



# STATISTICAL CHARACTERISATION OF CONSTRUCTION AND DEMOLITION WASTE IN INDIA AND ITS SUSTAINABLE MANAGEMENT

<sup>1</sup>Anas Ahmed

<sup>1</sup>Architect

<sup>1</sup>Architecture & Construction

<sup>1</sup>New Delhi, India

**Abstract:** India being the third world countries showing immense need and growth in terms of physical infrastructure facilities. Currently, construction sector contributes more than 5 percent of the nation's GDP and involves the employment of around 30 million people [1]. The Construction industry contributes a large portion of waste to landfills, which in turn results in environmental pollution and scarcity of usable land and, emission of toxic gases. Despite the adoption of several waste management strategies, waste reduction to landfill continues to seem an undefeatable challenge. The aim of this paper is to identify the causes of Construction and Demolition waste and measures to reuse the waste materials and steps taken by the government to reduce the waste caused by the construction industry.

**Index Terms - Construction & Demolition Waste, Landfill, Debris Recycle Plant, Sustainable Construction & Management**

## 1. Introduction

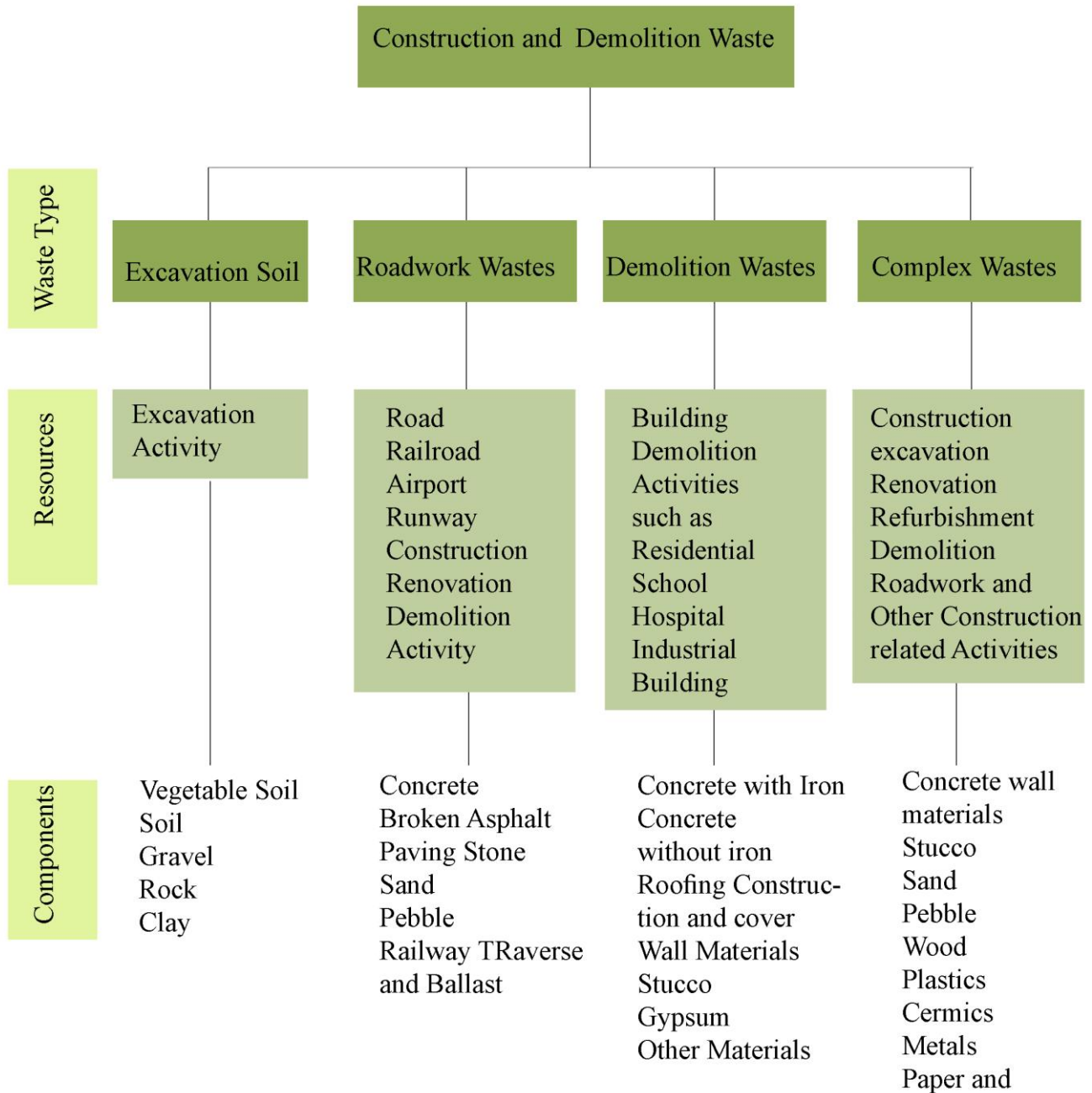
Construction and Demolition (C&D) materials consist of the debris generated during the construction, renovation and demolition of buildings, roads, and bridges. It is a challenging task to handle C&D waste because it is bulky, heavy and inert and also mixture of various materials of different characteristics. It is also difficult to choose any suitable disposal method, for example, it cannot be incinerated due to its high density and inertness. With the advent of sustainable practices in the construction industry, C&D waste generation and handling issues have been in focus to achieve the sustainable goals for our common future. Reduce, Reuse, Recycle (3Rs) and Landfill philosophy is highly useful in handling of C&D waste.



**Fig 1. Debris generated from demolition**

**1.1 C&D materials often contain bulky, heavy materials such as:**

- Concrete
- Wood (from buildings)
- Asphalt (from roads and roofing shingles)
- Gypsum (the main component of drywall)
- Metals
- Bricks
- Glass
- Plastics
- Salvaged building components (doors, windows, and plumbing fixtures)
- Trees, stumps, earth, and rock from clearing sites

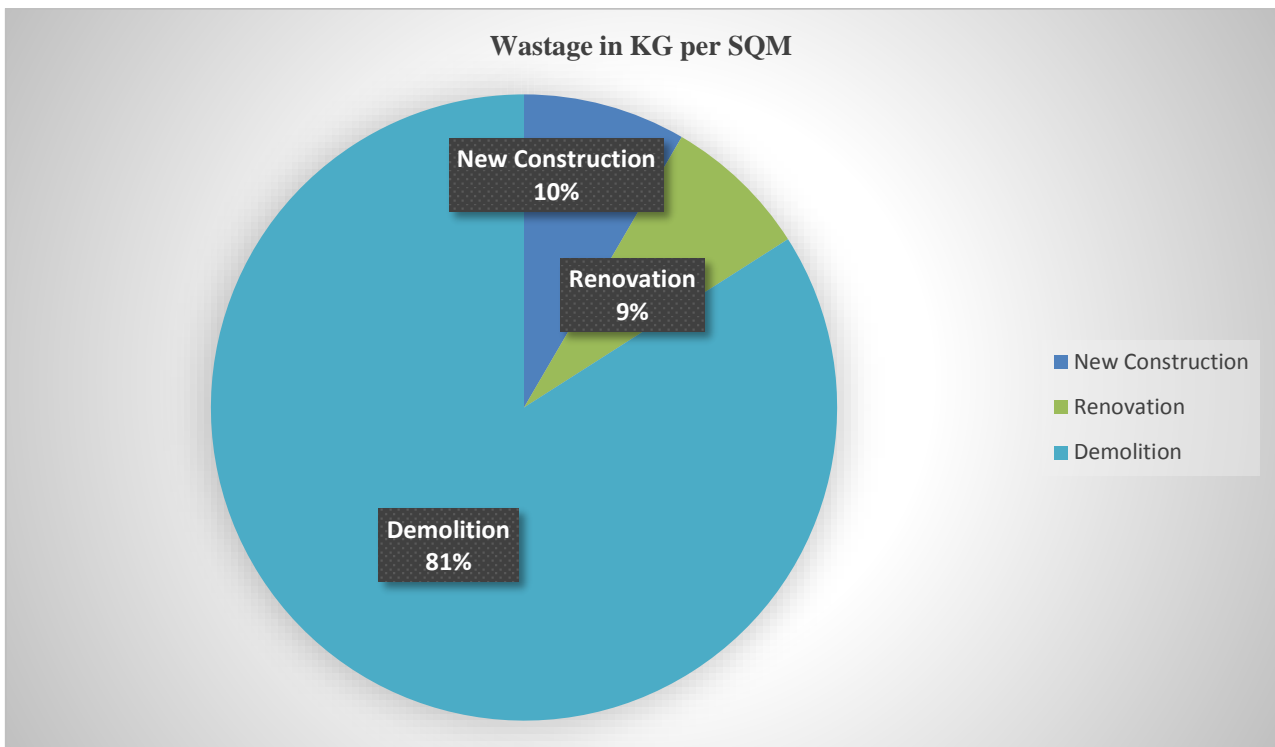


**Fig 2. Types of C & D Waste [Source: Centre for Science & environment]**

According to the Building Material Promotion Council (BMPTC), India generates an estimated 150 million tons of construction and demolition (C&D) waste every year. But the official recycling capacity is a meagre 6,500 tons per day (TPD) just about 1 per cent. [2]

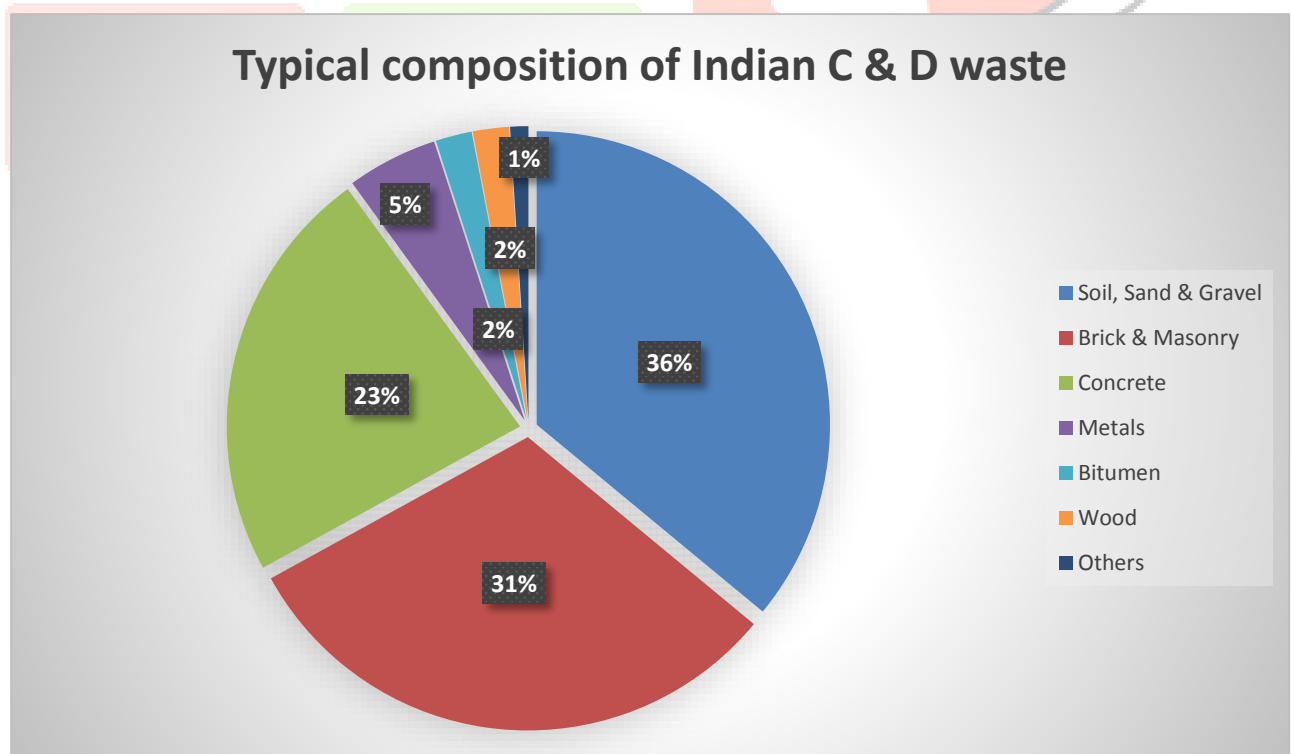
**1.2 Relation between new construction, renovation and demolition.**

As per the study conducted by Centre for Science and Environment of India, a new construction generates 40-60 kg of C&D waste per sqmt. then taking an average of 50 kg per sqmt., building repair produces 40-50 kg per sqmt. of waste. The waste produced per sqmt. of demolition is 10 times that generated during construction.



**Fig 3**

**Composition of C & D Waste in India:** Construction and Demolition waste are mainly composed of the materials in the chart mentioned below:



**Fig 4. Typical composition of Indian C & D waste (TIFAC)**



## 2.1 Initiatives taken by the Government to mitigate C & D waste:

In India, the Union Ministry of Environment, Forests and Climate Change (MoEFCC) is responsible for regulating and managing waste. One of the main activities of the ministry is prevention and control of pollution, and it has released many rules over the years to safely handle and dispose waste to ensure a clean environment. The Central Pollution Control Board and State Pollution Control Board ensure proper management of rules set forth by the MoEFCC.

## 2.2 Innovations and Impact

Infrastructure Leasing & Financial Services (IL&FS) Environment has set up India's first operational large-scale Construction & Demolition Waste Recycling facility for North Delhi Municipal Corporation, on a PPP framework. The plant at Burari, Delhi will help ease the pressure of the 5000 tons of C&D waste that Delhi generates per day, by recycling it into construction-grade aggregates. [3]



**Fig 5. Burari Recycle Plant**

1. Compliant with MSW Rules, the plant scientifically processes 2000 TPD of C&D waste into aggregates, which in turn is converted to Ready Mix Concrete, cement bricks, hollow bricks, pavement blocks, kerb stones, concrete bricks and manufactured sand, thereby reducing the consumption of fresh stones and sand, and mitigating pollution arising in the process. Over 16 lakh recycled concrete blocks from the plant are being used in the new Supreme Court Annexe building.
2. Using specially-adapted technology for Indian waste, the plant is able to recover about 95% of incoming C&D waste, and uses recycled sewage water for processing waste. The wet-processing technology minimizes dust and noise pollution.
3. The plant has attained certifications of International Organization for Standardization (ISO), Occupational Health and Safety Assessment (OHSAS) and Social Accountability (SA). The Ministry of Urban Development of the Government of India has written to all states to build facilities similar to the Burari facility in their cities.
4. Up to 2016, the project has helped save over 45 acres of urban land worth over Rs. 400 crores by reducing the burden on landfills. It also provides employment opportunities to the locals.[3]

2.3 C&D Waste Processing Flow Chart:

The C&D Waste Processing involves the following process.

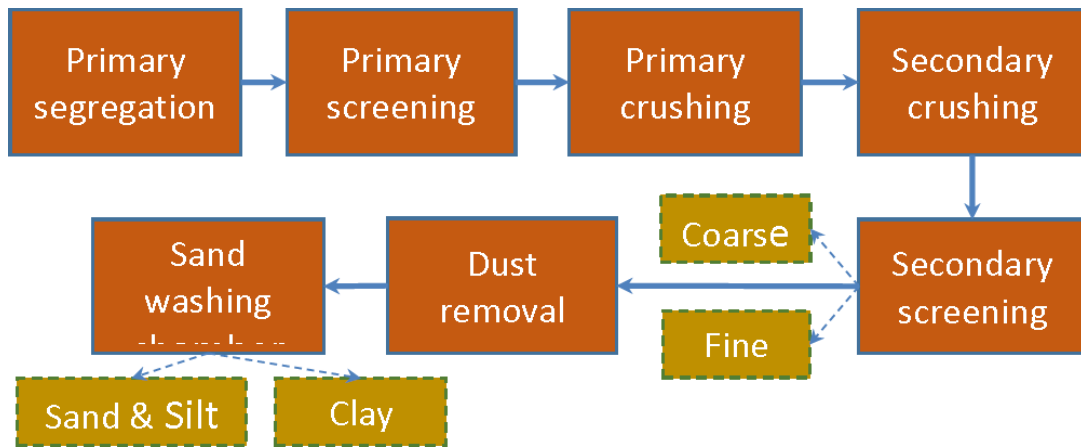


Fig 6. C&D Waste Processing Flow Chart:



Fig 7: Photographs of Construction & Demolition waste processing facility at Burari, Delhi



### 2.4 Construction materials from processed C&D waste:

The waste material from debris can be recycled to many useful products. Few of them are mentioned below:



**Pavers**



**Kerbstone**



**Jaali**



**Tiles**



**Wall Cladding**



**Concrete Block**



**Drain Cover**



**Compound Wall**

**Fig 8: Photographs of Construction materials from processed C&D waste**

### 3. Cost and Quality:

Repeated testing by the companies in Delhi and Ahmedabad, as well as by independent researchers has demonstrated that products made from C&D waste meet or exceed minimum standards for their intended applications. A study by GIZ and Development Alternatives (2015) tested compressive strength of paver blocks made from C&D waste collected in Bangalore and Ahmedabad as per BIS 15658:2006 protocol [4]. The results are depicted in Figure 9.

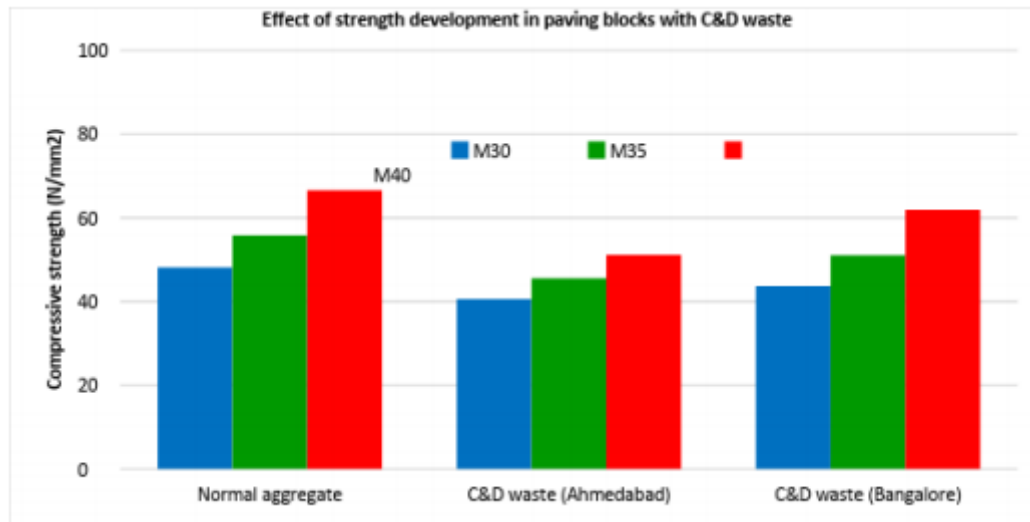


Figure 9: Test results comparing paver blocks made from natural aggregates versus recycled aggregates from C&D waste.

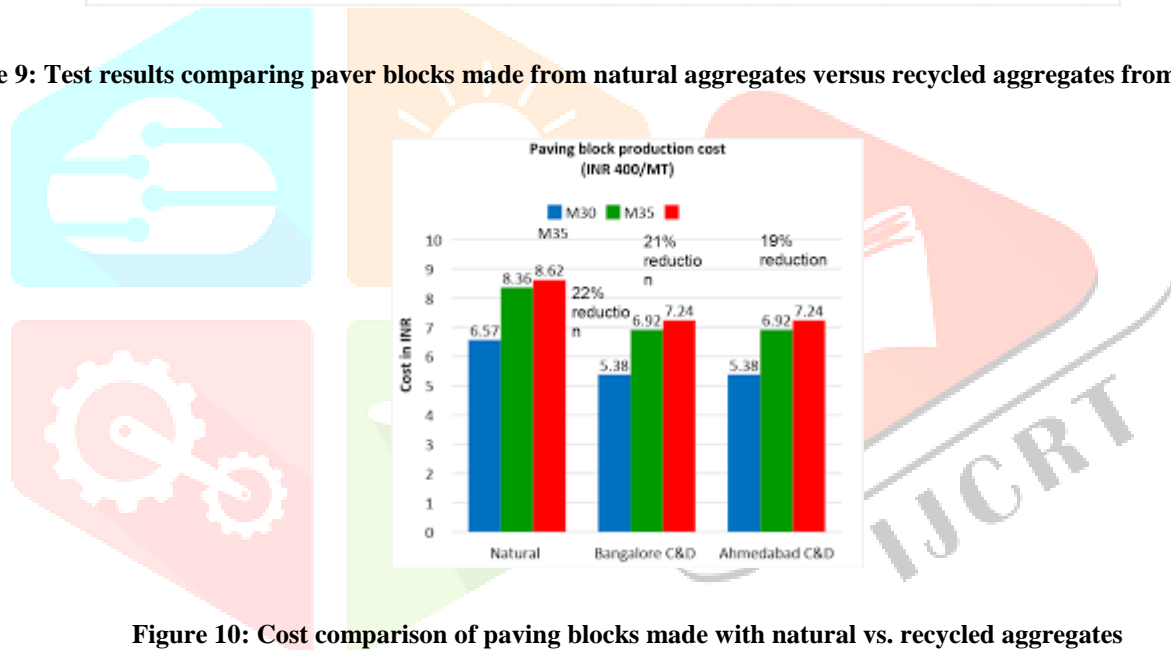


Figure 10: Cost comparison of paving blocks made with natural vs. recycled aggregates

Products made from recycled aggregates typically tend to have a cost advantage over conventional products since natural aggregates are transported over long distances in most places. This holds true as long as the collection and transportation cost of C&D waste does not become exceedingly high due to long transportation distances. The GIZ-Development Alternatives study<sup>13</sup> modelled production costs for paving blocks made from natural versus recycled aggregates using actual cost figures from Delhi (assuming collection and processing cost at Rs. 400/tonne). The results (Figure 10) show cost advantages of 19-22% for blocks using recycled aggregates.

### 4. Integrated Exhibition cum Convention Centre (Pragati Maidan): A live case study

#### 4.1 Solid Waste Generation and Management program during construction phase:

The solid waste expected to be generated during the construction phase will comprise of excavated materials, used bags, bricks, concrete, MS rods, tiles, wood etc. The following steps are proposed to be followed for the management solid waste [5]:

- Construction yards are proposed for storage of construction materials.
- The excavated material such as topsoil and stones will be stacked for reuse during later stages of construction.
- Excavated top soil will be stored in temporary constructed soil bank and will be reused for landscaping during operational phase of the project.

- Remaining soil shall be utilized for refilling / road work / rising of site level at locations/ selling to outside agency for construction of roads etc.  
Construction waste management is shown in below figure.

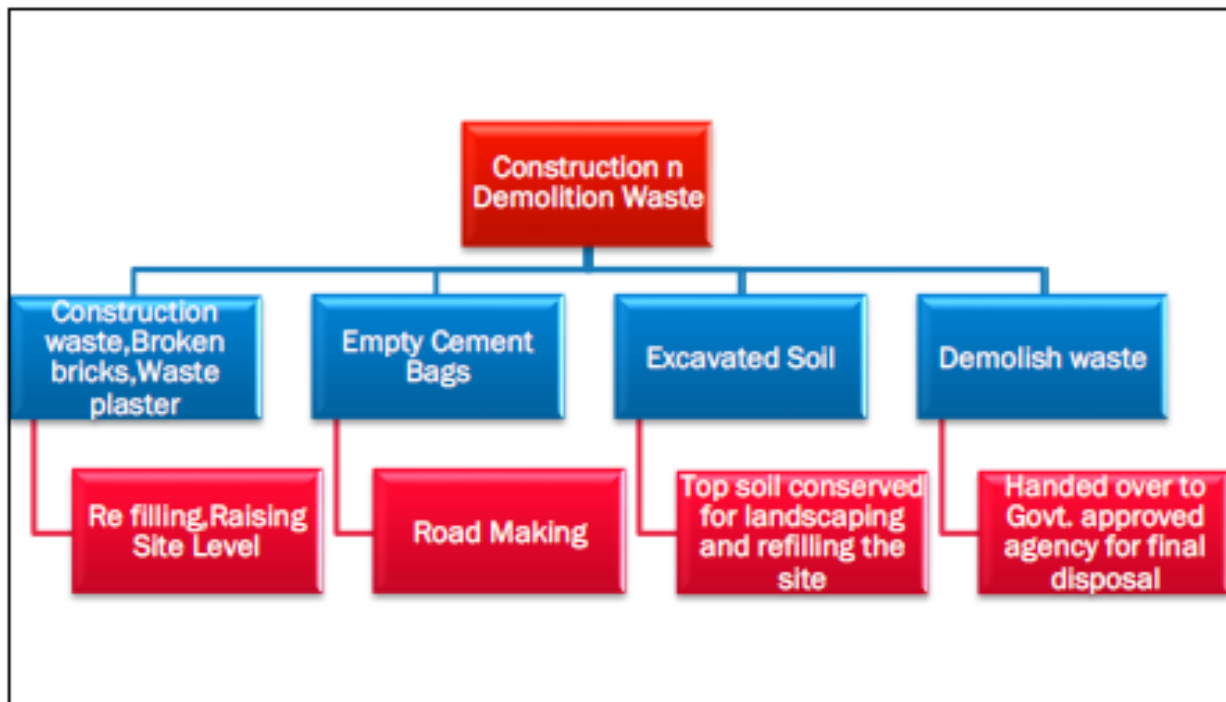


Figure 11

#### 4.2 C & D waste of Existing Buildings

- Construction and demolition waste of the site shall be kept within the premises.
- The waste shall be mainly comprising of concrete, RCC, brick work, flooring, finishes, pavement, doors, windows and ventilators, roofing, electrical, water supply, sanitary installations, rain water pipe with all fittings and fixtures etc.
- Waste shall be deposited at collection centre made at the site and will be transported and disposed to the Burari recycling plant of MCD by approved agency.
- As inert it shall be used to fill material for low-lying areas, landscaping, Road Making etc.
- Finer grade can be molded into blocks and slabs with appropriate binder.

#### 5. Guidelines and Policies framework by the Government for the management of C & D waste in India:

Appropriate measures in consultation with expert institutions for management of construction and demolition waste generated including processing facility and for using the recycled products in the best possible manner. [6]

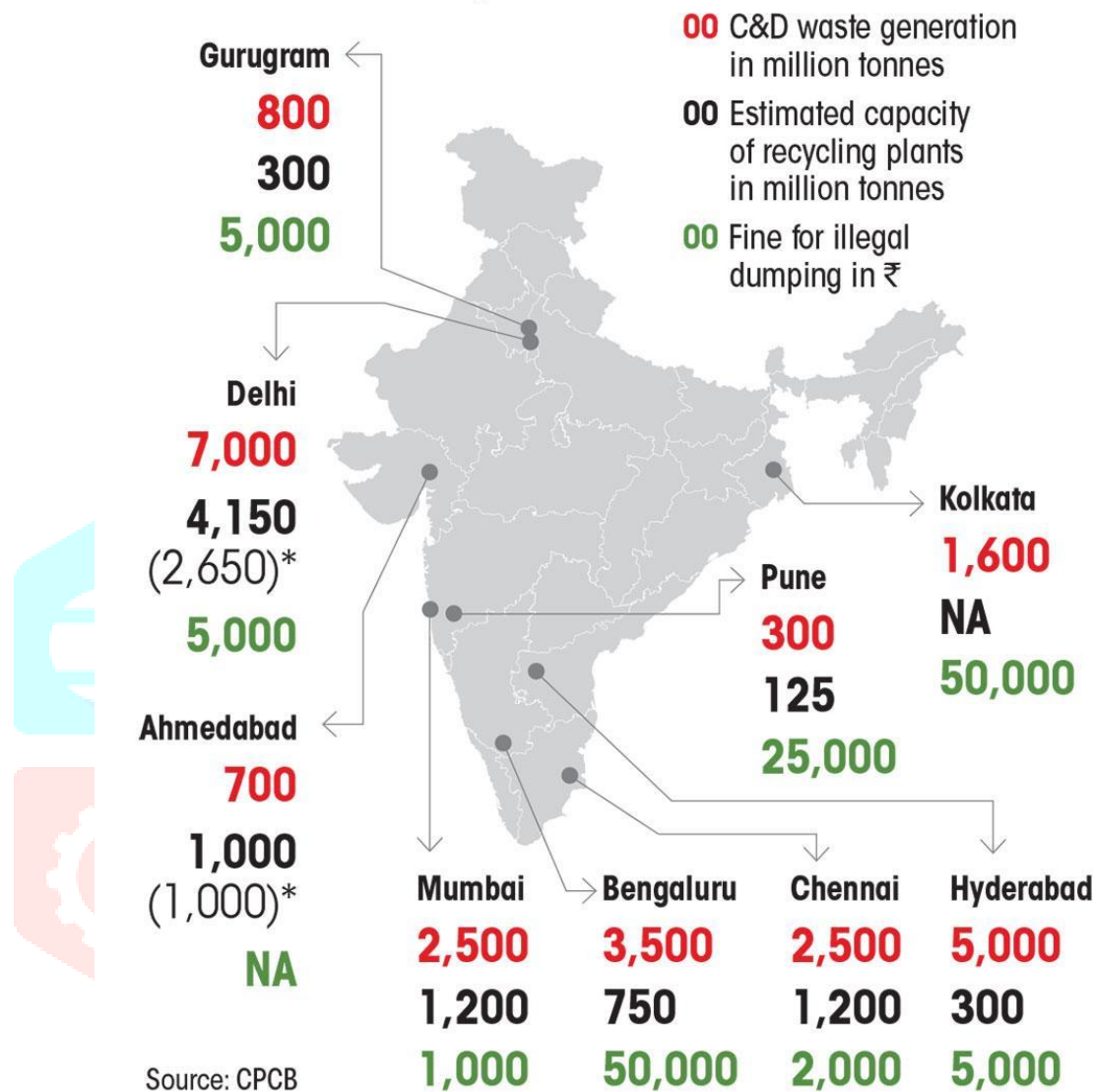
- Provision for giving incentives for use of material made out of construction and demolition waste in the construction activity including in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads.
- Procurement of materials made from construction and demolition waste shall be made mandatory to a certain percentage (say 10-20%) in municipal and Government contracts subject to strict quality control.
- Construction and demolition waste shall be utilized in sanitary landfill for municipal solid waste of the city or region as mentioned under Schedule.
- Ministry of Urban Development (MoUD) : Ministry of Urban Development vide circular dated June 28, 2012, directed States to set-up Waste recycle facilities in all cities with a population of over 10 lakhs ( one million plus cities ) to establish environment friendly C & D recycling facilities ( reference base being the first C & D waste processing facility commissioned in Delhi in Burari model ). The MoUD report 'Technical Aspects of Processing and Treatment of Municipal Solid Waste', Swach Bharat Mission (MoUD, 2016) also recognises the need for C & D waste management.



However the Government has not shown keen interest in regulating the recycle plants and there are only 2 cities with running plants in India namely Delhi and Ahmedabad. [7]

## Ill-equipped to recycle

Plants do not have the capacity to manage the waste cities generate



\*Additional capacity of plants in the pipeline.

All figures are based on the capacity of the proposed recycling plants except for Delhi and Ahmedabad, which have already set up their plants.

Fig 9. Debris recycle plant in India [7]

### 6. Conclusion:

1. There is a need to move towards an environment friendly construction approach to use the resources in a sustainable manner.
2. Need for building confidence and awareness in recycled products for quicker uptake.
3. There shall be easy access to the information regarding C & D generation, legislative and regulatory framework and procedures to all stakeholders and common public.
4. Need for adopting more environmentally friendly technologies to meet the SDG's Agenda 2030.
5. Check on Disposal of waste in ULB Dump yard.
6. More incentives on usage of recycled materials and fine on illegal dumping of waste materials by the government bodies.
7. Need of digitalization of construction sector with the help of technologies like BIM and Laser Scanning to avoid wastage.

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