Procedures and approaches to minimize emissions from construction

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Centre for Science and Environment
Construction & Demolition (C&D) waste means “the waste comprising of building material, debris and rubble resulting construction, re-modeling, repair and demolition of any civil structure”

Construction and Demolition Waste Management Rules, 2016
Why is this a concern?
CONCERNS

• C&D waste is routinely dumped in open drains and water channels, clogging them and leading to urban flooding during rains.
• Dumping of C&D waste in wetlands, water channels and riverbeds disrupts the hydrology and destroys the aquatic ecosystem.
• Leachate and fine chemical particles from C&D waste degrade the soil, leading to land and groundwater pollution. Especially hazardous components include paints, oil and asbestos sheets.
• C&D waste is filling up existing landfills and dump-yards, resulting in the need for more landfills or alternative dumpsites.
• C&D waste usually gets mixed up with other municipal solid waste during the process of transfer or at the collection site. Once mixed, it makes composting and/or recycling of MSW highly difficult.
• C&D waste includes hazardous substances such as sharps, broken glass, boulders, broken wooden logs, rusted metal, broken ceramics, etc., which create a hazardous environment when dumped on unfenced open places.
• C&D waste dumped on streets and footpaths blocks traffic and pedestrians, frequently contributing to traffic congestion and even accidents.
• C&D waste is one of the primary sources of fugitive dust pollution.
<table>
<thead>
<tr>
<th></th>
<th>Water Bodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pattinapakkam Beach</td>
</tr>
<tr>
<td>2</td>
<td>Yamuna, Delhi</td>
</tr>
<tr>
<td>3</td>
<td>Ram Nadi, Pune</td>
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<tr>
<td>4</td>
<td>Mangroves, Navi Mumbai</td>
</tr>
<tr>
<td>5</td>
<td>NRI Complex, Mumbai</td>
</tr>
<tr>
<td>6</td>
<td>Keelkattalai Lake, Chennai</td>
</tr>
<tr>
<td>7</td>
<td>Coimbatore</td>
</tr>
</tbody>
</table>
Composition of construction and demolition waste in India as per Technology Information, Forecasting and Assessment Council

- 36% Soil/sand, gravel
- 31% Masonry/brick
- 23% Concrete
- 5% Metals
- 2% Bitumen
- 2% Wood
- 1% Others
Sand Mining
It is killing our rivers twice
As waste lies waste... nature is devasted to support urban boom

Sand mining triggers debate

2012: Supreme Court order on stronger regulations for minor minerals

2013: National Green Tribunal declared sand mining with environmental clearance illegal.

Union Ministry of Housing and Urban poverty alleviation alerted Rajya Sabha in 2012 about the shortage of building material especially aggregates. Holding up housing and civic infrastructure projects...

Need substitutes and strategies to reduce stress on naturally sourced material
But, How big is the waste problem?

“No estimates or even guesstimates exist for construction and demolition waste” in the country

Comptroller and Auditor General of India 2008
<table>
<thead>
<tr>
<th>Year</th>
<th>Authority/Institute</th>
<th>Estimate (million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Ministry of Urban Development</td>
<td>10-12</td>
</tr>
<tr>
<td>2001</td>
<td>Technology Information, Forecasting and Assessment Council, Department of Science</td>
<td>12-15</td>
</tr>
<tr>
<td></td>
<td>and Technology</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>Ministry of Environment and Forest</td>
<td>10-12</td>
</tr>
<tr>
<td>2013</td>
<td>Centre for Science and Environment</td>
<td>530</td>
</tr>
<tr>
<td>2014</td>
<td>Ministry of Urban Development</td>
<td>No estimates exist</td>
</tr>
<tr>
<td>2015</td>
<td>Ministry of Urban Development</td>
<td>10-12</td>
</tr>
<tr>
<td>2015</td>
<td>Development Alternative and GIZ</td>
<td>750</td>
</tr>
<tr>
<td>2016</td>
<td>Ministry of Environment, Forest and Climate Change</td>
<td>530</td>
</tr>
<tr>
<td>2017</td>
<td>Building Material and Technology Promotion Council</td>
<td>150</td>
</tr>
</tbody>
</table>
According to TIFAC estimates:

New construction generates about 40-60 kg per sqm of build up area

Repair and renovation of existing buildings generates 40-50 kg per sqm

Demolition of buildings generate 300-500 kg per sqm

Mckinsey estimates for trend in built up area in India

Based on these CSE guesstimated:

Indian buildings in 2013 have generated more than 530 million tonnes - 44 times more than official estimates. More than other solid wastes

Additionally astounding amount of waste is generated from infrastructure projects - roads, flyovers, bridges etc
Small steps to make resource from waste

C&D waste can be recycled and reused in construction and minimize environmental degradation and pressure on land. Matured technologies are available.

**Small steps in Delhi and Mumbai:**

**MCD-ILFS-IEISL initiative in Delhi**  
C&D waste is being recycled into aggregates which are converted to Ready Mix Concrete, pavement blocks, kerb stones and concrete bricks.

**YUVA and CIDCO initiative in Navi Mumbai**  
This has recycled 1500 tonnes of C&D waste between 2002-06. But operations shut down as no policy and market support.
Types of recycling plants

In the Mobile C&D waste recycling plant, the material is crushed and screened and ferrous impurities are separated through magnetic separation. The plant is transported to the demolition site itself and is suited to process only non-contaminated concrete or masonry waste.

In the semi-mobile C&D waste recycling plant, removal of contaminants is carried out manually and the end product is also screened. Magnetic separation for removal of ferrous material is carried out. End product quality is better than that of a Mobile unit. These plants are not capable to process a of mixed demolition waste containing matter like metal, wood, plastic, etc.

Stationary C&D waste recycling plants are equipped for carrying out crushing, screening as well as purification to separate the contaminants. (ex. the 1st C&D waste processing facility commissioned in Delhi in Burari and operated by IL&FS)
Materials recovered from C&D

Mixed Waste

Concrete Waste

Recycled Aggregate (RA)

Recycled Concrete Aggregate (RCA)

Sand Substitute Aggregate - 3mm

Aggregate 10-20 mm

Aggregate 3-10 mm

Aggregate 3-10 mm

Aggregate 10-20 mm
Pavement Blocks and Kerbstones

No takers
What was coming in the way?

Indian standards used to permit only ‘naturally sourced’ material

No legal framework
Municipal Solid Waste (Management and Handling) Rules 2000 only made a brief mention of C&D waste without laying down any guidelines for its management.

No standards for recycled products
The BIS allows use of non-natural materials to be used for construction but doesn’t have any specific standard for recycled material, leading to major confusion among various agencies and developers. Most are abstaining from using recycled waste citing Indian standard specification related to aggregates for concrete state that these should be ‘naturally sourced’.

-- Only virgin materials (sand, aggregate) mined directly from nature can be used. This does not allow recycled or reused components

-- Any use of recycled aggregate become ‘illegal’

State construction agencies could not include these material in their Schedule of Rates
## 2016 Amendment of IS:383
### Coarse and Fine Aggregate for Concrete

**(Clause 4.2.1)**

<table>
<thead>
<tr>
<th></th>
<th>Maximum utilization in</th>
<th></th>
<th></th>
<th>Lean Concrete (less than M15 grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plain Concrete</td>
<td>Reinforced Concrete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Coarse Aggregate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Iron slag aggregate</td>
<td>50%</td>
<td>25%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>ii) Steel slag aggregate</td>
<td>25%</td>
<td>Nil</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>iii) Recycled concrete aggregate (RCA) (See Note 1)</td>
<td>25%</td>
<td>20% (only upto M20 grade)</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>iv) Recycled aggregate (RA)</td>
<td>nil</td>
<td>nil</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>2) Fine Aggregate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Iron slag aggregate</td>
<td>50%</td>
<td>25%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>ii) Steel slag aggregate</td>
<td>25%</td>
<td>nil</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>iii) Copper slag aggregate</td>
<td>40%</td>
<td>25%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>iv) Recycled concrete aggregate (RCA) (See Note 1)</td>
<td>25%</td>
<td>20% (only upto M20 grade)</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
National Building Code of India 2016

Part 11 of NBC 2016 on ‘Approach to Sustainability’, states that:

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

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

c. This percentage can be increased up to 50 percent for pavements and other areas which are under pure compression

Further support

Exemption from the compliance of norms (Schedule I (14))
The following are exempted from the norms of pollution from dust and noise as mentioned above:

a. 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.
This was urgently needed as cities are choking on construction and demolition waste with serious environmental and public health consequences.

The next step is to create a clear mechanism for stringent and scaled-up implementation in cities for improved collection, segregation and handling of waste; decentralised collection and recycling centres; penalty for littering; lower taxes on recycled products and public awareness.

Make developers responsible and accountable for good construction practices, onsite segregation of waste, reuse and disposal; and impose waste tax to minimize waste-generation.
The key highlights of the new notification on C&D waste:

- Mandates use of recycled products in construction, Local bodies will have to utilise 10-20 per cent of material from C&D waste in municipal and government contracts for construction.
- All large developers are accountable for collection and disposal of C&D waste.
- The Bureau of Indian Standards needs to prepare a code of practice and standards for products of construction and demolition waste.
- Indian Road Congress needs to prepare standards and practices pertaining to products of construction and demolition waste in road construction.
- Local authorities to give appropriate incentives to waste generators for salvaging, processing, and recycling, preferably in-situ.
- Recycling facilities will have to be created at a safe distance from habitation with adequate buffer zone.
- Local authorities to established a database and update it once in a year.
Current Scenario

C & D Waste Generators

- Collection and Disposal by Developer
- Handover to Private Transporter
- Illegal Disposal by Generators

- Sell

Anywhere in City (Road / Drain Side)

- Fringe Areas / City Outskirts
- Landfill Site
Proposed Scenario

**Monitoring Agency:** Urban Local Body

- **Direct Transportation of C&D waste Debris**
- **Transportation by developer**
- **Payment system**

- **Individual Generator**
- **Bulk Generator**
- **Govt Organizations**

- **Transportation by Developer**

- **Designated Points**

- **C&D Waste Processing Plant**

- **Revenue to ULB through collection of fee**

- **Transportation Charges by ULB**
So far

C&D Waste Management: 3-R Journey Till Now....

- **2007**
  - MCD & CRRI Proposed a Pilot Project for recovery and reuse of C&D Waste in Delhi

- **December 2009**
  - Concession agreement between MCD and IL&FS Environment Setting up of 500 TPD C&D Waste Recycling Facility

- **February 2009**
  - The First C&D Waste Processing Plant Commissioned

- **November 2013**
  - MoUD- GoI issued circular for possibilities of C&D Plant replication in all cities with one million plus population

- **February 2016**
  - Honorable NGT Praised & Recommended to support work on enhanced capacity of 2000TPD

- **August 2017**
  - EDMC Inaugurates 500 TPD Plant

- **December 2018**
  - DMRC Inaugurates 150 TPD Plant

- **70 designated points for collection**

- **Identified 27 designated points for collection**

- The plant received 40.6 Lakh Tonnes of C&D Waste & processed more than 37.30 Lakh tonnes of C&D Waste

IL&FS Environment
So far
CPWD has started **using recycled C&D waste** - the Supreme Court extension has exclusively used recycled C&D waste blocks. Total 1.8 million blocks are used.

The National Buildings Construction Corporation Ltd. also **recycled all the C&D waste** it generated in Government of India’s mega redevelopment of East Kidwai Nagar in New Delhi.

All Delhi government agencies will be required to incorporate a clause in their tenders that mandate use of a minimum of two per cent recycled products from construction waste in all future contracts for building works and **10 per cent recycled products** for road works. It expects the urban local bodies to **mandate 5 per cent** use of such products for non-structural applications while examining and approving building plans.
Global best practices

Hong Kong
C&D waste tax on developers lowers C&D waste at landfill by 60%. 100% waste utilisation is charged at $27 per tonne. More than 50% waste needing landfill disposal is charged at $125 per tonne. Revenue is used to subsidise recycling centres. Promoted efficient construction practices.

Singapore
Recycles 98 per cent of its C&D waste.

South Korea
C&D waste management part of Low Carbon Green Growth strategies. Have separate building codes for recycled asphalt concrete aggregates, recycled concrete aggregates, and road pavements. Effective recycling rate is 36% with a target of 45% by 2016.

European Union
EU 2004 regulations for Aggregates provides for “aggregates from natural, recycled, and manufactured material”. Some member countries report over 20% recycled material use.
London Olympic 2012 Stadium used 30% Recycled concrete in its construction.
Indian Best Practice

Supreme Court Extension Project used 1.8 million Recycled C&D waste blocks.
Deconstruct
CPCB for ban on construction activities in pollution ‘hotspot’ if Delhi air quality turns severe

On Friday the advisory recommended people to avoid strenuous physical activity such as running and jogging during the November 1-10 period.

New Delhi: After the air quality deteriorated to ‘severe’ category, the environment officials announced a blanket ban on construction and excavation work across the national capital region on Saturday. Accessing the gravity of situation the government has mentioned that the officials who will fail to stop such activities will face criminal prosecution.
Directions from the Hon’ble National Green Tribunal


The Hon’ble NGT dated 10.04.2015 in O.A No.95 of 2014 in the matter of Sanjay Kulshrestha Vs Union Of India & Ors inter alia directing that if any person, owner and or builder is found to be violating any of the conditions stated in this order and or for their non-compliance such person, owner, builder shall be liable to pay compensation of Rs 50,000/- per default in relation to construction activity at its sites and Rs. 5000/- for each violation during carriage and transportation of construction material, debris through trucks or other vehicles which all stakeholder agencies in NCR are implementing.
Directions from the Hon’ble Supreme Court


“It was submitted that Union of India and State Governments concerned must be directed to take steps to enforce the CPCB rules and norms against those engaged in such construction activities to prevent further rise of pollution levels. We see no reason to decline a direction to that effect. CPCB norms regarding prevention of pollution by putting curtains and other devices at construction sites must be strictly enforced by the enforcement agencies concerned. We direct accordingly.”
ACTIVITIES GENERATING DUST

- Sand/Grit Conveyor System
- Truck Movements
- Building Demolition
- Site Clearance
- Piling
- Soil Excavation
- Material Handling/Storage
- Mobile plant e.g. bulldozer, crane, crusher
Concrete Batching / Debagging/ Mixing
Building Demolition/Deconstruction
Truck movements
Site clearance
Soil excavation
Material Handling/Storage
Mobile pants – Crusher, Bulldozer etc.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Task</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether continuous dust/wind breaking walls of <strong>appropriate height</strong> have been provided around the periphery of the construction site?</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Whether <strong>tarpaulin or green-net</strong> on scaffolding around the area under-construction and the building is provided?</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Whether all vehicles including carrying construction material and construction debris of any kind <strong>cleaned and wheels washed before leaving the construction site</strong>?</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Whether all vehicles carrying construction material and construction debris are <strong>fully covered and protected</strong> so as to ensure dust from construction material or debris does not become air-borne in transportation?</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Whether all construction debris and construction material of any kind is <strong>stored on the site (not dumped on roads or pavements) and is fully covered in all respect?</strong> Ideally in a warehouse.</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Whether <strong>wet-jet</strong> being used in grinding and stone cutting?</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Whether <strong>unpaved surfaces and areas with loose soil are adequately sprinkled with water</strong> to suppress dust? Ideally site to be fitted with fine water spraying nozzle system.</td>
<td>Medium</td>
</tr>
<tr>
<td>8</td>
<td>Whether construction and demolition waste is <strong>recycled on-site or transported to authorised recycling facility</strong> and due record of the same is maintained?</td>
<td>Medium</td>
</tr>
<tr>
<td>9</td>
<td>Whether every worker working on construction site and involved in loading, unloading and carriage of construction material and construction debris are provided with <strong>dust-mask to prevent inhalation of dust particles</strong>?</td>
<td>Medium</td>
</tr>
<tr>
<td>10</td>
<td>Whether arrangement provided for <strong>medical help, investigation and treatment</strong> to workers involved in the construction of building and carry of construction material and debris relatable to dust emission?</td>
<td>Medium</td>
</tr>
</tbody>
</table>
| 11    | Whether **green belt or green air barriers created around the construction site?**  
**Note:** This method is usually not possible in under-construction site and should not be insisted upon if all high and medium significance requirements are fulfilled. | Low          |
| 12    | Any additional measures taken to control dust pollution.               | Low          |

* Three meter (3 mt) or one tenth of plot length whichever is higher
<table>
<thead>
<tr>
<th>Agency</th>
<th>Number of projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delhi</strong></td>
<td></td>
</tr>
<tr>
<td>DPCC</td>
<td>53</td>
</tr>
<tr>
<td><strong>Haryana</strong></td>
<td></td>
</tr>
<tr>
<td>HSPCB</td>
<td>138</td>
</tr>
<tr>
<td><strong>Uttar Pradesh</strong></td>
<td></td>
</tr>
<tr>
<td>Yamuna Expressway Authority</td>
<td>11</td>
</tr>
<tr>
<td>NOIDA Authority</td>
<td>45</td>
</tr>
<tr>
<td>Greater Nodia</td>
<td>156</td>
</tr>
<tr>
<td>GDA</td>
<td>116</td>
</tr>
</tbody>
</table>

But numbers were abysmal

Number projects larger than 20,000 sqm in NCR (as noted by EPCA in 2016)
Majority of construction within the city limit are under 20,000 sqm and thus outside purview of EIA.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Number of challans</th>
<th>Amount recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDMC</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>North-DMC</td>
<td>240</td>
<td>Rs. 23,00,000</td>
</tr>
<tr>
<td>East-DMC</td>
<td>440</td>
<td>Rs. 35,00,000</td>
</tr>
<tr>
<td>South-DMC</td>
<td>714</td>
<td>Rs. 33,50,000</td>
</tr>
<tr>
<td>Department of revenue</td>
<td>437</td>
<td>Rs. 60,85,000</td>
</tr>
<tr>
<td>PWD-Delhi</td>
<td>11</td>
<td>Rs. 95,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1700</strong></td>
<td><strong>Rs. 2,37,45,000</strong></td>
</tr>
</tbody>
</table>
Hawa Badlo

WHAT'S CHOKING OUR CITY?

% of Air pollution in Delhi-NCR

LEAF AND GARBAGE BURNING

Toxic smoke
34% WINTER 19% SUMMER

BUILDING AND CONSTRUCTION

Toxic smoke 8%

Citizen engagement
Graded Response Action Plan for Delhi & NCR

In pursuant to the Hon’ble Supreme Court’s order dated December 02, 2016 in the matter of M. C. Mehta vs. Union of India regarding air quality in National Capital Region of Delhi, a Graded Response Action Plan has been prepared for implementation under different Air Quality Index (AQI) categories namely, Moderate & Poor, Very Poor, and Severe as per National Air Quality Index. A new category of “Severe+ or Emergency” has been added. Ministry of Environment, Forests & Climate Change has notified for implementation of Graded Response Action Plan through Environment Pollution (Prevention & Control) Authority vide S.O. 118 (E) dated January 12, 2017 (copy enclosed).

<table>
<thead>
<tr>
<th>Severe + or Emergency (ambient PM$<em>{2.5}$ or PM$</em>{10}$ Concentration values of 300µg/m$^3$ or 500 µg/m$^3$ respectively persist for 48 hours or more)</th>
<th>Agency responsible/Implementing Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop entry of truck traffic into Delhi (except essential commodities)</td>
<td>Municipal Corporations and Traffic Police of Delhi and NCR Towns</td>
</tr>
<tr>
<td>Stop construction activities</td>
<td>Delhi Pollution Control Committee/Municipal Corporations of Delhi and NCR towns</td>
</tr>
<tr>
<td>Introduce odd and even scheme for private vehicles based on license plate numbers and minimize exemptions</td>
<td>Secretary cum Commissioner of Transport Department, NCT of Delhi, and Transport Commissioners of NCR towns</td>
</tr>
<tr>
<td>Task Force to take decision on any additional steps including shutting of schools</td>
<td></td>
</tr>
<tr>
<td>Severe (ambient PM$<em>{2.5}$ or PM$</em>{10}$ concentration value is more than 250 µg/m$^3$ or 430µg/m$^3$ respectively)</td>
<td>Agency responsible/Implementing Agency</td>
</tr>
<tr>
<td>Close brick kilns, Hot Mix plants, Stone Crushers</td>
<td>Chairpersons Delhi Pollution Control Committee, Chairpersons Pollution Control Boards of NCR towns</td>
</tr>
</tbody>
</table>
CSE Recommends

Construction Activities
Ensure dust pollution from construction. Check list for inspection of construction sites prepared under directions of NGT and EPCA.

Undertake control measures for fugitive emissions from material handling, conveying and screening operations. Needs enforcement.

Construction and Demolition Waste:
Provide a network of decentralized C&D waste segregation and collection sites across the city.

For material handling, construction and demolition, it should be obligatory on part of the developers to provide evidence of debris on-site recycling and/or disposal at designated site

Promote recycling of construction and demolition waste; change schedule of rates
Thank you!