CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

The construction industry continues to grow all over the world, benefitting the nation’s economy while providing essential infrastructure. It is one of the main contributors that contribute to the development of a nation. Construction industry fosters employment opportunities while promoting local and foreign investment opportunities which benefit the nation’s economy. However, the rapid development of a nation leads to a growing amount of construction and demolition (C&D) waste. C&D waste is one of the most voluminous waste streams generated and it increases the burden on landfill sites. Besides, C&D waste has been recognized as a major issue in the construction industry due to its direct impact on both the environment and the efficiency of the construction industry. According to Tam et al. (2014), pollution generated from construction industry activities bring on major challenges to the environmental management. C&D waste that is not managed properly may lead to soil and water pollution. Besides, construction material wastage also accounts for project cost overrun. Generally, about 21-30% of construction material wastage contribute to the cost overrun occurred in construction projects (John & Itodo, 2013).

Construction waste is usually incorporated with demolition waste. Thus, it is defined as the waste produced by new construction, refurbishment or demolition of a structure (Osmani, 2011). Construction waste is different from demolition waste. For instance, the construction masonry wastes are cleaner and newer compare to the demolition masonry wastes. Construction waste is more likely consist of homogeneous materials whereas demolition waste tends to be nonhomogeneous materials. Demolition
wastes mainly consist of mixed materials and debris. Generally, concrete, gravel, bricks, sand, stone, wood, plastic, metal, glass, paper, and etc. are the solid waste generated during C&D activities (Gull, 2011).

Concrete remains an indispensable material in the construction industry. According to Behera et al. (2014), the present usage of concrete is practically 20 billion metric tons per annum. Concrete consist of three basic components which are cement, aggregate and water. Aggregates play a crucial role where it makes up roughly 60% to 75% of ready-mix concrete’s volume. Natural aggregates are used in production of concrete, which led to a continuous and increasing demand of natural resources. This inevitably will lead to natural resource depletion in a long run as natural aggregates are not sustainable aggregates.

In recent years, many researches have been done on alternative aggregates as the substitutes of natural aggregates in concrete. Southern European countries practice the usage of ceramic materials in the construction industry (Gonzalez-Corominas & Etxeberria, 2014). For instance, tiles, bricks and blocks which are produced during construction and demolition are used.

1.2 PROBLEM STATEMENT

Production of aggregate from natural resources is an ongoing process to keep up with the development of a country. As envisaged by the year 2020, Malaysia at present is shifting from a developing country status towards achieving a developed nation status (Ismail et al., 2013). The construction industry is considered to be one of the crucial industries as it plays an important role in socioeconomic development of the country.

Natural aggregate is usually obtained by mining or blasting of rocks from quarries. In Malaysia, almost every state carries out its own aggregate production activities (Ismail et al., 2013). The process of extracting these materials is not an environmentally-friendly activity. This gives rise to environmental issues such as ground vibration, dust, noise, disturbed landscapes and habitat, and affected surface or groundwater (Langer et al., 2004). Natural aggregate comprises about 75% of the
components of concrete by volume. Thus, the consumption of natural aggregate is high in producing concrete. The ecological balance of the environment will be deeply affected by the exploitation of natural aggregates. Making aggregate resources available for our country’s increasing needs will be an ongoing challenge.

A considerable amount of research on incorporating wastes into production of concrete has been carried out due to increasing environmental awareness (Zimbili et al., 2014). Mainly the wastes used are C&D wastes. In United States, approximately 30% of C&D waste disposed of to landfill annually, which amounts to about 136 million tonnes (John & Itodo, 2013). In Hong Kong, 15.4 million tonnes of solid waste are generated from the construction industry in 2009 (Yu et al., 2013). It is about 23% of the total waste disposed in landfills. According to Liu et al. (2015), 32% of waste generated within United Kingdom and 44% in England are from C&D activities. Currently, a large portion of solid waste in Malaysia is from C&D waste. During construction of a new building, it is estimated that around 27068.40 tonnes of construction waste are generated from the construction site (Ismail et al., 2013).

The average percentage contribution of building material wastage during construction to project cost overrun is between 21 – 30%. Concrete is ranked first among the material wastage that contributes to project cost overrun. Material wastage at sites mainly happened due to poor supervision, re-work, and poor material handling (John & Itodo, 2013). Moreover, concrete which consists of natural aggregate also cost more than concrete with waste materials incorporated as aggregate. Generally, any improvement in the building material wastage level on construction has the potential to enhance the construction industry’s performance with cost-saving benefits.

1.3 OBJECTIVE

The main aim of this research project is to incorporate crushed porcelain granite tiles into concrete as partial replacement of both coarse and fine aggregate. The aim of the partial replacement of natural aggregates with waste materials from construction process is to minimize the construction waste being sent to landfill besides from