GUIDELINES ON

ENVIRONMENTAL MANAGEMENT OF CONSTRUCTION & DEMOLITION (C & D) WASTES

(Prepared in compliance of Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016)

MARCH 2017

CENTRAL POLLUTION CONTROL BOARD

(Ministry of Environment, Forests & Climate Change)

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Ministry of Environment, Forest & Climate Change
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Foreword

The Swachh Bharat Mission (MoUD) envisages processing of 100% solid waste generated in cities / towns by 2nd October 2019 as a key objective, which includes Construction and Demolition (C&D) wastes.

In course of preparation of these Guidelines it was noted that there are uncertainties in estimating the quantum of C&D waste generation, this can be attributed to several reasons like different methods adopted to estimate quantum of C&D waste generated, varying pace of developmental activities in cities, re-development of cities due to rapid urbanisation wherein demolition activities become necessary. Literature survey also indicated that the quantum and composition of C&D waste is project specific. It is also learnt that in the past Guidelines on C&D wastes have been brought out by CPWD under Guidelines for Sustainable Habitat - *PART IV: Guidelines on reuse and recycling of Construction and Demolition (C&D) Waste* (March 2014)' and also by Building Materials and Technology Promotion Council (BMTPC) titled "*Guidelines for utilization of C&D waste in construction of dwelling units and related infrastructure in housing schemes of the Government (year 2016)*".

CPCB has brought **'Guidelines on Environmental Management of C & D Wastes'** in compliance of Rule 10 sub-rule 1(a) of the C&D Waste Management Rules, 2016 and has attempted to address the issues pertaining to abatement of adverse environmental impacts arising from C&D waste management activities. These issues were not discussed in the Guidelines prepared by CPWD & BMTPC.

The guidance from expert members of 'Committee for implementation of C&D Waste Management Rules 2016' and feedback on the draft Guidelines on the website of CPCB are acknowledged. Unlike other rules addressing various key urban wastes such as MSW , plastic wastes, BMW, the Construction and Demolition (C&D) Waste Management Rules, 2016 are NEW rules that were notified on 29th March, 2016 by MoEF&CC. These Guidelines are expected to be helpful to all stakeholders and to academic institutions in carrying out further research on the subject.

(S. P. SINGH PARIHAR)

March 2017

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SECTION I

Objective and Scope

1. Urban waste management

Safe and cost-effective management of solid wastes (SW) is a significant environmental challenge for modern society. Rapid urbanization is changing the nature of solid waste management from a low priority, localized issue to a pervasive social and environmental problem with risks to public health and environment. Inadequately managed waste disposal has the potential to affect the health and environment. Management wastes need to incorporate the principles of waste minimization and recycling and work towards an integrated processing & disposal facility such that it is both effective & sustainable. In most urban wastes ex. Municipal Solid Waste (MSW), Biomedical Waste (BMW) or Construction & Demolition (C & D) Wastes - management of solid waste is required at all stages from waste generation to the final disposal.

A general approach to an integrated solid waste management plan would comprise of the following:

i. understanding the various waste management practices
ii. identifying waste management needs
iii. setting targets for actions required
iv. identifying budget requirements
v. identifying & coordinating with the stakeholders to achieve the targets
vi. arriving at a rational basis for setting up a waste processing / disposal facility
vii. Harnessing right tools for mass awareness

2. Swachh Bharat Mission

The Swachh Bharat Mission (under MoUD) envisages processing of 100% solid waste generated in cities / towns by 2nd October, 2019 as a key objective, which includes C & D wastes. Ministry of Urban Development (MoUD) vide its circular dated 28th June, 2012 stated all states to set up C & D waste recycling facilities in all cities with population of over 1 million.

3. C & D Waste Management Rules, 2016 - Notification

Unlike other rules addressing various key urban wastes such as MSW, plastic wastes, BMW, the Construction and Demolition (C & D) Waste Management

Rules, 2016 are NEW rules that were notified on 29th March, 2016 by the Ministry of Environment, Forest and Climate Change (MoEF&CC).

4. C & D waste – definition, applicability and waste generating activities

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

The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organization or authority who generates construction and demolition waste such as building materials, debris, rubble. Wastes also include surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

Under Rule 3, the following definitions have been provided:

a. Subrule (b) "**construction**" means the process of erecting of building or built facility or other structure, or building of infrastructure including alteration in these entities;
b. Subrule (d) **"de-construction"** means a planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized;
c. Subrule (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.

Activities which generate C & D waste in cities / towns are mainly from:

i. Demolition of existing, old dilapidated structures;
ii. Renovation of existing buildings (residential or commercial);
iii. Construction of new buildings (residential or commercial or hotel etc.);
iv. Excavation/ reconstruction of asphalt/ concrete roads;
v. Construction of new fly over bridges/ under bridges/ sub-ways etc.; and
vi. Renovation/ Installation of new water/ telephone/ internet/ sewer pipe lines etc.
vii. Present collection and disposal system.

5. Objectives and scope of the Guidelines

Rule 10 sub-rule 1(a) of C & D Waste Management Rules, 2016 gives the Duties of the Central Pollution Control Board (CPCB) which is as follows: to *'prepare operational GUIDELINES related to environmental management of construction and demolition (C & D) waste management'.*

In complying with the above Rule, the Guidelines have been prepared to:

a. promote an integrated approach, whereby environmental management of construction and demolition waste is given due consideration throughout the duration of the project;
b. approach towards reduction of environmental impacts.

The guidelines recommends pollution mitigation measures in operation of C & D dump sites / waste processing facilities. Though guidelines focus mainly on facilities generating more than 20 tons or more in one day or 300 tons per project in a month of installed capacity (bulk generators) in cities / towns however, the mitigation measures suggested can be scaled after consultation with the concerned department in the state government. The reference to 'operators' in these Guidelines imply operators of bulk C & D waste management / waste recycling / processing facilities.

Figure 1.1: Indiscriminate dumping of C & D wastes along roadsides

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SECTION II

Quantum & Composition of C & D Waste Generation

1. Definition of C & D waste generator and bulk generators

As per Rule 3 (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.*

Under the Rules w.r.t. quantum of waste generation addresses those sources generating more than **20 tons** or more in one day or **300 tons** per project in a month of installed capacity.

2. Uncertainty in quantum of generation of C & D wastes

During preparation of these Guidelines it was noted that there are uncertainties in estimating the quantum of C & D waste generation, this can be attributed to several reasons like different methods adopted to estimate quantum of C & D waste generated, varying pace of developmental activities in cities, re-development of cities due to rapid urbanization wherein demolition activities become necessary. Literature survey also indicated that the quantum and composition of C & D waste is project specific. It has been reported that the above quantum of C & D waste generation vary. However, it is estimated to account for approx. 25 - 30 percent of total solid waste generated. Some estimations of C & D wastes are provided below:

From MoUD:

a. *10 MT -15 MT (MT – million tonnes) per year by MoUD (2000);*
b. *Approximately 25-30 million tonnes of C & D wastes is generated annually in India of which 5% is processed*
c. *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% percent 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.*

The quantum of generation of C & D waste estimates available from other sources are summarized below:

a. 12 MT - 15 MT by TIFAC (2001);
b. 10 MT -12 MT by MoEF (2010) and
c. 12 MT by CPCB
d. 165-175 MT per annum between 2005-2013 (BMTC)

Forecast estimates: Presently, C & D waste generation in India accounts upto **23.75 million tons** annually and these figures are likely to double fold **upto 2016.** (Source: International Society of Waste Management, India).

Table 2.1: C & D waste generation in NINE cities

City	Area (Metropolitan region km^2)	POPULATION (CENSUS 2011)	No. of Wards / Zones	ULB	C & D WASTE GENERATION (TONNES PER DAY)
Chennai	1,189	6,500,000	200/ 15	Chennai Municipal Corporation (As per discussions with IIT-Madras)	2,500
Coimbatore	-	2,618,940	100/5	Coimbatore City Municipal Corporation (CCMC, 2015)	92
Bengaluru*	-	8,443,675	198/5	Greater Bengaluru Municipal Corporation (BBMP)(TIFAC, 2001)*	875
Mumbai	4,355	12,442,373	24/6	Municipal Corporation of Greater Mumbai (www.mcgm.gov.in)	2,500
Ahmedabad	-	6,063,047	64/6	Ahmedabad Municipal Corporation (As per discussions with AMC officials)	700
Patna*	99.45	2,514,590	72/4	Patna Municipal Corporation (TIFAC, 2001)*	250
Jaipur*	-	3,471,847	91/8	Jaipur Municipal Corporation (TIFAC, 2001)*	200
Bhopal*	-	1,917,051	70/ 14	Bhopal Municipal Corporation (TIFAC, 2001)*	50

Kolkata	-	4,496,694	144/-	Kolkata Municipal Corporation (As per discussions with KMC)	1,600
*Due to unavailability of data for these cities, 25% of MSW was taken as C & D waste based on TIFAC, 2001 study ; Ref. (a) A Baseline Study of the Automotive and Construction Sectors- : GIZ, IFEU, TERI, VDI, Development Alternatives (DA) (b) Market study on C & D waste utilization in Ahmadabad. : GIZ & DA					

3. Estimation of C & D waste generation for India

In literature, various methods have been employed to quantify the C & D waste generation at both regional and project levels. Technology Information, Forecasting and Assessment Council's (TIFAC) has developed some estimations on C & D waste generation which recognizes that the generation is project specific as follows:

a. Range 40-60 kg per sq.m of new construction,
b. Range 40-50 kg per sq.m of building repair,
c. Range 300-500 kg per sq.m for demolition of buildings.

From the above, it may be noted that the highest waste generation comes from demolition of buildings. C & D waste generation figures for any region fluctuate as it depends largely on the type & nature of construction / demolition activities of the project concerned. Various approaches for estimation of C & D waste generation in literature include the following:

i. The following FIVE categories of existing C & D waste quantification methodologies are reported :
    a. Site visit method
    b. Waste generation rate method
    c. Lifetime analysis method
    d. Classification system accumulation method
    e. Variables modelling method

    (Ref. Quantifying Construction and Demolition Waste: An Analytical Review, Volume 34, Issue 9, September 2014, Pages 1683–1692, Elsevier Ltd. All rights reserved).

    Approach to estimate C & D waste is through materials flow analysis is embedded in above methods.

ii. Estimation of C & D waste generation based on per capita multipliers or waste generation rate model. (International J. Global Environmental Issues, Vol. 12, Nos. 2/3/4, 2012, Waste quantification models for estimation of construction and demolition waste generation: a review).

Table 2.2: C & D (%) waste - by activity in the United States
(Ref: BMTPC, 2016)

C & D waste type	***Residential***	***Non residential***	***Total***
New Construction	*11%*	*6%*	*8%*
Renovation	*55%*	*36%*	*44%*
Demolition	*34%*	*58%*	*48%*
Total (%)	*100%*	*100%*	*100%*

4. Composition of C & D waste is project specific

a. The composition of C & D waste can vary depending on age of building being demolished / renovated or the type of buildings being constructed. As mentioned earlier, C & D waste generation figures for any region varies as it depends largely on the type and nature of construction / demolition project activities which may be regional / site / project specific.

   Under Rule 4 sub-rule (3) the segregation by bulk C & D waste generators shall be done into four streams such as:

   i. Concrete
   ii. Soil
   iii. Steel, wood and plastics
   iv. Bricks & mortar

b. Demolition waste characteristics: In India, when old buildings are demolished the major demolition waste is soil, sand and gravel accounting for bricks (26%) & masonry (32%), Concretes (28%), metal (6%), wood (3%) others (5%). Bricks, tiles, woods and iron metal are sold for reuse / recycling (BMTPC).

c. Excavations, concrete, masonry and wood together constitute over 90% of all C & D waste.

d. The typical composition of Indian C & D waste:

   The major constituents are concrete, soil, bricks, wood, asphalt and metal. Brick & masonary, soil, sand & gravel account for over 60% of total waste. (Source- Municipal Corporation of Delhi, Burari facility).

Table 2.3: Typical composition of Indian C & D waste

(TIFAC, 2001)

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

Figure 2.1: Indiscriminate dumping of C & D wastes along roadsides

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SECTION III

Initiatives in Promoting C & D Waste Products by GoI

1. The Rules promote C & D waste utilization

The Construction and Demolition (C & D) Waste Management Rules, 2016 promotes C & D waste utilization.

Under Rule (6) under Duties of Local Authority, the following sub-rules states:

i. sub-rule (9) 'shall device 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';

ii. sub-rule (10) 'shall create a sustained system of information, education and communication (IEC) for construction and demolition waste through collaboration with expert institutions and civil societies and also disseminate through their own website';

iii. sub-rule (11) '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'.

Under Rule (7) mentions the 'Criteria for storage, processing or recycling facilities for construction and demolition (C & D) waste and application of construction and demolition waste and its products'.

Under **Schedule I** (Rule (7) (1)): 'Construction and demolition waste shall be utilized in sanitary landfill for municipal solid waste of the city or region as mentioned under Schedule I'.

a. The Rule (7) sub-rule (3) gives Application of materials made from construction and demolition waste in operation of sanitary landfill shall be as per the criteria given in **Schedule II.**

b. The Rule (9) sub-rule (4) mentions that the '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'.

c. Rule (11) under Duties of Bureau of Indian Standards **(BIS)** and Indian Roads Congress **(IRC)** 'The Bureau of Indian Standards and Indian Roads Congress shall be responsible for preparation of code of practices and standards for use of recycled materials and products of

construction and demolition waste in respect of construction activities and the role of Indian Road Congress shall be specific to the standards and practices pertaining to construction of roads'.

2. Type of C & D wastes products proposed under Rules

The C & D wastes products suggested under the Construction and Demolition (C & D) Waste Management Rules, 2016 are as follows:

i. Under Rule (6) under Duties of Local Authority : sub-rule (11) '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'.

ii. Under **Schedule I** (Rule (7) (1)): 'Construction and demolition waste shall be utilized in sanitary landfill for municipal solid waste of the city or region as mentioned under Schedule I'. The Rule (7) sub-rule (3) gives Application of materials made from construction and demolition waste in operation of sanitary landfill shall be as per the criteria given in **Schedule II.**

iii. The Rule (9) sub-rule (4) mentions that the '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'.

3. Thrust areas in C & D waste management – National Building Code (NBC)

Some key thrust areas regarding C & D waste reuse / recycling:

a. Establish utilization of C & D wastes in concrete and concrete based products by preparing standards.

b. Quality control and certification.

c. Need for popularizing products from C & D waste.

d. R&D activities on continuous basis in tandem with manufacturing industry and users.

e. Achieving environment protection through C & D waste utilization.

f. Optimizing utilization pattern of traditional materials by interfacing the same with supplementary materials.

4. Initiatives to promote recycling of C & D waste in India

India has provisions for the protection and improvement of the environment in its constitution. *"The demand for aggregates in 2007 has seen an increase by five percent, to over 21 billion tonnes, the largest being in developing countries for example India".* (Study by Asian Institute of Technology (AIT), Thailand for some Asian countries included India, report released in May 2008). Construction accounts for nearly 65 per cent of the total investment in infrastructure and the trend is increasing, hence it is more important to know how to effectively manage C & D waste w.r.t. reuse & recycle. Some key initiatives on C & D waste management in India is given below :

a. Ministry of Urban Development **(MoUD)** : Ministry of Urban Development vide circular dated June 28, 2012, directed States to set-up such facilities in all cities with a population of over 10 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 (Page 227).

b. Ministry of Environment, Forest & Climate Change **(MoEF&CC)**:
Environmental considerations have been integrated into all levels and in National Environment Policy of 2006, incorporation of the concept of 3Rs, is reflected in all the notified waste management rules (MSW, plastic, BMW, HW, e-wastes). A Report of the Committee to 'Evolve Road Map on Management of Wastes in India (2010)' highlights C & D problems, it recognised the utility of the waste and also acknowledged lack of data on the waste generation. The C & D Waste Management Rules, 2016 were notified by MoEF&CC vide notification no. G.S.R. 317(E) dated 29th March, 2016.

c. Bureau of Indian Standards **(BIS) :**
Under the Construction and Demolition (C & D) Waste Management Rules, 2016 Rule (11) under Duties of Bureau of Indian Standards **(BIS)** and Indian Roads Congress **(IRC)**, **'**The Bureau of Indian Standards and Indian Roads Congress shall be responsible for preparation of code of

practices and standards for use of recycled materials and products of construction and demolition waste in respect of construction activities.

Role of Standards (BIS) in Utilization of C & D Wastes:

i. It is the basis for acceptance
ii. Wider use by increasing confidence in users consumers
iii. Transfer of technology
iv. Scope for review / amendment / revision / withdrawal
v. Techno-legal - Part of regulatory documents
vi. Techno-financial - Part of financing projects
vii. Basis for training / capacity building and R&D

IS 383 : 2016 Indian Standard COARSE AND FINE AGGREGATE FOR CONCRETE – SPECIFICATION (Third Revision) - Scope: This standard covers the requirements for aggregates, crushed or uncrushed, derived from natural sources, such as river terraces and riverbeds, glacial deposits, rocks, boulders and gravels, and manufactured aggregates produced from other than natural sources, for use in the production of concrete for normal structural purposes including mass concrete works. These manufactured aggregates are of two types namely:

i. Recycled Aggregate (RA) — It is made from C & D waste which may comprise concrete, brick, tiles, stone, etc.
ii. Recycled Concrete Aggregate (RCA) – It is derived from concrete after requisite processing.

BIS IS: 383 is the principal driver, the standard for coarse and fine aggregates for use in concrete was revised in January, 2016, permitting use of recycled aggregates up to 25% in plain concrete, 20% in reinforced concrete of M-25 or lower grade and up to 100% in lean concretes of grade less than M-15.

Table 3.1: IS 383 : 2016 Indian Standard COARSE AND FINE AGGREGATE FOR CONCRETE – SPECIFICATION (Third Revision)

C & D waste BIS IS: 383	Plain Concrete	Reinforced Concrete	Lean Concrete (< M15 grade)	Extent of Utilization
Recycled Concrete Aggregate (RCA)	25%	20% (only upto M25 grade)	100%	as Coarse Aggregate
Recycled Aggregate (RA)	nil	nil	100%	as Coarse Aggregate
Recycled Concrete Aggregate (RCA)	25%	20% (only upto M25 grade)	100%	as Fine Aggregate

National Building Code (NBC- CED 46) of India 2005 **:** Part 11 of NBC 2005 on '*Approach to Sustainability'(Chapter 11)*, states that :

i. Recycled Coarse Aggregate may be used in concrete for bulk fills, bank protection, base/fill of drainage structures, pavements, sidewalks, kerbs and gutters etc.
ii. Up to 30 percent of natural crushed coarse aggregate can be replaced by the recycled concrete aggregate
iii. This percentage can be increased up to 50 percent for pavements and other areas which are under pure compression specific to the standards and practices pertaining to construction of roads.'

d. Building Material & Technology Promoting Council **(BMTPC)**:
The demand of building materials for 2021-22 has been reckoned by Building Materials and Technology Promotion Council (BMTPC) as cement 380 million tonnes, steel 50 million tonnes, bricks 600 billion numbers, aggregate 400 million cubic meters and timber 40 million cubic meters. Data show that there is a considerable amount of shortage of conventional and traditional building materials in India. BMTPC in 2016 released "*Guidelines for utilization of C & D waste in construction of dwelling units and related infrastructure in housing schemes of the Government".*

e. Central Pubic Works Division **(CPWD)**: The "Guidelines for *Sustainable Habitat* (March 2014)" are based on reports of National Mission on 'Sustainable Habitat' by the Ministry of Urban Development (MoUD) and draft code on "*Approach to Sustainability*" as part of National Building Code (NBC 2005). The PART IV of the Guidelines for 'Sustainable Habitat' discusses '*Guidelines on reuse and recycling of Construction and Demolition (C & D) waste'.* The guidelines on Construction and Demolition (C & D) waste addressed the building industry activity.

f. **CPWD & NBCC**
Approximately 25-30 million tonnes of C & D wastes is generated annually in India of which 5% is processed. To address utilization of C & D wastes, the Central Public Works Department (CPWD) and National Building Construction Company (NBCC) have recommended use of recycled portions of C & D wastes in their construction activities or if the

same is available within 100 km from construction site. Reference was made to the BIS 383 : 2016 standards.

g. Indian Road Congress **(IRC) :**

Under the Construction and Demolition (C & D) Waste Management Rules, 2016, Rule 11 indicates the role of Indian Roads Congress **(IRC)** w.r.t. preparation of code of practices / standards for use of recycled materials and products of construction and demolition waste in respect of road works.

5. Roadmap for C & D waste management - TIMELINES & TARGETS

In MOEF Performance Audit was conducted during July 2007 to December 2007 through document analysis, collection of responses to questionnaires, physical collection and testing of samples. Records and documents relating to the issue in the Performance Audit were examined and a key observation was:

'MoEF, in consultation with the states, should prepare an action plan for the reduction, reuse and recycling of waste with clearly defined numerical targets as well as timelines for the achievement of targets'.

The following targets / timelines to be considered in C & D waste management, however in some cases the concerned dealing departments may revise them in consultation with experts and project proponents was C & D waste management is project specific.

A. C & D waste management - identification of bulk generators

Waste generators generating *more than 20 tons or more in one day or 300 tons per project in a month* are referred to as bulk C & D waste generators under C & D Waste Management Rules, 2016.

B. Roadmap for C & D waste management - Population of cities

The targets for commissioning processing facilities utilization of C & D waste for various cities are based on population under C & D Waste Management Rules 2016 as given below:

i. Cities with population of 01 million and above
ii. Cities with population of 0.5-01 million
iii. Cities with population of less than 0.5 million

C. Roadmap for C & D waste management - TIMELINES

The TIMELINES for achievement of targets: The roadmap for implementation of Construction and Demolition (C & D) Waste

Management Rules, 2016: Under Schedule III Timeframe for Planning and Implementation of the C & D Waste Rules [See Rule 13] (see below)

Schedule III [See Rule 13]

Table 3.2: Timeframe for Planning and Implementation

Compliance Criteria	**Cities with population of >=one million**	**Cities with population of 0.5-01 million**	**Cities with population of < 0.5 million**
1. Formulation of policy by State Government	12 months	12 months	12 months
2. Identification of sites for collection & processing facility	18 months	18 months	18 months
3. Commissioning and implementation of the facility	18 months	24 months	36 months
4. Monitoring by SPCBs	3 times a year / in 4 months	2 times a year / once in 6 months	2 times a year / Once in 6 months

D. Mandate for Utilization of C & D waste products - Numerical targets

   i. Under C & D Waste Management Rules, 2016, the Rule (9) sub-rule (4) mentions that the '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.'

   ii. Incentivisation recommended under BMTPC Guidelines: (i) All Government constructions may be mandated to use at least 20 per cent of recycled C & D waste products. (ii) The tipping fee for delivery of C & D waste to the recycling plant, terms & conditions of civic body with the concessionaire may be designed to keep the price of C & D waste recycled products about 20 per cent lower than the corresponding conventional products.

E. Incentivize On-site utilization of C & D wastes – numerical targets for C & D Plans

   i. To address utilization of C & D wastes the Central Public Works Department (CPWD) and National Building Construction Company (NBCC) have recommended use of recycled portions of C & D wastes in their construction activities or if the same is available within 100 km from construction site. Reference was made to the

BIS 383 : 2016 standards similar (or more stringent targets) to be proposed in other projects of both government and private sectors.

ii. BMTPC guidelines : All renovation projects involving demolition, even in private sector, may be mandated to use at least 20 per cent of recycled C & D waste products.

iii. Under the C & D Waste Management Rules 2016 '*Exemption from the compliance of norms (Schedule I (14)), the following are exempted from the norms of pollution from* ***dust and noise*** *as mentioned above:*

- *For construction work, where at least 80 percent construction and demolition waste is recycled or*
- *Reused in-situ and sufficient buffer area is available to protect the surrounding habitation from any adverse impact.*

iv. Mandate use of C & D waste products

BMTPC Guidelines*:* As and when C & D waste recycling plant is commissioned at a city, it may be made mandatory for all construction activities to use a specified percentage of building construction materials manufactured from recycled debris.

However, as C & D waste generation is project specific, the State departments may propose practical and achievable reuse / recycle targets in consultation with project proponents.

F. Criteria for setting up C & D waste processing facilities – BMTPC Guidelines

Building Materials and Technology Promotion Council (BMTPC) in year 2016 released ***"Guidelines for utilization of C & D waste in construction of dwelling units and related infrastructure in housing schemes of the Government".*** Regarding criteria for setting up C & D waste processing facilities it was recommended that the Civic bodies wherein current waste generation > than 2000 tpd, to set up more than one plant for recycling of C & D waste.

Figure 3.1: Indiscriminate dumping of C & D wastes along roadsides

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SECTION IV

C & D Waste Processing

1. Hierarchy in waste management

According to United Nations Environment Programme (UNEP), waste management includes both the components of prevention and disposal of waste. The waste management hierarchy can be traced back to the 1970s, when the environment movement started to criticize the practice of disposal-based waste management. It argued 'waste' that is made up of different materials should be treated differently as suggested:

a. Reduce its production
b. Explore its reuse and recycle potential
c. Final disposal

The same is echoed in India's waste management handling Rules either directly or indirectly and it includes C & D wastes.

Table 4.1: Waste management as per Hazardous Waste and Solid Waste Rules

HW Rules, 2016 (Rule 4)	Solid Wastes Rules, 2016 (Rule 3)
Hierarchy in waste management w.r.t. Responsibilities of the occupier for management of hazardous and other wastes- For the management of hazardous and other wastes, an occupier shall follow the following SIX steps, namely:- i. Prevention; ii. Minimization; iii. Reuse, iv. Recycling; v. Recovery, utilization including co-processing; vi. Safe disposal.	Definition **#57 "waste hierarchy"** means the priority order in which the solid waste should be managed by giving emphasis to prevention, reduction, reuse, recycling, recovery and disposal, with prevention being the most preferred option and the disposal at the landfill being the least;

According to this hierarchy, the priority of any country should be to extract the maximum practical benefits from products and to prevent and minimize the waste that is generated. Prevention is the most desirable waste management

option as it eliminates the need for handling, transporting, recycling or disposal of waste. It provides the highest level of environmental protection by optimizing the use of resources and by removing a potential source of pollution. Reducing waste includes any process or activity that avoids, reduces or eliminates waste at its source or results in reuse or recycling. The conventional method of waste disposal desirably to engineered sanitary landfill. Regarding C & D waste, prevention at source (encourage on – site management) is the preferable approach, since this reduces waste volumes to be subsequently handled & transported.

2. Importance of recycling C & D Wastes

a. Re-use and recycling 'wastes' has been promoted in all the waste rules.

b. It has been estimated that '*by 2013, 20 million square meters of office space will be completed in India. Half of the demand will come from the* ***metro-cities.*** *With the increasing demand for built spaces and scarcity of land, a trend of re-development projects is expected. With increased urbanization and increased housing demands, there will be a shortage of aggregates to the extent of 55,000 million cu.m in housing sector, where as the road sector requires an additional 750 million cu.m. of aggregates. This emphasizes the need of C & D waste management in India. The cost of construction materials is increasing enormously. In India, the cost of cement during 1995 was Rs. 125/kg and in 2012 the price increased to Rs. 330/bag. In case of bricks, the price was Rs. 0.66 per brick in 1995 and the present rate is Rs. 6 per brick in 2012. With the environmental hazards caused by excessive and illegal extraction of river sand, the mining of river sand was banned since April 1, 2012*' (Ref. Report (May 2008) report on practices in C & D waste management in some Asian (includes India) by AIT Thailand).

c. Recycling of C & D waste is important as it helps to reduce the dependence on natural resources and eliminates adverse environmental impacts ex. mining which is energy intensive activity. Recycling of C & D wastes has the additional advantage of controlling the quantum of C & D waste destined for disposal at landfills besides reducing transportation costs.

d. When opportunities for reuse or salvage are exhausted, recycling is the next level. C & D waste materials that can be recycled include acoustical ceiling tiles, asphalt, asphalt shingles, carpets, concrete, drywall, fluorescent lights,

land clearing debris (vegetation, stumpage, dirt), metals and metal alloys, structural steel, plastic film (sheeting, packaging), glass, wood etc.

e. The list of reuse and salvage materials include appliances, bathroom fixtures, bricks, blocks, masonry stone, structural steel, cabinets, carpeting, ceiling tiles, timber and timber based boards, door and window frames and shutters, flooring tiles, stone tiles/platforms, insulation, landscaping materials, lighting fixtures, metal framing including for partitions and ceiling, panelling, pipes, antique moldings, accessories and hardware of furniture, PVC water tanks, roofing sheets used for garages, outdoor areas, fabric of tensile structures etc.

f. From recyclability, building materials can be specified which will encourage recycling of building materials. The list of recycled content building materials include carpet, floor mats, flooring, cellulose insulation, ceiling tile, ceramic/porcelain tile, concrete masonry units, countertop, ductwork, fences/posts, fibre board, fibreglass, insulation, pilings, roofing, structural steel, wallboard, asphalt, concrete, drainage or backfill aggregate.

g. C & D and other inert waste may be utilized for making bricks, pavement blocks, construction materials such as aggregates etc. There are several plants of various capacities in India to make bricks, paver blocks, aggregates, etc. out of such waste material.

h. The Hon'ble Court's intervention on the controversy over sand mining in some states has focused the need to explore options for recycle, reuse and substitute naturally sourced building material (example sand) hence the spotlight on C & D waste management.

See **ANNEXURE II**: Potential uses of C & D wastes

3. 'Sustainable Model' on C & D waste management

The key components of a 'Sustainable Model' on Construction and Demolition (C & D) Waste Management Rules, 2016 can include the following:

i. Practical estimation of C & D waste generation
ii. Identified sites and timely acquisition of land for development of integrated C & D processing facilities with necessary approval from local administration / civic bodies
iii. Specifications / standards for recycled C & D waste products for quality acceptance
iv. List out and mandate use of recycled products from C & D wastes

v. Penalty - Landfill levy
vi. Map water bodies in a city / region – encroachment of water bodies in cities for generating 'land' is a common practice observed several cities
vii. Research on economically viable C & D recycling options
viii. Awareness campaign – tools for sensitization of general public

Refer **ANNEXURE III**: Global practices of utilization of C & D wastes.

Figure 4.1: Photographs of Construction & Demolition waste processing facility

Crushing units at Burari C&D waste recycling plant
Picture credits: IL&FS Pvt Ltd

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SECTION V

Existing Guidelines on C & D Waste Management

1. GUIDELINES w.r.t. Building Sector - Building Materials and Technology Promotion Council (BMTPC)

The demand of building materials for 2021-22 has been reckoned by Building Materials and Technology Promotion Council (BMTPC) which are as follows: cement 380 million tonnes, steel 50 million tonnes, bricks 600 billion numbers, aggregate 400 million cubic meters and timber 40 million cubic meters. Data show that there is a considerable shortage of availability of conventional and traditional building materials in India. BMTPC in year 2016 released "***Guidelines for utilization of C & D waste in construction of dwelling units and related infrastructure in housing schemes of the Government".*** The Guidelines pertain to building industry, salient features are given below:

i. The BMTPC Guidelines acknowledges the importance of Schedule III on time - frame for planning and Implementation [See Rule 13] in the *C & D Waste Management Rules 2016 notified by MoEF&CC vide G.S.R. no. 317(E) dated 29th March, 2016*

ii. Cities with population > one million : MoUD vide its circular dated 28th June, 2012 states all states to set up C & D waste recycling facilities in all cities with population of over 1 million.

iii. Direction to Bulk generators : The agencies that generate C & D waste in bulk quantity to deliver the C & D debris at the recycling plant

iv. Concession to bulk generators : The terms and conditions with the concessionaire and the fee levied on bulk producer of C & D waste are made available at a price at least 20% lower than corresponding materials from natural resources.

v. Criteria for setting up C & D waste processing facilities : The Civic bodies wherein current waste generation > than 2000 TPD, to set up more than one plant for recycling of C & D waste.

vi. Cities of population < one million : Sensitization and facilitation for re-use and recycling of C & D waste may also be taken up in cities of population less than 1 million to encourage such initiative. This is because mega cities and cities with million plus population account for only 23 per cent of urban population (Census 2011).

vii. Non-bulk generators : Collection points be provided so that small quantity generator of C & D waste is not required to transport the debris to a distance more than 2.5 to 3.0 km.

viii. C & D Collection centers : to be notified wherein small quantity generators of C & D waste can deliver the C & D debris. The system and arrangements for collection and supply of C & D waste to recycling plants may be worked out and defined in an unambiguous manner.

ix. Mandate use of C & D waste products :

   a. Mandate use of C & D waste products: As and when C & D waste recycling plant is commissioned at a city, it may be made mandatory for all construction activities to use a specified percentage of building construction materials manufactured from recycled debris.

   b. Incentivize utilization of recycled C & D waste products: (i) All Government constructions may be mandated to use at least 20 per cent of recycled C & D waste products. (ii) All renovation projects involving demolition, even in private sector, may be mandated to use at least 20 per cent of recycled C & D waste products. (iii) The tipping fee for delivery of C & D waste to the recycling plant, terms & conditions of civic body with the concessionaire may be designed to keep the price of C & D waste recycled products about 20 per cent lower than the corresponding conventional products.

x. Guidelines also proposes MANAGEMENT PLAN and MARKETING PLAN.

xi. Annexure-I of BMTPC Guidelines provides: Construction and Demolition Waste Management Rules, 2016, Gazette of India, Part-II, Section-3, Sub-section (ii)], Ministry of Environment, Forest and Climate Change.

2. GUIDELINES *w.r.t.* Building Sector - Central Public Works Department (CPWD)

CPWD's Guidelines for Sustainable Habitat (March, 2014): The Guidelines are based on reports of National Mission on Sustainable Habitat by Ministry of Urban Development (MoUD) and draft code on "*Approach to Sustainability*" as part of National Building Code (NBC 2005).

The above CPWD Guidelines has FOUR parts:

   a. Guidelines on Architectural Design and Layout.

   b. CPWD Sustainability index and Guidelines for materials.

c. Guidelines for selection of equipment for Electrical and Mechanical Services for sustainable buildings.

d. PART IV : Guidelines on reuse and recycling of Construction and Demolition (C & D) Waste

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 % percent 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.

(Ref. http://cpwd.gov.in/Publication/Guideleines_Sustainable_Habitat.pdf

3. GUIDELINES *w.r.t. ROAD* Sector

Under the Construction and Demolition (C & D) Waste Management Rules, 2016 Rule (11) under Duties of Indian Roads Congress **(IRC) '**The role of Indian Road Congress shall be specific to the standards and practices pertaining to construction of roads.'

As per literature surveys the urban waste that has been used significantly in road construction are 'plastic wastes'. There is scant documentation regarding 'authorised' utilization of construction and demolition (C & D) waste in ROAD works, though it is being used in filling low lying areas.

Case studies :

i. Construction of Rural Roads using C & D Waste Materials in Thanjavur, TN : Project includes addition of C & D waste in the sub-base layer of the road structure, the conventional laterite layer can be further strengthened – the quantity of utilization of laterite is reduced and thus leads to cost reduction in road laying (rural roads).

ii. Delhi government advisory C & D waste utilization: The Delhi government has issued an advisory on the use of products made out of recycled C & D waste by the Public Works Department (PWD). All Delhi government agencies will be required to incorporate a clause in their tenders that mandates use of a minimum of 2 per cent recycled products from construction waste in all future contracts for building works and **10 per cent recycled products for road works**. (Ref. CSE **August 26, 2015)**.

4. Need for inclusion of abatement of adverse environmental impacts in C & D waste management GUIDELINES

An overview of the available Guidelines on construction and demolition (C & D) waste:

i. The Building Materials and Technology Promotion Council (BMTPC) in 2016 released "***Guidelines for utilization of C & D waste in construction of dwelling units and related infrastructure in housing schemes of the Government".*** The construction and demolition (C & D) waste guidelines pertain to building industry.

ii. The Central Public Works Department (CPWD), the PART IV**: *Guidelines on reuse and recycling of construction and demolition (C & D) waste*** is available in CPWD's Guidelines for Sustainable Habitat (March 2014) – also address the building sector.

iii. Road sector: There is not much documentation regarding 'authorised utilisation' of construction and demolition (C & D) waste in ROAD works, though it is being used in road works.

iv. The 1st initiative by an ULB to address C & D wastes was done in September 2005, the Municipal Corporation of Greater Mumbai issued the Demolition and De-silting Waste (Management and Disposal) Guidelines.

v. GUIDELINES on **Environmental Management** of C & D wastes :

*'The waste generation from construction should not only be minimized, but should also minimize the hazardous effect from the generated wastes'. (*Source : CPWD Guidelines on C & D wastes *)*

CPCB **'Guidelines on Environmental Management of C & D Wastes'** in compliance of Rule 10 sub-rule 1(a) of the C & D Waste Management Rules, 2016 and has attempted to address the issues pertaining to abatement of adverse environmental impacts arising from C & D waste management activities. These issues were not discussed in the Guidelines prepared by CPWD & BMTPC.

Figure 5.1: Loss of C & D wastes - can be processed for reuse / recycle

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SECTION VI

Introduction to Guidelines on Environmental Management of C & D Wastes

1. Environmental degradation due to indiscriminate disposal of C & D wastes in cities

As per C & D Waste Rules (Rule 4 sub-rule (4)) there *should be no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.* Instances of environmental degradation caused in cities due to indiscriminate disposal of C & D waste are listed below:

i. Indiscriminate dumping of C & D wastes is a visually annoying and conveys poor enforcement of C & D waste in a city.
ii. Due to lack of options for dumping in designated sites, low lying areas or abandoned quarries, vacant plots or sometimes even the outskirts of the city often become targets for dumping debris from the construction and demolition (C & D) of a city.
iii. Often C & D is dumped on roadsides quietly by C & D waste generators.
iv. Private contractors remove waste to privately owned, low-lying land for a price, or more commonly, dump it in an un-authorized manner along roads or other public land.
v. C & D debris is being indiscriminately disposed along river banks or dumped in drains (nallahs) which hamper flow thereby encourage mosquitoes breeding due stagnant sewage / water or cause floods.
vi. Cases often reported are C & D wastes are used to illegally fill up water bodies and wetlands around urban centres for 'creating land' for real estate development.
vii. As C & D waste forms a part of solid waste it gets disposed in landfills, as this is the cheapest option of disposal of C & D waste.
viii. C & D waste from individual households finds its way into nearby municipal bins and waste storage depots making the municipal waste heavy, thereby affecting efficiencies of waste management treatment options ex. composting or energy recovery.

2. Environmental pollutants highlighted under C & D Waste Management Rules

In the Construction and Demolition Waste Management Rules, 2016 under **Schedule I** *Criteria for Site Selection for Storage and Processing or Recycling*

Facilities for construction and demolition waste [See Rule 7(1)] in the Table 6.1 the following environmental conditions have been listed:

Table 6.1: Environmental conditions for C & D waste processing facility

Sl. as per Schedule I	Recommendation on environmental issues
(7)	Processing or recycling site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
(8)	The approach and or internal roads shall be concreted or paved so as to avoid generation of dust particles due to vehicular movement and shall be so designed to ensure free movement of vehicles and other machinery.
(9)	Provisions of weigh bridge to measure quantity of waste brought at landfill site, fire protection equipment and other facilities as may be required shall be provided.
(10)	Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided and Safety provisions including health inspections of workers at landfill sites shall be carried out made.
(11)	In order to prevent pollution from processing or recycling operations, the following provisions shall be made, namely: (a) Provision of storm water drains to prevent stagnation of surface water; (b) Provision of paved or concreted surface in selected areas in the processing or recycling facility for minimizing **DUST** and damage to the site. (c) Prevention of **NOISE** pollution from processing and recycling plant: (d) provision for treatment of effluent if any, to meet the discharge norms as per Environment (Protection) Rules, 1986.
(12)	Work Zone air quality at the Processing or Recycling site and ambient air quality at the vicinity shall be monitored.
(13)	The measurement of ambient noise shall be done at the interface of the facility with the surrounding area, i.e., at plant boundary.

As per C & D Waste Rules (Rule 4 sub-rule (4)) there should be no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.

Under the C & D waste Rules 2016 '*Exemption from the compliance of norms (Schedule I (14)),* there are exemptions from the norms of pollution from ***dust and noise****:*

From the above it can be noted that C & D waste management / activities are dusty. The key pollutants that impact environment are **DUST & NOISE** besides other issues.

3. Effective C & D Waste Management – Opportunities for resource conservation & employment generation

Some key benefits of efficient recycling and reusing of C & D waste are listed below:

i. Reduces the pressure for utilization of new construction materials / need for further mining operations. Mining activity if not properly monitored degrades the environment

ii. Reduction of demand for energy and water in manufacture of building materials from mined / naturals resources (thereby reducing environmental impacts arising from mining , manufacturing and transportation)

iii. Reduces quantum of transportation and disposal of C & D wastes to be handled when on-site utilization is encouraged.

iv. Proper segregation of C & D waste avoids mixing with bio-degradable waste destined for MSW treatment facilities / landfills.

v. Promotes options for reuse / recycle of products from C & D waste.

vi. Roads sides and vacant plots could be freed from debris dumps thereby giving cities a better facelift.

vii. Creates employment generation and market :

C & D waste management activities (segregation , reuse & recycling being labour intensive activities , generate employment opportunities. The manufacturing & sale of recycled products creates a market this further opens further job opportunities.

4. Major operations in C & D processing plant

Major operations in a recycling plant are sorting, crushing, classification/sieving and washing. Sorting can either be done manually or using advanced devices. Before feeding the material into the crusher, a grizzly can be used to ensure the maximum feeding size of debris for the respective crusher. Generally, jaw crushers or horizontal impact crushers are used to crush the debris. Size classification is performed using appropriate screens of required sizes. Washing is done to separate fine particles (silt and clay particles)

and this operation can be done combined with size classification. Sorted aggregates of specific sizes are stored separately. Noise is generated from equipment, though operations generate both noise & dust (Ref. Study by IIT Madras on C & D waste Management for Chennai).

5. Overview of Construction & Demolition activities

Table 6.2: An overview of Construction & Demolition activities

Features	Construction activity	Demolition activity	Remarks
Activity awarded by	Mainly by : Development Authority / Housing Board / Slum Clearance Board / Private company		All factors depend on the size of the project / encroachments to be removed Mechanization of activities is being employed for expediency & reduce manual intervention / uncertainty Main Pollutants : NOISE & DUST generation
Activity executed by	Mainly outsourced to private contractors		
Key activity	Preparation of : concrete mixture (RMC) and concrete slabs is mechanized	Activity mostly mechanized to save time & reduce manual intervention however removable of recyclable components done mostly manually	
Nature of activity	Manual & mechanized	Manual & mechanized	
Quantum of waste generation per sqm	Low	Very high	
Fees / Rates for lifting wastes	Demolition: Rates for lifting demolition waste are fixed per cub.m or cubic feet by the concerned department after assessing the salvageable wastes ; Most local bodies have empanelled contractors for executing demolition activities		
Common equipment deployed at site	Movement of construction material – RMC, bricks, slabs , metal frames by pulley system or cranes	concrete breaker machines , JCBs, earth movers, pneumatic breakers	

Wastes that can be salvaged (Re-usable / Recyclable wastes	Construction : Wastes also include surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities. Demolition : Refer Annexure II	

6. GUIDELINES on Environmental Management of C & D Waste Management in India

The four common environmental impacts from an activity that may affect its surroundings are:

(a) Dust
(b) Noise
(c) Smoke
(d) Odour (fugitive emission)

In case of C & D waste management, the key parameters which impact environment are **DUST & NOISE**.

The draft "*Guidelines on Environmental Management of C & D Waste Management in India (2017)*" has been prepared by CPCB in compliance of under *Duties of the Central Pollution Control Board under Rule* 10 sub-rule 1(a) of Construction and Demolition (C & D) Waste Management Rules, 2016 states '-prepare operational_GUIDELINES related to environmental management of construction and demolition waste management'. Part II is in compliance of the above-mentioned rule.

CPCB constituted an expert Committee to advise it on matters pertaining to Implementation of C & D Waste Management Rules, 2016 that includes development of the above Guidelines.

Figure 6.1: Indiscriminate dumping of C & D waste results in choking drains

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SECTION VII

Guidelines on Environmental Management of C & D Wastes – Noise Management

1. Public complaints on NOISE generation

a. Construction & demolition activities often generate noise / vibration which lead to complaints from the public despite the limited time frame over which it takes place. Complaints typically arise when the community has no clear understanding of the extent or duration of the activities. The above underscores the need for identification and assessment of noise generating activities. A timely assessment can aid operators / contractors to change the schedule of activities to reduce noise before the construction / demolition activities and during the process.

b. Unacceptable noise is a nuisance and activities associated in C & D waste processing activity are associated with perceptible noise increases.

c. Noise from a C & D waste management facility is considered an environmental nuisance if the construction / demolition activity is conducted outside the stipulated hours of operation or on holidays.

d. Some health problems caused due to excessive exposure to undesirable noise levels include :

   i. Sleep problems, insomnia & fatigue.

   ii. Fall in speech communication, disturbance and diminished concentration thus adversely affecting job performance efficiency.

   iii. Psychological disturbance including impaired hearing.

2. Restrictions on noise from construction equipment - Noise Pollution (Regulation and Control) Rules, 2000

i. The above Rules highlights various sources of noise that impact ambient noise levels in public places ex. industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices.

ii. *An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area / zone for the purpose of these rules (Rule 3(5)).*

iii. Rule 5A (3), Rule 7(1) and Rule 8 (1) (a) (ii) provides restrictions on noise from construction equipment.

3. Guidelines for NOISE mitigation in C & D operations

Key noise generating sources in C & D waste management activities are:

a. Machinery deployed in construction / demolition activities
b. Operation of Gensets (Noisy)
c. Vehicle movement

a. Noise abatement - Machinery deployed in construction / demolition activities

The guidelines to reduce noise levels:

i. Define Construction / demolition periods / time / duration: Construction / demolition activities are restricted as per Noise (Regulation & Control) Rules 2000: Daytime: 6 am to 10 pm; Days of the week propose - Monday to Saturday.

ii. Days operations are permissible : Permissible days of operation to be determined as per feasibility by concerned department of the State Govt.

iii. Night ban: No C & D activity shall be undertaken within the premise.

Rule 5A under Noise (Regulation & Control) Rules 2000 **:** Restrictions on the use of horns, sound emitting construction equipments and bursting of fire crackers:- sub rule (3) Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

iv. Define permissible noise levels under Noise (Regulation & Control) Rules 2000 at the boundary of the facility / operations: The ambient air quality standards in respect of noise for different areas / zones are specified in the Schedule to the rules. The State Government shall categorize the areas into industrial, commercial, residential or silence areas / zones for the purpose of implementation of noise standards for different areas. All development authorities, local bodies and other concerned authorities while planning developmental activity or carrying out functions relating to town and country planning shall take into consideration all aspects of noise pollution as a parameter of quality of life to avoid noise menace and to achieve the objective of maintaining

the ambient air quality standards in respect of noise. The noise levels in any area / zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.

The ambient noise levels as per CPCB's noise monitoring in many cities have exceeded the area zone norms due to 'mixed' land-use (non-compatible landuse), rapid urbanisation, increased vehicular movement due to which there is significant background noise. As C & D waste management requires deployment of heavy machinery there will be significant noise generation. As C & D waste management (includes recycling) demonstrates nature of 'industrial' activity, the concerned authority may stipulate noise limits in the range applicable to industry area zone under the Noise (Regulation & Control) Rules, 2000.

SCHEDULE

(See rule 3(1) and 4(1))

Table 7.1: Ambient Air Quality Standards in respect of Noise
Noise (Regulation & Control) Rules 2000

Area Code and Category of Area / Zone	Day Time Limits in dB(A) Leq*
(A) Industrial area	**75**
(B) Commercial area	65
(C) Residential area	55
The above measurements are measured as LAeq which is the equivalent continuous (energy average) level (A-weighted).	

b. Noise abatement - Genset noise

Refer CPCB weblink on Genset standards: https://cpcb.nic.in/genset-notifications/

c. Noise abatement - due to vehicle movement

Due to vehicular traffic and material transportation within applied area. Abatement due to transport activities arising due to vehicles movement (operation of vehicles within, entering or leaving the site):

i. Regular checking and maintenance of vehicles should be ensured (valid PUC)
ii. For long distance transportation overhaul routes to be judiciously selected
iii. No parking outside the plant premise
iv. Earmarked areas for parking vehicles within premise
v. Smooth movement of incoming & out going vehicles / trucks
vi. Roads within premise tarred
vii. Minimum use of horns
viii. Operational Weigh bridge

d. Noise abatement measures - Other areas

There will be noise due to heavy earth moving machinery / crushing etc – depends on extent of mechanization & machinery Deployed. Machinery deployed in construction / demolition activities: The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling (acoustic provision).

i. Noise control: To control the noise regular preventative maintenance of equipment to be carried out. regular and proper maintenance of noise generating machineries to avoid noise increase.
ii. Periodical monitoring of noise will be done to adopt corrective actions wherever needed.
iii. Ear plugs to be made available to workers during the operational hours.
iv. Besides the operators prepare Noise Mitigation Plan (NMP) which addresses: management and mitigation strategies to prevent an environmental nuisance caused by construction / demolition / recycling activities impacting ambient noise levels.
v. Besides operators prepare Noise Mitigation Plan (NMP) which addresses: management and mitigation strategies to prevent an environmental nuisance caused by construction / demolition / recycling activities impacting ambient noise levels.
vi. Other initiatives include

- Maintain records of equipment / machinery maintenance
- Maintain records of monitored noise levels
- maintain records of complaints on noise

- Comply with Consent conditions issued by State Pollution Control Boards / PCCs and concerned authority

vii. Plantation activities: Plantation reduces propagation of dust and noise.

Figure 7.1: Dumping of C & D wastes near drains in cities

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SECTION VIII

Guidelines on Environmental Management of C & D Wastes – Dust Management

1. DUST – environmental pollutant in C & D waste operations

The importance of controlling dust / fine particles from construction and demolition activities are:

a. Dust emissions arising from C & D activities are an environmental nuisance both within the site and beyond the plant site / boundary.

b. Dusts from various C & D activities release wide range of particle sizes and material types and can cause both serious health problems ranging from eye irritation, nose, mouth and respiratory system.

The larger heavier particles settle out of the air quickly and are hazard to the operators of plant and equipment and those in the immediate vicinity. The smaller particles (usually invisible) can be transported further in the air and can cause health hazards beyond plant premise (several km away).

2. Guidelines for DUST mitigation in C & D operations

C & D debris management activities are dusty. Major dust generating sources in C & D management sites are:

i. Loading & unloading activities: waste & C & D products

ii. Incoming / outgoing vehicles

iii. due to machinery used in C & D operations

a. Dust Noise abatement - Dust from loading / unloading operations

i. Areas to be earmarked for delivery / deposition of C & D wastes

ii. A sheet cover over the debris : over designated transport vehicles at waste processing sites

iii. Sign boards to be displayed indicating do's & don'ts

iv. Dust (fugitive emissions suppression systems in place) : Water sprinklers to be sprayed at all unloading points.

v. For containing fugitive emissions (dust) also refer CPCB's report : Inventorization of Railway Sidings and Guidelines for their Environment Management (regarding loading / unloading activities)

weblink :
https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvTmV3SXRlbV8yMTZfUmVwb3J0X0ludmVudF9SYWlsd2F5U2lkaW5ncy5wZGY=

b. Dust abatement - due to vehicle movement

Transport movement: Dust abatement due to transport activities arising due to vehicles movement (operation of vehicles within, entering or leaving the site) can also include the following:

i. Monitor movement of vehicles (incoming / outgoing) carrying C & D wastes or processed C & D waste products only
ii. Transportation of C & D wastes should be done in covered vehicles to prevent fugitive dust emission.
iii. Regular checking and maintenance of vehicles should be ensured (valid PUC)
iv. For long distance, transportation routes of C & D wastes to be selected after discussion with local authorities
v. Earmark areas for parking vehicles
vi. Smooth movement of incoming & out going vehicles / trucks
vii. Roads within premise tarred
viii. Weigh bridge (to be operational)
ix. Dust suppression systems in place (fugitive emissions): Dust from roads , regular water sprinkling on haul road will suppress the dust.

c. Dust abatement – due to machinery used in C & D operations

The C & D operations include: crushing / hammering etc from machineries deployed at site causing dust emissions from machineries / equipment. Water sprinklers is a good practice to suppress dust emission, similar practice is adopted in stone crushing operations. Under Environmental Protection Rules 1986, Schedule I Standards for emissions & discharge of environmental pollutants refer Sl#31 Stone crushers.

d. Compliance of National Ambient Air Quality Standards (NAAQS)

Vide Notification dated 18th November, 2009 the National Ambient Air Quality Standards (NAAQS) were revised, the standards w.r.t. particulate matter need to be complied with at the outer boundary of the facility.

3. Other dust abatement measures and safety issues

i. Water requirement

a. Water will be required for dust suppression, for plantation and for drinking & domestic purpose.

b. No fresh water requirement shall be made for dust suppression

ii. Use of 'treated waste water' (preferably) in sprinklers for dust suppression

a. As ambient air quality standards need to be complied, any manmade intervention (like dust generating activities in C & D waste management) need adopt necessary dust suppression measures ex. Water sprinklers using treated waste water (controlling the dust particles in the air is as important as minimizing water usage) . Site operators need to demonstrate both (a) control of 'visible' dust in particular besides (b) fine dust from activities within their premises.

b. Treated waste water (sprinklers) to be used for washings / unloading areas / roads to suppress dust

c. Import wherever feasible treated waste water from other STPs for dust suppression / sprinklers

iii. Waste water management

a. Adopt ZERO effluent discharge system

b. All wash down of vehicles and equipment to be done in designated areas and wash water be treated for reuse within plant for suppression of dust.

iv. Residual waste disposal

Solid waste generation / management in C & D waste operations - residues (C & D waste processing facility) to be sent to nearest landfill in consultation with concerned authorities

v. Diesel use

Diesel use in equipment / gensets / vehicle movement generate emissions : Necessary pollution control measures to be adopted to reduce emissions

vi. Plantation / greenery (use of local species / low water uptake)

a. Grow trees at the periphery - The plantation minimizes propagation of noise and also arrests dust

b. To add to aesthetics : maintain water fountains , water bodies , landscaped areas wherever possible

c. plantation helps to reduce fugitive of emission and noise control

Under **Schedule I** Criteria for Site Selection for Storage and Processing or Recycling Facilities for construction and demolition Waste [See Rule 7(1)] : Sl#15 : A vegetative boundary shall be made around processing or recycling plant or site to strengthen the buffer zone.

vii. **Emergency facilities** : Equipment & Facilities: • Mobiles • Fire fighting equipment's • Emergency medical assistance

viii. **Protective gear** i.e. for dust and noise , goggles, helmet, face shield, hand gloves. First aid facilities to be in place

ix. **Training / Awareness program :** Training at all levels to staff on the following:

a. Knowledge of machineries being used • Procedure for reporting emergencies • location and use of fire fighting equipment • knowledge of alarm system • Training in first aid

b. Environmental head to be aware of need for proper maintenance and operation of equipment / machineries etc and conduct environmental awareness / safety program to the workers, supervisory staff and contract workers periodically

Figure 8.1: Continuous dumping of C & D wastes chokes city ponds / lakes

Table 8.1: National Ambient Air Quality Standards (NAAQS) –

[NAAQS Notification dated 18th November, 2009]

S. No.	Pollutants	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
			Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)	
1	Sulphur Dioxide (SO_2), µg/m³	Annual*	50	20	1. Improved West and Gaeke 2. Ultraviolet Fluorescence
		24 Hours**	80	80	
2	Nitrogen Dioxide (NO_2), µg/m³	Annual*	40	30	1. Modified Jacob & Hochheiser (Na-Arsenite) 2. Chemiluminescence
		24 Hours**	80	80	
3	Particulate Matter (Size <10µm) or PM_{10} µg/m³	Annual*	60	60	1. Gravimetric 2. TOEM 3. Beta attenuation
		24 Hours**	100	100	
4	Particulate Matter (Size <2.5 µm) or $PM_{2.5}$ µg/m³	Annual*	40	40	1. Gravimetric 2. TOEM 3. Beta attenuation
		24 Hours **	60	60	
5	Ozone (O_3), µg/m³	8 hours**	100	100	1. UV photometric 2. Chemi-luminescence 3. Chemical Method
		1 hours **	180	180	
6	Lead (Pb), µg/m³	Annual *	0.50	0.50	1. AAS/ICP Method after sampling using EPM 2000 or equivalent filter paper 2. ED-XRF using Teflon filter
		24 Hour**	1.0	1.0	
7	Carbon Monoxide (CO), mg/m³	8 Hours **	02	02	Non dispersive Infra Red (NDIR) Spectroscopy
		1 Hour**	04	04	
8	Ammonia (NH_3), µg/m³	Annual*	100	100	1. Chemi-luminescence 2. Indophernol blue method
		24 Hour**	400	400	
9	Benzene (C_6H_6) , µg/m³	Annual *	05	05	1. Gas chromatography based continuous analyzer 2. Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP)-particulate phase only, ng/m³	Annual*	01	01	Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m³	Annual*	06	06	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m³	Annual*	20	20	AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

** Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform interval.*

*** 24 hourly 08 hourly or 01 hourly monitored values, as applicable shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.*

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

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SECTION IX

Guidelines on Environmental Management of C & D Wastes – Other Issues

1. Importance of processing C & D Wastes - Centralized Vs De-centralized

a. SOLID WASTE (SW) RULES, 2016

i. Under SOLID WASTE (SW) RULES 2016, Rule 3 subrule 35. (Rule 3) "**processing**" of waste means *any scientific process by which segregated solid waste is handled for the purpose of reuse, recycling or transformation into new products;*

ii. Recognizing the major constraint in identifying land in cities for 'centralized' waste processing the **SW Rules 2016** has defined '*de-centralized' processing* of solid wastes, under Rule 3 subrule 15. **"Decentralized processing"** means *establishment of dispersed facilities for maximizing the processing of biodegradable waste and recovery of recyclables closest to the* ***source*** *of generation so as to minimize transportation of waste for processing or disposal.*

b. Application of Centralized Vs De-centralized processing of C & D wastes

The above application is also being adopted in C & D waste recycling as given below:

i. Non-bulk generators : *Collection points be provided so that small quantity generator of C & D waste is not required to transport the debris to a distance more than 2.5 to 3.0 km (Source :* BMTPC Guidelines)

c. To address utilization of C & D wastes the Central Public Works Department (CPWD) and National Building Construction Company (NBCC) to use recycled portions of C & D wastes in their construction activities or if the same is available within 100 km from construction site. (Ref. Vide MoUD Circular dated 23.03.2016 directing State Works Dept to issue directions on use of C & D wastes as it is mandatory for use in CPWD & NBCC works)

d. Decentralized of C & D waste may be inferred as 'on-site' Management of C & D wastes while centralized refers to the existing 'stand alone' C & D waste processing facility ex. facility of IL&FS in Burari, North Delhi.

2. Options in C & D waste management - Centralized Vs De-centralized processing / recycling facilities

As major components of Construction and Demolition (C & D) Wastes have the potential to be reused or recycled most of the city ULBs are gearing to set up integrated facilities of Construction and Demolition (C & D) waste collection and recycling facilities. Profitable use of recycled C & D waste minimizes the cost of managing such waste and requirement for valuable landfill space, besides giving employment opportunities to unemployed youth. It will also save on mining of natural resources and reduce transportation costs.

Three general ways to reuse C & D waste material in a building**:**

a) reuse the structure (corresponding to renovation and design for adaptability)
b) reuse the elements (corresponding to re-development) and
c) recycle the material (corresponding to re-processing or re-cycling)

The three possible options that can be explored in C & D waste recycling (AIT study - 2008)

a) Mobile C & D waste recycling
b) Semi-Mobile C & D waste recycling
c) Stationary plant C & D waste recycling

A brief of the three options are given below:

a. In the **Mobile** C & D waste recycling plant, the material is crushed and screened and ferrous impurities are separated through magnetic separation. The plant is transported to the demolition site itself and is suited to process only non-contaminated concrete or masonry waste.
b. In the **semi-mobile** C & D waste recycling plant, removal of contaminants is carried out manually and the end product is also screened. Magnetic separation for removal of ferrous material is carried out. End product quality is better than that of a Mobile unit. These plants are not capable to process a of mixed demolition waste containing matter like metal, wood, plastic, etc.
c. **Stationary C & D waste recycling plant plants** are equipped for carrying out crushing, screening as well as purification to separate the contaminants. (ex. the 1st C & D waste processing facility commissioned in Delhi in Burari and operated by IL&FS)

Options a & b options are often found to be practical for on-site operations as LAND availability and transportation in cities are MAJOR constraints besides public resistance to set up C & D facilities (Stationary plant C & D waste recycling).

3. Guidelines on Setback distances (or buffer zone distance)

In view of the above discussion on the application of Centralized Vs De-centralized processing of C & D wastes there needs to be a practical approach in applying setback distances. The purpose of a buffer zone is to minimize the potential environmental impacts from the operation of a construction and demolition debris management & disposal activities. The Table 9.1 summarizes conditions under TWO waste rules - regarding 'buffer zone distance' and the importance of assessment on a case to case basis as the sites are regional specific

a. Construction & Demolition (C & D) Waste Management Rules, 2016
b. Solid Waste (MSW matter) Management Rules, 2016

Table 9.1: Buffer area provisions under TWO Waste Management Rules

Under C & D Waste Management Rules, 2016	**Under Solid Waste (MSW matter) Management Rules, 2016**
(a) Under **Schedule I** Criteria for Site Selection for Storage and Processing or Recycling Facilities for construction and demolition Waste [See Rule 7(1)] • Sl(6) 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.** This will be maintained within the total area of the C & D waste processing. *The buffer zone shall be prescribed on case to case basis by the local authority in consultation with concerned State Pollution Control Board.*	(a) **Rule 3** Definitions , Sub-rule 7 : "**buffer zone**" means zone of no development to be maintained around solid waste processing and disposal facility, exceeding **5 TPD of installed capacity.** This will be maintained within total and area allotted for the solid waste processing and disposal facility. (b) **Rule 11.** Duties of the Secretary–in-charge, Urban Development in the States and Union territories.- • **Sub rule (j)** facilitate establishment of common regional sanitary land fill for a group of cities and towns falling within a distance of 50 km (or more) from the regional facility on a cost sharing basis and ensure professional management of such sanitary landfills; **a. Sub rule (l)** notify buffer zone for the solid waste processing and disposal facilities of more than five tons per day in consultation with the State Pollution Control Board; and (c) **Rule 14.** Duties of Central Pollution Control Board.-The

• Sl (14) The following projects shall be exempted from the norms of pollution from dust and noise as mentioned above: (a) For construction work, where at least 80 percent construction and demolition waste is recycled or reused in-situ and (b) sufficient buffer area is available to protect the surrounding habitation from any adverse impact. • (15) A vegetative boundary shall be made around Processing or Recycling plant or site to strengthen the buffer zone.	Central Pollution Control Board shall **sub-rule (h)** publish guidelines for maintaining buffer zone restricting any residential, commercial or any other construction activity from the outer boundary of the waste processing and disposal facilities for different sizes of facilities handling more than five tons per day of solid waste; (d) Under **SCHEDULE I** [see rule 15 (w),(zi), 16 (1) (b) (e), 16 (4)] Specifications for Sanitary Landfills (A) Criteria for site selection.- Sl (ix) A buffer zone of no development shall be maintained around solid waste processing and disposal facility, exceeding five Tonnes per day of installed capacity. This will be maintained within the total area of the solid waste processing and disposal facility. The buffer zone shall be prescribed on case to case basis by the local body in consultation with concerned State Pollution Control Board.

Buffer zone area around C & D waste processing facility :

a. The Environmental Protection Authority (EPA) has guidance which recommends separation distances between industrial activities and sensitive land uses. These buffers aim to protect sensitive land uses from unacceptable impacts on health and amenity that may result from industrial activities, emissions and infrastructure. The document, titled **Guidance for the Assessment of Environmental Factors, Separation Distances between Industrial and Sensitive Land Uses,** No. 3, EPA, June 2005 (web link http://www.epa.wa.gov.au/docs/1840_GS3.pdf). This guidance document recommends a separation distance of **1000m** between premises that crush or screen C & D waste. It is important to note that the separation distance is not intended to represent an absolute separation distance and does not replace the need to demonstrate best practice in the prevention and minimization of emissions at prescribed premises. It is however, a useful tool to factor into impact assessments.
b. It is widely recognized due to rapid urbanization maintaining 1000m separation distance due to mixed land-uses (non-compatible landuse) is a major challenge for transporting C & D waste for processing and subsequently transporting recycled C & D products. Siting needs to meet the

demand of the recycled products to make the processing wastes sustainable and economically sustainable.

c. Separation distances are necessary in order to minimize potential environmental conflicts between non-compatible land uses particularly due to rapid urbanization witnessed across the cities wherein the number of cities entering the million plus population bracket is on a steady rise. Besides adopting noise and dust control abatement measures , the following restrictions be considered regarding setback distances from the outer boundary of the such C & D facilities shall not be located within the following receptor setback distances:

   i. 200 metres from any Industrial/Commercial land use property /
   ii. 100 m from bank or high water mark of any watercourse or wetland / pond / lake
   iii. 150 metres of the right-of-way boundary of a public highway;
   iv. 50 metres from any other adjacent property;
   v. The Coastal Regulation Zone (CRZ) notified under the Gazette of India, Extraordinary, Part-II, Section 3, Sub-section (ii) of dated the 6th January, 2011) COASTAL REGULATION ZONE Notification Ministry of Environment & Forests (Department of Environment, Forests and Wildlife). Prohibited activities under the CRZ Notification are include – '*Dumping of city or town wastes <u>including</u> <u>construction</u> <u>debris</u>, industrial solid wastes, fly ash for the purpose of land filling and the like and the concerned authority shall implement schemes for phasing out any existing practice, if any, shall be phased out within a period of one year from date of commencement of this notification.'*
   vi. Location of sites within the flood plains - Due rapid urbanisation across the country in the last two decades , the relevant data of past 50 years may be used to justify establishing a C & D waste processing site
   vii. Any **other Notifications** under Central/ State Governments;
      - Notified Areas- Reserved Forests, Nature Protection, Sanctuary, Wild life Sanctuary, Eco-sensitive zones, Historical Monuments, places of tourist interest, etc.
      - State Policy / Plan
      - Master Plan of Development Authorities

Under the C & D waste management rules the threshold processing facility has been defined as 'exceeding 20 tons or more in one day or 300 tons per project in a Month of installed capacity' – (bulk C & D waste generator). As impacts are location specific , the above setback distances may be revised by the concerned local authority in consultation with SPCBs / PCCs.

Under **Schedule I** of the Rules Criteria for Site Selection for Storage and Processing or Recycling Facilities for construction and demolition Waste [See Rule 7(1)] at Sl#6 : The buffer zone shall be prescribed on case to case basis by the local authority in consultation with concerned State Pollution Control Board.

d. Other environmental factors that be considered are :
   i. Site within compatible land uses
   ii. provide all weather access roads
   iii. providing access to a year round suitable cover to the C & D waste material
   iv. no water collection within premises during rains / washings
   v. providing controlled access to the site
   vi. providing a appropriate fencing and sign board outside at site (do's /don'ts)

4. Inspection of C & D waste load

C & D waste processing facility shall inspect each waste load before unloading debris and shall accept only C & D Debris - no industrial waste shall be accepted at the C & D facility unless otherwise approval received from concerned authority. No untreated industrial effluent / wastes are to be accepted at the facility.

5. C & D waste processing facility – 'ORANGE' category activity

Consent to establish under section 21 of Air (Prevention & Control of Pollution) Act 1981 and under section 25/26 of Water (Prevention & Control of Pollution) 1974 has been treated as an **ORANGE** category project by Delhi Pollution Control Committee (DPCC) under the Product / activity : Processing / recycling of construction & demolition waste debris (malba) to IL&FS, the operator that

established the 1st C & D waste processing facility in Delhi. The categorization as ORANGE be considered by all SPCBs/PCCs to ensure harmonization when dealing with C & D processing activity. In Office Memorandum (OM) vide letter dated June 10, 2014 MoEF&CC on - Applicability of EIA 2006 Notification as amended from time to time for *standalone Construction & Demolition Waste processing facility* – the notification &CC mentions that this activity does not attract the provisions of the EIA 2006 Notification however the said activity will be governed by the consent mechanism under Air (Prevention & Control of Pollution) Act 1981 and under Water (Prevention & Control of Pollution) 1974.

6. GOOD PRACTICEs proposed: Constraints Vs opportunities in establishing C & D waste management facilities

Though city residents & NGOs have come forward to support waste management (ex. MSW) initiatives by ULBs however when it comes to identification of land / acquisition of land for WASTE MANAGEMENT, project proponents face severe public protests. A number of civic bodies in various cities have initiated the process of establishing C & D waste processing facilities in cities. Key requirements include appropriate site location, availability of necessary land , road infrastructure besides provision of weigh-bridge , storage area etc. In most of the cities C & D wastes are being dumped haphazardly in low lying or sometimes reaching landfills.

Some constraints Vs opportunities in establishing C & D waste management facilities w.r.t. adopting and listed below:

a) C & D waste management facilities w.r.t. population :

Under C & D Waste management Rules 2016 , Schedule III [See Rule 13] provides the Timeframe for Planning and Implementation of the rules based on population as follows :

- Cities with population of >= one million
- Cities with population of 0.5 - 01 million
- Cities with population of < 0.5 million

Ministry of Urban Development vide circular dated June 28, 2012, directed States to set-up such facilities in all cities with a population of over 10 lakh. (One million plus cities) to establish environment friendly C

& D recycling facilities. Refer **ANNEXURE I** Initiatives C & D waste management in 69 cities.

b) Quantification of C & D waste generation / processing is Region - specific:

Local bodies need to ascertain the quantum of C & D waste generation and its potential utilization taking into account the existing development / infrastructure projects and proposed regional plans w.r.t. compatible landuses in consultation with SPCBs/PCCs also. Referral documents for assessment of quantum of C & D waste generated / processed and the necessary land requirement in a region can be studied in the following documents under the C & D Waste Management Rules, 2016:

i. under [Rule (7)(2)] : The operator of the facility as specified shall apply in **Form I** for authorization from State Pollution Control Board or Pollution Control Committee.
ii. under [Rule (8)(2)]: State Pollution Control Board or Pollution Control Committee shall grant 'authorization' to construction and demolition waste processing facility in **Form-III** as specified under these rules after examining the application received in **Form I**;
iii. under [Rule (7)(3)] : The operator of the facility shall submit the annual report to the State Pollution Control Board in **Form II.**
iv. under [Rule (8)(3)] : Annual Report to be submitted by the State Pollution Control Board / Committees in **Form – IV** to CPCB.

c) Land acquisition :

Generally LAND disposal is 1st resort in waste management - Land disposal of solid wastes has been the oldest practice. Disposal of wastes by landfilling or uncontrolled dumping of commingled (mixed) wastes has been observed in many cities. Under SOLID WASTE RULES, 2016 Rule #3 subrule definition #57 - ***"waste hierarchy"*** *it mentions that prevention of waste should be the most preferred option and the disposal at the landfill being the least.* However in general 'land disposal' is 1st resort in waste management in several cities. The 'landfill' as a facility / destination for urban wastes is being gradually revised as availability of suitable land in cities is a major challenge besides the awareness of recyclability 'waste' has been growing over the years. The ULBs are

recognizing the importance of 'integrated' waste management i.e. processing cum disposal of wastes.

d) Using closed / capped landfills in cities – Land availability option

In cities where landfills have been capped and have complied with necessary closure conditions, the land can be used for installation C & D waste processing facility.

e) Bulk generators

Under the C & D Waste Rules w.r.t. quantum of waste generation addresses those sources generating more than **20 tonnes** or more in one day or **300 tonnes** per project in a month of installed capacity.

Criteria for setting up C & D waste processing facilities (BMTPC Guidelines) : The Civic bodies wherein current waste generation **> 2000 TPD**, to set up more than one plant for recycling of C & D waste.

f) Non-bulk C & D waste generators

The BMTPC Guidelines has suggested the following:

i. Non-bulk generators: *Collection points be provided so that small quantity generator of C & D waste is not required to transport the debris to a distance more than 2.5 to 3.0 km*

ii. C & D Collection Centers: *to be notified wherein small quantity generators of C & D waste can deliver the C & D debris. The system and arrangements for collection and supply of C & D waste to recycling plants may be worked out and defined in an unambiguous manner.*

As 'waste' generation is location / region specific the local bodies to identify sites for receiving / processing intermittent non-bulk C & D wastes.

g) Practice waste minimization 1st & waste disposal to be last option

i. Management of C & D waste should reflect the waste management hierarchy - waste prevention and minimization being the first priority succeeded by reuse and recycling. Waste prevention should be noted at all stages of project duration, waste disposal to be last option.

ii. Sorting and restoring the C & D waste at the source is a GOOD PRACTICE. The C & D waste may be segregated into following categories:

- for structures for buildings
- for use in road works
- building parts that could be salvaged

iii. Another level of segregation can be done among materials such as plastic, cables, glass, wood and plaster board.

iv. Some recommendations for use of recycled C & D wastes include

(a) To source the recycled concrete aggregates from sites being re-developed for use in the same site.

(b) For a given structure, only one type of manufactured coarse aggregate and one type of manufactured fine aggregate to be used.

v. Road projects : Utilization of bitumen and asphalt can be recycled in roads projects in consultation with concerned agencies.

vi. Besides cost savings, use of on-site crushers to produce such aggregates can reduce the transportation impacts of a project associated with the removal of C & D waste from site and the transportation of quarried aggregates.

vii. During site clearance / re-modelling / renovation / re-development works, there are opportunities for beneficial re-use and re-cycling of the demolition materials. The subsequent use of recycled materials in reconstruction works also reduces the quantities of waste which would need to disposed in landfill sites.

viii. Excavated spoil/topsoil can be carefully set aside and also be used creatively in the landscaping or for construction of embankments and screening / noise abatement berms in civil engineering projects.

h) <u>Encourage on-site C & D waste processing/ reuse</u>

India's first plant (stationary) for recycling of C & D waste was commissioned during 2009 at 10 acre site at Burari, Jahangirpuri in North Delhi by Infrastructure Leasing & Financial Services (IL&FS) under an agreement with North Delhi Municipal Corporation. A 'fixed' recycling plant requires higher volumes of demolition waste to justify high investment in complex, screening and separation systems, which are necessary to process mixed demolition waste. It has to be located in a place, where large volume of waste is easily transported and there is a market for recycled products.

Full advantage to be taken of all opportunities for the reuse of construction materials. Explore utilization of material generated for reuse on site or salvaged for subsequent reuse to the greatest extent possible, disposal should be considered as a last resort. Need to maximise the efficient use/reuse of materials. Encourage setting up C & D waste recycling facilities on-site ex. Operate mobile or semi mobile C & D waste processing plants , this will reduce volume of waste to be transported.

i) Hazardous wastes / toxic wastes streams

Hazardous wastes / toxic wastes streams should be kept separately from other wastes to avoid further contamination, their disposal to be done in consultation with SPCBs/PCCs under HW Management Rules 2016. Examples of C & D waste that are classified as hazardous include lead, tars, adhesives, sealants , asbestos . The concerned authorities shall examine the DEMOLITON PLAN submitted by the applicant to assess if there are any HW streams.

j) Market for utilization of C & D waste products

The capital investments involved in equipment and facilities required for recycling the materials is significant, unless the market for use recycled aggregate is developed, economic viability of C & D waste processing facilities would be a challenge.

k) Mandate utilization of C & D waste products in Govt & private projects

The building construction products manufactured from C & D wastes have been reported to satisfactorily meet necessary requirements of compressive strength and water absorption. The end products such as kerb stones, paving blocks of different shape, size and colour, hollow and solid blocks, manufactured sand etc. have been tested in laboratories and found to be satisfactory. Use of fine aggregates and coarse aggregates manufactured by recycling of C & D waste has also been validated scientifically for part replacement of natural aggregates

The Rule (9) sub-rule (4) mentions that the *'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.' Private developers to be also encouraged to mandate a percentage for procurement of materials made from construction and demolition waste subject to strict quality control.

i. Efficient building ratings like GRIHA, LEED etc. can explore factoring the utilization of C & D wastes in their computations

ii. Since CPWD, BIS and NBCC promote :

- Maximum of 20% replacement of aggregates in RCC with RCA (recycled concrete aggregates)
- 100% replacement of aggregates with RCA in light or non-load bearing lean concrete

Need to incentivize use of C & D waste products in both - structural and non-structural applications.

iii. Cost savings up to 15% can be observed for finished products such as paving blocks made from recycled aggregates (Ref. Market study on C & D waste utilization in Ahmadabad. : GIZ & Development Alternatives (DA).

l) Architectural initiatives

Though there may be several such instances however two examples are highlighted wherein creativity has been used to reuse C & D waste in buildings ex.

a. A school building in Rajkot, designed by Ahmedabad-based architect Surya Kakani, has been built from the debris of the Bhuj earthquake.

b. The Institute of Rural Research and Development (IRRAD) building in Gurgaon has innovatively recycled and utilised its own construction waste in the building.

m) Drainage

As per C & D Waste Rules (Rule 4 sub-rule (4)) there should be no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains. A proper drainage plan ensures planned disposal of water during rains / floods. Rivers to be protected from littering or deposition of construction and demolition waste to prevent obstruction to river flow.

Case study : Flood in Mega city - Mumbai ((Ref. Mumbai Marooned: An Enquiry into Mumbai Floods 2005) July 26, 2005 has gone down as a day no Mumbaikar will forget. A record 994 mm (37.2 inches) of rain

within 24 hours (75% of the downpour – 709 mm — fell in a five-hour period between 2.30 pm and 7.30 pm), widespread flooding and the loss of lives and property, the virtual shutdown of the city for two days (more in some areas)..... At least one-third of the surface area of the city is believed to have been flooded.

On issues on pertaining to waste management the following were the observations:

i. *According to official BMC figures, Mumbai generates about 7,800 tonnes of solid waste daily. However, this figure is probably significantly inflated by the contractor lobby. NGOs working in the field of solid waste management state that no one seems to have an accurate figure of the amount of solid wastes generated in Mumbai. (page 30).*

ii. *Construction debris, silt etc forms a substantial part (2,000 tonnes per day according to the BMC) of waste. This debris is also used to illegally fill low-lying land and mangroves. Construction debris such as concrete, cement and brick rubble can be used as road base and crushed and re-used to cast concrete blocks etc. These practices are legally mandated and in place in many developed countries. The recycling of construction debris should be legally mandated in Mumbai, and if necessary the required infrastructure (crushers etc) can be set up by tapping funds from the construction lobby (page 70).*

iii. *'Dumping of waste (solid or effluent) in rivers and nallahs must be punishable by a fine and/ or imprisonment. Within a year, the BMC should provide adequate waste disposal facilities to these areas or relocate those it cannot provide services to (page 75).*

iv. *Un-authorised construction on open Nallas and alongside Nallas and drains has narrowed the width of the drains thus reducing their clearing capacity; Drain choking incidents were reported at 14 places.*

(Ref. Mumbai Marooned: An Enquiry into Mumbai Floods 2005).

n) <u>Equipment deployment:</u>

Different types of sorting devices and screens are used for separating contaminants from end-product and grading the recycled product in

various grain sizes. Vibrating screens, star screens or disc-separators are used for removal of impurities. Other existing equipment include jaw crushers and impact crushers etc are used to suit the requirements of recycling and processing of C & D waste.

o) Green belt plantation

Green belt has been recognized as an effective shield to abate pollution mainly activities generating DUST. The report 'Guidelines for Developing Greenbelts' (CPCB March 2000) is a referral document to identify native species w.r.t. climatic zones. The criteria for selection for development of Green Belt include:

i. The plant species should be fast growing & native to the region
ii. They should have thick canopy cover preferably perennial.

p) Enforcement

Though stringent laws are being formulated by the civic bodies their enforcement however needs to be further strengthened Roads sides, vacant plots and river banks could be freed from debris dumps and drains freed from clogging if C & D waste is properly disposed /managed.

q) Training programs - Awareness of recycling C & D wastes

The BMTPC Guidelines highlights that for cities of population < one million : *Sensitization and facilitation for re-use and recycling of C & D waste may also be taken up in cities of population less than 1 million to encourage such initiative. This is because mega cities and cities with million plus population account for only 23 per cent of urban population (Census 2011).*

SPCBs / PCCs and ULBs to conduct sensitization training programs highlighting good practices and economic viability of establishing C & D waste recycling operations that are being implemented in various cities across the country.

7. C & D waste management - case study DELHI

All C & D plants coming up under the Public Private Partnership (PPP) model. Key features are given below:

i. Delhi generates approximately 3000 MT of C & D waste per day as per IL&FS

ii. Country's 1st C & D processing facility – Civic body: North Delhi Municipal Corporation (NMC); City – DELHI; Brief highlights: Site is at Burari, Jahangirpuri in North Delhi in collaboration with MCD developed by private operator IL&FS Environmental Infrastructure & Services Ltd (IEISL) to demonstrate the potential of a scientifically managed process in collection and recycling of C & D waste in Delhi of capacity 500 TPD. Plant commissioned during 2009 on a 10 acre site at Burari, Jahangirpuri in North Delhi.

iii. **Delhi East Kidwai Nagar, New Delhi :** 2nd C & D facility set up by private operator M/s Enzyme India Pvt. Ltd. in year 2014 on PPP model with 100% by back by NBCC with a capacity of 150 TPD

iv. **Delhi -Shashtri Park, New Delhi :** C & D plant in Delhi at Shastri Park in East Delhi at 2.5 acre site by private operator IL&FS, The facility will get mixed C & D waste from 15 designated sites of East Delhi.

v. Civic body South Delhi Municipal Corporation (SDMC): The proposed plant at Ghumanhera in West Delhi will have a capacity to process some 500 tonnes of C & D waste per day.

vi. Public Works Department (PWD): proposes to set up THREE C & D debris recycling plants in Delhi, each of installed capacity of 150 TPD. Two plots of two acres each identified at Tikri Kalan, Libaspur and near Nizamuddin Bridge, another plant being proposed at Kapashera**.**

vii. C & D charges :

   a. EDMC: There is a challan of up to Rs. 5,000/- for dumping waste illegally.
   b. SDMC: imposition processing fee of Rs 205 per MT at time of sanctioning building plan and Rs 225 per MT for lifting waste. The transportation charges would be increased by 10% every two year.

viii. Delhi government advisory C & D waste utilization

The Delhi government has issued an advisory on the use of products made out of recycled C & D waste by the Public Works Department (PWD). All Delhi government agencies will be required to incorporate a

clause in their tenders that mandates use of a minimum of 2 per cent recycled products from construction waste in all future contracts for building works and 10 per cent recycled products for road works. (CSE **August 26, 2015)**

8. Initiatives in C & D waste management in 69 cities

Based on literature survey the data on C & D waste management initiatives taken by some urban local bodies in some major cities have been compiled in **ANNEXURE I**: Initiatives in C & D waste management in 69 cities, the data demonstrates that cities are recognizing the importance of processing C & D wastes hence many cities have stipulated collection charges and introduced penalties for illegal disposal.

Salient features of Enforcement as derived from Annexure I is summarized:

a. C & D waste processing facilities are being established on PPP mode (private operators).
b. Land acquisition for C & D waste processing
   Most of the cities are either in the final stages of acquiring site for establishing C & D waste processing site or have identified alternate sites which need to be evaluated for be economic sustainability.
c. Intermediate collection points – Some ULBs have declared designated sites for dumping C & D debris.
d. Public services :
   i. Many ULBs have announced Helpline toll free number for citizens for reporting illegal dumping of C & D waste provided
   ii. Complaints by email: ex Chandigarh - Citizen can also be emailed at *bi_mcc@chdut.nic.in*. MCC has vouched that *malba* will be collected within 48 hours of the complaint.
   iii. Timing for C & D (malba) collection - Collection of *malba/ C & D waste* between 9 am and 5 pm. (Chandigarh)
   iv. Call centre number 040-21111111 and 'My GHMC App' (Greater Hyderabad)
e. C & D waste lifting charges :

Different criteria have been used to setting fees for lifting C & D wastes ex.

i. 0.5 to 0.75 tonnes - Rs. 500/- ; between 0.75 tonnes to 1.50 tonnes - Rs. 1,000/- ; between 1.50 tonnes to 3 tonnes – Rs 2,000 ; between 3 to 6 tonnes - Rs. 4,000/-

ii. For a structure > 80 sq m area Rs. 50/- per month ; Rs. 100/- charged for 120 sq. metre. Beyond 120 sq. metre, Rs. 200/- ; Stacking of construction/ demolition debris Rs. 1500/- per tractor trip Rs. 3000/- per truck trip

iii. To collect a quantity of *malba* between less than 25 cubic feet (cu ft) - Rs. 50 ;for > 25 cu ft Rs. 2 per cu ft extra is charged.

iv. GHMC user fee Rs 360 per tonne (Greater Hyderabad).

f. Penalty range:

i. Dumping of *malba* in front of houses, parks or at any other public space has been banned and any violation has a penalty of Rs. 500. (Chandigarh)

ii. A fine of Rs. 1,000 will be levied on those mixing construction debris with wet waste

iii. The civic body (PMC) has put a ban on dumping waste in open spaces, riverbeds, canals and quarries. Imposition fine of Rs 25,000 on such illegal dumping (Pune MC).

iv. The Corporation imposes a fine of Rs. 2000/-. (Chennai)

v. Penalty for not removing C & D waste , fine of Rs. 5000/- per tonne (Thiruvanthapuram).

vi. Penalty: For not delivering Construction and Demolition waste in a segregated manner as specified there is a fine of Rs. 1000/- & For dumping of construction and demolition waste in non-designated areas there is a fine of Rs 5000/-. (Shillong)

vii. Penalty: Violating norms while transporting construction debris , penalty Rs 5,000 (Ghaziabad)

viii. Penalty: Construction debris dumping on road, public places and open places = Rs. 1000/-.(Amravati)

ix. Penalty**:** Failure in lifting C & D Waste (at least one truck load) from designated location OR Failure in transportation of C & D Waste to the processing facility per instance processing facility per instance OR Failure to lift claimed C & D Waste from the generator within 48 hrs. per instance – fine Rs 2000 ; Failure to lift C & D Waste dumped on roadside within 24 hrs. per instance –

fine . Rs. 1000/- ; Non-performance of any other obligation under the Agreement for a continuous period of 7 (seven) days fine Rs. 10000/-. (Vijayawada)

x. Penalty: for of C & D wastes ; fine ranging from Rs. 100/- to Rs. 500/- (Surat)

Figure 9.1: Loss of C & D wastes "loss of opportunities to reuse / recycle

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ANNEXURE I : Initiatives in C & D waste management in 69 cities

Sl.	City	C & D waste generation TPD/Mt	Status of C & D waste processing / disposal facility
1.	**Panaji, Goa**	25 TPD	The Integrated Solid Waste Management (ISWM) system has been proposed for the year 2040, for a total capacity of 100 Tonnes per day. Out of 100 TPD, around 33 TPD of construction debris could be processed. C & D waste will be collected separately, zone-wise, for transportation to Integrated Solid Waste Management (ISWM) Facility for processing and land filling.
2.	**Coimbatore, TN**	850 TPD	Civic body - Coimbatore City Municipal Corporation (CCMC) estimates that of the 850 TPD wastes generated about 150 TPD is construction debris. CCMC has proposed a processing plant of capacity 100 TPD
3.	**Madurai**	295.26 TPD	Civic body - Madurai city corporation has earmarked places four locations for disposal C & D wastes : • at Vilankudi old dumping yard at ward 1 for zone 1 • at Masthanpatti (Palathottam) at ward 29 for zone 2 • at Gatelock Road at ward 71 for zone 3 and • at Vellaikal dumping yard at ward 94 for zone 4. Earlier C & D waste was being dumped along the river at Thirumalairayar Padithurai on south bank and Mathichiyam on the north bank. C & D lifting charges : Corporation fixed clearing charges for 0.5 to 0.75 tonnes - Rs. 500/- ; between 0.75 tonnes to 1.50 tonnes - Rs. 1,000/- ; between 1.50 tonnes to 3 tonnes – Rs 2,000 ; between 3 to 6 tonnes - Rs. 4,000/- Helpline toll free number for citizens for reporting illegal dumping of C & D waste provided
4.	**Nagpur**	1.120 TPD	Civic body : Nagpur Municipal Corporation (NMC) lifts, transports and dumps construction and demolition material at Bhandewadi dump yard engaging services of private operator m/s Kanak Resources Management Ltd.
5.	**Nashik**	-	Civic body : NMC has identified sites for dumping C & D debris. The responsibility for disposing the construction debris is with the waste generators and not with the Corporation. Inert processing unit of capacity 50 TPD comprises of mechanical sieve and air density separator, main purpose plant is to recover the construction material from the waste and or

			utilizing for construction activities to minimize landfill burden.
6.	**Ahmedabad**	295.26 TPD	Civic body : Ahmadabad Municipal Corporation (AMC) **:m/s** DNP Infrastructure Pvt. Ltd. has been awarded operations of a 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.
7.	**Indore**	100 TPD	Civic body : Indore Municipal Corporation (IMC) :Proposes to award 75 TPD C & D waste processing facility on four acres of land in Devguradia region for period of 15 years.
8.	**Ujjain**	30 TPD	C & D wastes dumped at MR-V Agar Road trenching ground located about 4 km from the city.
9.	**Agartala**	123 TPD	Civic body : Agartala Municipal Council , though no separate facility for C & D waste however existing 250 TPD involved in Solid waste processing plant (composting and scientific landfill) w.e.f. March 2014
10.	**Kanpur**	189 TPD	C & D wastes processed for making bricks , HBTI Kanpur is associated with project.
11.	**Varanasi**	24.6 TPD	Civic body :Varanasi Nagar Nigam transporting C & D waste to Karsda / Ramana land fill ,where the waste is used as covering material for municipal solid waste (MSW) at the site. Proposes to address C & D waste separately.
12.	**Bhubaneshwar**	196.8 TPD	Civic body: Bhubaneswar Municipal Corporation (BMC) proposes to set up a C & D waste processing plant on public-private-partnership mode. The civic body has identified two sites for dumping of waste - Patia and Kargil Basti. C & D charges : For a structure > 80 sq m area Rs. 50/- per month ; Rs. 100/- charged for 120 sq. metre. Beyond 120 sq. metre, Rs. 200/- ; Stacking of construction/ demolition debris Rs. 1500/- per tractor trip Rs. 3000/- per truck trip Disposal: Regional Landfill of non bio-degradable and inert material site at Brajrajnagar/ Jharsuguda.
13.	**Salem**	85 TPD	• Large quantity non-hazardous waste (e.g. C & D waste / flyash) disposed is being off in monofills (i.e. receiving one type of waste). The City Municipal Corporation has appointed a Bangalore-based private consultant to prepare a project report for the integrated solid waste management scheme.
14.	**Thanjavur**	Total MSW + C & D waste =	Construction of Rural Roads using C & D Waste Materials: By addition of C & D waste materials in the sub-base layer of the road structure, the conventional laterite layer of rural

		~ 60 TPD	road formation can be further strengthened; quantity of utilization of laterite is reduced and thus leads to cost reduction in road laying. • Dumpsite near STP site - Thepperaumanallur.
15.	**Vellore**	1.37 TPD	- Total (MSW + C & D)
16.	**Kochi**	25.2 TPD	- Total (MSW + C & D)
17.	**Sholapur**	44.3 TPD	- Total (MSW + C & D)
18.	**Aurangabad**	85.6 TPD	-
19.	**Mumbai – (Kalyan-Dombiwali)**	~650-700 TPD	As of 2014, Mumbai generates over 10,000 metric tonnes of waste per day - 8,000 metric tonnes of MSW and 2,000 metric tonnes of debris.
20.	**Thane**	600 TPD	-
21.	**Chandigarh**	3.5 TPD	Civic body **:** Municipal Corporation Chandigarh (MCC), MCC has also identified 18 low-lying areas for dumping of debris. Facility – MSW facility in Dadu Majra , after compressing waste it is then covered with a layer of C & D about 2 feet thick. C & D charge - Collection of *malba/ C & D waste* between 9 am and 5 pm. MCC has fixed amounts for *malba* collection. To collect a quantity of *malba* between less than 25 cubic feet (cu ft) - Rs. 50 ;for > 25 cu ft Rs. 2 per cu ft extra is charged. The rate at which MCC is charging to the residents, is hardly one third of the total cost incurred by the municipality. But the municipality does not mind spending this amount, as its aim is to make citizens conscious of cleanliness and contribute towards keeping their city clean. Penalty: Dumping of *malba* in front of houses, parks or at any other public space has been banned and any violation has a penalty of Rs. 500. Mobile helpline number MCC provide number 3274154 to book complaint for *malba* removal. Complaints can also be emailed at *bi_mcc@chdut.nic.in*. MCC has vouched that *malba* will be collected within 48 hours of the complaint.
22.	**Jaipur**	150 TPD	The state government proposes set up C & D Waste Processing Plants in 29 cities including

			state capital, Jaipur. In Jaipur a private company proposes to set up recycling facility capacity 300 TPD on 6 acres of land near the existing dumping stations.
23.	**Lucknow**	693.8 TPD	Disposal of C & D waste and inert material used as covering material in Telibagh Bhatha Maidan area.
24.	**Bengaluru**	1,000-3,000 TPD	Civic body : Bruhat Bengaluru Mahanagara Palike (BBMP) - The BBMP proposes to put up the C & D waste processing facilities in PPP mode in three abandoned quarry areas in Kannur, Mallasandra and Anjanapura , each with capacity to process 750 TPD he facility to BBMP. Penalty**:** A fine of Rs. 1,000 will be levied on those mixing construction debris with wet waste
25.	**Pune**	250-300 TPD	Civic body : PMC : The C & D waste in Pune constitutes 40% of MSW in Pune. District administration has allocated 2 acres of land at Wagholi for C & D waste processing. Penalty: The civic body (PMC) has put a ban on dumping waste in open spaces, riverbeds, canals and quarries. Imposition fine of Rs 25,000 on such illegal dumping.
26.	**Bhopal**	30-40 TPD	**-**
27.	**Hyderabad**	5000 TPD	Civic body **:** The transport wing deploys for Greater Hyderabad Municipal Corporation (GHMC) vehicles for collection and transportation of C & D waste from bulk generators. Proposed disposal sites - setting up of a decentralised C & D waste plants at four identified locations, Fathullaguda, Jeedimetla, Kothwalguda and Mallapur. C & D charge - GHMC user fee Rs 360 per ton. Public service : call centre number 040-21111111 and 'My GHMC App'.
28.	**Chennai, Tamil Nadu**	1143 TPD	Disposal: • According to Chennai Corporation- East, there is one dumping yard present in each of the 15 zones of the city. • There are two dumping sites in Chennai Perungudi and Kodungaiyur where, a large amount of C & D waste is being dumped. • Cooum, Adyar, Buckingham Canal and Pallikaranai marshland are popular sites where construction debris is dumped illegally. • C & D waste disposal designated areas : Sathangadu (Tiruvottiyur), CPCL junction (Manali), GNT Road Sembiam Sengundram Road (Madhavaram), Kodungaiyur (Tondiarpet), Moolakothalam crematorium (Royapuram), Otteri disposal yard (Thiru Vi Ka Nagar), Devi Karumariamman Nagar crematorium (Ambattur), 1st Avenue of Gajalakshmi

			Colony (Anna Nagar), Karaneeswarar Pagoda Street Recycling Plant (Teynampet), Anna Avenue (Kodambakkam), Ramavaram Bharathi Road (Valasaravakkam), MGR Nagar recycling plant (Alandur), Near Kotturpuram Railway Station (Adyar), Perungudi dumpyard (Perungudi) and Gangai Amman Koil Street Extension in Karapakkam (Sholinganallur). . • Penalty: The Corporation imposes a fine of Rs. 2000/-.
29.	**Thiruvananthapuram**	15.84 TPD	Penalty: For not removing C & D waste , fine of Rs. 5000/- per tonne.
30.	**Patna**	1000-1200 Total (MSW + C & D)	Civic body: Patna Municipal Corporation (PMC) - Site at Bairia , area of 80 acres approx. under PMC has been used for open dumping for last 2-4 years. Waste collected from across the 72 wards,as well as part of the waste collected from the three ULBs of Danapur, Phulwari and Khagaul is presently reaching the designated dump site at village Bairia on the Gaya road
31.	**Kolkata**	4837 TPD Total (MSW + C & D)	C & D wastes recycled in road construction in Kolkata: The recycling process is best suited to roads with light traffic.
32.	**Guwahati**	0.864 TPD	-
33.	**Shillong**	2.76 TPD	Disposal: proposed use at landfill site at Mawiong to cover as a layer (earth) for covering compacted garbage. Penalty: For not delivering Construction and Demolition waste in a segregated manner as specified there is a fine of Rs. 1000/- & For dumping of construction and demolition waste in non-designated areas there is a fine of Rs 5000/-.
34.	**Mumbai**	2500 tonnes/ day	In September 2005, the Municipal Corporation of Greater Mumbai issued the Demolition and Desilting Waste (Management and Disposal) Guidelines but due to lack of enforcement, demolition debris still ended up in dumping grounds. 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. Penalty: For not delivering Construction and Demolition waste in a segregated manner as specified there is a fine of Rs. 1000/-
35.	**Srinagar, J&K**	530 TPD	Srinagar Municipal Corporation has one dumping site at Syedpora Achan spread over 540

		(MSW + C & D waste)	kanals of land
36.	**Ludhiana**	17.57 TPD (MSW + C & D waste)	-
37.	**Amritsar**	600 tonnes/ day MSW	Propose to use C & D waste in making roads.
38.	**Faridabad (M.Corp.)**	26.52 TPD	Propose to set up C & D waste recycling facility near Kachra Chowk on the Gurgaon-Faridabad Road
39.	**Shimla**	99 TPD	C^D waste recycling plant proposed in Darni ka Bagicha area.
40.	**Jodhpur**	386 TPD	The existing trenching site is located at Dabi Road Nanta nearly 10-15 km from the city having area of 52.28 ha, there is a dumping site at Keru (15 km away from the city Jodhpur). Penalty: Selling of segregated/ un segregated waste and Usable/recyclable items from the MSW - Upto Rs 25,000/- per incident ; Waste found on road side/ on road Rs .500/- per incident
41.	**Dehradun**	13.5 kg/day	Civic body - Dehradun Nagar Nigam (DNN) The existing SW disposal site is located at Dateda Lakhond on Sahashradhara Road , distance of 7 km from the town.
42.	**Ghaziabad**		Density of construction waste in MSW samples = 1663.47 Kg/cu m Penalty: Violating norms while transporting construction debris , penalty Rs 5,000
43.	**Agra**	49.1 TPD	-
44.	**Meerut**	27.3 TPD	Recycle of C & D waste - Left over cement and mortars, cement concrete blocks, aggregate, sand and other inorganic material is recycled and reused as Granular Sub Base (GSB) layer of pavement. Earth rendered surplus from the excavation is utilized in the embankment works.
45.	**Allahabad**	31.01 TPD	Recycle C & D wastes - bricks of C & D in road works & river banks works
46.	**Amravati**	81.6 TPD	Penalty: Construction debris dumping on road, public places and open places = Rs. 1000/-.
47.	**Greater Visakhapatnum Municipal Corporation**	80 TPD	Civic body GVMC - C & D waste processing unit at Visakhapatnam under PPP model. The state government has accorded permission to the Swachha Andhra Corporation to float Request for Proposal for 80 TPD capacity recycling plant near Kapuluppada.

	(GVMC)		
48.	**Vijaywada**	70 TPD	Unauthorised disposal of C & D debris on Bandar Canal bund near Krishna Lanka , Kanaka Durga Varadhi and Eluru canal near Sitaramaraju bridge C & D waste processing unit at Vijaywada under PPP model. Penalty**:** Failure in lifting C & D Waste (at least one truck load) from designated location OR Failure in transportation of C & D Waste to the processing facility per instance processing facility per instance OR Failure to lift claimed C & D Waste from the generator within 48 hrs. per instance – fine Rs 2000 ; Failure to lift C & D Waste dumped on roadside within 24 hrs. per instance – fine . Rs. 1000/- ; Non-performance of any other obligation under the Agreement for a continuous period of 7 (seven) days fine Rs. 10000/-.
49.	**Kozhikode**	50 Kg/ day	Civic body - Municipal Corporation Kozhikode , propose to set up facility under PPP mode
50.	**Thrissur**	1.55 TPD	**-**
51.	**Malappuram**	14 TPD	**-**
52.	**Kannur**	15 TPD (MSW + C & D waste)	-
53.	**Kollam**	1.55 Metric tonnes/ day	Kollam MC has a disposal site (4 ha) at Kureepuzha 6 Km from the city centre functioning since 2002. Civic body- Kollam
54.	**Tiruchirappalli**	14.5 TPD	Civic body - Trichy Corporation passed a resolution to control the indiscriminate dumping of C & D wastes on roads, riverbanks, canals and ponds. The corporation plans to utilize the C & D wastes in brick-making, with the technical support from IIT –Chennai
55.	**Asansol**	45 TPD	Civic body – AMC , two waste disposal sites under the AMC at Kalipahari (27 acres) and other at Samdihi, Burnpur (area 03 acres) – mainly MSW , operator M/s. GEPIL
56.	**Jamshedpur**	30.93 TPD	Jamshedpur proposes to recycle a major part of its solid waste. Delhi-based consultant m/s Tetra Tech India Private Ltd to install a integrated solid waste management = compost plant + a sanitary landfill (disposal facility for inert wastes) + C & D waste processing facility to produce eco-friendly bricks. Site – at Khairbani on the city's outskirts.
57.	**Dhanbad**	26.93 TPD	Penalty**:** Dhanbad Municipal Corporation has decided to impose a fine of Rs 1,000 per day with immediate effect on citizens found guilty of dumping C & D wastes on public roads or dustbins.

58.	**Ranchi**	25.92 TPD	**Recycle C & D waste:** Brick making is used in processing C & D wastes
59.	**Raipur**	16.97 TPD	C & D waste segregated & sold balance used for filling low lying areas.
60.	**Dispur**	0.864 TPD	Most of the C & D debris used for the filling of low areas. Government has allotted a landfill site of 40 acres at Baragaon, 20 km away from Guwahati for composting MSW 100 TDP and dumping of C & D waste
61.	**Aizwal**	0.3 TPD	Civic body - Aizwal Municipal Corporation (AMC) has identified four low lying locations to dump the C & D wastes to develop flat land.
62.	**Kohima**	2.7 TPD	Civic body **-** KMC ; disposal site about 8 Kms away from the city on NH- 39 for MSW
63.	**Vasai Vihar City**	219 TPD	Civic body -Vasai Virar Municipal Corporation (VVMC)
64.	**Gandinagar**	36.50 TPD	Civic body –GMC ; C & D waste is transported by private contractors waste to privately owned low-lying land at a price
65.	**Surat**	1400 TPD (MSW & CDW)	For C & D the civic body has allotted 12,000 sq.m. land at Kosad for dumping. Helpline – toll -free number '1800-212-2829' for collection of C & D wastes. Penalty: for of C & D wastes ; fine ranging from Rs. 100/- to Rs. 500/-
66.	**Vadodara**	27.80 TPD	-
67.	**Rajkot**	100 TPD	Civic body -RMC taken initiative to collect and dispose C & D waste separately and setup a C & D processing facility of 100 TPD
68.	**Jabalpur**	26.60 TPD	Civic body - Municipal Corporation Jabalpur on PPP mode
69.	**Gwalior**	210 TPD (MSW + CDW)	Disposal site - Kedarpur.

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ANNEXURE II: POTENTIAL USES OF C & D WASTES

C & D waste	Potential use of C & D wastes
Concrete	The utilization of recycled aggregate is particularly very promising as 75 per cent of concrete is made of aggregates. Opportunity: The enormous quantities of demolished concrete can easily be recycled as aggregate and used in concrete. Research & Development activities have been taken up all over the world for proving its feasibility, economic viability and cost effectiveness. Work on recycled concrete has been carried out at few places in India by CBRI and CRRI, but waste and quality of raw material produced being site specific, tremendous inputs are necessary if recycled material has to be used in construction for producing high grade concrete.
Bricks	If deconstructed properly, bricks can be reused after removal of mortar. Broken bricks can be used for refilling or for manufacturing debris paver blocks or debris blocks.
Stone	Stone can be reused for plinth formation, masonry construction, landscape purpose, ledges, platforms, window sills, coping etc. depending upon the form of available stones.
Timber	Timber elements from deconstructed building may have aesthetic and antique value. Opportunity : Whole timber arising from construction and demolition works can be utilized easily and directly for reused in other construction projects after cleaning, de-nailing and sizing.
Plywood and other timber based boards	Plywood and other timber based boards can be either reused for interior works in new construction or it can be recycled for manufacturing of timber based boards.
Gypsum	In India, over 10 about of waste gypsum such as phosphor-gypsum, fluro-gypsum etc., are being generated annually. Opportunity : Plaster developed from this waste gypsum has showed improved engineering properties without any harmful effect. Phosphor-gypsum and lime sludge can be recycled for manufacture of Portland cement, masonry cement, sand lime bricks, partition walls, flooring tiles, blocks, gypsum plaster, fibrous gypsum boards, and super-sulphate cement.
Metals & metal alloys-	Ferrous Metals are the most profitable and recyclable material. Scrap steel is almost totally recycled and allowed repeated recycling. Structural steel can be reused as well as 100% steel can be recycled to avoid wastage at construction site.

	Advantage : Generally sold to a scrap metal dealer at a specified price. Metals like scrap iron can be mixed with the virgin metal in the foundry. In India more than 80% scrap arising is recycled.
Non ferrous metal	The main non ferrous metal collected from construction and demolition sites are aluminium, copper, lead and zinc . Opportunity : In India aluminium and copper are recycled and are valuable resources
Debris	Construction debris can be recycled to manufacture paver blocks which can be used in light traffic areas and masonry blocks. Other uses of processed debris include use in lean concrete for leveling purpose, as mortar for masonry, as bedding mortar for pavement tiles and used for land filling materials is comparable with new materials. Opportunity: Market potential on an average in Pune city estimates about 40 crores of bricks in a year.
Composite materials	The plastic wastes are best for recycling if these materials are collected separately and cleaned. Recycling is difficult if plastic wastes are mixed with other plastics or contaminants. Plastic may be recycled and used in products specifically designed for the utilization of recycled plastic, such as street furniture, roof and floor, PVC window noise barrier, cable ducting, panel. Constraint: The third largest consumer of composite materials is construction sector, automobile and aeronautics being first two largest consumers. Composite materials like thermoplastics are not only using non-renewable resources, they are non-biodegradable products. Thermoplastics (Polycarbonate, polyethylene, polypropylene, PVC etc.) can be recycled, but recycling involves high costs, whereas thermosets (Epoxy adhesives) are difficult to recycle. The lack of adequate markets, high recycling cost, and lower quality of the recyclates are the major commercialization barriers in recycling of composite materials. PVC-U sourced mostly from window and door fabricators is being recycled into wiring accessories and cable management systems including skirting and trunking. Composite materials can be down-cycled.
Ref : (https://www.researchgate.net/publication/256677141_construction_and_demolition_waste_management_with_reference_to_case_study_of_Pune	

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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, western province of Canada.	Re-use/recycling of C & D began in late 2008.
Nova Scotia, Canadian Province	Halifax Regional Municipality is (2011) diverting more than 80% of C & D waste from storage in landfill to reuse and recycling.
Netherlands, Sweden, Denmark, Austria, France and Switzerland	recycle 80 to 90% of their C & D waste.
Tokyo	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).
In Australia - cities of Sydney and Melbourne.	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.
USA, cities like New York.	• Have 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 neighbouring 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, Oregano USA	More than 2/3rd of C & D waste is getting recycled / reprocessed.
Minnesota, USA	About 70% of demolition debris and 60% construction waste are being salvaged, recycled and reprocessed.
Singapore	Reusing / recycling 980% C & D waste (land constrained area).
Indonesia and Malaysia	Reusing / recycling about 50 to 60% of C & D waste.
Portugal	reuse/recycling of C & D waste is less than 40%
Hong Kong	C & D waste utilization is 60%.
Korea	Effective cycling rate is 36 per cent, with a target of increasing this to 45 per cent by 2016.

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ANNEXURE IV

Criteria for site selection of C & D waste processing facility (SCHEDULE I)

(Note: numerals in brackets as per Notification of C & D waste Rules 2016)

i. (4) The processing or recycling shall be large enough to last for 20-25 years (project based on-site recycling facilities).
ii. (5) The processing or 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.
iii. (6) A buffer zone of no development shall be maintained around solid waste processing and disposal facility, 20 tons or more in one day or 300 tons per project in a month of installed capacity. This will be maintained within the total area of the solid waste processing and disposal facility. The buffer zone shall be prescribed on case to case basis by the local authority in consultation with concerned State Pollution Control Board.
iv. (7) Processing or recycling site shall be fenced or hedged and provided with proper gate to monitor incoming vehicles or other modes of transportation.
v. (8) The approach and or internal roads shall be concreted or paved so as to avoid generation of dust particles due to vehicular movement and shall be so designed to ensure free movement of vehicles and other machinery.
vi. (9) Provisions of weigh bridge to measure quantity of waste brought at landfill site, fire protection equipment and other facilities as may be required shall be provided.
vii. (10) Utilities such as drinking water and sanitary facilities (preferably washing/bathing facilities for workers) and lighting arrangements for easy landfill operations during night hours shall be provided and Safety provisions including health inspections of workers at landfill sites shall be carried out made.
viii. (11) In order to prevent pollution from processing or recycling operations, the following provisions shall be made, namely:
    a. Provision of storm water drains to prevent stagnation of surface water;
    b. Provision of paved or concreted surface in selected areas in the processing or recycling facility for minimizing dust and damage to the site.
    c. Prevention of noise pollution from processing and recycling plant.
    d. Provision for treatment of effluent if any, to meet the discharge norms as per Environment (Protection) Rules, 1986.
ix. (15) A vegetative boundary shall be made around Processing or Recycling plant or site.

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