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By

ABDUL HALIM BIN ABDUL GHANI

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MECHANICAL BEHAVIOR OF MULTIPLE BLENDED BINDERS MODIFIED CONCRETE UTILIZING LOCAL WASTE PRODUCT

By

ABDUL HALIM BIN ABDUL GHANI

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hereby declare that the thesis is based on my original work except for quotation and citations which have been duly acknowledgement. I also declare it has not been previously or concurrently submitted for any other degree at UTP or other institutions.

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ABSTRACT

Waste materials and by-products are undesirable material for the environment and these materials are eventually disposed of in landfills that are becoming scarce and expensive at the same time, leading to a waste disposal crisis. Several studies have been reported on the use of waste such as rice husk ash (RHA), silica fume (SF), PFA and microwave incinerator rice husk ash (MIRHA) as cement replacement material to produce durable concrete. The effect of the cement replacement material (CRM), when the SF, PFA and MIRHA combined together, the concrete quality have never been studied before. The multiple blended binders mix propoportions was design to be achieve certain category of concrete with respect to the strength, surface hardness, durability and cost are always important for concrete construction so that an appropriate mix is adopted for a given type of work. Selected waste products namely MIRHA, SF and PFA were used to replace ordinary Portland cement (OPC) from 0 to 28%. Several tests used conducted to monitor performance of these binders not only acting individually but also acting in combination.

The performance of the concrete with the various combination of binders was determined by slump value, ultrasonic (UPV), surface hardness, tensile strength, gas permeability and compressive strength test and the test results showed that MIRHA concrete containing multiple blended binders can perform better than OPC, SF and PFA control mix. 8% silica fume, 10% pulverized fuel ash and 5%, 7.5% & 10% microwave incinerator rice husk ash (MIRHA) were adopted as cement replacement material for sixteen (16) trial mixes.

Multiple blended binders concrete using waste product can still maintain the workability by utilising Sp. Even this waste material can cause a reduction in height of slump. Based

on the results obtained the compressive strength reached 70MPa which is the target strength for this research and it could be concluded that multiple blended binders could produce high-strength concrete. The multiple blinded binders concrete can be used as cement hardener or a part of structure repair material. The multiple blinded binders concrete also contributes to green building and sustainability environmental. Therefore, the multiple blinded binders concrete will increase durability properties. Indirectly, the multiple blinded binders concrete will also make a pro-long life span of the concrete.

A computer program was developed to identify the volume mix design with multiple blended binders for various grades and durability. Used this computer program also can be provided information in order to find out how much binders were needed to achieve a required strength and also to determine the actual price of the concrete.

ABSTRAK

Bahan buangan dan hasil sampingan ialah bahan tidak menyenangkan untuk persekitaran dan bahan-bahan ini akhirnya dihapuskan dengan menimbus yang menjadi sukar didapati dan mahal pada masa yang sama membawa kepada krisis pembuangan sisa.

Beberapa kajian telah dilaporkan pada penggunaan sisa seperti abu sekam padi (RHA), wasap silika (SF), abu bahan api terhancur (PFA) dan pembakar yang menggunakan gelombang mikro abu sekam padi (MIRHA) sebagai bahan gantian simen yang menjanakan ketahanan konkrit. Kualiti konkrit bagi kesan bahan gantian simen (CRM) ini, apabila digabung bersama masih lagi tidak pernah dikaji sebelum ini . Bahagian campuran pengikat bercampur berbilang yang dicadangkan akan mencapai kategori tertentu iaitu mengeras terhadap kekuatannya, ketahanan dan kos pembelanjaan amat penting untuk pembinaan konkrit supaya satu campuran yang sesuai dapat diterima untuk sesuatu jenis kerja.

Bahan sisa terpilih iaitu MIRHA, SF dan PFA digunakan untuk menggantikan simen Portland biasa (OPC) dari 0% hingga 28%. Beberapa ujian dijalankan bagi memenuhi sesuatu pretasi tertentu penjilid ini bukan sahaja bertindak secara individu tetapi juga bertindak dalam kombinasi.

Prestasi konkrit dengan pelbagai kombinasi penjilid telah ditentukan oleh nilai kebolehkerjaan, ultrasonik (UPV), kekerasan permukaan, kekuatan tegangan, ujian kebolehtelapan gas dan kekuatan mampatan dan keputusan ujian menunjukkan yang konkrit MIRHA mengandungi penjilid bercampur berbilang boleh bekerja dengan lebih baik daripada OPC, SF dan PFA dalam campuran kawalan.

8% silika wasap, 10% abu bahan api terhancur dan 5%, 7.5% & 10% pembakar yang menggunakan gelombang mikro abu sekam padi (MIRHA) telah diambil sebagai bahan gantian simen untuk enam belas (16) campuran percubaan. Berdasarkan keputusan, penjilid bercampur memperolehi kekuatan mampatan mencecah 70MPa yang mana kekuatannya memenuhi sasaran untuk penyelidikan ini dan ia boleh dibuat kesimpulan yang penjilid bercampur berbilang boleh menghasilkan konkrit berkekuatan tinggi. Penjilid bercampur berbilang ini juga boleh digunakan pada permukaan struktur yang memerlukan kekuatan pada permukaan atau boleh digunakan sebagai bahan baik-pulih struktur yang rosak. Ia juga dapat menyumbang kepada “green building” dan “sustainability environmental”.

Satu program komputer diciptakan untuk mengenal pasti bahagian jumlah campuran dengan penjilid bercampur berbilang untuk pelbagai gred dan ketahanan.
Berteraskan program komputer, maklumat boleh diperolehi supaya dapat mengetahui berapa banyak penjilid diperlukan untuk mencapai sesatu kekuatan yang diperlukan dan juga menentukan harga sebenar konkrit.

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