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Demolition Waste Management a Systematic Work Approach

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***Abstract*—In India Population growth is leading to industrialization, urbanization and modernization. It directly increases demand for new construction, renovation or demolition of structures. This all creates waste from construction and demolition of a structure which needs to be properly managed and organised. This paper focuses on pre- planning of waste management and process of managing it by Project Managers / Engineers or Architects. Planned process leads to less waste on site and management leads to healthy and sustainable environment. This is very crucial stage during construction and demolition. A Project Manager (PM) is crucial for construction waste management (CWM) by integrating sustainable practices into project planning, overseeing site implementation, ensuring proper segregation, recycling, and disposal, and managing costs, all while leading teams and communicating with stakeholders to minimize environmental impact and meet regulatory compliance. Their responsibilities range from planning waste reduction strategies and managing budgets for sustainable options to training staff and monitoring performance against waste targets.**

D Demolition waste is commonly referred to as Construction and Demolition (C&D) waste**, is generated during activities such as building demolition, renovation, infrastructure development, and redevelopment projects. With rapid growth urbanization and redevelopment across cities like Mumbai, Delhi, and Pune, India produces a large quantity of demolition waste every year. According to the Central Pollution Control Board (CPCB), India generates** 150–160 million tonnes **of C&D waste annually, though near about only a portion is scientifically processed or recycled. (jain, 2025)**

r Recent study shows no such mandatory process is adopted on sites for C&D waste management even though we have specific rules for C&D waste management (The construction and demolition rules 2016) which have been upgraded in 2025. No reports on site are generated for the C&D waste management. No such specific role regarding to the waste management is allotted to project manager or No such person with wide knowledge of C & D waste management is hired. No allocation of roles and duties regarding C&D waste management. No administrative checking by authorities. Despite the rules and regulations most of the sites doesn't make a mandatory process. C&D waste management is important and should be focused task.

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Mainly focusing on the demolition waste: The research emphasizes the need for integrating demolition waste management into project planning, scheduling, and Management. iIt proposes systematic monitoring through regular reporting, proper record maintenance, and the appointment of specialized demolition waste managers to improve efficiency. Adoption of structured waste management systems can significantly reduce project time, cost, and risk while promoting resource conservation and sustainable construction practices. The study concludes that strengthening institutional practices, improving data management, and encouraging reuse and recycling of demolition materials are essential for achieving sustainable development goals in the Indian construction industry.

I. INTRODUCTION

The rapid growth of urban development and infrastructure expansion has significantly raised construction and demolition (C&D) activities, resulting in the generation of large quantities of waste at construction sites and during structural demolition. Effective management of this waste has become a major concern for the construction industry due to its environmental impact, resource consumption, and operational challenges. Traditionally, waste management has been addressed mainly at the disposal stage; however, modern sustainable practices emphasize the importance of pre-planning and systematic management of waste from the primary stages of a project. (jain, 2025)

This research focuses on the pre-planning and management of waste generated during demolition processes, highlighting the need for organized strategies that minimize waste generation and promote reuse and recycling. Proper planning at the early stages of a project can improve resource utilization, reduce environmental impacts, and enhance project efficiency.
The study also examines the implementation and utilization of government regulations and guidelines established for managing construction and demolition waste. These regulatory frameworks aim to ensure environmentally responsible handling, segregation, transportation, recycling, and disposal of waste through a structured management process. Understanding how these rules are applied in practical project scenarios is essential for evaluating their effectiveness.
Furthermore, the research emphasizes the role of the Project Manager, Demolition waste manager in Demolition waste management. Project managers play a crucial role in integrating waste management practices into project planning, scheduling, procurement, and execution activities. Their responsibilities include monitoring waste generation, maintaining documentation, ensuring regulatory compliance, and promoting systematic waste handling practices within construction projects.

Overall, this study aims to highlight the importance of structured planning, keeping records, regulatory implementation, and managerial involvement in achieving efficient and sustainable demolition waste management practices.

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II. AIM

To establish a waste management program at the pre-planning stage, during execution and to outline the practices that can be followed to make the working program more systematic and relevant in a sustainable way.

III. OBJECTIVES

- To identify the major sources and types of demolition waste anticipated during the planning stage of large-scale construction project.
- The access the current pre-execution waste management practices adopted in demolition projects and evaluates their effectiveness.
- To examine the integration of waste management planning into project execution plans, including procurement, scheduling and logistics.
- To identify barriers and challenges in implementing effective execution demolition waste management.
- To guideline the procedure that would make system strong and more systematic.
- To do comparative analysis of available data depending on the research and case studies.

IV. SCOPE

- To examine how a producer's internal system can be strengthened to effectively support the government in achieving C&D waste management targets.
- To study how producers can develop a systematic internal framework for demolition waste management that improves cost efficiency and promotes sustainable construction practices.

V. LIMITATION

1. Data Availability & Accuracy

Lack of reliable waste quantification data India does not have a standardized, nationally consistent system for measuring demolition waste. Estimates vary wildly in this field annual C&D waste figures range from 150 to 500 million tones depending on the source making it difficult to establish a reliable baseline for research. Mongabay

Underreporting by companies Many demolition companies, especially small and medium-sized ones, do not maintain formal and standard records of waste generated, disposed of, or recycled. This limits ability to gather accurate primary or secondary data.

Absence of centralized data pre-2026 t the 2016 rules lacked a central portal to monitor waste generation and had weak reporting systems. This indicates that the historical data before April 2026 is largely incomplete or anecdotal, restricting longitudinal analysis. Mongabay

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2. Regulatory & Compliance Gaps

Rules are newly enacted The revised C&D Waste Management Rules only came into effect from April 2026. Since implementation is very recent, there is insufficient time to observe real-world compliance patterns, outcomes, or the effectiveness of enforcement limiting conclusions drawn from regulatory analysis. (Srish Prakash, 2026)

Low awareness among industry players Many demolition contractors and small companies may be unaware of the new rules, making survey or interview responses unreliable or inconsistent.
Uneven enforcement across states, State Pollution Control Boards vary in their capacity and willingness to enforce rules, meaning findings from one region may not be generalized nationally.

3. Industry Access & Cooperation

Reluctance of companies to share internal data - Demolition companies may be unwilling to disclose their internal waste management practices, costs, or non-compliance incidents, fearing regulatory scrutiny or reputational damage. This creates response bias in interviews, case studies and surveys.

Informal sector dominance - A large share of demolition work in India is carried out by unorganized, informal contractors who operate outside regulatory frameworks. These actors are difficult to identify, reach, and study systematically.
Limited sample size - The number of formally registered, large-scale or medium scale demolition companies (especially those meeting the 20,000 sq. m. threshold) is relatively small, restricting the statistical representativeness of the sample.

4. Internal Management Complexity

Variability in company size and structure - Demolition companies range from large organized firms to very small contractors. Internal management practices differ vastly, making it hard to generalize findings across the sector.

No standard internal framework - Unlike manufacturing industries, demolition companies rarely have formalized internal waste management systems, ISO certifications, or documented standard operating procedures (SOPs). Comparing across companies becomes methodologically challenging task

EPR compliance infrastructure is still developing Producers must register on a centralized online portal before commencement and receive a certificate within 15 days. Since the portal and its compliance ecosystem are newly operational, studying internal management against EPR obligations is premature. (Anamika rathore, 2025)

5. Methodological Limitations

Difficulty in on-site observation - Demolition sites are temporary, hazardous, and short-duration. Conducting direct observation of waste management practices is logistically challenging and also may not capture representative or typical behavior.

Self-reported data bias - Surveys and interviews with company managers rely on self-reporting, which can be subject to social desirability bias respondents may overstate compliance or best practices.

Generalization constraints - Findings from one city or region (e.g., Pune or Mumbai) may not apply to other cities due to differences in urban density, local bylaws, enforcement capacity, and types of structures being demolished.

6. Scope & Boundary Limitations

Overlapping waste streams - Demolition waste often gets mixed with construction and renovation waste on the same site, making it difficult to isolate and study demolition waste independently.

Exclusion of hazardous waste -Waste categories covered by other specific waste management rules are excluded from the C&D rules. Hazardous materials like asbestos or chemical-laden debris fall under separate frameworks, limiting the scope of a unified demolition waste study. (sun, 2025)

Focus restricted to formal sector Research constrained to registered companies will miss the significant informal demolition economy, creating a gap between research findings and ground reality.

7. Financial & Economic Data Gaps

Demolition companies rarely publish financial data related to waste management costs, recycling investments, or penalties paid. This makes it difficult to assess the economic feasibility of compliant internal waste management or to conduct cost-benefit analyses.

VI. DEMOLITION WASTE

Demolition waste refers to the debris and materials generated when an existing structure or building, bridge, road, or any civil infrastructure is torn down, dismantled, or deconstructed.
Definition under C&D Rules 2025

Construction & Demolition (C&D) waste includes debris from new constructions, renovations, and demolition of structures such as bricks, concrete, metal, wood, glass, plastic, tiles, and more.

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Debris waste including cement concrete, bricks, and tiles is considered for EPR target assessments. Usable or resalable materials like iron, wood, and glass are excluded from EPR target assessments and follow separate regulations. - (board, 2025)

The rules regulate generation, segregation, recycling, and disposal of C&D waste arising from construction, demolition, remodelling, renovation, and repair activities. Exemptions include waste from defence projects, atomic energy sites, natural disasters, and acts of war. Waste categories covered by other specific waste management rules are also excluded from this

C&D waste includes debris from new constructions, renovations, and demolition of structures such as bricks, concrete, metal, wood, glass, plastic, tiles, and more. (Anamika rathore, 2025)

Types of Demolition Waste
Demolition waste is broadly categorized into:
Inert/Debris Materials the bulk of demolition waste:

- Cement concrete chunks
- Bricks and masonry rubble
- Tiles and ceramics
- Stone and gravel
- Soil and excavated earth

Recyclable Materials separately handled:

- Steel and iron reinforcement bars
- Aluminum, copper, and other metals
- Glass (windows, panels)
- Timber, plywood, and wood
- Plastic pipes and fittings

Hazardous Materials require special handling:

- Asbestos (from old roofing/insulation)
- Lead-based paint
- Chemicals and solvents
- Electrical waste

In short, demolition waste is everything left behind after a structure comes down and under the new rules, generators are legally responsible for its proper segregation, recycling, and disposal. (harish gayakwad, jalindar patil, & neha, 2015)

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VII. STEP BY STEP RESEARCH STRUCTURE

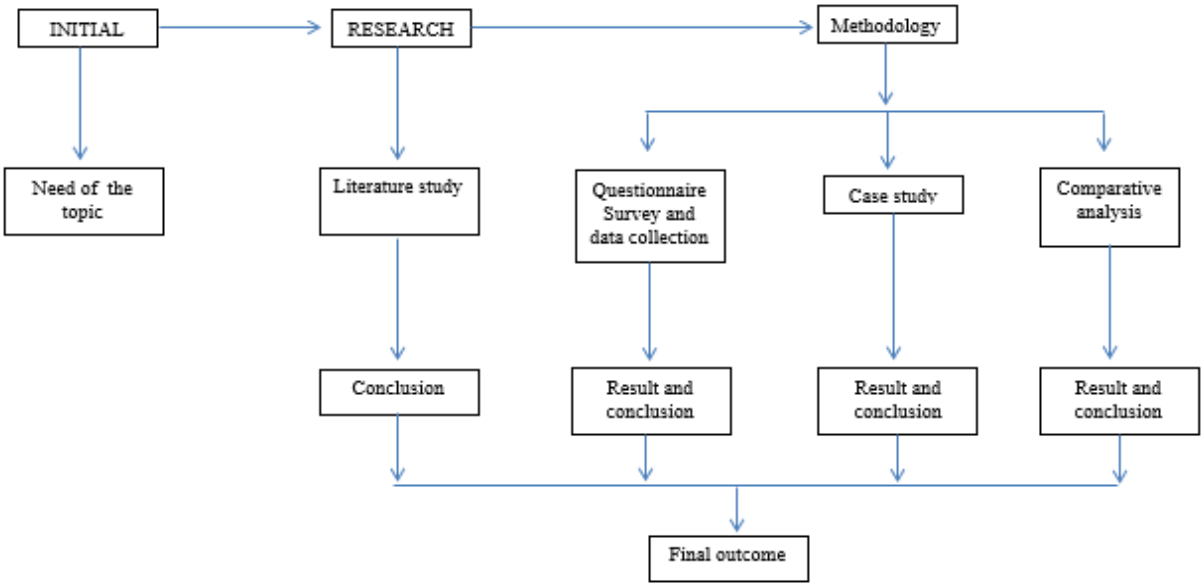


Fig 01 : Flow showing the process of research2.

VIII. LITERATURE REVIEW

8.1. Construction and Demolition waste management rules, 2025

- These rules are applicable to all activities of construction, demolition, remodelling, renovation and repair of any structure.
- It is provided for the environmentally sound management of construction and demolition waste in the country, including its segregation, collection, recycling, treatment and disposal, and to discourage unscientific disposal, promote waste management, prevent loss of recyclable value, and address pollution related issues radiating from dumping of such waste.
- Extended Producer Responsibility (EPR)

Introduces an EPR framework: Producers (builders/occupiers of projects ≥ 20,000 m² built-up area) are responsible for collecting, recycling, and disposing of all C&D waste generated by their projects. Producers must register on the official CPCB portal and submit detailed waste management plans for approval.

- Segregation & Registration Requirements

Mandatory segregation of C&D waste into defined categories (e.g., concrete, masonry, metal, wood, glass) to improve recycling efficiency.

Registration and compliance reporting via a designated online portal, with waste management plans outlining expected waste volumes and management strategies.

- Recycling, Reuse & Utilization Targets to be generated.
- Integration with Project Approvals -

Utilisation of processed C&D waste must be included in project approvals and part of regulated project planning.

- Enforcement & Penalties

Non-compliance can lead to penalty, environmental compensation, and potential cancellation of registration; unfulfilled EPR obligations may carry forward across years.

- Monitoring & Accountability

Central Pollution Control Board (CPCB) will monitor implementation through digital tracking, reporting, and waste utilisation data. (Board, 2025)

Some important definitions from the rukes:

1. Collection points: means designated places in the jurisdiction of the local authority where waste generators, other than producers, are required to deposit their construction and demolition waste to facilitate its management in an environmentally sound manner.
2. Construction and demolition waste: means the waste generated due to construction, demolition, remodelling, renovation, repair, and maintenance activities, and comprises of soil, sand and gravel, bricks and masonry, concrete, metal, wood, plastic, ceramic and such other items.
3. Extended producer responsibility: means the responsibility of a producer to manage construction and demolition waste and to meet recycling targets as per First Schedule to ensure its environmentally sound management;
4. Producer: means a waste generator, who is occupier or in charge of a building or building complex project having a built-up area of 20000 square meters and above;
5. Processing facility: means a designated establishment equipped with the requisite infrastructure to process construction and demolition waste operated by the recycler, to carry out processes of reception, storage, segregation, treatment, or manufacturing of value-added articles or materials out of construction and demolition waste;
6. Waste generator: means an occupier of the project having full control over the construction or reconstruction or demolition or renovation or remodelling activity resulting in the generation of waste;
7. Waste management plan: means a document prepared by producers, duly approved by local authority, for the management of construction and demolition waste to meet extended producer responsibility targets under First Schedule I
8. Waste utilisation plan: means a document prepared by occupiers of construction and re-construction projects, duly approved by the local authority, for the utilisation of processed construction and demolition waste to meet waste utilisation targets under the Second Schedule or the Third Schedule.

8.2 Research paper on Construction and demolition waste management and its impacts on the environment and human health: Moving forward sustainability enhancement by Seonho Lee, Heeun Chang, Jechan Lee.

- Context & Motivation -

Rapid population growth, industrialization, and urbanization have significantly increased construction and demolition activities globally, leading to large amounts of construction waste (CW) and demolition waste (DW) generation.

CW and DW are composed of diverse materials with varying properties and often contain pollutants.

- Environmental & Health Concerns

Many CW and DW types contain harmful substances (e.g., fine residues, heavy metals, persistent organic chemicals) that pose negative impacts on the environment and human health.

These impacts highlight the complexity and risk associated with current waste streams.

- Comprehensive Review

The study systematically analyses data on CW and DW generation, characteristics, and current management practices (e.g., reduction, reuse, recycling, landfill).

It also examines how management methods and waste constituents affect ecological and human health.

- Need for Sustainability Across Project Stages

Sustainable CW and DW management strategies should be integrated throughout all construction phases from planning and design to post-construction.

- Strategic Recommendations

The paper proposes sustainable management strategies based on eco-friendly approaches to reduce negative impacts of CW and DW.

The aim is to lessen the burden of CW and DW on the construction industry, urban communities, and environmental systems. (lee, Lee, & chang, 2024)

8.3. Article by lawrbit on construction and demolition waste management rules, 2025

The management of Construction and Demolition (C&D) waste has emerged as a critical environmental and urban governance challenge in India. April 1, 2026 marks the start of the Construction & Demolition Waste Rules (2025), replacing the 2016 regulations. The Ministry of Environment, Forest & Climate Change updated the framework to streamline segregation, collection, storage, transportation, recycling, treatment, and scientific disposal of construction and demolition waste. C&D waste includes debris from new constructions, renovations, and demolition of structures such as bricks, concrete, metal, wood, glass, plastic, tiles, and more. The rules apply to all construction, demolition, remodelling, renovation, and repair activities, with exemptions for defence projects, atomic energy sites, natural disasters, and acts of war, as well as waste categories covered by other specific waste management rules. One of the most significant introductions is the Extended Producer Responsibility (EPR) framework, under which bulk generators entities undertaking construction projects with a built-up area of 20,000 square metres or more are now mandated to recycle and reuse construction and demolition waste. Producers must register on a centralised portal, maintain disposal records, and channel waste only through

registered recyclers, bringing traceability and accountability to a sector that previously operated with minimal oversight.

The 2025 Rules also establish a phased recycling mandate aligned with circular economy principles. Beginning 2026–27, a minimum of 5% of construction materials must be sourced from recycled waste, with this requirement gradually increasing to 25% by 2030–31. This graduated approach allows market infrastructure and enforcement mechanisms to develop alongside rising compliance expectations, and draws inspiration from international models such as Germany's Circular Economy Act, which prescribes the use of recycled aggregates in public projects and has contributed to an 88 per cent recycling rate for C&D waste. Responsibilities under the rules are distributed across multiple stakeholders' contractors and service providers must help producers comply and follow operational standards such as IS 4130 for demolition safety, while Urban Local Bodies must monitor compliance, establish collection yards, recycling plants, and storage facilities. Compliance is further strengthened through a digital monitoring system, with centralised interface-based online monitoring having strong potential to bring transparency to the entire C&D waste lifecycle from generation to recycling.

Despite these advances, significant implementation challenges remain. Effective implementation will require the development of facilities capable of processing and recycling large volumes of C&D waste, necessitating collaboration between the government, private sector, and local communities. The penalty framework attempts to address non-compliance through environmental compensation, with producers that fulfil EPR after paying compensation being refunded a percentage of it depending on the time taken, while providing false information results in cancellation of registration with no refund. However, critics note that the 20,000 sq. m. threshold for EPR obligations excludes a large share of smaller demolition projects that collectively contribute substantially to total waste generation. Effective implementation will ultimately require stronger enforcement, fiscal correction to support recycled materials, and sustained awareness to drive compliance suggesting that while the 2025 Rules are a landmark step forward, their real-world impact will depend heavily on institutional capacity and industry cooperation. (Anamika rathore, 2025)

IX. METHODOLOGY

The methodology adopted for this study is designed to ensure systematic data collection and reliable analysis. The research approach combines both qualitative and quantitative methods to achieve the objectives of the study. A mixed-method design was chosen because demolition waste management involves not only measurable, numerical data such as waste quantities, recycling rates, and compliance percentages but also contextual, experiential knowledge held by industry practitioners, site managers, and regulatory officials. By integrating multiple methods, the study ensures that findings are both statistically grounded and rich in practical insight, thereby producing a more holistic understanding of demolition waste management practices within demolition companies.

9.1 The first component of the methodology involves a survey of related works, wherein existing literature, policy documents, regulatory frameworks, and prior research studies on construction and demolition waste management were systematically reviewed. This includes an in-depth examination of the Environment (Construction and Demolition) Waste Management Rules, 2025, industry reports, academic journals, and government publications. The survey of related works establishes the theoretical foundation of the study, identifies existing gaps in knowledge, and situates the current research within the broader academic and policy discourse on C&D waste management. It also informed the design of subsequent data collection instruments by highlighting key variables, themes, and indicators relevant to demolition waste generation, segregation, recycling, and internal company management.

9.2 The primary data for this study was collected through the administration of a well-structured questionnaire survey targeting key stakeholders in the demolition industry, including project managers, site engineers, environmental officers, and company owners. The questionnaire was carefully designed to capture both quantitative data such as the volume of waste generated, percentage of waste recycled, compliance with EPR targets, and costs associated with waste disposal and qualitative perceptions regarding challenges, awareness of regulations, and internal waste management practices. The questionnaire was pre-tested for clarity and reliability before being administered to ensure that responses accurately reflect the respondents' practices and opinions. Closed-ended questions facilitated statistical analysis, while open-ended questions allowed respondents to elaborate on specific experiences and constraints faced in managing demolition waste.

9.1.1 Project name and type of project-
9.1.2 What all documents have been submitted during permission process regarding C & D waste management?
9.1.3 Any royalty paid during permission?
9.1.4 Do you think C and D waste management is important?
9.1.5 Who looks after the C and D waste that is generated on site?
9.1.6 On site does C and D waste management work smoothly?
9.1.7 If not, what challenges do you face?
9.1.8 Does all rules and regulations on site are followed on site?
9.1.9 What according to a construction company is a very big issue regarding C and D Management?
9.1.10 Does authority co-ordinate regarding C and D waste during construction / demolition waste?
9.1.11 Do you have C and D Waste Processing facility nearby?
9.1.12 Your suggestions on C and D Waste management (right from the permission phase up to processing facility)

9.3 To complement the questionnaire data, one-on-one discussions were conducted with select industry professionals, regulatory authorities, and waste management experts. These structured and semi-structured interviews provided deeper insights into the internal workings of demolition companies, their decision-making processes around waste handling, and the practical challenges of complying with the 2025 Rules. Direct discussions allowed the researcher to probe beyond surface-level responses, clarify ambiguities, and gather nuanced, first-hand accounts that a standardised questionnaire alone cannot capture. Interviewees were selected purposively to ensure representation from different scales of demolition operations ranging from large registered firms to smaller contractors thereby capturing a diverse range of perspectives and practices across the sector.

9.4. Case studies of selected demolition projects and companies were undertaken to provide real-world, contextualised examples of demolition waste management in practice. Each case study involved site visits, document analysis, and observation of on-site waste handling procedures, allowing the researcher to assess the gap between regulatory requirements and actual implementation. The case study approach is particularly valuable in this research context because demolition projects are unique in scale, location, structure type, and duration, and a case-by-case examination reveals site-specific challenges that aggregate data may obscure. The cases were selected to reflect diversity in project type, company size, and geographic location, ensuring that the findings are representative and broadly applicable.

9.5. Finally, a comparative analysis was carried out to examine and contrast the waste management practices, compliance levels, and internal management systems across the studied companies and project sites. The comparative approach enabled the identification of best practices, common deficiencies, and areas requiring policy or operational intervention. Together, these five methodological components form an integrated research design that ensures the study is thorough, credible, and capable of generating actionable recommendations for improving demolition waste management both at the company level and within the broader regulatory framework.

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