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Management of construction and demolition waste in Delhi NCR: A stakeholder's perspective

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Abstract
The construction industry has been growing very fast in recent years due to increase in industrialization, urbanization and the population, due to which the demand for construction activities is increasing. As a result, there is increased generation of construction and demolition waste. The Indian construction industry generates about 10-12 million Tons of waste annually. Thus, effective management of construction and demolition waste is need of the hour. The present study on " Construction and Demolition Waste Management in Delhi NCR: A Stakeholder's Perspective" aimed at studying the construction management practices, different types of waste generated on the construction site, the process of collection, segregation and disposal of waste on site and stakeholder's perspective about reclaiming and recycling of construction and demolition(C&D) waste. The study revealed that the construction and demolition waste management planning was done at construction sites, there was huge gap in planning and the actual implementation of management practices. All the construction sites were generating similar type of construction waste and the amount of waste generated depends on the scale of operation and management practices. Further, it was seen that the C&D waste generated was segregated onsite largely by scrap dealers and supplied to material manufacturers, and waste recyclers. However, most of the rubble was either used to fill the excavated land or was dumped on open plots and road sides. The study has shown that the stakeholders had a positive approach towards recyclability and reclamability of C&D waste. Thus construction and demolition waste management onsite has scope for a lot of improvement. It is recommended that there should be stringent rules by government, mandating use of some percentage of materials made out of C&D waste in every construction project. Also incentives should be offered by government along with mandates to catalyse the process.

Keywords: Construction and demolition waste, management of C&D waste, process of C&D waste handling

1. Introduction
India has recognised itself as one of the world's wildest growing economies and this progression has carried with it a significant boost in construction activities. Increase in construction activities will increase the amount of construction and demolition waste. Construction & Demolition waste is produced whenever any construction and demolition activity takes place, such as building, roads, bridges, subway, flyover, remodelling etc. It produces a major portion of total solid waste production in the world. Instead of waste it is considered as resource for Construction industry.

The Waste Framework directive (2007) has defined waste as 'any substance or object the holder discards, intends to discard. Once material falls within this definition it will remain waste until it is fully recovered and is no longer a threat to the environment and human health (Shah, 2015) [19].

Waste generates from all human activities. Globally, cities generate about 1.3 billion tonnes of solid waste per year. This volume is expected to increase to 2.2 billion tonne by 2025 (World Bank, 2012). According to Danish Environmental Protection Agency (DEPA), 2015, 25% of the total waste generated is construction and demolition waste But Construction and Demolition waste can be an invaluable source of building material.

These waste materials have to be eventually disposed of in ways that do not endanger human health. In light of above, waste minimization is gradually seen as an ecologically sustainable strategy for alleviating the need to dispose of waste materials, which is often costly, time and space consuming.

Waste management in construction is important not only from the perspective of productivity but also from the environmental considerations (Rama, 2010).

In India, Management of C & D waste is not practising appropriately. The disposal of C & D wastes is becoming a major concern in the recent years. The wastes are being disposed of improperly and illegally in order to avoid transportation and tipping costs. Growing population and industrialization leads to the increase in demand for land which reduced the landfill site to dispose the waste. A lot of C&D waste is being used by land sharks to illegally fill up water bodies and wetlands around urban centres for real estate development. The rest is just being dumped into rivers and open spaces.

The improper handling of the construction and demolition waste has not only led to pressure on the environment but is also leading to severe health hazards.

2. Methodology

The present research was conducted on construction sites in Delhi NCR to study the construction and Demolition waste management practices onsite. Total sixteen construction sites were selected to conduct the research which comprises of eight public and eight private construction sites. These sites are selected by preparing a list of construction sites in Delhi NCR. Concerned authorities were approached and explained the purpose of the study. Consent has been taken to conduct the study. Final list of construction sites was prepared with those who agreed to participate. Construction sites were selected randomly from the final list.

Stakeholders formed unit of enquiry for the study which included construction management team, design team, waste recycling team and scrap handling team. For gaining insight into study objectives total of 128 stakeholders were interviewed. Interview schedule, tenders and checklist were used as tools for data collection. Structured interview schedule with open and close ended questions was prepared to understand the construction management process, prospects and challenges of reclamation, recycling and disposal of waste. The data was analysed using Microsoft excel. Pie charts and graphs were used to represent the data.

3. Results and Discussions

3.1: Profile of construction sites

There were sixteen construction sites which comprised of eight public and private construction sites each to augment the waste management practices holistically. These sites were further divided on the basis of type of construction, which consisted of ten commercial sites and six residential sites. Commercial sites were office buildings, monument and institutional buildings. Residential sites comprised of townships and societies. They were also studied on the basis of scale of operation to know the waste management practices on all type of projects. According to scale of operation there were nine large scale construction sites which comprised of 4 commercial and five residential sites. Seven construction sites are having medium scale of operation which consisted of six commercial sites and a residential site. There were 3 green projects and thirteen were non green projects. The mixed sample was studied to know each and every practice followed at site and to understand the waste management practices holistically.

3.2: Distribution of sample with regards to role of stakeholders in construction management on site

Role of construction management team: After getting the contract the construction management team studied the design and procured the material to start construction. Their responsibility included site management for the entire site, from material procurement to waste clearance. They managed all the activities on site from waste collection, partnering with various parties and supplying waste to them for processing. They also had an important role in reduction of waste onsite.

Role of Design team: The design team made the design according to the needs of the customer or owner and after finalization of design, they suggested the materials. After starting construction, they were involved in making the construction management team understand the design and perform accordingly. They had a very important role in finalization of material type, quality and quantity. Thus, the design team was asked about recycling and reclaiming of material and its prospects of reuse in the market.

Role of waste recycling plant: Waste recycling plants received waste from different sources, stored them and processed them to make new products. After products got made, they were involved in contacting the dealers for marketing of products.

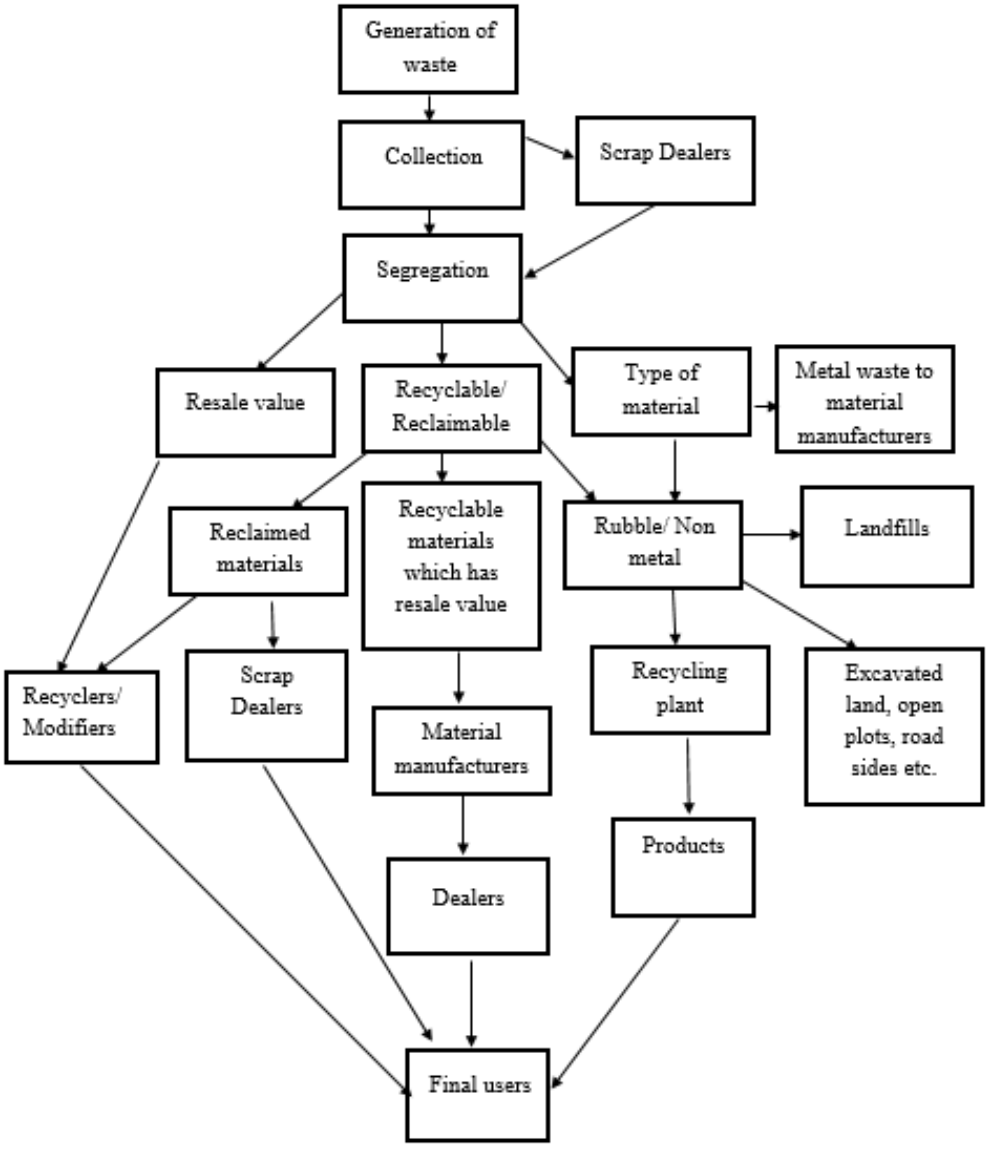
Scrap Handling Firms: They had the key responsibility of waste collection, segregation and disposal from site to the end place like different material manufacturers, recyclers and disposal in landfills, open lands etc.

3.3 Types and quantities of waste

All the construction sites were generating similar type of construction waste and the amount of waste generated depends on the scale of operation and management practices. Cement and concrete had maximum generation. Bricks and tiles were also generated waste in large quantity on construction site because they were delicate and were broken during transportation.

3.4 C&D waste management practices followed on sites

Findings and discussion with the stakeholders regarding waste management practices followed by the sample is as follows:



Process of C & D waste management from construction site to disposal

From the analysis the process of C&D waste is concluded as:

The waste generated on construction site was collected. The scrap dealers were contacted to collect waste. Waste was segregated by either scrap dealers or by construction management team. After segregation of waste could be done as per three criterion namely waste divided into three namely reclaimed materials which could be resale value, recyclable material/ reclaimable/rubble and types of material. Reclaimed waste was supplied to modifiers, scrap dealers, recyclers and then they sold the waste to the final user. Recyclable materials and materials having resale value supplied to material manufacturers to recycle waste. Products made out of C&D waste were supplied to dealers for marketing and through dealers it then reached the final users. Rubble while segregation had no resale value, it is either supplied to recyclers to make the products or dumped to landfills, excavated lands, open plots, road sides etc.

An effort was made to understand waste management practices followed by government owned construction sites and private construction sites and also procedure followed by green and non-green projects in C & D waste management. The waste management practises were similar in both type of construction sites i.e. government owned and private owned construction site. However, differences were observed in planning and disposal practices. Waste management plan was made by all government owned construction site whereas only three private owned sites reported of making waste management plan. When proved further, the afore mentioned private owned construction site were found to be large construction sites. Regarding disposal of waste all government sites were sending there rubble waste to recycling plants or to landfills whereas privately owned sites were either disposing off in unorganized manner to excavated land, road side dumps/ river banks. Regarding green and non-green projects, it appeared that green sites, as they were aiming for green certification were more efficient in following waste management practices.

The study highlights the waste management practices followed by the construction sites, gaps were observed in the planning and implementation of following waste management plan. The reason reported were lack of awareness amongst stakeholders, policy initiatives and regularity mechanism by the government with regard to handling of C & D waste.

Stakeholders shared bright prospects for reclaimed and recycled products provided market is aptly driven towards the same.

The study has shown that the stakeholders had a positive approach towards recyclability and reclamability of C&D waste. Opinions of different stakeholders were taken regarding C & D waste and its reclamability. According to design team, there was lack of awareness among customers due to which they were not ready to use the reclaimed

material in their projects. Also, they perceived that they would need to change their design as per reclaimed materials, which was an expensive task. Similarly, the stakeholders from waste recycling plant said that even though they were making recycled products, there was limited demand for them in the market. They opined that the products made from reclaimed materials were as durable as products made out of virgin raw material, however, customers were not ready to accept these products due to lack of awareness.

Thus construction and demolition waste management onsite has scope for a lot of improvement. It is recommended that there should be stringent rules by government, mandating use of some percentage of materials made out of C&D waste in every construction project. Also incentives should be offered by government along with mandates to catalyse the process. Further, a market has to be created for materials made out of C&D waste at affordable prices for encouraging the customer to use such products and to pave path towards sustainable construction management practices.

4. Conclusion

The present research holds potential in giving definite direction for framing of policy initiatives and regulatory mechanism in efficient waste management practices. The study is suggested to be shared with different stakeholders so that concerted efforts could be geared towards making construction management practices sustainable.

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