FLEXURAL STRENGTH OF CONCRETE BEAM BY USING WOOD BLOCK AS AGGREGATE REPLACEMENT

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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STUDENT'S DECLARATION

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

Pada masa kini, permintaan untuk industri konkrit semakin meningkat akibat daripada pembangunan industri hartanah. Kesan peningkatan dalam industri hartanah mengakibatkan permintaan dalam penggunan bahan mentah seperti batu kasar meningkat. Oleh itu, alternatif untuk menangani permintaan pasaran dengan menggantikan batu kasar secara semulajadi dengan blok kayu buangan dari kilang. Kajian ini dijalankan dengan menggunakan blok kayu sebagai pengganti batu kasar. Oleh itu, kajian telah di jalankan menggunakan spesimen rasuk yang bersaiz 150 mm x 200 mm x 1500 mm dan kiub bersaiz 150 mm x 150 mm x 150 mm. Spesimen ini telah menggunakan peratusan blok kayu yang berbeza iaitu 3% dan 6%. Sebagai langkah berjaga-jaga, permukaan blok kayu dicat untuk mengelak daripada kayu menyerap air. Ujian yang dijalankan untuk spesimen adalah kekuatan mampatan dan untuk rasuk ialah ujian lentur. Hasil daripada ujian kekuatan mampatan 6% merupakan gantian yang terbaik untuk menggantikan batu kasar dalam campuran konkrit berdasarkan kekuatan purata selama 7 hari iaitu 23.24 N/mm^2.

ABSTRACT

Nowadays, the demand for the concrete industry is raising consequent with the developing of new house property. The effect of the property industry may cause of demand in natural aggregate. It will issue to the all quarries industry to fulfil the market demand. Thus, alternative to deal with market demand by replacing the natural coarse aggregate with the waste wood block from factory. The study was conducted by using wood block as replacement of coarse aggregate. The study was involved by produce the beam size 150 mm x 200 mm x 1500 mm and cube specimen size 150 mm x 150 mm x 150 mm. The specimen was casting with different percentage of wood block replacement which is 3% and 6%. For the precaution, wood block was paint at the surface area to avoid water absorption. The test was carrying out for cube specimen was a compressive strength and for the beam was flexural test. By comparing the performance of the compressive strength for replacing 3% and 6% of wood block, it can be conclude to use 6% as a replacement for coarse aggregates based on the average compressive strength for 7 days which is 23.24 N/mm^2.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

%	Percentage
mm	Milimeter
g	Gram
Kg	Kilogram
MPa	Mega Pascal
RM	Ringgit Malaysia
No	Number
CO_2	Carbon Dioxide
N	Newton
Kg/m^3	Kilogram Per Meter Cube
N/mm^2	Newton Per Meter Cube
kN	Kilo Newton

LIST OF ABBREVIATIONS

ASTM	American Society For Testing And Materials
LVDT	Linear Variable Displacement Transducer
WWF	World Wild Fund
OPC	Ordinary Portland Cement

CHAPTER 1

INTRODUCTION

1.1 Background of Study

According to United Nation estimates, Malaysia current population is 31,993,056 people. Based on that estimation, the demand of housing industries are very steep. Therefore, the government come out with the development policy for housing to fulfil the demand of housing. However, the interest in construction activities led to shortage of building material such as cement, aggregate and other.

Concrete is part of the important material which use in construction building starting from the basic part which is foundation until the structure become the high-rise building. Concrete is the combination material by mixing the cement, water, aggregate which is fine and coarse aggregate. All of the mixing processes come up with different ratio to make sure the entire ingredient binding together. All the process to make sure our target to find the strength and durability of the concrete are curing properly.

Coarse aggregate is one of the materials to design the concrete mix design. Coarse aggregate usually the aggregate that greater than 4.75 µm (retained in No.4 sieve) while fine aggregate is less than 4.75 µm (passing No.4 sieve). The shape and the texture of aggregate can affect the properties of fresh concrete more than harden concrete. Concrete is more workable when using smooth and spherical aggregate compare by using rough angular or elongated aggregate. The smooth surface of aggregate can improve the workability but the rougher surface can generate stronger bonding.

Currently, there are various studies have been done to find suitable material to replace the coarse aggregate in concrete mix. Among researcher come out with their own idea to replace the coarse aggregate such as wood ash, rice husk, wood chip, wood

block, coconut shell and other waste material. Hence, the waste material should be reuse to make other product instead of been disposed or burned it because this process will affect and destroy the nature environment.

1.2 Problem Statement

Recently, the demand to buying the housing among Malaysian citizen is rising up. Thus, the government planning to construct low cost housing that focused on various housing program in both rural and urban area such *Skim Perumahan Rakyat 1 Malaysia* (PRIMA), *Skim Perumahan Mampu Milik Swasta* (MyHome), *Program Perumahan Rakyat (PPR)* and *Rumah Selangorku.* The objective of this program to make sure all the Malaysian can afford to buy housing in the future. Therefore, the demand for raw material for concrete will also be increase because the concrete is widely use in building construction to construct beams, floors, columns, slabs and more.

According to United Nation estimates, Malaysia current population is almost 31,993,056 people. Based on the report from (Anom. 2015), Khazanah Research Institute stated that the housing market in Malaysia classified as "seriously unaffordable" compare to global standard price. Approximately, the price for new house under construction in market almost between RM250,000 to RM500,000. At third quartile of 2017 was shown the housing price index for Malaysia market rose by 5.10%. Melaka was registered as the highest price for house follow by Selangor, Kuala Lumpur and Negeri Sembilan. Kuala Lumpur is most expensive house in Malaysia by the starting price is RM785,327 and Kelantan is the cheaper house in Malaysia by RM164,300. Therefore, the government come out with the development policy for housing to fulfil the demand of housing. To cater the market demand, developers shift their target to construct the affordable house that can own by Malaysian citizen. The annual supply of housing in Malaysia is approximately four units per 1000 of the population, this is less than the recommended 8 to 10 units per 1000 in developing countries, implying that the Malaysian housing deficit units are likely to be on the increase (AbdulLateef Olanrewaju et al., 2016). However, the interest in construction activities led to shortage of building material such as cement, aggregate and others.

To cater with this problem, one of the solutions is to use the waste material such as wood block as coarse aggregate replacement. This type of concrete can be cheaper than previously because it replacing some of coarse aggregate with this solid waste. This type of concrete can be more economical and environmental friendly. Waste recycling into building and construction materials would be one of several appropriate solutions not only to the environmental problems, but also to the reduction of building material costs. Hence, the waste material should be reuse to make other product instead of been disposed or burned it because this process will affect and destroy the nature environment. Sustainability of production systems is a key global issue for governments, industries and society, particularly in the timber processing and manufacturing sector. With products based on renewable natural resources from forests, this sector is well placed to provide products that enhance long term environmental, economic and social sustainability (Daian & Ozarska, 2009).

1.3 Objective

Objective of the research focus on:

i. To describe the flexural behaviour and mode of failure of the reinforcement concrete beam while load is applied.
ii. To determine the compressive strength of the concrete when using different percentage of waste wood block to replace coarse aggregate.

1.4 Scope of study

In this study will focus on produced concrete with different percentage of waste wood block as replacement of coarse aggregate. The test was conducted to investigate the strength of the concrete and flexural behaviour of the beam when using the waste wood block and without waste wood block. The percentage of the replacement of coarse aggregate calculated by volume of waste wood block is 3% and 6%. All the concrete preparation using concrete strength 25 MPa and the study is carry out to determine whether by replace the coarse aggregate with waste wood block can affect in concrete mixture.

The range size of waste wood block are between 15 mm to 20 mm while the thickness of the wood block between 20 mm to 30 mm. The dimension of the cube

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