



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 Issue: VII Month of publication: July 2025

DOI: <https://doi.org/10.22214/ijraset.2025.72928>

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A Statistical Assessment of Construction Waste Generation Patterns and Management Practices in Medium-Scale Urban Projects

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Abstract: *This study investigates the patterns of construction waste generation and the associated management practices in medium-scale urban construction projects. Data was collected from multiple active construction sites through site observations, interviews, and waste audits. The study classified waste materials and analyzed generation trends based on the construction stage. Statistical tools were employed to identify major contributors and correlations between project characteristics and waste volumes. The findings highlight that ineffective material handling, lack of planning, and poor storage contribute significantly to waste generation. Recommendations include stage-wise material control, on-site waste segregation, and awareness training. The study emphasizes the need for policy support and structured guidelines tailored to medium-scale projects to promote sustainable construction practices.*

I. INTRODUCTION

The construction sector is a major contributor to solid waste in urban environments. In India, construction and demolition (C&D) waste constitutes over 25–30% of total solid waste annually (CPCB, 2020). Medium-scale projects (G+3 to G+6 buildings) form a significant portion of urban development but lack structured waste management protocols. Uncontrolled waste leads to environmental degradation, cost overruns, and inefficient resource utilization. This study focuses on identifying waste generation patterns and current management strategies in such projects to recommend improvements based on statistical insights.

II. LITERATURE REVIEW

Swathi Arivalagan (2018) emphasized the need for proper waste classification and highlighted common waste types on Indian construction sites. Ajayi et al. (2017) found that material over-ordering and rework are major causes of waste. Studies by Tam et al. (2007) suggested that waste minimization begins at the design stage and depends heavily on awareness among stakeholders. However, data specific to medium-scale urban projects in India remains limited.

III. OBJECTIVES

- 1) To identify and categorize construction waste types in medium-scale projects
- 2) To quantify waste generated across construction stages
- 3) To assess current waste management practices on-site
- 4) To apply statistical tools to analyze generation trends
- 5) To recommend actionable strategies for waste reduction

IV. MATERIALS AND METHODS

A. Data Collection

Data was collected from five active construction sites. Structured site visits were conducted at various stages (excavation, structural, finishing). A standardized checklist and survey format were used to record waste quantities and management approaches.

B. Waste Classification

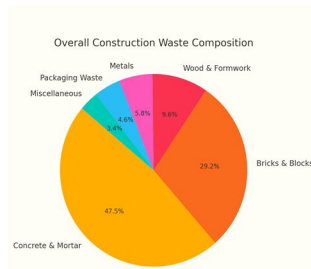
Waste was classified into six categories:

- 1) Concrete and mortar
- 2) Bricks and blocks

- 3) Metals
- 4) Wood and formwork
- 5) Packaging (plastic, cardboard)
- 6) Miscellaneous (tiles, glass, insulation)

C. Statistical Tools

Descriptive statistics, correlation analysis, and trend charts were used. Tools: Microsoft Excel and SPSS (where applicable).



Stage	Avg. Waste Generated (kg)	% of Total Waste
Excavation	300	12%
Structural	1080	44%
Masonry/Plaster	740	30%
Finishing	330	14%

V. RESULTS AND DISCUSSION

Highest waste generation occurred during structural works (~42% of total waste). Concrete and mortar accounted for the largest share (40%), followed by brick debris (25%). Sites with basic segregation practices reduced landfill waste by 15–20%. Correlation: Sites with dedicated storage areas for materials had significantly lower waste rates. Contractor awareness and presence of waste bins were also positively linked to better waste control.

The waste generation data collected from five medium-scale construction sites is presented in Table 1. The data includes quantities of major waste categories such as concrete and mortar, bricks and blocks, wood and formwork, metals, packaging waste, and miscellaneous debris.

Table 1: Construction Waste Generation Data (kg)

Site	Concrete & Mortar	Bricks & Blocks	Wood & Formwork	Metals	Packaging Waste	Miscellaneous
Site A	1250	780	250	150	120	100
Site B	1420	860	300	180	135	90
Site C	1180	730	230	140	110	95
Site D	1340	790	260	160	125	85
Site E	1280	810	270	155	130	88



Concrete and mortar consistently accounted for the largest share of waste at each site, followed by bricks and blocks. Sites with better material handling and planning showed slightly lower overall waste quantities. Further analysis based on this data revealed key patterns and correlations, as discussed below.

VI. CONCLUSION

Medium-scale urban construction projects contribute substantially to construction waste but receive limited attention in waste management policies. This study revealed that improper planning and material handling are major contributors. With simple changes—like designated storage zones, awareness campaigns, and on-site segregation—waste volume can be significantly reduced. Policymakers must create waste handling guidelines tailored to such projects and enforce basic compliance for sustainable urban development.

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