhile in direct shear test, 65%PFA was obtains the highest interface shear strength. However, results of interface shear strength for each configuration does not give significant difference. The optimum amount PFA as a filler material was in range 65% to 70% and for sand was in range 30% to 40%. Afterward, three configurations from each group 10% and 5% cement content tested on plate load test to observe the performance of sample on treated soft ground. Comparison study was applied on plate load test, six samples of PFA stone column compared with the conventional stone column and untreated soft soil. The result from plate load test shows that by applying additive materials such PFA and cement on conventional stone column have gave a better result two to four times on settlement improvement ratio and bearing capacity ratio. Numerical modelling was conducted using PLAXIS software in 2-Dimensional model. The numerical model has been verified with the experimental results. Four length and two value of area replacement ratio of each configuration were carried out to study the effect on treatment soft ground. From the generated results shows length of column and wide load area play a vital role on improving soft soil. Dimensional analysis method by using Buckingham Pi-Theorem was applied to analyse the results generated from numerical model for empirical equation prediction. six parameters involved for analysis of settlement improvement ratio and coefficient bearing capacity; undrained shear strength of PFA SC and soft soil, area replacement ratio, depth of soil, length and diameter of column. Both of equation prediction for settlement improvement ratio and coefficient bearing capacity have been compared with previous studies for further evaluation.

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TABLE OF CONTENT

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Nowadays, Environment friendly and sustainability one of the prior aims for engineering sectors. Consequence of utilization fossil fuel of coal in power production could leave negative impact if there no proper regulatory measure be considered. The use of coal for power generation has increased from year to year. China, America, Japan and India are among major consumers of coal in world power generation. Coal can be defined as a readily combustible black or brownish-black rock that consists of 50 percent by weight and more than 70 percent by volume of carbonaceous material (Indexmundi, 2012). In Malaysia, electricity generation from coal has grows at a rate of 9.7 percent per year and is predicted to increase substantially to meet the rising of demand for energy. Industrial sector domains the electricity demand which increase at 5.4 percent annually (Martunus et al., 2008; APERC, 2006). Asia Pacific Energy Research Center (APERC) cited from Inside Malaysia report, among the energy sources, coal is expected to grow rapidly in Malaysia in years soon, with predicted growth in demand 9.7 per cent between 2002 and 2030. The total coal consumption for electricity generation in Malaysia is projected to increase from 12.4 million tons in 2005 to 36 million tons in 2020. The country has huge supplies of coal resources, amounting to around 1.9 billion metric tons. Sarawak has the biggest coal reserves in Malaysia with 69 percent, 29 per cent in Sabah and the remaining two per cent of the reserves are in Peninsular Malaysia (Inside Malaysia, 2012). Coal ash has, since commercialized as a cement admixture in the first half of the 1950's, been widely used in applications such as a raw material for cement, cement mixtures, roadbed material, backfilling material, and embankment material, finding its way mostly into the cement sector, particularly, as a clay-alternative raw material for cement. In Malaysia, about 1200 MW or 20 percent of national electricity is supply by thermal power plant which is using coal as fuel. Stesen Janakuasa Elektrik Sultan Salahuddin Abdul Aziz Shah, Kapar, Selangor is using 100 tons coal per hour to generate 1200 MW for the national grid. Thus, it will be produced is 15 to 20 tone PFA per hour. Millions of tons of pulverized fuel ash produced each year due to the massive consumption of coal (Khairul et al., 2007). Coal ash has