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# Training Manual on Construction and Demolition Waste Management in India for Cities and Towns

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B-5/1, Safdarjung Enclave New Delhi 110 029 India T: +91 11 4949 5353 E: info@giz.de I: www.giz.de

# Responsible

Mr. Uwe Becker E: uwe.becker@giz.de

# Authors

DEVELOPMENT ALTERNATIVES Achu R. Sekhar, Krishna Chandran, Vaibhav Rathi Advisors: Dr. Soumen Maity, Dr. K. Vijayalakshmi

# Reviewers

GIZ Dr. Abhijit Banerjee, Dr. Rachna Arora, Uwe Becker

# Research Partner



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# 1. Introduction

# Objective

The objective of the training manual is to educate and inform on the severity of problem caused by Construction and Demolition (C&D) waste on the environment and serve as a reference manual providing detailed information towards management of C&D waste in an environmentally sustainable manner. It is intended that the manual be used for the purpose of training various stakeholders involved in the management of C&D waste in cities and towns. The sections of the training manual can be formed as training modules for providing necessary knowledge that an individual stakeholder will require to effectively and efficiently perform their respective duties with regards to implementation of C & D waste management rules (2016). In addition, the manual also provides some key information and benefits for businesses intended in recycling of C&D waste.

# **Project Background**

The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), under its International Climate Initiative, has launched a bilateral cooperation project with the Indian Ministry of Environment, Forests and Climate Change (MoEFCC) titled Resource Efficiency and Sustainable Management of Secondary Raw Materials (in short "Resource Efficiency"). The project aims to enable Indian key institutions responsible for the formulation of environment, climate, industry and resource policy to aid and establish institutional frameworks that improve resource efficiency. The project is being implemented by GIZ in India along with German and Indian partners. Development Alternatives is knowledge and implementation partner to GIZ and leading the project for achieving resource efficiency in construction sector with focus on Construction and Demolition waste. This manual is a consolidation of all the knowledge gained and developed during the implementation of this project in past 3 years.

# **Basic Structure of Manual**

The manual is designed for the training of regulatory authorities of cities and towns. The sections of the training manual are as below:

- 10.Introduction
- 11.Background on Construction and Demolition (C&D) waste
- 12.C&D waste Management Rules, 2016
- 13.Inventorisation of C&D waste in the city
- 14. Collection, Transportation and Disposal of C&D waste
- 15.Processing and Utilisation of C&D waste
- 16.Elements of Tendering
- 17. Monitoring and Supportive Policies
- 18.Best Practices in India

# Background on Construction and Demolition (C&D) Waste

# **Objective of the section**

Management of Construction and Demolition waste is a relatively new term in India and so is the need for it. The urbanizing trend leading to lack of availability of land and resource shortage in construction sector has led to notice the importance of C&D waste management in India which has brought about policy changes which specifies that all local governing bodies manage their C&D waste and also all polluters are responsible for the waste they generate.

Upon successful completion of the section, the participants should:

- · Have an insight on what is C&D waste and what is it composed of
- Knowledge on estimation of C&D waste quantities in Indian cities
- Understanding on the flow of C&D waste in India
- What C&D waste can be recycled / reused for
- Be familiar with the process of collection and transport of C&D waste

## What is C&D waste?

Construction and demolition (C&D) waste is generated from construction, renovation, repair, and demolition of houses, large building structures, roads, bridges and dams.

C&D waste is made up of:

- •Concrete
- •Soil
- •Steel, Wood and Plastics
- •Other materials bricks and mortar



Figure 1: Typical composition of C&D waste (Source : TIFAC, 2001)



Waste generated from construction, renovation, repair, and demolition of houses, large building structures, roads, bridges and dams



#### Figure 2: C&D waste generation and components

#### Why does C&D waste needs to be managed?

The importance of C&D waste management is not lost among the stakeholders especially in large cities, where impacts have already been felt. But still effective management of C&D waste is hampered by several challenges and implementation is far from ideal.

The improperly managed waste heaps impacts the system and the environment in multiple aspects which could broadly be classified into the following aspects

#### Social

- Huge heaps of C&D waste on footpaths, carriageways, alleys and all is a common scene in Indian cities turning the surrounding unaesthetic.
- The C&D debris usually could not be removed by normal street sweeping or household waste collection staff as they usually do not carry the equipment neither enough capacity in the collection vehicle nor enough manpower.
- Usually the polluters tend to dump other municipal solid waste on the heap making it a mix of waste further creating an unsanitary situation.
- The C&D waste is also stealthily dumped in open drains, water channels, and even riverbeds. The debris clog the drains and create water logging. Reports of water logging of drains turning to source for spread of epidemics is common in India
- Clearing drain silts is a major challenging activity for local governing bodies and a major percentage is consisted of C&D waste.

• The C&D waste also consists of several kinds of materials which include sharps, broken glasses, boulders, broken wooden logs, rusted metal, broken ceramics etc which create a hazardous environment when dumped on unfenced open places.



Figure 3: Unauthorised dumping of C&D waste

### **Environmental**

- C&D waste is also a source of environmental pollution. The C&D debris over course of time forms fine dust creating air pollution, and reducing visibility.
- The leachate and fine chemical particles degrade the soil leading to land pollution and in addition materials like paints, oil and asbestos sheets are common components of C&D waste which are bio-hazardous in nature having potential to endanger health of workers handling the waste, civilians and any living organism.
- Formation of silt deposits when dumped in wetlands and water bodies damaging the water ecosystem.

#### Economic

- C&D waste usually gets mixed up with other municipal solid waste during the process of transfer or at the collection site. Once mixed with MSW, C&D waste is very difficult to segregate. This results in increased processing cost and reduced efficiency
- •The huge volume of C&D waste results in occupying a large area of landfills and dumpyards resulting in governing bodies to find alternate space and creation of more landfills, again leading to economic inefficiency in the system.



Figure 4: Mixing with municipal solid waste

**Resource shortage** - India is witnessing a boom in construction industry due to the urbanization which leads to over exploitation of primary resource to match the demands. For instance almost 100% in case of cement and bricks, 40-60% of steel, 85% of paint and 70% of glass produced in India goes into the construction sector. The anticipated growth of the sector in the near future exert added pressure on limited stocks of resources especially

#### Secondary Raw Material

A secondary raw material is a usable waste material from an industry that can be reused or recycled to be substituted in place of primary raw materials sand, soil, stone and limestone which have been identified as most critical resources. Therefore use of secondary materials need to be promoted to supplement the use of primary materials and recycled C&D waste is one of the best available option available as secondary raw material.

#### C&D waste management Rules in India

The Ministry for Environment Forests and Climate Change (MoEFCC) notified Construction & Demolition Waste Management Rules, 2016 to regulate the handling of C&D waste generated in India. According to the new rules, the various stakeholders involved in C&D waste management have been assigned a specific role to be played in the process. Salient features of rules are covered in detail in chapter 3.

### Estimation of C&D waste across Indian cities

Management of C&D waste is a global concern and has not been managed or tracked properly by most countries. Even proper quantification of waste is not regularly maintained and only intermitted studies and data is available. Although many countries in the developed world have initiated proper management of C&D waste and has converted it from a waste management process to an income generating business.

ULB	POPULATION (CENSUS 2011)	C&D WASTE GENERATION (MILLION TONNES/ANNUM)	C&D WASTE GENERATION (TONNES PER DAY)
Municipal Corporation of Breater Mumbai	12,442,373	0.750	2,500
нини терт дек ла		- ut	
Delhi Municipal Corporation	16,787,941	1.380	4,800
(DMC, 2005)			
Greater Bengaloru Municipal Corporation (BBMP)	8,443,875	0.263	875
(TIFAC, 2001)*			5
Chennai Municipal Corporation	5,500,000	0.750	2,500
As per discussions with IIT-M	ladras		22
Kolkata Municipal Corporation	4,495,594	0.480	1,600
As per discussions with KMC		- No.	
Jaipur Municipal Corporation	3,471,847	0.060	200
(TIFAC, 2001)*			
Patna Municipal Corporation	2,514,590	0.075	250
(TIFAC, 2001)*		16	8
Ahmedabad Municipal Corporation	8,063,047	0.210	700
As per discussions with AMC	officials		S
Bhopel Municipal Corporation	1,917,051	0.015	50
(TIFAC, 2001)*		- (4)	9
Combatore City Municipal Corporation	2,618,940	0.028	92
(CCMC, 2015)			

#### Table 1: C&D waste generation data from selected cities

### How to implement a proper C&D waste management system?

A cradle to grave approach has to be adopted for proper management of C&D waste according to the national standards (C&D Waste Management Rules, 2016) where a properly implemented system exists. The system should contain proper collection of segregated C&D waste from the polluter, proper transportation of waste, storage of waste occurs at designated transfer stations or collection points followed by proper processing of waste into recycled or reusable products that have market value and where minimal rejects are produced which get deposited in designated landfills. A properly implemented management system also needs to contain proper quantification and classification system for C&D waste at different stages of handling and a properly implemented monitoring system with a neat documentation process.



Figure 5: Schematic of Current C&D Waste Management Processes in India

#### What can C&D waste be recycled / reused for?

C&D waste could be recycled and reused for multiple purposes depending on the composition and characteristics of the waste. The major applications of C&D waste which is practiced is listed below

- Granular Sub Base (GSB) Crushed C&D waste could be used as GSB layer for road constructions, regardless of the type of construction. The granular sub-base layer is formed by piling and compacting C&D aggregates of different sizes one over the other directly below the pavement surface. This acts as the load bearing and strengthening component of the pavement structure, in addition it provides drainage for the pavement structure and protects the structure from frost.
- Recycled Concrete Aggregates (RCA) Concrete waste could be recycled to make aggregates of different standard sizes to replace natural aggregates in construction processes. According to Indian standards RCA could be used in any kind of structural and non-structural applications
- Recycled Aggregates (RA) Crushed aggregates of standard size made from a mix of C&D waste materials is termed as Recycled Aggregates (RA). RA could be used for partial replacement of natural aggregates for construction of non-load bearing structures. According to Indian standards, it could replace 20% in plain cement concrete and upto 30% replacement in road construction but only if backed up by proven laboratory test results. RA could also be used for construction of prefabricated molded structures like paver blocks, kerb stones, concrete pots and RCC Sculptures.

Material	Process	End Use
Plain Concrete	Crushed	Aggregate
Fresh Concrete	Washed to remove cement & recover aggregate	Aggregate
Reinforced Concrete	Crushed & Steel bars removed Steel recycled	Aggregate
Clay bricks & roof tiles	Cleaned Crushed Pulverized	Masonry Aggregate Building Materials
Brick	Cleaned & Crushed	Aggregate & Filling material

#### Table 2: C&D waste and its potential use

- Manufactured Sand (M-Sand) Manufactured sand is also produced by crushing of C&D waste, but is much finer materials which could replace natural sand in construction activities of non-load bearing structures. According to Indian standards only materials of sieve size between 0.075mm 4.750mm is considered classified as M-sand and particles less than 0.075 mm are classified as dust particles, suitable only for daily cover for MSW.
- Smelting Scrap metal is melted through smelting process and is thus recycled to make new products. Almost all metal waste from C&D waste is reused or recycled through smelting
- **Backfilling** The most common practice for C&D waste use in India is as a backfilling material. It is dumped in pits, trenches etc and compacted for backfilling or used to increase elevation or to make top layer of surface for construction
- Reusing Materials of reuse value like wood, unbroken bricks and ceramics are being used and could be used in secondary market for construction of temporary structures or if treated properly could be used for permanent structures as well
- Other applications C&D waste is also applicable in other minor applications like carrier material in preparing fertilizers, filler material in roofing constructions, wall decorative chips etc.

Soil	Stone (Aggregates)
Demand for soil in brick making - 884 million tonnes/annum	Demand for stone as coarse aggregates in concrete – <b>1.1 billion</b> tonnes/annum

Table 3: Estimated demand for soil and aggregates and potential generation from C&D waste

	aggregates in roads – <b>5 million</b> tonnes/annum
Soil waste generated from C&D waste - <b>213</b> million tonnes/annum	Aggregates generated from C&D waste - <b>254</b> million tonnes

# 3. Construction and Demolition Waste Management Rules, 2016

# 1. Why separate rules for Construction and Demolition (C&D)

Government of India in the erstwhile Ministry of Environment and Forest published Municipal Solid Wastes (Management and Handling) rules, 2000 which was amended from time to time. Central government after reviewing the existing rules considered it necessary to make separate rules for management of construction and demolition waste due to following reasons,

- •To give thrust to segregation, recovery, reuse and recycle
- •To emphasis roles and accountability of waste generators and other stakeholders related to waste management

### 2. Objectives of this section

At the end of this section the reader should

- •Understand the definitions provided in the rules
- •Understand responsibilities and duties of all stakeholders to implement the rules
- •Understand the challenges in implementing the rules

# 3. Overview of this section

- Applicability of other regulations for management of C&D waste
- •Definitions in the rules
- •Schedules and forms in the rules
- Duties of stakeholders
- •Challenges for Local bodies Implement the rules

# 4. Reference to other policies, guidelines and regulations for management of C&D waste

- •Environmental (Protection) Act, 1986 (39 of 1986), Section 6 and 25
- National Environmental Policy 2006, Section 4 and 5.4

- •Municipal Solid Waste Management Rules, 2016
- •Guidelines on Environmental Management of Construction & Demolition (C & D) Wastes, CPCB, 2017

# 5. Definitions in the Rules

The rules specifically define terms relevant to implementation of its implementation. The important elements of the definitions are highlighted for better understanding of the reader.

# Construction

Process of erecting or alterations of building or built facility or other structure, or building of infrastructure

# **Construction and Demolition Waste**

Waste comprising of **building materials**, debris and rubble resulting from construction, remodeling, repair and demolition of any civil structure

# De-construction

Planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized

# Demolition

Breaking down or tearing down buildings and other structures either manually or using mechanical force (by various equipment) or by implosion using explosives

# Local Authority

Urban local authority such as municipal corporation, municipality, nagar palika, nagar nigam, nagar panchayat, municipal council including notified area committee, gram panchayats

# Service Provider

Authorities who provide services like water, sewerage, electricity, telephone, roads, drainage etc.

# Waste Generator

Person or association of persons or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defence establishments who undertakes construction or demolition

# 6. Forms and Schedules in the rules

## Forms:

The rules prescribes five forms with fixed formats for the purpose of,

- ✓ Obtaining authorisation for processing facilities
- ✓Annual reports
- ✓Accident reporting

The forms prescribed in the rules are meant for,

- •C&D waste processing facility
- •State pollution control board
- •Local authority

Table 4: Summary of all the forms attached to the rule
--

S	Form	Purpose	Responsibility	Concerned	Information to be submitted
no	Name			Clause in	
				the rules	
1.	Form-I	Application	Operator of the	Rule 7(2)	✓Detailed proposal of
		for obtaining	facility		processing facility
		authorization			✓Plan for utilisation of recycled
					products
					✓Preventive plan for accident
					during collection,
					transportation, treatment and
					processing of C&D waste
2.	Form-II	Issue of	Member	Rule 7(3)	✓Name of the authorized
		authorization	Secretary,		processing facility
		to the	State Pollution		✓Addresses of administrative
		operator of	Control Board		office and processing site of
		C&D waste			the authorized processing
		processing			facility
		facility			✓Validity of the authorisation

S	Form	Purpose	Responsibility	Concerned	Information to be submitted
no	Name			Clause in	
				the rules	
3.	Form-III	Annual	Local Authority	Rule 8(2)	✓Quantity and composition of
		Report			C&D waste generated
		submitted by			✓Details of storage facilities and
		Local			transportation
		authority to			✓Information of Public Private
		SPCB			Partnership proposals made
					for processing C&D along
					with details of technologies
					used for processing
					✓Provisions made to check
					unauthorized mixing of C&D
					and MSW, filling of low laying
					areas, encroachment on river
					banks, wet bodies, parks,
					footpaths etc.
					✓Cases registered/settled
					against non-compliance by
					appointed legal entities
					<ul> <li>Vessels provided to slums for</li> </ul>
					collection of C&D waste
4.	Form-IV	Annual	SPCB/SPCC	Rule 8(3)	✓Number of municipal
		report			authorities in the state for
		submitted by			managing solid waste
		SPCB/SPCC			✓Summary statements as per
		to CPCB			Schedule-I and III in the
					rules. To be attached as
					Annex-I and Annex-II
					respectively with the annual
					report
5.	Form-V	Accident	Operation in	Rule 14	✓Type of C&D waste involved in
		reporting	charge of		accident

S	Form	Purpose	Responsibility	Concerned	Information to be submitted
no	Name			Clause in	
				the rules	
			facility in local		✓Date and time of accident and
			authority OR		sequence of events leading
			operator of		to accident
			facility		✓Assessment of effects of
					accident
					✓Emergency measures taken
					✓Steps taken to alleviate the
					effects and recurrence of
					accident

### Schedules:

There are three schedules in the rules,

**Schedule-I:** It defines criteria for site selection for Storage and Processing or recycling facilities of C&D waste. This schedule is applicable to rule 7(1) in the C&D waste management rules. The schedule describes administrative route through with suitable site for storage and processing of C&D waste will be selected and handed over to operators of the processing facility. It also mentions the site compliance criteria for the processing facility.



Figure 6: Administrative route for site selection and handover to operator of facility

After the land is handed over to operator of the facility it has to be developed in accordance with the compliance criteria's set in the rules. These criteria focus largely on abatement of pollution (air, water and noise) allow smooth movement of vehicles during operation of the processing facility. Figure 2 lists and summarises the criteria. It is the responsibility of local authority to monitor the compliance of these criteria in consultation with state pollution control boards.

Compliance criteria for processing facility
Minimum life of processing facilty to be 20-25 years
Facility to be away from habitation, forest areas, national parks, water bodies, manuments, places of important cutural historical or religious interest
For processing facilites > 5 tons per day buffer zone of no development to be maintained.
Facility to be fenced or hedged and provide a gate to monitor vehicles
Approach and internal roads to be concreted or paved
Weigh bridge, fire protection equipment to be provided at the facility
Provision of storm water to prevent stagnation of surface water
Prevention of noise pollution from processing plant.
Sewage treatment facility to be provided at the facility
Air quality to be monitored in the work zone of facility
Noise quality to be monitored at the boundary of facility
Vegetative boundary to be maintained around the boundry of facility

Projects utilizing at least 80% of C&D waste in-situ and have sufficient buffer area to protect surrounding habitation can be exempted from pollution norms of dust and noise

#### Figure 7: Compliance criteria for processing facility

**Schedule-II:** Defines parameters for application and compliance criteria of materials made from C&D waste in a sanitary landfill. The schedule mentions use of processed C&D waste in three ways at a sanitary land fill,



# Drainage Layer(leachate collection, Top cover system) & Capping

 Crushed and graded stone or concrete material between 2mm-4.75 mm standard seive size



# Daily Cover

- · Fines from processed C&D waste with sizes up to 2 mm
- Mandatory to use C&D waste if available
- Fresh soil except soil excavated during landfill construction shall not be used



# **Civil Construction**

 Non stuctural applications such as Kerb stones, paving blocks etc. made with C&D waste can be used

## Figure 8: Applications of materials derived from C&D waste

**Schedule-III:** Defines timeframe for planning and implementation of C&D rules. The time frame is effective from date of notification of the C&D waste rules i.e. 29<sup>th</sup> March 2016. The chart below provides the timelines of completion of compliance criteria by cities mentioned in the rules.



# Figure 9: Timeline of planning and implementation of rules

# 7. Duties of stakeholders

Stakeholders mentioned and defined in the rules are,

- •Waste Generator
- •Service providers and their contractors
- •Local authority
- •State Pollution Control Boards or Pollution Control Committees
- •State Government or Union Territory Administration
- •Central Pollution Control Boards
- •Bureau of Indian Standards and Indian Road Congress
- •Central Government

The rules define duties each of the above mentioned stakeholders.

# **Duties of waste generator**

- $\checkmark$  Waste generators as defined in the rules are responsible for,
  - ≻Collection
  - >Storage of C&D waste generated within their premises
- ✓ Ensure that solid waste does not get mixed with C&D waste
- ✓ Deposit C&D waste to collection centres OR processing facilities as designated and authorised by local body.
- ✓Ensure that there is no littering or deposition of C&D waste to prevent obstruction of traffic, public and the drains
- ✓Waste generators who generate more than 20 tons per day OR 300 tons per project in a month shall,
  - Segregate waste in to 5 streams:







3. Steel



4. Wood and Plastics



5. Bricks and Mortar

18

1. Concrete

2. Soil

- Submit waste management plan and approval from local authority before starting construction, demolition or remodeling work.
- Pay relevant charges for collection transportation, processing and disposal as notified by local authority.

### Duties of service providers and their contractors

- ✓ Prepare comprehensive C&D waste management plan for area within their jurisdiction
- Clean C&D waste in the work area every day in a reasonable timeframe depending on the duration of work and quantity and type of waste generated. This should be done in consultation with local authority.
- ✓Tie up with authorized agencies for cleaning of C&D waste if logistics support is not available.

### **Duties of local authority**

- ✓ Issue direction for management of C&D waste as per the rules within their jurisdiction and seek detailed plan or undertaking as applicable from generator of C&D waste.
- ✓ Chalk out stages, methodology, equipment required, material involved in the activities required after Construction and Demolition.
- ✓ Safely dispose C&D waste contaminated with hazardous, toxic or nuclear material after consultation with concerned authority.
- Make arrangement for collection of C&D waste and ensure that clean-up is done at regular intervals.
- ✓Get the collected C&D waste transported to appropriate sites for disposal or processing.
- ✓ Give incentives to generator for salvaging, processing and or recycling C&D waste preferably in-situ.
- ✓ Examine and sanction waste management plan of generators within one month or within date of submission and approval of building plan, whichever is earlier.
- ✓ Establish C&D waste generation database and update once a year.
- ✓ Device appropriate measures for management of C&D waste and use of recycled products in best possible manner in consultation with expert institutions,

- Create sustained system of IEC activities for C&D waste management through collaboration with expert institutes and civil society organisations and also disseminate through their own website.
- ✓ Give incentive for use of products made with recycled C&D waste in construction activities

# Duties of state pollution control boards or pollution control committee

- ✓ Monitor implementation of the rules by local authority.
- ✓ Give authorization to C&D waste processing facility in Form-III after examining the application in Form-I.
- ✓ Prepare annual report with special emphasis on implementation status of compliance of these rules and submit to CBCB before 31<sup>st</sup> July of each financial year

# Duties of state government or union territory administration

- Prepare policy document for management of C&D waste as per the rules and within 1 year of notification of C&D waste rules. The responsibility policy making lies with Secretary in charge of development in the State government or Union territory.
- ✓ **Provide land** for storage, processing and recycling of C&D waste.
- ✓ Inclusion of site in approved land use plan by Town and Country planning department.
- ✓Make procurement of materials made with C&D waste up to a certain percentage mandatory in municipal and government contract, subject to strict quality control

# Duties of central pollution control board

- ✓ Prepare operational guidelines for management of C&D waste.
- ✓Analyse and collate the data received from SPCB/SPCC
- ✓Co-ordinate with SPCB/SPCC for any matter related to development of environmental standards
- ✓ Submit annual compliance report to central government before 30<sup>th</sup> of August of each financial year based on reports given by SPCB/SPCC

#### Duties of bureau of Indian standards and Indian road congress

✓ Prepare code of practices and standards for use of recycled materials and products of C&D waste in roads

#### **Duties of central government**

- ✓ Facilitation of local bodies in compliance of these rules by MoUD, MoRD and MoPR.
- ✓ Review implementation of the rules when required by MoEFCC

#### 8. Challenges for Local Bodies to Implement the Rules

Construction waste management is still a new area to deal for local bodies defined under the C&D waste rules. The following challenges exists for implementation of rules,

- Estimation of C&D waste: Estimation of C&D waste in India is the basic challenge faced by ULBs since there are no monitoring mechanisms available with most urban local bodies in India. The unorganized demolition and transportation of waste makes it difficult to track the waste generation and hence it's estimation.
- Tendering a PPP contract to C&D waste processing and recycling unit: The rules

have mandated local bodies to device appropriate measures for a processing facility. To fulfill this requirement a local body should be adept in drafting an appropriate tender for the waste processing unit. Limited knowledge on C&D waste logistics and management sometime leads to inappropriate tendering which prevents entrepreneurs in investing on a processing plant. This key and important challenge for local bodies will be addressed in further sections of this manual.

 Tracking C&D waste generation and dumping: Another significant challenge for the local bodies is to track generation and dumping of C&D waste. The rules does not mentions about penalizing generators on non-compliance to the rules. It also does not specifically gives guidelines on a demolition permits at city level which will help track and document the generation of C&D waste. Local authorities can club demolition permits with the building permits for better tracking of demolition activities in the city. Investing in infrastructure such as GPS tracking of vehicles carrying C&D waste and weighing bridges at designated C&D waste dumping sites will help in transparent and efficient tracking and documenting C&D waste. Local bodies should either generate funds or be provided with some percentage of money required to install and manage this infrastructure from state or center.

# 4. Inventorisation of C&D waste in the city

# 1. Why do inventorisation of C&D waste?

Inventorisation of C&D waste is crucial for decision making on following

- ✓ Capacity and technology of C&D waste processing plant that should be installed
- ✓ Products that can be made from C&D waste
- ✓ Amount of funds that need to allocated for management of C&D waste
- ✓ Management practices to be adopted for C&D waste

## 2. Objectives of this section

At the end of this section reader will be,

- •Informed about methodologies of C&D waste inventorisation
- •Able to understand current challenges and gaps of C&D waste Inventorisation
- •Able to assess a C&D waste inventorisation approach

### 3. Overview of this section

- •Scope of Inventorisation
- •How to conduct inventorisation of C&D waste in your city?
- •Challenges in Inventorisation

#### How to estimate the generation of C&D waste?

The first step towards management of Construction and Demolition (C&D) waste is to quantify the C&D waste generated. Waste quantification models which has been utilised all over the world and other models available from literature review are presented here for better understanding and implementation for quantifying C&D waste at specific sites. However the accurate estimation of C&D waste depends on the availability and accessibility of data in cities and towns.

#### 1. Site visit method

This methodology requires investigators to visit the construction or demolition sites for a realistic survey. Measurements are conducted through weighing C&D waste directly on site where onsite interviews are conducted with professionals for fine tuning the estimated generation. Although this method this method is very practical and suitable for measuring waste produced from all of

the waste generation activities, it not appropriate for estimating the C&D waste generation at a regional level because of the high requirement of time, labour and money<sup>i</sup>.

#### 2. Per-capita multiplier

Per-capita multiplier is one of the earliest methodologies developed from methodologies that were used to quantify municipal solid waste (MSW). Per-capita multiplier is an easy way to quantify C&D waste as this method is based on population statistics of the region and C&D waste generation data available with local authorities This type of estimation is less reliable as it often leads to more than 10 folds variation in the quantity estimated.

#### 3. Waste Generation rate model

Waste generation rate model is widely used by researchers around the world to estimate the quantity of waste generated in the city. In this method, the amount of construction and demolition activity happening in the sector has to be estimated and an appropriate activity specific waste generation rate has to be multiplied with the quantum of activity to get the total estimate. Statistical data such as number and the area of waste generation has to be collected for estimation in this model.

Estimation based on waste generation model<sup>ii</sup>

$$Q = \sum \sum \sum A_i * q_{jk} * p_k$$

Where

**Q** is the total quantity of demolition waste generated in a region (in kg);

**A**<sub>i</sub> refers to the total amount of demolition activity in the i<sup>th</sup> part of the region (sq.m.);

i is the number of parts or zones in the region;

**q**<sub>jk</sub> is the waste generation rate of j<sup>th</sup> type of major material from k<sup>th</sup> type of building(Kg/sq.m.);

m is the number of major materials

 $\mathbf{p}_{\mathbf{k}}$  refers to the proportion of the k<sup>th</sup> type of building in the region; and

 ${\bf n}$  is the number of different types of building in the region

### 4. C&D Waste estimation survey for cites and towns

Although an estimated 10-25% of the total MSW generated in Indian cities is considered as C&D waste, quantification of Construction and Demolition waste is regarded as a pre-requisite for successful implementation of C&D waste management in a city, since the waste characteristics changes in each locality and geography. The selection of most appropriate

method for processing or management is recommended based on the quantification study, region specific conditions and needs.

The above mentioned methodologies are for site specific estimation of waste. For a city/town scale estimation of waste generated a different scale of estimation is required. Specific field study need to be undertaken to identify the following critical factors that affect the waste generation in a city including

- •Age of buildings
- •Construction / Demolition / Recycling / Reusing practices
- •Type of building materials used

A study need to be conducted in the city which includes, detailed data collection on the critical factors based on a survey on a selected sample size (case studies), the data collected need to be later analyzed through extrapolation of data over quantity and time to generate the quantity of C&D waste generated and the characteristics of C&D waste that reached the dumpyard/landfill (the percentage and quality of waste that reach the landfill need to be analysed).

#### 5. Construction and Demolition Permit Method

The ULB can utilize demolition, construction permits also to quantify an annual generation of C&D waste. A model format of the permit as Annexure 3. If the ULB do not have demolition permits, byelaws need to be amended by the ULB to implement those. If the total area of construction or demolition is known the quantity of C&D waste can be calculated using the TIFAC formula.

#### **TIFAC Thumb Rule Method**

According to the Technology Information, Forecasting and Assessment Council's (TIFAC's), thumb rule (TIFAC, 2013), a new construction generates 40-60 kg of C&D waste per sq m, on an average 50 kg per sq m. The waste produced per sq m of demolition is 10 times that generated during construction which is around 300-500 kg of C&D waste per sq.m. and for building repair/renovation TIFAC estimates that it produces 40-50 kg per sq m of waste. Therefore the estimates of waste

TIFAC Th	umb Rule
	Estimated
Type of	Waste
Activity	Generation
	(Kg/sq.m)
Construction	50
Domolition	400
Demonuon	100

generation can be calculated depending on the type of activity such as Construction, Demolition and renovation. The total built-up area of construction, demolition and renovation collected from demolition, construction and renovation permits can be multiplied by the TIFAC thumb rule to have an approximate waste generation for the city.

# 5. Collection, Transportation and Disposal of C&D waste

# How to Collect and transport C&D waste?

## Collection

**Existing Practices** – C&D waste in most ULBs is not collected or transported in an orderly manner. The waste is either collected by a random transportation contractor and used for

backfilling elsewhere or dumped on unfenced land which is mostly illegal. Some municipalities have designated landfills for disposal, where the waste generator has to dump waste at his own arrangements which in most cases is not practiced since it is either far away on outskirts of city or the designated area is not known to the waste generator due to improper communication by the ULB. Among the ULBs which have a collection yard a few have a proper tracking system by means of weigh bridges.

**Changes to be adopted** - As per new rules C&D waste should be kept in the generator's compound and then transported to designated disposal site prescribed by the local

transported to designated disposal site prescribed by the local governing body.

# **Transportation**

The C&D waste should be segregates and stored at the site of generation and transported in a covered manner to the designated location on self-arrangements or through other systems provided by ULB, whichever is mentioned in the by-laws of the city council. Either way both the generator and the transporting body should maintain records of the quantum of waste transported to the dumping area. The local governing body could also provide fenced transfer stations as designated dumping units to facilitate easy transport of waste for the generator. The waste reaching the designated transfer stations of the ULB should be recorded and transported by the governing body to the final dumping (only for productive purposes) or processing site.

C&D waste is transported from the site by trucks or tractors to disposal sites by paying a minimal fee to the transporters. These transporters can be private or empanelled with the ULB. The ULB transports the waste to the disposal site from these points or contracts with private contractors to do so. Vehicles carrying C&D waste should be covered to avoid dust, air pollution and spilling of debris on roads. Larger quantum of waste (more than 2 Tons) should be transported only by empanelled trucks registered with the ULB and they should be available to the public to utilize. These trucks can also be enabled with GPS devices for tracking of waste

Weighbridge is a a platform used to weigh very heavy objects like trucks. The weight of trucks is mostly weighed on a loaded and unloaded situation in order to measure the load it carried. The sensors under the weight bridge measure the reading which is captured electronically or digitally and flow from the collection points or demolishing site to the waste processing facilities. The waste needs to be quantified at disposal or processing site by weighing of trucks.



Figure 10A: Material and cash flow for a planned C&D waste management in a city with processing unit



Figure 10B: Material and cash flow for a planned C&D waste management in a city without processing unit

#### Tracking of waste transportation (monitoring)

The transportation of waste can be monitored through the use of permits. Before a demolition, the generator should apply for construction, demolition and renovation permit with filled in information on the estimated quantity of waste to be generated and the waste management plan. The permit request will be verified by the ULB and an upfront payment should be submitted to the ULB by generator of C&D waste. As mandated by the new rules the charges should be designated by the ULBS. The payment includes C&D waste management, transportation and processing charges and a refundable safety deposit. The permit is granted only after the site visit and verification by the sanitary officer or designated person by ULB. The permit should contain a tracking code which can be used to track the quantities of waste picked up from the site and quantities reaching the designated processing or dumping location and hence discourage illegal dumping on the way. The weighing of C&D waste can be done either at weighbridges designated by ULB or at the C&D waste processing and intermediate dumping facility and the weight should be recorded. The weight slips need to be maintained by the generator / transporter so that the ULBs can verify the weigh slips with the amount of C&D waste mentioned in the permit.

If there is a processing facility in the city, it should weigh the incoming waste and inform ULB in real time about the details of generator and quantities of waste based on demolition permits

If there is no processing facility in the city, the municipal corporation should record the incoming waste at the intermediate dumping locations based on the weigh slips furnished by the generator.

A waste generator can apply for refund to the ULB based on the permit and weighing slips if the waste is transported at his own cost. ULBs upon verification of information and documents can refund the transportation charges to the generator from the deposit collected for generation of C&D waste. The provisions for the above mentioned monitoring process can be included as bylaws by ULBs. . It is advised that all the data is stored in digital form and in cloud system at the processing units / designated locations to ensure ease of data access to ULBs. Developing an online portal for accessing live data for the generator using their demolition permit number will make the system more user friendly.

#### Land requirements

Establishment of dedicated disposal sites or transfer stations demand land area for improving the system of collection and transportation of C&D waste. The state government or the concerned Urban Local Body (ULB) is responsible for identification of place needed to set up transfer stations or disposal sites. Setting up of collection points is one of the key components of waste disposal practices. The presence of more than one transfer station per zone is suggested for an efficient management system. The establishment of more transfer stations will make the transportation process easier for corporation thereby reducing the distance of travel for small generators of waste. In big cities, where there is an unavailability of large lands for the use of transfer station, setting up of small transfer stations with an average size is recommended. However, having an appropriate system in place to comply with C&D waste disposal plan is crucial.

The area required for transfer station and processing facility depends on the waste generated and size of plots available, which needs to be decided by a feasibility study and city engineering department.

For example, Delhi has 168 C&D collection points / transfer stations and Ahmedabad has 16 designated collection points. In case of space constraints, a transfer station with a lower storage capacity can be set up in a land space of about 500 sq.m. In such a case, it is recommended that two transfer stations be set up in a high generation zone.

The land chosen for setting up of processing facility needs to have adequate facilities such as proper access roads, compound wall, entrance gate, administration building, warehouse for storage of value added products, underground water tank (sump), IT systems, electrical connections, support structures etc. The detailed criteria for cite selection for Storage and Processing or Recycling Facilities for Construction and Demolition Waste is mentioned in Schedule I of the C&D waste rules 2016.

For cities with higher waste generation capacity of 4000-5000 TPD, may need more than one processing facility in different zones and for cities with a generation capacity of 1000 TPD or less can have a single centralized processing facility. In small towns where the generation of C&D waste is low, using a mobile crushing unit for processing C&D waste is encouraged. Mobile crushers come in all sizes and processing capacities starting from bobcat machine sized crushers with a processing capacity of around 5 TPH and higher. Since the entire assembly line needs to be mounted on mobile units the processing capacity of these units will be comparatively limited to around 200 TPH. As the mobile crushing units have an advantage to moving around, small towns can fund and utilize this facility for processing operations. The option of having a jointly funded common facility can also be considered for a cluster of small towns. However, the maximum travel distance from generation to processing should be 30 k.m

### Disposal

**Existing practices** – C&D waste is mostly being disposed in MSW dumpyards or landfills mostly plain land in many Municipalities it is also filled inside MSW landfill, in which case it occupies huge spaces and reduces capacity of the landfill, but it is also used as daily cover in MSW landfills. Although only a minimum quantity of C&D waste generated is reaching the ULB landfills. A huge portion of the waste is disposed of in low lying areas, open grounds, road sides or any other unguarded open space in the city

**Changes to be adopted** – The C&D waste that comes out as a waste product after processing need to dumped into a separate sanitary landfill and should not be mixed with other MSW waste. The hazardous C&D waste need to be dumped in a hazardous waste landfill. C&D waste should not be allowed to be dumped in the landfills before recovering useful materials from the waste stream.

More than 90% of the C&D waste composition in Indian cities can be processed/recycled and reused as secondary raw materials. Even for cities which do not have dedicated recycling facilities, the C&D waste debris should be disposed at designated dumping sites which provides an opportunity for recycling them in the future

# 6. Processing and Utilisation of C&D waste

The Construction and Demolition (C&D) Waste recycling is still in its infant stage in India. However its potential to be implemented in a large scale is clearly visible due to the present and projected infrastructure developments by 2020. The construction and demolition activities spurring out as a result of the growing economic activities generates huge amount of waste each year which were seen to be often disposed in landfills. In 2015, the urban C&D waste generation in India was estimated to be 716 million tonnes and is projected to increase to 2.7 billion tonnes per annum in 2041. The sensitization of C&D waste is slowly gaining momentum in the recent years due to the rising cost of materials (Sand, stone and gravel) used for construction in addition to the labour and waste disposal costs. This scenario strongly favors the use of secondary raw materials which can be recovered from waste stream and reused in all applicable areas across the sector.

#### How to process C&D waste?

**Existing practices** – Mostly C&D waste is not processed. In a handful of ULBs in India waste is processed into secondary raw materials, which are used to make non-load bearing building materials.

**Changes to be adopted** – The C&D waste which does not get reused is usually consists of debris and inert. The waste could be segregated and processed into crushed aggregates of different sizes and used in variety of applications which include paver blocks, aggregates of concrete, GSB layer and many other applications depending on the characteristics of the material and the market demand

#### Construction and Demolition (C&D) waste processing in India

The Construction and Demolition waste occupies a major share of the total waste mass in almost all developed and developing counties. In many countries a huge portion of the C&D waste is processed and utilized as a raw material then being dumped into a landfill. In the recent times, because of stringent environmental laws being enforced and the changes being made to the MSW Management rules in the country, processing of C&D waste is also gaining popularity in Indian cities.

#### Technologies for C&D waste processing

Since Indian C&D waste (that reaches the landfill) basically consist of debris of concrete, mortar, bricks and tiles, the processing usually just involves crushing, downsizing the material, washing and sieving it into uniform sizes aggregate particles, that can substitute primary aggregates in the construction market. The processing method is very similar to a stone crushing process and uses the same machinery and equipments used in the stone crushing industry. C&D processing units can be basically classified into two types, Stationary crushers and Mobile crushers.

#### Stationary processing unit

Stationary C&D waste processing unit is an assembly of crushing, sieving and washing machinery interconnected by conveyer belts for material movement. The machinery are housed on steel/concrete platforms on a permanent basis. The crushing units will also have dust control systems, noise control systems, magnetic separator devices and other additional devices based on the requirements. The systems are either semi-automated or completely automated units. The capacity of the processing units also varies according to the need from 100 TPD – 2000 TPD or even more.



Figure 11: C&D Waste Processing Facility, AEP Pvt ltd, Ahmedabad, 1100 TPD Processing Capacity

#### Mobile crushing units for C&D waste recycling

Mobile C&D waste crushing units today, finds its use very occasionally in Indian cities but with the rapid urbanization trends, it can be seen as a successor to the stationary C&D crushing units. The technology is very similar to the stationary processing unit but all the equipment will be mounted on top of customized mobile unit/truck. The concept involves integrating all the equipments on one truck, which has a customized chassis and body compared to conventional trucks. This kind of design provides the flexibility to ensure that the crushing station can be

easily transported by and moved to construction/demolition sites to enable on-site crushing without the transfer of materials from one place to another, saving significant transportation costs given the quantity of waste to be processed is large. The feasibility of the technology also depends on the use of finished product, distance to be transported, availability of labour and nature of waste (segregated waste). Mobile crushers come in all sizes and processing capacities starting from bobcat machine sized crushers with a processing capacity of around 5 TPH and higher. Since the entire assembly line needs to be mounted on mobile units the processing capacity of these units will be comparatively limited to around 1000 TPD.



Figure 12: Zenith Mobile C&D Waste Crusher, 40TPH processing capacity

#### Technology Option for small towns and cities

For small cities and towns, which generate very less quantity of waste different approaches may be adopted for waste management and utilization. C&D waste recycling is new in India, experience from the first few recycling units has shown that a centralized stationary processing facility is financially viable only for waste generation above 100 TPD. However as the market and business models mature stationary processing facilities might be viable for smaller capacities also.

Although mobile crushing units are a viable decentralised model that could be adopted by small cities, such kind of a facility is not recommended for cities generating C&D waste quantities less than 20-30 TPD. For such cities, the following processing technologies are recommitted.

#### Mini Mobile Crusher

The utilisation of mini mobile crushers is a practical solution for ULBs generating less than 1 or 2 truck loads of C&D waste per day. The mini-crushers with processing capacities of around 5TPD can be maintained by the ULB for processing waste into finer secondary raw material or the mini crushers can be maintained by designated pre-cast concrete building material manufacturers, to whom the C&D
waste can be delivered as business models similar to what is being trialed out by FMCs in India can be adopted to process C&D waste (www.fmc.org.in/dstpaverblock)





Figure 13: Red Rhino Mini Mobile Crusher, 5TPD processing capacity (left). Customised foundry slag crushing device (right)

#### Cluster processing approach

A cluster approach for processing C&D waste is also feasible if ULBs sharing close boundary can operate a common C&D waste treatment facility. The stationary facility can be located at a common region accessible or equidistant from multiple ULBs. The facility can be maintained by a single ULB and other ULBs can supply C&D waste on a prorate based on a written agreement. Urban Development Authorities responsible for management for multiple ULBs (e.g Chennai Metropolitan Development Authority can also be adopt this kind of approach.

Optionally the cluster can also operate a mobile crushing unit that can be shifted between ULBs over fixed duration of days based on a written agreement. The material can be stockpiled in each ULB until a sufficient quantity is stocked to bring in the machine and process the C&D waste over a specific time period. Both the above mentioned approaches are suggested for ULBS sharing close boundary within 20 -30 kms.

#### Secondary Construction Materials from C&D waste



Figure 14: Processing of C&D waste to develop secondary construction raw materials

#### Secondary Construction Raw materials

The C&D waste processing is basic crushing, washing and segregation of C&D waste where the C&D waste debris is converted into smaller size aggregates of uniform size and nature. The processing of stones, concrete chunks, brick bats, excavated soil, sand and mortar can result in multiple products including construction coarse aggregates ( 6mm, 10mm, 16mm etc), construction fine aggregates ( M-sand, dust) and clay soil. The product line depends on the market requirement and the associated processing efficiency and technology used in the processing unit.







Figure 16: Process outlay for processing of C&D waste into secondary raw materials

#### **Product Development**

The aggregates processed from C&D waste can be used for manufacture of a huge variety of secondary building materials. The building material development from secondary raw material needs to be based on **proper market assessment for the products in the city.** The product development also depends on the characterization of the local C&D waste. A list of products that can be developed from processed C&D waste has been attached as annexure (refer annexure 4). The details structural and nonstructural application of C&D processed C&D waste has been mentioned in C&D Waste Management Rules India 2016 (refer annexure 2)

Very large aggregates	Replacement of primary aggregates for sub-base layer
Coarse	Replacement of virgin aggregates and sand for non structural construction application
Aggregates & Fine aggregates	Replacement of virgin aggregates and sand for street furniture
The apprepares	Partial replacement of virgin aggregates and sand in load beading structural application
Clay and silt	Manufacture of compressed earth blocks to replaced burned clay bricks

Table 5: Utilisation of processed C&D waste

#### National Building Code (NBC- CED 46) of India 2005 : Part 11 of NBC 2005

'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.ii. Up to 30 percent of natural crushed coarse aggregate can be replaced by the recycled concrete aggregate
- iii. 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.

# **Products and Certification**

One of the main issues faced by C&D waste processing units in India is selling of the products made with processed waste. To ensure enhanced sales of C&D waste based products there are two approaches that can be adopted,

- 1. Preferential buy back by government and private construction
- 2. Green labelling of products

The preferential procurement is dealt in a greater detail in following sections of this manual. Green labelling of product is another very effective approach in increasing uptake of these products in the market. One of the most popular green product label in India is GRIHA (Green Rating of Integrated Habitat Assessment). GRIHA has a set system of green labelling of products. A product is assessed on one of the following criteria, recycled content, embodied energy, permeability and quality. Once green labelled a product is added to a 'GRIHA product catalog' which is a repository of green products in India and their manufacturer's details. Any building aspiring to attain green features or green certifications can use any of the products mentioned in the catalog and earn points for their green building certificate. Thus green labelling will provide C&D waste based products a bigger market for sale. This will help in increasing the demand for recycled products and ensure higher utilisation of C&D waste.

# 7. Elements of Tendering

# **Section 1: General Information**

ULB shall invite tenders from eligible bidders for Collection, Transportation, Storage, Processing and Recycling of agreed amount of (\_\_\_\_\_ TPD) of CDW based on a Design, Finance, Build, Operate, & Transfer (DFBOT) contract.

**Concession period** should be 25 years, with review every 5 years. After 25 years, review will lead to continuation, modification or termination.

## ULB shall adopt 3-stage bidding process:

Criteria 1: Eligibility

Criteria 2: Technical Proposal

Criteria 3: Financial Proposal

#### **Eligibility Criteria:**

- •Registered company. Written agreement of all members, if consortium is bidding.
- •Satisfactorily completed in the last 5 years at least one project on civil engineering construction, building materials manufacture, or waste management and recycling projects worth INR \_\_\_\_\_.
- •Owned or leased a minimum number of \_\_\_\_\_\_ trucks in good condition.
- •Achieved in last two financial years a minimum financial turnover of INR \_
- •Demonstrated availability of Liquid assets and/or availability of credit facilities of no less than INR \_\_\_\_\_.
- •Not have been disqualified by any government authority, or have record of poor performance.

Pre-tender queries, site visits, and tender amendment protocol shall be communicated by ULB.

Costs associated with tendering and method of payment shall be stated by ULB for bidders.

## Section 2: Scope of Work

**Project area:** ULB shall clearly delineate project boundary, transportation routes and location of sites with clear maps.

**Waste generation:** ULB shall have estimated average availability of CDW in the project area from bulk generators and open spaces in TPD. Data on trends, seasonal variations, etc. to be provided by ULB. Bidder shall plan for CDW expected over next 25 years.

**Minimum waste assurance:** ULB shall ensure that the bidder will be the sole agency responsible for collection of CDW in the project area. The ULB shall assure the bidder a

minimum quantity of CDW on a monthly/quarterly basis to ensure financial viability of the project. If minimum guaranteed amount is not met, the ULB shall provide monetary compensation to the bidder at a rate quoted in the tender by the bidder.

**Waste composition and acceptability:** ULB shall communicate the typical composition of CDW in the project area along with degree of expected variation. This will help determine acceptability criteria based on non-CDW streams (more than \_\_\_\_\_% non CDW) or presence of hazardous materials.

## Collection of waste:

- •The bidder shall set up a toll free helpline for CDW generators which will be advertised by the ULB and bidder.
- •ULB shall share the mandatory CDW Management Plan of bulk generators within the project area with the bidder on a regular basis.
- •The bidder shall be responsible for collection of CDW from bulk and small generators as well as from open spaces within the project area as notified by the ULB. Collection should take place within an agreed upon timeframe.
- •The ULB shall pay the bidder for CDW waste collection and transportation at a rate quoted in the tender by the bidder.
- •CDW brought to collection centres or processing facility by the ULB or private generators shall be accepted free of charge by the bidder, provided minimum acceptability criteria are met.

# Transportation of waste:

- •Bidder shall arrange for adequate number of vehicles that are appropriate for the proper collection and transportation of CDW.
- •Vehicles used for transporting CDW should be GPS enabled.
- •ULB shall provide the guidelines for the timing and routes for transportation of waste.

## **Collection centres:**

- •ULB shall identify and allot an adequate number of land parcels within the project boundary to the bidder to serve as intermediate CDW collection centres. The number and distribution of such parcels shall be determined in the ULB's CDW Management Plan. The bidder shall be responsible for maintaining and operating these sites on a DBOT basis.
- •The bidder shall use these sites for inspection, sorting, and storing of CDW, pending transfer to the processing facility. The bidder may choose to develop these sites through the provision of necessary facilities at own expense.

## **Processing Facility:**

•ULB shall identify and allot a land parcel to serve as CDW processing facility. The size of the parcel shall be determined based on the estimated amount of the CDW generation in the project area as assessed in the ULB's CDW Management Plan.

- •Bidder shall be responsible for undertaking necessary site development, design and construction of equipment and infrastructure necessary for weighing, sorting, and processing of CDW and manufacture of finished products.
- •Bidder shall be responsible to accurate weighing of incoming and waste and record keeping of such data.
- •Bidder shall be responsible for maintenance and operation of the facility in accordance with applicable safety and environmental rules.
- •Bidder shall arrange for appropriate management and disposal of any hazardous waste. Bidder shall also arrange for disposal of any unrecovered/unutilized waste to the nearest sanitary landfill.

#### **Recycled Materials:**

- •Bidder shall be free to sell recovered materials and manufactured building products from the facility as market permits.
- •Bidder shall ensure that such products meet applicable BIS standards and any other standards recommended for green building products.
- •ULB shall help to promote procurement of such green building products in public projects.

**Reporting:** The concessionaire will be required to keep accurate records and report to the ULB on quantity and characteristic of incoming C&D waste, rejected waste, hazardous waste management, sale of products and disposal of unutilized residue to landfills at a frequency determined in the concession agreement.

**Permission and Clearances:** The concessionaire will be responsible for obtaining all required permissions and clearances from State Pollution Control Board and any other concerned government agencies.

**Review:** The agreement will be reviewed every 5 years. The review may lead to continuation, modification, or termination of agreement, as mutually agreed.

#### **Section 3: Tendering Process**

**Document preparation and submission:** All documents must be prepared in prescribed format and necessary supporting documents must be provided. Submission of all documents must be done in the accordance with the prescribed method within the stipulated deadline. Any errors, inadequacies, or delays will lead to rejection of bid.

**Fees and Money Deposit:** Transaction fees must be paid in prescribed format. An Earnest Money Deposit (EMD) of Rs. \_\_\_\_\_ shall be paid as a Bank Guarantee in the prescribed format. The EMD of unsuccessful bidders will be returned within 20 days of the end of tender validity. The EMD of the successful bidder will be discharged when the bidder has signed the Concession Agreement and furnished the required Performance Security Deposit.

**Evaluation of Tenders:** The ULB shall open all pre-qualified bids on date notified. The ULB has right to reject any bids that are incomplete or inadequate. Bids shall be scored based on technical proposal and only those meeting the ULB's threshold will have their financial proposal considered. The ULB may ask bidders for further information and/or clarification on both technical and financial proposals, if necessary. The entire process shall remain confidential.

**Award Criteria:** The bids will be evaluated on QCBS (Quality cum Cost Basis). Bid with the highest aggregate score comprising 80% (total weighted score based on technical proposal) + 20% (total weighted score based on financial proposal) will be the winning bid.

In the financial proposal, bidders will quote two prices as follows (for details, refer to Template document):

- a)Rate to be paid by ULB to bidder for collection and transport of C&D waste (INR/tonne with distance range), and
- b)Rate to be paid by ULB (INR/ tonnes) to bidder as compensation against minimum quantum of waste assured.

**Award and Agreement:** The winning bidder will be notified by the ULB in writing. The notification of the award will form the basis of the Concession Agreement subject to the furnishing of Performance Security Deposit. When this requirement is met, the ULB shall promptly notify other bidders that their bids have been unsuccessful.

Within 20 days of receipt of the award notification, the successful bidder shall deliver to the ULB a **Performance Security Deposit** for construction in the form of a bank guarantee for an amount equivalent to 5% of the accepted project set up cost. This will be refunded after 1 year of plant operation. Further, prior to commercial operations, the bidder shall provide Performance Security Deposit for operation in the form of a bank guarantee for an amount equivalent to 5% of the estimated operational cost for subsequent 5 years. This will be refunded after the project review at 5 years, and fresh bank guarantee will be required to cover the next 5 years of operation.

Upon receipt of the bank guarantee, the ULB shall prepare a detailed **Concession Agreement** between the ULB and the successful bidder. The agreement will include all the terms and conditions for operating the C&D waste management system and processing facility. Within 45 days of award notification, the successful bidder shall form a **Special Purpose Vehicle** (SPV) for execution of the Concession Agreement. The agreement will be signed between the ULB and the SPV within 60 days of award notification.

# 8. Monitoring and Supporting Policies

The management of C&D waste is crucial for any city, realizing this, Governments and policy makers around the world have enacted policies that induce the practices that favor reuse/recycle. In the Indian scenario, the MoEFCC has drafted a new set of rules in 2016 exclusive for C&D waste providing the guidelines on handling the C&D waste being generated. According to the new C&D waste management rules, the various stakeholders of the C&D waste have been assigned specific duties for management of generated waste. The strict enforcement of rules combined with regular monitoring procedures and supporting policies can serve as effective systems for the management of C&D waste.

# Monitoring

A series of monitoring and inspection mechanisms should be in place for disposal practices of C&D waste in order to prevent unauthorised dumping. For example when applying for a building demolition permit, the owner or developer can be given an evaluation report by the demolishing contractor which estimates the amount of waste that is expected to be generated and based on the generation estimates, the generator needs to be pay an amount as monetary deposit. On paying the deposit, the permit for demolition/renovation is issued. Simultaneously, the developer informs the contractor that the waste must be handled by the designated processing facility established in the city. Once the construction work is completed, the waste processing facility gives a certificate for correct management of waste handled and on producing this certificate at the town hall, the waste delivered by the developer is verified with the waste treatment plant and the monetary deposit is refunded. This type of tracking systems involves multiple stakeholders but ensure proper disposal and handling of C&D waste. For effective monitoring, the government can make use of extensive IT systems such as GPS tracking of vehicles and centralized data entry for movement of waste streams from one place to another besides appropriate tests and inspections.

## **Supportive Policies**

The presence of supportive policies in place to ensure sustainable waste management practices can trigger the growth of the recycling industries. A few Indian cities have already implemented or designed such policies to create an environment favorable for carrying out C&D waste recycling facilities. Some of the suggested and implemented policies for C&D waste management are discussed below,

**A. Preferential procurement/Buy-Back Policy for finished C&D waste products:** This is the most important and effective policy in encouraging and ensuring successful business of C&D waste management in a city. A ULB or a state urban department should preferentially buy back certain percentage or certain type of products made with C&D waste. This will give an ensured business to the processing unit and also encourage the use of recycled material in construction projects. For example, a preferential procurement policy for purchasing final products from C&D waste processing unit has been adopted by the Ahmedabad Municipal Corporation (AMC).

Under this policy minimum 50% of tender total quantity of requirement for paver block for its own various civil works as per the Schedule of Rates will be purchased by AMC.

**B. Notify demolition permit in the city:** The notification of demolition permit will serve as an effective tool for monitoring and financing management of C&D waste. Rajkot Municipal Corporation has issued a resolution to collect demolition waste charges upfront at the time of giving building permits.

C. Ban landfilling of C&D waste: As discussed earlier C&D waste mixed with MSW losses its recycling value. Hence ULB should ban dumping of C&D waste in an MSW landfill.

**D.** Provision to use recycled aggregate in concrete in codes and specifications: Use of recycled aggregates has been allowed in the recently amended IS code 383 by Bureau of Indian Standards. Thus C&D waste aggregates can be used in concrete.

# 9. Best Practices

Pilot initiatives in Delhi, Ahmedabad and Bengaluru have shown that C&D waste can be recycled and reused in construction. While such efforts are commendable, good practices across the world offer lessons for developing, implementing and sustaining an effective C&D waste management system. Several initiatives from across the world show the way to counteract the challenges faced by India in the management of C&D waste.

#### C&D waste recycling plant, Burari, Delhi

Delhi Municipal Corporation is the pioneers in India to initiate an integrated C&D waste recycling unit in a ULB level. The recycling facility in Burari, Delhi is installed, operated and maintained on a Public Private Partnership (PPP) basis between the Delhi Municipal Corporation and Infrastructure Leasing & Financial Services Private Limited (IL&FS Pvt Ltd).

The processing plant of 2000 TPD processing capacity was commissioned in 2010 and running successfully ever since, is an excellent case study for business models that could be adopted across India.

500TPD of C&D waste is collected from designated disposal sites by IL&FS. If the waste is not made available for collection, ULB has to bear the cost which has been agreed in the contract. Currently the waste is processed at a rate of 1000TPD and the processing technology includes both dry processing and wet processing. Around 95% of C&D waste is recycled and processed into aggregates and M-sand. Utilising the recycled materials the unit produces finished products including kerb stones, paver blocks, concrete bricks and precast reinforced cement concrete structures like drain slabs, roofing structures etc. The materials have tested and approved by Bureau of Indian standards (BIS) for usage in construction applications



Figure 17: Photo of Burari C&D waste processing plant

Recycling of C&D waste is has bared a multiple fruit bearing tree which solves the issues of handling the C&D waste (which under existing circumstances could not be processed with Municipal Solid Waste) and also getting an additional source of revenue by sale of recycled products. The treatment plant in Burari is the first of its kind in India but taking lessons from the initiative, several Urban Local Bodies from different parts of India are planning to process their C&D waste. Owing to their success in Burari, Delhi Municipal Corporation has commissioned 3 other recycling units of which a 500TPD processing plant has already started operation in Shasthri Park

#### C&D waste recycling plant, Ahmedabad

Following the success of DMC the Ahmedabad Municipal Corporation (AMC) has also initiated to install and operate a Construction & Demolition (C&D) Waste Recycling unit with a processing capacity of 1100 TPD. However the unit is currently operating at 300 TPD.

AMC has started the initiative and is running the project on PPP basis from June 2014, where C&D Waste is processed and recycled into aggregates which in-turn is used to prepare finished products including paver blocks, Curb-stones, Concrete tiles, prefabricated structures etc.



Figure 18: Photo of Ahmedabad C&D waste processing plant

AMC is presently processing 300 TPD of waste and the finished products are mainly used in government projects. Paver blocks are used for paving footpaths for road projects and even in other infrastructure projects, precast structures like slabs, precast toilets, precast sculptures etc are also used in other construction projects by the Urban Local Body (ULB).



Figure 19: Photo of aggregates produced at Ahmedabad C&D waste processing plant

The product is being sold under the trade-name Nu-Earth materials. Nu-Earth Curbstones, Nu-Earth Rubber Mould Paver Blocks, Nu-Mould Steel Mould Paver Blocks and Nu-Earth Hollow bricks are few among the many fast moving products in the market. being sold under the trade-name Nu-Earth materials. Nu-Earth Curbstones, Nu-Earth Rubber Mould Paver Blocks, Nu-Mould Steel Mould Paver Blocks and Nu-Earth Hollow bricks are few among the many fast moving products in the market.

Annexure 1

C&D Waste Management Rules 2016

#### [Published In the Gazette of India, Part-II, Section-3, Sub-section (ii)] Ministry of Environment, Forest and Climate Change

#### **NOTIFICATION**

# New Delhi, the 29<sup>th</sup> March, 2016

**G.S.R. 317(E).**-Whereas the Municipal Solid Wastes (Management and Handling) Rules, 2000 published vide notification number S.O. 908(E), dated the 25<sup>th</sup> September, 2000 by the Government of India in the erstwhile Ministry of Environment and Forests, provided a regulatory frame work for management of Municipal Solid Waste generated in the urban area of the country;

And whereas, to make these rules more effective and to improve the collection, segregation, recycling, treatment and disposal of solid waste in an environmentally sound manner, the Central Government reviewed the existing rules and it was considered necessary to revise the existing rules with a emphasis on the roles and accountability of waste generators and various stakeholders, give thrust to segregation, recovery, reuse, recycle at source, address in detail the management of construction and demolition waste.

And whereas, the draft rules, namely, the Solid Waste Management Rules, 2015 with a separate chapter on construction and demolition waste were published by the Central Government in the Ministry of Environment, Forest and Climate Change vide G.S.R. 451 (E), datedthe 3<sup>rd</sup> June, 2015 inviting objections or suggestions from the public within sixty days from the date of publication of the said notification;

And Whereas, the objections or suggestions received within the stipulated period were duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by sections 6, 25 of the Environment (Protection) Act, 1986 (29 of 1986), and in supersession of the Municipal Solid Wastes (Management and Handling) Rules, 2000, except as respect things done or omitted to be done before such supersession, the Central Government hereby notifies the following rules for Management of Construction and Demolition Waste –

**1. Short title and commencement.-**(1) These rules shall be called the Construction and Demolition Waste Management Rules, 2016.

(2) They shall come into force on the date of their publication in the Official Gazette.

**2. Application.**-The rules shall apply to every waste resulting from construction, re-modeling, repair and demolition of any civil structure of individual or organisation or authority who generates construction and demolition waste such as building materials, debris, rubble.

**3. Definitions** –(1) In these rules, unless the context otherwise requires,-

(a) "ACT' means the Environment (Protection) Act, 1986 (29 of 1986);

(b) "construction" means the process of erecting of building or built facility or other structure, or

building of infrastructure including alteration in these entities,;

- (c) **"construction and demolition waste**" means the waste comprising of building materials, debris and rubble resulting from construction, re-modeling, repair and demolition of any civil structure;
- (d) **"de-construction"** means a planned selective demolition in which salvage, re-use and recycling of the demolished structure is maximized;
- (e) "demolition" means breaking down or tearing down buildings and other structures either manually or using mechanical force (by various equipment) or by implosion using explosives.

## (f) "form" means a Form annexed to these rules;

- (g) "local authority" means an urban local authority with different nomenclature such as municipal corporation, municipality, nagarpalika, nagarnigam, nagarpanchayat, municipal council including notified area committee and not limited to or any other local authority constituted under the relevant statutes such as gram panchayat, where the management of construction and demolition waste is entrusted to such agency;
- (h) "schedule" means a schedule annexed to these rules;
- (i) "service provider' means authorities who provide services like water, sewerage, electricity, telephone, roads, drainage etc. often generate construction and demolition waste during their activities, which includes excavation, demolition and civil work;
- (j) "waste generator" means any person or association of persons or institution, residential and commercial establishments including Indian Railways, Airport, Port and Harbour and Defence establishments who undertakes construction of or demolition of any civil structure which generate construction and demolition waste.

(2) Words and expressions used but not defined herein shall have the same meaning defined in the ACT.

## (4) Duties of the waste generator -

(1) Every waste generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules.

(2) The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately.

(3) Waste generators who generate more than 20 tons or more in one day or <u>300</u> tons per project in a month shall segregate the waste into four streams such as concrete, soil, steel, wood and plastics, bricks and mortar and shall submit waste management plan and get appropriate approvals from the local authority before starting construction or demolition or remodeling work and keep the concerned

authorities informed regarding the relevant activities from the planning stage to the implementation stage and this should be on project to project basis.

(4) Every waste generator shall keep the construction and demolition waste within the premise or get the waste deposited at collection centre so made by the local body or handover it to the authorised processing facilities of construction and demolition waste; and ensure that there is no littering or deposition of construction and demolition waste so as to prevent obstruction to the traffic or the public or drains.

(5) Every waste generator shall pay relevant charges for collection, transportation, processing and disposal as notified by the concerned authorities; Waste generators who generate more than 20 tons or more in one day or <u>300</u> tons per project in a month shall have to pay for the processing and disposal of construction and demolition waste generated by them, apart from the payment for storage, collection and transportation. The rate shall be fixed by the concerned local authority or any other authority designated by the State Government.

# (5) Duties of service provider and their contractors -

(1) The service providers shall prepare within six months from the date of notification of these rules, a comprehensive waste management plan covering segregation, storage, collection, reuse, recycling, transportation and disposal of construction and demolition waste generated within their jurisdiction.

(2) The service providers shall remove all construction and demolition waste and clean the area every day, if possible, or depending upon the duration of the work, the quantity and type of waste generated, appropriate storage and collection, a reasonable timeframe shall be worked out in consultation with the concerned local authority.

(3) In case of the service providers have no logistics support to carry out the work specified in subrules (1) and (2), they shall tie up with the authorised agencies for removal of construction and demolition waste and pay the relevant charges as notified by the local authority.

# (6) **Duties of local authority-**The local authority shall,-

(1) issue detailed directions with regard to proper management of construction and demolition waste within its jurisdiction in accordance with the provisions of these rules and the local authority shall seek detailed plan or undertaking as applicable, from generator of construction and demolition waste;

(2) chalk out stages, methodology and equipment, material involved in the overall activity and final clean up after completion of the construction and demolition ;

(3c) seek assistance from concerned authorities for safe disposal of construction and demolition waste contaminated with industrial hazardous or toxic material or nuclear waste if any;

(4) shall make arrangements and place appropriate containers for collection of waste and shall remove at regular intervals or when they are filled, either through own resources or by appointing private operators;

(5) shall get the collected waste transported to appropriate sites for processing and disposal either through own resources or by appointing private operators;

(6) shall give appropriate incentives to generator for salvaging, processing and or recycling preferably in-situ;

(7) shall examine and sanction the waste management plan of the generators within a period of one month or from the date of approval of building plan, whichever is earlier from the date of its submission;

(8) shall keep track of the generation of construction and demolition waste within its jurisdiction and establish a data base and update once in a year;

(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;

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

(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.

# (7) Criteria for storage, processing or recycling facilities for construction and demolition waste and application of construction and demolition waste and its products-

(1) The site for storage and processing or recycling facilities for construction and demolition waste shall be selected as per the criteria given in **Schedule I**;

(2) The operator of the facility as specified in sub- rules (1) shall apply in **Form I** for authorization from State Pollution Control Board or Pollution Control Committee.

(3) The operator of the facility shall submit the annual report to the State Pollution Control Board in **Form II.** 

(3) Application of materials made from construction and demolition waste in operation of sanitary landfill shall be as per the criteria given in **Schedule II**.

# (8) Duties of State Pollution Control Board or Pollution Control Committee-

(1) State Pollution Control Board or Pollution Control Committee shall monitor the implementation of these rules by the concerned local bodies and the competent authorities and the annual report shall be sent to the Central Pollution Control Board and the State Government or Union Territory or any other State level nodal agency identified by the State Government or Union Territory administration for generating State level comprehensive data. Such reports shall also contain the comments and suggestions of the State Pollution Control Board or Pollution Control Committee with respect to any comments or changes required;

(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**;

(3) State Pollution Control Board or Pollution Control Committee shall prepare annual report in **Form IV** with special emphasis on the implementation status of compliance of these rules and forward report to Central Pollution Control Board before the 31<sup>st</sup>July for each financial year.

## (9) Duties of State Government or Union Territory Administration-

(1) The Secretary in-charge of development in the State Government or Union territory administration shall prepare their policy document with respect to management of construction and demolition of waste in accordance with the provisions of these rules within one year from date of final notification of these rules.

(2) The concerned department in the State Government dealing with land shall be responsible for providing suitable sites for setting up of the storage, processing and recycling facilities for construction and demolition waste.

(3) The Town and Country planning Department shall incorporate the site in the approved land use plan so that there is no disturbance to the processing facility on a long term basis.

(4) 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.

(10) Duties of the Central Pollution Control Board - (1) The Central Pollution Control Board shall,-

(a) prepare operational guidelines related to environmental management of construction and demolition waste management;

(b) analyze and collate the data received from the State Pollution Control Boards or Pollution Control Committee to review these rules from time to time;

(c) coordinate with all the State Pollution Control Board and Pollution Control Committees for any matter related to development of environmental standards;

(d) forward annual compliance report to Central Government before the 30<sup>th</sup>August for each financial year based on reports given by State Pollution Control Boards of Pollution Control Committees.

(11) **Duties of Bureau of Indian Standards and Indian Roads Congress** -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.

#### (12) Duties of the Central Government -

(1) The Ministry of Urban Development, and the Ministry of Rural Development, Ministry of Panchayat Raj, shall be responsible for facilitating local bodies in compliance of these rules;

(2) The Ministry of Environment, Forest and Climate Change shall be responsible for reviewing implementation of these rules as and when required.

**13. Timeframe for implementation of the provisions of these rules** -The timeline for implementation of these rules shall be as specified in **Schedule III**:

14. Accident reporting by the construction and demolition waste processing facilities-In case of any accident during construction and demolition waste processing or treatment or disposal facility, the officer in charge of the facility in the local authority or the operator of the facility shall report of the accident in **Form-V** to the local authority. Local body shall review and issue instruction if any, to the incharge of the facility.

# Schedule I Criteria for Site Selection for Storage and Processing or Recycling Facilities for construction and demolition Waste [See Rule 7(1)]

- (1) The concerned department in the State Government dealing with land shall be responsible for providing suitable sites for setting up of the storage, processing and recycling facilities for construction and demolition and hand over the sites to the concerned local authority for development, operation and maintenance, which shall ultimately be given to the operators by Competent Authority and wherever above Authority is not available, shall lie with the concerned local authority.
- (2) The Local authority shall co-ordinate (in consultation with Department of Urban Development of the State or the Union territory) with the concerned organizations for giving necessary approvals and clearances to the operators.
- (3) Construction and demolition waste shall be utilized in sanitary landfill for municipal solid waste of the city or region as mentioned at Schedule I of the rule. Residues from construction and demolition waste processing or recycling industries shall be land filled in the sanitary landfill for solid waste.
- (4) The processing or recycling shall be large enough to last for 20-25 years (project based on-site recycling facilities).
- (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.
- (6) 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 authority in consultation with concerned State Pollution Control Board.

- (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.

(14) The following projects shall be 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.

(15) A vegetative boundary shall be made around Processing or Recycling plant or site to strengthen the buffer zone.

# Schedule II Application of materials made from construction and demolition waste and its products. [See Rule 7(3)]

Sl. No.	Parameters	Compliance Criteria
1	Drainage layer in leachate collection system at bottom of Sanitary Landfill Gas Collection Layer above the waste at top of Sanitary Landfill and Drainage Layer in top Cover System above Gas Collection Layer of Sanitary Landfill For capping of sanitary landfill or dumpsite, drainage layer at the top	Only crushed and graded hard material (stone, concrete etc.) shall be used having coarse sand size graded material (2mm – 4.75mm standard sieve size). Since the coarse sand particles will be angular in shape (and not rounded as for riverbed sand), protection layers of non-woven geo-textiles may be provided, wherever required, to prevent puncturing of adjacent layers or components.
2	Daily cover	<ul> <li>Fines from construction and demolition processed waste having size up to 2 mm shall be used for daily cover over the fresh waste.</li> <li>Use of construction and demolition fines as landfill cover shall be mandatory where such material is available. Fresh soil (sweet earth) shall not be used for such places and borrow-pits shall not be allowed. Exception – soil excavated during construction of the same landfill.</li> <li>During hot windy days in summer months, some fugitive dust problems may arise. These can be minimised by mixing with local soil wherever available for limited period.</li> </ul>
3	Civil construction in a sanitary landfill	Non-structural applications, such as kerb stones, drain covers, paving blocks in pedestrian areas.

# Schedule III Timeframe for Planning and Implementation [See Rule 13]

Sl. No.	Compliance Criteria	Cities with population of 01 million and above	Cities with population of 0.5-01 million	Cities with population of less than 0.5 million
1	Formulation of policy by State Government	12 months	12 months	12 months
2	Identification of sites for collection and 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 – once in 4 months	2 times a year – once in 6 months	2 times a year – once in 6 months

\*The time Schedule is effective from the date of notification of these rules.

# FORM – I See [Rule 7 (2)] Application for obtaining authorisation

:

To,

The Member Secretary

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

Correspondence address	
Telephone No.	
Fax No.	
Nodal Officer and designation (Officer authorized	
by the competent authority or agency responsible for	
operation of processing or recycling or disposal facility)	
Authorisation applied for (Please tick mark)	Setting up of processing or recycling facility of construction and demolition waste
Detailed proposal of construction and demolition waste processing or recycling facility to include the following	
Location of site approved and allotted by the Competent Authority.	
Average quantity (in tons per day) and composition of construction and demolition waste to be handled	

at the specific site.	
Details of construction and demolition waste processing or recycling technology to be used.	
Quantity of construction and demolition waste to be processed per day.	
Site clearance from Prescribed Authority.	
Salient points of agreement between competent authority or local authority and operating agency (attach relevant document).	
Plan for utilization of recycled product.	
Expected amount of process rejects and plan for its disposal (e.g., sanitary landfill for solid waste).	
Measures to be taken for prevention and control of environmental pollution.	
Investment on project and expected returns.	
Measures to be taken for safety of workers working in the processing or recycling plant.	
Any preventive plan for accident during the collection, transportation and treatment including processing and recycling should be informed to the Competent Authority (Local Authority) or Prescribed Authority	
Date:	Signature of Nodal Officer

## Form-II

## See [Rule (7) (3)] Format for Issue of Authorisation to the Operator

File No.:	
Date :	

To,

 Ref : Your application number \_\_\_\_\_\_Dt. .....

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

1. The validity of this authorisation is till \_\_\_\_\_\_. After expiry of the validity period, renewal of authorisation is to be sought.

2. The \_\_\_\_\_\_ State Pollution Control Board or Pollution Control Committee may, at any time, for justifiable reason, revoke any of the conditions applicable under the authorisation and shall communicate the same in writing.

3. Any violation of the provision of the construction and demolition Waste Management Rules, 2016 shall attract the penal provision of the Environment (Protection) Act, 1986 (29 of 1986).

Date: Place: (Member Secretary) State Pollution Control Board/ Pollution Control Committee

# Form –III

#### See [Rule 8(2)]

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

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

Telephone No :
Fax :
Email ID:
Website:

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

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

(a) Total quantity of construction and demolition waste generated during the whole year in metric ton

Any figures for lean period and peak period generation per day ...... Average generation of construction and demolition waste (TPD) Total quantity of construction and demolition waste collected per day Any Processing / Recycling Facility set up in the city ...... Status of the facility

(b) Total quantity of construction and demolition waste processed / recycled (in metric ton) Non-structural concrete aggregate

	5400
Manufactured sand	:
Ready-mix concrete (RMC)	:
Paving blocks	:
GSB	:

Others, if any, please specify :

(c) Total quantity of Construction & Demolition waste disposed by land filling without processing (last option) or filling low lying areas

No of landfill sites used	:	
Area used	:	
Whether weigh-bridge :	Yes	No
facility used for quantity esti-	mation?	

:

(d) Whether construction and demolition waste used in sanitary landfill (for solid waste) as per Schedule III

Yes No

#### 2. Storage facilities

(a) Area orlocation or plot or societies covered for collection of Construction and Demolition waste

(b) No. of large Projects (including roadways project) covered

(c) Whether Area or location or plot or societies collection is Practiced (if yes, whether done by

Competent Authority or Local Authority or through Private Agency

:

or Non-Governmental Organization)

(d) Storage Bins								
(u) Storage 1	5115		Spo (Sh	ecificatio ape & Si	ons ize)	Existi Numb	ng er	Proposed for future
(i) C (ii) C	ontainers or receptacle (Capacity Dthers, please specify	/) : :						
(e) Whether attended for	all storage bins/collection spots a daily lifting	are :		Yes		No		
(e) Whether Waste fr (please t and equipme	lifting of Construction & Demoli rom Storage bins is manual or me ick mark) please specify mode ont used	ition echar :	nical M (spe	lanual ecify equ	Mecha ipment)	nical	Others	,
3. Transpor	tation	- E	 Exist	ing Actu	ally Rec	juired/I	roposec	l number
	Truck:Truck-Hydraulic:Tractor-Trailer:Dumper-placers:Tricycle:	-						

Refuse-collector Others (Please specify)

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

:

:

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

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

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

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

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

:

#### 8. Are municipal magistrates appointed

for taking penal action for non-compliance with these rules: Yes No [If yes, how many cases registered & settled during last three years (give year wise details)]

Dated: Commissioner

#### Signature of Municipal

#### Form -IV

#### See [Rule (8)(3)]

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

To,

The Chairman, Central Pollution Control Board, PariveshBhawan, East Arjun Nagar, Delhi-110032

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

## Date:

Place:

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

# Form –V See [ Rule14] <u>Accident reporting</u>

1.	Date and time of accident :
2.	Sequence of events leading to accident :
3.	The type of construction and demolition waste involved in accident :
4.	Assessment of the effects of the accidents a. on traffic, drainage system and the environment :
5.	Emergency measures taken :
6.	Steps taken to alleviate the effects a. of accidents :
7.	Steps taken to prevent the recurrence a. of such an accident :

8. Regular monthly health checkup of workers at

- a. Processing / recycling site shall be made
- 9. Any accident during the collection,
  - a. transportation and treatment including
  - b. processing and recycling should be informed
  - c. to the Competent Authority (Local Authority) or
  - d. Prescribed Authority

Date : Place: Authorized Signatory Designation

[18-6/2014-HSMD] Bishwanath Sinha, Joint Secretary Annexure 2

Preferential procurement document - Ahmedabad

# Ahmedabad Municipal Corporation Department of Solid Waste Management

C Block, 5<sup>th</sup> Floor, Sardar Patel Bhavan, Danapith, Ahmedabad – 380001 Tel. No. 079 – 25350841, Fax No. 079-25350841 Email: swm@ahmedabadcity.gov.in

To, Amdavad Enviro Projects Pvt. Ltd., E/5, Ojas Apartment, Near Nehrunagar Cross roads, Ambawadi, Ahmedabad – 380018

Subject: - About procurement of the final product manufactured by Amdavad Enviro Projects Pvt. Ltd.

Context: - (1) Amdavad Enviro Projects Pvt. Ltd.'s letter dated 18/04/2016 (2) Health and Solid Waste Management Committee's Resolution number 29 dated 22/06/2016 and Standing Committee's Resolution number 387 dated 30/06/2016

With reference to the above mentioned subject and context, it is hereby informed that the Standing committee, with respect to resolution number 1022 dated 06/09/2016, has given approval to DNP Infrastructure Pvt. Ltd. to collect all the construction and demolition waste and transport the same to Gyaspur Pirana to the plant which has been set up on a public private partnership basis since 30 years which can process 300 Metric tonnes of garbage on daily basis. Department of Solid Waste Management has given the Letter of Award to DNP Infrastructure Pvt. Ltd. and as per the Letter offer of award, A Concession Agreement has been made with the newly set up organisation Amdavad Enviro Projects Ltd. by DNP Infrastructure Pvt. Ltd. as on 21/10/2013. With reference to that, AEPPL has been operationalised as on 10/05/2014.

According to the aforesaid Reference Letter – 1, it is presented that AEPPL will manufacture finished products/goods like brick, hollow block, paver block, curb stone, sand, green ready mix concrete, aggregates etc. from C & D Waste. If products manufactured from the Waste Treatment Plant are utilised by AMC, then there will be a proper recycling of all the construction and demolition waste on daily basis.

AEPPL Plant Products like Paver Block and Curb stone should be procured by the City Engineer and manhole(without frame) should be procured by the Superintendent (Central Stores); the minimum rate should be considered after comparing the existing rates form the AMC tender and/or SOR. As per approval from Solid Waste Management Committee resolution no 29, dated 22/06/2016 and standing committee no. 387 dated 30/06/2016, 50% requirement of paver blocks and curbstone and 25% requirement of manhole cover of the AMC (which can be increased/decreased as per requirement) needs to be procured by the respective zones/projects from the Agency. The copy of the document/circular is attached herewith.

You are requested to take account of this notice and follow the necessary procedures.

#### Circular

With respect to the Standing Committee Resolution No. 1022, dated 06/09/2012, Amdavad Enviro Projects Pvt. Ltd. (AEPPL) has been given the contract of collecting construction and demolition waste of Ahmedabad city and transport the same to the plant at Gyaspur Pirana set up since 30 years under public private partnership, which can process 300 metric tonnes of waste on daily basis

With reference to the approval given by Solid Waste Management Committee Resolution Number 29 dated 22/06/2016 and Standing Committee Resolution number 387 dated 30/06/2016, your respective departments are required to following the below mentioned procedure in case of procurement of paver block, curbing and manhole cover (without frame):

"Procurement of 50% of requirement of paver blocks and curbing stone and 25% of requirement of manhole cover (without frame) (which can be increased or decreased as per requirement) should be done by the respective departments/projects from AEPPL and the rates should be as per the existing rates of that particular time period of Ahmedabad Municipal Corporation approved tender and/or SOR rates, whichever is less. "

Deputy Municipal Commissioner (Solid Waste Management Department)

Copy to:

- 1. Honourable Municipal Commissioner For your Information
- 2. All Zonal Deputy Municipal Commissioners
- 3. Related Department Deputy Municipal Commissioner (Traffic, Parks and Garden, Fire Brigade, Municipal School Board, AJL, Kankaria Lake Front, Zoo and Balvatika, Water and Drainage Project, S.T.P., SRFDCL, Road Project, Bridge Project, Light, Housing Project, SNP, Swimming Pool, Gymnasium, AMTS)
- 4. City Engineer (WRM) and City Engineer
- 5. Joint Director (Mechanical)
- 6. All Additional City Engineers
- 7. All Zonal Assistant Municipal Commissioner
- 8. Superintendent, Central Stores
- 9. Director, Solid Waste Management Department
- 10. Amdavad Enviro Projects Pvt. Ltd., Behind Torrent Power Sub Station, Gyaspur, Ahmedabad, Mobile No. 9898478110, 9979846734

Annexure 3

Sample Construction/Renovation/Demolition permit

Dated	
Name of Individual	/Institution
Project name	
Type of work:	(construction, renovation, demolition)
Location	
Construction Comm	iencement date
<b>Construction</b> Comp	letion date
Estimated waste ge	neration tonnes/day (average; maximum and minimum)
	Excavated Earth materials (vegetation, sand, soil)
	Concrete
	Bricks and Mortar
	Debris
	Metals
	Others
Plan for Manageme	nt of C&D waste
	Estimated quantity of waste to be reused on-site in tonnes/day (average)
	Estimated quantity required to be disposed (tonnes per day) average
above and duration	Provisions for waste storage (tonnes) for each category listed
Quantity of waste o	ommitted to (bidder) in tonnes/day

Annexure 4

Products made from C&D waste

# Construction Materials from Processed C&D waste



**Paver Block** 



Kerb Stone



Tile



Jalli



Wall Cladding



**Concrete Block**
## Street furniture from processed C&D waste



Bollard



Wire Fence



Pre-cast compound wall



Planter



Drain Cover



Park Bench

## Pre-cast structures from processed C&D waste



On-site assembly type toilet (Model developed by AEP Pvt Ltd)



Pre-cast Toilet (Model developed by AEP Pvt Ltd)



Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Resource Efficiency Project B-5/1 Safdarjung Enclave New Delhi 110029

T: +91 11 4949 5353 E: uwe.becker@giz.de I: www.giz.de Development Alternatives Group

B-32, Tara Crescent Qutab Institutional Area New Delhi 110016

T : +91 11 2654 4100 E : vrathi@devalt.org I : www.devalt.org

