

**FACTOR GENERATING CONSTRUCTION  
WASTE MATERIALS ON SITE**

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## SUPERVISOR'S DECLARATION

I/We\* hereby declare that I/We\* have checked this thesis/project\* and in my/our\* opinion, this thesis/project\* is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

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I hereby declare that the work in this thesis 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 Universiti Malaysia Pahang or any other institutions.

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## ABSTRAK

Pertumbuhan pesat dalam aktiviti pembinaan meningkatkan masalah sisa pembinaan di seluruh dunia. Penjanaan sisa pembinaan boleh memberikan impak negatif kepada projek pembinaan. Untuk mengurangkan kesan negatif, diperlukan untuk mengenal pasti punca yang mempengaruhi pembaziran sisa. Tujuan penyelidikan ini adalah untuk mengenal pasti faktor yang paling penting menyumbang kepada penjanaan sisa pembinaan di tapak. Hasil penyelidikan ini akan memberikan pemahaman tentang jenis sisa pembinaan yang dihasilkan di tapak, faktor yang mempengaruhi sisa pembinaan yang dihasilkan dan faktor yang paling penting yang menyumbang kepada bahan buangan pembinaan menjana. Berdasarkan tinjauan penyelidik dan kajian masa lalu, faktor yang mempengaruhi penjanaan sisa pembinaan dikelompokkan kepada lima kategori: Reka bentuk, Pengendalian, Pekerja, Pengurusan dan Perolehan. Data dan maklumat telah dikumpul dengan menyebarkan tinjauan soal selidik kepada pekerja pembinaan yang berdaftar dengan CIDB (Lembaga Pembangunan Industri Pembinaan) atau PKK (Pusat Khidmat Kontraktor). Data yang diperoleh dianalisis dengan menggunakan Indeks Kepentingan Relatif (RII) dan didasarkan pada kumpulan mereka. Dari hasil dan analisis data, ranking tertinggi yang ditunjukkan oleh kebanyakan penyelidik adalah faktor reka bentuk yang menyumbang kepada pembentukan sisa pembinaan besar. Sementara itu, faktor kedua tertinggi adalah pekerja, diikuti dengan pengendalian, pengurusan dan perolehan. Melalui mengenalpasti punca-punca penting, peserta industri pembinaan boleh mengelakkan dan memberi amaran tentang bagaimana pembaziran dihasilkan. Ia akan memberikan manfaat yang besar kepada negara dari segi perlindungan alam sekitar, ekonomi dan masyarakat

## **ABSTRACT**

Rapid growth in construction activities increases construction waste problems around the world. The generation of construction waste could give negative impact to the construction project. In order to reduce the negative impact, it is needed to identify the cause that effecting the waste generation. The aim of this research is to identify the most significant factor contribute to the construction waste generation at site. This research outcome will provide understanding about the types of construction waste generate on site, factor affecting the construction waste generated and the most significant factor that contribute to the construction waste materials generate. Based on the past researcher and literature review, the factors that affecting the construction waste generation were grouped into five categories: Design, Handling, Workers, Management and Procurement. The data and information were collected by distributed the questionnaire survey to the construction workers that are registered with CIDB (Construction Industry Development Board) or PPK (Pusat Khidmat Kontraktor). The data obtained were analysed using Relative Importance Indices (RII) and were ranked based on their group. From the result and data analysis, the highest ranked as indicated by most researchers was design factor that contributes to large generation of construction waste. Meanwhile, the second highest factor were workers, followed by handling, management and procurement. Through identifying the important causes, construction industries players can avoid and alert about how the waste was generated. It will gives a great benefit for country in term of protection of the environment, economic and society.

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## LIST OF SYMBOLS

RII                    Relative Importance Indices

## **LIST OF ABBREVIATIONS**

CIDB                      Construction Development Board Malaysia

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction

The construction industry is one of the main contributors towards the development of nations, providing the necessary infrastructure and physical structures for activities such as commerce, services and utilities. The industry generates employment opportunities and injects money into a nation's economy by creating foreign and local investment opportunities (M. Agung, 2009).

However, despite these contributions, the construction industry has also been linked to global warming, environmental pollution and degradation (Jones & Greenwood, 2009). Construction waste generation and unsustainable use of depleting natural resources as building materials, are also linked to the adverse environmental impacts of the construction industry. Globally, it is estimated that approximately 10 to 30 per cent of wastes disposed of in landfills originates from construction and demolition activities.

In Malaysia, construction waste is one the single largest waste stream and yet despite a number of government policy initiatives to address this issue, sustainable resource and waste management on site remains a low priority for the majority of the contractors (Begum, 2009).

Construction waste generation is becoming a pressing issue in Malaysia (Begum, 2010). There are a lots of construction waste generated in the country because of rapid development in construction industry. Demand of houses and major infrastructure projects make the amount of construction waste getting increased (Nasaruddin et al., 2008; Siti et al., 2008).

## **1.2 Background of Problem**

Construction is an imperative industry that plays a vital role in the socio-economic growth of a country. It provides necessary infrastructure and physical structure for activities such as commerce, services, and utilities (Khan, Liew, & Ghazali, 2014). However, the industry is facing the problem of construction wastes generation. According to Oh (2014) in *The Star* daily publication in March 2014, Solid Wastes Management and Public Cleansing Corporation highlighted that in 2007, Kuala Lumpur generated 1.04 million metric tonnes of construction wastes per year and this amount is expected to increase to 1.34 million metric tonnes a year by 2020. Masudi et al. (2011) stated that wastage level for major materials in some projects in Malaysia may reach up to 10%.

This generation of wastes has negative impact to the environment, cost, productivity, time, social, and economy of the industry (Kozlovská et al., 2013; Marzouk et al., 2014; Osmani, 2012; Wang et al., 2008). In addition, production of wastes may weaken the efficiency, effectiveness, value, and profitability of construction activities (Augustine, 2011). Therefore, it is needed to identify the main cause of the waste generation.

In Malaysia, it was found that there were five significant factors that caused generation of construction wastes in this country. The factors are poor site management or supervision, lack of experience, inadequate planning and scheduling, mistakes and errors in design, and mistakes during construction (Nagapan et al., 2012a). In addition, contractors and consultants agreed that three most important factors that contribute to generation of material wastes at construction site are rework contrary to drawings and specification, design changes and revision, and wastes from uneconomical shapes (Adeweyu et al., 2013).

There are various factors that contribute to generation of construction wastes. These factors pose different levels of risk in wastes generation. Various researchers have identified factors that contribute to wastes generation. A study conducted in Sri Lanka



revealed that the domestic construction industry workforce is ignorant of the flow of activities that generated wastes (Senaratne et al., 2008).

Therefore, it can be concluded that construction waste may be generated by various which can be negative impacts towards environment, economy and society. By identifying the factor affecting the waste generation, it may help the construction player to figure out the best way to reduce this problem.

### **1.3 Problem Statement**

Construction industry plays a key role in socio-economic development of any country. Nowadays construction industry is rapidly growing because of increase in standard of living, demands of infrastructure projects, changes in consumption habits, as well as natural increase in population. This growth has contributed significantly in waste generation, which has become serious problem for every nation.

Waste is one of the serious problems in construction industry. Globally, waste volumes are increasing quickly, even faster than the rate of urbanization. Currently, the world cities are generating about 1.3 billion tonnes of solid waste per year. This volume is expected to increase to 2.2 billion tonnes by 2025. As countries urbanise, their economic wealth increases. As standards of living and disposable incomes increase, consumption of goods and services increases, which results in a corresponding increase in the amount of waste generated (Hoorweg et al., 2012). Many researchers and practitioners indicate that there are many wasteful activities during design and construction process. Wahab et al. (2011) described waste emanates during different stages of construction which are during planning, estimating and construction stage. Furthermore, Ekanayake et al. (2008) shows waste occur during design, operational, procurement and material handling. The majority of these consuming time and effort without adding value for the client thus resulting losses in material, delay times and execution of unnecessary work.

## REFERENCES

- Begum, R. A., & Pereira, J. J. (2011). C&D waste profile of the Malaysian construction industry: Need a centralized database. Sustainable Technologies (WCST), 2011 World Congress on (pp. 73-76). IEEE.
- C. Llatas, "A Model for Quantifying Construction Waste in Projects according to the European Waste List," *Journal of waste management*, vol. 3, pp. 1261-1276, 2011.
- Desa, A., Kadir, N. B. A., & Yusoff, F. A Study on the Knowledge, Attitudes, Awareness Status and Behaviour Concerning Solid Waste Management. *Procedia Social and Behavioral Sciences*, Volume 18, (2011), pp. 643-648.
- E. M. Nazech, et al., "Identification of Construction Waste in Road and Highway Construction Projects," in 11th East Asia-Pacific Conference on Engineering and Construction, 2008.
- Foo, L. C., Rahman, I. A., Asmi, A., Nagapan, S., & Khalid, K. I. (2013). Classification and quantification of construction wastes at housing project site. *International Journal of Zero Wastes Generation*, 1(1), 1–4.
- Hoornweg, D., & Bhada-Tata, P. (2012). A global review of solid waste management. World Bank Urban Development Series Knowledge Papers, (March), 1–116. Retrieved from <https://openknowledge.worldbank.org/handle/10986/17388>  
Hoornweg
- Hasan, A. B. C., Ridzuan, A. R. B. M., Yusof, Z. B., Noordin, B. B., Atan, I. B., & Ghani, A. H. B. A. (2013). Estimation model of construction waste materials in Malaysia: Steel. In *Business Engineering and Industrial Applications Colloquium (BEIAC)*, 2013 IEEE (pp. 709-713). IEEE.
- Hassan, S. H., Ahzahar, N., Fauzi, M. A., & Eman, J. (2012). Wastes management issues in the Northern Region of Malaysia. *Procedia - Social and Behavioral Sciences*, 42, 175–181.
- H. Lau, et al., "Composition and Characteristics of Construction Waste Generated by Residential Housing Project," *International Journal of Environment Resources*. vol. 2, pp. 261-268, 2008.

- J. Y. Wang, et al., "An Investigation of Construction Wastes: An Empirical Study in Shenzhen," *Journal of Engineering, Design and Technology*, vol. 6, pp. 227-236, 2008
- K. M. S. Wan, et al., "Contributors to Construction Debris from Electrical and Mechanical Work in Hong Kong Infrastructure Projects," *Journal of Construction Engineering and Management*, vol. 135, pp. 637-646, 2009.
- Kofoworola, O. F., & Gheewala, S. H. (2009). Estimation of construction wastes generation and management in Thailand. *Wastes management (New York, N.Y.)*, 29(2), 731–8.
- Lu, W., & Yuan, H. (2011). A framework for understanding wastes management studies in construction. *Wastes management (New York, N.Y.)*, 31(6), 1252–60.
- Lu, W., Yuan, H., Li, J., Hao, J. J. L., Mi, X., & Ding, Z. (2011). An empirical investigation of construction and demolition wastes generation rates in Shenzhen city, South China. *Wastes management (New York, N.Y.)*, 31(4), 680– 687.
- Masudi, A. F., Hassan, C. R. C., Mahmood, N. Z., Mokhtar, S. N., & Sulaiman, N. M. (2011). Construction wastes quantification and benchmarking: A study in Klang Valley, Malaysia. *Journal of Chemistry and Chemical Engineering*, 5(10), 909-916.
- Wahab, A. B., & Lawal, A. F. (2011). An evaluation of wastes control measures in construction industry in Nigeria. *African Journal of Environmental Science and Technology*, 5(3), 246–254.
- Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. *Journal of Advanced Research*, 5(1), 49-55.
- Nagapan, Sasitharan, Ismail Abdul Rahman, Ade Asmi, Aftab Hameed Memon, and Imran Latif. 2012. "Issues on Construction Waste: The Need for Sustainable Waste Management." *CHUSER 2012 - 2012 IEEE Colloquium on Humanities, Science and Engineering Research (December 2012)*:325–30.
- Nagapan, S., Rahman, I. A., Asmi, A., Hameed, A., & Zin, R. M. (2012c). Identifying causes of construction wastes - case of Central Region of Peninsula Malaysia. *International Journal of Integrated Engineering*, 4(2), 22–28.

- Nazech, E. M., Zaldi, D., & Trigunarsyah, B. (2008). Identification of construction wastes in road & highway construction projects. Proceedings Eleventh East Asia-Pacific Conference on Structural Engineering and Construction (EASEC11) (pp. 1–7).
- N. M. Siti and Z. M. Noor, "Approach in Construction Industry: A Study on Prefabrication Method as a Tool for Waste Minimization" in International Conference on Environmental Research and Technology, 2008.
- Osmani, M., Glass, J., & Price, A. D. F. (2008). Architects' perspectives on construction wastes reduction by design. *Wastes Management*, 28(7), 1147– 1158.
- O.F. Kofoworola and S.H. Gheewal "Estimation of construction waste generation and management in Thailand", *Journal of Waste Management*, Vol. 29 (2), pp. 731–738, 2009.
- Spies, S. (2009). 3R in construction and demolition wastes (CDW) – potentials and constraints. GTZ – German Technical Cooperation Division for Environment, Resource Efficiency and Wastes Management.
- Wahab, A. B., and Lawal, A. F. An evaluation of waste control measures in construction industry in Nigeria. *African Journal of Environmental Science and Technology*, Volume 5, (2011), pp. 246-254. [
- Wang, J.-Y., Kang, X.-P., & Tam, V. W.-Y. (2008). An investigation of construction wastess: an empirical study in Shenzhen. *Journal of Engineering, Design and Technology*, 6(3), 227–236.
- Winkler, G. *Recycling Construction and Demolition Waste* Publisher: McGraw-Hill, (2010).
- Yu, A. T. W., Poon, C. S., Wong, A., Yip, R., & Jaillon, L. (2013). Impact of construction wastes disposal charging scheme on work practices at construction sites in Hong Kong. *Wastes Management (New York, N.Y.)*, 33(1), and 138–46.
- Yunpeng, H. (2011). Minimization management of construction wastes. 2011 International Symposium on Water Resource and Environmental Protection (ISWREP), China (pp. 2769–2772). IEEE.

Yuan, H. (2012). A model for evaluating the social performance of construction wastes management. *Wastes management (New York, N.Y.)*, 32(6), 1218–28.