

# **Construction Waste Management: Level of Practice of Contractors**

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## **ABSTRACT**

*Construction wastes have become a major environmental problem not only in Malaysia but also throughout the world. Tonnes of demolition and construction wastes are produced daily. While most wastes are destined to landfill areas, some of them are disposed of and dumped illegally in private lands. Hence, if the production of wastes is not controlled and managed properly, Malaysia will eventually face major environmental problems as a result of rapid dwindling of available dumping and landfill areas. Controlling and managing construction wastes are becoming more and more eminent and important to healthier living environment of the future generation. Construction sites wastes should be managed and minimised to mitigate negative effects to the environment. This paper will look on the basic procedure of construction waste management that has been practised by the contractors. Finally, this paper will proposed basic waste management guidelines as a basic preparation that consist of three (3) main factors; basic preparation of Waste Management Plan (WMP), estimating of construction waste, and sorting or separation techniques of building waste.*

**Keywords:** *environmental problem, construction wastes, waste management*

## **Introduction**

The construction industry consumes huge amounts of natural resources and produces a significant quantity of construction and demolition (C&D) wastes, about four time rate of household waste production. For example, in 2004, about 20 million tonnes of C&D waste was generated in Hong Kong and approximately 136 million tonnes of C&D debris was generated in US in 1996 (Franklin Associates, 1998). The quantity of C&D waste is affected by the ever-increasing use of land for new construction, renovation, demolition of old structures and the reconstruction or expansion of the road transportation network.

In Malaysia, with the demands in implementing major infrastructure projects, together with many commercial building and housing development programmes, a large amount of construction waste is being produced by the construction sector. A study by Hassan et al. (1998) shows that on average, the breakdown of waste generation according to source: 36.73% from household waste, 28.34% from industrial and construction waste while other sources (market and commercial waste, institutional waste, landscaping waste and street sweeping waste) account for the remaining 34.93% in the Central and Southern region of Malaysia. This shows that, in Malaysia construction waste forms a significant portion of wastes which is finally disposed of in landfills.

Construction waste management is the process of planning and implementing the handling and disposal of building materials on the construction site. It involves applying the conservation hierarchy, reduce, reuse and recycle to construction materials and methods. Research, training and development of a construction waste management plan are integral parts of this process. The objective is to examine the management of these wastes in all forms, thus, fostering the opportunity for cross-fertilisation rather than artificial separation into a series of non-exclusive subsets established by regulation and/or law: e.g. the air problem, soil contamination, groundwater impact, mixed waste, superfund wastes, and reactor decommissioning wastes.

### Sample Projects in the Implementation of Waste Management Plan (WMP)

Table 1.1 shows the three (3) projects that have been chosen for this study.

Table 1: Sample Project

CONTRACTOR	PROJECT
A	Construction of the Marine Police Base in Port Klang, Selangor Darul Ehsan. Contractor: Pulau Reka-Kembang Maju Joint-Venture
B	Cadangan Merekabentuk, Membina dan Menyiapkan Kompleks Stor Teknikal KL-TIMUR/ KL – Pusat dan 'Local Warehouse' di Atas Lot 11553 Mukim Hulu Kelang, Daerah Gombak, Selangor Darul Ehsan. Contractor: Satriadesa Corporation Sdn. Bhd.
C	Design, Construction, Equipping, Commissioning And Maintenance Of A New Healthcare Facilities And Renovation And Refurbishment Works For Institut Jantung Negara Sdn. Bhd. (IJN) Jalan Tun Razak, Kuala Lumpur Contractor: UEM Construction Sdn. Bhd.

## Findings

### *Years of Experience in Waste Management Plan (WMP) among the Contractors*

The survey results reveal that all the contractors have implemented Waste Management Plan (WMP) but in different levels of practice and plan. Contractors A and C have experience of more than 10 years in practising Waste Management Plan while Contractor B has less than 5 years of experience. This is shown in Table 1.2.

**Table 1.2:** Years of Experience in Waste Management Plan (WMP) Practice

Contractor	Years of Experience in WMP
A	10 – 15 years
B	< 5 years
C	10 – 15 years

Although the contractors have already had their own Waste Management Strategy and Plan, the improvement of the quality management system still has to be measured to minimise the environment impact that can be caused by the improper waste management system.

Applying environmentally friendly technology on site is one of the most effective measures to improve waste management practices (Tan et al., 1999). A study by McDonald (1998) emphasised the significance of establishing the WMP method during the construction phase. Further, a study by Chen et al. (2000) classified four (4) groups of measures against construction pollution; namely, technological methods, managerial methods, planning methods, and building material methods.

The implementation of the Waste Management Plan (WMP) method has several benefits. Pollution prevention, better allocation of resources, better regulatory compliance, evaluation of risks and plans for preventing potential problems can be achieved through implementation of the method (Tibor, 1996).

### *Level of Practice among the Waste Minimisation Factors*

This paper also presents the same twelve (12) waste minimisation factors

to all respondents. The respondents were asked to indicate their perception of the level of practice of each factor overall in the Malaysian construction by selecting one of five (5) scale points (from Not Practised at all to Most Frequently Practised ). The survey results are summarised in Table 1.3. Most of the respondents indicated that buying repairable, refillable and durable materials is most frequently practised in the Malaysian construction industry, thus the number of ranking 4 to 5 is given by most of them with mean values 4.44.

Table 1.3: Level of Practice among the Waste Minimization Factors

	N	Minimum Scale	Maximum Scale	Mean	Standard Deviation
Buying repairable, refillable and durable materials	34	2	5	4.44	0.504
Buying materials that have reuse packing	34	2	5	3.76	0.606
Using non-toxic or less toxic product	34	1	5	3.47	0.929
Changing design of the construction process	34	2	5	3.71	0.760
Using low waste technology	34	2	5	3.88	0.537
Offering education or training programmes or reward (bonus) programmes	34	3	5	3.03	0.870
Facilitate reusing or recycling for sorting different types of waste	34	2	5	3.94	0.776
Purchasing raw materials that are just sufficient	34	2	5	3.68	0.768
Using materials before expiry dates or damaged	34	1	5	3.71	0.719
Exchange waste with others	34	1	5	3.74	0.751
Reusing materials	34	3	5	4.12	0.537
Recycling of materials for resource recovery or as a by-product	34	2	5	4.12	0.640

In addition, reusing and recycling of materials for resource recovery or as a by-product is also frequently practised. This evidence is echoed in the findings of the studies by Poon (2000) and Shen and Tam (2002)

which shows reduction, reuse and recycling of construction and demolition wastes as the most effective measure and recommendable practice for the Hong Kong construction industry.

The respondents followed the same procedure to give the grade for the rest of waste minimisation factors in the survey. The survey results demonstrated that reusing or recycling for sorting different types of waste the other factors, using low waste technology, buying materials that have reuse packing, exchanging waste with others, changing design of the construction process, using materials before expiry dates or damaged, and purchasing raw materials that are just sufficient are perceived as the practice of waste minimisation factors in the Malaysian construction with mean values more than 3.50.

It is worth noting that offering education or training programmes or reward/bonus programmes are perceived as the least practised factors in implementing waste management in the Malaysian construction industry.

Shen and Tam (2002) found that applying environmentally friendly technology on site is considered as a less attractive environmental management measure to the Hong Kong contractors. This is supported by the factor of using low waste technology, which is perceived as the least practised in the Malaysian construction industry. One of the typical low waste technologies for the construction industry is the application of pre-cast components. However, the local construction practice is typically characterised with a variety of building design modes and congested site space, which limits the use of the pre-cast technology. The general view in the local construction is that any application of the waste minimisation factors, such as using low waste technology, changing design of the construction process as well as offering education or training programmes or reward/bonus programmes will involve increasing costs and efforts. This is likely true to individual construction firms for short term, but underestimates the long-term benefits for both construction business and the public. This also reflects the local business culture dominated by pursuing short-term profits among the contractors in the Malaysian construction industry.

## **The Implementation of Waste Management Plan (WMP)**

From the overall results, it is clearly stated that the most important factor in WMP is from the point of how the materials on site are organised by the contractors. This includes the best use of materials, reusing, recycling and the method of purchasing raw materials to reduce waste on site. The contractors should know how to estimate the quantity of materials to be used in order to reduce waste materials on site. In the first place, the contractor should also have the strategy to prevent waste on site.

In order to improve the WMP by the contractors, the following strategies should be considered:

*Prevent waste in the first place*

The guidelines drawn by the State of Washington, Department of General Administration, Division of Engineering and Architectural Services state that the most important factor to reduce waste on site is by waste prevention. This will include the following steps:

- i) Design to Prevent Waste
  - Design with standard sizes for building materials
  - Specify materials and assemblies that can be easily disassembled at the end of their useful life
  - Design pre-cast concrete members for concrete (tilt-up) construction
  - Choose durable non-toxic interior finishes or materials
  - Design spaces to be flexible for changing uses
  - Consider reusing materials (on-site) or installing salvaged materials from off site sources
  
- ii) Plan for Waste Prevention
  - Target specific practices producing practices for waste prevention
  - Include waste prevention measures in a Waste Management Plan.
  - Progress of waste management plan is presented in the meetings and further discussion on recommendations or improvements of waste management.
  
- iii) Use Construction Methods that Prevent Waste
  - For wood construction, use advanced framing techniques, trusses for roof or floor framing, finger jointed studs and trim and engineered wood products
  - Consider using wood frame wall panels prefabricated off site
  
- iv) Practice Job Site Waste Prevention Methods
  - Set up central cutting areas for wood and other materials
  - Reuse concrete forms or choose reusable metal or fibreglass

- forms
  - Clearly mark areas key to waste prevention, such as the material storage, central cutting and recycling stations
  - Practice material storage and handling procedures to prevent loss or damage
- v) Purchase to Prevent Waste
- Purchase salvaged, recycled or recycled content materials and equipment
  - Check to ensure the correct amount of each material is delivered to site
  - Maintain and up-to-date material ordering and delivery schedule to minimise the amount of time that materials are on-site and reduce the chance of damage
  - Replace toxic materials with less toxic or non toxic products to reduce hazardous packaging
  - Choose products with minimal or no packaging
  - Ask suppliers to deliver supplies using sturdy, returnable pallets and containers. Have suppliers pick up pallets and empty containers
  - Require suppliers to take back or buy back sub-standard, rejected or unused items

While all people involved should be encouraged to contribute their ideas and suggestions on ways to minimise waste, one person (or the Environmental, Health and Safety Manager) should act as the Site Waste Manager and be responsible for overseeing the management of building wastes. This person will be responsible for managing waste reduction initiatives and coordinating the activities of other employees. The key role of a site waste manager is as follows:

- Ensure that all relevant legislation and the contractor's duty of care are complied with
- Initiate waste reduction, reuse and recycling
- Ensure all site personnel know their responsibilities for site waste management
- Co-ordinate waste management on site, gather data about waste on site, keep accurate records on waste movement on and off site
- Ensure that all waste storage areas and containers are properly labelled to show site workers where to deposit specific materials
- Be aware of the construction activities currently taking place on site and the activities planned in the short term. Conduct a sur-

vey of wastes likely to be generated on site and keep a record of them for planning ahead

- Whenever possible, ensure the re-use or recycling of material already on site before it is carted away or new materials are imported
- Obtain a list of potential buyers or collectors of materials to be re-used or recycled
- Encourage all site personnel to use their initiative in coming up with ideas of how to reduce, reuse and recycle wastes.
- Set up an 'Ideas Board' where people can have their say and record suggestions that they may have for reducing, reusing and recycling wastes
- Inform designers so that waste can be reused and recycled on site or on another site

### *Managing Subcontractors*

It can be very difficult to coordinate waste management on sites where there are a large number of subcontractors. The following are some suggestions on supervision :

- a) Many sites are now using a system of allowable waste percentages. In the early pre-work agreements the site manager decides how much waste is acceptable, and agrees a percentage with the subcontractor. If they waste more than the agreed amount, they can be charged extra costs. This is a great incentive to reduce wastes by efficient use of materials. The lower the allowable percentage, the more care people will take with materials. Setting the right level is crucial.
- b) Make subcontractors be responsible for both purchasing the raw materials they need, and disposing of any waste material from their activities. This will give them a direct financial incentive to use materials efficiently with the minimum of wastage. Make subcontractors aware of wastage and the costs involved in dealing with wastes. Hold regular meetings to discuss wastage on site.

(Wilson et al., 1997)

## **Conclusion**

Waste management arrangements should be put in place during the construction and operation to maximise the reduction of waste materials. The WMP would be developed and implemented in accordance with the requirements of relevant waste management legislation and policies for the



project. In view of this, Construction Industry Development Board (CIDB) should provide some initiatives that encourage contractors to practise this issue from the point of waste reduction, involvement of all parties, reusing and recycling measures in the construction sector. These contractors should also be promptly rewarded in the sense that waste minimisation, such as reducing, reusing and recycling activities, are implemented for improved waste management.

In this regard, CIDB can promote some education and training programmes and construction campaigns encouraging contractors to practise these least practised factors in the construction sector. Waste minimisation should be integrated into the construction process and planned at the design and tender stage. The selection of sub-contractors should take into account their waste reduction plan as part of the assessment criteria. Provision of waste reduction training to on-site staff is also considered important in raising environmental awareness and helping site staff implement a better working procedure to reduce the generation of material wastage. Thus, local authorities can use some positive (monetary) and negative rewarding (punishment) methods at construction sites. They can also make some attempt to encourage the contractors to separate and recycle wastes and to motivate their attitudes and behaviour towards efficient waste management. The government should provide guidelines for contractors in implementing waste reduction in line with governmental ordinances.

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