

# **Strategy for Promoting Processing of Construction and Demolition (C&D) Waste and Utilisation of Recycled Products**

Draft

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## Foreword and Acknowledgements

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## EXECUTIVE SUMMARY

The Construction and Demolition (C&D) waste management and utilisation strategy is intended to help facilitate the implementation of the C&D Waste Rules 2016 to ensure that ULBs across the country are able to adopt proper C&D waste management and recycled products find appropriate and adequate utilisation. Although India produces enormous amounts of C&D waste and volumes are expected to grow further with time, there are no reliable estimates of generation volume, either at the local or national level. Management of the waste has historically been poor, with a very small fraction diverted for reuse and the rest dumped, often in an unauthorised manner, causing myriad environmental problems.

The C&D Waste Rules 2016 laid out detailed duties and responsibilities of different stakeholders ranging from waste generators to ULBs to state and central government ministries and agencies. It also provided templates for documents needed for each management step to ease implementation. However, implementation of these Rules has not been to the full extent, despite guidelines and advisories in support of the Rules being issued by different agencies such as CPWD, BMTPC, MoHUA, etc. Delhi and Ahmedabad have pioneered C&D waste management in India with adoption of Public Private Partnership (PPP) which is regarded as sustainable. Best practice in India and abroad shows that 80-90% of C&D waste can be reused after processing in a variety of applications including landscaping, earth works and civil engineering applications. Processing technology is also not complicated, comprising mainly of crushing, screening and washing to recover coarse and fine recycled aggregates, which can then be used directly or converted into pre-cast products. Independent testing has confirmed that the quality of products made from recycled aggregates can meet relevant standards and cost of such products can also be competitive with that of conventional products provided transportation distances are not prohibitive. BIS and the Indian Roads Congress have also come up with standards prescribing limits up to which recycled aggregates can be safely used in different applications.

Despite such prospects, C&D waste management and utilisation has not progressed as envisaged under the 2016 Rules due to several factors. The biggest challenges are at the ULB level. In addition to land, financial resources and personnel constraints, ULB capacities to develop the management and business model are limited. In the absence of adequate state-level facilitation, ULBs continue to dedicate their limited resources towards MSW, which is seen as a higher priority by the public. Additionally, the construction industry has its own set of challenges. Demolition has historically been dominated by small players with entrenched ways of working which often involve “getting rid” of the waste to cut costs. On the other hand, recycled products are perceived as inferior in quality and there are concerns about their economic viability.

In these context, without a coordinated effort, implementation at the necessary scale will still remain a challenge for all its stakeholders. Ministry of Housing and Urban Affairs along with its specialised agencies and/or empanelled consultants shall handhold the ULBs for C&D waste management. An ad hoc expert task force needs to be created for developing a standard methodology for inventorisation and characterisation of C&D waste. An online web-portal, as part of the existing Swachh Bharat Mission portal, may be used for data agglomeration for proper inventorisation as well as for dissemination of best practices, toolkits on technology, management and business models, etc. In parallel, facilitation by state level agencies and departments (such as Urban Development) needs to be accelerated to ensure wide implementation throughout each state, and not just in a few pioneer cities. Special emphasis should be placed on the needs of smaller towns where the generation may not be enough to justify a large central processing facility. Sustained engagement with the

construction industry will also be important, in collaboration with industry associations such as BAI, CREDAI, etc., addressing both their roles as responsible generators of waste and potential users of recycled products. Finally, there needs to be a push to promote utilisation of recycled products through a variety of channels including public procurement, development of standards and certification, green rating, quality assurance, GST rebates, and so on. This multi-faceted facilitation strategy, in collaboration with a wide range of stakeholders, needs to be sustained over the medium term, till the time a viable market for recycled products develops, allowing the private sector to profitably pursue recycling on its own.

## 1. Preamble

As part of the on-going support to Resource Efficiency Strategy of NITI Aayog and European Delegation to India, the European Union Resource Efficiency Initiative for India (EU-REI), a consortium led by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH with The Energy and Resources Institute (TERI), Confederation of the Indian Industry (CII) and adelphi proposed to develop a comprehensive Construction and Demolition (C&D) waste management strategy to promote circular economy in India. The goal of the strategy is to provide a framework of implementation of the C&D Waste Management Rules, 2016. Primary beneficiaries of the strategy will be the Urban Local Bodies (ULBs), Central and State Public Works Departments (CPWD & SPWD), Local Contractors. The strategy will strengthen the existing policy framework by Ministry of Environment, Forests and Climate Change (MoEFCC) as well as entrust Building Materials & Technology Promotion Council (BMTPC), Ministry of Housing and Urban Affairs (MoHUA) to further develop the implementation road map. Furthermore, the study will create additional value for relevant regulatory (e.g., Central Pollution Control Board) and implementing bodies, such as public enterprises involved in infrastructure development tasked with management of C&D waste. In addition, the paper will inform strategic decision making on resource efficiency at NITI Aayog.

## 2. Context and Scenario of C&D Waste in India

Due to rapid urbanisation, India's construction sector is projected to grow at a rate of 7-8% over the next 10 years and is likely to become the world's third largest by the middle of the next decade<sup>1</sup>. It is estimated that almost 70% of buildings supposed to exist by 2030 are yet to be built<sup>2</sup>. Such massive construction will rely heavily on raw materials such as sand (for concrete and mortar), soil (for clay bricks), stone (for aggregates) and limestone (for cement); the extraction and production of which have significant ecological impacts. Some of these materials, especially sand, are already facing supply constraints (often due to environmental bans and restrictions), thus affecting the sector. Current estimated annual consumption of these five categories of materials are depicted in Box A<sup>3</sup>.

### 2.1 Generation estimates

The construction boom in India is leading to the generation of enormous quantities of C&D waste and this trend is likely to further increase in the decades ahead. Especially in the older cities, significant demolition often precedes construction, as older buildings are demolished to make way for newer ones, typically high-rises. Although comprehensive estimates of C&D waste generation in the country are not known, 12-15 million tonnes/annum generation is reported by a TIFAC study in 2001<sup>4</sup>. With a significant construction

<b>BOX A: Estimated annual consumption of construction materials in India</b>
Sand: 750 million tonnes
Soil: 350 million m <sup>3</sup>
Stone (aggregate): 2 billion tonnes
Limestone: 242 million tonnes
Cement: 297 million tonnes

<sup>1</sup> Betts et al. (2013). Global Construction 2025: A Global Forecast for the Construction Industry to 2025. Global Construction Perspectives and Oxford Economics.

<sup>2</sup> Sankhe et al. (2010). India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth. McKinsey Global Institute.

<sup>3</sup> GIZ, TERI and DA. (2016). Material Consumption Patterns in India: A Baseline Study of the Automotive and Construction Sectors. New Delhi, GIZ.

<sup>4</sup> TIFAC. (2001). Utilisation of Waste from Construction Industry. New Delhi.

boom, many experts believe that this quantum is underestimated<sup>5,6</sup>. A 2015 survey of 10 cities<sup>7</sup> across India also seems to reinforce the conclusion that the TIFAC 2001 estimate is probably a significant underestimate (see Table 1).

Table 1: C&D waste generation in select Indian cities<sup>7</sup>

City	Population (Census 2011)	Daily CDW generation (tonnes/day)	Annual CDW generation* (million tonnes/annum)
Mumbai	12,442, 373	2,500	0.75
Delhi	16,787, 941	4,600	1.38
Bengaluru	8,443, 675	875	0.26
Chennai	6,500,000	2,500	0.75
Kolkata	4,496, 694	1,600	0.48
Jaipur	3,471, 847	200	0.06
Patna	2,514, 590	250	0.08
Ahmedabad	6,063, 047	700	0.21
Bhopal	1,917,051	50	0.02
Coimbatore	2,618,940	92	0.03

\* Daily generation has been multiplied by 300 to calculate annual generation since CDW generation is not constant throughout the year, almost disappearing during the monsoon rainy season

The 2017 CPCB ‘Guidelines on Environmental Management of C&D Waste’, also quote the above-mentioned data for nine cities, excluding Delhi.<sup>8</sup> It further highlights that the quantum of C&D waste generation vary over time.

The 2018 “Ready Reckoner” on CDW generation released by the Buildings Materials & Technology Promotion Council (BMTPC), MoHUA estimates that 100 million tonnes of CDW is the closest approximation for nationwide generation. This figure is based on zero-based estimate with existing housing stock of 110,139, 853 in urban areas and 220,695,914 in rural areas (based on 2011 Census), coupled with rate of renovation and new construction of 5.75 billion sq. m. area during 2005-2012. This once again reaffirms that TIFAC 2001 data needs revision through a robust methodology for inventorisation and regular data collection.<sup>9</sup>

## 2.2 Current C&D waste management practices

Management of C&D waste is still a challenge for urban local bodies. Most cities do not have formal demolition permits and developers hire local contractors for demolition. Even government agencies like PWD invite bids for demolition based on what contractors would pay for recoverables. The recoverables of immediate secondary market value, such as metal rods, pipes and fixtures, wooden frames, etc., are salvaged by the informal sector, typically from demolition sites, leaving behind the “rubble” composed of bulky materials such as

<sup>5</sup> Centre for Science & Environment. (2014). CSE Brief. New Delhi. See:

<http://cdn.cseindia.org/userfiles/Construction-and%20demolition-waste.pdf>

<sup>6</sup> Ram, V. and Kalidindi, S. (2017). Estimation of construction and demolition waste using generation rates from Chennai, India. *Waste Management and Research*, 35(6): 610-617.

<sup>7</sup> GIZ and DA. (2015). Resource Efficiency in the Indian Construction Sector: Market Evaluation of the Use of Secondary Raw Materials from Construction and Demolition Waste. New Delhi, GIZ.

<sup>8</sup> Central Pollution Control Board. (2017). Guidelines of Environmental Management of C&D Wastes. New Delhi, CPCB

<sup>9</sup> Building Materials & Technology Promotion Council. (2018). Utilisation of Recycled Produce of Construction & Demolition Waste: A Ready Reckoner. New Delhi. Ministry of Housing & Urban Affairs.

concrete, stones, bricks and mortar, etc. A small fraction of this rubble is used for back-filling in construction projects, both for private projects and public works, and the same demolition contractors arrange for its transportation to sites where it is needed. It is estimated that such uses may account for only 10-30% of generated C&D waste depending on the site and region.<sup>7</sup> The remaining fraction of C&D waste is disposed, either in designated landfills/dump sites or often in unauthorised places such as road sides, river beds and low-lying areas causing a host of nuisance, safety and environmental problems.

### 2.3 Best practices of C&D waste management in India

Scientific processing and utilisation of C&D waste has achieved isolated successes in India. Delhi was the first city to implement a C&D waste management plan through a pilot processing facility developed under a public-private-partnership (PPP) in 2010. After the initial success of the pilot plant processing waste at 500 tonnes per day (TPD), the capacity of the plant has been increased to 2,000 TPD. To minimise transportation distances and associated costs, Delhi planned to have a distributed network of processing facilities in different zones of the city. Accordingly, two more smaller (500 TPD and 150 TPD respectively) plants have recently come online (2017-18), with planning for more under way.

Ahmedabad was the second city in India to implement C&D waste processing, by adopting a similar PPP model as that in Delhi. A 300 TPD processing facility was launched in 2014, the capacity of which was increased to 600 TPD 2016 after successful operation and now to 1,000 TPD in 2018. Table 2 summarises the key features of the Delhi and Ahmedabad C&D waste management plans.

Table 2: Key features of the Delhi and Ahmedabad C&D waste management plans

<b>Feature</b>	<b>Delhi</b>	<b>Ahmedabad</b>
Year established	2010	2014
Model	Public Private Partnership between Delhi Municipal Corporation (New Delhi Municipal Corporation – NDMC and East Delhi Municipal Corporation-EDMC) and IL&FS Environmental Infrastructure & Services Limited	Public Private Partnership between Ahmedabad Municipal Corporation and Amdavad Enviro Projects Private Limited (AEP)
Number of processing plants	3 in operation (more in planning stages)	1
Capacity	First plant: 2,000 TPD Second plant: 500 TPD Third plant: 150 TPD	300 TPD (increased capacity to 1000 TPD)
Tipping Fee (INR per tonne)	For NDMC <sup>10</sup> Service Area: 147/tonne (with annual escalation of 5%) For EDMC <sup>11</sup> Service Area: 375/tonne (with annual escalation of 3%)	178/tonne

<sup>10</sup> New Delhi Municipal Council

<sup>11</sup> East Delhi Municipal Corporation

Products	Recycled aggregates, manufactured sand, paver blocks, curb stones, tiles, hollow blocks/bricks	Paver blocks, tiles, hollow blocks/bricks, pre-fabricated structures like frames, manhole covers, benches, etc.
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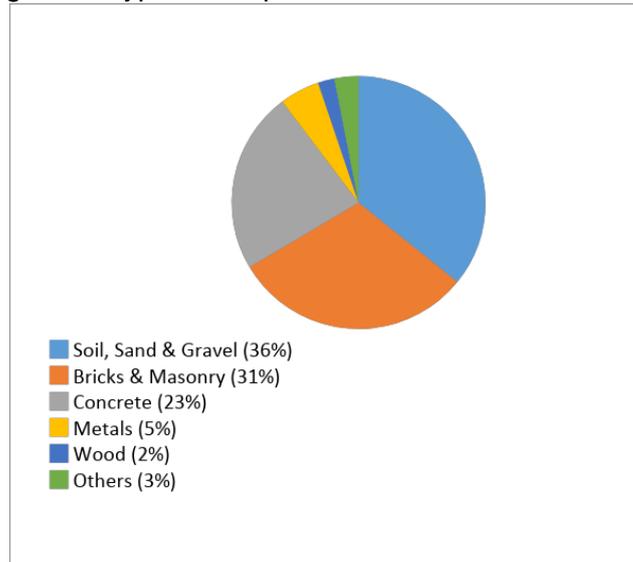
In both Delhi and Ahmedabad, Design Build Operate Finance and Transfer (DBOFT) model is being followed. The Municipal Corporation contracts a private party and this authorised agency is responsible for both transportation and processing of the C&D waste and develops the necessary infrastructure with its own financing. The Municipal Corporation offers land to the contracted party for establishing the processing facility and also designates a series of intermediate collection points at favourable locations throughout the city. The authorised agency collects C&D waste from these designated collection points as well as from unauthorised dumps, as directed by the urban authority, and transports it to the processing facility. The municipal corporation pays the authorised agency an agreed fee per tonne of waste that is collected and transported. The authorised agency may also collect fees directly from large generators (such as Metro Rail) for waste collection; however, if generators bring waste to the processing facility at their own expense, the agency accept it without charge. Therefore, the private partner has two sources of revenue – the “tipping fee” from the ULB and the sale of recycled products made from C&D waste. This ensures the viability of the enterprise. However, in both Delhi and Ahmedabad, market uptake of recycled products made from C&D waste remains an ongoing challenge.

## 2.4 Potential for C&D waste utilisation in India

### Recycling and products

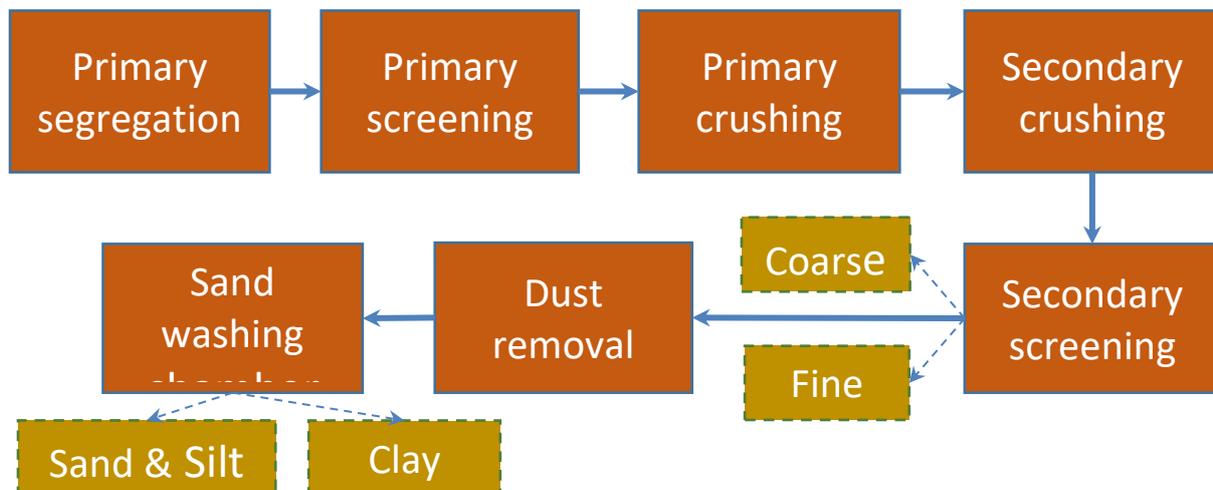
Characterisation study of C&D waste in India by TIFAC (2001) shows that most fractions including bulky material (concrete, bricks) and fines (sand, excavation soil) are amenable to recycling with proper processing equipment and techniques. Figure 1 shows the typical composition of C&D waste in India.

Figure 1: Typical composition of C&D waste in India<sup>12</sup>



Recycling of C&D waste starts with segregation of unwanted residual material such as plastic, wood, metal fragments, etc (constituting 10% of the total waste as per the TIFAC composition). The remaining bulky waste is fed into crushers and reduced to smaller and smaller sizes, with size fractions separated depending on end use. Fines are typically best recovered with a “wet process”. A simplified diagram depicting C&D waste processing is shown in Figure 2.

Figure 2: C&D waste processing steps and outputs



These coarse and fine aggregates of various sizes can be used directly as recycled aggregates in construction or used to manufacture a range of pre-cast products, as shown in Table 3. A selection of products made from recycled aggregates is shown in Annex 3.

Table 3: Utilisation of processed C&D waste

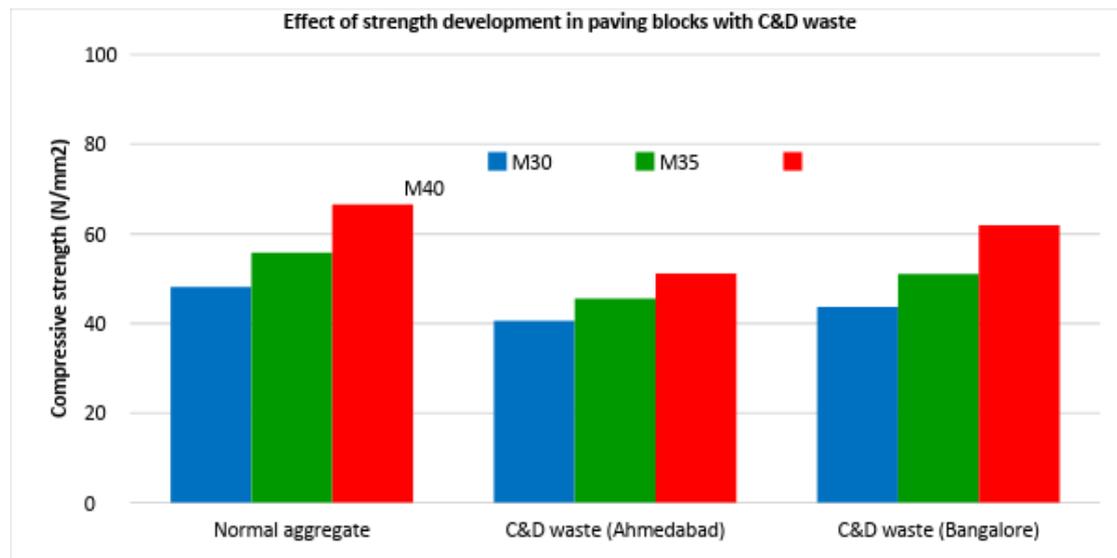
<sup>12</sup> TIFAC. (2001). Utilisation of Waste from Construction Industry. New Delhi: Technology Information, Forecasting and Assessment Council.

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

### Cost and quality

Repeated testing by the companies in Delhi and Ahmedabad, as well as by independent researchers has demonstrated that products made from C&D waste meet or exceed minimum standards for their intended applications. A study by GIZ and Development Alternatives (2015)<sup>13</sup> tested compressive strength of paver blocks made from C&D waste collected in Bangalore and Ahmedabad as per BIS 15658:2006 protocol. The results are depicted in Figure 3.

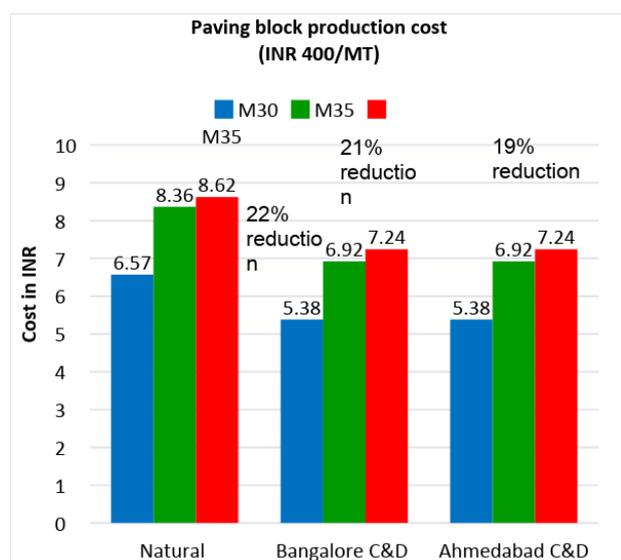
Figure 3: Test results comparing paver blocks made from natural aggregates versus recycled aggregates from C&D waste<sup>13</sup>



Products made from recycled aggregates typically tend to have a cost advantage over conventional products since natural aggregates are transported over long distances in most places. This holds true as long as the collection and transportation cost of C&D waste does not become exceedingly high due to long transportation distances. The GIZ-Development Alternatives study<sup>13</sup> modelled production costs for paving blocks made from natural versus recycled aggregates using actual cost figures from Delhi (assuming collection and processing cost at Rs. 400/tonne). The results (Figure 4) show cost advantages of 19-22% for blocks using recycled aggregates.

<sup>13</sup> GIZ and Development Alternatives. (2015). Resource Efficiency in the Indian Construction Sector: Market Evaluation of the Use of Secondary Raw Materials from Construction and Demolition Waste. New Delhi, GIZ.

Figure 4: Cost comparison of paving blocks made with natural vs. recycled aggregates<sup>13</sup>



### Standards and certification

Recycled aggregates have different and non-uniform properties and therefore cannot be used safely for all kinds of applications. However, they can be safely used in a variety of applications, when necessary restrictions are in place. BIS has revised the BIS 383 standard in 2016 to allow for specific uses of recycled coarse and fine aggregates within certain restrictions (see Table 4).

Table 4: Prescribed utilisation of recycled aggregates in BIS 383:2016

S. No.	Type of Aggregate	Maximum Utilisation, %		
		Plain Cement Concrete	Reinforced Cement Concrete	Lean Concrete (less than M15 grade)
1	Coarse Aggregate			
	Recycled Concrete Aggregate (RCA)	25	20 (only up to M25 Grade)	100
	Recycled Aggregate (RA)	Nil	Nil	100
2	Fine Aggregate			
	RCA	25	20 (only up to M25 Grade)	100

The National Building Code of India (2005) also allows for the use of recycled aggregates in certain applications (see Box B).

**Box B: National Building Code (NBC- CED 46) of India 2005 : Part 11 of NBC 2005**

'Approach to Sustainability' (Chapter 11), states that:

Recycled Coarse Aggregate may be used in concrete for bulk fills, bank protection, base/fill of drainage structures, pavements, sidewalks, kerbs and gutters, etc.

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

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.

The Indian Roads Congress (IRC) has issued 'IRC-121:2017 Guidelines for Use of C&D Waste in Road Sector' outlining what kind of materials from recycled C&D waste and in what proportion, may be safely used for specific road construction/repair applications.

Despite the presence of these standards, the market uptake of products made from C&D waste has been a concern due to the apparent lack of confidence among potential buyers. Certification is an important way to improve market acceptance when carried out by neutral third parties according to established protocol. GIZ supported Amdavad Enviro Projects (AEP) Private Limited to get their paving blocks certified. The blocks were tested against technical performance criteria (e.g., compressive strength) and certified by an independent, nationally accredited laboratory. Further, the "recycled content" of the blocks was certified by independent certifier, ICMQ-India as per ISO 14020 protocol. Finally, these certifications led to inclusion of the green recycled products in the GRIHA Product Catalogue (the most widely recognized green-building rating system in India). Prospective buyers can automatically get points towards their green rating upon using these pavers. The two certificates are shown in Table 5.

Table 5: Certification of paving blocks produced by AEP, Ahmedabad

Recycled Content Certification from ICMQ-India	Certificate for listing in GRIHA Product Catalogue						
 <p><b>GIG 01-17/B</b></p> <p>THIS IS TO CERTIFY THAT</p> <p><b>CONCRETE PAVER BLOCK</b>  <b>"NuEarth Rubber Mould Paver Blocks"</b></p> <p>Realized by <b>AEP – Amdavad Enviro Project Pvt Ltd</b>  Unit <b>NAROL VISHALA ROAD PIRANA AHMEDABAD (GUJARAT)</b></p> <p>HAS BEEN ASSESSED AND IS IN COMPLIANCE WITH THE GREEN REQUIREMENTS</p> <p><b>GET IT GREEN</b>    <b>BRONZE</b></p> <p>REFERENCE DOCUMENT: IBCI PEP 01</p> <p>THE SCOPE OF THE CERTIFICATION COVERS THE ENVIRONMENTAL ASPECTS SPECIFIED IN THE ANNEX 1 WHICH IS PART OF THIS CERTIFICATE</p> <p>THIS CERTIFICATE IS VALID UNTIL EXPIRY OR UNLESS SIGNIFICANT CHANGES IN THE PRODUCT, PROCESS OR OTHER CONDITIONS HAVE BEEN OCCURRED AFTER THE SIGNATURE OF THE CERTIFICATION CONTRACT</p> <table border="1"> <thead> <tr> <th>FIRST ISSUE</th> <th>CURRENT ISSUE</th> <th>EXPIRY</th> </tr> </thead> <tbody> <tr> <td>31.03.2017</td> <td>31.03.2017</td> <td>30.03.2020</td> </tr> </tbody> </table> <p>The Managing Director</p> <p>ICMQ Certification India Pvt.Ltd, A/102 Sagartech Plaza, Andheri Kurla Road, Sakinaka Junction, Andheri East, 400072 Mumbai.  e-mail: <a href="mailto:sustainability@icmq.in">sustainability@icmq.in</a> – <a href="http://www.icmq.in">www.icmq.in</a></p> <p><small>THE CURRENT STATUS OF CERTIFICATION IS AVAILABLE ON <a href="http://www.icmq.in">WWW.ICMQ.IN</a>  DO NOT ALTER OR DESTROY THIS CERTIFICATE UNDER ANY CIRCUMSTANCES  Penalty of the certifier subject to withdrawal of consent with the Registrar</small></p>	FIRST ISSUE	CURRENT ISSUE	EXPIRY	31.03.2017	31.03.2017	30.03.2020	 <p><b>GRIHA Council</b>  This is to certify that the product</p> <p><b>"Amdavad Enviro Projects Pvt. Ltd. - Nu Earth Concrete Pavers"</b></p> <p>has been included in the GRIHA Product Catalogue under the following categories:</p> <p><b>GRIHA V.2015 criterion: 31</b>  <i>Please note: Projects will only be able to claim points under the assessment criterion if they are found to be compliant with GRIHA V.2015 criterion 4</i></p> <p><b>GRIHA V.3 criterion: 34</b>  <i>Please note: Projects will only be able to claim points under the assessment criterion if they are found to be compliant with GRIHA V.3 criterion 5</i></p> <p><b>SVAGRHA criterion: 14</b>  <i>Please note: Projects will only be able to claim points under the assessment criterion if they are found to be compliant with SVAGRHA criterion 2</i></p> <p>This product can be used in GRIHA &amp; SVAGRHA registered projects to meet the GRIHA &amp; SVAGRHA norms, respectively.  This is valid only for the product which has been mentioned above.</p> <p>The certificate for the above mentioned product is valid from  <b>4th May 2017 - 3rd May 2019</b></p> <p>  <b>Sanjay Seth</b>  Chief Executive Officer</p> <p><small>Note: This evaluation has been done based on the documentation - In the form of 3rd party test results and/or declarations - submitted by the manufacturer to GRIHA Council.  GRIHA Council is a joint initiative of Ministry of New and Renewable Energy, Government of India and The Energy and Resources Institute (TERI) to implement GRIHA (Green Rating for Integrated Habitat Assessment), India's National Rating System for Sustainable Habitats.  www.grihaIndia.org</small></p> 
FIRST ISSUE	CURRENT ISSUE	EXPIRY					
31.03.2017	31.03.2017	30.03.2020					

**Box C: International best practice: Germany<sup>14</sup>**

Due to strictly enforced waste disposal laws and disposal fees that encourage recycling, over 90% of C&D waste produced in Germany is utilised for a wide range of applications as summarised in the table below. The vast majority of recycling and reuse applications in Germany involve very simple technologies and techniques (such as crushing and sorting) that are either already in use or easy to implement in India. Only a small fraction of recycled C&D waste in Germany is used for advanced structural applications (e.g. load bearing concrete) for which detailed standards and protocols have been developed. This is a niche area of ongoing innovation in Germany; however for India, the widespread reuse of recycled C&D waste in simpler applications may be more relevant in the foreseeable future.

<sup>14</sup> Dittrich, et al. (2015). Overview on standards for recycled C&D waste in Germany. IFEU, Heidelberg.

Gardening and landscaping	Earth work	Civil engineering	Structural engineering
<ul style="list-style-type: none"> <li>• Drainage material</li> <li>• Layer in sport fields</li> <li>• Improvement of soil characteristics</li> <li>• Improvement of bearing capacity e.g. below garden walls</li> </ul>	<ul style="list-style-type: none"> <li>• Filling of line ditches and working spaces</li> <li>• Noise protection dams</li> <li>• Anti-freeze sublayers below buildings</li> <li>• Soil exchanges</li> <li>• Improvement of bearing capacity of earth/soil</li> <li>• Construction of temporary streets</li> </ul>	<p>Unbounded:</p> <ul style="list-style-type: none"> <li>• Gravel base layer and anti-freeze base layer</li> <li>• Combined gravel and anti-freeze base layer</li> <li>• Upper layer</li> <li>• Improvement of bearing capacity of plane and ground</li> <li>• Road pavement and flagging</li> </ul> <p>Bounded:</p> <ul style="list-style-type: none"> <li>• Bituminous bounded base layer</li> <li>• Hydraulically bounded base layer</li> <li>• Concrete base layer</li> </ul>	<p>As input in concrete:</p> <ul style="list-style-type: none"> <li>• Mix-in-situ concrete</li> <li>• Ready mixed concrete</li> <li>• Structural elements out of concrete</li> <li>• Concrete goods</li> </ul> <p>As input in other construction materials</p> <ul style="list-style-type: none"> <li>• Mortar</li> <li>• Stones, such as burned bricks, sand-lime bricks or lightweight concrete</li> </ul>

### Guidelines and Advisories

In 2012, the Ministry of Urban Development (MoUD), vide its circular dated June 28, 2012 desired all states to set up environment friendly CDW recycling facilities in all cities/towns with population of over 1 million. The MoUD report, 'Technical Aspects of Processing and Treatment of Municipal Solid Waste', under Swachh Bharat Mission also recognised the need for CDW Management.

Central Public Works Department's (CPWD) 2014 'Guidelines for Sustainable Habitats' included a set of 'Guidelines on re-use of recycled C&D waste.'<sup>15</sup> The guidelines include ways and precautions for recycling of CDW as well as

emphasise the need for a deconstruction plan in order to recover useful products that can be reused without much processing.

BMTPC in 2016 released the 'Guidelines for Utilization of Construction & Demolition Waste in Construction of Dwelling Units and Related Infrastructure in Housing Schemes of the Government' to address the considerable shortage of conventional and traditional building materials in India based on high demand of building materials by 2021-2022.

The Ministry of Housing and Urban Affairs (MoHUA), vide a letter dated March 23, 2016 circulated a notification by CPWD on mandatory use of recycled portions of C&D waste in construction activities, if the same is available within 100 km of the construction site. It also specified that coarse and fine varieties of Recycled Concrete Aggregate (RCA) derived from

#### **Box D: International Best Practice on Recycled Products for use in Structural Applications**

ERC-Tech, a Czech Company, has patented technology for strengthening the structural properties of C&D waste particles by use of nano-additives in a highly controlled way. The technology makes it possible to use C&D waste aggregates in structural applications.

<sup>15</sup> Central Public Works Department. (2014). CPWD Guidelines for Sustainable Habitat. India. CPWD, Gol.

C&D Waste are to be used in Lean Concrete, Plain Concrete Cement (PCC), and Reinforced Concrete Cement (RCC) used in construction.

Delhi PWD issued an advisory to all Delhi Government Departments in 2015, mandating 2-10% use of recycled C&D waste products in building construction and road works. The advisory was reissued by the Delhi PWD in 2018<sup>16</sup>. This updated advisory also mandates the use of C&D waste products and also advises that more small capacity C&D waste recycling plants, i.e., 500 TPD, should be installed at different locations in the city, including at least one for each major stakeholder of the government. The advisory also notes that North Delhi Municipal Corporation has made available seven dumping locations for C&D waste generated from individual houses.

### 3. Highlights of C&D Waste Rules 2016

Recognising the problems arising from C&D waste, the Government of India has notified the “Construction and Demolition Waste Management Rules” in 2016. These rules are quite comprehensive and address responsibilities of different stakeholders including generators, municipal bodies, state Pollution Control Boards, Urban Development Departments, etc. Duties and Responsibilities of the Stakeholders under 2016 Rules are outlined in Table 6 and relevant timelines in Figure 6.

**Box E: Definition of C&D Waste under 2016 Rules**

“Waste comprising of building material, debris and rubble resulting from construction, remodelling, repair or demolition of any civil structure”.

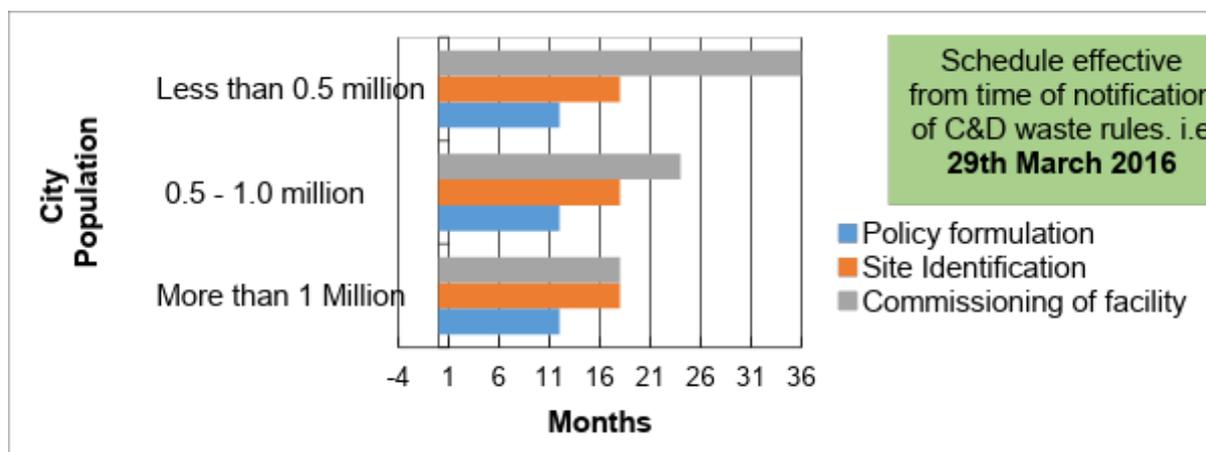
Table 6: Duties and responsibilities of stakeholders under 2016 Rules

Stakeholder	Duties and Responsibilities
Waste generator	<ul style="list-style-type: none"> <li>• Properly collect and store waste within their premises ensuring no spill over or mixing with MSW.</li> <li>• Deposit waste in designated locations as notified by local authority.</li> <li>• Submit waste management plan and get approval before starting construction/demolition work.</li> <li>• Pay relevant charges for collection and disposal as notified by local authority.</li> </ul>
Utility service providers and their contractors	<ul style="list-style-type: none"> <li>• Prepare comprehensive waste management plan.</li> <li>• Collect and store waste securely by avoiding local disruption or pollution.</li> <li>• Arrange with urban local authority for disposal paying the relevant charges.</li> </ul>
Local authority	<ul style="list-style-type: none"> <li>• Main actor responsible for waste management. May contract third party but still responsible for oversight and outcome. Should do a feasibility study before finalizing management plan.</li> </ul>

<sup>16</sup> Office of the Director (Local Bodies), Government of NCT of Delhi. (2018). Use of Recycled Products from Construction and Demolition (C&D) Waste. Government of NCT Delhi. See: [https://pwwdelhi.gov.in/writeread/Circular/Cir\\_201802161507462320.pdf](https://pwwdelhi.gov.in/writeread/Circular/Cir_201802161507462320.pdf)

	<ul style="list-style-type: none"> <li>● Pass by-laws mandating C&amp;D waste management and fix relevant charges and penalties.</li> <li>● Designate intermediate collection points and site for processing facility, if needed in collaboration with state agencies.</li> <li>● Examine and approve waste management plan of generators and collect relevant fees.</li> <li>● Make arrangements for collection, transportation and processing, in contract with private party.</li> <li>● Establish C&amp;D waste generation database through linking waste management permits and monitor compliance.</li> <li>● Carry out sustained IEC activities for all stakeholders.</li> <li>● Create incentives for use of recycled products including through preferential purchase agreements in municipal contracts.</li> </ul>
State Pollution Control Board/Committee	<ul style="list-style-type: none"> <li>● Monitor implementation of the Rules by local authority.</li> <li>● Authorise C&amp;D waste processing facility as per criteria and monitor environmental compliance.</li> <li>● Prepare annual reports for CPCB.</li> </ul>
State government	<ul style="list-style-type: none"> <li>● Prepare policy document for C&amp;D waste management.</li> <li>● Help cities identify land for waste management where necessary.</li> <li>● Facilitate preferential procurement of recycled materials by all state agencies.</li> </ul>
CPCB	<ul style="list-style-type: none"> <li>● Prepare guidelines for C&amp;D waste management.</li> <li>● Analyse data collected by SPCBs and prepare annual compliance report for central government.</li> </ul>
BIS/Indian Roads Congress	<ul style="list-style-type: none"> <li>● Prepare standards for suitable utilisation of recycled products from C&amp;D waste in construction and in roads.</li> </ul>
Central government	<ul style="list-style-type: none"> <li>● Compliance facilitation by MoHUA, MoRD.</li> <li>● Review of implementation by MoEFCC.</li> </ul>

Figure 6: Timelines for implementation of the 2016 Rules



The Rules also provide the compliance criteria for setting up and operating a C&D waste processing facility, summarized in Figure 7.

Figure 7: Compliance criteria for C&D waste processing facility

- Minimum life of processing facility 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
- Provisionof 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

Finally, the Rules also provide a range of forms and templates for ease of implementation by different stakeholders, as shown in Table 7.

Table 7. Forms provided with C&D Waste Rules

<b>Purpose of Form</b>	<b>Responsibility</b>
Application for obtaining authorisation	Operator of CDW processing facility
Issue of authorisation to operator of CDW processing facility	State Pollution Control Board (SPCB)
Annual Report to SPCB	Urban Local Authority
Annual Report to CPCB	SPCB
Accident Reporting	Operator of CDW processing facility
Waste Management Plan	C&D waste generator

## 4. Rationale/Justification for C&D Waste Strategy

Although the C&D Waste Management Rules were notified in 2016, little progress has been made in the intervening two years in terms of widespread adoption of C&D waste processing and utilisation in India. In case of the first two cities with processing facilities – Delhi and Ahmedabad – their facilities actually pre-dated the 2016 Rules. Despite the enabling policy framework, not much progress has been made on the implementation 2016 Rules.

Therefore, it is necessary to understand the importance/benefits of proper C&D waste management as well as identify the challenges and roadblocks so that an effective implementation strategy can be adopted.

### 4.1 Economic and social benefits

- i. Hauling bulky C&D waste for disposal is a substantial expense for municipal bodies which can be significantly reduced (or avoided) with an appropriately designed C&D waste management system in which generators pay for disposal, as envisioned under the 2016 Rules.
- ii. Mixing of C&D waste with solid waste worsens the municipal solid waste management system and also causes imbalances in the tipping fee rates of the MSW management.
- iii. C&D waste processing into recycled products can generate employment through new enterprises, as already seen in Delhi and Ahmedabad.
- iv. Unauthorised dumping of C&D waste creates widespread nuisance, safety and aesthetic problems which can be ameliorated with proper C&D waste management.

### 4.2 Environmental benefits

- i. Unauthorised dumping of C&D waste in drains and hydrological channels obstructs drainage and worsens flooding.
- ii. Piles of C&D waste contribute to particulate air pollution when carried by wind.
- iii. Unauthorised dumping of C&D waste in wetlands or stream/river channels disrupts local hydrology and associated ecosystems.
- iv. Hazardous materials associated with C&D waste may leach out and contaminate soil and groundwater from unauthorised dumps.
- v. Utilisation of recycled products from processed C&D waste helps relieve pressure on natural resources by reducing extraction of virgin materials like sand.

### 4.3 Congruence with existing government policies and priorities

- i. Swachh Bharat Mission: Flagship programme of Government of India for improving waste management and resource recovery; C&D waste management falls squarely within its objectives. Cities must demonstrate improvements in cleanliness and waste management in comprehensive annual surveys, which should serve as an incentive to municipal bodies.
- ii. AMRUT<sup>17</sup>: Mission for urban infrastructure improvement with emphasis on pedestrian zones in 500 ULBs. Recycled products made from C&D waste (e.g., paver blocks) can be used beneficially for pedestrian zones.
- iii. Smart Cities Mission: Mission envisions transformative projects in cities with an emphasis on innovation. C&D waste processing as well as utilisation of recycled products can be included in such projects.
- iv. Housing for All (Pradhan Mantri Awas Yojana): Ambitious mission to address severe housing shortages by constructing 1.2 crores affordable housing units by 2022. Incorporation of “sustainable green materials” is encouraged by the mission, and recycled products from C&D waste can find utilisation.

## 5. Assessment of Challenges and Roadblocks

There remains a host of challenges and roadblocks faced by both government agencies and the private sector that are hindering a wider and quicker adoption of C&D waste management initiatives. It is important to properly understand these challenges so that proposed actions can target them effectively.

### 5.1 Municipal bodies/Local authorities

Local authorities/municipal bodies have the most important role in planning and implementing C&D waste management in their respective jurisdictions under the 2016 Rules. Even if the collection, transport and processing is actually contracted out to a private entity, the local authority is ultimately responsible for the overall performance of the management scheme. However, local authorities/municipal bodies appear to be the weakest link hindering rapid adoption of initiatives and face several challenges. Several factors are responsible for this, including:

- a) City officials may understand the broader aspects of C&D waste management but require support to develop tailor-made solutions to their specific circumstances
- b) Cities do not have adequate capacities and trained personnel to take up the initiatives
- c) Cities do not have financial resources to hire a consultant for an initial feasibility study and/or a DPR
- d) Cities are not convinced how the business case would work in their circumstances, and are apprehensive about the model being a drain on their budget
- e) C&D waste management is considered a low priority (the public is more concerned about MSW), especially in the absence of strong coordination/facilitation by state-level agencies.

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<sup>17</sup> Atal Mission for Rejuvenation and Urban Transformation

### Land shortage

Indian cities are densely populated and poorly planned with respect to infrastructure and necessary civic amenities, hence land shortage is a universal problem. The situation is particularly acute in larger cities where satellite towns are spread all across their borders. Setting up any kind of waste management/recycling facility requires significant amount of land, and that too in zones sufficiently far from residential areas. Many large cities are already struggling to identify appropriate land for MSW management, let alone CDW management which is seen as less urgent. Often, the only feasible option for a large enough land parcel is outside the borders of the municipal body which requires effective collaboration with other entities, especially state government level departments/agencies. Even identifying smaller land parcels needed as intermediate C&D waste collection centres throughout the city/town are a challenge.

### Lack of monitoring capacity/resources

Local authorities/municipal bodies typically suffer from chronic shortages in personnel and resources. They are hard pressed to monitor, collect and dispose MSW adequately, a matter of greater concern to the public, and initiating a new C&D waste management system is an additional responsibility to them for which they feel unprepared. Most cities do not have demolition permits and therefore demolition sites and practices are poorly monitored, if at all. An ideal management plan would require the creation of a new C&D waste monitoring system, as envisioned by the 2016 Rules, for which effective coordination would be required between the ULB's Building Department and the Waste Management Department.

### Lack of capacity and experience in C&D waste management

In addition to the overall capacity/resource issues, C&D waste management is a relatively new topic that many municipal officials have little awareness or experience of. Experience shows that even after capacity development workshops are held, local authorities/municipal bodies are unsure of how to proceed with waste estimation, feasibility planning, tendering and so on. In many cases, inexperience or prior negative experience with PPPs may be an additional cause of hesitation. The ability to hire a consultant for a feasibility study is limited by funding shortages; even when consultants are hired there is sometimes no guarantee that they will provide appropriate guidance.

### Concern about finances and business case

Due to chronic financial pressures, local authorities/municipal bodies are instinctively wary of any new commitments that appear to them as a new source of expenditure. During capacity development workshops it is typically difficult to convince them about the successful business case employed in the Delhi and Ahmedabad models. The tipping fee paid to the contracted party by the ULB is seen as an unjustified burden when in reality it may not be a net expense given that: a) the ULB saves money by not having to haul bulky C&D waste, and b) the 2016 Rules allow the ULB to impose charges on waste generators; tipping fees can be paid from this revenue. In some cases, urban officials have even proposed that the contracted party actually pay the ULB rather than receiving a tipping fee for each tonne of C&D waste, and/or share profits from selling recycled products with the ULB. Not surprisingly, this deters potential investors since recycled C&D waste products are still a nascent market in India.

### Lack of urgency/priority

In many cities/towns, even preliminary discussion and planning has not happened on C&D waste management, while in others progress has stalled after preliminary discussions. C&D waste management is seen as a low priority, in the context of overall shortage of personnel/resources. MSW disposal is of greater concern to the public and there have been MSW-related lawsuits in many cities. As a result, MSW collection and disposal is treated as a higher priority.

## **5.2 Private sector/Construction industry**

The construction industry also has an important role to play – both in ensuring that their generated waste is disposed properly and in gradually increasing the adoption of recycled products in construction practices. Larger players should ideally adopt significant in-situ utilisation of C&D waste in their projects, wherever feasible, and could consider investing in processing facilities as a business option.

### Lack of awareness and concern

The construction industry is entrenched in its ways and is historically used to turning a blind eye to how C&D waste is disposed; getting them to change their ways is likely to be a difficult and gradual task. At the same time, there is little awareness about C&D waste recycling and utilisation beyond using rubble as a filling material.

### Dominance of the unorganised sector in demolition

The demolition sector is overwhelmingly dominated by small players in the unorganised sector, the only exception being a handful of specialised companies whose niche is high-tech demolition related to large infrastructure projects. This naturally makes it difficult for urban officials to monitor and regulate small demolition contractors who are typically not registered and are used to getting away with disposing of C&D waste in unauthorised locations.

### Lack of confidence in recycled products

The experience in Delhi and Ahmedabad has shown that the market for recycled products made from C&D waste is still quite weak in India. Engagement with the construction industry repeatedly demonstrates that potential buyers are hesitant about such recycled products that they perceive to be inferior in quality. Even when informed about the updated BIS standard (383) that allows recycled aggregates in many applications, potential buyers appear risk averse, pointing to their clients who seem to prefer “conventional” products.

### Poor economic viability of recycled products

Currently aggregates are taxed at 5% and manufactured products are taxed at 18% making the use of recycled products economically unviable for customers. GST relaxation for C&D waste recycled products including manufactured products such as tiles, paver blocks, bricks, sand and aggregates may be considered.

**Box F: Best practices in on-site utilisation of C&D waste in Indian redevelopment projects**

- Godrej Vikhroli project, Mumbai
- East Kidwai Nagar redevelopment project by NBCC, New Delhi

### **5.3 State government agencies/Departments**

While local authorities/municipal bodies have the most important responsibility in planning and implementation of C&D waste management, state government agencies and departments can often play a crucial role in ensuring proper coordination and paving the way for successful implementation.

#### Low involvement of state urban departments

State urban departments are supposed to frame policies on C&D waste management, supplementing the 2016 Rules, to help implementation taking local context into account. Moreover, the active involvement of state urban departments (sometimes, with other related agencies) may be needed for suitable land identification and dedication for establishing waste processing facilities, as outlined in section 5.1. In most cases, their engagement has been poor; C&D waste management appears to be a low priority issue.

#### Low engagement by public construction agencies

State government agencies such as PWD, Housing Development Board/Authority, City Development Authority, public sector utility companies, etc. are involved in significant construction/demolition work. As per the 2016 Rules, these entities are supposed to coordinate with local municipal bodies about proper disposal of their C&D waste, implement in-situ utilisation of C&D waste in their own projects wherever feasible, and adopt policies to buy recycled products. However, engagement has remained weak, partly as a result of coordination challenges between state and local government level entities.

## **6. Proposed C&D Waste Management Model**

Based on the experience in Delhi and Ahmedabad, and using the 2016 Rules as a guideline, GIZ and Development Alternatives has developed a standardised C&D waste management model for cities<sup>18</sup>. The basic steps are outlined below.

#### Preliminary assessment and inventorisation

City conducts preliminary assessment of waste generation trends, suitable locations for collection and disposal, collection and transportation costs, market for recycled products, etc. Based on construction and demolition permits, city can arrive at a rough estimate of waste generation based on the TIFAC thumb rule, depicted in Table 8.

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<sup>18</sup> See GIZ and Development Alternatives. (2017). Training Manual on Construction and Demolition Waste Management in India for Cities and Towns. New Delhi, GIZ.

Table 8: TIFAC thumb rule

TIFAC Thumb Rule	
Type of Activity	Estimated Waste Generation (kg/sq.m.)
Construction	50
Demolition	400
Renovation	45

Land Availability

City identifies suitable land for a processing facility for the designed capacity and raw material/finished product storage. If needed, state government intervention may be required for suitable land. In addition, a network of intermediate collection points across the city are identified to minimise transportation distances. For smaller ULBs, cluster approach may be adopted with neighbouring towns, if close by.

Adoption of by-laws and charges

City adopts/amends by-laws to mandate C&D waste permit system for all generators, duties of generators, and notification of collection/disposal sites. Charges for collection, transportation and disposal are also levied on all generators and penalties are fixed for violations.

Adoption of business model and selection of private agency

The ULB shall decide on the best suited business and operation model for collection, transportation and processing of C&D waste. Keeping in view the capital-intensive infrastructure and high O&M, the PPP model (DFBOT) is best suited for the management of the C&D waste. In an ideal arrangement, the ULB shall adopt an output-oriented model.

### Operation, monitoring and communication

The ULB shall collect upfront user charges from generators while approving their waste management plan which is tied to the construction/demolition permit. Subsequently, penal provisions for not complying with C&D waste Rules/by-laws to be implemented in letter and spirit. Generators are required to dump their waste to their nearest designated intermediate collection point. The contracted agency transports waste from these sites to the processing facility. Each disposal site has a weigh-bridge that instantly records the amount of waste entering against the tracking serial number associated with each generator's construction/demolition permit. That way it is ensured that the waste produced by each generator actually reaches the designated site/s and is not disposed in an unauthorised manner.

#### **Box G: Options for smaller towns**

In smaller towns where the waste generated is below 100 TPD, a processing unit may not be viable. In some rare instances, it may be possible for neighbouring towns to have a joint plant provided they are close enough to each other. In most cases, a mobile crusher may be a suitable option and the recycled aggregates produced may be used by the town's own civil works, other public agencies such as PWD, or local building material manufacturers may be incentivised to use them.

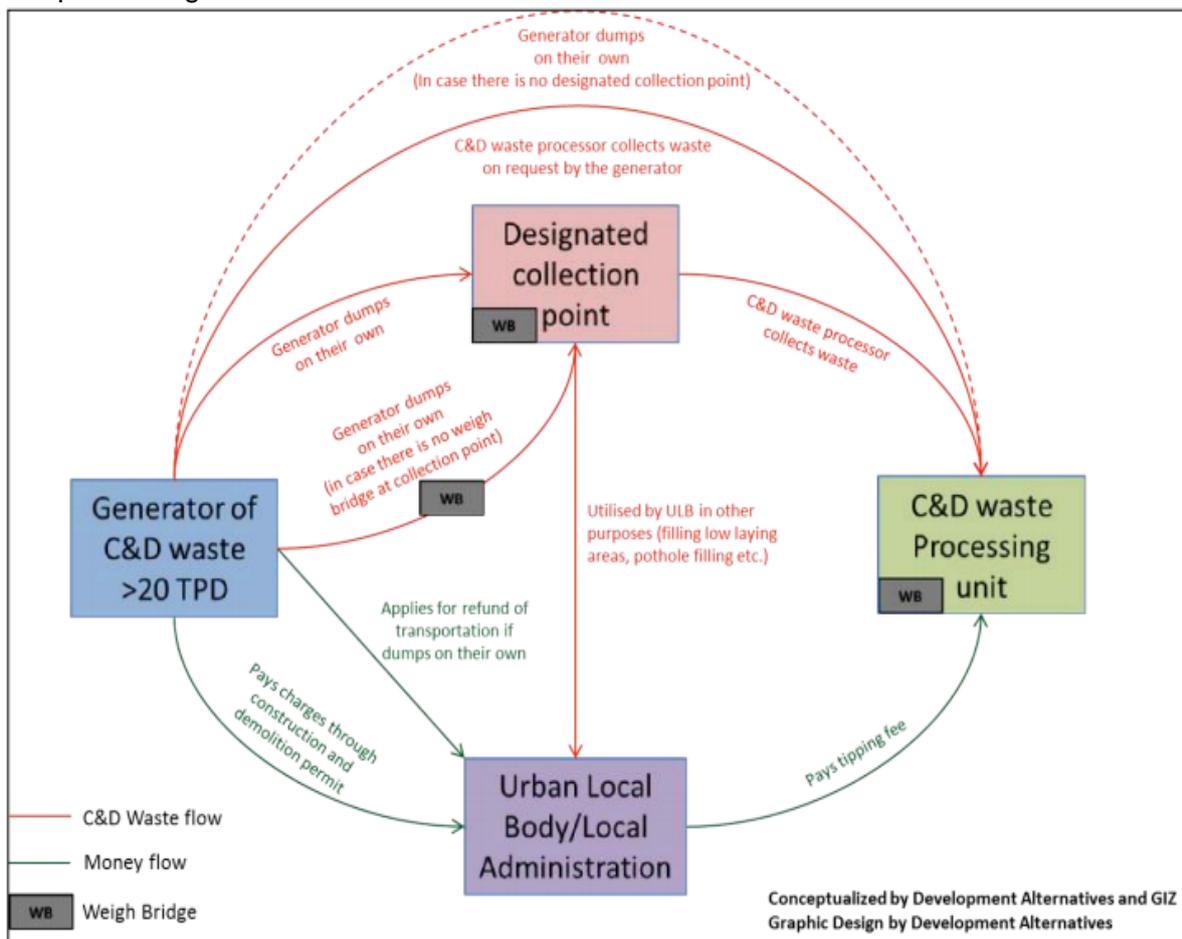
The ULB must also undertake sustained and comprehensive IEC activities targeted towards all stakeholders such as small generators, bulk generators, demolition contractors, builders and developers, covering all aspects of the ULB's CDW management plan including by-laws, designated disposal sites, fees and fines, authorised collection and transportation agencies, permitted re-use of CDW, etc. An information and complaint redressal helpline must be also made active.

### Public procurement of recycled products

City adopts preferential procurement policy to use recycled products made from C&D waste in municipal civil works and encourages other private and public entities to do the same. For a sample public procurement policy, see Annex 1.

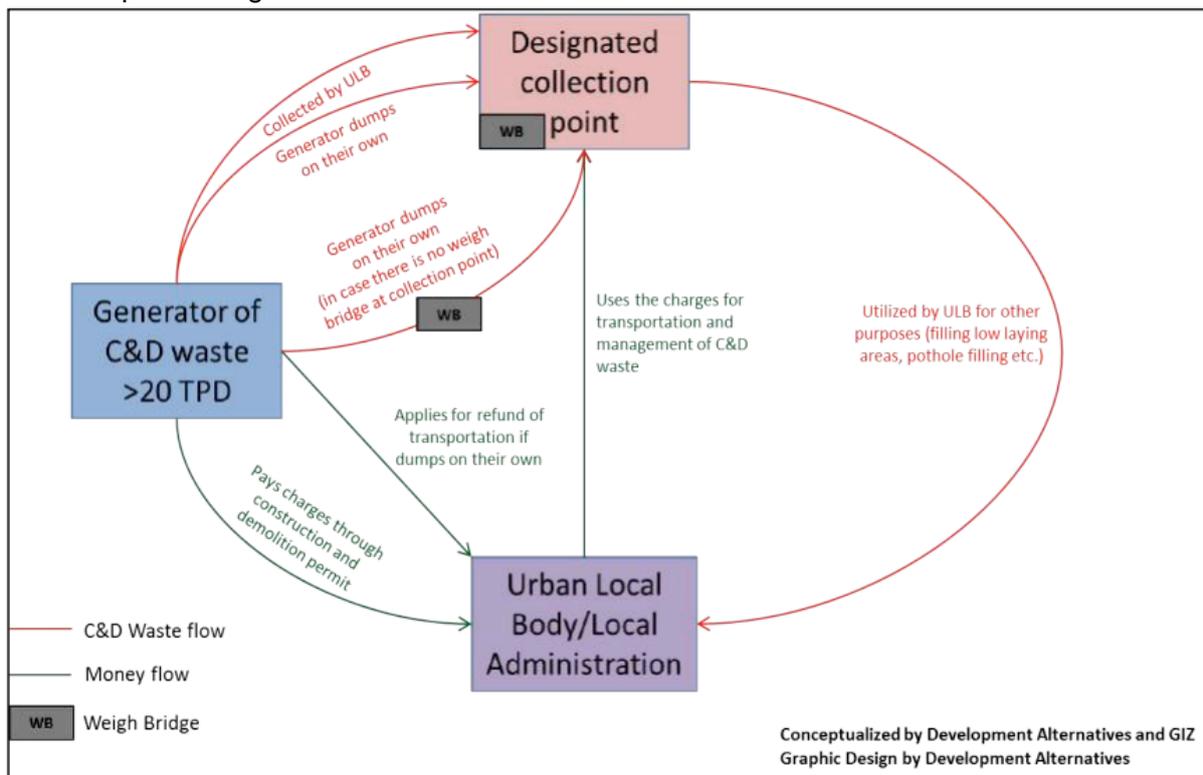
This standardised management model with a processing unit is depicted in Figure 8 in a simplified way.

Figure 8: Material and cash flow in standardised C&D waste management model in a city with processing unit



As mentioned in Box F, for smaller towns with low CDW generation rate, a processing facility may not be required. Smaller towns may follow a cluster approach whereby a common C&D waste treatment facility is operated jointly if several towns are located close by. This facility may be located in a common region accessible or equidistant from multiple ULBs. Alternatively, smaller towns may operate a mobile crushing unit that can be moved to sites where C&D waste is generated (see Box G for more details). Crushed and sorted C&D waste (recycled aggregates) may then be taken away by end-users, based on type of application (e.g. backfilling/landfill use/road repair or construction/etc). A standardised model C&D waste management model without a processing unit is depicted in Figure 9.

Figure 9: Material and cash flow for a standardised C&D waste management model without a central processing unit



A centralised web-platform to serve as an online market place can be developed. The platform may include information on the C&D waste generated and the place of generation to provide updated information to the users for prompt utilisation.

#### Box H: Mobile Crushers



Mobile crushers, consisting mostly of crushing and screening equipment, are ideal for on-site treatment of C&D waste. They are easily transportable using hook lift lorry and ready to operate in a short time. Materials such as wood or metal must be removed manually before feeding the waste into the crusher. Concrete, stones, brick and mortar and mixed CDW can be fed into screening section designed as per crusher feed size. Oversized materials should be resized by rock breaker/hammering before feeding. Based on the nature of waste feed, either recycled concrete aggregate or recycled (mixed) aggregate would be obtained. Some prominent mobile crusher manufacturers include Rubble Master, Terex, and Kleemann.

## 7. Components of C&D Waste Strategy

Ministry of Housing and Urban Affairs (MoHUA) would take the role of lead agency in driving forward the C&D Waste Strategy. MoEFCC will continue to play a regulatory role in compliance. Salient components of the C&D Waste Strategy are outlined below.

### 7.1 Inventorisation and Characterisation of C&D waste

A comprehensive assessment of total C&D waste generation in India is required, as elaborated in section 2.1. Municipal authorities while trying to estimate the quantum of C&D waste typically rely on the waste that is hauled to the landfills or dumped in locations under their direct jurisdiction. However, a significant portion of the waste (“rubble”) is diverted for illegal filling before construction and/or disposed of in places beyond the municipal jurisdiction (say, in riverbeds or along highways outside cities).

The TIFAC Thumb Rule, mentioned in section 6, estimates C&D waste generation based on the area being constructed/demolished (50 kg/m<sup>2</sup> for construction and 400 kg/m<sup>2</sup> for demolition). In the absence of a more detailed methodology, municipal authorities may use this rough guide for approximate estimation. ULBs need to know the exact area of buildings/projects that will undergo construction/demolition to adopt this methodology for C&D waste Quantification. It is recommended that ULBs create easily accessible inventory from construction/demolition permits. The lack of precise estimates of the quantum of C&D waste need not hold up plans for setting up a management plan with a recycling facility. Even with an estimate based on C&D waste collected, the city can go ahead with the planning since the standard (prudent) approach to minimise risk is to plan the first facility at a level much lower than actual generation, with the option of future expansion.

In addition to inventorisation of the amount, characterisation of the C&D waste is necessary because the composition of C&D waste can vary from city to city. It is important to know the composition of C&D waste in a particular city since the composition affects: a) the management plan, including collection, transportation and storage, b) the processing techniques and technologies used, and c) the products to be manufactured out of recycled waste.

#### Implementation

MoHUA may constitute an ad hoc expert task force comprising of reputed expert institutions such as IITs, CBRI, TIFAC, GIZ, EU-REI, etc. for this purpose. The task force will: a) select a quantity estimation method best suited for the Indian context out of many approaches in use worldwide, b) use this method to estimate the total amount of C&D waste generated per year in the country, c) prepare a simple model for cities for estimating C&D waste generation within their own boundaries without having to undertake long and detailed studies, and d) prepare a standardised method for cities to characterise the composition of C&D waste in Indian context.

The Swachh Bharat Mission (SBM) online portal, already in use by ULBs to report on MSW, may be expanded for collecting information on C&D waste generation nationwide.

MoHUA may consider developing a centralised web-platform to serve as an online market place. The platform may include information on the C&D waste generated and the place of generation to provide updated information to the users for prompt utilisation.

## **7.2 Planning Assistance (Handholding) for Cities**

Experience shows that progress towards implementation of C&D waste management frequently stalls after some degree of initial planning, sometimes even when capacity development efforts are conducted. “Handholding” assistance to ULBs is absolutely essential, ideally throughout the planning stages. Such assistance has to be conceived carefully since there have been instances where cities have received “guidance” from consultants that was not appropriate to their circumstances resulting in stalled progress. Experts/consultants would be needed to engage with the city over an extended period of time, providing guidance on a range of issues:

- a) Geographic mapping of waste generation hotspots, possible locations for intermediate collections and final processing facility, transportation distances, etc.
- b) Framing of by-laws on C&D waste management incorporating appropriate levels of fees and penalties for generators
- c) Development/augmentation of construction/demolition permits consolidated into an easily accessible inventory and linking them with project approvals
- d) Development of a financial model for cities with little or no net cost for C&D waste management, where the revenues generated from upfront fees collected from generators are used to pay tipping fees to the contracted party for collection and processing
- e) Development of tendering documents
- f) Development of reporting and monitoring framework and procedures
- g) Development of public procurement policy for recycled products
- h) Identification of financial assistance from central/state bodies/schemes for planning and implementing C&D waste management.

### Implementation

MoHUA may empanel suitable expert agencies/consultants who can provide such handholding assistance to cities. MoHUA’s task force may also develop approaches for handholding assistance. From time to time, MoHUA may disseminate best practices, develop toolkits for capacity development for infusing confidence in ULBs for taking necessary action.

## **7.3 Promoting State-level Facilitation**

While ULBs have the central responsibility in implementing the C&D Waste Rules, state government level departments and agencies have an important secondary role to play in bringing about effective C&D waste management in their respective states. State level facilitation is essential because:

- a) State agencies, particularly Urban Development Departments (UDD), may be able to provide funds for initial planning to cities
- b) State agencies including UDDs and Pollution Control Boards (PCB) may be able to provide technical expertise to cities who need them, especially smaller towns
- c) Sometimes suitable land for a processing facility may only be available outside the jurisdiction of a municipal body, so coordination with state level agencies is essential
- d) State agencies like PWD, Housing Boards, etc. are significant generators of C&D waste and need to adopt policies for C&D waste management, in coordination with municipal bodies. These agencies are also ideal entities to adopt Public Procurement Policies for recycled products since they are significant bulk consumers.
- e) A sustained “push” by state level agencies, accompanied by facilitation, can convey a sense of urgency to municipal bodies who may otherwise tend to accord lower priority

to C&D waste management. Sustained state level engagement is imperative for adoption of C&D waste management throughout the state in a time-bound manner; otherwise progress may be restricted to one or two “resourceful” cities only.

State-level engagement has been relatively weak so far and needs to be further strengthened.

#### Implementation

MoHUA may take the lead in convening key state government officials to provide momentum to state engagement in C&D waste management using the 2016 Rules as a guide. Appropriate incentives may be considered for the best performing states, not limited to special recognition.

### **7.4 Promotion of awareness in construction industry**

Developing an industry-oriented awareness and capacity development material and sharing them through a web-portal (as outlined in section 7.2) is only the first step. Sustained outreach and engagement is required to change perceptions and entrenched business practices in the construction industry, including utilisation of recycled products. The construction industry is heterogeneous and made of different types of actors – builders/developers, demolition contractors, architects, building material manufacturers, etc.; capacity development needs to target all such actors. Industry and professional associations may be roped in to achieve this. Such associations can adopt these capacity development initiatives through workshops, trade shows, and their own publications. Once the industry associations are convinced that a) the industry needs to meet this legal mandate (2016 Rules), and b) profitable business opportunities can be realized, they are likely to take over this responsibility. Scientific experts from government and industry need to be harnessed in such outreach efforts to convince stakeholders about effective waste management practices and processes as well as the reliability of recycled products made from C&D waste. The potential for new profitable investments in recycling C&D waste need to be stressed, with special emphasis on marketing such “green” products through eco-labelling or other forms of recognition in the market such as certification from bodies like GRIHA, IGBC, etc. BMTPC can also be an important stakeholder in this effort.

#### Implementation

MoHUA can initiate engagement with professional and industry associations such as CII, FICCI, Builders Association of India (BAI), Indian Institute of Architects (IIA), CREDAI, etc. These bodies can subsequently take over the responsibility of outreach to the wider construction industry with minimal involvement of the government. Frequent capacity development events should be organised in each city by these associations and their partners (say, once every quarter) to make sure that a significant portion of the industry in that region has been reached. The bigger players may be targeted first and then gradually moving down to the smaller players. This high frequency of events only need to be maintained for the first couple of years to achieve a minimum threshold of awareness across the industry; subsequently such events may be scaled back to a lower frequency as deemed appropriate.

### **7.5 Promoting utilisation of C&D waste recycled products**

Implementing an effective C&D waste management system is inadequate unless recycled products find use in construction; this is often referred to as “closing the loop”. Recycled coarse and fine aggregates can be used directly, for example in road construction or Ready-Mix Concrete (RMC), or a variety of pre-cast products can be manufactured with these recycled aggregates including paver blocks, hollow blocks, tiles, etc. However, there is lack of awareness and/or confidence in such recycled products as discussed in section 6, leading to poor market uptake. This is despite the presence of policies including:

- a) Revised BIS 383 standard that permits the use of recycled coarse and fine aggregates for non-structural applications
- b) CRRI certification of recycled aggregates for use as Granular Sub Base (GSB) in road construction
- c) 2016 Rules calling for preferential public procurement of recycled products by municipal bodies and other government agencies such as PWD
- d) MoUD 2012 notification for all states to set up environment friendly CDW recycling facilities in all the cities/towns with population of over 1 million.
- e) CPWD 2014 Guidelines on re-use of recycled C&D waste as included in the Guidelines for Sustainable Habitat.
- f) BMTPC 2016 Guidelines for Utilization of Construction & Demolition Waste in Construction of Dwelling Units and Related Infrastructure in Housing Schemes of the Government
- g) Ministry of Housing and Urban Affairs vide a letter dated March 23, 2016 circulated a notification by CPWD on mandatory use of recycled portions of C&D waste in construction activities, if the same is available within 100 km of the construction site. Delhi PWD department issued a 2015 advisory to all Delhi Government Departments mandating 2-10% use of recycled C&D waste products in building and road works. Advisory was reissued by the Delhi PWD department in 2018 that also mandated the use of C&D waste products and also advised that more small capacity C&D waste recycling plants i.e. 500 TPD should be installed at different locations in the city.<sup>19</sup>
- h) Green building rating schemes such as GRIHA promoting the use of recycled products from C&D waste.

It is clear that a broader policy push is necessary to alter market dynamics to foster greater uptake of recycled products from C&D waste, including efforts to safeguard recycled product quality and financial viability. Once a mature market develops for such recycled products, there will be less need for financial incentives.

### Implementation

- i. Successful Preferential Public Procurement policies such as those in Delhi and Ahmedabad should be circulated as a template<sup>20</sup> by the MoHUA in their capacity development efforts with guidance on how they can be adapted to a particular city's circumstances if necessary.
- ii. MoHUA may guide state agencies such as PWD, Housing Board, etc. to adopt Preferential Public Procurement policies in a time-bound manner.
- iii. MoHUA may direct CPWD for inclusion of various recycled products from C&D waste in their Schedule of Rates.
- iv. MoHUA to engage with BIS to investigate further development/amendment of standards and the prospects for ISI certification of several categories of products made from C&D waste.
- v. MoHUA to engage with BIS for increased inclusion of recycled products made from C&D waste into future revisions of the National Building Code.
- vi. MoHUA to engage with Indian Roads Congress for increased adoption of recycled aggregates in road making.

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<sup>19</sup>Office of the Director (Local Bodies), Government of NCT of Delhi (2018), Advisory on Use of Recycled Products from Construction and Demolition (C&D) Waste, [https://pwwdelhi.gov.in/writeread/Circular/Cir\\_201802161507462320.pdf](https://pwwdelhi.gov.in/writeread/Circular/Cir_201802161507462320.pdf)

<sup>20</sup> Procurement policy of Ahmedabad is reproduced as a template in the GIZ C&D Waste Manual for Cities produced under Indo-German collaboration with MoEFCC.

- vii. MoHUA to engage with MoEFCC for inclusion of recycled products made from C&D waste in the revived “Eco-Mark” labelling scheme.
- viii. MoHUA to engage with Ministry of Finance to explore GST rebates on recycled products.
- ix. MoHUA to engage with green building rating schemes such as GRIHA and IGBC for inclusion of a greater range of products made from C&D waste into their certification schemes.
- x. MoHUA may make necessary arrangements for developing quality checks of recycled products that involve reliable and transparent third-party testing.

## 8. Recommendation Summary and Action Agenda

Category/Component	Challenges	Institutional Steps/Implementation Agency	Action Items	Outputs (if any)	Timeline
Inventorisation and characterisation of C&D waste	<ul style="list-style-type: none"> <li>- nationwide estimate dated/not reflective of current reality</li> <li>- ULBs have poor records</li> <li>- ULBs lack expertise on methods in inventorisation and characterisation</li> </ul>	MoHUA to convene ad hoc task force comprising of reputed institutions such as IIT, CBRI, TIFAC, EU-REI, GIZ, etc. for inventorisation and characterisation of C&D waste	Task Force to: <ol style="list-style-type: none"> <li>select quantum estimation method best suited for Indian context</li> <li>use this method to estimate nationwide generation</li> <li>prepare simple standardised method for cities to estimate and characterise waste</li> <li>SBM portal to be expanded to include data on C&amp;D by ULBs</li> <li>Centralised web-platform to serve as an online market place can be developed</li> </ol>	<ul style="list-style-type: none"> <li>- Simple standardised method for cities to estimate and characterise waste in Indian context</li> <li>- web-portal</li> </ul>	January-June 2019
Planning assistance (handholding) for cities	<ul style="list-style-type: none"> <li>- ULBs unsure on preparing a management plan related to their particular circumstances</li> <li>- lack of suitable personnel and/or financial resources to hire consultant</li> <li>- ULBs concerned about business case/revenue loss</li> </ul>	MoHUA to empanel expert agencies/consultants to provide handholding assistance to cities making sure that only the recommended approach is used	<ul style="list-style-type: none"> <li>- Empanelled consultants to provide assistance to cities on developing detailed management plan, financial model and implementation strategy</li> <li>- MoHUA may disseminate best practices and C&amp;D management models along with development of toolkits covering technical aspects, management models, business case, tendering documents, etc.</li> <li>- MoHUA, with appropriate consultants and expert agencies, to conduct capacity development workshops for ULBs</li> </ul>	Capacity development toolkits for ULBs	<ul style="list-style-type: none"> <li>- Toolkits ready by June 2019</li> <li>- Capacity development workshops throughout 2019</li> <li>- Handholding assistance on an ongoing basis</li> </ul>

Accelerating state-level facilitation	Low engagement by state agencies hindering technical/financial assistance, land identification, as well as compliance by cities	MoHUA to convene key state government officials to provide momentum for state engagement	State-level facilitation and recognition of efforts		Jump-starting engagement in the first half of 2019 - Continued engagement on an ongoing basis
Promotion of awareness in construction industry	- Entrenched perceptions and business practices - Heterogeneous industry with significant informal/unorganized actors	MoHUA to engage with professional and industry associations such as CII, FICCI, BAI, CREDAI, IIA, etc.	- Industry associations to conduct sustained outreach covering all types of industry actors using capacity development manuals/toolkits on “deconstruction”, recycling and reutilisation - special emphasis to be placed on technical standards (e.g., BIS) as well as “green” marketing and certification through BMTPC/GRIHA/IGBC	Capacity development manuals/toolkits for construction industry	- Manuals/Toolkits disseminated in the first half of 2019 - Engagement/outreach on an ongoing basis
Promoting utilisation of C&D waste recycled products	- lack of awareness about recycled products - perception of inferiority about recycled products	- MoHUA to engage with various stakeholders such as CPWD/PWDs, BIS, GRIHA/IGBC, BMTPC, etc.  - Sustainable public procurement of C&D products by government agencies to promote market development	- ULBs and State agencies to adopt public procurement in a time-bound manner - CPWD/IRC to promote increased adoption of C&D waste products - BIS to promote standards and inclusion in National Building Code - MoFinance to consider GST rebates - MoEFCC to adopt Eco-Mark label - MoHUA to make arrangements for quality checks or recycled products through third-party testing	- Preferential Public Procurement Template - Eco-labelling and certification standards	- Adoption of Preferential Public Procurement in 2019 - Inclusion in SoR in 2019 - Engagement with BIS/IRC on standards/codes on ongoing basis - Eco-labelling and certification on ongoing basis

**Priority:** Expediting the implementation of management plans and commissioning of C&D waste facilities in cities/towns of population of more than 1 million.

## **ANNEX 1: PREFERENTIAL PROCUREMENT POLICY - 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](mailto: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.

Director  
(Solid Waste Management)

## 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

## ANNEX 2: SAMPLE CONSTRUCTION/DEMOLITION PERMIT

Dated
Name of Individual/Institution
Project name
Type of work: _____ (construction, renovation, demolition)
Location
Construction Commencement date
Construction Completion date
Estimated waste generation tonnes/day (average; maximum and minimum)
Excavated Earth materials (vegetation, sand, soil)
Concrete
Bricks and Mortar
Debris
Metals
Others
Plan for Management 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
Provisions for waste storage (tonnes) for each category listed above and duration
Quantity of waste committed to (bidder) in tonnes/day

## ANNEX 3: 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**



**Fence Post**



**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.*)