INVESTIGATION ON THE PROPERTIES OF OIL PALM SHELL CONCRETE IN COMPARISON TO NORMAL WEIGHT CONCRETE

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SUPERVISORS'S DECLARATION

This project report entitled "INVESTIGATION ON THE PROPERTIES OF OIL PALM SHELL CONCRETE IN COMPARISON TO NORMAL WEIGHT CONCRETE" is prepared and submitted by Filipe Waqabitu (I13004078) as partial fulfilment of the requirement for Bachelor of Engineering (HONS) in Civil Engineering, INTI International University.

APPROVED BY: Date ...12/5/2019...

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Supervisor

DR. NURHAZNIZA ABDUL RAHMAN

STUDENTS DECLARATION

I hereby declare that this final year project report is based on my own original work and I have no other sources or resources that the ones mentioned.

I have indicted all quotes and citations that were literally taken from publications, or that were in close accordance with the meaning of those publications, as such. All sources and other resources used are stated in the reference.

I also declare that it has not been previously or concurrently submitted for any other degree at INTI INTERNATIONAL UNIVERSITY or any other institutions.

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ABSTRACT

This research involves the investigation of Oil Palm Shell (OPS) as an aggregate component in lightweight concrete. The aim of this research project is to utilise OPS in the production of light weight concrete and determine whether the properties of OPS concrete is suitable for it to be used in construction. There are various physical and mechanical tests that were to be conducted on OPS Concrete along with a control samples of normal weight concrete (NWC). One of the most important factors that is being considered in this project, is the weight of the OPS concrete in comparison to that of the NWC. Therefore, the theoretical densities were determined from the mix design, and then it was determined experimentally by weighing of the concrete test cubes. Since this project is investigating a lightweight concrete, the Department of Environment (DOE) method for concrete mix design, can only be used for determining the mix design of the control samples of NWC. For OPS concrete, trial mixes need to be conducted to determine the concrete mix proportions. The OPS concrete and the NWC were all designed to 30MPa. Three trial batches of OPS concrete were conducted with varying amounts of OPS; namely 65%, 80.5%, 78.4% and these proportions were selected on trial and error basis. Superplasticiser was also used in two concrete batches (one OPS concrete batch and one NWC batch) to aid in workability at low water/ cement ratio. The mechanical testing involved compression test and slump test to determine workability. All specimens were cured in water and the samples were tested for compressive strength on day 7, 14 and 28.

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INTRODUCTION

1.1 General

The construction industry is one of the most extensive fields within an economy, as structures are continuously being fabricated and constructed at a neck-break speed, to provide for the escalating demands within a country's economy. Since the rate of construction is becoming more and more exponential, the demand for construction materials also surges to new heights (Olutage, 2010). With the surge in the demand, it will indefinitely and inevitably cause the price for construction to increase, and this would act as a stimulus that would generally increase the value of all forms of constructions, whether it be housing, condominiums and infrastructure. This is a huge concern because, not everyone within a society will have the capacity to pay for inflation in the housing markets that was triggered by high demands in construction materials (Yew et al., 2014)

Currently, the housing market is thriving for the contractors and the demand is now up till a point that it is quite impossible for ordinary lay-people to own a home. This is evident right here in Kuala Lumpur Malaysia, where the price of houses go up to tens of millions of Ringgits. This as it is, is unimaginable.

There needs to be Engineering consideration into the use of locally available materials that could be incorporated into concrete, that would be credible enough to be used for construction of low-cost housing. These low-cost housing developments, could not only be aimed at improving the lives of less fortunate people, but all classes of people. Allowing for a material to be used that could decrease the cost of housing, would increase the confidence in the housing markets (Johnson et al., 2011).

The construction and infrastructural industry in many develop countries have identified a way in which construction cost would be decreased. This is by incorporating artificially or naturally produced lightweight aggregates. Lightweight aggregate concrete (LWAC) has a lower density and so is generally lighter than conventional concrete. When it is used in concrete, it would allow for the fabrication of concrete of a significantly lighter weight than conventional concrete (Khankhaje et al., 2016). Conventional concrete generally has a bulk density of 2400 kg/m^3 and in contrast LWC has a bulk density that is not higher than 2000 kg/m^3.

It is a well-known fact that the research on lightweight concrete (LWC) has sparked a lot of interest from numerous Academics and researchers. This is primarily due to the advantages of LWC, which include; savings on reinforcement, formwork and scaffolding, foundation expenditure as well as the savings derived from the reduced cost for transportation and fabrication of the structures (Teo et al., 2007). One such alternative is Oil Palm Shell (OPS), which is the form of agricultural waste originating from the Palm Oil industry.

The Oil Palm Industry is one of the most significant industries in the Malaysian Economy. Malaysia is one of the Global-leaders in the production and export of Palm Oil as it yields more than half of the world's palm oil productions (Shafigh et al., 2012).

Fruit Bunches, palm oil shells, pericarp and palm oil mill effluent are examples of the waste products that are produced in the production of palm oil. These leftover materials serve no other purpose, and so are disposed by means of incineration. Most of the time the palm kernel shells are just left to rot in huge mounds and this poses as a form of pollution as we at this time do not have the expertise to judge its detrimental effect to the environment (Khankhaje et al., 2016). Therefore, the utilization of palm oil/ palm kernel shells as a sustainable construction building material, would aid in the preservation of our natural resources.

OPS is hard in nature and does not deteriorate easily once bound in concrete and therefore, it does not contaminate or leach to produce toxic substances (Teo et al., 2011). If OPS concrete is used as a structural component in the construction industry, it would not only be beneficial to the environment, but also advantageous to low income families as this concrete can be used for the construction of low cost houses, especially those in the vicinity of oil palm plantations.

1.2 Problem Statement

There is concern in the increasing cost of construction and housing especially in heavily populated regions of the world. Due to the high demand to fabricating structures to cater for the growing population, the rate of construction is now at a neck-break speed. This is having a detrimental effect on the housing market. Since the demand for housing is increasing, the cost of houses would increase, and as such the demand for the material would also increase. These are chain reactions that lead to inflation in a market that is growing exponentially to a point where the carry capacity for the cost seems to be unattainable. Even for working class adults nowadays, it is virtually impossible to buy a house of their own, and this is primarily due to the cost.

There needs to be alternatives that could be used in concrete fabrication that would inevitably decrease the cost of the construction. The alternative that has been identified is Oil Palm Shell (OPS). OPS is a waste material for the Palm Oil Industry, which is a booming industry here in Malaysia. These OPS Aggregates are usually just disposed of in landfills.

There would be two main advantages in the use of OPS as an aggregate. First, it would drastically decrease the need to dispose of OPS into the environment, which is a major form of land pollution. Furthermore, it could be used in concrete fabrication. This is of great advantage since OPS concrete is a Lightweight concrete, with a density no greater than 2000 kg/m^3. The lighter the concrete the lesser costs as there would be fewer reinforcements, scaffolding and formwork.

In a country like Malaysia, which is one of the key players in the chain of supply for palm oil, the exploitation of OPS as a constituent in sustainable building material, would help reduce the cost of construction. Oil palm shell is a huge agricultural solid waste that is produced on a mass scale in the palm oil industry. It was estimated that over 4 million tonnes of OPS solid waste is produced annually (Shafigh et al., 2011a). Since Oil palm shells show promising properties such as: lower bulk density (making it a lot lighter than conventional aggregates), the hardness of the shell, and lower chances of deterioration it needs to be investigated to adequately know if OPS aggregates can truly serve as a constituent of concrete fabrication.