

Review of Construction Waste Management Policies in India and other Nations

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Abstract: -- The issue of construction waste management is one that is paramount in any country, especially in developing countries. The scarcity of the availability of raw material has made it very important to study the use of recycled construction waste for newer construction projects. This review is intended to study the guidelines of construction waste management in major countries around the world and layout guidelines that are suitable for India. This will help Indian Government in solving this issue. Various countries like Australia, Germany, Ireland, United States of America, Nigeria, Indonesia, South Korea information and their policies regarding the building materials and construction are studied. They have an environmental impact at every step of the building process and extraction of raw materials, processing, manufacturing, transportation, construction and disposal at the end of a building's useful life. The lowering of the embodied impact of buildings is significant given the contribution of re-use that the re-use and recycling industry. Communicating the benefits of re-use and recycling and highlighting how barriers have been overcome will help to address the misperception that re-use of construction and demolition waste in infrastructure is novel, difficult and risky. Landfilling is considered to be undesirable due to environmental and ecosystem hazards. Now, most of the landfills are on the verge of arriving at its full capacity. This paper deals with the comparison of construction waste management policies in India and other countries of the world.

Index Terms— Construction, waste, management, policy, comparison.

I. INTRODUCTION

Any construction or demolition project involves some sort of Construction and Demolition waste that is generated. Management of these wastes is of prime importance as poor management has deleterious effects on the environment. It also leads to large-scale wastage of resources and also money. As a result, the waste that might be generated in a given project should be identified in advance. After identification, proper measures must be implemented so as to eliminate the waste wherever possible and try to reduce it to some extent if complete elimination is not possible. In some places the waste generated is disposed of in water, open lands etc., which should be made illegal in all countries as this leads to a lot of environmental issues. Traditionally, landfills have been used as an effective way of disposing of the construction waste. But as the land available for landfills reduces due to urbanization, it is the need of the hour to come up with better ways of disposal of wastes.

In India, it is mandatory to set-up plants for construction waste management in all cities with a population of over 10 lakhs. In the National Capital Region alone, about

5,000 tons of construction waste is generated according to a report by The Hindu. There must be awareness created in the construction sector about the benefits of waste management. Also, there is need of proper education of ways to segregate, identify and reduce wastes and also an attempt should be made to show how it is more economically viable to do the same instead of just disposing of the waste. There are countless ways of using the recycled product which is generated at these plants which otherwise would have been disposed of. The aggregates that are generated can now be used for construction activities provided that it meets the BIS standards.

II. OBJECTIVES OF STUDY

The objective of this study is to compare the waste management regulations of various countries. To execute the C&D waste management nationwide there needs to be a revision in the policy by the government to make sure that the construction waste are properly recovered, recycled and reused. Along with making rules and

regulations government should also form a body which ensures proper enforcement of this law all over the country. Rules and regulations for proper management of C&D waste vary in different countries. This depends upon type of construction materials used, quantity of waste generated and also on how serious does government take this waste generation issue and degree of pollution due to it. Since different rules and regulations are present in different countries we can compare them and find out difference in them.

A waste management plan to be successful and be implemented properly must take into account the following factors:

- 1) Different types of waste that can be expected from the construction process should be listed carefully.
- 2) Certain limitations need to be provided for each of the categories so as to reduce the overall waste. Waste sent to landfills must be reduced.
- 3) Recycling and reducing methods must be taken into account for each type of waste.
- 4) Methods of disposing of the waste must be found out.
- 5) General awareness must be created at the site and proper segregation of waste must be done.

III. WASTE MANAGEMENT IN OTHER COUNTRIES

Different countries have different policies of construction waste management. These guidelines vary due to differences of standards between countries, development of real-estate sector of the nation and types of construction materials used. Before comparing and analyzing rules and regulations of different countries, we should know the current global practices of utilization of C&D waste given in table shown below extracted from-Guidelines on Environmental Management of Construction & Demolition (C & D) Wastes (Source: ANNEXURE III: Global Practices of Utilization of C& D Wastes) (Ref. BMTPC Guidelines)

City / country	C & D Waste utilization
Ontario, Canada	A target fixed to divert 50% of the C & D waste from landfills by 2000 using 1987 waste production levels as baseline.
Alberta, Canada.	Re-use/recycling of C & D began in late 2008.
Netherlands, Sweden, Denmark, Austria,	Recycle 80 to 90% of their C & D waste.

France and Switzerland	
Australia	The reuse and recycling is more than 80%.
UK	The Olympic Stadium in London used 30% recycled concrete in its construction. United Kingdom regulations explicitly permit use of recycled and manufactured aggregates in non-structural framework without any discrimination in relation to aggregate from natural resources. 28% of aggregates used in UK are recycled C & D waste aggregate.
New York, USA.	Has no place for landfill for disposal of C & D waste, as was practiced a decade ago. Does not have any C & D waste disposal facility, it exports C & D waste to neighboring states by paying a tax Construction sites use C & D waste in renovations or new construction
California , USA	Reusing / recycling about 60% of C & D waste.
Portland, USA	More than 2/3rd of C & D waste is getting recycled / reprocessed
Portugal	Reuse/recycling of C & D waste is less than 40%
Hong Kong	C & D waste utilization is 60%.
Tokyo, Japan	Enforced the construction waste recycling law in 2002. The current rate of recycling of waste concrete is more than 99% (Source: Tokyo Metro Waste Management web site).

III. ANALYSIS OF CONSTRUCTION WASTE MANAGEMENT

Most construction waste goes into landfills, which in many places is non-segregated increasing the burden on landfill loading and operation. About 3,900 kg of waste are typically thrown into the landfill during the construction of a 200 square meter home. This waste may include bricks, stone, timber, concrete, metal alloys, non-ferrous metals, gypsum, debris etc. All these waste materials are easily recoverable and can be recycled and reused as shown below:

- 1) Bricks: If the building is deconstructed properly then recovered bricks can be used after processing it. It can be used for manufacturing paver blocks and debris blocks.
- 2) Timber: Timber coming from C&D works can be recovered easily and can be directly reused in other construction purposes after processing it.

3) Concrete: The demolished concrete can be recycled as aggregate and can be used in concrete. Research on recycled concrete has been carried out in India by CBRI and CRRRI for finding method to produce high grade concrete.

4) Metals & alloys: Metals are the most important in terms of profit and recycling. Scrap steel is almost totally recovered and recycled. Structural steel can also be reused to avoid wastage at construction site.

5) Non-ferrous metal: The main non-ferrous metal collected from C&D sites are lead, copper, aluminum and zinc.

6) Gypsum: Plaster produced from this gypsum has showed better engineering properties without any harmful effect. Phosphor-gypsum can be recycled for manufacturing different types of cement, flooring tiles, gypsum plaster partition walls and fibrous gypsum boards.

V. TABLE SHOWING COMPARISON OF LAWS IN DIFFERENT COUNTRIES

Sr. No.	Description	Germany	Indonesia	USA	Nigeria	S. Korea	Ireland	Australia	India
1)	Shall make provision for giving incentives for use of material made out of construction and demolition waste in the construction activity including in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads.				✓	✓			✓
2)	Prevention of waste and if prevention is not possible the composition of waste must be improved in order to Reuse or Recycle.	✓	✓	✓	✓	✓	✓	✓	✓
3)	Recycle unavoidable wastes, to reduce the toxicity of the waste, to ensure that an environment-friendly treatment or disposal is maintained.	✓		✓	✓		✓	✓	✓
4)	Bulky materials such as aggregates for construction (asphalt, concrete, etc.) cannot be transported by road over long distances (usually maximum 35 km)			✓	✓	✓			
5)	The responsible municipalities should encourage the utilization of mobile or semi-mobile recovery installations.	✓							
6)	The disposal of waste is only permitted when recycling is much more expensive or impossible and the waste is unavoidable.	✓			✓	✓	✓		
7)	States should to set-up recycling facilities in all cities with a population of over 10 lakhs.								✓

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8)	C & D waste processing facility shall inspect each waste load before unloading debris and shall accept only C & D Debris	✓	✓		✓	✓	✓	✓	✓
9)	A buffer zone of no development shall be maintained around solid waste processing and disposal facility, exceeding 20 tons or more in one day or 300 tons per project in a month of installed capacity.								✓
10)	Enterprises will also generate non-recyclable waste which must not be mixed together with recyclable waste and must instead be disposed of separately.	✓			✓	✓	✓		✓
11)	If waste generation is more than 20 tons or more in one day or 300 tons per project in a month shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan.					✓			✓
12)	Waste wood can always be recycled either materially or energetically except contaminated wood which is treated thermally, dumping of wood on landfill sites is prohibited.						✓	✓	
13)	Construction material manufacturers responsible for ensuring that their products are designed to reduce wastage, facilitate recovery after usage, work towards making them recyclable and make them environmentally compatible with post-recovery applications.	✓			✓	✓		✓	
14)	Appropriate storage of all hazardous wastes on-site will be undertaken including the burning of fuels, lubricants etc. so as to minimize exposure to on-site personnel (and the public) and to also minimize the potential for environmental impacts	✓					✓	✓	✓
15)	Both the owner of the waste and the transporter are legally responsible for proving the waste was transported to a lawful place.					✓		✓	
17)	Construction site can be subjected to additional regulations water runoff resulting from the project impede the use of rivers and streams in the area, or harm the health, property or natural environment of area residents.					✓			
18)	Certain projects are designated to use recycled aggregate, for which the use of recycled construction waste is mandatory of standards that are specified.					✓			
19)	Demolition contractors provide invaluable service to building owners by taking over responsibility of recovering, processing a building's materials. To accomplish this								

	demolition and recycling contractors must demolish buildings in such a way that material recycling is made possible. They are bound to do this both by legal requirements for C&D waste management.	✓							
20)	Waste concrete:								
	i) It can be used in road construction and waste material.	✓				✓		✓	
	ii) It can be used as aggregate in new concrete.	✓				✓		✓	
	iii) Crushed concrete can be used as primary material on unpaved roads and rural areas.	✓				✓		✓	
21)	Certification program for C&D materials allowing recyclers to market their materials with the confidence that they are suitable for a particular application. Likewise a builder may compare new materials with certified recycled materials, and take better advantage of the cost savings and ecological benefits inherent in recycled material.	✓						✓	
22)	Companies that specialize in C&D waste management will be contacted to determine their suitability for engagement. Each company will be audited in order to ensure that relevant waste collection permits are held.						✓		
23)	A review of all the records for the waste generated and transported off-site, as well as waste accepted, should be undertaken through the C&D phase. Each material type will be examined in order to see where the largest percentage waste generation is occurring.						✓	✓	

VI. WASTEMANAGEMENT IN INDIA AND ITS SHORTCOMINGS

In India, recycling technology is in developing stage and it's largely unorganized which makes it very less efficient. Major part of waste produced is dumped in landfills which are controlled by state and union territory government through civic bodies. Now there are many recycling units setup to check dumping of C&D waste in landfills. These treatment units are setup mainly in big cities like Nasik, Ahmadabad, Indore, Bengaluru, etc. The following are Statistics of Waste Generation:

Source: Guidelines on Environmental Management of Construction & Demolition (Prepared in compliance of Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016)

1) 10-15 million tonnes per year by MoUD (2000);

2) Approximately 25-30 million tonnes of C & D wastes is generated annually in India of which 5% is processed;

3) The amount of C & D wastes in India has been estimated to be 10 - 12 million tonnes annually and the proportion of concrete estimated as 23 to 35% of total waste. Considering 30% of C & D wastes of 12 million tonnes as concrete, and 50% of the concrete as coarse aggregate, the total available recycled concrete aggregate (RCA) in India is of the order of 1.8 million tonnes annually. Civic bodies are working hard to enforce the rules and regulations framed by State Pollution Control Board under guidance of Central Pollution Control Board by charging hefty fines.

VII. SUGGESTIONS TO IMPROVE IN INDIA'S POLICY

The following are the various ways by which India's waste management policies can be improved.

1) As we have seen in the comparison of regulations of different countries, India has lesser number of regulations. This leads to an excessive amount of construction waste to be generated. So, upon careful study all the above regulations of different countries must be implemented in India.

2) Also, in countries like Japan, the C&D waste reuse is as high as 99%. In India, the situation is nowhere near this level. A change in policy must be implemented so as to meet this standard which not only will help our country save money but also reduce the detrimental effects that construction waste have on our environment.

3) Studies have to be done to estimate the increase in waste generation in the future so that proper planning can be done to make recovery and recycling processes more efficient

4) Study of various waste management techniques with regards to economic feasibility, technological competence, and environmental impact should also be done.

5) A policy implementing a waste management plan on every site is also critical. Waste management should not be an afterthought but a dynamic process that is outlined before the start of the project. This Waste Management Plan will act as a reference document throughout the construction and demolition process.

6) A manual that dictates construction and demolition waste management from scratch is the need of the hour. C & D management regulations do exist but are rarely followed. Enforcement of the same must be strictly checked by the competent authorities.

7) A comparative chart of cost of recycling operations and the energy demands for utilization of every material needs to be done. The chart should outline the costs of transporting, labor work, and recycling operations of every material waste that can be generated.

VIII. CONCLUSIONS

Sustainable construction must be taught from graduation level and must but discussed regularly in construction related conferences and promote its practise otherwise destruction of environment is inevitable. Incentive schemes must be properly executed in every city around the country by civic body for enforcing better sustainability. Rules and regulations are of no use if they are not strictly enforced, so municipal officers should continuously monitor whether proper recycling, treatment

and disposal is properly carried out. Planning and execution of work should be properly synced between clients, contractors, engineers etc., so they can act together and reduce the C&D waste. There should be a guideline book provided to engineers, contractors, owner etc., for free either in the form of hard copy or open sourced in website so they can get it anytime. Construction materials should be reused at site as much as possible and disposing it only if recycling is impossible or uneconomical. Recycling of the construction waste is also a method for economy and reducing wastages.

REFERENCE

1. A. A. Dania, J. O. Kehinde and K. Bala -A Study of Construction Material Waste Management Practices by Construction Firms in Nigeria
2. Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects.
3. (<https://www.leanbusinessireland.ie/includes/documents/WMConstructionandDemolition.pdf>)
4. Edge Environment Pty Ltd for the Government Of Australia -Construction and Demolition Waste Guide, Recycling and Re-use Across the Supply Chain
5. Guidelines on Management of C & D wastes (cpb.nic.in/upload/NewItems/NewItem_228_Final_C&D_March_2017.pdf)
6. H. Schlosstr, S.Weisleder, D.Nasseri - Construction and Demolition Waste Management in Germany, TuTech Innovation GmbH, 27-10-2006.
7. Mooresfort, Latin, C O Tipperary Construction Waste Management Plan by. (EPA export 19-11-2013).
8. South Korea's waste management policies INCO4/12-13.

9. T. Napier - Construction Waste Management by
(<https://www.wbdg.org/resources/construction-waste-management>)

10. V. Anagal- Construction and Demolition Waste Management with reference to Case Study of Pune, (<https://www.researchgate.net/publication/256677141-construction-and-demolition-waste-management-with-reference-to-case-study-of-Pune>)

