THE ASSESSMENT ON THE ACCEPTANCE OF WASTE MATERIALS AS A PARTIAL CEMENT REPLACEMENT IN MALAYSIA CONSTRUCTION INDUSTRY

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We hereby declare that We have checked this thesis, and, in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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ABSTRAK

Di Malaysia, kerja pembinaan telah meningkat dalam beberapa tahun. Namun begitu, peningkatan industri pembinaan ini telah menyebabkan peningkatan pengeluaran simen. Pengeluaran simen telah menyebabkan implikasi kepada persekitaran yang menjadi punca utama isu ancaman global. Untuk mengawal masalah ini, beberapa penyelidikan telah dilakukan beberapa dekad yang lalu bagi mencari bahan buangan yang mempunyai sifat kimia dan mekanikal yang sama sekaligus dapat digunakan sebagai pengganti simen secara separa didalam industri pembinaan. Sebilangan besar hasil kajian menunjukkan prestasi positif, malangnya penyelidikan ini berhenti di peringkat penyelidakan sahaja dimana semua bahan buangan ini jarang digunakan di dalam industri pembinaan. Hal ini kerana, industri di Malaysia tidak menggunakan bahan buangan ini di dalam kerja pembinaan mereka oleh alasan yang tidak jelas. Oleh itu, kajian ini dilakukan untuk mengkaji faktor-faktor ketidaklaksanaan bahan buangan sebagai pengganti secara separa kepada simen di dalam industri pembinaan di Malaysia dari sudut perspektif industri. Kajian ini bertujuan untuk mengkaji penerimaan bahan buangan sebagai pengganti kepada simen secara separa. Untuk mencapai matlamat tersebut, objektif kajian ini adalah; (1) Menganalisis sifat dan prestasi bahan buangan didalam konkrit; (2) Mengenal pasti faktor-faktor ketidaklaksanaan bahan buangan sebagai pengganti kepada simen secara separa; (3) Penyelesaian yang sesuai bagi melaksanakan pengunaan bahan buangan di dalam industri pembinaan di Malaysia. Objektif pertama dapat dicapai dengan tinjauan literatur secara intensif dan sesi wawancara bersama 10 pakar di dalam sektor kerajaan dan swasta iaitu Jabatan Kerja Raya (JKR), kontraktor berdaftar di dalam Kelas G1-G7, perunding serta pembekal. Untuk mencapai obketif kedua dan ketiga,140 set soalan soal selidik telah diedarkan kepada responden yang mempunyai latar belakang didalam industri pembinaan di Malaysia. Data yang diperoleh dari sesi temu bual dan soal selidik telah dianalisa menggunakan kaedah Relative Importance Index (RII) bagi mencari kriteria mengikut kepentingan relatif bagi faktor dan penyelesaian masalah kajian ini. Sebelum menjalankan RII, Common Method Bias (CMB) dan Cronbach's Alpha Analisa,α telah dijalankan untuk mengkaji kebolehpercayaan kajian dan keputusan bagi CMB ialah 32.665% dan α=0.976. Daripada RII analisa, faktor utama ke tidaklaksanaan bahan buangan adalah; (1) Syarikat, pelanggan dan pengguna akhir tidak mengetahui jenis bahan buangan yang ada; (2) Syarikat, pelanggan dan pengguna akhir takut dengan kegagalan produk dan jangka hayat pembinaan menggunakan bahan buangan; (3) Kekurangan data kuantitatif sifat konkrit menggunakan bahan buangan; (4) Syarikat, pelanggan dan pengguna akhir bimbang mengenai kualiti konkrit yang mengandungi bahan buangan tidak sama seperti kualiti konkrit biasa; (5) Kurangnya pengetahuan umum mengenai penggunaan dan faedah bahan buangan; (6) Syarikat tidak yakin dengan penerimaan pembeli; (7) Kekurangan pasaran untuk membeli bahan buangan; (8) Kekurangan peralatan untuk memproses bahan buangan sebelum digunakan dalam simen; (9) Syarikat tidak mempunyai permit untuk menggunakan bahan buangan; (10) Ruang tambahan diperlukan untuk menyimpan bahan buangan sebelum digunakan; (11) Kekangan kewangan dan masa bagi memproses bahan buangan. Oleh iu, penyelesaian yang paling sesuai adalah; (1) Industri harus lebih terbuka dan inovatif; (2) Universiti dan industri harus mewujudkan hubungan yang lebih baik; (3) Lebih banyak penyelidikan, analisa dan data mengenai bahan buangan harus dilakukan; (4) Lebih banyak program dan persidangan pendidikan harus dilakukan; (5) Badan kerajaan harus memainkan peranan dengan meluluskan dan memasukkan penggunaan bahan buangan dalam klausa. Oleh itu, kajian ini dapat dijadikan rujukan untuk mengatasi masalah kajian.

ABSTRACT

In Malaysia, the construction works have been increasing in several years. However, the increased number of construction works have led to an increase of cement production. The production of cement itself has caused wider environmental implications which is the main cause of global threat issues. To control the problem, several researches has been conducted in the past few decades to find new waste materials that have the same chemical and mechanical properties which can be used as a partial cement replacement in construction. Most of the results showed a positive performance of concrete containing waste materials, unfortunately this research stopped at the research stage only where all of these waste materials are rarely used in the construction industry. This is because, most industry in Malaysia do not use these waste materials as a partial cement replacement in their construction work due to unclear reasons. Therefore, this study has been conducted to investigate the factors of un-utilizing of waste materials as a partial cement replacement in Malaysia's construction industry from an industrial perspective. This study aims to investigate the acceptance of waste materials as a partial cement replacement. To achieve that aim, the objectives are to (1) To analyse the properties and performance of waste materials in concrete; (2) To identify the factors of un-utilizing waste materials as a material for partial cement replacement (3) To identify a suitable solution to utilize the use of waste materials in the Malaysian construction industry. The first objective can be achieved by intensive literature review on the properties and performance of waste materials in concrete and an interview session with 10 experts from the government and private sector which are Jabatan Kerja Raya (JKR), registered contractor Class G1-G7, consultants as well as suppliers. To achieve second and third objective, a total of 140 sets of questionnaire surveys were distributed to all the respondents from a construction site background in Malaysia. The data obtained from the interview sessions and questionnaire design on the factors of un-utilizing of waste materials as a partial cement replacement and the solutions to overcome the related problems has been analysed by using the Relative Importance Index method (RII). Before conducting the RII, Common Method Bias (CMB) and Cronbach's Alpha analysis, α has been conducted to investigate the reliability of the study and the results for CMB is 32.665 % and α=0.976. From the RII analysis, the main factors of un-utilizing of waste materials are (1) The company, client and end user are unfamiliar with the type of waste materials available; (2) The company, client and end user fear a product failure and service life of construction using waste materials, (3) Lack of quantitative data on the properties of concrete using waste materials; (4) Company, client and end user fear that the quality of concrete containing waste materials are not the same with the quality of normal concrete; (5) Lack of general knowledge regarding the usage and benefits of waste materials; (6) The company is not sure of the buyer's acceptance; (7) Lack of market to buy waste materials; (8) Lack of equipment to process the waste materials before used in cement; (9) The company does not have special permits and regulations to use waste materials; (10) Extra space needed to store waste materials before been used; (11) Financial and time constraints in processing waste materials. Therefore, the suitable solutions are; (1) Industry should be more open and innovative; (2) Universities and industry should create a better connection; (3) More research, analysis and data regarding waste materials should be done; (4) More educational programmes and conferences should be conducted; (5) Government should play a role by approving and including the usage of waste materials in a clause. Thus, this study can be a reference to overcome the study problem.

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