



Ministry of Housing & Urban Affairs  
Govt. of India

# CAPACITY BUILDING PROGRAMME ON IMPLEMENTATION OF WASTE MANAGEMENT RULES, 2016



Ministry of Environment, Forest &  
Climate Change, Govt. of India



## TOOLKIT ON CONSTRUCTION & DEMOLITION WASTE MANAGEMENT RULES-2016



Central Pollution Control Board



National Productivity Council



- Objectives and Scope of the Toolkit
- Historical Background of Construction Waste Management
- Indian Scenario of C&D Waste Processing
- Effects of C&D Waste
- Rationale for C&D rules
- Chronology of evolution of C&D Waste Rules

# **TOOLKIT CONSTRUCTION & DEMOLITION WASTE MANAGEMENT RULES, 2016**

**Overview of  
C&D  
Waste  
Management**

**Features of  
C&D  
Waste  
Rules 2016**

**Duties of  
stakeholders**

**Management &  
Recycling of  
C&D waste**

**Your Guide For  
Safe & Scientific Management Of  
C&D Waste**

**1<sup>st</sup> Edition  
June, 2019**

# Preface

National Productivity Council (NPC) is pleased to present to you the 'Construction & Demolition Waste Management Rules-2016'. This toolkit has been crafted specially for all the stakeholders involved in the generation, collection, storage, transportation & treatment of construction & demolition waste.

The toolkit has five sections, broadly classified under effects of C&D waste, features of C&D waste rules 2016, duties of stakeholders, tools for effective implementation of C & D Rules, environmental benefits of recycling C&D waste & finally recycling of C&D waste. It provides useful tips, case studies, methods and practices that should be followed in the Construction & Demolition waste management.

The toolkit has been brought together by a team of good technocrats and environmentalists from various regulatory authorities in the country. It has been carefully reviewed by experts.

This toolkit is to ensure safe and scientific management of Construction & Demolition waste for all the citizens everywhere at all times.

NPC would welcome any suggestions and feedback on this publication so that 'The Toolkit' becomes a trusted companion and part of all stakeholders.

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National Productivity Council

*Note: 1. All pictures used in the toolkit are from various sources, which have been duly referred to.  
2. This publication is purely for education purpose and not for commercial purpose.*

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# CHAPTER1: OVERVIEW OF C&D WASTE MANAGEMENT

## 1.1 Objectives and Scope of the Toolkit

The objective of this toolkit is

- To aid the trainer with background reading material in an easy to adapt and customize training programs to different stakeholders.
- To aid the stakeholders to comprehend their roles in implementing these rules.

The scope of this training kit is to provide reading material for capacity builders and stakeholders in the area of C&D Waste Management as per C&D Waste Management Rules, 2016.

## 1.2 Historical Background of Construction Waste Management

Recycling of demolition waste was first carried out after the Second World War in Germany to tackle the problem of disposing large amount of demolition waste caused by the war and simultaneously generate raw material for reconstruction. Considerable research has been carried out in U.S.A, Japan, U.K, France, Germany, Denmark and in other developed countries for recycling concrete, masonry, bricks, bituminous and other constituents of waste from Construction Industry.

In India Central Building Research Institute (CBRI), Roorkee, and Central Road Research Institute (CRRI), New Delhi have done studies to assess and demonstrate possibility of using construction waste to substitute new materials via recycling.

According to Technology Information, Forecasting and Assessment Council (TIFAC), study, 70% of the construction industry is not aware of recycling techniques and concludes the need for quality standards for recycled aggregate materials and recycled aggregate concrete to help setting targets for quality products and assure the user of a minimum quality requirement, thus encouraging him to use it.

The C&D rules takes into account the historical perspective of the problems of C&D waste disposal and methods deployed to manage them, both locally and globally.

## 1.3 Indian Scenario of C&D Waste Processing

In India, it is very common to see huge piles of C&D waste, stacked alongside of major roads resulting in traffic jams, congestion and disruption & choking of drains. Around 30% of the total municipal solid waste generated in the country comprises C&D waste.

TIFAC has conducted a techno-market survey on 'Utilization of Waste from Construction Industry' targeting housing/building and road segment. The total quantum of waste from construction industry is estimated to be 12 to 15 million tons per annum out of which 7-8 million tons are concrete and brick waste.



As per the Central Public Health & Environmental Engineering Organization (CPHEEO), the Indian Real Estate Industry alone is facing a shortage of aggregates to the extent of 55,000 million cum. In addition, 750 million cum of aggregates would be required to achieve the targets of road construction sector, which will lead to tremendous pressure on natural resources.

The C&D Waste generated in each city would reflect different characteristics based on each city's growth pattern and lifestyle. While retrievable items such as bricks, wood, metal, tiles are recycled, the concrete and masonry waste, accounting for more than 50% of the waste from construction and demolition activities, are not being adequately recycled in India.



**Figure 1 - 1 – Dumping of C&D Waste in Public Places**

The traditional practice in India is to dispose this waste in landfills or illegally dump in rivers and water bodies. Faced with growing environmental concerns and lack of landfill space, most cities like Ahmedabad, Delhi, Mumbai and Pune are opting for recycling and recovery of materials from C &D waste.

#### **1.4 Effects of C&D Waste**

Construction activities occur to build/rebuild new structures or old structures. Demolition activities are growing due to old structures needing renovation or replacement with time to make way for vertical structures or flats in line with growing needs of the society. All such activities generate C&D waste.

Disposal of such debris in a safe environment is a big challenge for the builders, developers, and owners. When on one hand the disposal of debris is a challenge, then, on the other hand, there is an acute shortage of naturally available aggregates for the construction of buildings. Reduction of this demand is possible only with the reusing or recycling of waste generated from the construction activities.

Construction, renovation, and demolition projects create environmental and economic problems in addition to waste. These include depletion of already diminishing natural resources, air and water pollution from waste that is improperly disposed of, and, for many state and local governments, pressure on premium landfill space and taxpayer money. As virgin materials become scarcer and more costly, some increased recycling of construction, renovation, and demolition waste has occurred, but most of these materials continue to be discarded. Moreover, many types of construction materials and demolition waste contain persistent, bio-accumulative toxins (PBTs) and other hazardous substances.

Typically, demolition activity is undertaken by specialized demolition contractors who bring their own equipment and personnel and transport the residual waste. The property owners pay fee to the demolition contractors, which is decided based on the recoverable value of recycled materials – steel, wood, glass, pipes etc. by demolition contractors.

The environmental impacts of unmanaged C&D waste are evident. Waste to resource approach towards recycling C&D waste brings great benefit.

Environment and Social Impacts of Unmanaged C&D Waste include:

- ❖ Impose strain on landfill needs;
- ❖ Hazardous portion of waste, such as asbestos, could lead to potential harm to the environment and public health issues;
- ❖ Illegal dumping affecting the bio-habitat of dump area and creates potential public health issues such as mosquito breeding;
- ❖ Potential high value of recycled material not tapped and gets buried in landfills or illegal dumps leading to economic loss;
- ❖ Increasing quantity of C&D Waste leads to un-sustainable situation;
- ❖ Reliance on mines and natural sources for building material leads to escalating price, un-sustainable supply and high transportation costs;

To address the problems of resource depletion, increasing demand for building materials, societal awareness on pollution effects (dust, pollution due to traffic congestion owing to roadside disposal) of C&D waste these rules were framed.

### **1.5 Rationale for C&D Waste Management rules**

India's population living in cities and urban areas increased from 14% at the time of independence to 27.8% during 2001; again it has increased from 27.8 percent in 2001 to 31.16 percent in 2011. The increased urbanization and scarce land created opportunity and demand for multistoried housing flats in place of independent houses. The demolition of old structures generates C& D waste besides new construction requiring building materials creating the need to manage demolition waste through 3R's principles and planned disposal.

The rules are framed to address

- The current common practice to pile C&D waste in the road or illegally dump in less populated areas causing traffic congestion.
- C&D waste from individual households finding its way into nearby municipal bins
- To avoid mixing of this waste with municipal waste as these in MSW make it heavy, and degrading its quality in MSW processing such as composting or energy recovery etc.
- To prevent clogging of surface drains blocking free flow of water runoff and obstructing them.
- To create a framework for organized storage, collection, reuse or disposal of waste generated.
- To meet the demand for aggregates in the housing and road sectors through recovery of materials from C& D waste to reduce significant gap in demand and supply.
- To reduce resource depletion due to sand mining which is becoming a major source of problem. Recycling of aggregate material from construction and demolition waste will reduce the demand-supply gap.

### **1.6 Chronology of evolution of C&D Waste Rules**

C&D waste is one of the major components of MSW and is a major hindrance in waste processing when mixed with MSW and delivered at the processing facility. C&D waste finds a brief mention in Schedule III of the Municipal Solid Waste (Management and Handling) Rules, 2000 and the "Manual on Municipal Solid Waste Management" of the MoUD, 2000 has a chapter on C&D waste which lays down basic guideline on its handling.

Municipal Corporation of Greater Mumbai has notified Construction & Demolition and Desilting Waste (Management & Disposal) Rules 2006.

The Delhi government has decided to mandate recycled products from C&D waste in prospective contracts for building works and road works. Following the verdict, all Delhi government authorities are required to incorporate a clause in their tenders: It mandates use of a minimum of two percent recycled products in all future contracts for building works

and ten percent recycled products for road works. Five percent use of such products is expected for non-structural applications during examining and approving building plans.

To address the growing problem of C&D waste, and have uniformity in approach to address the issue which is being randomly and separately being addressed by each state, C&D Waste Management Rules 2016 were enacted by MOEF&CC vide Gazette notification G.S.R. 317(E) Part-II, Section-3, Sub-section (ii).

Key highlights of the recent developments:

- Mandatory for large cities to setup recycling plant within 18 months and smaller cities within 2-3 years.
- Generators of waste are required to pay notified collection and processing fees.
- Imposition of heavy penalties on illegal dumping of C&D Waste.
- Use of Construction & Demolition waste (20% to 100%) is allowed in construction. IS-383 standard code revised.
- Introduction of Centralized Helpline number including Mobile App in Delhi.



## CHAPTER 2: FEATURES OF C&D WASTE RULES-2016

The Government has notified Construction & Demolition Waste Management Rules, 2016 for the first time. These rules shall be called the “**Construction and Demolition Waste Management Rules, 2016**”. The guiding principle of these Rules is to recover, recycle and reuse (3R's) the waste generated through construction and demolition. Segregating construction and demolition waste and depositing it to the collection centers for processing will now be the responsibility of every waste generator.

Cities with a population of more than one million will commission processing and disposal facility within 18 months from the date of final notification of these rules, while cities with a population of 0.5 to 1 million and those with a population of less than 0.5 million will have to provide these facilities within two years and three years respectively. (Rule – 13)

Monitoring shall be made by State Pollution Control Boards (SPCBs) 3 times a year i.e. once in 4 months for cities having population more than one million. Cities with population of 0.5-1 million and less than 0.5 million shall be monitored by SPCBs 2 times a year i.e. once in 6 months. (Rule – 13)

“Permission for construction will be given only when the complete construction and demolition waste management plan is presented”, and large generators of waste will have to pay relevant charges for collection, transportation, processing and disposal, as notified by the concerned authorities.

The following are the important features of the Construction & Demolition Waste Management Rules, 2016.

### 2.1 Application (Rule – 2)

- Applies to everyone who generates construction and demolition waste.

### 2.2 Duties of waste Generators (Rule – 4)

- Every waste generator shall segregate construction and demolition waste and deposit at collection center or hand over to the authorized processing facilities.
- Shall ensure that there is no littering or deposition so as to prevent obstruction to the traffic or the public or drains.
- Large generators (who generate more than 20 tons or more in one day or 300 tons per project in a month) shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or remodeling work,
- Large generators shall have environment management plan to address the likely environmental issues from construction, demolition, storage, transportation process and disposal / reuse of C & D Waste.
- Large generators shall segregate the waste into streams such as concrete, soil, steel, wood and plastics, bricks and mortar,

- Large generators shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities;

### 2.3 Duties of Service providers and Contractors (Rule –5)

- The service providers shall prepare a comprehensive waste management plan for waste generated within their jurisdiction, within six months from the date of notification of these rules,
- Shall remove all construction and demolition waste in consultation with the concerned local authority on their own or through any agency.
- **Accidents** if any during the process shall be **Reported** to Local authority on time (**FORM-V**) (Rule – 14)

### 2.4 Duties of State Government and Local Authorities (Rule –6 & 9)

- The Secretary, Urban Development Department in the State Government shall prepare state's policy with respect to management of construction and demolition waste within one year from date of final notification of these rules.
- The concerned department in the State Government dealing with land shall provide suitable sites for setting up of the storage, processing and recycling facilities for construction and demolition waste within one-and-a-half years from date of final notification of these rules.
- The Town and Country planning Department shall incorporate the site in the approved land use plan so that there is no disturbance to the processing facility on a long term basis.
- The department shall procure and utilize 10-20% materials made from construction and demolition waste in municipal and Government contracts.
- Local Authority (LA) shall place appropriate containers for collection of waste, removal at regular intervals, transportation to appropriate sites for processing and disposal.
- LA shall seek detailed plan or undertaking from large generator of construction and demolition waste and sanction the waste management plan;
- Seek assistance from concerned authorities for safe disposal of construction and demolition waste contaminated with industrial hazardous or toxic material or nuclear waste if any;
- LA shall give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ;
- LA shall establish a database and update once in a year,
- Million plus cities (based on 2011 census of India), shall commission the processing and disposal facility within one-and-a-half years from date of final notification of these rules
- 0.5 to 1 million population cities, shall commission the processing and disposal facility within two years from date of final notification of these rules
- For other cities (< 0.5 million populations), they shall commission the processing and disposal facility within three years from date of final notification of these rules
- LA shall review and issue instructions to the in- charge of the facility if any **accidents** reported by in charge of the processing facility (Rule – 14). Checklists of safety concerns are included in **annexure-1** for reference.

## 2.5 Duties of CPCB, SPCB or Pollution Control Committee (Rule –8 & 10)

- The Central Pollution Control Board shall prepare operational guidelines related to environmental management of construction and demolition waste.
- SPCB shall grant **authorization** to construction and demolition waste processing facility **(Form-III)**
- Monitor the implementation of these rules by the concerned local bodies
- Submit **annual report** to the Central Pollution Control Board and the State Government. **(Form IV)**

## 2.6 Standards for products of construction and demolition waste (Rule –11)

- The Bureau of Indian Standards need to prepare code of practices and standards for products of construction and demolition waste
- Indian Roads Congress needs to prepare standards and practices pertaining to products of construction and demolition waste for roads construction.

## 2.7 Duties of Central Ministries (Rule –12)

- The Ministry of Urban Development, and the Ministry of Rural Development, Ministry of Panchayat Raj, shall facilitate local bodies in obtaining compliance of these rules;
- The Ministry of Environment, Forest and Climate Change shall review implementation of these rules as and when required.

## 2.8 Facility for processing / recycling facility (Rule –7)

- The operator of the facility shall obtain **authorization** from State Pollution Control Board or Pollution Control Committee. **(Form-I)**
- The processing / recycling site shall be away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands and places of important cultural, historical or religious interest. **(Schedule-I)**
- The processing/recycling facility exceeding five Tonnes per day capacity, shall maintain a buffer zone of no development around the facility.
- The operator of the facility shall submit the **annual report** to the State Pollution Control Board **(Form II)**.

**Table - – Schedules in C&D Waste Management Rules-2016**

Schedule I	:	Criteria for Site Selection for Storage and Processing or Recycling Facilities for Construction and Demolition Waste [See Rule 7(1)]
Schedule II	:	Application of materials made from Construction and Demolition waste and its products [See Rule 7(3)]
Schedule III	:	Time frame for Planning and Implementation [See Rule 13]

## CHAPTER 3: IMPLEMENTATION GUIDANCE FRAMEWORK

This chapter is designed to provide a framework for implementing C & D Waste Management rules 2016 with respect to activities of government, public & private agencies and other stakeholders within the timelines targeted under the rules. Implementation of C & D Waste Management rules can be visualized as four parallel work elements in three time frames based on cities population. The four parallel work elements are visualized to be executed by:

- Central Governmental ministries and government agencies having the macro role of overseeing overall implementation, providing guidance, assessing and reviewing the relevance of policy through agencies as given in figure below.
- State/Regional local level governmental agencies playing the regional and local role of formulating local policy, action plan and modalities of implementing action plan.
- Infrastructure development and operational agencies assessing, establishing and operating collection, processing facilities besides marketing processed products.
- Opinion makers, community leaders, NGOs and other awareness generation and go-between actors among generators and government agencies to ensure generators follow the rules and processors process in safe and environmentally compliant manner.

### 3.1 Stakeholders involved in the implementation of C&D Waste Management

This can be understood from the chart below.

CENTRAL AGENCIES	STATE LEVEL/LOCAL AUTHORITY	FACILITY DEVELOPERS/OPERATORS	GENERATORS
<ul style="list-style-type: none"> <li>• MoEFCC</li> <li>• CPCB</li> <li>• MoUD</li> <li>• MoRD</li> <li>• MoPR</li> <li>• BIS</li> <li>• IRC</li> </ul>	<ul style="list-style-type: none"> <li>• Secretary In-charge, Urban Development</li> <li>• SPCB</li> <li>• Municipal Corporation</li> <li>• Town &amp; Country Planning Department</li> </ul>	<ul style="list-style-type: none"> <li>• Public</li> <li>• Private</li> <li>• Public-Private Partnership</li> </ul>	<ul style="list-style-type: none"> <li>• Large scale(&gt;20T/d or &gt;300T /Project/Month)</li> <li>• Small scale</li> </ul>

The implementation of the rules requires understanding of activities to be performed by each of these stakeholders and comprehension of interdependency on each other. The chart below provides the activities to be undertaken by key stakeholders. The activity progress information flow from one stakeholder to the other is indicated by color coding of text and directional arrows. It may be noted that Facility Planner, Developer and operator are indicated separately for ease of understanding but all three roles may be performed by single contractor or government agency.



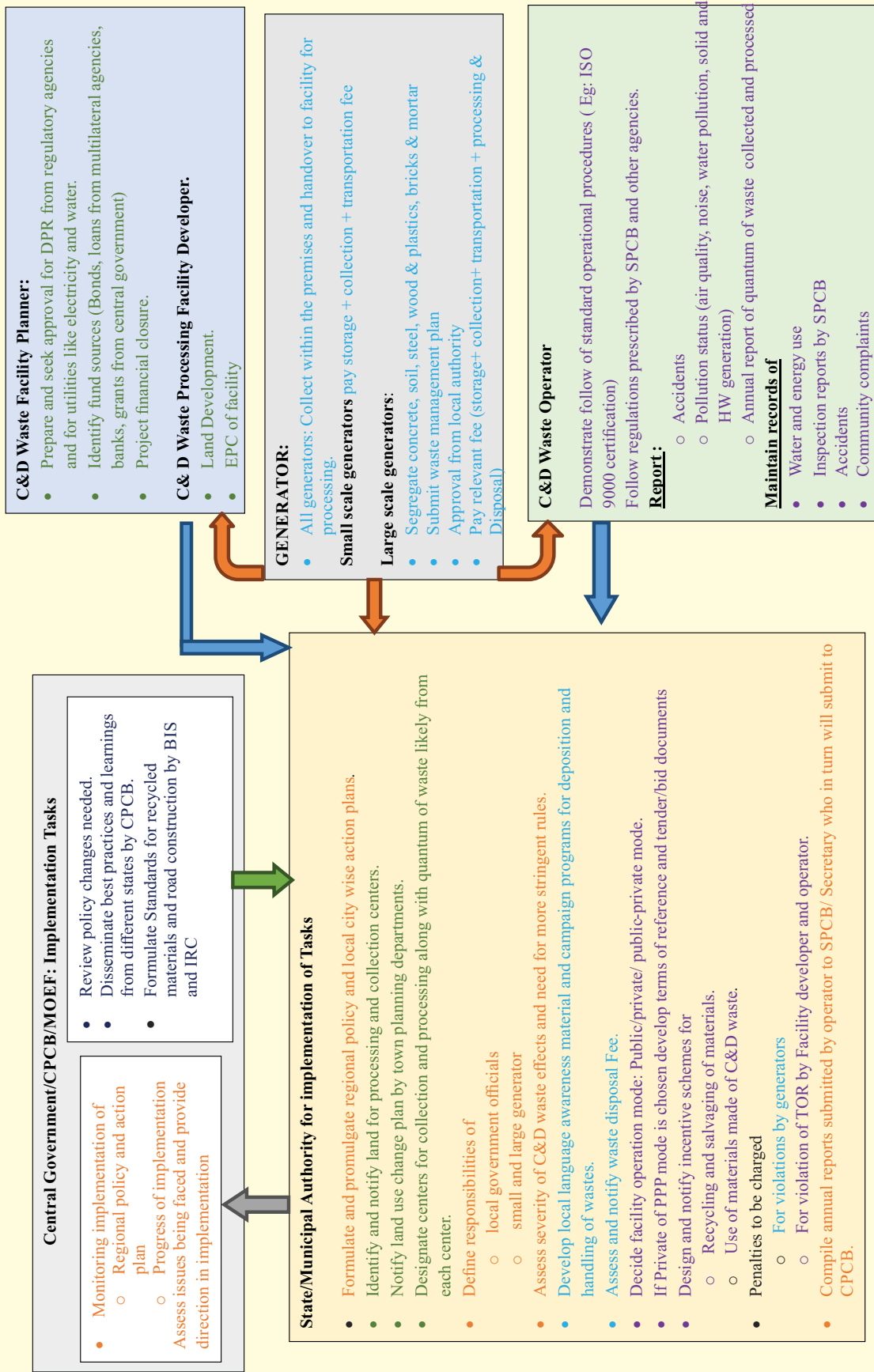
Municipal Authority being the prime implementation body needs to ensure all departments/sections understand roles and responsibilities pertaining to the implementation of C & D Waste Management Rules.

This is essential to not only ensure effective assessment of the prediction of waste generators but cost effectively manage it across the entire chain of C & D waste management, starting from deposition by generators at designated centres to final processing to recover waste materials and dispose unusable waste in a scientific manner. The table below summarizes the roles different departments may have to undertake for further effective implementation of C & D rules.

Municipal Department/ Section	Role
Building permission/development cell	Assess the quantum that is likely to be generated and the trends that are likely to emerge in C & D activities area/ ward wise.
Public Health	Assess and identify the severity of the waste effects for more stringent rules
Town Planning department	Based on this data, collection centres and their capacity requirement can be assessed.
Building permission/development cell & Town Planning department	The land for the processing and collection centres will have to be identified and to notify the land use change plan.
Training department	Build capacity on the responsibilities of the generators and the local government bodies
Public Relations department	Dissemination of the waste handling and deposition awareness messages in local languages.
Solid waste management department	<ul style="list-style-type: none"> <li>• Prepare TOR for collection, processing &amp; disposal.</li> <li>• Technical criteria for selection of contractors.</li> <li>• Supervise operating cost at site.</li> </ul>
Procurement cell	<ul style="list-style-type: none"> <li>• Define type of bidding/tendering &amp; evaluation criteria</li> <li>• Draft contract</li> </ul>
Electoral representatives in consultation with Mayor and Executive Management officers	Incentive schemes for recycling and salvaging of materials may be developed and notified
Accounts and finance department	Costs for collection and disposal will have to be fixed and notified.
Legal cell/PRO cell	The activities that constitute violation of TOR by facility developers and operators, needs to be clearly defined, while drafting and engaging the contract.
Chief Engineer and Municipal Commissioner/Secretary	The annual reports submitted by the operators to the Municipal Authorities will have to be compiled and produced to the SPCB/Secretary and CPCB.

The interdepartmental/section interaction/communication approaches accordingly needs to be established and updated to make the implementation process effective.

## ACTIVITY CHART FOR IMPLEMENTING C & D WASTE MANAGEMENT RULES, 2016



Agencies, planning collection centers need to undertake a forecast study about the likely C&D waste generation in each area and accordingly design the facility. A new residential area may not need the facility for next 15-20 years and an old or upcoming area may require the facility and hence this aspect needs to be addressed keeping local conditions in mind.

As per the rules the C&D waste needs to be stored by generators within their premises and either deposited at collection center on their own or through facility arranged by local public/private agency for a fee. Since the criteria is waste needs to be stored within one's premises how it will be stored is left to the generator with a mandate that the waste does not cause littering, blockage of drains and not obstruct traffic. Also, the amount of waste for minor or moderate repairs in existing buildings, to complete destruction, varies and no standardized bin sizes can be advocated.

### 3.2 Tools for effective implementation of C & D Rules 2016

For effectively implementing the activities outlined in the chart above

- Operators can use form-I to seek approval of local authority and authorities can issue permission in Form –II. For aggregating information at local to state level Form-III and then from state to central level Form-IV can be used to enable policy makers to review progress and make amendments to policy or give directions.
- Checklists can be used to monitor progress of work for each hierarchical level. Templates outlining key monitoring elements are developed as checklists and presented below which can be further refined based on local conditions.

CHECKLIST FOR CENTRAL LEVEL AGENCIES		
Activities to monitor	Yes	No
Regional policy has been framed		
List of city wise action plans outlining areas identified and notified by town and country planning department.		
Copy of letter stating chosen method for developing process ( public/ private/ public-private)		
Terms of reference, bidding method and process developed		
Copy of letter of award of contract to developer and operator		
DPR approval letter by SPCB and other agencies submitted by developer		
Land allotment for Collection & processing done		
List of NGOs, community leaders identified		
Public awareness and campaigns in regional level promoted		
Fee charges for collection fixed		
Subsidy framework and quantum fixed for use of processed material done		
List of officials designated with responsibility for each city		

### CHECKLIST FOR STATE LEVEL AGENCIES

Activities to monitor	Yes	No
List of approved designated centres		
Responsibilities of local authorities fixed		
Stringency of existing rules sufficient		
Location specific bye-laws required for ----- city		
Awareness and campaign plans of each city and budget allocated		
Fee of disposal fixed		
Subsidy quantum and mode of disbursal framed		
Collection & treatment through Public/ private/ public-private agency		
Penalties for violation of contract fixed		

### CHECK LIST FOR LOCAL CITY/ MUNICIPAL CORPORATION AUTHORITY /SPCB

Activities to monitor	Yes	No
Quantity of waste generation estimated in----- locality		
Tender has been floated		
DPR prepared/reviewed		
DPR approved		
Responsibilities of generator fixed		
Fund raising formalities carried out		
Land allotted for the facility		
Land development completed		
EPC started		
Construction and commissioning completed		
Inspection by SPCB		

### 3.3 Time frames for C & D waste management implementation

These checklists need to be looked in conjunction with desired time frame for implementing the rules as given in table below to appreciate interdependencies among various stakeholders and the need to work in coordinated manner to ensure timely, qualitative and quantitative completion of development of collection and processing facilities.

Compliance criteria	Cities with population of 01 million and above	Cities with population of 0.5-0.1 million	Cities with population of less than 0.5 million
Formulation of policy by state Government	12 months	12 months	12 months
Identification of sites for collection & processing facility	18 months	18 months	18 months
Commissioning & implementation of the facility	18 months	24 months	36 months
Monitoring by SPCBs	3 times a year-once in 4 months	2 times a year-once in 6 months	2 times a year-once in 6 months

# CHAPTER 4: C&D WASTE DEFINITION, CHARACTERISTICS, GENERATION & QUANTIFICATION – SOURCES AND CONSTITUENTS

## 4.1 Definition of C&D Waste

As per Rule 3 (c) "construction and demolition waste" means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;

Construction and Demolition (C&D) waste is generated whenever any construction or demolition takes place. These wastes consist of mostly inert and non-biodegradable material like concrete, tiles, brick aggregates, plaster, wood, plastics, gypsum, glass, metals, solvents, asphalt, asbestos, excavated soil & rock particles etc, many of which can be recycled. These wastes are heavy, bulky and occupy considerable amount of space when dumped without processing. Conventionally, these wastes excluding metal and wood are regarded as a material with limited economic potential, but actually these wastes provide an ideal solution to minimize the problems of virgin material exhaustion ( E.g.: Sand, aggregates etc).

During construction activity, excessive cement mix or concrete left after work is over due to rejection/ demolition caused by change in design or wrong workmanship etc. Construction wastes are mainly leftovers from new construction materials like Excavated material such as rock and soil, Waste asphalt, broken bricks, concrete, plasterboard, timber and vegetation during construction and all other wastes includes from construction activities on a typical construction site.



Figure 4 1 – Demolition & Construction Waste

4.2 C&D Wastes generated from different type of sources:

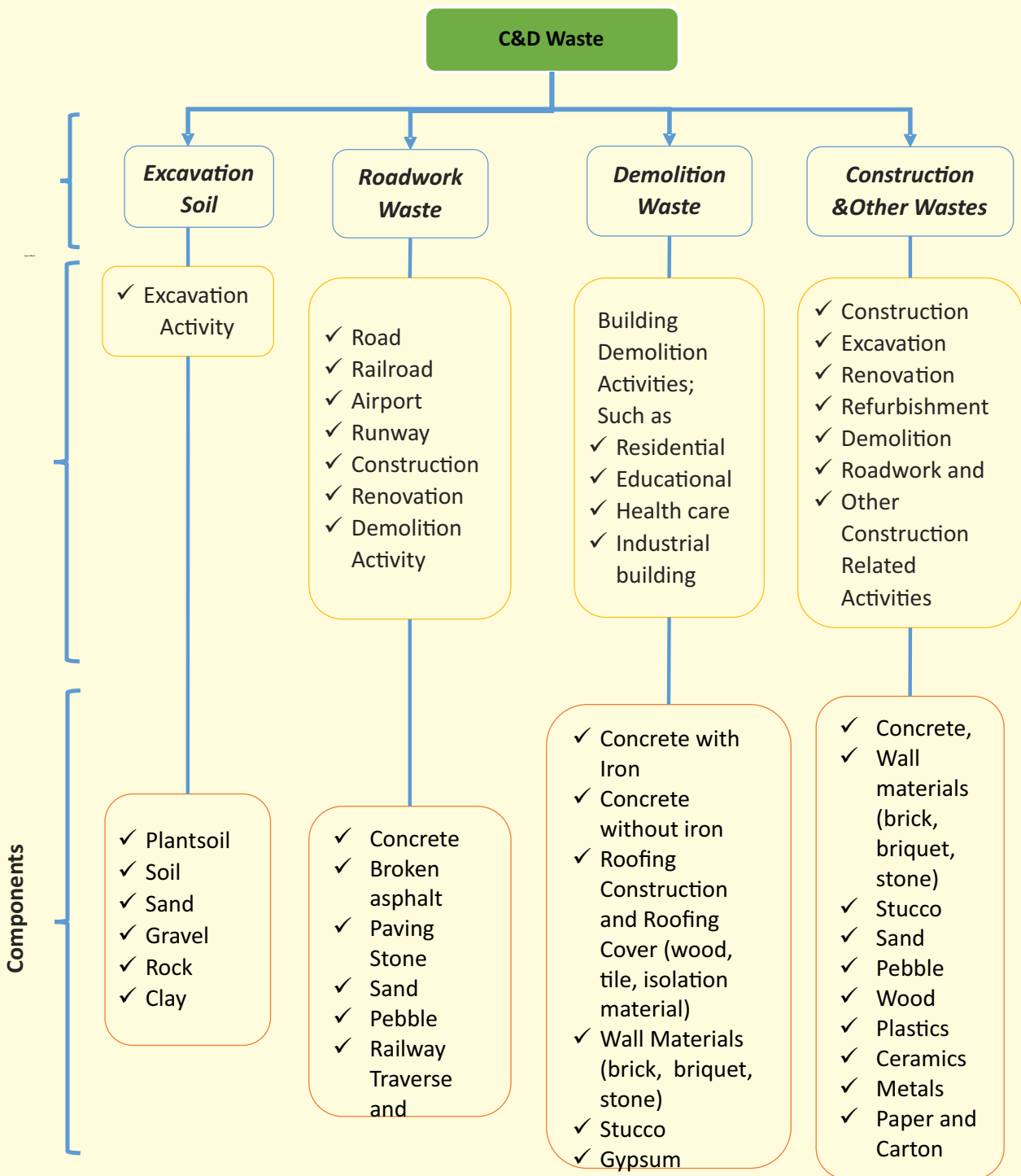


Figure 4 2 – Sources of C&D Waste

### 4.3 C&D Waste Components and Quantification:

C&D waste can be classified into two components;

**Table 4.1 – Components of C&D Waste**

1. Major components includes	2. Minor components includes
<ul style="list-style-type: none"><li>• Cement concrete</li><li>• Bricks</li><li>• Cement plaster</li><li>• Steel from RCC</li><li>• Doors &amp; windows</li><li>• Roofing support systems</li><li>• Rubble</li><li>• Stones &amp; Clay (Soil from excavation)</li><li>• Timber etc.</li></ul>	<ul style="list-style-type: none"><li>• Conduits</li><li>• GI pipes/Iron pipes/Plastic pipes</li><li>• Electrical fixtures</li><li>• Panels</li><li>• Asbestos and contaminated soil</li><li>• Glass</li><li>• Plastic carry bags, sachets of tobacco and other plastics, Clothes, Cement bags, gunny bags, Thermocol, etc.</li></ul>

Demolition wastes are mainly the collection of all construction materials from a building after removal of salvageable components like doors and windows. Demolition wastes are much larger in volume than the construction wastes. According to Danish Environmental Protection Agency (DEPA), 2003, 30% of the total waste generated was C&D waste. Of this 70-75% waste generated was from demolition activity, 20-25% from renovation and remaining 5-10% from new building developments

In India the following amount of C&D Wastes are generated during different activities.

- ✓ Demolition of Pucca and Semi-Pucca buildings on an average generates 500 and 300 kg. Per Sq.m. Respectively.
- ✓ Estimated waste generation during construction is 40 to 60 Kg. per Sq.m.
- ✓ Waste generation during renovation/ repair work is estimated to be 40 to 50 kg. Per Sq.m.

The disposal of C&D waste contributes to environmental concerns including wasted materials and embodied energy, greenhouse gas generation and other environmental impacts associated with producing new materials instead of using existing materials. Concurrently, the number of C&D landfills is declining, which means fewer disposal options, greater hauling distances, and increased fuel consumption and vehicle emissions.



#### 4.4 Physical Composition of Construction & Demolition Waste:



Figure 4.3 – Physical Composition of C&D Waste

#### 4.5 Characteristics & Quantity Estimation of C&D Waste:

It is commonly understood that C&D waste can be considered a resource and can be reused on-site or elsewhere, or recycled. Central Pollution Control Board has estimated current quantum of solid waste generation in India to the tune of 48 million tons per annum out of which, waste from construction industry only accounts for more than 25%. Management of such high quantum of waste puts enormous pressure on solid waste management system.

C&D waste can be characterized based on the source of generation or the components of the waste as shown in following figures.

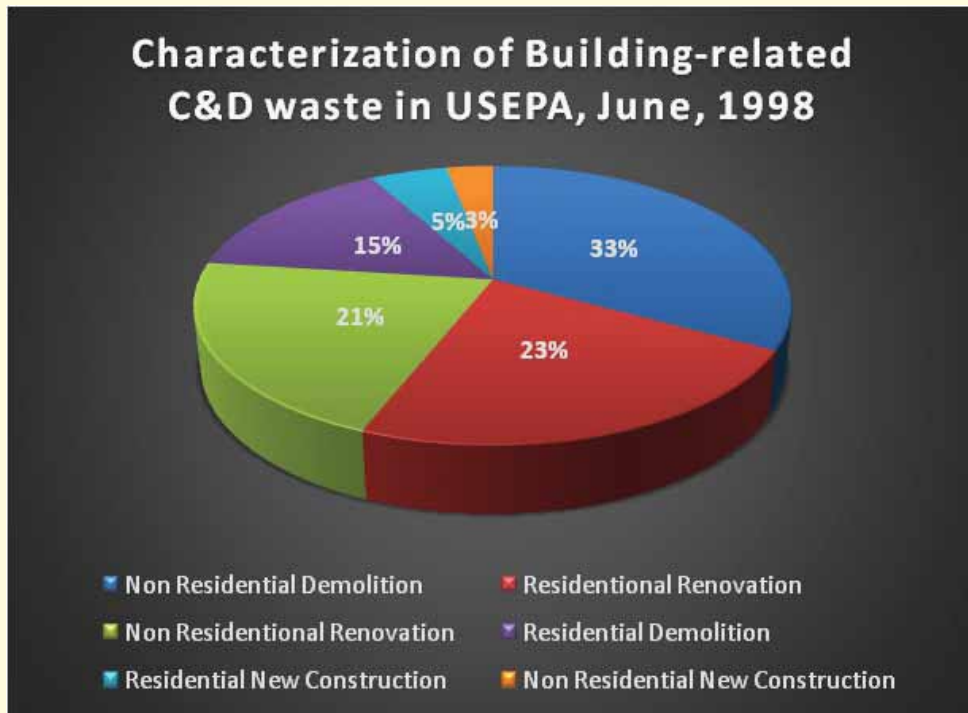


Figure 4.4 –Characterization of Building-related C& D waste in USEPA, June, 1998

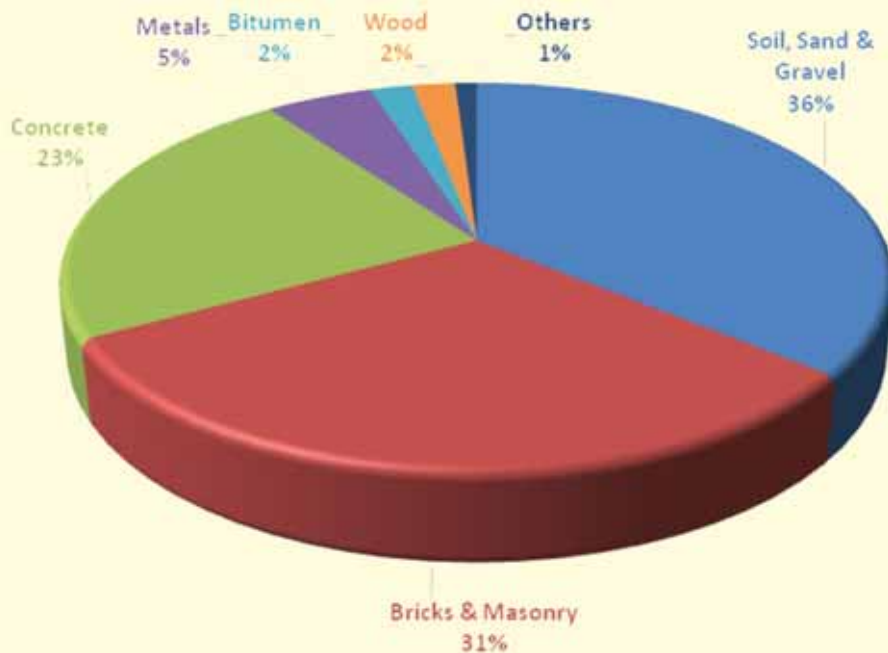
**Estimate of C&D waste:**

TIFAC calculated waste from the construction industry accounting for 25 percent of solid waste or 12 to 14 million tons per annum. Methodology for C& D waste estimation is given in annexure-2. Though it is very difficult to predict the characteristics of C&D Waste, it can broadly be categorized as mixture of following materials:

**Table 4.2 – Typical composition of Indian C&D waste**

Material	Composition
Soil, Sand & Gravel	36%
Brick & Masonry	31%
Concrete	23%
Metals	5%
Bitumen	2%
Wood	2%
Others	1%

Source: Technology Information, Forecasting and Assessment Council, Department of Science and Technology, Government of India, 2001



**Figure 4.5 – Typical C&D Waste Composition in India**

#### **4.6 C&D Waste Processing and Recycling opportunities**

Reuse and recycling of C&D waste is one component of a larger holistic practice called sustainability or green building construction being practiced in most developed countries. Re-utilization or recycling is an important strategy for management of such waste.

Construction and demolition waste can be used in the following manner:

- Reuse (at site) of bricks, stone slabs, timber, conduits, piping railings etc. to the extent possible and depending upon their condition.
- Sale / auction of material which cannot be used at the site due to design constraint or change in design.
- Plastics, broken glass, scrap metal etc. can be used by recycling industries.
- Rubble, brick bats, broken plaster/concrete pieces etc. can be used for building activity, such as, leveling, under coat of lanes where the traffic does not constitute of heavy moving loads.
- Larger unusable pieces can be sent for filling up low-lying areas.
- Fine material, such as, sand, dust etc. can be used as cover material over sanitary landfill.
- Use as a granular sub-base (the layer above compacted earthen sub-grade) in road construction. Sub-base is generally constructed using non-plastic moorum. Processed C&D waste (after sizing and sieving) can be used in road pavement for sub-base construction.

C&D waste being a free draining material, its proper particle gradation can be used in place of moorum.

#### **4.7 Economic Benefits of Using C&D Waste Recycled Products:**

1. Use of recycled aggregate up to 30% does not affect the functional requirements of the structure as per the findings of the test results.
2. Various tests conducted on recycled aggregates and results compared with natural aggregates are satisfactory as per IS 386.

#### **4.8 Environmental benefits of recycling C&D waste**

The environmental benefits of recycling C&D waste are considerable. By assessing carbon dioxide and energy use at a large scale recycling plant, researchers have shown that, over its 60 year life span, the carbon dioxide emissions prevented will be ten times as much as those produced, and eight times as much energy will be saved, than is used .

It eases the production and emission of greenhouse gas and other pollutants by reducing the need to extract raw materials and transporting the materials long distances. It reduces the need for new landfills and the costs involved in it. Recycling saves energy and also reduces the environmental impact. It creates employment opportunities in recycling industries. A lot of money can be saved by reducing the project disposal costs, transportation costs and the cost of new construction materials by recycling old materials onsite.

#### **4.9 Two Pillars of C&D Waste Stream Utilization:**

1. Reusing of C& D Waste: It does not require any further processing to convert into a useful product. The items which are usable directly are screened out from the debris and put into the possible use without further processing.
2. Recycling of C&D Waste: Once the waste generated from construction and demolition activities has been segregated and reusable items are taken out, the leftover is available for further processing i.e. recycling into next useful stage.

#### **4.10 RECYCLING OF WASTE CONCRETE**

Recycling of waste concrete is done to reuse the concrete rubble as aggregates in concrete. The recycled aggregates have less crushing strength, impact resistance and specific gravity and have more absorption value as compared to fresh aggregates.

##### **4.10.1 Necessity of Concrete Recycling:**

Millions of tonnes of waste concrete are generated every year around the world due to following reasons:

- Demolition of old structure,
- Destruction of buildings and structures during earthquakes and wars,
- Removal of useless concrete from structures, buildings, road pavements etc.
- Waste concrete generated due to concrete cube and cylinder testing, destructive methods of testing of existing structures etc.

##### **4.10.2 Advantages of Concrete Recycling:**

Usually demolished concrete were shipped to landfills for disposal, but due to greater

environmental awareness, the concrete is being recycled for reuse in concrete works. There are a variety of benefits in recycling concrete rather than dumping it or burying it in a landfill. Keeping concrete debris out of landfills saves space there.

#### 4.10.3 Other Benefits of Recycling of Concrete are:

- Local Product – Local Sources
- Reduces Truck Traffic
- Alternative to a Non-Renewable Resource
- Cost Savings
- No Disposal Fees
- Better Trucking Utilization (Reduced Costs)

Using recycled material as gravel reduces the need for gravel mining. There are also economic benefits. Recycled concrete is a construction material that the community does not need to pay for; those who generated the concrete waste pay a fee to have it recycled.

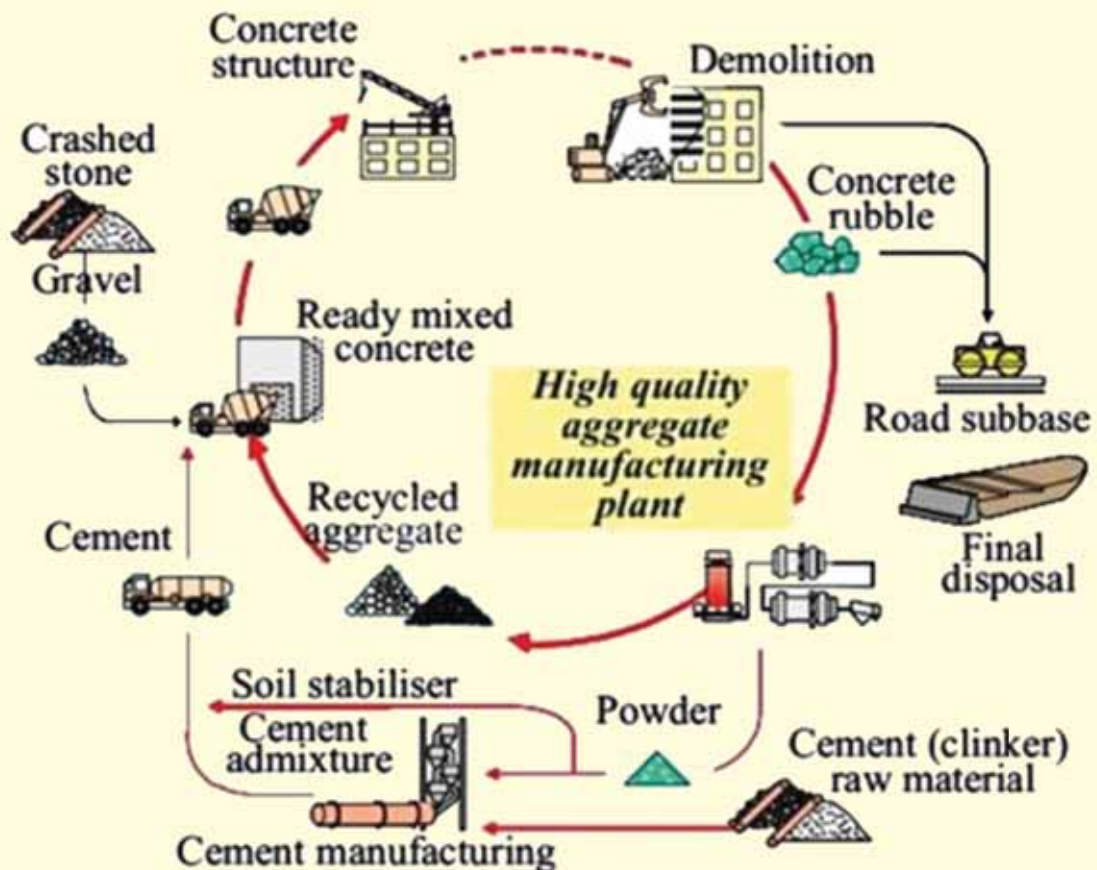


Figure 4.6 – Process of Waste Concrete Recycling

#### 4.10.4 Quality of recycled aggregate and its concrete:

The strength of recycled aggregate concrete is about 10 to 15 per cent less as compared to concrete with fresh aggregate. However suitable mix designs may be



made and reliable results obtained. The mix requires slightly higher quantity of cement or using admixtures to reduce water requirement.

Recycled aggregate concrete can be safely used as plain concrete. With proper corrections in mix design, it can be used for R.C.C. works also.

#### 4.11 Process of C&D waste Recycling

Crushing and screening systems start with primary jaws, cones and/or large impactors taking rubble from 30 inches to 4 feet. A secondary cone or impactor may or may not need to be run, and then primary and secondary screens may or may not be used, depending upon the project, the equipment used and the final product desired.

A scalping screen will remove dirt and foreign particles. A fine harp deck screen will remove fine material from coarse aggregate. Further cleaning is necessary to ensure the recycled concrete product is free of dirt, clay, wood, plastic and organic materials. This is done by water floatation, hand picking, air separators, and electromagnetic separators.

Occasionally asphalt overlay or patch is found. A mixture of asphalt and concrete is not recommended but small patches are not detrimental. The more care that is put into the quality, the better product you will receive.

With sound quality control and screening you can produce material without having to wash it as with virgin aggregate which may be laden with clay and silt.

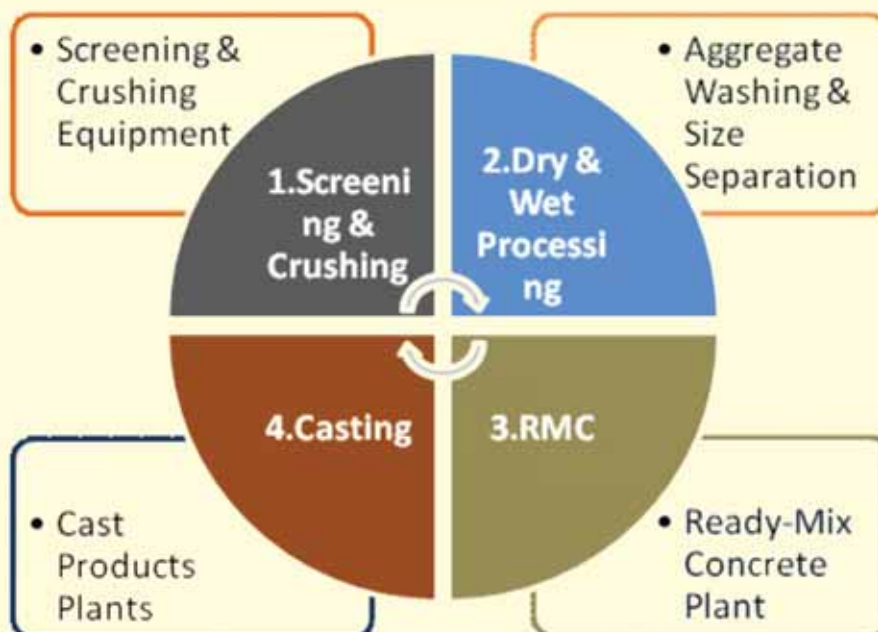


Figure 4.7 – Cycle of C&D Waste Processing

Usually demolished concrete were shipped to landfills for disposal, but due to greater environmental awareness, the concrete is being recycled for reuse in concrete works. There are a variety of benefits in recycling concrete rather than dumping it or burying it in a landfill. Keeping concrete debris out of landfills saves space there. Other benefits of recycling of concrete are (a) Local product local sources. (b) Reduces truck traffic. (c) Alternative to a non-renewable resource. (d) Cost savings. (e) No disposal fees. (f) Better trucking utilization (reduced costs).

Using recycled material as gravel reduces the need for gravel mining. There are also economic benefits. Recycled concrete is a construction material that the community does not need to pay for; those who generated the concrete waste pay a fee to have it recycled.

The strength of recycled aggregate is good and quite similar as compared to concrete with fresh aggregate. However suitable mix designs may be made and reliable results obtained. The mix requires slightly higher quantity of cement or using admixtures to reduce water requirement. Recycled aggregate concrete can be especially used safely used as plain concrete. With proper corrections in mix design, it can be used for R.C.C. works also.

#### **4.12 Machinery for Recycling**

Once the structure is demolished as per the plan in an Engineered manner, use of appropriate equipment and machinery is essential in the recycling process. Such equipment may be jaw crushers, magnetic separators, vibratory screens, washing equipment.

The new recycling plant consists of the following technologies:

1. Feed hopper
2. Pre Screening
3. Washing & Aggregate cleaning
4. Trash Screen for removal of light weights
5. Sizing Screen for washed Aggregate
6. Hydro cyclone system for Sand washing
7. Water Management system for recycling of process water

Among the major & minor components of C&D Waste, the most unpredictable and difficult materials are Clay (Soil) and all types of floating materials like plastic carry bags, sachets, thermocol etc. Recycling Technology has provided the solutions to tackle these difficult materials and make C&D Waste an acceptable quality product for re-use.

#### 4.13 C&D Waste Processing Flow Chart:

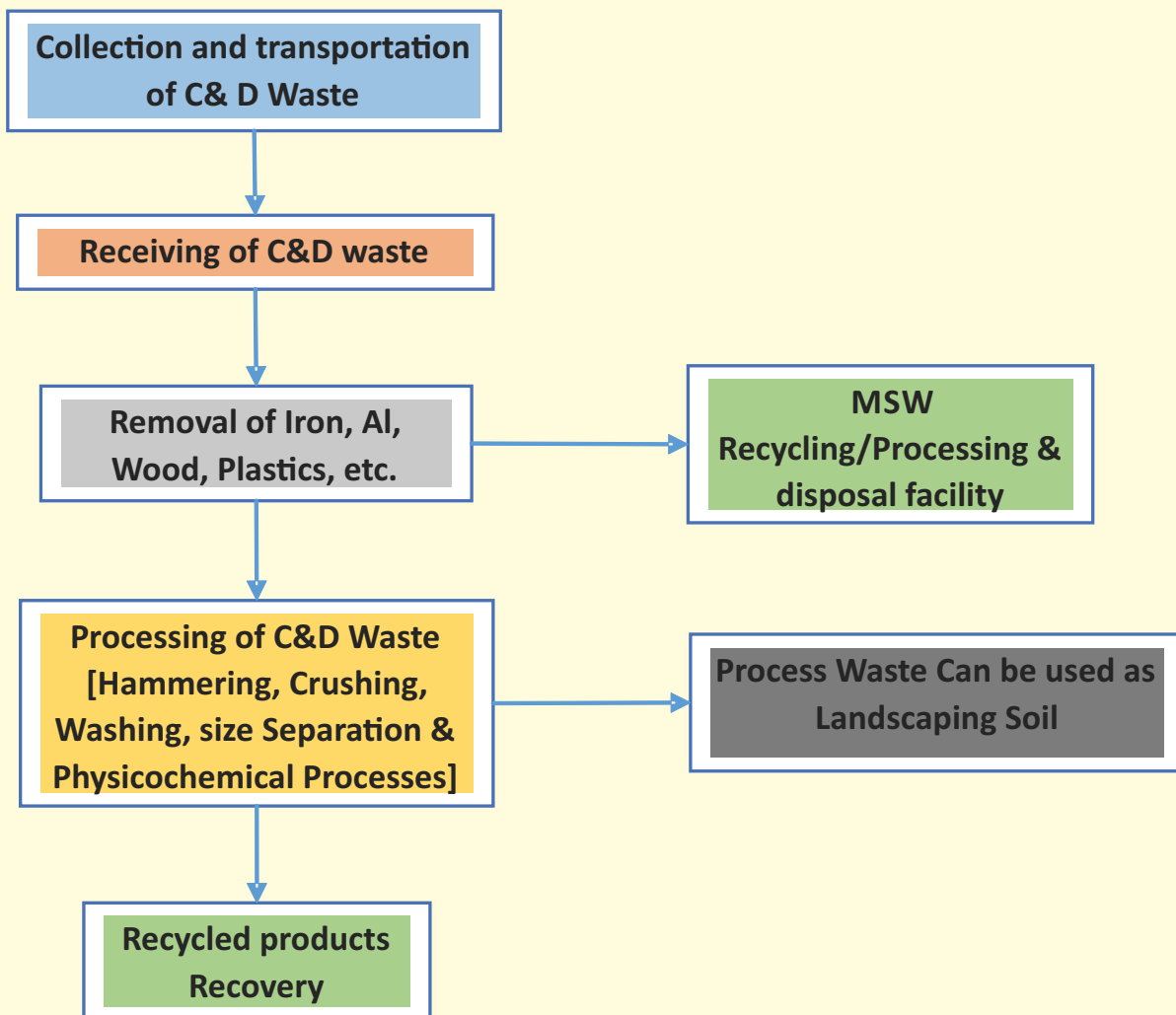


Figure 4.8 – C&D Waste Processing Flow Chart:

In view of significant role of recycled construction material and technology in the development of urban infrastructure,

The following products can be recovered from recycling:

1. Recovery of washed sand for construction
2. Recovery of 2-3 sizes of mixed Aggregates
3. RMC made with recovered material
4. Value-added products like Kerb Stones, Pavement Blocks and Concrete Bricks etc.

These products made from recycled material were tested in various laboratories and found to be suitable for specified purposes. Today, these products are actually being sold in the market bringing extremely high return to the investor.



**4.14 Products from C&D Waste Processing:**



Recycled Sand






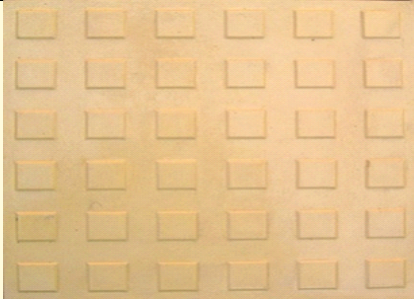
Recycled Aggregate

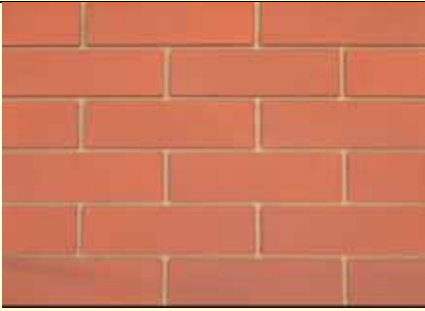







Trash such as Plastic, Wood and Chips etc. removed






#### 4.15 C&D Waste Recycled Products& its Applications

**Table 4.3 – Different Products obtained from C&D Waste Processing**

S. No.	Product Name	Image specimen	Uses
1.	<b>Ready Mix Concrete.</b>		<ul style="list-style-type: none"> <li>• Most versatile construction material.</li> <li>• Used in all kind of construction activities.</li> </ul>
2.	<b>Hollow Bricks</b>		<ul style="list-style-type: none"> <li>• Used in construction of buildings and houses, especially compound walls.</li> <li>• Provides heat insulation.</li> </ul>
3.	<b>Pavement blocks</b>		<ul style="list-style-type: none"> <li>• Parking Pavements.</li> <li>• Pedestrian Pathways</li> <li>• Passageway</li> </ul>
4.	<b>Tiles</b>		
	(i)	<b>Chequered Tile</b>	

	(ii)	Brick Tile		<ul style="list-style-type: none"> <li>• Pedestrian subways</li> <li>• Special effects in drive ways</li> <li>• Creative items like artifacts</li> </ul>
	(iii)	Dumble Tile		
	(iv)	Wall Tile		
	(v)	Interlocking Tile		
	(vi)	Tech Tile		
5.		Kerbstones		



6.	Granular Sub Base (GSB)		<ul style="list-style-type: none"> <li>• Used for the load bearing layer immediately below the pavement layer.</li> <li>• Provide strength and support to the overlying pavement.</li> </ul>	
7.	Manufactured Sand		<ul style="list-style-type: none"> <li>• Used for construction and land filling purpose.</li> </ul>	
<b>Aggregates</b>				
8.	(i)	5mm to 10 mm		<ul style="list-style-type: none"> <li>• Sold as per customer requirements.</li> </ul>
	(ii)	10mm to 20 mm		<ul style="list-style-type: none"> <li>• Sold as per customer requirements.</li> </ul>
9.	Loose soil /Excavated Soil		<ul style="list-style-type: none"> <li>• Can be sold for land filling purpose.</li> <li>• Also, further reuse options are being explored for the same.</li> </ul>	

#### 4.16 Uses of C&D Waste Recycled Materials

Rapid infrastructural development such as highways, airports etc. and growing demand for housing has led to scarcity & rise in cost of construction materials. Most of waste materials produced by demolished structures are disposed by dumping them as land fill. Dumping of wastes on land is causing shortage of dumping places in urban areas. Therefore, it is necessary to start recycling and re-use of C&D waste to save environment, cost, and energy.

#### 4.17 Potential uses for materials commonly found in concrete debris

**Table 4.4 – Potential Uses of Materials Segregated from C&D Waste Processing**

Material	Potential use
Asphalt	Road sub-base fill
Concrete	Crushed and mixed to make new asphalt cement blocks, crushed and screened aggregate can be used in asphalt concrete
Dirt	Landscaping landfill cover
Metal	Scrap metal dealers
Wood	Timber/wood pulp shredded for fuel, animal, bedding, landscaping, manufactured building products and compost
Brick	Masonry crushed for ornamental store
Glass	Fiberglass insulation sandblast, aggregate in asphalt reflective beads
Gypsum	Soil amendment, gypsum board, absorbent media
Plastic	ABS, plastic lumber, PVC, Highway barriers
Polystyrene	Insulation
Porcelain	Crushed for aggregate
Corrugated Cardboards	Paper mills, Fuel pellets
Carpet	Landfill cover
Roofing Shingles	Asphalt paving

#### 4.18 C&D Waste Cradle to Cradle - Stakeholders

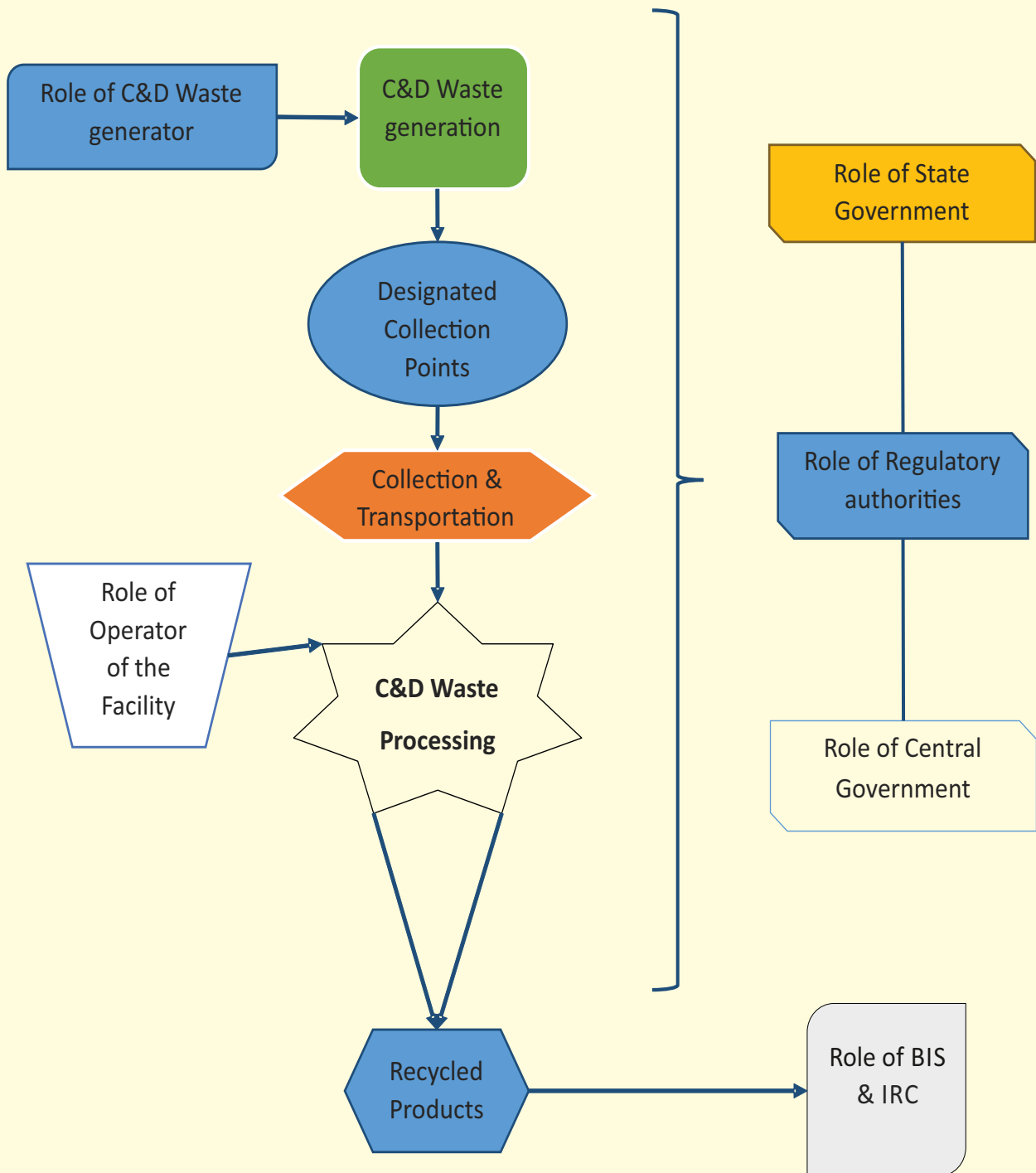


Figure 4.9 – Cradle to Cradle Stakeholders

## CHAPTER 5: GENERAL TERMS & DEFINITIONS AS SPECIFIED IN THE RULES (RULE – 3)

The following are the general terms & definitions given in C&D Waste Management Rules-2016

- (a) **"ACT"** means the Environment ( Protection) Act, 1986 (29 of 1986);
- (b) **"construction"** means the process of erecting of building or built facility or other structure, or building of infrastructure including alteration in these entities,;
- (c) **"construction and demolition waste"** means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;
- (d) **"de-construction"** means a planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized;
- (e) **"Demolition"** means breaking down or tearing down buildings and other structures either manually or using mechanical force (by various equipment) or by implosion using explosives.
- (f) **"form"** means a Form annexed to these rules;
- (g) **"local authority"** means an urban local authority with different nomenclature such as municipal corporation, municipality, nagar palika, nagar nigam, nagar panchayat, municipal council including notified area committee and not limited to or any other local authority constituted under the relevant statutes such as gram panchayat, where the management of construction and demolition waste is entrusted to such agency;
- (h) **"schedule"** means a schedule annexed to these rules;
- (i) **"service provider"** means authorities who provide services like water, sewerage, electricity, telephone, roads, drainage etc. often generate construction and demolition waste during their activities, which includes excavation, demolition and civil work;
- (j) **"waste generator"** means any person or association of persons or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defence establishments who undertakes construction of or demolition of any civil structure which generate construction and demolition waste.

## CHAPTER 6: ANNEXURES

### 6.1 Annexure– I: C&D Waste Materials Checklist

The following checklist template will be useful when planning to salvage, reuse and recycle demolition materials

Demolition Materials	Comments and Concerns
Air conditioning equipment	CFC
Air conditioning: Computer room packages	CFC
Air conditioning: Mini central systems	CFC
Air conditioning: Window units	CFC
Aluminum: Handrails, other	
Appliances, white goods	
Asbestos Containing Materials: Insulation, floor and ceiling tile, floor and wall coverings, roofing felt and shingles, wall board, siding, ductwork, adhesives, caulking, putties, taping and spackling compounds.	
Asbestos: Various possible materials	Testing, removal
Asphalt	
Asphalt: Paving	
Asphalt: Shingles	
Batteries	
Brass	
Brick	
Bronze	
Cabinets	
Cable: Various	
Cardboard	
Carpet, padding and backing	
Cast iron: Radiators, pipes, other	
Clay tile blocks	
Compressors	CFC
Computer equipment	



Computers, monitors	
Concrete	
Concrete masonry units	
Decking: Wood	
Door frames: Wood, metal	
Doors: Heavy vault	
Doors: Thin panel and various	Non-rated
Doors: Wood, Metal	
Ductwork	
Earth	
Electric switchgear, feeder cables, conduit	
Electrical equipment	PCB
Electrical: Cable	
Elevator cabs, machinery, shaft equipment, rails	
Fabric	
Fiber glass	
Fire suppression equipment	
Fixtures & fittings: Plumbing	
Fixtures: Electrical	
Flooring: Carpet	
Flooring: Wood	
Fuel storage tanks	
Furniture: Metal	
Furniture: Reusable	
Furniture: System	Can be re-manufactured
Furniture:Wood	
Glass: Interiorandexterior	
Glass: Plate	
Glass: Wired, laminated	
Glazing compound: Asbestos, lead possible	Testing
Gutters and flashing	
Gypsum blocks	
Gypsum board	

Hardwood	
Hazardous materials	
Heavy timbers	
Insulation	ACBM
Interior air handlers and controls	
Kraft paper	
Lamps: Fluorescent	Mercury retrieval
Lead: Paint	Testing, removal
Lead: Roofing	
Lead: Flashing	
Lead: Piping	
Light bulbs	
Light fixtures: Decorative	
Light fixtures: Fluorescent and utility fixtures	
Light fixtures: Vintage fluorescent, incandescent	PCB Ballasts
Marble: Toilet partitions	
Marble: Walls	
Metal: Brass	
Metal: Bronze	
Metal: Cable	
Metal: Castiron	
Metal: Conduit	
Metal: Copper	
Metal: Galvanized Steel	
Metal: Miscellaneous	
Metal: Steel	
Mirrors	
Paper	
Partitions, demountable panels	
Partitions: Aluminum tracks, miscframing	
PBX/telephone equipment, conduit, cables	
Petroleum products	

## 6.2 ANNEXURES – II (Tipping Fee & Containers Specifications)

TIPPING FEES TO BE PAID BY AUTHORIZED AGENCY FOR DISPOSAL OF WASTE AT DESIGNATED DISPOSAL SITES:

C&D WASTE VOLUME	ILLUSTRATIVE RATES, (Rs/Container)
Container (<3 m <sup>3</sup> )	90
Container (6 m <sup>3</sup> )	180
Container (9 m <sup>3</sup> )	270
Container (>12 m <sup>3</sup> )	360

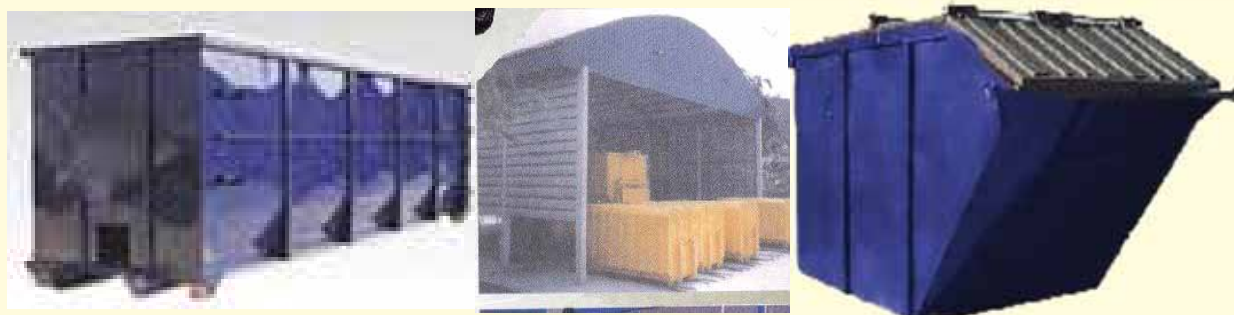
### SPECIFICATIONS OF TYPICAL CONTAINERS TO BE USED FOR STORING C&D WASTE

Container Specification	Model	
	Hook Loader	Dumper Placer
Container Type	Closed	Closed
Volume (m <sup>3</sup> )#	9 & 12-16	1.5*, 2.5-3.5**, 4.5-5***
Material Of Construction	Commercial Mild Steel of Appropriate IS specification (Not less than 3mm for walls/sides and not less than 4mm for floor/bottom)	
Recommended Chassis	16-25 T GVW	7*, 9**, 12*** T GVW
Lifting Arrangement	Rear lifting	Rear lifting

#Dimensions of the containers to adhere to the RTO norms. Total loading not to exceed 25 tonnes GVW. The containers shall have integral securement system to ensure that the rear end of the container is well secured with the vehicle chassis.

Illustrative Pictures of Different Containers & Vehicles:

#### Typical Containers



### Typical Hook Lifts



### Typical Dumper Placers



### 6.3 ANNEXURE – III: Quantity Estimation of C&D Waste

#### Quantity Estimation of C&D Waste:

The following formulae can be used to estimate the quantity of C&D Waste

$$\text{Formula: } A \times G_{ave} \times 0.000454 = Q_p$$

Where,

A=Project Square Footage

$G_{ave}$  =Weighted Average Generation Rate (Refer below Table)

$Q_p$  = Total Project C&D Waste

0.000454 = Conversion Factor from lbs to tons

#### Weighted Average C&D Waste Generation Rates

S.No	Type	Residential (lbs/sq.ft)	Non-Residential (lbs/sq.ft)
1.	New Construction	4.38	3.89
2.	Renovation	Varies	17.67
3.	Demolition	115.00	155.00

(Source: Franklin Associates, "Characterization of Building-Related Construction and Demolition Debris in the United States," U.S. Environmental Protection Agency, Jun. 98, p. 2-2, 2-3, 2-6, 2-7, 2-8, 2-9, 2-10, and A-5.)

#### 6.4 ANNEXURE–IV: Case studies of Delhi, Ahmedabad and Mumbai

Delhi: Delhi produces about 4,000 to 4,600 tons of C&D waste per day. The inert but bulky waste is either disposed in city landfills or dumped in open spaces, water bodies and flood plains. Typical construction waste in Delhi consists of Concrete (23%), Soil and sand (36%) and bricks and masonry (31%). ii. The Municipal Corporation of Delhi, working in cooperation with the private sector, established a C&D recycling plant with the aims of diverting waste from landfill and developing the market for C&D waste. The plant, a public private partnership in operation since the end of 2009, had an original design capacity of 500 tonnes per day that was expanded in 2014 to 2000 tonnes per day. iii. Incoming material is inspected and weighed. Plastics, metals, wood and certain other materials are separated out by both manual and mechanical means. The remaining waste is again separated, this time sorted into whole bricks for internal use and sale, large pieces of concrete and mixed C&D waste that is managed using dry processing to crush and grade the concrete and C&D waste and also wet processing for mineral processing and washing. The plant recovers products such as sand, stone and ready-mix concrete and uses these to manufacture other value-added products such as paving blocks and tiles, kerbstones and bricks. By early 2015, the plant had sold well over a million tonnes of recycled products.



Figure 6.4.1 - C&D Waste recycling plant in Delhi

The second 500 TPD capacity of C&D Waste recycling plant in Delhi (presently under commissioning process) will experience a quantum jump in technological advancement in C&D Waste recycling as compared to the first plant due to space constraints.

**Mumbai:** Mumbai generates about 2300 metric tons of construction waste every day. In September 2005, the Municipal Corporation of Greater Mumbai issued the Demolition and Desilting Waste (Management and Disposal) Guidelines. The Youth for Unity and Voluntary Action

(YUVA) and City Industrial Development Corporation (CIDCO) then came up with a decentralized solution for recycling debris into construction material such as bricks and interlocking pavers. An electric-powered machine basically used in pharmaceutical and chemical industries has been modified for the purpose. Cement and water are other inputs. The debris is sourced from construction sites and is broken down into particles, 30-40 millimeters (mm) in diameter. The particles are then powdered down by a pulverizing machine.

Special screens enable the machine to ground the particles to desired levels of fineness. Coarse aggregates around 10 mm in diameter, for example, require screens with large gaps. The dust controller sections of the machine filter out unwanted light materials like wood particles and sundry other organic items. Cement and water is then added to the pulverized material to mould it to a brick-like shape. Moulded bricks are then cured (hardened by repeated wetting and drying) for 14 days and then sun-dried. Laboratory tests show compressive strength of blocks at 59 kg per square centimeters which is quite high compared to burnt clay bricks and water absorption ratio at 9.8% well below the allowed limit of 10%. Transverse strength is higher than natural aggregates products.

YUVA gets its debris free and people who supply the waste are given discounts on the products. Two community centers in Rapar, Gujarat, one such centre in Mumbai, and a few other buildings in the country's financial capital have already used the recycled debris.

**Pune:** Pune Municipal Corporation has recently decided to reserve 18 acres of open land in the Yeolewadi village, around 20 km from the city, to set up a modern construction and demolition (C&D) waste processing plant, with a 100 tonnes per day (TPD) capacity. According to Pune Municipal Corporation (PMC) statistics, with rapid urbanization and constantly increasing C&D, the city generates an average of 125 tonnes of such waste every day, which has been contributed to heavily by the recent demolitions drives. This plant will reprocess C&D debris and re-use it in brick production. Cement, bricks, tar, etc. will be segregated and processed with modern machinery. The plant is expected to be set up in co-ordination with a private entity.

**Gurgaon:** According to the members of a citizens' group in Gurgaon named Malba Hatao, the municipal commissioner of the city has promised to earmark a site wherein a construction waste recycling plant can be set up soon along with allotment of multiple transit dumping sites across the city in coordination with other civic agencies such as the Haryana Urban Development Authority (HUDA) and the Department of Town and Country Planning (DTCP).

**Ahmedabad:** Ahmedabad Municipal Corporation (AMC) has awarded the work to Private agency to operate 300 TPD C&D waste processing plant 5 acres of land on PPP mode for 30 years. It is operational from October, 2013, involved in collection & transportation of such waste from 24 designated locations.





**Figure 6.4.2 – C&D Waste Processing plant & Recycled Products in Ahmadabad**

The Clean India campaign of Govt. of India further reinforces the need of similar facilities across all major cities, to get rid of illegal dumping of C&D Waste either on land or in rivers or blocking large stretches of land resources. The ever growing needs of construction land and construction material close to the heart of city are going to be in high demand. Establishment of multiple numbers of small to medium capacity C&D Waste recycling facility within close proximity of demolition and construction site may provide a viable solution for City Municipalities as well as to businesses interested in investing for a profitable venture from Waste recycling.



**6.5 ANNEXURE –V: FORM –I**

**See [Rule 7(2)] Application for obtaining authorisation**

To,  
The Member Secretary

\_\_\_\_\_ Name of the local authority or Name of the agency : appointed by the  
municipal authority

Correspondences address  
Telephone No.  
Fax No.

Nodal Officer and designation (Officer authorized by the  
competent authority or agency responsible for operation of  
processing or recycling or disposal facility)  
Authorization applied for (Please tick mark)

Setting up of processing or recycling facility of  
construction and demolition waste

Detailed proposal of construction and demolition waste  
processing or recycling facility to include the following

Location of site approved and allotted by the  
Competent Authority.

Average quantity (in tons per day) and composition  
of construction and demolition waste to be handled  
at the specific site

Details of construction and demolition waste processing or  
recycling technology to be used.

Quantity of construction and demolition waste to be  
processed per day.

Site clearance from Prescribed Authority.

Salient points of agreement between competent authority  
or local authority and operating agency (attach relevant  
document).

Plan for utilization of recycled product.

Expected amount of process rejects and plan for its  
disposal (e.g., sanitary landfill for solid waste).

Measures to be taken for prevention and control of  
environmental pollution.

Investment on project and expected returns.

Measures to be taken for safety of workers working  
in the processing or recycling plant.

Any preventive plan for accident during the collection,  
transportation and treatment including processing and  
recycling should be informed to the Competent Authority  
(Local Authority) or Prescribed Authority

Date:

Signature of Nodal Officer

**6.6 ANNEXURE-VI: Form-II**

See (Rule (7) (3))

Format for Issue of Authorization to the Operator

To,

\_\_\_\_\_

Ref: Your application number Dt. ....

The -----State Pollution Control Board or Pollution Control Committee after examining the proposal hereby authorizes ----- having their administrative office at----- to set up and operate construction and demolition waste processing facility at -----on the terms and conditions (including the standards to comply) attached to this authorization letter.

1. The validity of this authorization is till----- . After expiry of the validity period, renewal of authorization is to be sought.
2. The----- State Pollution Control Board or Pollution Control Committee may, at any time, for justifiable reason, revoke any of the conditions applicable under the authorization and shall communicate the same in writing.
3. Any violation of the provision of the construction and demolition Waste Management Rules, 2016 shall attract the penal provision of the Environment (Protection) Act, 1986 (29 of 1986).

Date:

Place:

(Member Secretary)  
State Pollution Control Board/  
Pollution Control Committee

6.7 ANNEXURE-VII: Form –III

See (Rule 8(2) )

**Format of Annual Report to be submitted by Local Authority to the State Pollution Control Board**

- (i) Name of the City or Town.....
- (ii) Population.....
- (iii) Name and address of local authority or competent authority

Telephone No:.....  
Fax:.....  
Email ID:.....  
Website:.....

- (iv) Name of In-charge or Nodal Officer dealing with construction and demolition wastes management with designation.....

**1. Quantity and composition of construction and demolition waste including any deconstruction waste**

- (a) Total quantity of construction and demolition waste generated during the whole year in metric ton  
Any figures for lean period and peak period generation per day.....  
Average generation of construction and demolition waste (TPD)  
Total quantity of construction and demolition waste collected per day  
Any Processing / Recycling Facility set up in the city.....Status of the facility
- (b) Total quantity of construction and demolition waste processed / recycled (in metric ton)  
Non-structural concrete aggregate :  
Manufactured sand :  
Ready-mix concrete (RMC) :  
Paving blocks :  
GSB :  
Others, if any, please specify :
- (c) Total quantity of Construction & Demolition waste disposed by land filling without processing (last option) or filling low lying are  
No of landfill sites used :  
Area used :  
Whether weigh-bridge: Yes No  
Facility used for quantity estimation?
- (d) Whether construction and demolition waste used in sanitary landfill (for solid waste) as per Schedule III: Yes No

**2. Storage facilities**

- (a) Area or location or plot or societies covered for collection of Construction and Demolition waste
- (b) No. of large Projects (including roadways project)covered
- (c) Whether Area or location or plot or societies collection is Practiced (if yes, whether done by Competent Authority or Local Authority or through Private Agency or Non- Governmental Organization)
- (d) Storage Bins:--

Specifications (Shape & Size Number) Existing Number Proposed for future

- (i) Containers or receptacle(Capacity) :
- (ii) Others, please specify :
- (e) Whether all storage bins/collection spots are  
Attended for daily lifting : Yes No
- (f) Whether lifting of Construction &Demolition Waste from Storage bins is manual or mechanical  
(Please tick mark) please specify mode : Manual Mechanical Others,  
and equipment used (specify equipment)

**3. Transportation -----**

Existing Actually Required/Proposed number  
-----

- Truck :
- Truck-Hydraulic :
- Tractor-Trailer :
- Dumper-placers :
- Tricycle :
- Refuse-collector :
- Others (Please specify) :

**4. Whether any proposal has been made to improve Construction and Demolition waste management practices**

**5. Have any efforts been made to involve PPP for processing of Construction & Demolition waste: If yes, what is (are) the technologies being used, such as:**

Processing/recycling Technology	(Quantity to be processed)	Steps taken
-----		
Dry Process :		
Wet Process :		
Others, if any, Please specify :		



**6. What provisions are available to check unauthorized operations of:**

- Encroachment on river bank or wet bodies:
- Unauthorized filling of low line areas :
- Mixing with solid waste :
- Encroachment in Parks, Footpaths etc. :

**7. How many slums are provided with construction and demolition waste receptacles facilities:**

**8. Are municipal magistrates appointed for taking penal action for non-compliance with these rules:**

Yes No

[If yes, how many cases registered & settled during last three years (give year wise details)]

**Dated:**

**Signature of Municipal Commissioner**

## 6.8 ANNEXURE-VIII: Form-IV

See (Rule (8)(3) )

### Format of Annual Report to be submitted by the State Pollution Control Board / Committees to the Central Pollution Control Board

To,  
The Chairman,  
Central Pollution Control Board,  
Parivesh Bhawan, East Arjun Nagar,  
Delhi-110032

1. Name of the State/Union territory:
2. Name & address of the State Pollution Control Board/Pollution Control Committee:
3. Number of municipal authorities responsible for management of municipal solid wastes in the State/Union territory under these rules :
4. A Summary Statement on progress made by municipal authorities in respect of Implementation of Schedule III] : Please attach as Annexure-I
5. A Summary Statement on progress made by municipal authorities in respect of Implementation of Schedule IV : Please attach as Annexure-II

Date:

Chairman or the Member Secretary  
State Pollution Control Board/  
Pollution Control Committee

Place:

## 6.9 ANNEXURE-IX: BIBLIOGRAPHY REFERENCES

- 1) C&D Waste Management Rules-2016 by MoEF&CC, GOI
- 2) CPHEEO- 2016 : Municipal Solid Waste Management Manual Part- II, Chapter- 3, Section 3.7
- 3) Construction & Demolition and De-silting Waste (Management and Disposal) Guidelines by MUNICIPAL CORPORATION OF GREATER MUMBAI -2006
- 4) TIFAC – “Utilization of Waste from Construction Industry” 2001 Publication - India
- 5) IL&FS Environmental Infrastructure & Services Limited- Products Catalogue
- 6) CDE Asia Limited catalogue
- 7) Construction and Demolition Waste Management Guide by U.S Air force
- 8) Construction and Demolition Waste Management Pocket Guide by U.S Air Force

### *Contribution by:*

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## NATIONAL PRODUCTIVITY COUNCIL

NPC is a national level organization to promote productivity culture in India. Established as a registered society in 1958 by Government of India, it is an autonomous, tripartite, not for profit organization with equal representation from the Government, Employers and Employees' organizations, apart from technical & professional institution on its governing council. Besides providing training, consultancy and undertaking research in the area of productivity, NPC also implements the productivity promotion plans and programmes of the Tokyo based Asian Productivity Organization (APO), an inter-governmental body of which the Government of India is a founder member.

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