

Study of Construction and Demolition Waste Management in India

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Abstract— The construction industry constitutes 40-50% of India's capital expenditure on projects in sundry sectors such as highways, roads, bridges, railways, energy, airports, irrigations, residential etc. and is the second most immensely colossal industry after agriculture in India. As of 21st March 2017, the construction industry's contribution to India's GDP is 7.74%. Construction & demolition waste are the waste materials that are produced in the process of construction, renewal or demolition of residential or non-residential structures. The construction industry generates a huge amount of C&D waste which ends up in landfills disturbing the environment and ecological balance. In this paper the current scenario of India's C & D waste, waste management and the initiatives by the Government of India to curb the growing impact of environmental degradation is overviewed. This paper also highlights the sustainable waste management hierarchy so as to tackle this waste problem effectively.

I. INTRODUCTION

The construction industry is a major contributor to solid waste generation across the world. Surveys conducted in several countries have found that the amount of waste generated by the construction and demolition (C&D) activity is as high as 20% to 30% of the total waste entering landfills throughout the world. It is becoming a major concern for town planners and builders to handle and manage the C & D waste asserting to the increasing quantum of demolition's rubble, perpetuating shortage of dumping sites, increase in conveyance and disposal costs and above all mounting concern about pollution and environmental deterioration.

CDW arises from activities such as the construction of buildings in civil infrastructure, total or partial demolition of buildings and civil infrastructure, road planning and maintenance. In some countries even materials from land levelling are regarded as construction and demolition waste. The undesirable environmental effects of C&D waste started from dumping them into forests, streams, river and empty land that has caused and resulted erosion; contaminates wells, water tables and surface.

Worldwide, cities generate about 1.3 billion tonne of solid waste per year. This volume is expected to increase to 2.2 billion tonne by 2025, says a 2012 report by the World Bank. Building materials account for about half of all materials used and about half the solid waste generated worldwide. The construction industry in India generates about 10-12 million tonnes of waste annually, according to a study, and Pune contributes to almost 125 tonnes of the amount every day.

The demand of building materials for 2021-2022 has been estimated by Building Materials and Technology Promotion Council (BMTPV) as cement 380 million tonne, steel 50 million tonne, bricks 600 million numbers, aggregates 400 million cubic meters, timber 40 million cubic meters. Data shows there is a considerable amount of shortage of conventional and traditional building materials in India.

II. OVERVIEW OF CONSTRUCTION AND DEMOLITION WASTE IN INDIA

'Construction and Demolition waste' means waste comprising of building materials, debris and rubble resulting

from construction, re-modeling, repair and demolition of any civil structure. The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organization or authority that generates construction and demolition waste such as building materials, debris, rubble. Construction by nature is not an eco-friendly activity. Presently, Construction sector in India is rising at the rate of 10% per annum and so is the construction waste.

In 2000 the survey conducted by TIFAC denoted that the total quantum of waste from construction industry was estimated to be 12 to 14.7 million tons per annum which included wasted sand, gravel, bitumen, bricks, and masonry, concrete. While there are no exact statistics for the current scenario, it is estimated that approximately 30,000 tonnes of C&D waste is generated daily in India. Waste is generated at different stages of construction process. Estimated waste generation during construction is 40 to 60 kg per square meter. Similarly, waste generation during renovation/ repair work is estimated to be 40 to 50 kg per square meter. The highest contribution to waste generation is due to demolition of building. There is no adequate or satisfactory data for accessing to this issue. This is because there is no separate regulatory frame work for handling the construction and demolition waste management in India, as it is considered in the municipal solid waste management. Due to which it is getting difficult to access the information or to handle the construction and demolition waste management. As report prepared by the MoEF (Ministry of Environment and Forest) in 2008 estimated that 0.53 million tonnes/day of waste is generated in the country.

III. COMPOSITION OF CONSTRUCTION WASTE GENERATED IN INDIA

The composition of construction waste depends on the structure types. For example, if the structure is a flyover or a bridge structure the composition will be usually concrete and steel. If the structures are residential buildings then the composition will be in different forms. It consists of concrete, steel, wood, tiles, bricks, plastics etc.

TABLE I. Composition of construction and demolition waste.

Components of C & D waste	TIFAC (%)	MCD Survey	Survey IL & FS (%)
Soil/Sand, Gravel	36	43	41.5
Bitumen	2	-	-
Metals	5	-	0.4
Concrete	23	35	-
Wood	2	2	1.5
Other	1	1	7.6

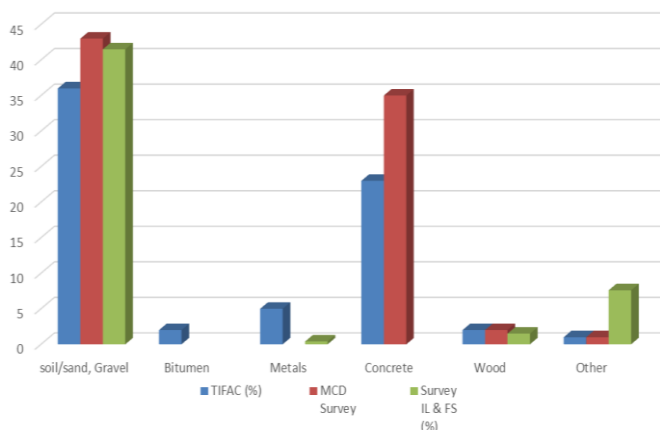


Chart I. Typical composition of Indian Construction Waste.

IV. CURRENT SCENARIO

In general, 90-95% of the total construction material waste can be recycled and the recycling of construction material can reduce the load on landfills which is around 25% of the total waste generated in India. However, little has been done to manage and utilize C&D waste in a scientific manner. More often, private contractors remove C&D waste to privately owned low-lying land for a price or dump it in an unauthorized manner along roads or other public land. This increased unscientific dumping is putting severe pressure on scarce urban land and is resulting into reducing life spans of landfill.

Earlier, construction agencies like CPWD said that Indian laws permitted the use of only naturally sourced building material. The IS: 323-1970 Indian standard specification related to aggregates for concrete, laid down by the Bureau of Indian Standards (BIS), stipulated that concrete can be made only with naturally accessed materials. Thus, construction agencies cited this rule to avoid using recycled C&D waste.

However, ‘Municipal Solid Waste (Management and Handling) Rules, 2000’ and the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) programme of the Ministry of Urban Development laid special emphasis on MSW management. Albeit, despite huge investments and encouragement from the Central Government, only 4 out of 45 municipal corporations that were granted assistance under JNNURM for waste management have been able to complete their projects. The principal reasons reported for non-compliance were lack of technical knowledge, lack of community participation, financial resources and limited awareness of the recycling techniques available in the country. Apart from the recent buzz around green construction, client specifications do not make special mention of use of materials re-cycled from waste and debris as imperative. Cost of disposal of waste from construction industry to landfill also

has a direct bearing on recycling operations. Lack of any penalty for dumping or incentives to adopt recycling is another reason for this initiative moving at a snail’s pace. Yet, there have been some initiatives across the country that is worth mentioning albeit having a small impact. The Building Material and Technology Promotion council (BMTPC), an apex body that promotes development and use of innovative building materials and technologies, has a scheme called Performance Appraisal Certification Scheme (PACS). New products manufactured by using recycled waste in fact, any new product, system or technique not covered so far by the BIS — can be certified under this scheme after evaluation. It has been used to certify new construction material (such as bamboo).

V. THE 3 R’S OF SUSTAINABLE WASTE MANAGEMENT HIERARCHY

Most of the modern western countries all over the world have set different regulations in order to decrease and also manage the amount of waste generated in different parts of their industries. A new concept regarding the construction management waste has been proposed under the name of “3R” concept, which relates to three main concepts of waste management namely reuse, recycle and reduce. Reducing waste, Recycling and Reusing resources are three components of 3R concept. Reducing means choosing and utilizing factors to decrease the produced waste value. Recycling means using waste as a resource. Reusing involves using the waste that still has useable situation. Reduce is the most important factors compared to reuse and recycle for minimizing the waste.

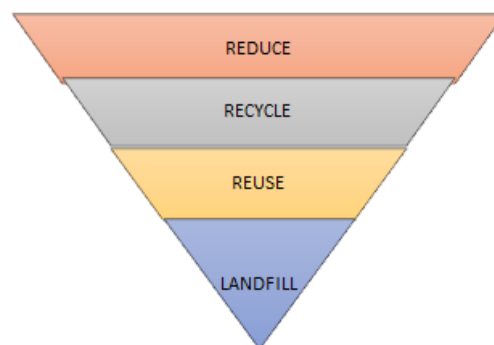


Fig. 1. Sustainable Waste Management Hierarchy.

A. Reduce:

The concept of reducing construction waste is essential to the waste hierarchy. It is process of reduction of waste generation in various stages of construction by efficient material planning. Wastage generation can be identified during the design process itself and care should be taken during execution stage to decrease the waste that may generate. The less material you have in a structure, the less opportunity for waste and there will be less to recycle and reduce. Consider open frame ceilings, shelves without cabinet doors, finished floor as subfloor/decking.

B. Recycle:

Recycling is conversion of solid waste to new material by using raw material. The process of converting waste material

to usable construction material replacing the natural materials in some proportion is called Recycling process. Materials can also be recycled onsite into new construction or offsite at a C&D processor. Typical materials recycled from building sites embrace metal, lumber, asphalt, pavement, concrete, roofing materials and wallboard. Recycling saves money by minimizing disposal costs and replacing fresh materials at some extent. The materials which are obtained after recycling of waste materials can be used with natural materials to make concrete and also manufactured sand with the natural sand in cement mortar.

C. Reuse:

It is a process of reuse of generated waste material as landfill. Reuse of generated waste material is done at the same or at another site under construction. In this process materials are sorted during and after construction to look for the items that may be reusable. One of the best examples for how this is being done today is the modular construction of homes and office buildings that is being created out of discarded shipping containers reusing them as homes and offices saves them from the landfills and doesn't require the additional expenditure of natural resources.

D. Benefits of the 3 R's:

1. Donating or saving materials for reuse is free alternative to paying disposal fees
2. Recycling fees are generally lower than disposal fees
3. Tax deductions from donating materials to non-profits
4. Helping local government meet their goal of reducing disposal by 50%
5. Creating business and product opportunities associated with recycled materials add to the growth of our local economy.

VI. GOVERNMENT INITIATIVES

The construction industry accounts to nearly 65 per cent of the total investment in the country's infrastructural development and is said to increase in the years to come, with this it becomes much more important how to effectively manage the C&D waste that is generated on a daily basis. Some of the key initiatives undertaken by the Government of India are given below:

1. *Ministry of Urban Development (MoUD)*: Ministry of Urban Development vide circular dated June 28, 2012, directed States to set-up such facilities in all cities with a population of over 10 lakh to establish environment friendly C&D recycling facilities. The MoUD report 'Technical Aspects of Processing and Treatment of Municipal Solid Waste', Swachh Bharat Mission (MoUD 2016) also recognizes the need for C&D waste management.
2. *Bureau of Indian Standards (BIS)*: Earlier there were no specifications or codes for C&D waste recycling / products / processing, however BIS IS: 383 was the principal driver, the standard for coarse and fine aggregates for use in concrete was revised in January 2016, permitting the use of recycled aggregates up to 25% in plain concrete, 20% in

reinforced concrete of M-25 or lower grade and up to 100% in lean concretes of grade less than M-15.

3. *National Building Code (NBC) of India 2005*: Part 11 of NBC 2005 on 'Approach to Sustainability', states that:
 - a. Recycled Coarse Aggregate may be used in concrete for bulk fills, bank protection, base/fill of drainage structures, pavements, sidewalks, curbs and gutters etc.
 - b. Up to 30 percent of natural crushed coarse aggregate can be replaced by the recycled concrete aggregate.
 - c. This percentage can be increased up to 50 percent for pavements and other areas which are under pure compression.
4. *Urban Local Body: Pune Municipal Corporation (PMC)*: PMC generates approximately 250 MT of C&D waste per day from various sources. The PMC has placed a ban on dumping debris at open spaces, the riverbed, nullahs and quarries, charging a fine of Rs 25,000 for violations. Dumping of construction debris on both sides of the Mula river resulted in flash floods in year of 2010. On both, the Pune and Pimpri-Chinchwad side of the bridge, dumping of debris has reduced the width of the river. A two-acre plot of barren land at Wagholi has been identified by the civic body to set up a debris processing plant.

VII. CONCLUSION

- Indian laws only permitted the use of natural sourced building materials; construction agencies alluded these rules to avoid the use of recycled C&D waste, whereas after the provision of Guidelines on Environment Management of C&D Waste Management in India in 2016, the use of Recycled C&D waste has been encouraged by the Government.
- A separate legal regulatory frame work for handling the construction and demolition waste management in India must be formulated.
- Builders and developers must be levied a charge for generating Construction and Demolition waste.
- The segregation of recyclable and non-recyclable C&D waste must be done at the source of generation to aid the process of recycling.
- With the implementation of these guidelines, an approach has been initiated towards reduction of environmental impacts.

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