ON-LINE RECOGNITION OF DEVELOPING CONTROL CHART PATTERNS PERFORMANCE OF CONCRETE PAVEMENT CONTAINING COAL BOTTOM ASH

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DEDICATION

This project report is dedicated to my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake. It is also dedicated to my mother, who taught me that even the largest task can be accomplished if it is done one step at a time.

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ABSTRACT

The purpose of this study is to investigate the performance of the concrete pavement contains several percentages of coal bottom ash (CBA). Many power plants produce very large quantity of the coal bottom ash as a waste. The way to get rid of the CBA in very dangerous and could cause hazards to the environment and the surroundings. As using of coal bottom ash can help in solving environmental problems, thus this study is to investigate the possibility of using it as a replacement of fine aggregate in improving the performance of concrete pavement. Concrete specimens prepared containing 0%, 10%, 20%, 30% and 40% of coal bottom ash as a replacement of fine aggregates. This study performed on compressive strength, Porosity, permeability, density and skid resistance. It has been found that the compressive strength decreases with the increase of the coal bottom ash content at early ages. Also, the percentage of the absorption increases as the percentage of CBA content increase. Same as the volume of permeable pore spaces (voids), it also increases with the increase of the CBA content. On the other hand, the density decreases with the increase of the CBA content. Results also show that the British pendulum number increases with the increase of content of the CBA.

ABSTRAK

Tujuan kajian ini adalah untuk mengkaji prestasi turapan konkrit yang mengandungi beberapa peratus sisa arang batu. sisa arang batu yg banyak dihasilkan sebagai sisa industri. Kaedah pelupusan sisa arang batu di tanah terbuka adalah bahaya kepada alam sekitar dan masyarakat sekitar. Penggunaan sisa arang batu boleh membantu dalam menyelesaikan masalah alam sekitar, maka kajian ini adalah untuk mengkaji kemungkinan menggunakannya sebagai pengganti agregat halus dalam meningkatkan prestasi turapan konkrit. Spesimen konkrit disediakan mengandungi 0%, 10%, 20%, 30% dan 40% sisa arang batu sebagai pengganti agregat halus. Kajian ini dilakukan pada kekuatan mampatan, keliangan, kebolehtelapan, kepadatan dan rintangan tergelincir. Didapati bahawa kekuatan mampatan menurun dengan peningkatan kandungan abu bawah arang batu pada usia awal. Sama seperti jumlah ruang liang yang dapat ditapis (lompang), ia juga meningkat dengan peningkatan kandungan sisa arang batu. Sebaliknya, ketumpatan berkurangan dengan peningkatan kandungan abu berasaskan arang batu. Keputusan juga menunjukkan bahawa bilangan pendulum British meningkat dengan peningkatan kandungan sisa arang batu.

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LIST OF ABBREVIATIONS

RHA	-	rice husk ash
FA	-	Fly Ash
MK	-	metakaolin
SF	-	silica fume
LOI	-	Loss on Ignition
CBA	-	Coal Bottom Ash
ACAA	-	American Coal Ash Association
ASTM	-	American Society for Testing and Materials
BPN	-	British Pendulum Number
UTM	-	Universiti Teknologi Malaysia

LIST OF SYMBOLS

A	-	Mass of oven dried sample in air
B	-	Mass of surface-dry sample in air after immersion
C	-	Mass of surface-dry sample in air after immersion and boiling
D	-	Apparent mass of sample in water after immersion and boiling
g1	-	Bulk density, dry
g2	-	Apparent density
ρ	-	Density of water
Mg	-	Mega grams
m	-	meters
kN	-	Kilo Newton
MPa	-	Mega Pascals
D	-	The wet density of concrete
C	-	The cement content
W	-	The free-water content

CHAPTER 1

INTRODUCTION

1.1 Problem Background

The waste of construction and industry is very dangerous to the environment. However, many researches have been studying the suitable alternatives for these wastes. The major problem that is facing the environment and the human being is the disposal of these kinds of wastes. Disposing these kinds of wastes is the main concerns and the most focused subjects to insure a safe environment. Coal bottom ash is considered to be the biggest industrial waste the power plants produce. A study recently shows that the burning around 3 million to of the coal could produce around 1 million on of the bottom ash. The production of many sorts of energy and many sorts of materials such as steel and concrete in mainly uses coal. Coal is considered as a significant source of fuel in Malaysia. Nowadays, fossil fuels become the foremost basis for energy generation. The demand for fossil fuels has increased due to a high demand for electricity generation, as well as the consumption of fossil fuels by several countries such as USA, EU, India, and China.

1.2 Problem Statement

Concrete is a composite material composed of fine and coarse aggregate bonded together with a cement paste that hardens over time. When aggregate is mixed together with dry Portland cement and water, the mixture forms a fluid slurry that is easily poured and molded into shape. The cement reacts chemically with the water and other ingredients to form a hard matrix that binds the materials together into a durable stone-like material that has many uses. Often, additives (such as pozzolans or superplasticizers) are included in the mixture to improve the physical properties of the

wet mix or the finished material. Concrete has been widely used as paving material for highways, airports, streets, local loads, parking lots, industrial facilities, residential areas, and among other types of infrastructures. Concrete pavement is one of the oldest forms of road construction and is still widely used until today. Concrete is the main component of concrete pavements. Concrete pavement is slightly deflected under loading because of the high elasticity modulus of the surface course. By varying the proportions of Portland cement, aggregate, and water, newly mixed concrete pavements exhibit plastic and malleable properties, whereas hardened pavements show strong and durable properties. Concrete has been widely used as paving material for highways, airports, and residential areas, among others. Pozzolanic materials, such as silica fume (SF), fly ash (FA), metakaolin (MK), blast-furnace lag, and rice husk ash (RHA) are used to improve the performance and durability of Portland cement concrete.

Concrete pavement completely depends on flexural strength not as same as concrete asphalt, so it is critically important to find the replacement optimum percentage of the coal bottom ash which gives the highest compressive strength and the other durability factors. Malaysia produces million tons of CBA (coal bottom ash) as an industrial waste. Reusing this waste instead of disposal as a replacement with the fine aggregate in concrete in an environmentally friendly option. Through a number of percentages of coal bottom ash replacements in order to improve the performance and the durability factors of the concrete pavement is the key issue.

1.3 Research Goal

Research Objectives

This study carried out the investigation of replacing the sand (fine aggregates) by CBA (coal bottom ash) with the percentages (0% (control mix), 10%, 20%, 30% and 40%) on concrete pavement and determine the optimum replacement. Compressive

strength test performed on specimens containing mixes with percentages replacement mentioned above in the ages of 7, 14, 28 and 56 days, and some other durability aspects the significantly affects concrete pavement like density, porosity, permeability and skid resistance.

There are a several numbers of objectives that can be achieved by replacing a percentage of fine aggregates with CBA (coal bottom ash), this work is focused at the following objectives:

1) To investigate the properties of the concrete pavement containing coal bottom ash.
2) To determine the optimum percentage of replacing coal bottom ash in the concrete pavement.

1.3.1 SCOPE OF THE RESEARCH

The central question to be examined in this study is to seek the optimum percentage of replacing the fine aggregates with CBA (coal bottom ash) in the concrete pavement. Furthermore, to study the performance of the concrete pavement, more specifically the effects on the compressive strength, density and other durability aspects that influences the concrete pavement.

1.3.2 Significant of the Research

The environmental issue is a major problem in many countries. They are seriously taken this problem with technology and enforcement by law to reduce this pollution. In Malaysia, the way in handling the pollution on coal ash is by using conventional method which is the waste were stored in manmade ponds. This study might contribute to solve some of the coal waste problems and reduce the pollution.

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