

1.0 Introduction

Construction industry is one of the industries that play an important role in developing and enhancing economic sector and also the development of one's country. Although the construction industry contributes to the development but at the same time this is not an environmental friendly activity because a lot of problems may exist if the progress and development of this industry are not well planned. This is supported by Shen (2002), where construction industry is not by nature an environmentally friendly activity and it is a major contributor to environmental impacts, which are typically classified as air pollution, noise pollution and water pollution. While according to Tam et al., (2006), construction industry is one of the biggest generators of pollution in Hong Kong and becoming a critical issue. Moreover, wastes generated from construction industry consist of relatively huge amount of chemical waste (Bossink, 1996).

1.1 Construction Industry in Malaysia

Malaysia is one of the countries that are categorized as emerging industrialized country; and of the 20 largest export nations worldwide. It is ranked 29th out of 118 countries by the "Global Enabling Trade report 2008". This industry is an important element of Malaysia economy because it is widely linked with many other parts of the economy such as basic metal products which include the iron and steel industries and electronics. This industry also shares 3.3 % of the country's GDP (2003) and employs over 500,000 workers in some 54,500 local companies. 80 % of these companies are small and medium sized company. (MGCC,2009).

Malaysia construction industry generally can be divided into two areas which is general construction and special trade work. General construction consists of building construction (residential construction and commercial construction) and civil engineering construction (sewers, roads, highways, bridges and tunnels). The second area is special trade works which comprises of metal works, electrical works, tiling, flooring, painting, glass works and others.

Each type of construction project need an organization or team to design planned the structure, to construct and to maintain the construction project. General construction for example building construction activity is usually done by 'general contractor'. The general contractors will take full responsibility for the complete job, except for specified portions of the work that may be passing to the special trade contractors (subcontractor).

Special trade contractors usually do only specific trade such as painting, carpentry or electrical work. Beyond fitting their work to the other trades, specialty trade contractors have no responsibility for the structure as a whole. They always obtain orders for their work from general contractors, architects or property owners. Most of their work usually involves repair work. For Malaysia construction industry, all the contractors have to be registered with the Construction Industry Development Board (CIDB) during the construction works. Contractors registration for building construction is the highest in number compared to other category (Figure 1.1) due to the demand on building construction compared to other type of construction.



(Source: CIDB Construction Quarterly Statistical Bulletin, Third Quarter 2006)

Figure 1.1: Contractors registration by category

Residential and commercial (non-residential) projects are seen as the major project category in Malaysian construction industry compared to the others project category (Table 1.1).

Table 1.1: Number and Value of Projects Awarded by Status of Contractors and Project Category as of June 2008

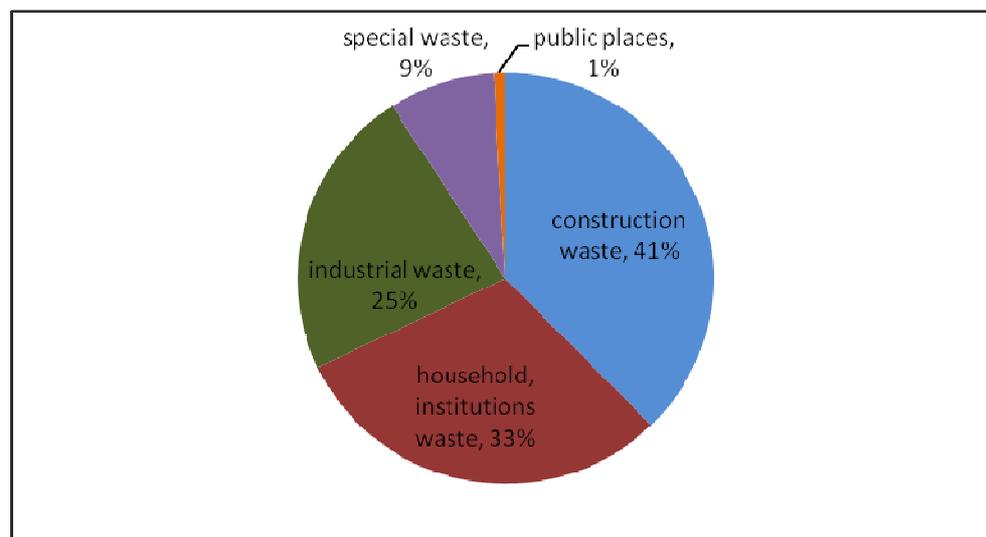
Project category	Total number of project		
	2006	2007	2008
<i>Residential</i>	1,716	1,626	528
<i>Non – residential</i>	1,922	2,068	633
Mix development	117	104	25
Social amenities	545	1315	494
Infrastructures	1463	1604	395
Others	5	28	9

(Source: CIDB, 2009)

According to related article by The Malaysian German Chamber of Commerce in 2009, the positive performance by residential project which is 3.5% (January-June 2007 : 0.9%) growth during the first 6 months of 2008 is due to the accelerated implementation of Government's low and medium housing programs.

These include the construction of 36,000 units of affordable houses by Syarikat Perumahan Negara Berhad. Apart from that, the liberalization of the Foreign Investment Committee ruling on foreign purchases of properties and the promotion of MM2H (Malaysia My Second Home) also lead to the expansion of this project category. For that reason, it reflected high number percentage of construction activities for high-end condominium construction which mainly are in Selangor and Kuala Lumpur.

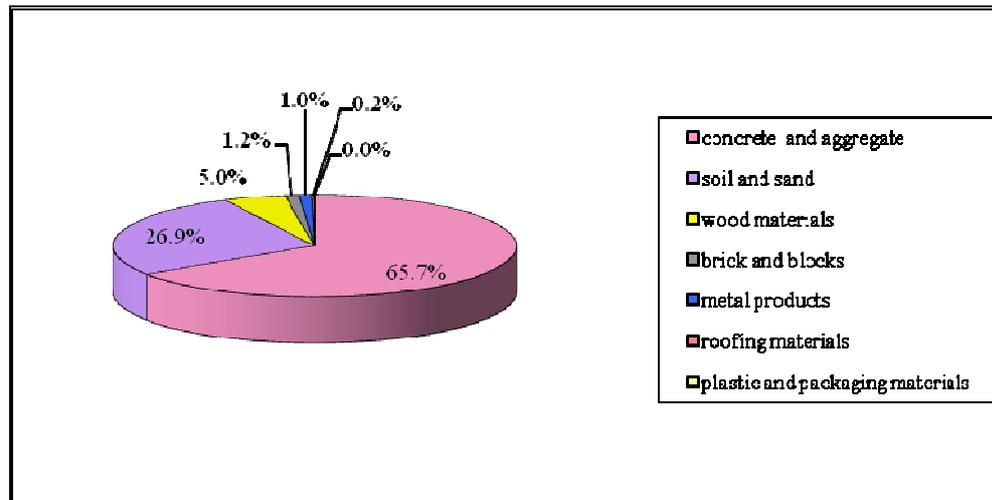
From the aspect of waste generation from construction industry in Malaysia, a study conducted by Larsen (2007) found that construction waste is seen as the highest composition of solid waste generated (41 %) as shown in Figure 1.2 followed by household & institution waste (33%), industrial waste (25%), special waste (9%) and waste from public places (1%). From the same study, Larsen (2007) found that construction waste consists the most composition in illegal dumping activity which is 39%, followed by industrial and commercial (33%), bulky and green waste (17%) and residential (11%).



(Source: Ib. Larsen (2007); SWMC Malaysian Government-(MHLG)/ Danida)

Figure 1.2: Total waste generated in Peninsula Malaysia 2007

Composition of construction waste generated in Malaysian construction industry (Figure 1.3) consists of concrete and aggregate (65.8%), followed by soil and sand (27%), wood (5%), brick and blocks (1.2%), metal products (1%) and others (less than 0.2%) such as roofing materials and packaging waste (Begum et al., 2006).



(Source: Begum et. al., 2006)

Figure 1.3: Composition of generated construction waste materials on the site

In order to overcome the construction industry waste generation problem and to minimize the cost of construction activity as well as to change from an industry employing conventional technologies to a more systematic technologies, Ministry of Housing and Local Government of Malaysia been introduced IBS (industrialized building system) in early 1960's after few visits to European countries and evaluated the European housing development program (Thanoon et al., 2003). This action by the Ministry is also to overcome problems faced such as inadequate labourers and a need for the project to be completed faster in order to save the construction cost. Today, the implementation of IBS in Malaysia construction industry has evolved.

IBS is introduced to promote as an alternative to conventional construction method. In the effort to streamline the implementation of IBS in Malaysia construction industry, the government had included the details of IBS aspect in the 9th Malaysian Plan. According to the plan, IBS was introduced in Malaysia construction industry to encourage alternative construction material and technology. In addition, to encourage the implementation of the IBS in Malaysian construction industry, the Treasury of Malaysia has issued a new Circular regarding the implementation of IBS on 31st October 2008 outlining the objective, background, implementation guidelines, the National IBS Secretariat, Monitoring & Agencies responsibilities. It is directed to all Ministries, Agencies, State Governments and Local Authorities (CIDB, 2009). IBS method will be explained further in section 2.3.2.

1.2 Aim and Objective of study

The most importance of this study is to examine and estimate the construction waste generated from residential and commercial building which use different types of construction method ; conventional and prefabricated method. In order to distinguish the situation of Malaysian construction industry in the aspect of construction waste generated and construction waste management, this study will looks into 3 main objectives and 2 sub-objectives.

1.2.1 Main objectives

- i) to investigate the wastage level of construction material from conventional and prefabrication construction method.
- ii) to analyse and to compare the waste index generated between conventional construction method and prefabrication method for residential and commercial building.
- iii) to identify the cause of building construction waste generated on site.

1.2.2 Sub objectives

- i) to identify the possible methods for the calculation of the construction waste generated in Malaysian construction industry.
- ii) to gather the information on site activities and waste management practices by from site visits.

1.3 Project assumption

From the early literature review of construction industry and construction waste production at construction site, it can be assumed that different construction material and composition of waste will be generated at each different site. Prefabrication method should be the best method in minimizing construction waste and conventional method is expected to generate more construction waste at site. It is also can be assumed that size of construction project will have an implication on the amount of construction waste generated.