UNIVERSITI TEKNOLOGI MARA

PERFORMANCE OF SELF CONSOLIDATING CONCRETE WITH RECYCLED CONCRETE AGGREGATE

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Self Consolidating Concrete (SCC) is an emerging class of concrete materials that offers great potential for improved ease of positioning and scaled down cost through reduced time and labour. Generally, tonnes of Construction and Demolition Wastes (C&DW) are raised daily. The situation is similar to the paper industry where large amount of the wastes or paper sludge generated every day and at the same time bringing potential and devastating harmful impact to the surroundings. For this reason, the search into the use of coarse and fine recycled concrete aggregate produced from crushed concrete waste is looked into. Many researchers had found that waste materials have unique properties that could improve the quality of self consolidating concrete produced. Nevertheless, on that point there is no study available on using Waste Paper Sludge Ash (WPSA) as cement and coarse and fine Recycled Concrete Aggregate (RCA) as coarse and fine aggregate replacement materials respectively in self consolidating concrete. Therefore, the reuse of RCA and WPSA generated as the supplemental material for the replacement of aggregate and cement are significant in reducing the environmental impact. This research was focused on the strength characteristic and the chloride permeability level of SCC containing RCA and WPSA. The influence of RCA content in the range from 0% to 100% of Natural Aggregate (NA) to the strength characteristic and the chloride permeability level of SCC containing optimum WPSA was identified and compared with SCC containing normal mixes. In this research, three (3) series of concrete specimens were cast with different water cement ratios (0.53, 0.49 and 0.45). The concrete specimens were subjected to strength at the age of 3, 7, 14, 21, 28, 56 and 90 days and durability at the age of 28, 56 and 90 days. The result indicated that the compressive strength and chloride permeability of SCC containing 100% RCA replacement give better performance than the 0% RCA replacement. Based on the finding, SCC containing 100% RCA replacement can be categorized same as a conventional concrete hence it can be utilized for construction purposes. RCA can also acts as an alternative replacement in concrete for replacing the NA.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

The use of self-consolidating concrete has gained a wider acceptance in current years. It is not only reduces noise due to a vibration free environment, but also shortens the duration of construction. The term Self-Consolidating Concrete (SCC) refers to a novel type of high performance concrete mixture which flows under its own weight while maintaining sufficient resistance to segregation. Segregation resistance plays an important role for SCC because poor segregation resistance would cause poor deformability, blockage around congested reinforcement and non-homogeneous properties of the hardened concrete (Khayat *et al.* 1999). In order to increase the segregation resistance of SCC, high powder (i.e. limestone powder, fly ash) content is normally required. Instead, a viscosity agent often employed to insure a high resistance to segregation (Khayat *et al.* 1997).

There are many factors that influence to the performance of SCC. One of the major factors is the quality and properties of aggregate. The use of construction waste as a source of aggregate for the production of new concrete has become more common in the recent decade. The increasing charges for landfill, on the one hand, and the scarcity of natural resources of aggregate, on the other hand, encourages the use of waste from construction sites as a source for aggregates. Aggregate is an important component material used to produce concrete whereby about 75% of concrete mixtures consist of aggregates (Kothai and Malathy, 2014). The Freedonia Group (2009) reported that the worldwide demand for coarse and fine aggregates is forecasted to increase 2.9 percent annually through 2013 to 28.7 billion metric tons, valued at $128 billion. The demand for the natural aggregates has caused an increase in the exploitation of aggregate sources that eventually lead to their scarcity. Thus, the need for preserving the natural resources from exhaustion and finding the proper way to reuse the construction waste material.

In a research carried out by Department of Statistics [Malaysia] (2002) on middle income countries (Malaysia included) it shows that about 34,000,000 tons of