

A Comparative Study of Life Cycle Assessment of Construction Materials and Construction Waste Management

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Abstract—Construction is an important part of infrastructure and economic growth in developing countries. In this process, the construction industry produces a lot of waste, which is harmful to the environment and costly to the project. Therefore, waste management is very important for the construction industry. Waste management is defined as reducing waste and using appropriate resources by managing them. In this article, we will examine the basic concepts and factors of waste production by reviewing the relevant literature. This project also explores the environmental impacts of various household products through a life cycle assessment. This study aims to compare the environmental performance of traditional materials and other materials and to provide suggestions for the selection of environmentally friendly materials in construction. To achieve this goal we created a survey containing twenty questions regarding waste generation. Following the review, the data was analyzed and processed. The findings will help companies improve their ability to avoid, reduce, reuse and recycle physical and non-physical waste. Based on results analysis, find ways to reduce, reuse and recycle waste and provide reduction methods and learn more about zero waste to save construction.

Key Words: Types of Construction Waste, Causative factors for generation of construction waste, Steps to be taken for Waste Controlling

I. INTRODUCTION

The construction industry plays an important role in the development of the country's infrastructure. Each project creates new citizens and changes old ones to improve the entire life process. However, due to the new construction or demolition of existing projects, waste is produced, which increases the budget and increases environmental pollution. Management of construction and demolition waste has become a significant environmental problem in many cities. This has been a difficult problem in India since the last nineties because there are not enough treatment plants

to deal with the large amount of waste.

II. OBJECTIVES OF THE STUDY

The study, consisting of literature review, questionnaire survey and work-site visits aims to identify the following:

- To identify the causes of material waste on site.
- To find the material wastage level for various trades of building projects and explore ways to avoid or reduce material waste.
- To investigate the environmental impacts of various construction materials through a life cycle assessment approach.

CONSTRUCTION WASTE COST

Construction waste is defined as clean, heterogeneous waste materials produced by various construction methods. Waste is unwanted products or materials. Waste is divided into two main categories: Physical waste and non physical waste.

❖ PHYSICAL WASTE:

Physical waste is defined as waste resulting from construction, renovation, and demolition activities, including excavation or grading, building and construction, ground clearance, demolition, construction and maintenance. In general per capita waste generation in developing countries is higher than in developing countries in the region.

❖ NON PHYSICAL WASTE

Non Physical waste occurs during construction. Compared to normal waste, intangible wastes are time and cost overruns of construction waste. Similarly, researchers in Indonesia define waste as affecting not only the use of waste materials but also other activities

such as maintenance, waiting time, and delay time. Some researchers reported that it can lead to waste of both time and cost. Additionally, waste may be considered useless during the construction process, which consumes materials, equipment, labour and capital.

CONSTRUCTION WASTE COST

Since many activities are carried out on the construction site during construction and various types of waste are generated from the site, this adds billions of dollars to the annual project budget. If the contractor can effectively control or reduce waste generation on site, a large amount of money can be saved with this small effort and this money can be investigated in future projects.

LCA and Use Phase of Construction Projects

LCA is a method or tool that measure the amount of environmental impact of a product or service. Compared to products or services, the concept of “life cycle” involves expansion in time and space.

The term expansion means that the product or service under review is followed “from cradle to grave”. Cradles can often be used to extract raw materials and oil to create a product (or provide a service) that is analyzed. A deposit can be defined as the place or time where raw materials or resources pass from nature to technological process.

PHASES OF AN LCA

LCA is divided into 4 phases:

1. Goal and Scope definition
2. Inventory analysis
3. Impact assessment
4. Interpretation

1. GOAL AND SCOPE DEFINITION

Goal and Scope definition is the first step of LCA. The effectiveness of LCA depends on the definition of the global and what needs to be done first. When performing LCA, reality needs to be transformed into a model. System modeling can be done in many ways.

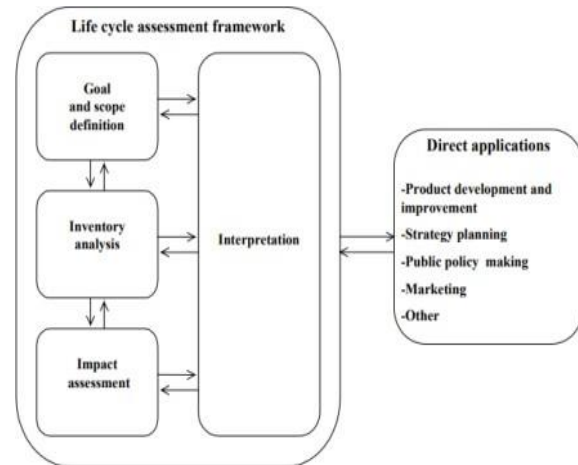


Fig Phases of LCA

2. INVENTORY ANALYSIS

Product Life cycle analysis includes data collection and calculation procedures. The design principles defined in the objectives and definitions are translated into a process tree or process diagram. Each activity in the process tree is divided into processes, which are the smallest units in LCA.

3. LIFE CYCLE ASSESSMENT

Life cycle Impact Assessment (LCIA) is the third stage of life assessment. The purpose of LCIA is to evaluate the product life cycle (LCI) results of the product to better understand the importance of the product on the environment.

4. INTERPRETATION

Interpretation of LCIA depends on the purpose and analysis. Originally this phase was “Development Assessment”, but was recently changed to “Descriptive” because the objectives and resources did not require assessment development.

III. LITERATURE REVIEW

Rawshan Ara Beguma et al. (2007) “Implementation of waste management and minimisation in the construction industry of Malaysia” identified some waste minimization factors which are helpful for implementation for construction waste management system in the construction industry. And provided proof on the important stage of contribution and the stage of construction practices among the waste minimization factors the model of weighted average of factors and 14 minimization and practiced index

value of factors and analyzed indicate the most important, less important and important factors that contribute to waste minimization and the maximum construction practiced, less practiced waste minimization factors in the construction industry of Malaysia.

Effie Papargyropoulou et al. (2011) "Sustainable construction waste management in Malaysia" a constructor's perspective focused on Malaysian construction sectors current status of waste management and level of sustainable practices on construction sites of waste management and examined attitudes and response of Malaysian contractors towards waste management by interviews were conducted with Malaysian contractors. The findings concluded that industry's level of awareness and commitment on waste management very low and disappointing.

Al-Hajj A. et al. (2012) "Material Waste in the UAE Construction Industry: Main Causes and Minimization Practices" identified from data collection from two case studies of construction projects construction practices to reduce construction waste generation in the UAE construction sites by a literature review of research. and concluded that of people are lack of awareness, less importance towards the waste management on sites and showed that contractors are consider that waste management is extra cost of the project.

Mansi Jain et al. (2012) "Economic Aspects of Construction Waste Materials in terms of cost savings – A case of Indian construction Industry" focused on the economical aspects of waste minimization of construction waste materials in terms of cost savings of construction projects of India. And found that Due to lack of site waste management systems, lack awareness of waste minimization in Indian construction industry cause of generation of large quantities of material waste. This affect not only at environmental but also in terms of economically as waste materials handling cost. And found various causes for the waste generation like lack of awareness among owners and contractors, lack knowledge of labor, lack of proper training and education towards waste minimization system.

Nitish Bagdi et al. (2013) "Management for Construction Materials and Control of Construction Waste in Construction Industry: A Review" used

secondary data for the implementation of waste management practices in construction sector in India. Data based upon results from interviews of stockholders which focused on some of the significant issues and challenges and connected with the implementation of waste management system of India. And found that lack of awareness of contractors and the construction workforces are major challenges connected with the implementation of waste minimization practices in Indian construction industry.

Job Thomas et al. (2013) "Construction Waste Management: A Review" enlightened the waste minimizations 3R System of reduces, reuse and recycle for the construction waste management in India. and the resources from construction and demolition (C&D) wastes is yet another benefits for recycle materials for the construction industry of India. And also identified that the some wastes are reduce by proper design in early stage .it can possible to minimize the some level of C&D waste generated taking proper construction and demolition methods.

Manal S. et al. (2014) "Assessment of different construction and demolition waste management approaches" developed a detailed process for to calculate construction and demolition waste management approaches by use of Decision Matrix technique. And introduced procedure helps the decision maker such as the C&D contractor or Transportation firms as well as the policy maker on strategic level to take the different influencing factors. Provided data, when planning; changing or implementing C&D waste management systems and approaches. And recommended to make a cost and benefit analysis for each stakeholder in the CDWM system considering weighing the discussed pros and cons of every approach.

Shishir Bansal et al. (2014) "A Sustainable Approach towards the Construction and Demolition Waste" concluded that there are less amount of natural construction resources so it is necessary to reduce C&D waste generation and increase reuse/recycling as the construction industry .in view of international experiences, shortage of aggregate from natural sources being discovered in many parts of the country, so now recycled aggregate can use in constructions processes. The government Municipal waste laws are required to modify and prepare effective plans 16 and strict rules and

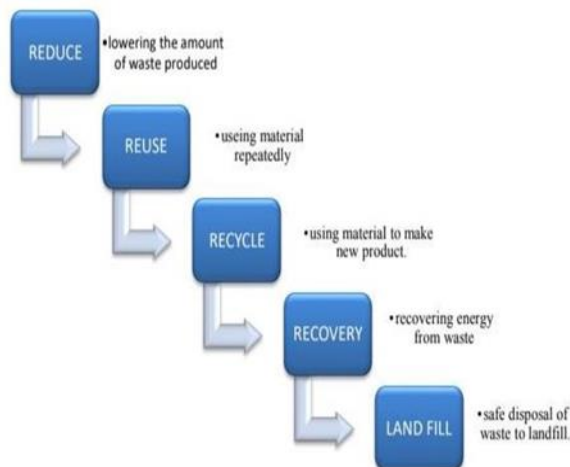
regulations are important forget out of this problem. And recycled products are important to promote the use.

AbhijithHarikumaret al. (2014)“Quantification of Construction and Demolition Wastes by Using Effective Modelling Software” suggested the reusing of the material waste is very good and helpful especially when it will be useful in minimizing demolition of earth’s stone crust and green forest cover by aim of reduced mining. By proper reduce, reuse and recycling, these waste materials will not addition of wastes at dumping and disposal sites. Showed that Construction industry can help by encouraging use of recycled concrete stones and bricks. Towards its commitment to protection of environment.

IV. RESEARCH METHODOLOGY

This project includes research articles, surveys, collecting data from various construction companies, using software to analyze the data and using statistical methods to evaluate the information. Essentially, a method is a collection of methods, implementations, procedures, methods, procedures and rules. In project management, the process is specific and rigid and usually includes steps and activities for each stage of the life cycle.

STEPS TO BE TAKEN FOR WASTE CONTROLLING



1. REDUCE

Resource reduction involves the use of processes, particles or products to reduce or eliminate traces or toxic effects of pollutants and wastes

2. REUSE

Reuse technology refers to the use of reusable materials in the same application or at a lower level of application. Recycling technology is the best option when waste generated cannot be reduced or prevented.

3. RECYCLING

Recycling refers to materials that are recycled and turned into new or used products. Approaches to reuse and recycling of construction and demolition waste depend on the market for disposable materials in the waste and the potential for mixed waste or separate items.

4. LANDFILL DISPOSAL AND ZERO WASTE

Waste disposal is “without alternative” because it is the main responsibility in waste management and the ultimate fate of all non- value-added waste, construction and waste disposal are usually controlled by the landfill.

V. DATA COLLECTION AND ANALYSIS

Data collection is the process of collecting and analyzing information about variables of interest in a way that enables one to answer formulated rearch questions, consider and measure results. Depending on the collection method, data can be divided into four types: observation, experiment, simulation, and derivation. The type of research data you collect will affect how you manage the data.

Questionnaire part includes the following:

- The first section includes questions for anyone with experience in on-site waste management, including the participant’s experience, company size, and the participant company’s business type.
- The second part of the survey, finding waste and packaging, waste production laws, advantages of recycling at the construction site, etc is located. The third part of the survey focuses on factors that promote waste management, including the availability of adequate training, the organization/company waste management plan.

VI.CONCLUSION

Waste use is a major problem that directly affects the financial and environmental aspects of the construction industry worldwide. The aim of this study is to

investigate waste and reuse in the construction industry. By identifying key points in the construction process, construction stakeholders can remember the best way to implement new practices on each project to reduce waste, delays, and excessive costs. Based on the results and findings of this research, the following recommendations are made to reduce waste generation in a construction site. Additionally, on-site workers must adopt appropriate waste management procedures. Based on the above waste management model, it is recommended to use the WM contractor model in the company. It will also be beneficial for construction companies to develop waste management plans in the future. This research paper is the best way to learn about the future of on-site waste management. Most construction workers appear to use zero waste in manufacturing waste.

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