TECHNICAL VIABILITY STUDY FOR COMMERCIALISATION OF STEEL SLAG AS NON-CONVENTIONAL MATERIAL FOR THE MALAYSIAN CONCRETE INDUSTRY

BY:`

HJ KAMRAN SHAVAREBI ALI MCIOB

PRO. MADYA ZARINA YASMIN HANUR HARITH MCIOB

JULY 2006

Tarikh: 18.7.2006

NO. Fail Projek: ST 928 (10601)

Prof Dr. Azni Zain Ahmad
Penolong Naib Canselor (Penyelidikan)
Institut Penyelidikan, Pembangunan dan Pengkomersilan
Universiti Teknologi MARA
40450 Shah Alam

Ybhg Prof,

LAPORAN AKHIR PENYELIDIKAN "TECHNICAL VIABILITY STUDY FOR COMMERCIALISATION OF STEEL SLAG AS NON-CONVENTIONAL MATERIAL FOR THE MALAYSIAN CONCRETE INDUSTRY"

Merujuk kepada perkara di atas, bersama-sama ini disertakan 2 (Dua) naskah Laporan Akhir Penyelidikan oleh kumpulan Penyelidik dari Fakulti Senibina ,Perancangan dan Ukur untuk makluman pihak puan.

Sekian, terima kasih.

Yang benar,

HJ KAMRAN SHAVAREBI ALI MCIOB

Ketua
Projek Penyelidikan

TABLE OF CONTENTS

ABSTRACT

Deposits of natural sand, gravel, and stone especially those located close to major urban centers, may get depleted or become costly owing to transportation costs and environmental restrictions. The utilisation of industrial by-products as raw materials need to be carried out rapidly in order to save natural resources become depletes.

This research study describes the work carried out in laboratory to identify the potential usage of Electric Arc Furnace Slag (EAFS) or steel slag as coarse aggregate in concrete as well as its compressive strength and its aggregate properties compared with natural aggregates. The developments and innovations of new material system or the emergence of unconventional construction materials need to be carried out because it brings advantages towards environmental problems and future construction industries since it's just being abundant or rarely in used.

Several mixes of concrete are designed in order to analyse concrete strength incorporating 10%, 50% and 100% of slag aggregate and compared it with control mix which using 100% of granite aggregate. Accordingly, physical properties and Mechanical properties and accelerated durability test (carbonation depth) for granite and steel slag aggregate were investigated.

From the result obtained, the compressive strength of concrete specimen incorporating 100% of steel slag achieved better performance compared with that of natural aggregate concrete for grade 20, 30 and 40 respectively. The mixture with EAFS aggregate presented highest strength result at 28^{th} day. Similarly, some of the physical properties of the EAFS aggregate were better than that of natural aggregate (granite). The steel slag aggregate possesses good physical and mechanical properties and has sufficient stability for use as coarse aggregate in concrete industry in Malaysia.

CHAPTER 1

INTRODUCTION

1.1 AN OVERVIEW

Concrete is the most widely used construction material commonly made by mixing portland cement with sand, crushed rock and water. There are several reasons in why concrete is most widely used as engineering material; possesses excellent resistant to water; ease with which structural concrete element can be formed into a variety of shapes and sizes; and the cheapest and most readily available material on the job. (Mehta and Monteiro, 1993)

As the human civilisation has entered 21st century that brings along a huge population increase and aggressive consumption of natural resources, we are challenge to look for new alternatives for construction raw material in order to effectively used our already depleting resources. Therefore, in the future, considerations of energy and resource conservations are likely to make the choice of concrete as a structural material more attractive. (Swamy, 1983)

1.2 BACKGROUND OF STUDY

As the volume of waste and by-product materials generated in our society and the cost of disposal continue to increase, the needs to increased pressure and incentive to recover and recycle these materials for use in secondary applications must be executed. The advantages of using industrial by-product as raw material in construction offers triple benefits, namely, conservation of fast-declining natural resources, planned gainful exploitation of waste