UNIVERSITI TEKNOLOGI MARA

PROPERTIES OF QUARRY DUST FINE POWDER (QDFP) CONCRETE

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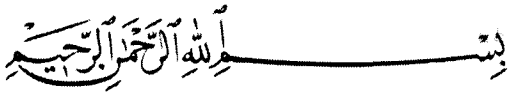
ABSTRACT

Concrete is a popular construction material all over the world and cement is the most important constituents for its production. However, the production of cement creates some problems to the environment that can pose particular risks to human and living things on earth. Therefore, study on the suitability of using by-product materials as partial cement replacement (PCR) in concrete become popular among the researchers and builders. Industrial by-products such as fly ash, rice husk ash, silica fume, slag, palm oil fuel ash have been investigated by PCR. However, study on Quarry Dust (QD) is still lacking. Quarry Dust Fine Powder (QDFP), considered as a by-product material is obtained from the grinding process of QD. QDFP contains high silica content that is almost 70% which is four times higher than OPC. According to ASTM C618-2003, QDFP can be classified as pozzolanic material. Thus, this research was conducted to determine the suitability of QDFP as PCR in concrete. This research highlights the performance of QDFP concrete by conducting mechanical properties tests which were compressive strength (destructive test) and Schmidt Rebound Hammer (non destructive test), while the durability index tests consist of water permeability and water absorption tests. Various QDFP concrete made of four different water binder (w/b) ratios (0.3, 0.4, 0.5 and 0.6) with different replacement of QDFP which are 3%, 5%, 10% and 15% by weight of cement were prepared. The specimens were tested at 7, 28, 60, 90 and 120 days of water curing. The results show that higher replacement level of cement with QDFP (up to 15%) lower the compressive strength, lower rebound number readings, increase the coefficient of permeability and increase the water absorption in comparison with the plain OPC concrete. Prolong the days of curing would increase the compressive strength and rebound number readings and enhanced permeability and water absorption characteristics of QDFP concrete. It also exhibited that the compressive strength and rebound number readings taken decreased as the w/b ratio increases. In contrast, the coefficient of permeability and water absorption increased with higher w/b ratio. From Analysis of Variance (ANOVA), the p-values obtained confirmed that there is significant difference and significant interaction among the different ratios and different replacement of QDFP concrete. The regression analyses presents the relationship between the compressive strength, rebound numbers readings, coefficient of permeability and water absorption of QDFP concrete. The overall tests result revealed that QDFP can be utilized in concrete mixture as PCR.

ACKNOWLEDGEMENT



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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Concrete is one of the most widely used material in construction industry. Based on the global usage, concrete placed second after water as a utilized substance (Safiuddin *et al.*, 2007). In construction industry, the use of concrete become most popular among the engineers and builders as the concrete give benefits in term of its low cost, availability of construction, workability, durability and its convenient compressive strength (Abd *et al.*, 2008; Nima *et al.*, 2011).

Cement is an essential component of concrete. The most commonly used cement in general concrete construction is Ordinary Portland cement (OPC). In Malaysia, there are many companies associated with cement productions such as Lafarge Malayan Cement (LMC), Tasek Corporation Berhad, Yeoh Tiong Lay (YTL) Corporation Berhad and Cement Industries of Malaysia Bhd (CIMA). The cement produced should meets the quality requirements specified in MS 522: Part 1: 1989 under an effective system of testing, control and monitoring conforming to requirements under Standards and Industrial Research Institute of Malaysia (SIRIM). Recently, the demand of cement is rapidly increasing and it will continue to grow. Rashid Hussein Bank (RHB) Research Institute Sdn Bhd forecasted that the demand for domestic cement consumption in Malaysia grows to 6% year to year from 16 million tonnes in 2010 to about 18 million tonnes in 2012 (The Borneo Post, 2011). However, the production of cement associated with problems related to environment such as pollutions and global warming. Mehta (1999) stated that the production of 1 metric-tonne of cement results in the emission of about 1 metric-tonne of CO_2. Besides, the cost per bag of cement is expensive due to the increasing of worldwide demand of cement for construction industry.

With the increasing cost of concrete, tremendous efforts have been done in the area of concrete technology to utilize by-products and waste materials which can be as a partial cement replacement (PCR) in concrete production. The application of blended cement in replacing Portland cement has been introduced to suit the current requirements (Raman *et al.*, 2005a; Meyer, 2009; Sumrerng, 2008). In last decade, cementitious materials also known as pozzolans are used as constituents in concrete. Thus, many