SOLID WASTE MANAGEMENT IN BUILDING CONSTRUCTION SITE

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ABSTRACT

The construction industry is one of the key economic development activities in Malaysia. An increase in the construction sector also contributed to the increase in environmental pollution. Among the causes of environmental problems is the removal and disposal of construction waste is not controlled. Construction waste from construction work, renovation work, the work of demolishing illegally constructed buildings of all types of buildings, whether residential buildings or buildings not dwellings. Construction waste management a very important systematic practiced at the construction site. Alternative measures such as, the cycle must be performed because wastage is not only detrimental to both the contractor and the client but also cause loss of natural resources and the country's economic resources. This research related to the construction of solid waste at the construction site of the building that is to identify the factors and the amount of waste at the construction site and the construction of solid waste that can be recycled. The scope of the study includes the Solid construction waste in building construction site in area of Kuala Lumpur. The objective for this project was achieved through literature review, questionnaires, observations on a construction site, and interviews were done against the contractor. The data obtained showed comparison between Semi D housing projects and building High Rise. This research has found that for housing projects have the highest rate of Semi D for the composition of waste building materials by 17% for the rest of the building materials wood/plywood. The composition of the second highest for debris from construction projects this is Semi D concrete/Mortar and Tiles by 13%. For High Rise building project, the concrete/mortar and wood/plywood is the highest composition of residues from waste which overall 15% respectively. The composition of the second highest for the rest of this material was stone aggregate, sand and steel/iron reinforcement by 13%. This study also covers the frequency of this building material waste reused and causes of the occurrence of wastage at construction sites.

ABSTRAK

Industri pembinaan merupakan salah satu kegiatan pembangunan ekonomi yang penting di Malaysia. Peningkatan dalam sektor pembinaan ini juga telah menyumbang kepada peningkatan pencemaran alam sekitar. Antara punca masalah alam sekitar ini adalah pembuangan dan pelupusan sisa pembinaan yang tidak terkawal. Sisa pembinaan terhasil daripada kerja pembinaan, kerja pengubahsuaian, kerja merobohkan bangunan daripada semua jenis bangunan sama ada bangunan tempat tinggal atau bangunan bukan tempat tinggal. Pengurusan sisa pembinaan yang sistematik amat penting dipraktikkan di tapak bina. Langkah alternatif seperti kitaran semula harus dilaksanakan kerana pembaziran bukan sahaja merugikan kedua-dua pihak kontraktor dan klien tetapi juga menyebabkan kehilangan sumber semulajadi dan sumber ekonomi negara. Kajian ini berkaitan dengan sisa pepejal pembinaan di tapak pembinaan bangunan iaitu untuk mengenal pasti faktor dan jumlah sisa buangan di tapak bina dan sisa pepejal binaan yang boleh dikitar semula. Skop kajian merangkumi sisa pepejal pembinaan di tapak pembinaan di kawasan Kuala Lumpur. Objektif bagi projek ini dicapai melalui kajian sastera, borang soal selidik, pemerhatian di tapak pembinaan, dan temubual yang dilakukan terhadap kontraktor. Data yang diperolehi menunjukkan perbandingan di antara projek perumahan Semi D dan bangunan High Rise. Kajian ini telah mendapati bahawa bagi projek perumahan Semi D mempunyai kadar tertinggi bagi komposisi sisa bahan binaan iaitu sebanyak 17% bagi sisa bahan binaan kayu/Papan lapis. Komposisi kedua tertinggi bagi sisa bahan dari projek pembinaan Semi D ini adalah konkrit/Mortar dan jubin iaitu sebanyak 13%. Bagi projek bangunan High Rise pula, konkrit/mortar dan kayu/Papan lapis merupakan komposisi sisa bahan yang tertinggi daripada keseluruhan sisa iaitu sebanyak 15% masing-masingnya. Komposisi kedua tertinggi bagi sisa bahan ini adalah tetulang batu agregat, pasir dan besi/ferum iaitu sebanyak 13% setiap satu. Kajian ini juga meliputi kekerapan sisa bahan binaan ini diguna semula dan punca-punca berlakunya pembaziran di tapak pembinaan.

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LIST OF SYMBOL

AI	Average Index
Ai	constant expressing the weight given to i
Xi	variable expressing the frequency of response
%	Percentage

LIST OF ABBREVIATION

GDP	Gross Domestic Product
C & D	Construction and Demolition
PPSPPA	Waste Management Corporation and Public Cleansing
DBKL	Kuala Lumpur City Hall
IBS	Industrialized Building System
PE	polyethylene
PP	polypropylene
PS	polystyrene
PVC	polyvinylchloride

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The construction sector in Malaysia is one of the sectors that contribute to the increase of the national economy. Based on statistic quarterly construction 2014, Based on the construction quarterly statistics 2014, the value of construction work in the fourth quarter recorded a growth of 9.7% or equivalent of RM27.1 billion. Table 1.1 shows the performance of construction sector. Then discuss the result. In the 10th Malaysia Plan, the Government has allocated funds amounting to almost RM230 billion for development expenditure comprises development projects physical infrastructure which includes works like renovation and maintenance of Government assets, public utilities and so on.

Table 1.1: The performance of the construction sector

Quarterly	No. project	Construction work value (RM million)	Changes in percent (%)	
			(QoQ)	(YoY)
ST4 /2014	10,000	27,099	7.1	9.7
ST3 /2014	9,835	25,301	0.5	10.7
ST4 /2013	9,652	24,692	8.1	11.3

An increase in the construction sector also contributed to the increase in contamination to the environment and global warming is a hot issue is addressed at present. Among the causes of environmental problems is the removal and disposal of construction waste is not controlled. Systematic management of construction waste is critical of practices on construction sites. According to Tchobanoglus (2002), construction waste arising from construction work, renovation, work demolishing illegally constructed buildings of all types of buildings, whether the building of residence or non-residence, building work to repair roads, repair bridges and clearing caused by nature or caused by humans themselves.

Typically, building materials have been damaged or wastes cannot be used again for construction works as it does not meet the specifications of the design. However, alternative measures such as recycling should be implemented because wastage is not only detrimental to both the contractor and the client, but also result in loss of natural resources and the country's economic resources.

1.2 PROBLEM STATEMENT

Malaysia is a country that is rapidly developing. Construction of buildings and infrastructure are visible everywhere across the country. The development of this emerging is to provide facilities to the people. However, this development is done to some extent present a problem in the management of construction waste. For example, in Europe in 1990, a resolution was made to establish a policy as a strategy to improve the management of construction waste is increasing (European Commission, DG ENV. 3, Management of Construction and Demolition Waste, 2000). While in Malaysia, the local authorities and the Department of environment will be responsible for the management of this waste.

Preventive measures and good management in controlling the flow of the rest of the building, directly will be able to assist in reducing the impact of prevailing against the environment. Solid waste management and Construction must be in accordance with reference to the country's solid waste management Policy (DPSPN). Careful planning, monitoring and control system at the site will help to prevent or reduce construction waste.

For example, keeping construction goods such as wood, brick, steel and others can happen damage should be compiled and stored in a place that is supposed to maintain the quality and quantity of the item.

In Malaysia, most of the contractors less take note of construction waste management. But there are a few contractors who often take the easy way by throwing construction waste into the wrong places such as remote areas and away from the view of society. This is unethical and harmful to all parties. Daily News (2003) revealed that some irresponsible contractor has dump their construction waste into the river.

Generally there are various types of disposal systems that can be used for the disposal of construction waste. Among them is by doing waste recycling, reuse of waste and the waste disposal in landfills. However, this construction materials management often ignored because this matter is considered not so important and will be harmful to the cost of the contractor. But there are a few contractors who take the easy way of doing construction residues burning this openly and will pollute the environment.

1.3 RESEARCH OBJECTIVE

The objective depends on what we want to achieve. The objective is target for everything that we want to do. This thesis has a few objectives that related to the solid construction waste in building construction site. So many things we need to find to realize these objectives are:

a) To identify factors of solid waste in building construction site.
b) To identify the quantity in percentage of the construction waste at construction site.
c) To propose the solid waste in the construction of buildings that can be recycled.

1.4 SCOPE STUDY

The scope of the study determined at an early stage in an accessibility review of literature and information gathering is focusing on fields, spaces, aspects that set the objective that is designed to achieve at the final stage of this study.

The scope of the study includes:

a) Solid construction waste in building construction site.
b) Site study has been carried out in an area of Kuala Lumpur.

1.5 SIGNIFICANCE OF STUDIES

The results that can be expected is to show an advantage in the implementation of waste management on construction. With the completion of this study, it is hoped that the findings could be a guide to the contractor to carry out the "Management Practices Neglected" in the aspects of handling construction waste. The results of this study will provide a better understanding and be able to learn about the importance of the construction waste management on construction. With this, a renewal can be done to improve the management of existing construction waste so that it can reduce the risk to the environment.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The construction sector is one of the most active industries in Malaysia. On average, the number of development projects implemented in Malaysia amounted to an average of nearly 6,000 projects a year, and it accounted for approximately 4.9% of gross domestic product (GDP) the country. In the 10^{th} Malaysia Plan, the Government has allocated funds amounting to almost RM230 billion for development expenditure comprises development projects physical infrastructure which includes works like renovation and maintenance of Government assets, public utilities and so on. However, from one of the other angles, rapid development can give serious impact to the environment if waste is produced for these activities are not well managed and the increase in the generation of waste growing from year to year is not controlled. For example, City of Kuala Lumpur alone, a total of almost 400 illegal waste pile locations has been identified from 2008 to 2010 and 80% of them detected emanating from solid waste construction. The problem has now become a national issue that contributed to a variety of environmental problems around as well as being one of the cause of the problem spreading dengue epidemic disease including.

Table 2.1: Generation of municipal solid waste in Malaysia according to states from 1996 to 2009 (Agamuthu et al., (2009)

State	**solid waste generated (tons/day)**							
	1996	**1998**	**2000**	**2002**	**2004**	**2006**	**2008**	**2009**
Johor	1613	1786	1915	2093	2255	2430	2578	2655
Kedah	1114	1215	1324	1447	1559	1680	1782	1835
Kelantan	871	950	1034	1131	1213	1302	1382	1423
Melaka	433	480	515	563	605	650	690	711
Negeri Sembilan	637	695	757	828	890	957	1015	1046
Pahang	806	879	957	1046	1125	1210	1284	1322
Perak	1286	1402	1527	1669	1795	1930	2048	2109
Perlis	165	180	196	214	230	247	262	270
Pulau Pinang	916	999	1088	1189	1278	1375	1458	1502
Selangor	2380	2595	2827	3090	3322	3573	3790	3904
Terengganu	743	811	883	965	1038	1116	1184	1219
Kuala Lumpur	2105	2305	2520	2755	3025	3323	3525	3631
WP Labuan	NA	NA	46	70	74.3	81.2	86.1	88.7
Sabah	NA	NA	NA	2490	2642	2887	3062	3154.3
Sarawak	NA	NA	NA	1905	2012	2208	2343	2413
Total	13,069	14,297	15,589	21,455	23,063	24,969	26,489	27,283

Note: NA - Not available.

Table 2.1 to describe the generation of municipal solid waste by individual states in Malaysia from 1996 to 2009. Johor, Kuala Lumpur and Selangor states are the top three ranked in the municipal solid waste generated. The total amount of waste presented in Table 2.1 total data year 2009 is the 27,283 tons/day is greater than the one reported by the Ministry of Housing and Local Government (MHLG, 2010). With the advancement in living standards, it is not surprising if the amount of solid waste generated continues to rise over the years. Waste generation has since increased with population expansion (Agamuthu and Fauziah, 2011).

2.2 DEFINITION

2.2.1 Construction Waste

According to Chen et al (2002) construction waste can be closely defined as debris of construction and demolition (C & D). Specifically, construction waste refers to solid waste containing no liquids and hazardous substances, largely inert waste, resulting from the process of construction of structures, including building of all types (both residential and nonresidential) as well as roads and bridges. Construction waste does not include clean-up materials; lend waste, solvent sealers, adhesive living garbage, furniture appliances or similar materials.

Construction waste is the "by-product generated and removed from construction, renovation and demolition work places or sites of building and civil engineering structures" by Hong Kong Polytechnic (2006).

Environmental Protection Department (July 2013) defined Construction waste means any substance, matter or thing which is generated as a result of construction work and abandoned whether or not it has been processed or stockpiled before being abandoned. It is a mixture of surplus materials arising from site clearance, excavation, construction, refurbishment, renovation, demolition and road works.

All of these statements prove that, the amount of construction waste depends on the economic and cultural conditions in a country. However, its contents may be described in a general sense. Depending on their origin and including demolition waste. On the other hand, in terms of materials, construction waste consists of mainly concrete, brick, wood, glass, metal, plastic and roofing.

2.2.2 Recycling

The definition of recycling construction waste materials should be linked in the construction sector. There are several definitions, including:

According to "Oxford Learner's Dictionaries" recycling is a process of treating things that have already been used so that they can be used again.

Recycling is a process of isolation, cleaning and processing of waste for the purpose of producing a new product. This process is carried out at a construction site by Contractor Guide (2003).

City of Austin Green Building Program (2003) defined recycling is the separation and recycling waste materials which can be recovered produced during construction and renovation. Packaging materials, new pieces of building materials, building materials and construction waste material is a material that has the potential to be rectified.

All of these statements prove that there are similarities in terms of the purpose of recycling of materials that can be recycled to produce new products or reused for other materials. Study recycling means material processing are broken, damaged, excessive rust, or that have been used to gather again to repair and reused to produce the same material or as additives for improvement in other products to avoid going waste in construction and pollute the environment.

2.3 WASTE FACTOR

In general, recycling of construction waste materials is influenced by many factors an obstacle, directly or indirectly. These factors should be considered by the parties involved, such as recycling companies and contractors before the program cycle to begin. This barrier waste factor is material management and handling, separate and space.

2.3.1 Material Management and Handling

The management and handling of materials in the construction site plays and important role in waste management. Improper material management and handling could lead to higher generation of construction waste. For example, if solid wood concrete mold (Special) is not protected from rain and hot weather by using canvas or cloth, wood will decrease life expectancy. This is because the problem of low quality materials and the effects of the weather will cause the wood cannot be used again. Then Woods will be scrapped if building materials are not well maintained and operated. Storage and handling of materials on construction sites should be implemented correctly to reduce the production of building materials are damaged. Figure 2.1 below shows the systematic and improper material storage.

Figure 2.1: (a) Systematic material storage (b) Improper material storage

2.3.2 Separate

In addition, the separation is one of the methods to avoid and reduce construction waste. Separation is a process for separating solid waste which can be recycled by types and components of waste from solid waste to be disposed. It is intended to enhance the value of the materials are separated on construction sites as in Figure 2.2 (a) and (b). Indirectly, it helps reduce the amount of solid waste sent to landfills.

Figure 2.2: (a) and (b): Example of Construction solid waste separate at the construction site

2.3.3 Space

After the separation, material wastage should be placed at a construction site at a specific period up to the quantity enough to send to processing. For certain materials such as wood and compound, large space should be provided because usually these substances transported in large pieces. In addition, a space for houses ' drop box ' recycling and routes for the carrier must also be taken into account that the process of recycling operations can be carried out properly as in Figure 2.3.