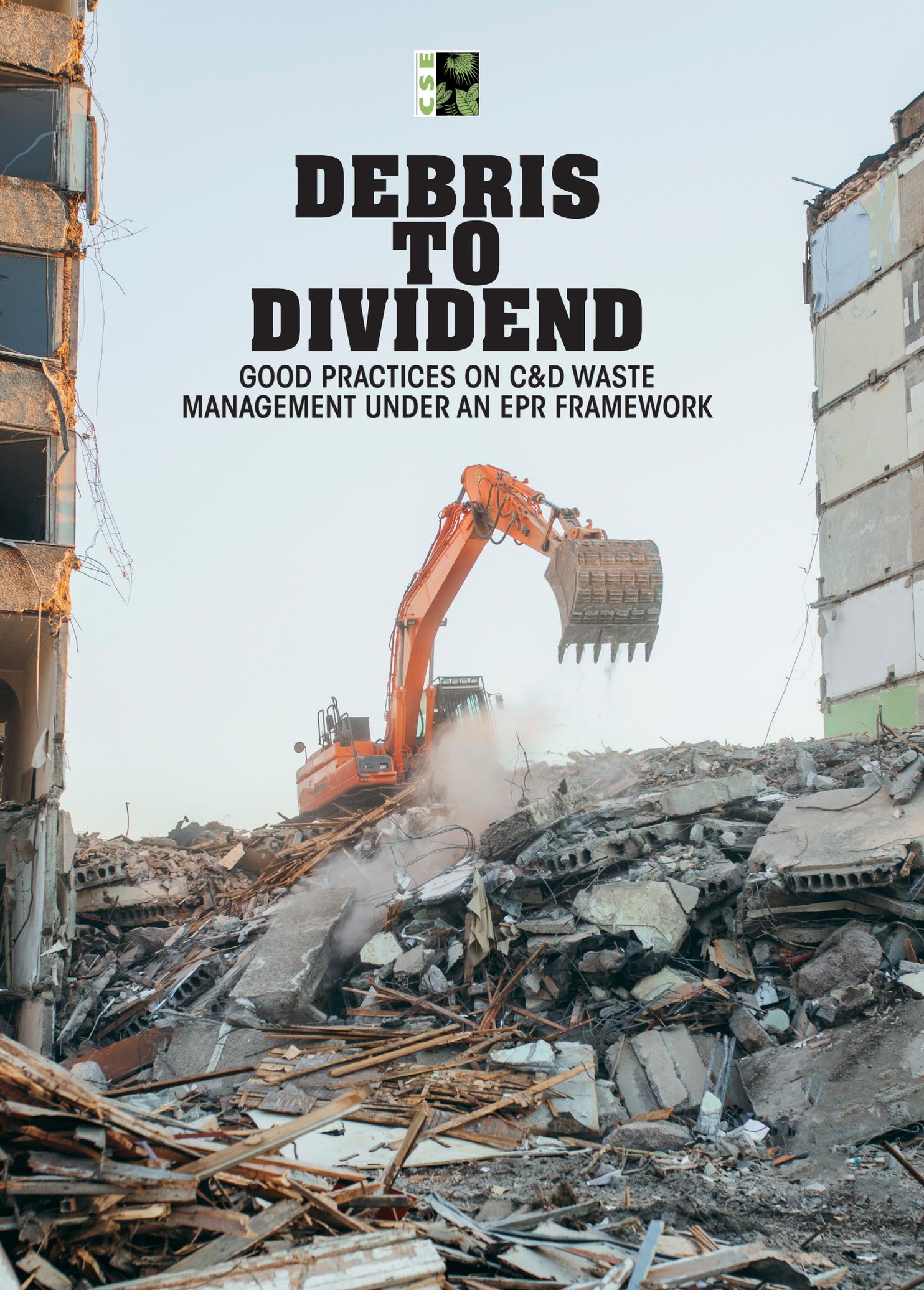




DEBRIS TO DIVIDEND

GOOD PRACTICES ON C&D WASTE
MANAGEMENT UNDER AN EPR FRAMEWORK





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MANAGEMENT UNDER AN EPR FRAMEWORK**

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INTRODUCTION

Management of construction and demolition (C&D) waste and dust control at construction sites has drawn considerable attention within the ambit of clean air action as well resource circularity. This assumes significance from the perspective of the prolific growth of the construction industry and massive expansion of built spaces, which is expected to more than double by 2040.¹ India's construction market is set to become the third largest globally by 2025 as per Invest India, the national investment promotion and facilitation agency set up under the Department for Promotion of Industry and Internal Trade.²

It is critical for the sector, therefore, to opt for a circular policy for two reasons: to address its problem of toxic fugitive dust emissions, and to enable recycling and reuse of its waste material. The latter can help manage the galloping demand for new virgin construction material, which leaves behind significant environmental footprints.

The C&D Waste Management Rules, 2016 did kick off recycling of C&D waste, but it was a slow start. The main catalysts have been the Swachh Bharat Mission 2.0, recommendations of the XV Finance Commission and the National Clean Air Programme of 2019 which provided the much-needed push and support to cities. In fact, Swachh Survekshan 2025-26 has increased the points on C&D waste management from 120 to 200 for the purpose of ranking of cities.³ This gives cities a strong impetus to plan and improve their C&D waste management systems.

Further, the latest Environment (Construction and Demolition) Waste Management Rules, 2025 require all large generators (20,000 sq m built-up area) to mandatorily recycle and reuse C&D waste along with a centralised digitally-tracked monitoring and enforcement system. While these rules are laid out in the right direction and will help cities speed up with the development of their respective C&D waste management systems, they also indicate that there is room for improvement and clarity. This is evident from the C&D waste and dust management practices adopted by certain cities in India that are performing above and beyond the requirements of these rules. This report is a compilation of these practices which can be held up as examples for other cities as an opportunity to leapfrog in recycle and reuse performance.

A DECADE OF LEARNING

The decade since the notification of the 2016 rules has resulted in 34 operational plants nation-wide, with a combined capacity to process roughly 16,000 TPD as of 2024 and over 36 additional facilities in the pipeline — according to the 2024 CSE report titled *Rubble Recast*.⁴ However, the progress has been slow. This processing capacity constitutes a national recovery rate of a meagre 4 per cent, considering the official — grossly underestimated — C&D waste generation of 150 million tonne (MT) annually.⁵ Unofficial estimates are at least

four times higher than this number which makes the current recycling capacity almost negligible. There is a strong need to investigate why the establishment of recycling systems has been slow.

CSE studied the C&D waste ecosystem of nearly 20 cities across India which include non-attainment and million-plus cities. This assessment has revealed not only the gaps, but also the good and innovative practices. The most significant gap involves the lack of a cohesive ecosystem approach. Some cities focus on providing infrastructure, some on penalties, while others are working towards clearing their legacy waste — most of these approaches remain piecemeal.

CSE's 2023 report *Construction and Demolition Waste: Closing the waste loop for sustainability* revealed that cities face several ecosystem gaps in areas such as clear mandate to manage C&D waste; steps for curbing illegal dumping; estimation of quantities; legacy waste management; user-friendly collection systems; interfaces for fee collection; recycle and reuse; and the lack of awareness.⁶ As ULBs move towards designing or improving their C&D waste systems, they will have to internalise these aspects for compliance and results.

WHAT DO THE NEW RULES ENTAIL?

The Union Ministry of Environment, Forest and Climate Change (MoEF&CC) has notified the Environment (Construction and Demolition) Waste Management Rules, 2025; these will come into effect from April 1, 2026. The rules transform C&D waste management from a near voluntary, under-monitored system to a centralised, mandatory, time-bound, digitally-tracked monitoring system with quantitative targets and financial consequences for non-compliance through an extended producer responsibility (EPR) and waste utilisation framework.

The new rules push ULBs to build C&D waste infrastructure and ecosystems within 12 months of coming into effect and actively enforce compliance. Enforcement has been weak till now due to non-availability or inadequacy of C&D waste infrastructure in many cities. It is now expected to be more stringent with the centralised Central Pollution Control Board (CPCB)-run online portal that has been put in place; waste generators have been made more accountable as well. The rules legally bind 'producers' or projects with r20,000 sq m built-up area to not only recycle and reuse those materials in new construction, but also prove this obligation to the apex regulatory body — CPCB — through purchase of EPR certificates. These obligation targets increase from 25 per cent in 2025-26 to 100 per cent in 2028-29 onwards for recycling and 5 per cent in 2026-27 to 25 per cent in 2030-31 onwards for reutilisation.

The rules also define roles and responsibilities of the key actors involved, such as ULBs or development authorities, waste generators, recyclers, the CPCB, state pollution control boards, state urban development and municipal administration departments and road construction agencies. These actors have to work closely in development and operation of the portal and complete their duties within the stipulated time as per the rules.

BEST PRACTICES: LEAPFROGGING TO SUPERIOR PERFORMANCE

CSE's assessment of cities has identified a few notable practices that build a guidance framework for all urban centres in the country. Interestingly, these best practices leapfrog the requisites placed by the new rules and even create room for improvement in them. For instance, Delhi already mandates bulk waste generators to deposit 100 per cent of their waste at the recycling plant, which is higher than the recycling requirement of 25 per cent in the first year under the new rules. Chandigarh provides incentives to all generators to reuse recycled materials, which is higher than the new 5 per cent reutilisation mandate. Pimpri-Chinchwad's model ensures door-to-door collection and stringent enforcement. This report throws a spotlight on such practices that could help cities generate a practical, effective and strong system and push them towards material circularity.

- **DELHI** has the most mature and well-rounded ecosystem among the selected cities — it includes on-site management in construction sites, collection and transport systems, extensive infrastructure, capacity for recycling, and a policy for uptake of the recycled material.
- **CHANDIGARH** has adopted a framework for C&D recycling with a strategy for uptake of the recycled material in construction and municipal infrastructure. This is combined with a strong communication and public outreach programme.
- **HYDERABAD** has demonstrated a decentralised model for C&D waste recycling and a method for integration of the informal sector.
- **NOIDA**, in Uttar Pradesh, demonstrates stringent application of dust control measures in its C&D waste recycling plant.
- **PIMPRI-CHINCHWAD** in Maharashtra has incorporated third-party enforcement to arrest illegal dumping of C&D waste.
- **NATIONAL CAPITAL REGION TRANSPORT CORPORATION** and **DELHI METRO RAIL CORPORATION** illustrate good practices in dust and waste management in linear infrastructure projects — something that several cities have been unable to address.

KEY LEARNINGS AND THE WAY FORWARD

While the new rules lay out the duties of different actors and the minimum compliance needed, the success of these rules and material circularity in the country will rest on a few critical factors. Since the launch of these rules, CSE has held discussions with several ULBs, recyclers and field experts on national, regional and local forums. This has helped determine these critical factors and shape the perspective on how the roles and responsibilities of key actors like urban local bodies, SPCBs, the construction industry and the recycling market will transform. This could prove to be a crucial learning curve, especially for cities that have not designed their C&D waste ecosystems yet.

ULBs remain the anchor in the system

All ULBs need to actively plan for C&D waste management infrastructure which includes collection points, processing facilities and intermediate waste storage facilities (IWSF) on local, regional or cluster basis within a 12-month deadline. IWSFs are needed where there are no recycling facilities. ULBs need to carry out baseline assessments, which would include fresh waste generation estimations, legacy waste quantification, the recycling capacity needed and its expansion plan. Identification and notification of collection points and sites for recycling facility and IWSFs are vital steps which need to be carried out with planning and regulatory bodies as well as with the private sector. Planning for finances and resources will also need to be done.

Development or amendment of C&D waste bye-laws is a crucial step for all ULBs. These must include clear provisions on segregation, collection and transportation of C&D waste, user charges, development of waste management plans, demolition permits, penalties on non-compliance, and mandate for reuse of C&D waste. These provisions must be addressed separately for small generators and producers, and include EPR and waste utilisation targets. They will also have to plan for awareness of the general public and training of staff.

Monitoring and enforcement responsibilities of ULBs have expanded and will become more intense with the digital interface to be developed and maintained by the CPCB under the new rules. ULBs must now approve waste management plans along with building permissions, monitor the producers' compliance on recycling and reutilisation targets, and report non-compliance to SPCBs. This means they have to create several checks and balances in the system to ensure compliance.

ULBs will need nuanced adoption of the new rules

While most requirements remain consistent for all ULBs, the new rules may shape a distinct course of action for city authorities in terms of recycling. For instance, ULBs like Delhi and Gurugram require bulk waste generators to bring their waste directly to the recycling plant. Such cities will need to integrate the new rules with the current system. These cities may need to renegotiate PPP concession agreements, allow PPP operators to compete for EPR certificates, and implement flow control amidst multiple recyclers. This includes mandating that all waste in the municipal area must go to the municipal plant (to prevent undercutting by new plants), setting price caps on private recycling facilities, and even making EPR compliance dependent on using municipal facilities.

ULBs can exempt or set minimal EPR certification charges or enable issuance of certificates equivalent to the waste recycled, in cases where producers bring all their waste to the recycling facility. Cities that are setting up their C&D waste ecosystems have the option of creating a hybrid user charge that includes the cost of processing, transporting and the certificate. ULBs will certainly need to expand revenue streams by creating guaranteed demand across the city through mandatory use of recycled products in municipal procurement.

Recycling infrastructure remains vital for enabling circularity

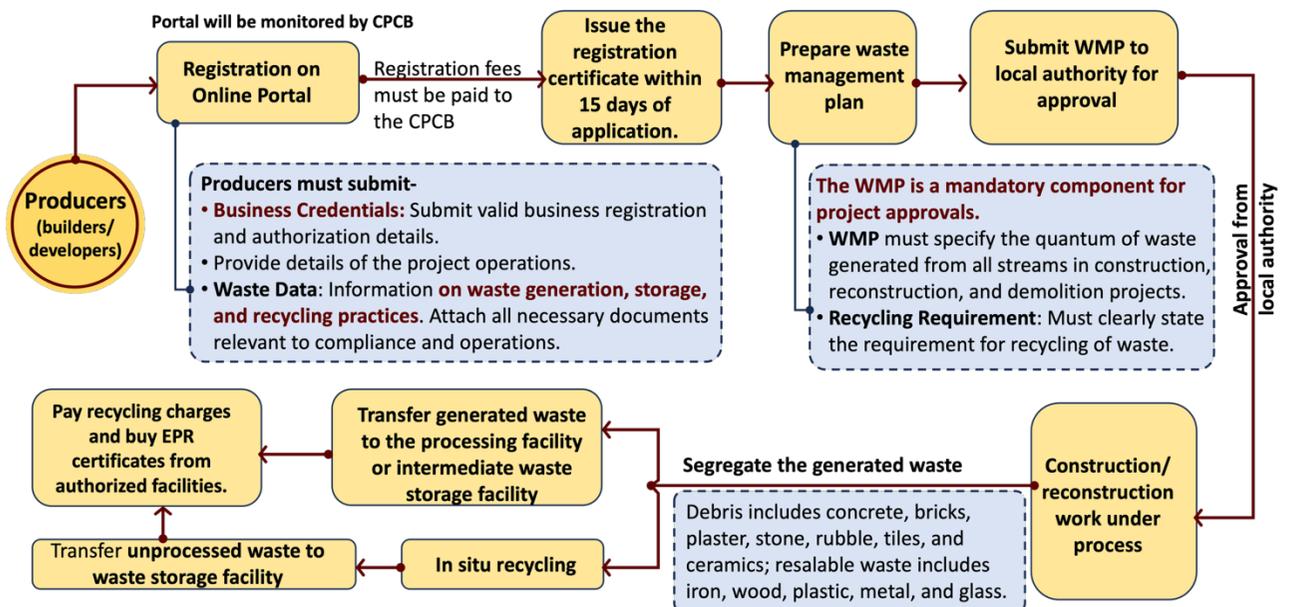
ULBs and recyclers will have to ensure timely development of C&D waste management infrastructure. This includes notification of collection points, intermediate waste storage facilities, recycling centres and a market place for recycled products (online or on-site). This means assessments will need to be done to understand gaps: quantum of legacy waste, fresh waste generation, processing capacity and expansion plan, number of collection points, IWSFs, need for staff (to handle the EPR portal and C&D waste) etc will need to be determined.

Consequently, studies to plan and projects to develop the requisite infrastructure will need to be commissioned. This will require prompt action from the state departments. Standard operating procedures (SoP) will be given by the state departments for urban development and municipal affairs; however, ULBs will have to create credible and swift enforcement systems along with initiating capacity building exercises.

Construction sector should brace for accountability

The new rules categorise all developers, real estate companies, infrastructure project concessionaires and government departments as a ‘Producer’ in case their projects involve r20,000 sq m built-up area. Their responsibility shifts from a variable mechanism to a specific and stringent one (see Figure 1: Responsibility of the Producers under the new rules). Producers must prepare and submit a waste management plan clearly identifying the quantum of waste that will be generated from their projects and the strategy they will use to recycle and reuse it. They can either process the debris *in situ* using mobile crushers or send it to a registered recycler.

Figure 1: Responsibility of the Producers under the new rules



The prior process fetches higher EPR weightage which will encourage producers to recycle the waste *in situ*. However, this will require an authorisation by the ULB and the SPCB, and will increase enforcement needs for dust control and other environmental compliances. Producers will also have to account for recycled materials in their bill of quantities (BoQ) and may need to prepare a reutilisation plan.

New revenue stream for ULBs and recyclers to process legacy and unclaimed waste

The new rules place an added expenditure on Producers with the purchase of EPR certificates, especially in cities where they are already handing their waste over to the ULB or recyclers for processing. The cost of the certificate is an obligation under the new rules that they have to meet, which will be split equally between the ULB and the recycler. This cost will be regulated by the CPCB, and will range from 30 to 100 per cent of the environmental compensation for non-fulfilment of exchange of EPR certificate. However, the revenue earned through sale of certificates will support ULBs and recyclers for managing legacy and unclaimed waste. This stream can further help ULBs strengthen their C&D waste ecosystem.

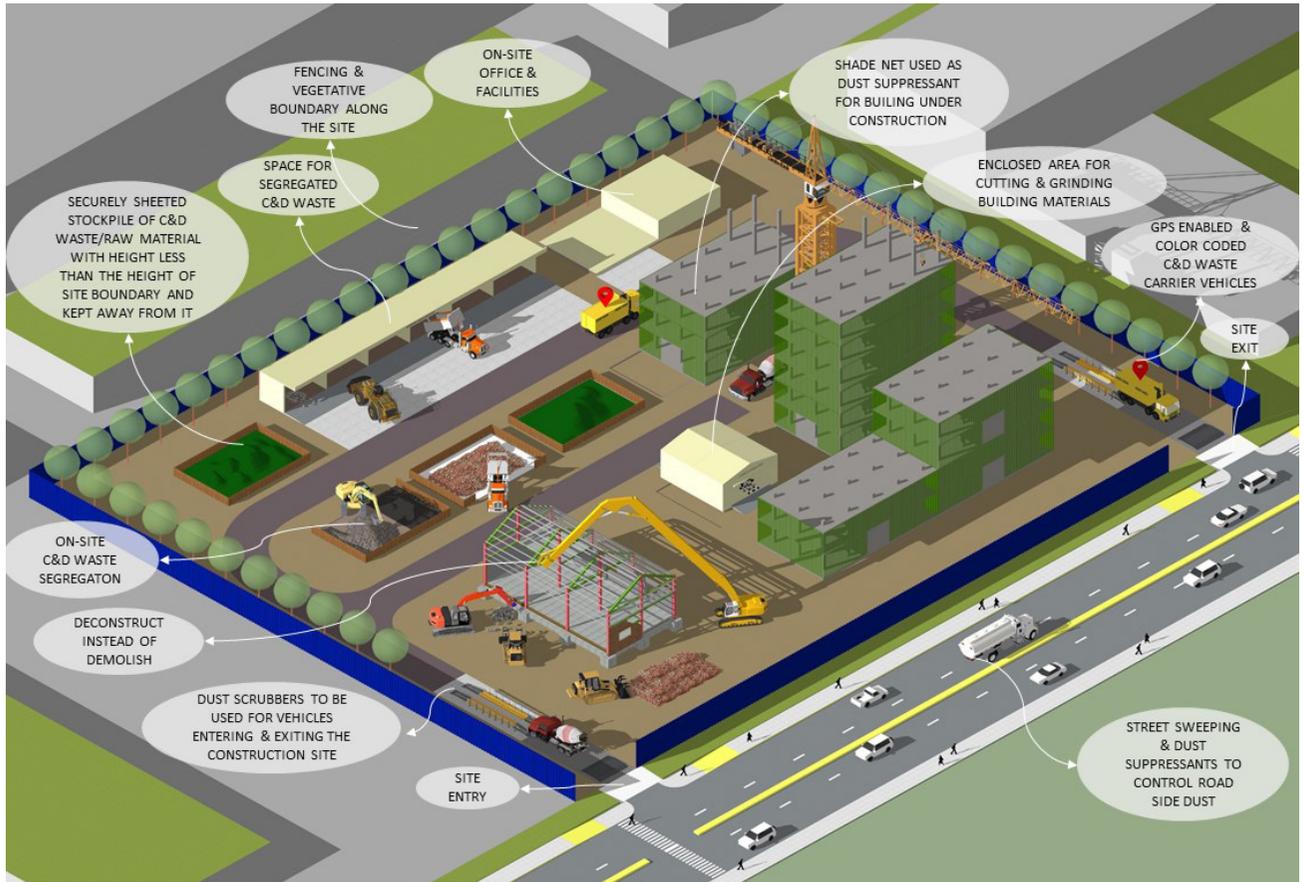
Increased technical requirements for developers

The construction sector will need move quickly on issues like planning for registrations, exploring recycling options (*in situ* or authorised recycler), quality assurance of recycled products, and pricing of EPR certificates, among others. Big developers who are potential producers will need to build knowledge on waste management and reutilisation plans, deconstruction plans, recycling technologies, recycled products and financial implications of these. Currently, there are no guidelines on how to prepare waste management or reutilisation plans.

The construction industry as well as ULBs need to be engaged on the requisites of these plans (see *Figure 2: A typical waste and dust management plan for a construction site*). For instance, some of the essentials for a waste management plan are identifying the location for segregated stockpiling of C&D waste and reusable materials based on estimations, circulation routes, dust control measures and *in situ* recycling spots, and ensuring routine checks, signages, communication and education of staff.

In the longer term, Producers will need building designs for their recycling plans. These plans may include reducing waste generation by using modular components and less composite materials. This is an area that will need substantial research and capacity building.

Figure 2: A typical waste and dust management plan for a construction site



Reutilisation in road works could be increased

The new rules provide a minimum target for reutilisation of C&D waste in road construction projects. This starts from 5 per cent each in 2026-27 and 2027-28 and increases to 15 per cent of the total road construction materials by 2030-31. However, IS:383 already allows for substitution of recycled coarse aggregates to the tune of 20 per cent in M25 grade reinforced concrete and 25 per cent in plain concrete. In fact, the Bureau of Indian Standards (BIS) is working to upgrade this to 40 per cent.

Similarly, the National Council for Cement & Building Materials (NCCBM) has carried out experiments which concluded that even the untreated coarse recycled concrete aggregate can replace natural aggregates by up to 40 per cent. This makes the 5-15 per cent reutilisation target quite conservative. States and cities need to recognise this as they have an opportunity to go for more stringent mandates.

Need to address linear and infrastructure projects

The rules do not categorically address linear or infrastructure projects like construction of sewage and drainage networks, water pipelines, rail tracks (railways and metro rail) etc. These projects form a large proportion of municipal and public works, but they may not fall under the '20,000 sq m built-up area' purview. Consequently, the new rules do not mention recycling of waste generating from linear projects; only waste utilisation has been referred to. A big gap is that India does not have a thumb-rule on how much waste is generated from road construction or any linear project. This absence might be contributing to the gross under-estimation of C&D waste in the country.

New waste quantification metrics are crucial for infrastructure planning

The last TIFAC study on C&D waste composition and quantification dates to 2001, which is before the first C&D plant in India became operational in 2009. The study does not reflect the current scenario of waste generation and composition. As a result, cities are still struggling with quantification of both fresh C&D waste and legacy waste. They rely on assessments conducted by plant operators which may not be reflecting the real situation.

For instance, Jaipur has recently operationalised a 300-TPD (tonne per day) plant, but estimations by CSE show that the city may be generating close to 1,000 TPD of fresh C&D waste.⁷ Three methodologies were used to arrive at this estimate. One used the available RERA data on construction projects, the second projected generation due to construction as per the city master plan, and the third used cement consumption data which turned out to be the closest indicator of the ground situation. Cement consumption can point to the ongoing linear and infrastructure projects in the city. There is also the legacy waste, which is in addition to this. Cities need to account for all these sources of waste and conduct estimations. This is crucial in order to plan recycling infrastructure that remains feasible over a longer term. State governments need to initiate these assessments while developing standard operating procedures and capacity of ULBs and development authorities.

Need to develop guidelines for baseline assessment and plan for recycling infrastructure

Minimum technical requisites for the identification of a collection point, IWSF and recycling plant is a subject that has not received adequate attention so far. Cities now need to plan for infrastructure like collection points, IWSFs and recycling plants after determining the gaps, as per the new rules. In the absence of clear technical guidelines, cities are taking *ad-hoc* steps — such as planning for one collection point for every ward (as in Delhi) or every zone (as in Jaipur). Recently, the Commission for Air Quality Management in NCR and Adjoining Areas released an order to all ULBs and development authorities to ensure at least one collection point for every 5 km X 5 km area in their respective jurisdictions.⁸ Considering that NCR has cities as large as Delhi and as small as Bharatpur, this guidance may not be appropriate.

These guidelines for infrastructure gap assessment and planning must be technically sound — they should consider the minimum road width for ingress and egress of waste hauling vehicles, ensure that the infrastructure is not built close to sensitive receptors,

and enable dust control measures, among other things. The new rules mandate state urban development and municipal administration departments and SPCBs to prepare these guidelines and carry out gap assessments as well. The sooner these guidelines and assessments are rolled out, the quicker will the cities be able to establish their C&D waste ecosystems.

Rationalise user charges for small generators through cross-financing

Most cities have struggled to get their primary waste collection processes right. The high disposal fee creates a significant burden for small waste generators, discouraging them from using scientific disposal methods and often leading to illegal dumping. To address this issue, fees for small generators should be rationalised and kept within reasonable limits. Innovative approaches, such as cross-financing, can be utilised to achieve this. Delhi has developed a model where bulk waste generators pay a higher processing fee than the municipality, allowing the plant operator to balance the costs and keep the tipping fee for the municipality to a minimum.

New systems must learn from the traditional informal system

The informal sector offers a convenient option to generators to get rid of waste. In areas without a proper C&D waste management ecosystem, this remains the only option. The informal sector recovers valuable material from C&D waste, but the rest of it often gets dumped illegally in city peripheries, forest areas, low-lying areas and waterbodies. Even though the environmental costs for the city are high, the informal sector continues to be a more convenient option for the waste generator through its better accessibility, a strong network of informal actors (contractors, transporters, scrap dealers, etc), wider presence across the city, and lesser disposal costs. CSE conducted a value trade chain assessment in Kolkata and Jaipur to understand how the different materials flow from construction sites to scrap dealers, and on to the final disposal systems.⁹ The study also highlighted areas in a city that contribute to air pollution and need to be regulated.

As cities design their C&D waste system, they need to learn from the informal systems. For instance, Hyderabad has recognised the strength of the network of transporters that haul C&D waste and internalised them in the formal system. This has resulted in a two-pronged benefit. One, the transporters are recognised and, therefore, cannot engage in indiscriminate disposal. Two, the informal sector still has its job. However, this has necessitated an incentive for the transporters to work with the ULB while making it convenient for generators. Cities need to explore similar solutions and implement them in a way that is easier and cheaper for generators, while making them accountable.

Need to address new and emerging materials

A construction or demolition site produces a variety of materials. The Global Housing Technology challenge was launched by the Union Ministry of Housing and Urban Affairs to promote use of new and alternative materials such as those that use insulation products, glass wool and other composites. New policies and bye-laws need

to recognise such materials. Accordingly, recyclers also need to prepare reuse or disposal mechanism for them.

Mandate reuse of materials

Circularity of materials can be achieved only when the recycled material is used back in construction and substantially replaces the naturally sourced material. Enabling this will require both a policy push and a market to facilitate the materials. There are cities that have mandated minimum use of recycled materials. For instance, the Delhi government has mandated 2-10 per cent replacement of naturally sourced materials with recycled ones in all public works. Chandigarh has subsidised purchase of recycled materials and linked occupancy certificates with it. Such mandates are not only enablers of C&D waste reuse, but also contribute as a crucial revenue source to sustain the plants. All cities must notify these mandates in their bye-laws. They must establish markets (online or offline) for sale and purchase of recycled products. For instance, integrating C&D recycled materials into government material portals, such as the Platform for Infrastructure and Materials Providers (INAMPro), would enable prospective buyers, including government contractors, to easily compare prices and availability, thereby simplifying the procurement process.

Reduce the tax levied on recycled C&D products

Recycled aggregates produced by a C&D waste plant are subjected to a 5 per cent tax rate, while concrete recycled products like tiles, blocks and bricks face a higher tax rate of 18 per cent. In comparison, a conventional red brick is taxed at only 5 per cent. The market competitiveness of recycled products in comparison to their virgin material counterparts is significantly influenced by their pricing. An elevated tax rate on recycled products serves as a deterrent for potential buyers, hindering their inclination to purchase these environment-friendly alternatives. In essence, a higher tax burden on recycled items negatively impacts their market appeal and adoption.

Need more and advanced testing of recycled materials

Improving material testing procedures is essential to guaranteeing the highest quality of recycled products entering the market, thereby expanding the scope for replacing natural materials. ULBs need to ask the recycling plants to establish material testing laboratories and associated equipment as part of procurement conditions. Improved testing will lead to better quality and increased uptake of recycled materials.

UNLOCKING A NEW RECYCLING MARKET

The mandate to recycle 25 per cent in the initial year of the rules means recycling of 37.5 MT of C&D waste annually — this is based on the official waste generation estimate of 150 MT. In this conservative scenario, a capital expenditure of roughly Rs 3,850 crore (~US \$425 million) will be needed in the country for a recycling capacity of 410,959 TPD. In an ambitious scenario (100 per cent recycling by 2028-29), this increases to Rs 15,070 crore (~US \$1.6 billion).

The new rules have a provision of recycling *in situ* and/or handing the waste over to a recycler. EPR certificates will have higher credits for *in situ* recycling, according to the rules. This indicates that more Producers might be interested in deploying *in situ* methods.

While this decentralised processing is better in terms of eliminating transportation needs, this could challenge current waste feed going to the municipal plant. Also, this will require stronger efforts to curb dust emissions and noise.

Other new business opportunities include:

- **For collection and transportation:** GPS-enabled vehicle fleets, digital waste tracking platforms, private collection centres and integrated waste storage facilities
- **Recycling:** Large processing plants (200-500 TPD), mobile/*in situ* plants (less than 200 TPD), technology providers (wet or dry processing)
- **Product manufacturing:** Coarse aggregate production units, sand production units, blocks and tiles production units, ready-mix concrete units with recycled aggregates, etc
- **Technology and services:** EPR certificate trading platforms, waste management planning consultation, quality testing laboratories, compliance monitoring systems (like third-party enforcers), etc

While the things to do are a lot for a future with resource circularity, cities have both the impetus and support to kick-start and develop their C&D waste ecosystems. The provisions under the new rules have the potential to replace an estimated one billion tonne of materials by 2030 if completed in time. However, India currently has a capacity to recycle only 4 per cent of the official 150 MT. To recycle even 25 per cent of this figure, India needs to expand its recycling capacity of 16,000 TPD by more than six times. This means enormous efforts need to be made by all actors. The best practices highlighted in this document will, hopefully, guide cities on several aspects that are needed to move towards such a future.

DELHI

An ecosystem approach to C&D waste management

TOWARDS FUGITIVE DUST CONTROL AT CONSTRUCTION SITES

In 2014, the Environment Pollution (Prevention and Control) Authority (EPCA) — as part of an ongoing public interest litigation (PIL) in the Supreme Court of India — took on board an order by the National Green Tribunal (NGT), dated 10.04.2015 in OA No 95 of 2014. The order pointed out that the dust pollution from construction and other allied activities was one among the several problems the city was facing.

These directions were circulated vide orders dated November 26, 2014 and December 4, 2014, which laid down the steps to be taken by anyone responsible for construction, carrying construction material and dealing with debris. Failure to comply with these directions would lead to immediate stoppage of construction activity in all the identified sites/projects in the state of Uttar Pradesh, the Noida and Greater Noida Authority, the Haryana Urban Development Authority and the state of Haryana, and the NCT of Delhi.

A Supreme Court order (dated 16.12.2015) followed, with a checklist of measures recommended by CPCB for mitigating dust pollution. This strengthened the norms for dust control from construction and related activities. Violation of these norms would fetch heavy penalties for those involved in the construction activity.

Graded Response Action Plan (GRAP) and construction activities: In November 2016, Delhi was struck by pollution at an emergency scale: 14 times the standard, higher than what was recorded during the infamous London smog incident and certainly the highest ever in Delhi. The EPCA responded by putting together priority actions like wet suppression of dust from construction activities. It also developed an accountability mechanism to identify the agency and actions that had been taken to check pollution from construction activities. A guidance note was prepared for inspection of such sites; the EPCA demanded close monitoring by the Supreme Court and stringent enforcement. On February 9, 2016, the Authority notified a 12-point checklist titled '*Guidance on measures to be adopted to control dust emissions from construction activities larger than 20,000 sq m of built-up area*'.

In 2017, the Union Ministry of Environment, Forest and Climate Change (MoEFCC) notified the Graded Response Action Plan (GRAP) in Delhi. The Plan called for dust control measures at construction sites and stoppage of all construction activities when the air quality index hit 'very severe' or 'emergency' levels. To strengthen enforcement, the EPCA called for the following:

- Action to be taken by development authorities and municipal corporations in the case of construction projects with areas between 20,000 sq m to 1,50,000 sq m

- Action to be taken by state pollution control boards (SPCBs) for construction projects with areas greater than 1,50,000 sq m, which were not complying with environmental clearance guidelines
- Listing by the SPCBs of all construction projects in NCR having an area greater than 1,50,000 sq m

Dust control from road construction: The EPCA also called for the SPCBs to immediately impose fines on road construction agencies which were not following dust control measures adequately; a fine of Rs 50,000 was to be imposed as penalty per day per stretch. The CPCB released two documents which included guidelines to curb dust emissions during the handling of construction material and C&D waste.

In 2018, with the notification of the Environment (Protection) Amendment Rules, dust control measures were firmed up as mandatory practices for dust-free construction activities. These measures comprise installation of wind breaks and water sprinkling systems and covering of material and C&D waste stockpiles and vehicles carrying construction material, among others.

In 2021, these Rules, as well as the 12-point checklist for guidance on dust control measures, were adopted by the Delhi government as 'Dust Mitigation Measures for Construction and Demolition Activities'. Two points were added to them: one, installation of anti-smog gun/s and paving and blacktopping of roads leading to construction sites for sites with built-up area more than 20,000 sq m.⁴

Delhi's anti-dust drive: To implement the mandate of dust control measures in a stringent manner, the Delhi Pollution Control Committee (DPCC) launched an anti-dust drive in 2021. Under this, all projects involving construction or demolition with a plot area of 500 sq m or more were asked to register on the DPCC's designated web portal. The project proponents were directed to carry out dust self-assessments/audits every fortnight and upload the reports on the portal. To support this, the DPCC has also released a guidebook on dust mitigation measures. It incorporates visuals and illustrations from real-world construction and demolition sites, allowing implementers to better grasp the practical application of the measures.

It has been mandated that while all projects must install PM_{2.5} and PM₁₀ sensors at their sites, these must be linked to a live dashboard on the DPCC's portal to provide real-time air quality data at and around those sites. There is a graphical guideline on the website that explains this entire process of self-assessment and uploading of information on the portal. This system is still in place and is being monitored today by the Commission for Air Quality Management (CAQM) in Delhi NCR and Adjoining Areas, which was set up in 2022.

DELHI'S INITIATIVE TO TACKLE DUST POLLUTION FROM CONSTRUCTION AND DEMOLITION ACTIVITIES

A TIMELINE

2014

- NGT directs Delhi and neighbouring cities to stop construction at sites that violate NGT order and MoEFCC's Environment Impact Assessment (EIA) guidelines of 2010.⁵

2015

- Delhi government authorises its revenue department and municipalities to enforce NGT's dust control guidelines.⁶ By May 2016, fines and notices had resulted in a total collection of Rs 11,850,000.⁷
- Supreme Court's 16.12.2015 order directs Delhi government to enforce CPCB rules and regulations to curb pollution from construction activities.⁸

2016

- In February, EPCA issues 12-point dust control checklist for construction sites over 20,000 sq m.⁹
- In April, NGT raises the fine amounts for dust pollution violations.¹⁰
- In November, Delhi witnesses a spike in pollution levels.
- EPCA, in collaboration with municipal bodies and state departments, develops a mobile app¹¹ for tracking pollution complaints, including from construction dust, along with an accountability mechanism and inspection guidelines to monitor agencies and enhance enforcement.¹²

2017

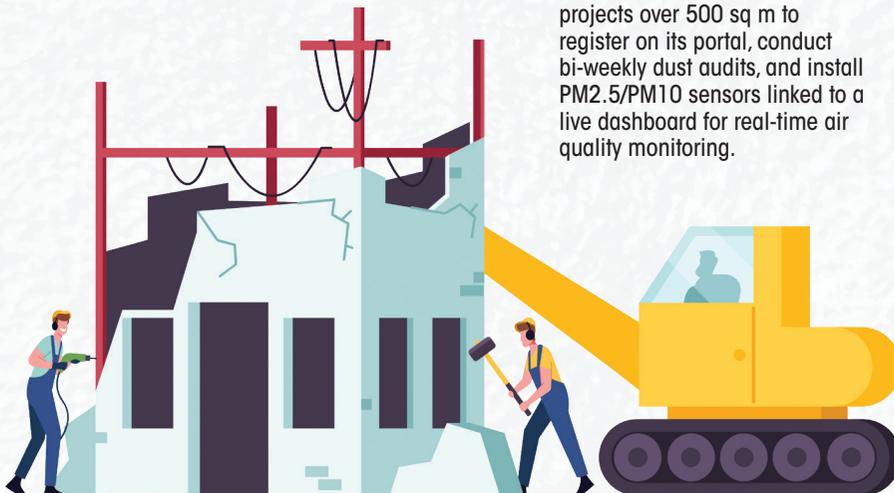
- MoEFCC notifies GRAP in January and entrusts EPCA with the task of overseeing its implementation.
- In November, EPCA meets stakeholders, ordering construction halts and fines for poor dust control on road projects.
- CPCB releases two documents that lay out guidelines regarding dust mitigation measures while handling construction material and C&D waste.

2018

- MoEFCC comes out with the Environment (Protection) Amendment Rules that provide dust mitigation compliance measures applicable for C&D activities

2021

- DPCC's 2021 anti-dust drive mandates all construction projects over 500 sq m to register on its portal, conduct bi-weekly dust audits, and install PM2.5/PM10 sensors linked to a live dashboard for real-time air quality monitoring.



DUST CONTROL IN LINEAR INFRASTRUCTURE PROJECTS

Dust control guidelines notified so far address measures to be taken on construction sites and during transportation of materials in the city. They do not address the specific and functional challenges faced by linear infrastructure projects. Instead of a confined polygonal area, these projects span long distances involving highways, railways and viaducts. In case of elevated construction, measures like wind barriers and dust covers become ineffective. There is a lot of movement of heavy vehicles too as they carry prefabricated components of bridges and highways. In the process, these projects cross city boundaries or even state boundaries, thus changing jurisdictions. All these factors make dust management in linear projects practically challenging.

A few agencies responsible for such projects are addressing the tricky problem of dust management innovatively. The Delhi Metro Rail Corporation (DMRC) and the National Capital Region Transport Corporation (NCRTC) are two such agencies which are demonstrating best practices of dust control in linear projects.

A CSE survey team visited several project sites of both the agencies and compiled information on how they are arresting dust dispersal and building a learning curve. In linear projects, there are usually three sections for dust control: first is the batching plant, second is the active construction area, and third is the C&D waste recycling plant.

The DMRC, for instance, has its own C&D waste recycling plant of 150 tonne per day (TPD) capacity located in Mundka. The plant processes C&D waste generated in the course of metro rail construction only. Each section demonstrates good and replicable dust control practices.

Use of vehicle-mounted and elevated stationary anti-smog guns: Both DMRC and NCRTC have deployed vehicle-mounted and stationary anti-smog guns at active construction sites. Anti-smog guns spray a fine mist of water into the air to capture and settle airborne dust and particulate matter. Using high-pressure nozzles, they break water into ultra-fine droplets that bind with pollutants. This makes them heavier and causes them to fall to the ground. These guns, when mounted on vehicles, can enable coverage of wider areas for longer periods for dust suppression. Placing anti-smog guns at higher points facilitates improved mist dispersion with wider coverage. This is particularly useful when the project has elevated structures.



Anti-smog guns kept at high elevation of buildings

Paving of roads and wheel washing at entry-exit points: Hard-paving or black-topping of roads that lead to a construction site can reduce the amount of dust that gets dispersed with every vehicle that comes in and leaves the site. Washing of wheels of the vehicles at entry and exit points can further reduce dust from leaving the site and dispersing in the city. It keeps the roads clean as well. The DMRC has used both the methods at a few metro stations that are being constructed, as well as at their concrete-mixing plant.



Blacktopping or hard-paving entry and exit points across the linear stretch

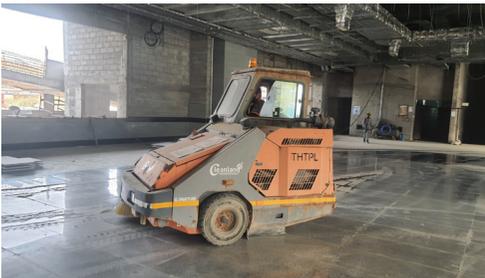
●●● DEBRIS TO DIVIDEND



Wheel washing stations at a DMRC site entrance



Mechanical sweeping: The NCRTC has employed mechanical sweeping machines at some of its large station construction sites. These machines efficiently remove dust and debris from expansive areas, ensuring consistent cleaning while reducing reliance on manual labour. Additionally, they aid in waste management by preventing debris build-up, and keeping the site organised.



Mechanical sweeping machine at NCRTC stations



Enclosed storage and wet suppression of materials: The DMRC has installed a system within its batching plant where the loading and unloading of material takes place within an enclosed space. The material is sprayed with water with the help of a nozzle to avoid emissions of fugitive dust during its handling.



Material handling taking place within enclosure



THE C&D WASTE MANAGEMENT ECOSYSTEM

Highest C&D waste recycling capacity: Delhi has the highest C&D waste processing capacity in India, with the maximum number of operational recycling plants. It now has a well-rounded ecosystem for collection, transportation, processing and uptake of recycled products — that too, in a sprawled and space-constrained geography that offers abundant ridge areas and river plains which can attract indiscriminate disposal. Delhi's success has been the result of almost two decades of efforts, and was accomplished with the help of timely decisions and relevant mandates, all the while learning from its own experiences and mistakes.

Like many other cities in India, Delhi too used to face the problem of illegal dumping of C&D waste into and on its waterbodies, ridge areas, parks, open lands, railway lands, roads and highways. To tackle this, in 2004 and 2005, surveys of C&D waste in Delhi were conducted by the Municipal Corporation of Delhi (MCD) and IL&FS Environmental Infrastructure & Services Ltd (IEISL), a city-based company which partners with ULBs to set up and operate C&D waste recycling plants.¹³ Based on this, the first C&D recycling plant in India was established in Burari in Delhi in 2009, with a processing capacity of 500 TPD.

However, far from being a solution, it ended up raising more questions. This is because a plant does not just work in isolation — it needs an entire ecosystem support to function viably. While attempting to solve these questions and fitting parts of the puzzle together, Delhi began developing its own ecosystem which became a benchmark for many other cities in the country.

Initially, the plant faced challenges due to insufficient quantity and quality of the waste received. The 2010 Commonwealth Games was a significant catalyst for clearing the city's debris — preparations for the Games had resulted in the generation of enormous amounts of C&D waste that had started to clog the city by 2008.¹⁴ The Delhi government set an August 10, 2010 deadline for its municipalities to remove all the debris.¹⁵ This redirected more waste to the plant, effectively addressing the common challenge faced by many recycling facilities in the country today — that of insufficient raw materials.

Regulatory action to enable use of recycled products: The recycling plant also needed to sell the recycled products that it produces to become financially viable. A roadblock was brought to light by a CSE investigation around 2013 — it found that IS:383-1970, the Indian standard for concrete aggregates set by the Bureau of Indian Standards (BIS), allowed only 'naturally accessed material' for concrete production. Concerned about potential non-compliance, construction agencies refrained from using recycled C&D waste. Recognising this issue, BIS established a fast-track panel in early 2014 to include aggregates from non-natural sources in Indian standards; the results of this initiative were, however, not visible immediately.

Mandate for market uptake of recycled products: In the meantime, the plant faced difficulties in generating demand for its recycled products. The situation began to improve in 2015-16 when the Department of Urban Development of the government

of NCT of Delhi made it mandatory for all municipal and local government bodies in Delhi — including the Public Works Department (PWD), Department of Irrigation and Flood Control, DSIIDC, and the Delhi Jal Board — to use recycled C&D waste products for construction and maintenance projects. In the meantime, in 2016, the BIS updated IS 383: *Coarse and Fine Aggregate for Concrete Specification*, officially acknowledging recycled C&D waste as a legitimate alternative to natural aggregates in concrete mixes.¹⁶ These developments helped increase the demand for recycled C&D waste products within the market.

By now, several pieces of the waste management puzzle had started falling into place. But one concern remained: the waste being collected still came largely from bulk waste generators and not from smaller generators. The C&D Waste Management Rules came in 2016 and clearly defined the roles of the waste generator and the service provider. The Rules required the waste generator to deposit the waste at collection centres identified by the local body, or hand it over to an authorised C&D waste processing facility. This called for a collection system in the city so that the waste generators could dispose of their waste only in the formal manner.

A well-distributed and user-convenient collection system: Delhi's C&D waste management system is structured to ensure extensive coverage through a widespread network of 132 collection points¹⁷ distributed across the city's three ULBs and 272 wards/circles, providing easy access to waste disposal facilities for residents, contractors and construction personnel. The MCD, encompassing 250 wards, has 106 designated collection centres with 61 more planned in future.¹⁸ The New Delhi Municipal Council (NDMC), which oversees 14 circles, has 25 collection centres. The Delhi Cantonment Board (DCB) has eight circles with one designated collection centre.

This ensures that nearly every two wards have a designated point for C&D waste collection — this demonstrates a deliberate effort to ensure convenience and accessibility city-wide. When collection points are strategically placed within two-three km of waste generators, as recommended by the Building Materials and Technology Promotion Council (BMTPC)¹⁹, it minimises the need for long-distance transportation, cutting down vehicular emissions and fuel consumption caused by waste-carrying vehicles. When waste is collected closer to its source, it also brings down the number of times it is handled — this, in turn, reduces incidences of spillage during transit and decreases exposure to wind. By enabling quicker,



C&D waste collection points within Municipal Corporation of Delhi area

localised disposal, multiple collection points create a more sustainable and efficient waste management system, contributing less to the urban air quality and reducing health hazards for city residents.

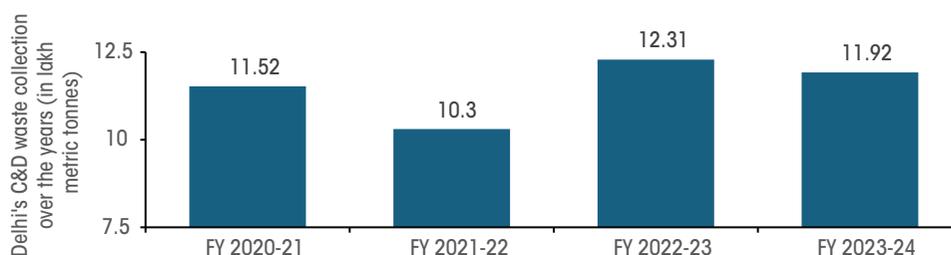
The MCD has smartly utilised the existing space in wards in a space-constrained city. MCD junior engineers have a ward office with some storage space within the premises. These storage spaces have been converted into C&D waste collection points with clear demarcations and signages. Each space has its own collection vehicle and logbooks to keep track of the waste deposition. When these points get full, the junior engineer calls the plant operator to take the waste for processing. This is the secondary collection leg of the process. This process is done during early morning hours to avoid troubling nearby residents and activities.

Delhi has steadily progressed towards this widespread network, with more collection points being added regularly. The increase in collection points has yielded positive results, with the MCD having reported a 38 per cent reduction in illegal dumping from October to November 2023.²⁰ On the other hand, MCD has achieved a steady collection of about 12 lakh metric tonne as of 2024, as per to the annual report submitted to DPCC (*see Graph 1: Delhi's C&D waste collection over the years*).

With the city largely expanding northward and westward, new waste collection points are also being set up in places like Narela, Shahdara (North), Shahdara (South) and Rohini zones to meet the increasing demand for proper waste disposal.²¹ These additional collection points will not only improve waste management efficiency, but also help reduce air pollution by minimising the distances that waste transport vehicles need to travel. Shorter trips mean lesser fugitive dust from the C&D hauling vehicles, lower fuel consumption and fewer emissions.

Improved transportation system — skip-hauler system: Skips — metal bins — curb dust emanating from handling of waste and support enforcement. The NDMC has introduced color-coded skips and vehicles for C&D waste collection and transportation. The red coloured skips can be distinguished from other street elements and easily identified by small waste generators. The colour coding also extends to C&D waste hauling vehicles,

Graph 1: Delhi's C&D waste collection over the years



Source: Compiled from annual reports submitted to DPCC



C&D waste collection points within New Delhi Municipal Council area (left); color-coded C&D waste carrying vehicles of NDMC (right)

which enables quick recognition of authorised transporters. Against the colour-coded vehicles, it becomes easier for the enforcers to distinguish illegal hauling and dumping of C&D waste. By combining accessibility with clear visual cues, the NDMC's system simplifies waste disposal for citizens while improving regulatory oversight.

Another benefit of this system is control of dust pollution and better adherence to dust control norms. Storage, loading and unloading of debris is a significant source of fugitive dust emissions and safety concerns, particularly when handled manually. These emissions not only contribute to local air quality but also pose health risks to workers and residents in the vicinity. Moreover, manual handling has several safety risks for the workers while they deal with heavy and sometimes sharp rubble. When the debris lies on the roadside without confinement it not only acts as an obstruction for pedestrians and vehicles, but also stirs up dust with every passer-by.

The NDMC's skip-hauler system addresses these concerns. The skips keep the C&D waste confined, reducing fugitive dust and eliminating the risk of injuries to passers-by. In this system, the hauling trucks are equipped with a special hook that xattaches to metal skips. The cranes in these trucks lift the filled skips and place them securely on the vehicle; they can also replace them with an empty skip. The skips have hooks to fasten covers to prevent dust emissions both while being used for collection and for transporting waste to the transfer station. With minimum disturbance, this system significantly curbs the release of dust into the atmosphere. In addition to its environmental benefits, the mechanism improves operational efficiency, reduces manual labour, and speeds up the waste collection process, creating a cleaner and safer urban environment.

Decentralised recycling reduces transportation distances: As Delhi has steadily expanded, so has its waste processing capacity to over 11 times from where it started initially. There are five recycling plants in the city with a combined processing capacity of 5,150 TPD,²² which is the highest in the country. Instead of one large plant, this decentralised approach offers several advantages. Firstly, it reduces the distance for transporting the waste. This cuts costs as well as carbon emissions while minimising particulate pollution. This also eases traffic congestion by lowering the number of heavy vehicles on roads; optimises vehicle utilisation which reduces capital investment; strategically places plants near construction hotspots to improve efficiency; and fosters healthy competition by providing waste generators with multiple convenient options for disposal and processing.

Delhi's journey in C&D waste recycling began in 2009 with its first 500-TPD facility at Jahangirpuri in the northern part of the city. This was soon followed by a plant at Shastri Park (1,000 TPD) in the east. Over time, additional facilities were established in the western regions, including Bakkarwala (1,000 TPD) and Ranikhera (1,000 TPD). In addition, a recycling plant at Mundka has a processing capacity of 150 TPD and particularly caters to the C&D waste coming out of projects handled by the Delhi Metro. The Jahangirpuri plant has since then expanded its capacity to 2,000 TPD, making it the largest such facility in the country (see Table 1: C&D recycling plants in Delhi).

The city has also attempted decentralised waste recycling through mobile recycling plants. In 2014, the NBCC – the Indian government's civil engineering enterprise – piloted *in situ* recycling of demolition waste for the East Kidwai Nagar redevelopment project. A temporary 150-TPD C&D waste recycling plant was set up under a PPP model, with NBCC ensuring 100 per cent buyback. The project involved demolishing 2,444 houses, and the recycled waste was used to produce aggregates, manufactured soil, and downstream products like RMC, bricks, blocks, and tiles.²³

Map 1: C&D waste recycling plants in Delhi



However, the city's decentralisation aspect remains partially unfulfilled as it still does not have a permanent C&D recycling plant to cater to its southern parts. The municipality initially planned setting up a C&D recycling facility in Maidangarhi; however, this faced hurdles. In 2024, the municipality floated a tender for a recycling facility to be set up on a seven-acre plot in Tehkhand, Okhla. The plant will cater to the south and central zones of Delhi cutting down travel distances of debris further within the city. It will initially be of 1,000 TPD, but will be expanded to 2,000 TPD within two years of its establishment.²⁴

Reducing transportation distances has a direct effect on lowering overall costs, as is reflected in the average tipping fee of Rs 210 per tonne charged to municipalities in Delhi. This fee is significantly lower than those charged by other plants, demonstrating the cost-efficiency of decentralised recycling facilities.²⁵

Mandatory reuse to generate demand for recycled products: The uptake of C&D recycled materials is a crucial factor in achieving a circular economy. Creating a sustainable business model for C&D recycling plants hinges on ensuring that revenue from the sale of recycled products becomes the dominant source of income. As per the 2016 C&D Waste Management Rules, use of materials made from C&D waste is to be mandated by the state government/Union territory administration. The Rules suggest up to 20 per cent use of C&D waste products in municipal and government contracts.

Delhi has taken strategic steps and policy initiatives to cultivate a mature market for C&D waste recycled products. The city began this effort in 2015, predating the 2016 Rules. The GNCTD issued an advisory on July 27, 2015, mandating the use of recycled C&D waste products in Delhi. Another advisory was also issued on September 14, 2015 by the deputy secretary (PWD/UD).²⁶ In July 2016, the Department of Urban Development, GNCTD, mandated all municipal bodies and the departments of GNCTD to use recycled C&D waste products. According to the order, all departments are to use minimum 2 per cent of recycled products in building works and 10 per cent in road works. Further, all ULBs are to mandate 5 per cent use of recycled products for non-structural applications by everyone. The order also laid down provisions for enforcement and compliance.



The Supreme Court Annexe building used 1.8 million recycled C&D waste blocks

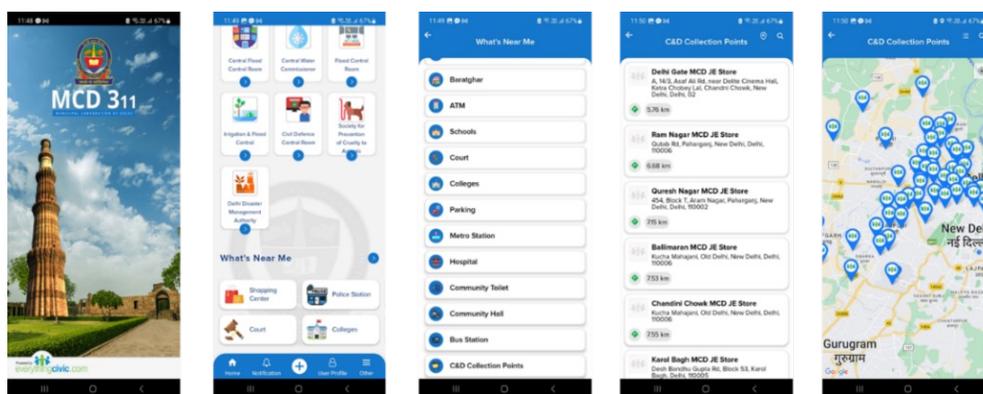
Such mandates, along with demonstration by iconic projects, improved awareness and acceptance of recycled products. For instance, the Supreme Court Annexe building in New Delhi used 1.8 million blocks made of recycled aggregates, conserving nearly 25,000 tonne of fertile soil. Such efforts pushed utilisation of recycled products to 2.5 lakh metric tonne (MT) in 2018-19 from just 60,000 MT in 2017-18.²⁷

The DPCC also called on all agencies such as NHAI, NBCC, CPWD, etc to increase the reuse of recycled materials as per directions notified under Section 5 of the Environment (Protection) Act, 1986. This was done on January 14, 2020 to further these agencies' uptake in line with the annual targets set by MoHUA.²⁸ For the financial year 2023-2024, MoHUA set a target of 16.015 lakh MT of recycled products.²⁹ In response, Delhi's C&D waste facilities saw a total offtake of 7.423 lakh MT.³⁰ Of this, government departments utilised 2.517 lakh MT, accounting for 33.9 per cent, while private parties took up a larger share of 4.906 lakh MT, contributing 66.1 per cent.³¹

This private sector involvement highlights its critical role in sustaining the demand for recycled materials. Meanwhile, the government's steady uptake ensures consistent utilisation of recycled products, supporting the city's efforts towards sustainable waste management and a circular economy. The CPWD Schedule of Rates (SOR) 2023 for Delhi has also played its part by incorporating materials derived from C&D waste into this widely used document. This has provided a big endorsement, instilling confidence among builders and contractors about the quality and reliability of these materials.

Tools to enable public outreach: Over the years, the city has developed tools to enhance awareness among waste generators through digital platforms to inform and engage citizens: this includes introduction of a mobile app and a website which provide access to the MCD helpline for requesting C&D waste collection services and informing users about C&D waste collection points in their vicinity. This is a crucial component of a successful and efficient C&D waste collection system.

The MCD 311 app is the official mobile phone app for several municipal services. The app has incorporated C&D waste management by listing down the waste collection points within the municipal area. This list can be accessed by:



Interface of MCD 311 app to find C&D waste collection points

- Clicking on the 'what's near me' tab
- Selecting 'C&D collection points' option
- Selecting the nearest collection point as guided by the options and the distance to them, and the map that shows all the designated C&D collection points

The NDMC has a similar app by the name 'NDMC Citizen' that enables placing collection request. The MCD website also lists down the designated sites in each ward for disposing of C&D waste. To strengthen the collection system further, regular training of citizens and transporters is essential. Civic departments are actively conducting citizen awareness drives and sensitisation programmes to ensure proper debris collection and to prevent illegal roadside dumping.³²

CHANDIGARH

Comprehensive approach towards recycling and uptake of recycled products

A STATE-MANAGED SYSTEM

Chandigarh's C&D waste management system is designed and operated solely by the Municipal Corporation of Chandigarh (MCC) without involvement of any private party. It is the only government-run C&D waste management system in the country and has a recycling plant with a capacity of 150 TPD, operationalised in 2019. This system is able to collect most of the waste generated in the city, process it, deter illegal dumping and make profits by sale of recycled material. A key factor behind this success is its strong focus on information, education and communication (IEC).

The Waste Management Rules, 2016 place the major onus of managing waste on its generator. This requires tremendous efforts by the city — it has to familiarise the public about the several processes involved in waste management; and about their responsibilities and the consequences of failing to fulfil them. Recognising this, the MCC engaged KPMG Consultants to develop a comprehensive IEC strategy for city's waste management systems, including the C&D waste stream. This strategy involves engaging the public through various mediums of communication — digital, print, audio-visual and physical (events and interactions).

INNOVATIVE REGULATORY INSTRUMENTS TO ENSURE MARKET UPTAKE OF RECYCLED PRODUCTS

Chandigarh's Waste Management Policy of 2019 provides for mandatory reuse of recycled C&D waste in an innovative way. There are two parts to this process.

Firstly, the policy includes a provision for waste generators who have paid processing charges at the time of building plan approval — they are entitled to receive processed material free of cost, amounting to 50 per cent of the charges paid, within one year.

Secondly, to buy materials from the plant, developers and waste generators need to place a demand request specifying the types of products and their quantities needed — the plant must respond to this. In case it is not able to meet the demands placed by buyers, it will have to issue a non-availability certificate.

These two provisions push the developer and waste generator to use recycled waste as much as possible and bridge the gap between policy and practice towards increased use of recycled materials.

PRODUCT DIVERSITY

Chandigarh has also demonstrated wider diversity of the products that are made from recycled aggregates. In addition to the usual paver blocks and aggregates that most recycling plants produce, the Chandigarh plant also manufactures a variety of material that can be utilised by municipalities for different applications — street furniture and amenities, coverings of sewer drains etc. This leads to much higher value addition and increases the revenue potential

PUBLIC OUTREACH TO STRENGTHEN IMPLEMENTATION

Digital communication: The MCC regularly posts information on its website and social media platforms such as X, Youtube, Facebook and Instagram. Approximately 10 per cent of the content is dedicated to C&D waste management, as per the MCC’s IEC experts.

Printed communication: The MCC disseminates information related to C&D waste through newspapers, magazines and advertisements. It also uses outdoor media outreach platforms like hoardings, banners and posters that are placed at public spaces.

Audio-visual communication: The municipality runs ads and public messages on radio and television. This is complemented by dedicated Residents Welfare Association (RWA) and Market Welfare Association WhatsApp groups to ensure targeted messaging for specific wards.

Public events: The MCC strategically utilises major annual public events, such as the Rose Festival, Teej Mahotsav and the Swachhta hi Sewa campaign, to set up informational



C&D waste stall featuring tiles, bricks and pavers at the Zero Waste 52nd Rose Festival, 2024



Posts covering toll-free number for C&D waste collection and events, on the social media platform, X

stalls and booths. These stalls showcase recycled C&D waste products, highlighting their benefits and applications, and provide information on the toll-free number for door-to-door collection services.

The outreach strategy also includes guided tours of the C&D waste management plant for visiting delegations and student groups from outside Chandigarh. These tours provide insights into the plant's operations, the broader waste recycling ecosystem, and real-world examples of public spaces constructed with C&D waste recycled materials such as Chandigarh's Waste to Wonder park located at sector 32. This park utilises recycled materials to make benches, picnic tables, kerbstones and interactive play spaces. Expansion plans include collaboration with the community and social media influencers to spread the word on the city's C&D waste management system.

HYDERABAD

Innovative decentralised recycling

Hyderabad has developed the largest C&D waste management system in southern India, with four decentralised recycling facilities strategically distributed across the city. While this is largely in response to the city's rapid growth — a population that has nearly doubled from 1991 (43.4 lakh) to 2011 (76.8 lakh) — fuelling demand for housing and infrastructure and a rise in C&D waste, Hyderabad is reaping multiple benefits from its C&D waste management system.

The primary advantage of multiple C&D waste recycling facilities is that it reduces travel distances and the linked user charges. Transportation is the most dynamic part of the recycling cost and can form its major proportion in a large city. Hyderabad ULB pays a tipping fee of Rs 450 per tonne for transport and processing. In case a generator brings waste directly to the plant, they pay only 25 per cent of this fee to the plant operator.

Further, shorter trips due to decentralised plants reduce the need for vehicles to be owned and operated by the ULB, and bring down the capital costs. Short trips also cut down fuel consumption tremendously as Hyderabad is a sprawled city. Lesser tail-pipe emissions support better air quality. Limited movement of heavy debris-laden trucks across the city reduces fugitive dust and particulate matter, which benefits both public health and the environment.

Decentralised plants enable recycling strategically near the construction hotspots of the city. This not only makes it easier for the generators to recycle and reuse C&D waste, but also reduces illegal dumping. Short trips support enforcement by providing a closer eye on the operations involving waste handling and movement of vehicles. Additionally, shorter transport routes reduce congestion on city roads, enhancing overall urban mobility and related emissions.

Greater Hyderabad Municipal Corporation (GHMC) spans four districts — Hyderabad, Rangareddy, Medchal and Sangareddy — across 650 sq km. The first of the four plants was set up in 2020 in Jeedimetla and caters to the northern part of the municipal area. It was followed by the Fathullaguda plant in 2021, located in the east. Both the plants are operated by the city-based RE Sustainability Ltd and provide a processing capacity of 1,000 TPD.

In 2021-22, the GHMC sought to establish two more plants but lacked the land needed for them. The commissioner proposed a PPP model where the concessionaire provided the land — but the proposal did not gain traction due to no precedence of this model. Later, an interested concessionaire, the Hyderabad-based SSREC, set up recycling plants in Shamsabad and Thumakunta to cater to the southern and the expanding new north-eastern outskirts of the city.³³

As of September 2024, a total of 2,950,378.57 metric tonne (MT) of C&D waste had been deposited at the four recycling plants. Of this, approximately 769,221.1 MT, which accounts for about 26 per cent, had been successfully processed into recycled products.

Map 2: C&D waste recycling plants in Hyderabad

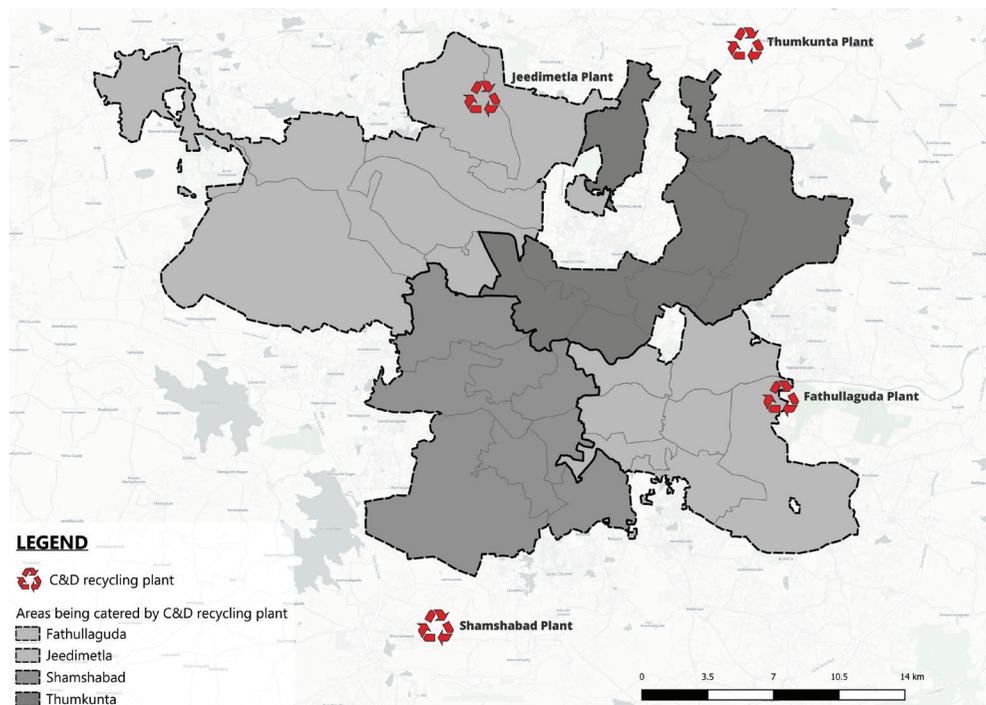


Table 1: Capacities of C&D waste recycling plants in Hyderabad

Plant location	Processing capacity (TPD)	Caters to circles (number)	Waste quantity collected at the plant till September 2024 (metric tonne)
Jeedimetla	500	8 Circles	1,598,208.49
Fathullaguda	500	7 Circles	261,432.11
Shamshabad	500	8 Circles	143,849.51
Thumakunta	750	7 Circles	189,862.24
Total	2250		2,193,352.35

Source: 'Debris Deliberations', CSE's national conference, November 11, 2024

INTEGRATION OF THE INFORMAL SECTOR

Hyderabad has deployed a door-to-door waste collection model that utilises the strength of the informal sector. This improves collection efficiency, reduces municipal costs and at the same time prevents job loss for informal workers as they transition into a formal ecosystem.

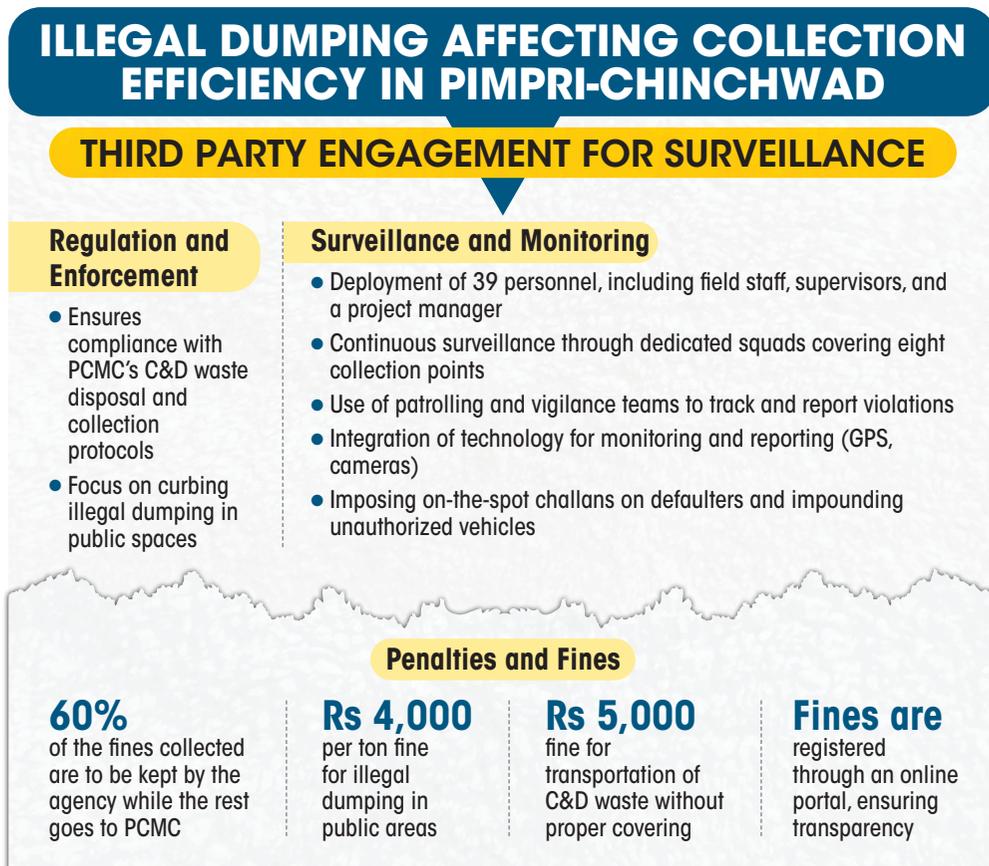
To enhance transparency and compliance, QR tags have been added to waste collection trucks/vehicles. The codes scanned at collection points help track vehicles and verify authorisation; they also assist the police in identifying official waste collectors. This system prevents illegal dumping and enhances accountability. Capacity building of the workers helps bring down fugitive emissions during handling as well.

PIMPRI-CHINCHWAD

Innovation in the collection system

Developing the C&D waste collection system: Pimpri-Chinchwad is a rapidly developing city in the Pune urban area. The Pimpri-Chinchwad Municipal Corporation (PCMC) began dedicated C&D waste management in 2019 and set up a C&D waste recycling plant in 2020. The Corporation identified the need to improve the collection of C&D waste and curb illegal disposal after observing numerous incidents of illegal dumping across the municipal area. However, being short-staffed, it planned to hire a private agency to look after city’s enforcement needs.

Figure 3: Key aspects of PCMC’s third party engagement for surveillance



This outsourcing of surveillance and enforcement brought personnel, technology and equipment to PCMC through which it seeks to strengthen compliance. This initiative commenced in 2024 and brought into play a more accountable and efficient waste management system by ensuring the C&D waste reached the plant, while mitigating the environmental hazards of open dumping, such as dust pollution and contamination of waterbodies.

The PCMC has looked at the engagement in detail to prevent role overlaps and gaps. While the third party brings to the table several resources, their primary duty is to ensure compliance with the PCMC's C&D waste-related protocols and cracking down on illegal dumping. The third party is to be paid to compensate for the humanpower it brings and with 60 per cent of the fines collected, according to the agreement. This approach incentivises the agency to impose fines diligently, ensuring no defaulters are overlooked. The PCMC has also defined penalties for specific offense and created an online portal to enter details of the imposed fines to maintain transparency.

NOIDA

Controlling fugitive dust from the recycling plant

As a number of cities set up their C&D waste recycling facilities, their need to comply with dust control norms and demonstrate good dust mitigation practices has also increased. With a direct bearing on the health of the workers at the plant and of nearby citizens, these practices have become paramount. The C&D waste recycling plant at Noida demonstrates these practices clearly and strongly. To check the air quality at the plant, a test is carried out every three months in which the concentration of various pollutants including heavy metals (lead, arsenic, etc) is assessed.

According to an estimation based on US Environment Protection Agency benchmarks, three broad dust control measures from CPCB guidelines on environmental management of C&D wastes can bring down PM10 emissions drastically:

- **Proper management of unpaved roads:** Measures such as limiting vehicle speed, applying water or dust suppressants, and paving the surface can bring down fugitive dust emissions by 57 to 73 per cent.
- **Material handling:** Measures such as covering stockpiles during high wind, implementing wet dust suppression measures and erecting three walls around stockpiles can lead to a reduction from 72 to 85 per cent.
- **Installation of wind barriers:** Installing wind barriers around the site can lead to a reduction scenario ranging from 4 to 88 per cent.

Cumulatively, the three measures have the potential to reduce dust emissions by up to 93 per cent. Noida has taken dust control measures beyond these categories.

SECURED BOUNDARY

The entire site has seven-metre high wind barriers made of metal sheets running along the boundary of around 500 m. As per the plant operator, this boundary was erected in 2020 at a cost of about Rs 30 lakh.



Covered transportation (left), wetting of debris (middle) and covered storage (right)

The site also has a vegetative buffer running along the wind barriers. The buffer varies from 3 to 6 m in thickness. Nearly 13-15 tree species, including Chukrasia, Kanner, Banana, Bamboo, Jamun, and Neem have been planted. Trees act as natural dust barriers as they trap particulate matter on their leaves. Over time, dust build-up reduces their effectiveness, so they are periodically washed to maintain their role as filters. Regular cleaning also supports tree health and helps reduce dust in the area.

MATERIAL HANDLING

Material handling is required at different stages of C&D waste processing at the plant. It involves loading, unloading, storage, transportation and processing of materials – all of which require specific attention and handling to arrest fugitive dust.

Covered transportation: At the first step, trucks carrying C&D waste to the plant are covered with a green net. Before unloading, a worker sprinkles a generous amount of water on the waste to control the dust. Once dumped in the storage area, the waste is kept under cover to prevent dust dispersion caused by wind movement.

Processing in enclosures: The processing of C&D waste, including activities like sorting, crushing and screening, takes place inside an enclosed structure approximately 80 m x 25 m in size; the enclosure is made up of metal sheets. Additionally, a vegetative barrier of trees has been established around the outer periphery of the shed. An anti-fogging machine, connected to a water tank on a vehicle, discharges fine mist to control dust during the first crushing phase.

Paved base and an extensive drainage system: Debris falling from conveyor belts dries into dust and impacts air quality. Regular cleaning is challenging on unpaved surfaces, so the plant is paving areas under equipment for easier maintenance and dust reduction. Additionally, stormwater drains prevent stagnation, which can create mud that dries into airborne dust and also damages surfaces. An extensive drainage system helps minimise this and maintains surface integrity.

Management of roads: The waste carrying trucks travel to the dumping point at the plant, with high-pressure sprinklers keeping the path wet. Initially, the system was automatic in



Processing takes place within a covered area; there is also a vegetative barrier outside the recycling shed



Wetting of roads, wind barrier, and low drop height at the collection centre

which the sprinklers activated once dust was detected at the site. This system was found to be too water-intensive and was replaced with a manual system. A staff member monitors the wetness levels of the road and turns on the sprinklers based on requirement. Wherever the sprinklers are not present, the wetting is carried out manually by a vehicle.

Recently, the plant paved a dedicated pedestrian path, separate from the vehicular route, to reduce dust. The new surface minimises dust and maintenance issues.

Cleaning of fallen debris: The plant regularly cleans the places where mud and debris accumulate, especially after the rain. If not removed, this could dry into dust or spread via vehicle tires, worsening the air quality.

BEYOND THE PLANT

Noida has 14 collection points for depositing C&D waste. Dust mitigation measures have been implemented at these collection points to minimise fugitive dust generated during the loading, unloading, and handling of the waste. The ground at the collection points is regularly sprinkled with water, and a 4-5 meter wind barrier wall helps contain dust during loading and unloading. Vehicles transporting C&D waste remain covered with a cloth, removed only during loading and unloading. The drop height while unloading the waste is kept minimum to avoid fugitive dust from escaping.

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The latest Environment (Construction and Demolition) Waste Management Rules, 2025 brings an extended producer responsibility framework for large generators along with a centralised digitally-tracked monitoring and enforcement system for all ULBs. While these rules are laid out in the right direction, certain cities are already performing above and beyond the requirements of these rules. This report is a compilation of these practices which can guide other cities to leapfrog in recycle and reuse performance as well as dust control. The report also highlights a few critical factors that will determine the success of these rules and material circularity in India.



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