

A Review on the Study of the Techniques of Reducing Construction Waste in High-Rise Building in Lucknow Area

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ABSTRACT:-

One of the significant problems in construction industry is perhaps the waste materials. It has been observed from various construction sites that, even those materials which are least wasted affects the cost of construction; On the other hand the environment also gets polluted by the waste materials. This review has literally been undertaken to study the techniques of minimizing the waste of construction in high-rise buildings in Lucknow. So, in short the construction waste adversely affects both the cost of project and the environment as well. Therefore construction waste has become a severe problem, which has to be eradicated or at least minimized. So, In order to do optimum minimization of construction waste there are certain techniques which are adopted, and among them the following techniques have proved to be beneficial:- (1) 3R(reduce, Reuse, and Recycle) technique, (2) Information modelling at design stage, (3) Pre-casting and Pre-fabrication, (4) Sustainable design of construction, (5) Increasing the awareness on waste reduction, (6) Virtual prototyping, (7) Modern methods of construction, (8) Good operating practices, (9) Technology or process modification, (10) Site sorting of waste. Many of the researchers have worked on the techniques of reducing the waste of construction with especial emphasis on the three R(reduce, reuse and recycle) technique. It is hoped that this paper may help in knowing the techniques of waste minimization.

KEYWORDS:- construction waste minimization, techniques, cost of project, environment

1. INTRODUCTION

The country's infrastructure is very much dependent upon the construction, but side by side the construction can also leads to certain environmental as well economical problems due to the waste produced by it. The waste of the construction activities is quite higher enough as compared to the waste produced by other sort of activities. Due to the wastage of materials in construction, the project cost also gets Increased. It also have bad impact on the environment which incurs bad health. Too. Waste reduction in the construction industry is important not only from the perspective of efficiency, but also from the environmental point of view.

The construction materials which are wasted more are listed as follows:-

- a) Concrete waste
- b) Steel waste
- c) Masonry waste
- d) Timber waste

The construction materials which are less wasted are listed as follows:-

- a) Polyvinyl chloride pipes waste
- b) Tiles waste
- c) Putty and paints waste
- d) Plumbing fixtures waste

- e) Glass waste
- f) Electrical fixtures waste
- g) Sand waste

The objectives of this research are listed hereunder:-

- To determine various techniques of reducing the construction waste especially in high-rise building in Lucknow area.
- To study various literature reviews pertaining to this topic and to infer new ideas based on the result of the research.
- To do a research on the techniques of minimizing the waste of construction in high-rise buildings.
- To Confirm fundamental financial advantages as well as environmental advantages of waste minimization.

The scope of this review includes the following:-

- The problem of dumping and disposing the waste gets reduced.
- The project cost is minimized.
- Minimizes the harmful impacts on the environment.

2. LITRATURE REVIEW

Baldwin N. Andrew, Austin A. Simon, Poon Chi-Sun, Shen Li-Yin, Wong Irene (2007) have defined the high-rise buildings as those buildings which requires repetitive design in the plan of the floor which is then divided into separate components. Therefore, the design of high-rise building is unlike from other buildings. The improvement of the waste reduction at both the design and the construction stage as well can be achieved by implementing the “information modelling technique” at design stage. Design structure Matrix (DSM) and information modelling techniques are adopted in order to increase the efficiency of design of high-rise building, which thereby assists in eliminating the waste in construction activities.

Mr.M.KalilurRahman , Mr.S.S.Janagan (2015) have concluded that in order to minimize and avoid the generation of waste the potential and elementary causes behind the generation of construction waste should be identified and then accordingly various tools and techniques can be applied in order to minimize the construction waste based on the significant factors behind the wastage of the materials. The factors are classified into seven categories: design, handling, workers, management, condition of site, procurement and external factors. After identifying the root causes of construction waste, suitable techniques are adopted accordingly to diminish the construction waste.

R. Shreena Shankari, D.Ambika and S.S. Kavithra (2017) have discussed those factors that are responsible for minimum wastage of construction material. It has been observed from different sites that even those materials that are wasted in smallest amount contribute to certain percentage of construction cost. Cost saving is perhaps the potential benefit behind waste management plan. It also determines the waste management significance, quantity of generated waste in a project, tools of reducing the waste. The wastage of material is the major problem in the construction industry. Focusing on the waste management plan is a crucial step to reduce the wastage in construction. The wastage of materials can also be minimized by altering the specifications. Focusing on the strategies for minimizing wastage of construction materials is necessary for the site engineer. This technique will eventually reduce the wastage of material as well as increase the profitability of the project by reducing over-budget in a project.

Suresh Kumar Lachimpadi, Joy Jacqueline Pereira, Mohd Raihan Taha, Mazlin Mokhtar (2012) have reported that in order to minimize the generation of construction waste of high-rise building, the construction is categorized into the following three methods: (1) conventional construction system, (2) mixed system and (3) industrial building system. To reduce the environmental pollution the effective management have to be adopted. For the sustainable progress of construction the industrialized building system (I.B.S.) is to be adopted. A data of base line is provided for construction waste that are basically the three R (recycle, reuse and reduce). In order to improve the construction efficiency new technologies are injected into the traditional system by using intermediate mixed system.

Mohd Reza Esa, Dr Anthony Halog and Farrah Zuhaira Ismail (2015) have found that, the generation of construction waste has been increased with the rapid development of economy, this increase of construction waste necessitates to develop and enhance the construction waste management practice, it is therefore crucial to identify the factors responsible for the generation of construction waste. Hence, selected papers are reviewed to recognize the challenges and problems related to the management of waste in the construction industry, whereas the quantity of generated waste is the literal issue due to the limited landfills.

Andrew Baldwin, Chui-Sun Poon, Li-Yen Shen, Simon Austin and Irene Wong (2007) have stated that in order to reduce the waste of construction the “Decisions within the design process” in quite helpful. It has been inferred by the designers of industry that the waste of construction can be efficiently minimized at detailed design stage in various ways. In order to model the effect of design decision on process of construction the “virtual prototyping technology” is used. The waste reduction is not only a matter of site but also includes the decisions taken during the whole designing process in a project. Use of “information modelling process” has proved to be very effective in apprehending the connections of various decisions of design in the process of construction.

Monika Mhaske, Milind Darade, Pranay Khare (2017) have stated that, usually heavy wastage occurs in any sort of construction task, hence if the construction waste is not properly treated then, it may become the cause of soil pollution as well as water pollution. The huge wastage can thus be minimized by determining the causes of waste generation and then accordingly applying suitable techniques. This paper recognizes the five main construction activities from where the waste is generated from five different sites and then determines the causes of waste generation, and accordingly allude the suggestions to minimize waste; They have also done a questionnaire survey from 20 different sites. This study shows that the top three activities of waste generation in construction are: Casting of RCC slab and beam, Brickwork and Plastering. This study also founds that the main problem in the construction project is inadequate planning of construction waste.

Vivian W.Y. Tam, C.M. Tam (2006) have mentioned that one of the major problems in the construction is the environmental problems that usually occurs due to the generation of waste. It seems that it is perhaps quite difficult to control the environmental pollution which is caused due to construction waste. Special preference is given to the three r techniques that reuse, recycling and reduce. This paper gives special attention on the practices of recycling of waste material. Like the aggregates can be used in the work of low grade. Those material which are studied here are:- (1) non-ferrous metal (2) masonry, (3) concrete, (4) ferrous metal, (5) glass, (6) brick, (7) asphalt, (8) paper and cardboard, (9) plastic and (10) timber. Therefore, the viable technology and most effective technique of reducing the generation of construction waste is the three R (reuse, recycling and reduce) technique.

Noraziah Wahi, Corina Joseph, Rudy Tawie, Roseline Ikau (2016) have concluded that, if the construction waste management is not done in a proper way then, the huge construction waste can cause very adverse impact to the environment. All the stakeholders are equally responsible based on their rank to manage the construction waste. Hence, for any city or country to take step towards sustainable and clean environment, it is necessary for that city to benchmark itself to any progressed and developed city and country of the world. Even if the economy of the nation gets enhanced then also the problem of construction waste management

will persist until the necessary actions and techniques are not emulated from the developed nations and cities for reducing the construction waste especially in high-rise buildings. The role of government is also very crucial for the fulfillment of requirements and standards for managing construction waste.

M.Osmani (2012) have stated that, as per the latest estimate by the government of United Kingdom, there is approximately 120 million tons/year of the construction and demolition waste is produced. The potential responsibilities of waste management in a project lies on the designers, contractor, supplier and clients. In United Kingdom, presently for construction waste management, the main drivers are the fiscal measures and legislative measures, since it has direct relation with waste disposal cost, high tax of landfill and requirement of compliance with site waste management regulation 2008. However, it is perhaps a bit failure of the legislation to give responsibilities to the architects and engineers to design the project in such a way as to ensure minimum waste, and it is even far better to implement waste reduction techniques just prior to the start of construction.

Nurzalikh Saadi, Zulhabri Ismail and Zarina Alias (2016) have mentioned that Construction industry is one of the important industries that generate wealth and the development of social and economic of the country. The insufficient implementation of waste management practices in the construction projects has led to the unsuccessful result in reducing environmental impacts and illegal dumping. This paper presents a review of existing literature on construction waste management in Malaysia and initiatives that have been implemented in the Malaysian construction industry. The pattern of literature indicates that the existing construction waste management initiatives provided by the Malaysian government are insufficient in terms of the inert landfill to meet the increase in construction waste. In addition, the initiatives implemented are seemingly inefficient due to lack of enforcement and implementation. Thus, it is essential to fill in the gaps by way of more effective initiatives and improvement to the existing practices in order to achieve effective construction waste management.

Peddavenkatesu, B.Harish Naik Yakkaluru (2016) have concluded that the Material waste has been recognized as a major problem in the construction industry that has important implications both for the efficiency of industry and for the environmental impact of construction projects. Moreover, waste measurement plays an important role in the management of construction projects since it is an effective way to assess their performance, allowing areas of potential improvement to be pointed out. Construction industry produces more amount of the construction waste every year. Companies related to the various construction project concentrate on the increasing profit by adopting improved productivity and compressing scheduled of the project without concentrating on management of construction waste. This is also observed that not only the cost of the project gets increased due the construction waste material but also significant amount of valuable land is got occupied with waste generated by construction industry which have negative impact on our environment.

Weisheng Lu and Hongping Yuan (2011) have mentioned that during the past decades, construction and demolition waste issues have received increasing attention from both practitioners and researchers around the world. A plethora of research investigating a wide range of topics on construction and demolition waste management has been published in scholarly journals. The aim of this paper is to develop an intuitive framework to help understand the state of the art of the whole lifecycle thinking and motivate the participation of all project stakeholders involved. Meanwhile, future research should be conducted by envisaging the multidiscipline characteristic of construction and demolition waste management.

Maria Kozlovska and Marcela Spisakova (2013) have concluded that the new objective of European with regards to construction is to regain 70% by weight of construction and demolition waste union there are certain modern construction methods which can be applied in order to reduce the wastage in construction. Among the techniques of reducing the construction waste, sustainable design of construction seems to be very effective in cost reduction of waste disposal and also minimizing negative impacts on the environment. Construction waste can also be prevented by using modern methods of construction. In order to implement

waste reduction program the estimation of construction waste amount is very important. Analysis is also made on various foreign researches pertaining construction demolition waste in different phases of construction. Hence, software Cenkros plus is used in sustainable design of construction.

Mark Kelly and Donall Dowd (2015) in the European union approximately one third of the total waste is produced from the construction and demolition activity. In Ireland the rate of generation of waste has been altering since about last ten years. In the year 2001 it was 3 million tons, then in the year 2007, it was about 18 million tons, then again it reduced to 3 million tons in the year 2011, which describes the correlation between the economic growth and rate of generation of (C&DW). The contribution of all the stakeholders is required in order to have a more resource efficient construction project. The waste management strategies should be implemented during the construction phase of the project.

Ruane Fernandes de Magalhaes, et al (2017) have reported that the construction industry is well known for producing waste harmful to environment, as well as its ill effects have retarded with the progress process of cities. Even though there are certain researches being done exclusively on the environmental effect on the residential building, less knowledge is usable pertaining the minimization in the construction waste production in cities infrastructure projects. This research provides the practices to minimize the waste in the construction projects.

Saheed O Ajayi, et al. (2017) have mentioned that a mixed method approach, which involves field study and survey research were used in order to collect the genuine data. These measures include contractual provisions for waste minimizations, segregation of waste, maximization of material reuse, effective logistic management. It has also been seen that few firms do not possess waste management policies. Overall it has also been concluded from the survey that construction waste minimization is much dependent upon the construction firms, hence they should be much aware of it.

Andrew Baldwin, Chi-Sun Poon, Li-Yin Shen, Simon Austin and Irene Wong (2006) have stated that, the minimization of construction waste should be done at the source itself. Since the on-site concreting comprises of majority of waste generation hence, in order to reduce the wastage in construction, there should be the reduction in on site concreting. Therefore prefabrication and precasting techniques proves to be efficient in minimizing the waste at construction site. In precast design the standardization is essential criteria, it is more specifically favorable for high rise buildings.

Sasitharan Nagapan, Ismail Abdul Rahman, Ade Asmi (2014) have concluded that the trouble of construction waste throughout the globe especially in developing countries is mainly due to the high increment in construction activities. It results in the degradation of the environment, overall high economy, time overrun, etc. The “frequent design changes” has been found to be one of the most important factors responsible for construction waste. Likewise improper planning, labor’s errors, lack of care in storage of materials, etc. also contributes to the production of waste.

Timothy Olubanwo Adewuyi, Isaac Abiodun Odesola (2016) based on their study have mentioned that, the most commonly adopted techniques are; daily confirming that all the facilities of storage are properly secured before the staff leaves the site; the deliveries should be properly checked whether all the materials are available or not; using the construction materials before their date of expiration. By adopting all these strategies, the wastage of materials can be minimized to a certain extent.

3. CONCLUSION

In the construction industry, the Material waste has been regarded as one of the great problems. Construction waste has crucial connections with both the environment as well as the economy. That means, the construction waste severely degrades the environment and makes the project over budgeted. The concern pertaining to the wastage of materials in the construction industry is also increasing day by day, therefore, there are certain

techniques and approaches that are studied and adopted in order to minimize the wastage of construction in high-rise building. Perhaps the techniques which have been proved to be most effective are listed as follows:-

- 3R (Reduce, Reuse, and Recycle)
- Information modelling at design stage
- Pre-casting and pre-fabrication
- Sustainable design of construction
- Increasing the awareness on waste reduction
- Virtual prototyping
- Modern methods of construction
- Good operating practices in construction
- Good Technology or process modification in construction
- Site sorting of waste

By adopting the above mentioned techniques there will indeed the reduction in the amount of construction waste to a much extent especially in the high rise buildings. This paper was aimed at studying the national as well as international scenario in terms of waste of high-rise building which has been increasing rapidly, and accordingly discovering the waste reduction techniques. Much efforts should be made to ensure zero waste in the construction. Still further research is required in order to enhance the techniques of waste reduction. By implementing the best methods of waste minimization, a large amount of saving can be achieved, thus making the project overall economical. When waste will be reduced then naturally the requirement of landfill site will also decrease thereby making the environment clean. Full efforts should be made to reduce the waste of the construction at the source itself. Therefore, for Lucknow to move towards least generation of waste in the construction of high-rise buildings and to impart green or sustainable construction, the city has to benchmark itself to a developed Nations like Hong Kong in handling construction waste issues. The construction companies should be also encouraged to learn these techniques and to implement them to reduce construction waste especially in high-rise buildings.

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