INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

POTENTIAL USE OF RECYCLED AGGREGATE AS AN ALTERNATIVE FOR ORDINARY AGGREGATE IN CONCRETE

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SUPERVISOR'S DECLARATION

This Project report entitled "Potential Use of Recycled Aggregate as an Alternative for Ordinary Aggregate in Concrete" is prepared and submitted by Lee Yun Gen, I13003633 as a partial fulfillment of the requirement for Bachelor of Engineering (HONS) in Civil Engineering, INTI International University.

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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

Recycled aggregate is considered as reused substance coming from the previous used construction or demolition of buildings. In order to reduce such waste material and reduce the usage of ordinary aggregate, it is added into to concrete mix. This study focuses mainly on the effect of recycled aggregate in concrete in terms of workability, compressive strength, flexural strength and water absorption. The course aggregate was replaced by recycled aggregate in certain range of weight percentage, then various test were conducted and data obtained was compared to the control sample. From the water absorption test of aggregate, recycled aggregate has a lower initial water content and higher water absorption rate, compared to ordinary aggregate. Results showed that recycled aggregate also increased the slump value and workability of concrete. 20% of the recycled used aggregate replacement is the optimum percentage has archived because it yields the highest compressive strength of the concrete, by 15% approximately. Similar to the flexural strength, 20% of recycled aggregate replacement has reached the highest value of flexural strength as well. As for the durability performance, due to the cement paste sticking on the surface of recycled aggregate, its high porosity helps the recycled aggregate to absorb more water than regular aggregate. The study suggests that recycled aggregate is beneficial to the concrete in aspect of workability and mechanical performance, thus it should be cast into concrete mixing, to reduce the waste of unused material. Moreover, it would help in preserving the environment.

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LIST OF ABBREVIATION

RA	Recycled Aggregate
CA	Coarse Aggregate
BA	Bottom Ash
RC	Recycled Ceramic
CS	Coconut shell
RB	Recycled Bricks
W_{dry}	Weight of dry aggregate
W_{wet}	Weight of wet aggregate after soaking in water for 24 hours
W_i	Initial weight of aggregate before test

CHAPTER 1

INTRODUCTION

1.1 Introduction

Infrastructure and building construction development nowadays across the world has created a huge demand for construction materials. Especially in urban area of well-developed countries in the world, the growth of infrastructures has significantly increased over these years. Such development brings economic growth and requires massive amount of construction materials to construct infrastructure. In worldwide, statistically there is approximately 25 billion tons of concrete are manufactured annually (World Business Council for Sustainable Development, 2009).

As we know in common, standard concrete is a mixture of cement material, aggregate, and water, sometimes with admixture. Among all the ingredients, aggregates form the major part. Aggregate can takes up for 60% till 80% of the volume and 70% till 85% of the weight of concrete, depending on the ratio of water-cement-aggregate. Due to this, the usage and demand of aggregate has been largely increased. In record, around two billion tons of aggregate are produced each year in the United States. U.S. Department of Transportation Federal Highway Administration (2004) stated that by the year 2020, the aggregate production is increased by more than 2.5 billion tons annually. Similarly, the consumption of the aggregate was 110 million tons in the UK in year 1960 and reached nearly 275 million tons by the end of 2006 (Waste & Resources Action Program, 2006).

Therefore, reduce the use of aggregate or replace it with a lower cost of material is one of the feasible method to be used, which is recycled aggregate. Research on recycled aggregate as coarse aggregate replacement plays an important role in the concrete making industry. The

usage of those unused aggregate not only decreases the demand of ordinary aggregates, but also promotes a more sustainable and eco-environmental method.

1.2 Background of Study

Recycled aggregate is considered as reused substance coming from the previous used construction or demolition of buildings. Similar to primary aggregate, the recycled or secondary aggregate are granular material which is used in concrete manufacture for increasing its strength. Some surface of recycled aggregate has a coating of mortar attached on it and has a darker colour, while fresh aggregate are mostly white in colour and clean, purely crushed stone. The recycled aggregate mainly used for road planning, lightweight concrete making industry and others. These aggregates can be further categorized into "manufactured aggregate" and "natural aggregate".

Construction aggregates are obtainable from stone mills or quarries. They are one of the most mined material in the world, compared to other metal elements. During the process of extraction, the sources of natural aggregate are bedrocks beneath underground or unconsolidated deposits. Some of them are surface-mined which does not require drilling into underground or blasting. After that, they are crushed into smaller pieces using industrial crusher machine. The following process is screening of products by its size and gradation control. The final products will be mixed with sands and then stockpiled on the nearby area. Besides mixing it with cement and water to become concrete, they are also been used in landscaping, road construction, and base material for foundations.

Concrete is the mixture combination of the materials such as fine aggregate, coarse aggregate, cement and water. Concrete is widely used for making different types of structures. Each of them has different purpose, such as foundations are used to transfer the loading form the building to the soil beneath, concrete retaining wall is used to prevent the soil from sliding downward. Other application includes bridges, road paving, concrete wall, dams and beams. Normally the strength of the concrete is ranged between 25N/mm^2 to 50 N/mm^2, depending on its structural function. Higher strength requires more cement water ratio in making concrete.