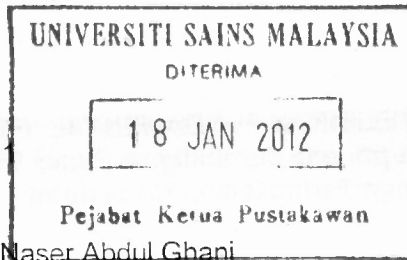




USM UNIVERSITI
SAINS
MALAYSIA

Pejabat Pengurusan Dan Kreativiti Penyelidikan
Research Creativity and Management Office

No. Fail : F0353
Tarikh : 2 Disember 2011



Canselori,

Universiti Sains Malaysia
Aras 6, Bangunan Canselori
11800, USM Pulau Pinang
T : (6)04-653 3108/3178/3988/5019
F : (6)04-656 6466/8470
(6)04-653 2350
L : www.research.usm.my

Prof. Madya Ir. Dr. Abdul Naser Abdul Ghani
Pusat Pengajian Perumahan, Bangunan & Perancangan
Universiti Sains Malaysia

Tuan,

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)

Tajuk Projek : Investigation of Strength and Durability of Paper Based Concrete for
Development of Design Formula and Procedures

No. Akaun : 203/PPBGN/671144

Dengan hormatnya perkara di atas dirujuk.

2. Terlebih dahulu saya ucapkan ribuan terima kasih di atas satu salinan laporan akhir untuk projek penyelidikan seperti tajuk di atas.

3. Adalah dimaklumkan walaupun projek ini telah selesai, kerjasama Jabatan Bendahari dipohon untuk menguruskan penutupan akaun projek pada selewat-lewatnya **31 Disember 2011**. Tempoh ini bertujuan untuk menyelesaikan semua urusan tuntutan dan bayaran yang telah dibelanjakan di dalam tempoh projek. Walau bagaimanapun, tuan dinasihatkan supaya tidak mengeluarkan borang-borang pesanan baru di dalam tempoh ini.

4. Selanjutnya sila ambil perhatian terhadap perkara-perkara berikut sekiranya berkaitan:

- (i) Semua penerbitan harus merakamkan penghargaan kepada **Skim Geran Penyelidikan Fundamental (FRGS)** dan tuan dipohon mengemukakan satu salinan ke Pejabat ini.
- (ii) Bahagian Penyelidikan & Inovasi boleh/akan mengagihkan semula peralatan yang telah dibeli menggunakan peruntukan geran ini seandainya terdapat penyelidik lain yang memerlukan peralatan tersebut.

5. Akhir sekali, tahniah di atas usaha dan kejayaan pihak tuan dapat menyelesaikan projek ini dengan jayanya.

Sekian, terima kasih.

“BERKHIDMAT UNTUK NEGARA”
‘Memastikan Kelestarian Hari Esok’

Yang menjalankan tugas,

(AMRA OTHMAN)
Penolong Pendaftar
Unit Pengurusan Geran & Kontrak

HAN, HAR, SM

LAPORAN AKHIR SKIM GERAN PENYELIDIKAN FUNDAMENTAL (FRGS)


Tajuk Projek : Investigation of Strength and Durability of Paper Based Concrete for
Development of Design Formula and Procedures

No. Akaun : 203/PPBGN/671144

s.k. Dekan Penyelidikan
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

Dekan
Pusat Pengajian Perumahan, Bangunan & Perancangan
Universiti Sains Malaysia

Timbalan Dekan
(Pengajian Siswazah & Penyelidikan)
Pusat Pengajian Perumahan, Bangunan & Perancangan
Universiti Sains Malaysia

 Ketua Pustakawan
Perpustakaan Hamzah Sendut
Universiti Sains Malaysia

Penolong Bendahari Kanan
Unit Kumpulan Wang Penyelidikan
Jabatan Bendahari
Universiti Sains Malaysia

Pegawai Sains
Pelantar Sains Fundamental
Pejabat Pelantar Penyelidikan
Universiti Sains Malaysia

} Disampaikan satu salinan laporan akhir
projek untuk simpanan Perpustakaan

} Mohon kerjasama pihak puan untuk
menguruskan penutupan akaun projek
selewat-lewatnya pada **31 Disember**
2011 dan mohon kemukakan satu salinan
penyata kewangan terakhir ke Pejabat ini
untuk tujuan rekod



**FINAL REPORT
FUNDAMENTAL RESEARCH GRANT SCHEME (FRGS)**

*Laporan Akhir Skim Geran Penyelidikan Asas (FRGS) IPT
Pindaan 1/2010*

A RESEARCH TITLE : Investigation of Strength and Durability of Paper Based Concrete
Tajuk Penyelidikan

PROJECT LEADER : Ir Dr Abdul Naser Abdul Ghani
Ketua Projek

PROJECT MEMBERS : 1. Dr Noor Faisal Abas
(including GRA) 2. Dr Mohd Zailan Sulieman
Ahli Projek 3. Ritzawaty Mohd Shukeri

PROJECT ACHIEVEMENT (*Prestasi Projek*)

B ACHIEVEMENT PERCENTAGE					
Project progress according to milestones achieved up to this period	0 - 50%		51 - 75%		76 - 100%
Percentage					100
RESEARCH OUTPUT					
Number of articles/ manuscripts/ books <i>(Please attach the First Page of Publication)</i>	Indexed Journal			Non-Indexed Journal	
Conference Proceeding <i>(Please attach the First Page of Publication)</i>	International			National	
	1 (first page attached)				
Intellectual Property <i>(Please specify)</i>					
HUMAN CAPITAL DEVELOPMENT					
Human Capital	Number				Others (please specify)
	On-going		Graduated		
Citizen	Malaysian	Non Malaysian	Malaysian	Non Malaysian	
PhD Student					
Master Student			1 graduated in 2010		
Undergraduate Student					
Total			1		

EXPENDITURE (Perbelanjaan)

C Budget Approved (Peruntukan diluluskan) : RM 120,000.00
Amount Spent (Jumlah Perbelanjaan) : RM 120,000.00
Balance (Baki) : RM 0
Percentage of Amount Spent : 100 %
(Peratusan Belanja)

**ADDITIONAL RESEARCH ACTIVITIES THAT CONTRIBUTE TOWARDS DEVELOPING SOFT AND HARD SKILLS
(Aktiviti Penyelidikan Sampingan yang menyumbang kepada pembangunan kemahiran insaniah)**

D

International		
Activity	Date (Month, Year)	Organizer
(e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit)	International Conference on Built Environment in Developing Countries 2008 (Dec 2008)	USM
National		
Activity	Date (Month, Year)	Organizer
(e.g : Course/ Seminar/ Symposium/ Conference/ Workshop/ Site Visit)		

PROBLEMS / CONSTRAINTS IF ANY (Masalah/ Kekangan sekiranya ada)

E The research could have taken shorter time if the testing and instrumentation works were supported by a full time electronic expert.

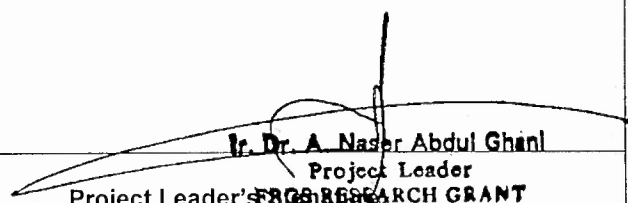
RECOMMENDATION (Cadangan Penambahbaikan)

F An electronic/instrumentation officer or experience electronic/instrumentation technician should be hired as full time staff for the laboratory.

G

This research documented extensive literature review on the subject and discusses the results of an investigation of utilization of wastepaper as additional materials in concrete mixes, for which it must be assured that the resulting concrete has the proper mechanical strength. In preliminary works on the subject, it was found that the addition of wastepaper reduces the mechanical strength of concrete. The test results also revealed that as the content of the paper increased the water to cement ratio for the mix was also increased. With the addition of 25% wastepaper in proportion to the amount of cement, the mechanical strength decreases significantly. Concrete mixes containing various contents of the paper were prepared and basic strength characteristics such as compressive strength, splitting tensile, flexural, ultrasonic pulse velocity, carbonation, water absorption, and unit weight were determined and compared with the controlled mix. Four concrete mixes containing the wastepaper, which are controlled mix, 5%, 10%, 15% as an additional materials to concrete were prepared with ratios of 1:2:3 by weight of cement, sand, and gravel respectively. The maximum size of gravel was 20mm. It was found that wastepaper content of up to 5% in concrete mix can produce acceptable concrete strength for structural applications. It was also found that concrete tensile strength increased by 3.5% as a result of the 5% wastepaper addition.

Therefore, the addition of waste paper sludge in concrete mix reduces compressive strength of the concrete but improves the tensile strength. Tensile strength improvement can be beneficial for concrete and reinforced concrete construction. However, it was also discovered that carbonation effect from waste paper addition could limit the use of steel as reinforcement material. This could lead to the use of other material such as polymeric material as new reinforcement alternatives. Nevertheless, the increase in tensile strength alone is a discovery that could lead to more detail investigations on the advantages of using waste paper in concrete mix especially for possible application in crack control.


Ir. Dr. A. Naser Abdul Ghani
Project Leader
Project Leader's SIGNATURE
Account No: 203/PPBM/671144

Date : Mar 3 2011
Tarikh

Project Leader's SIGNATURE
Tandatangan Ketua Projek

COMMENTS, IF ANY/ ENDORSEMENT BY RESEARCH MANAGEMENT CENTER (RMC)

(Komen, sekiranya ada/ Pengesahan oleh Pusat Pengurusan Penyelidikan)

H

.....
.....
.....

Name:
Nama:

Signature:
Tandatangan:

Date:
Tarikh:

CONCRETE MIX WITH WASTEPAPER

Ritzawaty binti Mohamad Shukeri² and A. Naser Abdul Ghani¹

^{1, 2}Universiti Sains Malaysia, Pulau Pinang, Malaysia

Corresponding Author: ritz_ms@hotmail.com

ABSTRACT: Malaysia is facing a serious challenge in disposing of waste in the many landfills throughout the country that are near or at capacity. The landfill situation is resulting in high disposal costs and potential environmental problems. If current trends continue, with waste production projected to grow by 5% each year, landfills would be at full capacity by 2020. This paper reports on the results of an investigation of utilization of wastepaper as additional materials in concrete mixes to be used for housing projects, for which it must be assured that the resulting concrete has the proper mechanical strength. Concrete mixes containing various contents of the paper were prepared and basic strength characteristics such as compressive strength, splitting tensile, flexural, and water absorption were determined and compared with a control mix. Four concrete mixes containing of the waste, which are control mix, 5%, 10%, 15% as an additional materials to concrete were prepared with ratios of 1:2:3 by weight of cement, sand, and aggregate respectively. The maximum size of aggregate was 20mm. In earlier work on the subject during trial mix, it was shown that the addition of wastepaper reduces the mechanical strength of concrete. The test results also revealed that as the content of the paper increased the water to cement ratio for the mix was also increased. With the addition of 25% wastepaper in proportion to the amount of cement, the mechanical strength decreases significantly. Overall, a high correlation was observed between density and strength of concrete containing paper.

Keywords: Wastepaper, Compressive strength, Concrete mix

1.0 INTRODUCTION

This research is aim to evaluate the addition of wastepaper to concrete mix, to study the effect of wastepaper on the strength of concrete, and to develop mixture proportions for concrete containing wastepaper. Wastepaper has been used as building materials for decades, especially in cementitious matrices, and since then a lot of research has been conducted to develop the mechanical properties of the composite like compressive, tensile, flexural strength, and etc. Most of the published works on recycling of papers are from paper mill (Bai et al., 2003; Chin et al., 1998; Chun et al., 2006; Gallardo, 2006; Kraus, 2003; Naik et al., 2004), or to manufacture cement board (Fuwape et al., 2007; Okino, 2000).

Use of wastepaper in structural concrete could become an economical and profitable substitute to landfills, incinerator, or other use options.

No research results have been reported on the use of wastepaper in structural concrete. This paper reports the results of research on the use of wastepaper in concrete.