PUNE RESEARCH DISCOVERY ISSN 2455-9202
AN INTERNATIONAL JOURNAL OF ADVANCED STUDIES VOL 5, ISSUE 3

ANALYSIS OF CONSTRUCTION AND DEMOLITION WASTES IN RESIDENTIAL SECTOR OF PUNE

Ar. NIKHIL GADAVE, Prof. Ar. APARNA PANGANTI
Dr. D.Y.Patil College Of Architecture, Akurdi, Pune, India
Email Id- nikhil.gadave@gmail.com

ABSTRACT: Waste generation is increasing and has become a major problem to the health of people and their surrounding environment. Growth in population and change in consumption patterns with increasing demand has increased production of waste generation leading to harmful environment conditions. Wastes are categorized into several types such as commercial waste, solid waste, medical waste and construction waste. Construction industry produces maximum amount of toxic wastes. Wastes generates by all sites which is unavoidable.

Pune has been considered as a fast developing city with ongoing construction projects that produce large amount of toxic waste. Different types of the wastes in the construction sites can cause many problems for the society and also environment. With increasing demand for built spaces and scarcity of land, a trend of redevelopment projects is upcoming. Construction and demolition waste management in Pune is subject of concern in construction market so there is need of managing waste.

This paper examines present practices of construction and demolition waste of residential project using R.C.C framework and masonry construction in Pune and analyses waste generation and its disposal patterns and proposes appropriate measures through the technique of 4 R's [Recovery, Reuse, Recycle and Reduce].

Key words – Waste generation, Construction waste, Demolition, Waste management.

INTRODUCTION

Construction and demolition waste has been defined as 'waste which generates from construction, renovation and demolition activities. Also include excess and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities. The different types of wastes to be generated will include - Excavated materials, Concrete, Tiles, brick, ceramics, asphalt concrete, Plaster, Glass, Metal and steel, Plastics, Wood, asphalt, and Concrete rubbles, etc. Due to the increase in the economic growth after development and redevelopment projects in the country and upcoming rise in the urbanization in the cities has made construction industry to grow drastically, but also environmental impacts from construction and demolition (C & D) waste are increasingly becoming a major problem in urban solid waste management. Environmental issues such as increase in the flood levels due to the illegal disposal of construction and demolition waste into the rivers, resource depletion, shortage of landfill and illegal disposal on hill slopes in the metro cities. The paper deals with current C & D waste issue in residential sector in Pune.

AIM:

To scrutinize the present current practices of construction and demolition waste and analyze the disposal pattern in the city of Pune.

OBJECTIVE:

- To study existing practice done for managing construction and demolition waste.
- To analyze the disposal pattern of construction and demolition waste.
- To focus on waste generated from residential projects and reduce it at source.

SCOPE AND LIMITATION:

The paper only talks about the disposal in Pune city and it limits to the RCC framework type residential project waste management. It will only contain the study of management pattern and provide appropriate measures through the technique of 4 R's [reduce, reuse, recycle and recovery].

RESEARCH QUESTIONS:

How much amount of construction waste is generated at construction site?

Why construction waste is not given importance in India?

Necessity of Construction and Demolition waste Management.

With the global concern of conservation of energy and natural resources, there is urgent need of implementing Construction and Demolition waste management strategies through technological and design solutions of deconstruction, recycling and reusing and functional development of policy making, administrative and monitoring system for implementation of the same. Development of human resources for implementation of Demolition waste management through awareness and training is another important concern. Demolition work towards exploring newer applications and maximizing use of existing technologies for a sustainable Demolition waste management is need of a time.

Present condition related to Construction and demolition wastes in India:

Construction by nature is not an eco-friendly activity. Construction reports for nearly 65% of the overall investment in infrastructure and the tendency is growing. Presently, C & D waste generation in India accounts up to 175 million tones annually. In India nearly 50% of Construction & Demolition waste is being re-used and recycled, while the remainder is mostly land filled. At present, private contractors remove this waste to individual owned, low-lying land for a price, or more frequently, dump it in an unofficial manner along roads or other public land of waste respectively. To address the problem of waste management in the country the government constituted a committee to evolve a road map for the management of waste in India and to propose a policy and scheme for waste management.(TNN, 2016)

Present condition related to construction and demolition wastes in Pune:

Pune is the eight largest metropolis in India with a population of about 30 lakhs. It is rapidly developing and has growth in construction activities it is appropriate to link the generation of construction and demolition with the growth of construction industry and related issues. With construction and demolition wastes becoming a major cause of pollution in water bodies, public spaces, green areas, the Pune Municipal Corporation has decided to set up a processing plant and proper system for collection and disposal of construction and demolition waste. Reuse and recycling norms for this waste will also be inculcated in the sanitation by-laws.Pune generates approximately 250 MT per day of construction and demolition waste from various sources. To address the C&D waste, in Pune

- PMC has prepared a DPR to understand quantity, quality and sources of construction and demolition waste
- Discussion with various shareholders and understanding their concerns.
- Developed separate tenders for collection and transportation as also for processing and disposal of construction and demolition waste
- District administration has already allocated 2 acres of land at Wagholi for construction and demolition waste processing (PMC, n.d.)

METHODOLOGY:

Definitions Related to Construction Waste:

Construction and Demolition Waste Construction and demolition (C&D) debris is defined by EPA as the waste material produced in the process of construction, renovation, or demolition of structures (both buildings and roads). In addition, it includes the materials generated as a result of natural disasters. Components of C&D debris include materials such as concrete, asphalt, wood, brick, metals, wallboards and roofing shingles.

Definition of Recycling:

Recycling is the process of collecting and preparing recyclable materials and reusing them in their original form or in manufacturing processes that do not cause the destruction of recyclable materials in a manner that precludes further use. (Gull, 2011)

Definition of Waste Management:

Waste management is the process involved with waste once it has arisen including site planning, transportation, storage, material handling, on-site operation, segregation, reuse and recycling and final disposal. (Shah, 2015)

Construction waste management hierarchy:

The concept of 4R which refers to reduce, reuse, and recycle and recovery particularly in the context of production and consumption is well known today. The best approach to manage construction waste is to minimize it at the source before it becomes problem.

Figure 1: Waste Management Hierarchy

Reduction at the source could be implemented almost throughout the project phase from starting work to ending the projects. Reduction is more on perfect planning of material used on project to reduce the waste produce. **Reuse** method is defined as re-employment of materials to be reuse in the same work or in lower grade work. Materials such as earthworks, concrete, steel, tiles, glass, and wood can be profitably reused in the project. **Recycle** method is defined as utilizing wastes as raw materials in other applications. Recycling can be done successfully and utilized during the construction phase and contractors have to use this cost saving method. A **recovery**technique is a process of generating energy from the waste materials that cannot be reduced, reused and recycled. This technique is a waste – to – energy recovery technique which is recommended universally for conservation of natural resources. (Kamal, 2009)

Components:

C&D waste has two components in India:

Major components in C & D waste:

Cement concrete, Bricks, Cement plaster, Steel (from RCC, door/window frames, roofing support, railings of staircase etc.), Rubble, Stone (marble, granite, sand stone), Timber/wood (especially demolition of old buildings)

Minor components in C & D waste:

Conduits (iron, plastic), Pipes (GI, iron, plastic), Electrical fixtures (copper/ aluminum wiring, wooden baton, switches, wire insulation), Panels (wooden, laminated), others (glazed tiles, glass panes).

Construction and demolition waste handling:

In India, contractors play an important role in waste management. Contractual arrangements require that demolition wastes have to be disposed of by the contractor at his cost. In India, services of demolition contractors are taken when an old building is to be demolished due to deterioration of the building or to make way for construction of a new building. According to Technology Information Forecasting and Assessment Council [TIFAC] study,

-Items recovered during demolition are sold in the market at a discount to price of new material.

- Items, that cannot be re-used, are disposed to landfill site.

- Pune municipal corporations has allocated landfill site for C&D waste, while others want to minimize it to prolong useful life of landfill sites.

- Components of C & D wastes are not separated.

- Builders/owners bear the cost of transportation, which at present, ranges between INR 270 to 585 per truckload depending on the distance of demolition site from landfill area.

- Municipal authorities incur cost of INR 75 to 90 per tons of waste, but presently no charge is levied by them on the owner or builder.

- Even directives don't exist for disposal of waste to landfill areas for waste management in India and hence presently penal action against violators is practically not taken.

RESULTS AND FINDINGS-

1. Issues associated with construction waste were due to:
a. Illegal dumping at open sites to avoid to pay extra charges.
b. Inefficiencies such as unsegregated waste collection.
c. Amount of Waste generated.

2. Some of the practices such as waste quantification, waste segregation, implementation
of 3Rs (Reduce ,recycle and reuse)were done.

3. Dust as environmental pollutant: Dusts from various construction activities & from the companies who have their

own RMC plant release wide range of particle sizes and material types and can cause health problems ranging from eye irritation, nose, mouth and respiratory system. Health issues regarding the collection and transportation of waste in open trucks.

4. Public complaints on noise generation: Construction & demolition activities often generate noise / vibration which lead to complaints from the public despite the limited time frame over which it takes place.

i. Also health problems caused due to excessive exposure to undesirable noise levels include: i.e Sleep problems, insomnia & fatigue.
ii. Fall in speech communication, disturbance and diminished concentration thus adversely affecting job performance efficiency.
5. Environmental Impact : Illegal dumping was affecting the bio-habitat of dump area and creates potential public health issues.
6. Challenges associated with the implementations of waste minimizations were due to:
i. Lack of ownership of waste due to the presence of multiple contractors on the construction site.
ii. Awareness and education among the construction workforce.
iii. Regulations

7. Use the excavation waste material in site preparation.

8. Develop a training program for all workers so they are familiarized with waste management plan and disambiguated in order to be able to cope with the plan and work efficiently.

9. All recyclable material should be clearly segregated and stored inappropriate in containers or stockpiled.

10. Tool-box workshops, sessions & conferences should be conducted for workers, site managers, project managers.

CONCLUSION:

The environmental issues which have been studied will help the management to take into consideration before starting up the project. Education on waste management through toolbox workshops, sessions, conferences should be held for practicing persons to create awareness about the waste management. As discussed in the paper, all the stakeholders have their role to play in this regard for sustainable development. The materials like gypsum are also recycled & used in various other purpose. The study of significant factors contributing to waste will help in planning the activities of project. Once the issues and challenges are known it can be helpful for the upliftment of better future planning.

Reduce: Waste management requires the coordination among the those involved in design and construction process from architects, structural to the execution team of civil engineers, contractors, labors .All should need to plan material management and order the required amount of materials. Also allow adequate and safe material handling and storage on-site to avoid construction waste. Proper site facilities must be provided to the workers for encouraging them. All materials should be clearly segregated and stored inappropriate in containers or stockpiled at the point of creation.

Reuse: For the reuse of materials firstly the segregation of waste must be done at the generation point. Most of the construction waste generated is reused onsite for development activities like landscaping, pathways etc.

Recycle: Recycling of construction waste by converting it to raw material may offer dual benefit of saving landfill space and reduction in extraction of natural raw material for new construction activities. Further some of the reused materials needs to discard out, so the teams need to plan for its better future reuse to prove that the construction can be sustainable.

By the adaption of 3R concept, waste minimizing technologies e.g construction management plan and reuse of materials should be adopted to minimize construction waste.

Sr. No.	Environmental Benefits
01	Can avoid the potential health hazard due to pollution.
02	Limited reuse of land sites.
03	Energy required in transportation will reduce.
04	Depletion of sustainable resources could be minimized.

Sr. No.	Economic Benefits
01	Cost of transportation waste to land fills also reduces.
02	Gain of financial benefits from using recycled material.
03	Cost of maintaining landfill site will reduce.

Market shall be developed for reusable, salvage and recycled content materials through the development of Waste Exchange Centre (WEC) as an online platform for waste exchange.

This platform will allow qualified and selected members to access information regarding the generation of waste, its quantity, location, quality and the organization. Through an interactive user-interface, the members will then be led to the information on treatment processes, costs, recycling options and the organizations involved in the transactions. This is a valid proposal of ISWM plan for Pune developed by Environment Management Centre for Pune Municipal Corporation.

Checklist for minimizing the construction waste generated.

Positive impact	Environment	Health	Material saving	Cost
Design stage				
Exact requirement of material so that it can be procured and stored.			Tick	Tick
Use eco-friendly material those made from recycled content.	Tick	Tick		
Site management				
Execution of site management plan.	Tick			Tick
Minimum vehicular movement on site.	Tick	Tick		
Provision for separate yards with raised platform and for sand, aggregate, masonry.	Tick		Tick	Tick
Excavation material from site				
Excavation to required size only.	Tick			Tick
Recycle the loose soil for clay blocks and moulding.	Tick			Tick
Building material on site.				
Steel				
Use cut size length from manufacturing units.	Tick		Tick	Tick
Send unused steel for recycle.	Tick			Tick
Crush sand				
Stock material in separate yards			Tick	Tick
River sand				
Stock material in separate yard			Tick	Tick
Use sand pebbles after sieving as course aggregate in concrete work.	Tick		Tick	Tick
Concrete				
Use crusher for concrete waste to form aggregate of small size which could be utilized in structural concrete.	Tick	Tick	Tick	Tick
Tile				
Use of granite piece in sill of window.	Tick		Tick	Tick
Pieces of tiles can be used in non structutal work.	Tick		Tick	Tick
Paint				
Buckets, cans and brushes can be send to recycling.	Tick			Tick

RECOMMENDATION:

1. All recyclable material should be clearly segregated and stored inappropriate in containers or stockpiled.
2. Tool-box workshops, sessions & conferences should be conducted for workers, site managers, project managers.
3. Construction recycling unit should be set up in every town and state.
4. Separate department in municipal bodies should be created for addressing the issues of collection and disposal of construction waste.
5. Onsite portable crushers for concrete crushing should be used which reduces the construction cost & also reduces the pollution generated while transporting the waste.

FUTURE SCOPE OF STUDY:

1.There is need for the protection of land, water and environment. Municipal rules need to push for optimal use of building materials, waste prevention ,on-site segregation and disposal.

2.Pre-fabricated elements are universally believed to reduce time, money and waste materials during construction. So pre-fabricated elements, brings several issues to the project and needs more investigation which could be carried out in future studies.

3.Some of the policies discussed in this report were only recently enacted and the future success of the policies is unknown. Lessons learned from following the progress of these policies will help other cities also.

4.The market capacity analysis greatly depended on central sources that collected data on the amount of materials consumed in each state. Since few sources exist that compile this information, additional sources are needed to provide better and more complete information.

5.Sustainability & Engineering can also conduct further studies on the waste diversion potentials for the materials that are not currently being recycled, such as plastic, bonded systems, materials which are difficult to separate (for instance because of adhesives or nails) and specially mixed waste.

ACKNOWLEDGEMENT:

I would like to thank my guide Ar. Aparna Panganti for her valuable time and support. I would also like to thank Engineer and contractor Mr. Rahul Bhalerao for helping me out as well as arranging various site visits. Their inputs helped me in completing the report.

REFERENCES:

1. Harish. P. Gayakwad, Neha. B. Sasane, "Construction and Demolition Waste Management in India" Volume: 02 Issue: 03 ,June-2015

2. Zodpe Shraddha R., Konnur B. A., "Review on Construction and Demolition Waste Management" Volume 5, Issue 1 January 2018,IJETSR

3. A. A. Dania, J. O. Kehinde and K. Bala "A Study of construction material waste
management practices by construction firms in nigeria."

4. Mr.M.KalilurRahman1, Mr.S.S.Janagan, "Construction Waste Minimization and Reuse Management" Volume: 02 Issue: 08 Nov-2015,IRJET

5. Abioye Oyenuga London South Bank University "Challenges in Managing Construction and Demolition Waste". Article in Journal of Solid Waste Technology and Management March 2014