CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Concrete is one of the widely-used materials in the world due to urbanization. Large consumption on river sand as fine aggregate for concrete industry has increased the global demand and some other countries are facing shortage of natural sand. Based on global usage, the consumption of river sand is placed at second position after the fresh water (Villioth, 2014). River sand has been depleted in a large-scale to satisfy the high market demand and led to the environment issues. As a result, river sand has become expensive and scarce (Rahman & Wahab, 2013).

According to Jumaat et al. (2010), over mining sand from river beds will bring the impact of lowering the water table and sinking of bridge peers. Besides that, it has led to environmental problems such as damaging the ecosystem of the river, polluting the water source and destabilizing the river bed and banks. Dependency on mining activities needs to be reduced to preserve the natural resources.

In the backdrop of such a bleak atmosphere, there is a large demand for alternative materials from industry waste. Lately, some waste materials such as sheet glass powder, Class F fly ash, recycle concrete, limestone powder, siliceous material have been used to replace fine aggregate in concrete production (Frigione, 2010). Reuse of waste or recycling material is one of the effective ways to preserve the natural resources as well as reduce the environmental burdens. Therefore, replacement of aggregate in concrete production by solid waste such as quarry rock dust will be one of the alternative solutions.

In Malaysia, quarry rock dust is one of the waste material that are facing landfill disposal problems and health and environmental hazards (Divakar, Manjunath, Aswath, & Student, 2007). According to Minerals Yearbook (2013), 50,000 metric tons of quarry rock dust being produced each year from rock extraction activities in quarrying industry. By utilizing quarry dust in concrete production can develop a new alternative option for concrete industry to turn the waste material into a valuable resource as well as produce concrete with lower cost. The suitability of quarry rock dust to replace fine aggregate in concrete mix needed to be identified.

1.2 PROBLEM STATEMENT

River sand which being used as fine aggregate in concrete industry are usually washed and graded at the pit or plant. The cost for the river sand treatment are expensive and couldn't be avoid to ensure its' quality.

In concrete production, aggregate occupied more than 75 % of volume in concrete mix. Furthermore, aggregate is a non-renewable resource. The large consumption of aggregate in concrete industry is bringing negative impact to the environment. Therefore, replacement of aggregate by waste material such as quarry rock dust is a wise action to be taken.

Quarry rock dust with the particle size less than 4.75mm is a by-product from the rock crushing industry. It was applicable in large amount such as 200 million tonnes per year (Kumar & Siksha, 2015). This has caused disposal problem for the waste material and increase the landfill activities. The replacement of fine aggregate by quarry rock dust is a mutual solution to reduce quarrying activities and protect the environment.

1.3 OBJECTIVE

The objective of this study are:

i. To maximize the usage of by-product from quarrying activity.
ii. To identify the optimum percentage of quarry rock dust replacement in eggshell concrete.
iii. To determine strength characteristics of eggshell concrete with quarry rock dust as fine aggregate replacement.

1.4 SCOPE OF STUDY

This study mainly focuses on the feasibility of the usage of the Quarry rock dust as partial substitutes for fine aggregate in Eggshell concrete. The mix design of grade 30 concrete mixes will be designed following the ASTM and BS standard with constant of 0.5 water to cement ratio (w/c). 15% of eggshell powder will be used to replace cement in concrete mix and the quarry rock dust with the size less than 4.75mm will be used to replace 0%, 25%, 50%, 75%, 100% of fine aggregate in eggshell concrete mixing.

The test will be carried out on fresh and harden concrete are slump test, Vicat test, compressive strength test, flexural strength test and splitting tensile strength test. The tests will be conducted in cubes specimen with size of 100mm x 100mm x100mm, cylinders specimen with size of 100mm x 300mm and beams specimen with size of 100mm x 100mm x 500mm. The specimen will undergo water curing and tested at age of 7, 14 and 28 days. The optimum percentage of Quarry rock dust replacement will be determined.

1.5 RESEARCH SIGNIFICANT

The demand for natural sand as fine aggregate in concrete industry increased drastically especially in developing countries. Since the sand was non-renewable resources with limited supply, the natural sand has become scarce and extensively expensive with no guaranteed on long term supply. In these situation, quarry rock dust which is a by-product