

INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

**A STUDY ON PERVIOUS CONCRETE WITH
FLY ASH REPLACEMENT**

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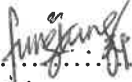
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SUPERVISOR'S DECLARATION

This project report entitled 'A Study on Pervious Concrete with Fly Ash Replacement' is prepared and submitted by Lauw Hong Aik I12000423 as partial fulfillment of the requirement for Bachelor of Engineering (HONS) in Civil Engineering, INTI International University

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Date: 13/5/2017

STUDENT'S DECLARATION

I hereby declare that the final year project 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 INTI INTERNATIONAL UNIVERSITY or other institutions.

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ABSTRACT

The fly ash replacement with 0 %, 5 %, 10 %, 15 % and 20 % will conduct for getting the optimum result of mechanical properties of pervious concrete. The mechanical properties were measured like compressive strength, flexural strength, splitting-tensile strength, sieve analysis, porosity, and permeability. Besides that, the relationship of the compressive strength versus porosity and permeability versus porosity has been plotted during the 28th days. In additional, the method of measured the permeability is used constant head method. This research find out the optimum of fly ash replacement is 5 % with the highest of compressive strength and splitting-tensile strength follow by 8.57 MPa and 7Mpa respectively. However, the permeability is 4.34 L/min which fall in the requirement range of 0.67 L/min to 10 L/min.

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LIST OF ABBREVIATIONS

AIV	Aggregate Impact Value
Al_2O_3	Aluminum Oxide
CaO	Calcium Oxide
IPV	Inter-particle Void Index
SiO_2	Silicon Dioxide
SO_4	Sulfate
WWII	World War II

CHAPTER 1

INTRODUCTION

1.1 Background

Pervious concrete is a subsequent mixture of aggregates, water, cement and without the fine aggregate like sand and filler. It is also known as porous concrete, permeable concrete, and no-fines concrete. Pervious concrete is special and helpful to solve environment issues, supporting the green movement, and sustainable. Mithun et al (2016) was said the application of pervious concrete for surfacing and load bearing walls was used in Europe as early as 1800s. Due to the cost efficiency reason, since the content of cement mortar can be reduced. It is more widely use in 1920s due to the lack of cement supply after the World War II (WWII). In 1970 s, the America just started to use it. However, Indian used it on 2000.

It is know that pervious concrete is a mixture design that has high porosity and permeability compared to the normal mixture design. The feature of porosity enables the water to be directly passed through it, reducing the amount of runoff during raining. The problem of flooding is getting serious and serious because of over development in cities and destroy the green zones in the Earth. The state of government implicate housing laws which the majority of cities before construct the houses, apartments, commercial shop lots, condominiums and so on must proposal, plan and construct the retention or detention pond in the housing areas in order to control large amount of water directly flow into the rivers which causing the flooding. Otherwise, the development projects will be rejected until the satisfied the requirements of state of government. The construction fees of retention or detention ponds will increase the overall project costs, it cause the housing price to increase. All the expenses will bear by the owner who purchases the house. Besides, the function of pervious concrete not only for storm water management, it also helping to recharge the groundwater and can

delay the settlement of housing happening since the volume of voids in ground level under control. Therefore, the cost for housing repairing can be minimized and extend the service life of houses. For the environment issues, the pollutants can be reduced and mitigates before it entering into streams, ponds, and rivers. By reducing pollutants inside the catchment areas, it works to maintain, protect, and provide a healthy ecosystem for living beings. During the hot weather, it can be worked to reduce heat island effect by absorbing the sun's rays. In the western country, the pervious concrete is commonly used to apply to resist the formation of ice build-up and thawing cycle. For the pervious pavement, it not only provides better skid resistance but also save the construction cost by offering a better resistance to extreme weights and vibrations. Last but not least, the benefits of pervious concrete not only can save a lot of cost for infrastructure, it provide a low impact to the environment.

1.2 Statement of Problem

Nowadays, a lot of traffic accidents happening due to skidding and hydroplaning are not the new issues in Malaysia. The application of pervious concrete for pavement will help to remove the runoff of water immediately and provide a dry surface for road. At the same time, surface runoff may contain pollutants which will flow into the ponds, river, and streams it destroy the habitat of the marine life. Pervious concrete can work as a filter in order to improve the quality of the water before flow being discharge. Last but not least, the "Green Cement" which is contains certain percentage of fly ash to replacement the cement to enhance the cement paste quality. Therefore, activities of mining of cement plants can be control or minimize and low environment impact such as air pollution, sound pollution and so on.

1.3 Research Objectives

The project embarks on the following objectives:

- i. To evaluate the mechanical properties of pervious concrete which has the containing of fly ash replacement
- ii. To identify the rate of permeability of pervious concrete
- iii. To determine the optimize replacement of fly ash in pervious concrete

1.4 Scope of Study

This project focuses on investigating the mechanical properties of pervious concrete with partial replacement of cement using fly ash. The type of Fly ash used for this research is Class F. Fly ash is used to replace cement at 0 %, 5 %, 10 %, 15 %, 20 %. The aggregate size is limited to 14 mm stockpile. The experiment will be investigating the mechanical properties such as compressive strength, splitting strength, and flexural strength. The entire cylinders test will be tested at 7th day, 14th day and 28th day only. The beam will be casted and test for 28th day for flexural strength. The volume of water will measure for 30 seconds. The mix design just only contains water, cement, fly ash, and aggregates (14 mm) without adding any admixture inside.

1.5 Significance of Study

The use of fly ash to replace certain percentage of cement contain in pervious concrete are become a trend in the future. The “Green Cement” is a type of cement which mixes of Ordinary Portland cement with fly ash. The replacement can reduce or controls the activities of cement mining that are generate the air pollution and sound pollution to the atmosphere. Fly ash is a good replacement and helping to minimize the emission of carbon dioxide to the Earth. The utilization of pervious concrete in roads or housing development can help saving a lot of unnecessary cost and it is environment friendly. The function of fly ash use to increase or improve the strength, durability, workability, and even finishing of the pervious concrete. Last but not lease, pervious concrete pavement can reduce splashing which directly increase skid resistance for the road’s users.