Pertanika J. Sci. & Technol. 25 (S): 47 - 54 (2017)

SCIENCE & TECHNOLOGY

Journal homepage: http://www.pertanika.upm.edu.my/

# Contractors' Perspective on Material Waste Reduction in Kuala Lumpur

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## ABSTRACT

In the area of sustainable development, construction waste is an important issue that must be tackled responsibly. It is an assortment of waste, at the stage of construction. This paper assesses waste minimisation or reduction measures and such practices in the Kuala Lumpur construction industry. A structured questionnaire survey was conducted to obtain contractors' views on 25 waste minimisation measures discussed in literature. Data was analysed using frequency analysis method and average index analysis method. The results showed that adoption of proper site management techniques is widely practised. The adoption of these waste minimisation measures could lead cost savings to the construction industry and prevent environmental degradation.

*Keywords:* Construction industry, Kuala Lumpur, measures, waste minimisation

## INTRODUCTION

The construction industry is the main generator of waste and thus, its key challenge remains having an efficient management in reducing environmental contamination (Lachimpadi et al., 2012). Manny countries push towards preserving a balance between development while at the same time attain sustainable development (Al-Hajj & Hamani, 2011). Sustainable development that encourages re-use of built assets or minimise waste in order to reduce pollution (Ofori et al., 2000) has become the biggest challenge for nations across the globe because construction waste poses serious environmental problems (Begum et al., 2007; Osmani 2012; Poon et al., 2013).

The construction industry has posed serious environmental issues in Malaysia over the last two decades (Begum et al., 2007) had done a study on implementation of waste

ARTICLE INFO

*Article history:*
Received: 29 September 2016
Accepted: 05 April 2017

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ISSN: 0128-7680 

management and minimisation in the Malaysian construction industry and found that the environmental issues are becoming more serious and should be curbed. Therefore, the vast implementation of the construction waste minimisation are the vital area of concern especially in Kuala Lumpur due to its' status as fast growth development city in Malaysia.

Waste minimisation is defined as technology, procedure or action employed to prevent, remove or lessen construction waste or transform those waste for re-use (recycling) (Singh, Brueckner & Padhy, 2015). The Environmental Protection Agency of USA (2000) defines waste minimisation as "any method that reduces the volume or toxicity of a waste that requires disposal". A variety of measures to minimise construction waste has been reported (Al-Hajj & Hamani, 2011; Begum & Pereira, 2011; Yates, 2013). Polat and Ballard (2004) opine that minimisation is most efficient for diminishing adverse impacts of construction waste and reducing waste disposal problem because cost of the latter is more expensive than waste prevention. It is important therefore, to identify and evaluate measures to reduce waste the construction industry. This paper discusses the views of contractors in Kuala Lumpur on waste minimisation measures.

## MATERIALS AND METHODS

This research examined 25 waste minimisation measures found in the literature (Ahankoob et al., 2012; Al-Hajj & Hamani, 2011; Lu & Yuan, 2013; Osmani, Glass & Price, 2008; Osmani, 2012). The measures were pre-tested in a pilot study involving five selected contractors in Kuala Lumpur to evaluate their applicability to the current study. Results showed the instructors had an in-depth understanding and knowledge of the waste minimisation measures.

A survey using structured questionnaire was conducted between January 2016 and April 2016. The questionnaire had three sections: respondents' background, respondents' knowledge on the measures which were pre-tested in the pilot study the level of practice of waste minimisation measures.

The research sample was selected Grade 7 construction firms listed under Construction Industry Development Board (CIDB). There were 1355 registered contractors and in order to achieve 95% confidence level with 0.5 margin of error (Kelley et al., 2003), the sample size needed was 299. However, due to time constraint, we were only able to interview 223 firms.

The 25 waste minimisation measures (WWM) were coded as WMM1 to WMM 25 and Likert scale was used to measure their efficiency. Thus, the respondents select one of the choices available for each row of answers: Always equals to 5; Never = equal 1, thus the mean is 3. If the mean score is <3.00, it indicates that the respondents are less keen to apply the measure on site. However, if the means score is >3.00, it indicates the opposite.

## RESULTS AND DISCUSSION

### Respondents' Background

The average years of experience of the contractor firms surveyed ranged between 10 and 20 years, 20% of respondents are Site Managers with the second highest responses rate, 12% are Project Managers followed by Quantity Surveyors with the highest response rate of 56%.

Lastly, 12% of respondents are from other professions such as Construction Managers and Assistance Manager.

## Waste Minimisation Measures to Waste Reduction

Respondents were interviewed on their waste minimisation measures. The outcome indicated there were no significant differences between all parties at 5% significance level. Table 1 shows average index and ranking of each type of waste minimisation measures.

Table 1
*Average index on contribution of the waste minimisation measures*

| Rank | Waste Minimisation Measure | Average Index |
|---|---|---|
| HIGH | Adoption of proper site management techniques (WMM 1) | 4.41 |
| | Proper storage of materials on site / Provide convenient containers for materials storage and retrieval (WMM 13) | 4.18 |
| | Encourage re-use of waste materials in projects (WMM 2) | 4.18 |
| | Early and prompt scheduling of purchases and deliveries (WMM 6) | 4.12 |
| | Good coordination between store and construction personnel to avoid over ordering (WMM 20) | 4.12 |
| | Ensure appropriate dimensions and quality of materials (WMM 14) | 4.12 |
| | Checking materials supplied for right quantities and volumes (WMM 9) | 3.94 |
| | Accurate and good specifications of materials to avoid wrong ordering (WMM 8) | 3.94 |
| | Employment of skilled workmen (WMM 19) | 3.82 |
| | Minimising design changes (WMM 4) | 3.71 |
| | Use of more efficient construction equipment (WMM 17) | 3.71 |
| MEDIUM | Purchasing raw materials that are just sufficient (WMM 10) | 3.65 |
| | Vigilance of supervisors / improving supervision (WMM 22) | 3.65 |
| | Change of attitude of workers towards the handling of materials (WMM 18) | 3.65 |
| | Recycling of some waste materials on site (WMM 3) | 3.65 |
| | Training of construction personnel (WMM 21) | 3.59 |
| | Mixing, transporting and placing concrete at appropriate time (WMM 25) | 3.59 |
| | Access to latest information about types of materials on the market (WMM 7) | 3.47 |
| | Increase use of off-site prefabrication (WMM 15) | 3.41 |
| | Careful handling of tools and equipment on site (WMM 24) | 3.35 |
| | Issuing raw materials that are just sufficient to sub-contractor (WMM 12) | 3.18 |
| | Just in time operations (WMM 5) | 3.12 |
| | Use of low waste technology (WMM 11) | 3.00 |
| | Using materials before expiry dates (WMM 16) | 3.00 |
| | Waste management officer or personnel employed to handle waste issues (WMM 23) | 2.76 |

The 25 waste minimisation measures were further divided into three categories of waste reduction: high, medium and low contributions (Table 1). The rating was classified based on their average index score: 1 represents lowest contribution to waste reduction, 3 represents medium while 5 is the highest contribution.

Eleven measures including "adoption of proper site management techniques" (WMM 1), "proper storage of materials on site or provide convenient containers for materials storage and retrieval" (WMM 13) and "encourage re-use of waste materials in projects" (WMM 2) were categorised as high level of contribution to waste reduction, with average index rating near or more than 4.20. Contractors consider waste minimisation measures, which result in cost saving to the organisation, as representing high contribution to waste reduction. According to Sin et al., (2012), inappropriate management of construction waste has multifold adverse impacts. Thus, Malaysia government is urged to improve waste management techniques and cooperate with private sectors to adopt proper site management techniques.

"Waste management officer or personnel employed to handle waste issues" (WMM 23) is the lowest contributor to waste minimisation measure with a score 2.76. The contractors considered employing of waste manager as unnecessary and a waste of money.

## Level of Practice of Waste Minimisation Measures

The responses of contractors on waste minimisation measures were compared, and the results showed no difference at 5% significance level. The responses of both groups were therefore combined ranging from "never practiced" to "always practice" as shown in Table 2.

Table 2
*Average index on practice of waste minimisation measures*

| Rank | Waste Minimisation Measure | Average Index |
|---|---|---|
| OFTEN | Proper storage of materials on site / Provide convenient containers for materials storage and retrieval (WMM 13) | 3.97 |
| | Early and prompt scheduling of purchases and deliveries (WMM 6) | 3.71 |
| | Adoption of proper site management techniques (WMM 1) | 3.68 |
| | Good coordination between store and construction personnel to avoid over ordering (WMM 20) | 3.68 |
| | Minimising design changes (WMM 4) | 3.53 |
| | Ensure appropriate dimensions and quality of materials (WMM 14) | 3.53 |
| SOMETIMES | Checking materials supplied for right quantities and volumes (WMM 9) | 3.24 |
| | Accurate and good specifications of materials to avoid wrong ordering (WMM 8) | 3.24 |
| | Using materials before expiry dates (WMM 16) | 3.21 |
| | Training of construction personnel (WMM 21) | 3.15 |
| | Purchasing raw materials that are just sufficient (WMM 10) | 3.09 |
| | Use of more efficient construction equipment (WMM 17) | 3.09 |
| | Change of attitude of workers towards the handling of materials (WMM 18) | 3.09 |

Table 2 *(continue)*

| | | |
|---|---|---|
| | Access to latest information about types of materials on the market (WMM 7) | 3.09 |
| | Employment of skilled workmen (WMM 19) | 3.06 |
| | Careful handling of tools and equipment on site (WMM 24) | 3.03 |
| | Mixing, transporting and placing concrete at appropriate time (WMM 25) | 3.00 |
| | Increase use of off-site prefabrication (WMM 15) | 2.94 |
| | Encourage re-use of waste materials in projects (WMM 2) | 2.94 |
| | Vigilance of supervisors / improving supervision (WMM 22) | 2.91 |
| | Just in time operations (WMM 5) | 2.91 |
| | Issuing raw materials that are just sufficient to sub-contractor (WMM 12) | 2.88 |
| | Recycling of some waste materials on site (WMM 3) | 2.76 |
| | Use of low waste technology (WMM 11) | 2.76 |
| | Waste management officer or personnel employed to handle waste issues (WMM 23) | 2.76 |

A measure with the highest rank has the highest level of waste minimisation. The rating range measures was based on their average index score: 1 represents measures that were never practised, 2 represents measures rarely practised, 3 represents measures practised sometimes, 4 represents measures often practised and 5 represents measures always practised. The range between the highest and lowest values is 4. This range is divided by 5 to represent the five scales which are never, rarely, sometimes, often and always practice measure. From Figure 2 and Table 2, no waste minimisation measures that did not fall under the category of "always" had been implemented by contractors in Kuala Lumpur. The most popular measure was "proper storage of materials on site or provide convenient containers for materials storage and retrieval (WMM 13) with an average index of 3.97. The other two measures under "always" category are "early and prompt scheduling of purchases and deliveries" (WMM 6) and "adoption of proper site management techniques" (WMM 1).

"Recycling of some waste materials on site" (WMM 3), "use of low waste technology" and 'waste management officer or personnel employed to handle waste issues' are among the lowest practices to waste minimisation in Kuala Lumpur's construction sites and these three measures had a score of 2.76. Although 'recycling of some waste materials on site' was ranked number 12 in the priority level of waste minimisation measures to waste reduction, the contractors were less keen to implement this measure on their site due to the reason it was not always cost-effective. This was confirmed by Hiete et al. (2011) and Yuan et al. (2011) as construction waste is heterogeneous, making recycling efforts difficult. However, , contractors are encouraged to re-use built assets and adopt better environmental management system to reduce waste (Ofori et al., 2000).

## CONCLUSION

This study examined waste minimisation measures by contractors in the Kuala Lumpur construction industry. Respondents perceived adoption of proper site management techniques,

proper storage of materials on site or providing convenient containers for materials storage and retrieval and boost to re-use the waste materials in projects as measures that are most effective in contributing to waste minimisation. Employing waste management officers to handle waste issues and recycling of waste materials on site are perceived as measures with low contribution to waste reduction and the least practised. This could be contractors believed these measures will increase cost rather than profit. Therefore, in order to help the construction industry in Kuala Lumpur to achieve minimisation of waste materials, it is recommended that government should enact laws and implement policies that promote positive attitudes towards waste minimisation at all levels in a construction project.

## ACKNOWLEDGEMENT

The authors acknowledge INTI INTERNATIONAL UNIVERSITY for its support.

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