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Construction Waste Minimization and Reuse Management

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Abstract - ***Construction industry has been developing rapidly around the world. The development has led to serious problem in generation of construction wastes in many developing countries and expectation of the natural resources to large extend. The construction wastes clustered into physical and non-physical waste and it has greater impact to environment, economy and social of each country. Before it can be managed well, it is important to understand the root cause of the generation. This paper identifies and detects factors contributed to the generation of construction waste. Mapping technique was applied for identification works and interview was conducted to detect the physical and non-physical waste. These factors were grouped into seven categories: Design, Handling, Worker, Management, Site condition, Procurement and External factor. The significant factors of each category of waste were determined. The findings will help construction players to avoid, reduce and recycling the physical and non-physical wastes. Furthermore, the paper has put forward some recommendations for better improvements in construction.***

Key Words: *Construction Wastes, Reduce Waste*

1. INTRODUCTION

Construction and demolition waste management has become one of the major environmental problems in many municipalities. It has been a pressing issue in India since the late nineties due to the running out of disposal sites to manage the huge amount of waste generated. The building industry is consuming a considerable amount of resources, from the most common material sand to the valuable natural assets like timber. If the life cycle of the material on site, from its transportation and delivery to the end fate, is closely examined, it is generally known that there is a relatively large portion of the materials being wasted because of poor material control on building sites. There are two main kinds of building construction waste, structure waste and finishing waste. Concrete fragment, reinforcement bars, abandoned timber plate and pieces are generated as structure waste during the course of construction. Finishing waste (including a wide range of waste materials) is generated during the finishing stage of a building. For instance, surplus cement mortar arising from screed scatters over the floors inside the building. Broken raw materials like mosaic, tiles, ceramics, paints and plastering materials are wasted because of careless use. The packaging of public and household facilities such as gas cookers, bathtubs, washtubs and window frames are also parts of the finishing wastes. Bossink and Brouwers (1996) estimated from a Dutch study that about 1–10% by weight of the purchased construction materials leave the sites of residential projects as waste. Many resources can be conserved and the amount of C&D waste required to be disposed of should be greatly reduced if better management of materials is practiced on building sites. The strategy to manage C&D materials comprises three major tasks: reduce, reuse and recycle. In this paper, it will concentrate on reducing building waste through better materials control.

1.1 Objectives of the Study

The study, consisting of literature review, questionnaire survey and work-site visits aims to identify the causes of material waste on site, find the material wastage level for various trades of building projects and explore ways to avoid or reduce material wastage and zero waste for future building projects.

1.2 Scope of the Study

This study focus on the zero waste management at construction site which are through interview and questionnaire to the contactor and project manager at construction site. This study also By the result analysis the waste minimization, reuse and recycling will be found and the mitigation measures will be provided and to gets more information about method used in zero waste management construction.

1.3 Construction Waste

Construction waste can be defined as any materials by product of human and industrial activity that has no residual value. Waste is a product or material that is unwanted. Construction waste clustered into two groups namely the physical and non-physical waste.

1.4 Waste Minimization & Recycling Goals

Starting with a goal will help guide the decision-making process, as well as provide direction for subcontractors and suppliers. It is also provides a baseline for measuring how well the project succeeded with waste minimization and recycling. This provides you with "boasting rights." As will be discussed in the final section of this document, in addition to the cost savings and environmental good that is achieved through waste minimization and recycling, it positions your business in a unique niche that can benefit your overall business development. Being able to prove that you have succeeded in the past is therefore essential. Having a goal and measuring your results provides that proof.

1.5 Waste Minimization Strategies

Waste minimization includes:

- Using only those materials that you need;
- Decreasing the amount of material that has to be disposed of as trash; and
- Diverting materials from disposal to reuse or recycling.

Minimizing what you need to buy and planning to use these materials efficiently is the first step to avoid waste. There are many effective strategies to achieve this; all of which also lead to cost savings and increased profitability. Consider the following strategies; many of which you may already be part of your regular practices, but new ideas may occur to you as you move through this list. In all instances, apply the old adage "measure twice cut once" and avoid over-estimating and rounding-up the purchasing requirements. Rounding-up leads to wasted money and wasted materials that you have to deal with at the end of the job.

1.6 Physical Waste

Physical construction waste is defined as waste which arises from construction, renovation and demolition activities including land excavation or formation, civil and building construction, site clearance, demolition activities, roadwork, and building renovation. However, some defined directly to solid waste: the inert waste which comprises mainly sand, bricks, blocks, steel, concrete debris, tiles, bamboo, plastics, glass, wood, paper, vegetation and other organic materials. Another way to understand the physical waste or construction debris can be seen in construction site. This type of waste consists a complete loss of materials, due to the fact that they are irreparably damaged or simply lost. The wastage usually removed from the site to landfills.

1.7 Non Physical Waste

The Non-physical waste normally occurs during the construction process. By contrast with material waste, non-physical waste are time and cost overrun for a construction projects. Similarly, researchers from Indonesia defined waste as not only associated with waste of materials but also other activities such as repair, waiting time and delays. Besides that, the waste can be considered as any inefficiency that results in the use of equipment, materials, labor and money in the construction process. In other words, waste in construction is not only focused on the quantity of materials on-site, but also overproduction, waiting time, material handling, inventories and unnecessary movement of workers. From the interview it was found that least attention was given for this type of waste in construction industry.

2. METHODOLOGY

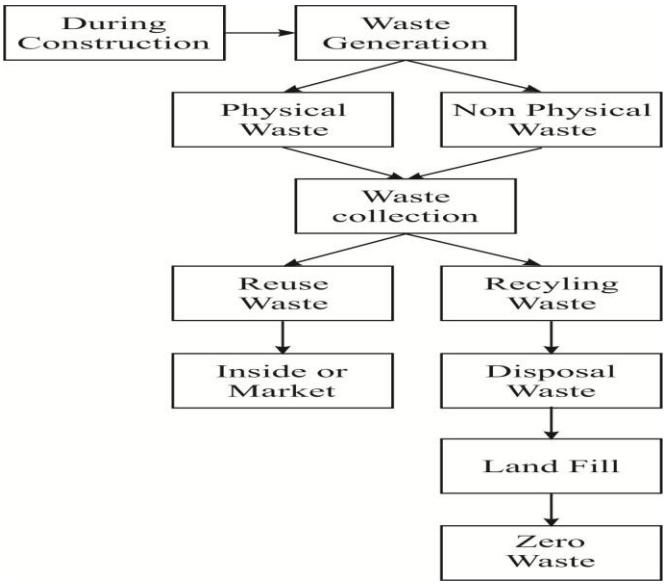


Fig 2.1 Methodology Flow Chart

2.2 Method of Surveying

The general methodology of this study relies largely on the survey questionnaire which will be collected from the local building contractors of different sizes by mail or by personnel meeting. A thorough literature survey was initially conducted to identify the waste management factor that affect the performance of construction industry as a whole. This study has adopted the more general and broad definition of waste management factors from other literature. Also some interviews with industrial practitioners were conducted to produce to check effectiveness of questionnaire.

2.3 Questionnaire Structure

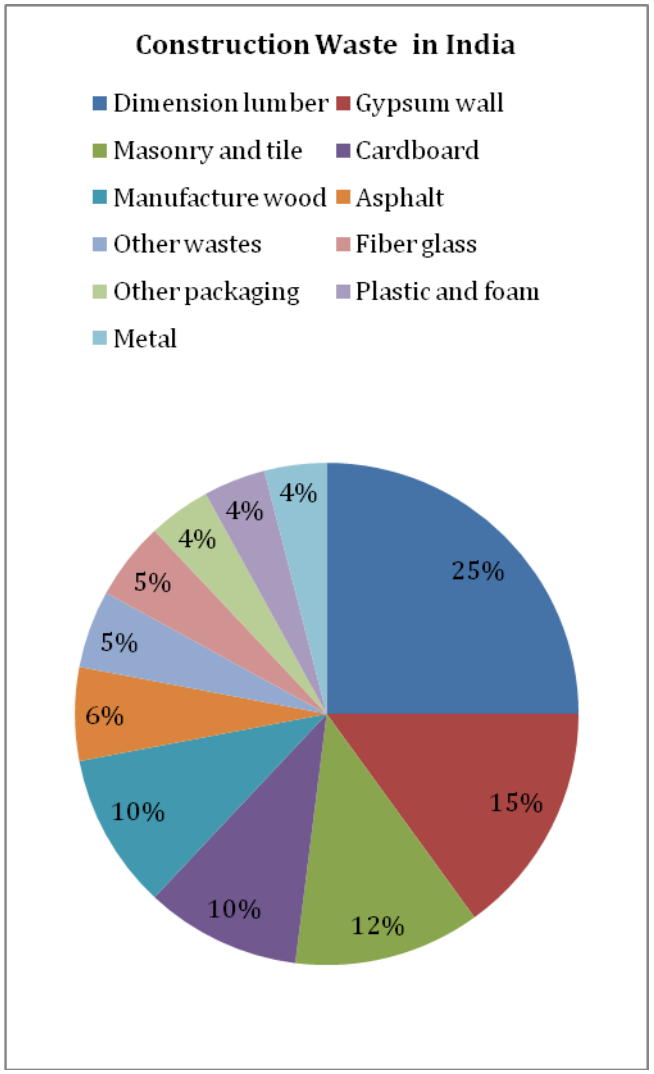
The questionnaire was tested with survey for clarity. The questionnaire survey is divided into two parts. The first part consist of general information like type of company, experience value of their project etc and the second part consist of the construction waste management factors for evaluation.

Waste management factors for this study are classified into seven categories namely,

1. Design
2. Handling
3. Worker Workers' mistakes
4. Management
5. Procurement
6. Site condition
7. External Factor

2.4 Estimated Composition of Construction Wastes in India

Waste Type	Percent(%) by volume
Dimension lumber	25
Gypsum wall	15
Masonry and tile	12
Cardboard	10
Manufacture wood	10
Asphalt	6
Other wastes	5
Fiber glass	5
Other packaging	4
Plastic and foam	4
Metal	4
Total	100



3. CONSTRUCTION WASTE MANAGEMENT

Construction waste has a major impact on the environment and is becoming a worldwide problem. In India, due to the commercial building and housing development and also the demands in implementing major infrastructure projects, there is a large amount of

construction waste is being produced by the construction sector. Waste became more harmful to health and to natural environments as a result of waste quantities accumulated and increased. Therefore, the construction waste management is an important area of concern in the construction industry of India. Construction waste management is to enhance a builder's operation and image, as well as the image of the entire home building industry. The construction waste management plan implemented represents the first steps in developing a holistic strategy for minimizing waste generation from the construction process.

Waste management also includes handling of waste, which including treatment, storage and disposal. Moreover, it is important to know the composition and quantity of the waste so that disposal can be handled in a planned manner. Waste minimizing is not only to reduce production costs but also to reduce liability at the same time. The general contractor bears some responsibility for any waste generated from unauthorized or illegal disposal of wastes, particularly potentially hazardous wastes at jobsites and to protect the company from any potential liability.

In order to reduce the total disposal cost, reduce and recycling are the most effective ways to manage the construction and demolition wastes. Besides that, it is important that the contractors should use materials efficiently to avoid pay twice for the materials wasted on job sites. Furthermore, resource conservation also should be considered. Contractors is responsible to do their part to conserve natural resources and landfill space by looking at their waste stream and seeing resources instead of refuse.

There are four options of the management of construction and demolition waste, which is source reduction, reuse, recycling and land filling.

3.1 Source Reduction

Source reduction involves the use of processes, practices or products to reduce or eliminate the generation or the toxicity of pollutants and wastes. Source reduction includes, but is not limited to, material substitution, process substitution and process elimination, source reduction involves reducing the amount of material used through more careful estimating to eliminate waste.

Reduction is the most efficient method to minimize the generation of solid waste. Source reduction does not incur costs for waste handling, recycling, and disposal for waste that is never created. Hazardous materials are usually the main target for reduction. Moreover, the rising of hazardous waste disposal costs would encourage the contractor to reduce it.

3.2 Reuse

Reuse techniques is defined as re-employment of materials to be reuse in the same application or to be used in lower grade applications. Once the wastes generated cannot be reduced or unavoidable, reuse techniques is a desirable option.

A variety of reusable and unused materials could be found in construction activity such as lumber of different sizes, piping, plywood, asphalt shingles and so on. The re-use of products or materials that would otherwise become waste can provide a range of social, economic and environmental benefits. Many building materials may be reusable during renovation projects where a new building is built following the demolition.

3.3 Recycling

Recycling is the reprocessing of a reclaimed material and converting it into a new material or use. Reuse and recycling opportunities for construction and demolition wastes depend on the markets for the individual materials comprising the wastes and the ability to process the commingled waste or separate the individual materials.

The benefits from waste recycling are not solely environmental, but economic and aesthetic as well. Recyclable materials have differing market values depending on the presence of local recycling facilities, reprocessing costs, and the availability of virgin materials on the market. In general, it is economically feasible for construction sites to recycle those waste materials.

Significantstrides have been made in the recycling over the years and it is possible to believe that there will be greater amounts of construction and demolition waste be recycled in the future due to the environmental concerns, increasing cost for the disposal of construction and demolition waste by landfilling, higher tipping fees and the success of entrepreneurs in processing both source-separated and mixed wastes.

3.4Landfill Disposal and Zero Waste

Disposal is the "no alternative" option because it is the last functional element in the solid waste management system and the ultimate fate of all wastes that are of no further value, construction and demolition waste is commonly managed via land filling. There are some management concerns that must be considered such as environmental impact, public concerns and the adaptability for multiple uses in the waste management system.

In the management of existing landfills, the major concern is to ensure that proper operational procedures are followed carefully and routinely. The basic issues for the planner and manger are:

1. Justification of need for a landfill
2. Evaluation and community acceptance of the landfill location
3. Landfill design and cost-effectiveness
4. Management policies and regulations

3.5Construction Waste Recycling

Recycling is the removal of material from waste for reprocessing. Recycling is recognized today as a solid waste management strategy that is preferable to landfilling or incineration and environmentally more desirable.

Recently, increased awareness of the environment, concern over guaranteeing sustainable development, and aware of the need to organize waste management have all contributed to enhancing the image of recycling as an important instrument to attain these environmental objectives. The recycling of waste materials has many benefits, which will indirectly protect the natural environment.

In almost all communities in the country today, there is a growing concern for recycling and the environment. The true success of a construction and demolition waste recycling operation must be determined by establishing the scale of the operation to be implemented and its resulting economics. Before establishing a waste recycling operation, it is important to identify all possible alternatives.

3.6Advantages of Recycling

Recycle technique is defined as utilizing wastes as raw materials in other applications. It takes less energy to process recycle materials than it does to use virgin materials.

The advantages of a construction and demolition recycling program include:

- Avoid trash collection and disposal fees
- Save resources and money through deconstruction
- Improve organization's public image
- Make new products from old materials
- Improve the market for recycled content products
- Help community meet local and state waste reduction goals.

4.CONCLUSION

Construction waste management is required for a country to develop in a sustainable manner. It helps to address issues related to environment, social and economy. Once the root causes of waste generation are notified, it can either be avoided or minimized to benefit the world for better future. This study has identified significant factors contributing to waste in construction projects. By identifying the significant factors in construction process, construction players are able to notice the best ways to apply new practice for reducing material waste, time delay and cost overrun in any project. Based on the results and findings of this study, the following recommendations are made to reduce the construction waste generation in any construction projects. The aim of this study is to investigate the waste recycling and reuse in the construction industry. It can be concluded that generally the construction personnel are Zero waste of the construction waste.

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