

**INVESTIGATION ON THE POTENTIAL OF LOCAL AGGREGATES IN PRODUCING HIGH STRENGTH
CONCRETE WITH FLY ASH**



**RESEARCH MANAGEMENT INSTITUTE (RMI)
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR
MALAYSIA**

BY :

**NARITA BINTI NOH
CHIEW FEI HA
SITI ZAIDAH OTHMAN**

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1. Letter of Report Submission

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Assistant Vice Chancellor
Research Management Institute(RMI)
Universiti Teknologi Mara
40450 Shah Alam

Dear YBhg Professor,

FINAL RESEARCH REPORT ON ' INVESTIGATION ON THE POTENTIAL OF LOCAL AGGREGATES IN PRODUCING HIGH STRENGTH CONCRETE WITH FLY ASH'

With reference to the above, enclosed are three copies of the final Research Report entitled '**INVESTIGATION ON THE POTENTIAL OF LOCAL AGGREGATES IN PRODUCING HIGH STRENGTH CONCRETE WITH FLY ASH**' by a group of researchers in university Teknologi MARA Sarawak, Kota Samarahan Campus. This is Dana Kecemerlangan Project.

Thank You

Yours sincerely,



Narita Binti Noh
Project Leader

5. Report

5.1 Proposed Executive Summary

High strength concrete become more popular among engineers due to load carry by the building itself and the demand of skyscrapers being built in Malaysia. Generally, high strength concrete can be similar to normal concrete but with the presence of superplasticizer and cementitious material like fly ash, silica fume and granulated slag will boost the strength of concrete due to physical and chemical reaction within concrete itself. As the demand for high strength concrete increases in the local construction market, there is a need to develop high strength concrete using local aggregates. High strength concrete that is made from local aggregates will minimize construction cost, and at the same time results in more durable and lasting buildings. As the suitability of local aggregates for producing high strength concrete is not proved, there is a need for further investigation.

In this study, fly ash will be used as cement replacement material that is mixed with local aggregates to develop high strength concrete. The objectives of this study are as follows:

- a) To optimize high strength mix design, using local aggregates with fly ash as partial replacement of cement
- b) To investigate the effect of using local aggregates in the properties of fresh and hardened high strength concrete

Therefore, trial mixes using fly ash as different percentages of the total cementitious materials are made. Fresh and hardened concrete properties was done in laboratory. 10% of fly ash was recommended in producing high strength by using local aggregate.

The aim of this study is to help the construction industry and manufacturing market. If local aggregates are found to be suitable for producing high strength concrete, this means we are able to produce cheaper high strength concrete for the local construction market.

5.2 Introduction

Background of study

In recent years, high-strength concrete has increasingly been used in civil engineering work because it has an advantage of reducing the sizes of structure element like beam and column, which are essential in high-rise building. According to ACI 363, concrete having a 28-day compressive strength higher than 41 MPa can be considered as high-strength concrete. Generally, high-strength concrete is achieved by using super plasticizer to reduce the water–binder ratio and by using supplementary cementing materials such as silica fume, natural pozzolan, or fly ash in order to create extra strength by pozzolanic reaction (Jaturapitakkul et al., 2002). Where fly ash is by product of coal combustion in the form of suspended ash particles or fine-grained material with spherically shaped particles consisting primarily of SiO₂, Al₂O₃, and Fe₂O₃ (M. E., Kalinski & B. T., Hippley.,2005).

Historically, fly ash was being used for landfill, however the amount of fly ash production become higher from time to time. Therefore, a study on material properties incorporate with fly ash, silica fume and ground granulated slag as partial replacement of the cement content was being done by Mehta (2002) in order to save our planet. Lim *et al.*, (2004) agreed with Siddique (2010) These cement replacement materials act as pozzolanic materials and fine fillers that improve the microstructure of the hardened concrete which make it denser and stronger .Furthermore, presence of Ca(OH)₂ during hydration process will lowers the heat of hydration and improves the durability when used in concrete as a cement replacement (Nochaiya et al., 2009).Knowing the benefit of using fly ash as cement replacement material and it can be easily obtained from coal-fired power plant in Kuching. Therefore, fly ash is used as cement replacement material in this study, as the use of fly ash is comparatively less costly than the other types of cement replacement materials.

Problem Statement

Since, there a numerous of study conducted on fly ash as cement replacement material around the world and the result had been publish shows that the strength of the concrete was increase and it more durable. However, the suitability of using local aggregates in producing high strength concrete with fly ash in Sarawak is very little. Therefore there is a need for a study to