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A Study on Construction Material Waste Minimization: Reasons and Suggestions

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Abstract - *As landfills grow scarcer, the need to reduce trash generated at all phases and recycle building and demolition debris is becoming increasingly crucial. Through a systematic questionnaire survey, this study assessed the awareness of construction professionals in India on the perception of sustainable construction and waste management, resulting in empirical evidence on levels of significant contribution to waste reduction through waste minimization steps. According to the study, there is no government control on building site waste, and other variables such as employee training, business waste management plan, financial reward, and promotion are seen as more beneficial incentives to reduce waste by respondents.*

Key Words: Material Waste Minimization, Reasons And Suggestions.

1. INTRODUCTION

Construction projects have grown substantially as a result of increased urbanisation and economic expansion, adding to the creation of C&D trash. Construction and demolition waste (C&D) is generated during the construction, refurbishment, and destruction of buildings, roads, bridges, dams, and utility facilities. The building industry necessitates various procedures and consumes a significant quantity of energy. The construction business necessitates a variety of procedures and consumes a significant quantity of money. The growth of infrastructure inert and non-biodegradable materials such as concrete, ceramic, plaster, metal, broken tiles, brick masonry, and similar construction projects is followed by the construction, reconstruction, and demolition of houses, highways, bridges, subways, runways, flyovers, factories, and similar construction projects. These wastes are heavy, dense, and take up a lot of room on the job site, on the side of the road, or in the municipal garbage bin.

Waste from residential building development or demolition finds its way into local municipal bins and garbage storage facilities, making municipal waste too strong to be treated further, such as composting or energy recovery and incinerated. The country's growing population and the demand for land for other purposes have reduced the amount of land available for garbage disposal. Surface infiltration is frequently prevented from flowing into the groundwater table by vegetation development, resulting in a high degree of environmental imbalance. Reuse or recycling is an important strategy for dealing with such trash. Other benefits that support the implementation of the reuse/recycling approach include lower raw material extraction, reduced transportation costs, improved income, and reduced environmental effect, in addition to rising waste management concerns. The initial depletion of traditional natural aggregate reserves necessitated the adoption of recycling/reuse technology in order to maintain the traditional natural aggregate for other critical tasks. Most nations now lack understanding of resource efficient building operations. Unnecessary material waste, poor on-site management, and a lack of understanding of the need for waste reduction are all frequent in the construction industry.

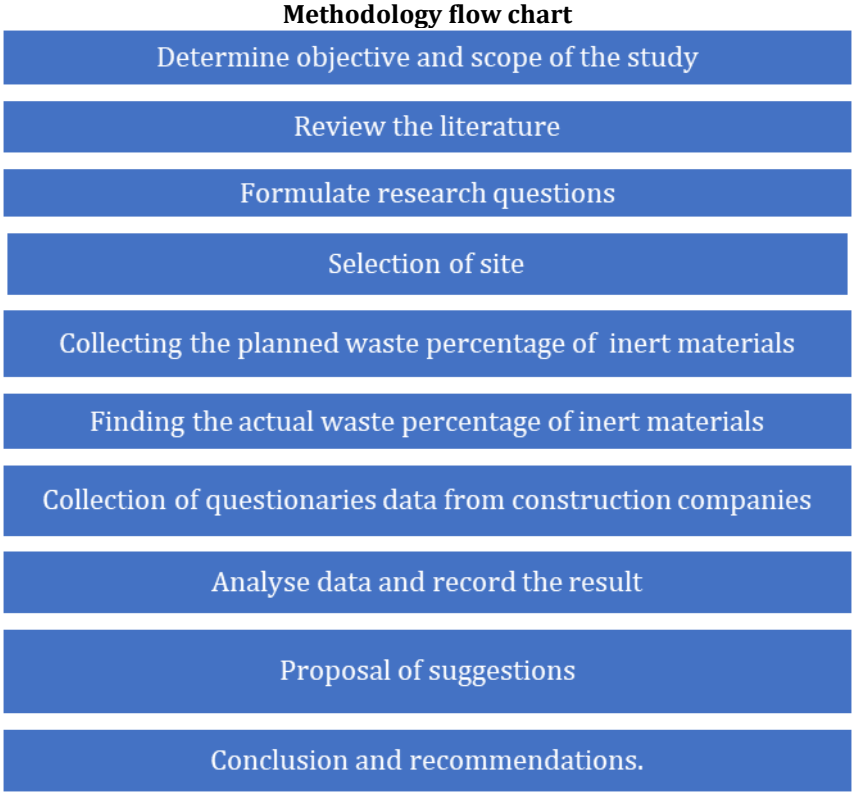
1.1 Aim

The primary goal of this study is to quantify the construction wastes created on the job site from the foundation to the final stage. Cement, sand, aggregate, steel, and bricks are the most common building materials that end up as trash.

2. METHODOLOGY

Building project selection and data collecting on waste created activity-by-activity for main construction materials. Through site monitoring and discussions with project participants, identify the sources of waste creation and design waste mitigation measures. Cement, sand, aggregate, steel, and bricks are the most common building wastes, according to the literature. The data is used to compute stage-by-stage standard waste and stage-by-stage actual trash produced. The proportion of waste created at the site is calculated using these statistics and a comparison between standard trash and actual waste produced at the location.

Methodology flow chart



The projected and actual construction wastes are compared in terms of quantity. There are suggestions for reducing the amount of garbage created. Before being dumped at a landfill, the construction trash was not sorted. Because there is no plan on the CWMP, the site is suffering a lot of construction debris that needs to be disposed of in a landfill. The major goal of this study is to look at trash created in high-rise buildings, identify the sources of waste, and offer waste reduction techniques. The description and analysis of the site waste material (inert waste) is estimated using a literature research.

3. DATA COLLECTION

To identify the causes of waste generated on site and to identify the waste minimization strategies, field monitoring and interviews with various participants of the projects such as project manager, site engineers, and site supervisors were conducted.

3.1 SITE 1

This project has obtained data from G+2 Residential flat with plot area/buildup area 5000sqf/10400sqf. Periodic on-site monitoring for this project were undertaken to identify the waste generated, minimization strategies and causes of material waste.

3.2 SITE 2

This project has obtained data from G+1 Residential flat with plot area/buildup area 4500sqf/5943sqf. Periodic on-site monitoring for this project were undertaken to identify the waste generated, minimization strategies of material.

3.3 SITE 3

This project has obtained data from G+4 Residential flat with plot area of 4500sqf. Periodic on-site monitoring for this project were undertaken to identify the waste generated, minimization strategies of material.

4.DATA ANALYSIS

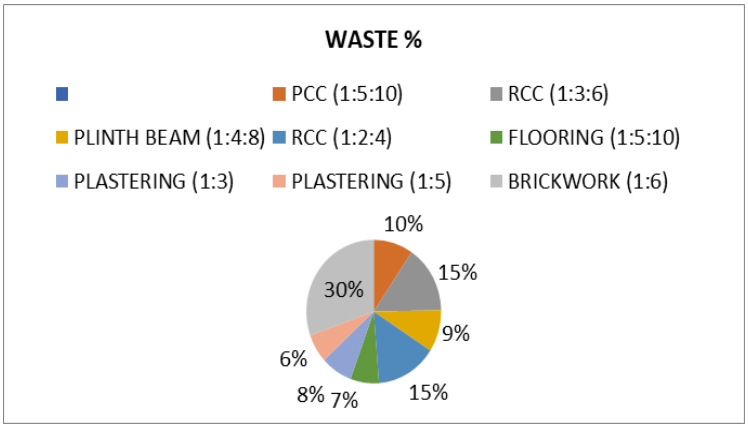
4.1SITE 1

In this work process the entire waste % of each and every activity is calculated for the inert materials. The detailed tabulation and figure are shown below.

Table 4.1.1 stage by stage actual waste %

WORK PROCESS	WASTE %
PCC (1:5:10)	2.5
RCC (1:3:6)	4
PLINTH BEAM (1:4:8)	2.5
RCC (1:2:4)	3.85
FLOORING (1:5:10)	1.8
PLASTERING (1:3)	2
PLASTERING (1:5)	1.7
BRICKWORK (1:6)	8

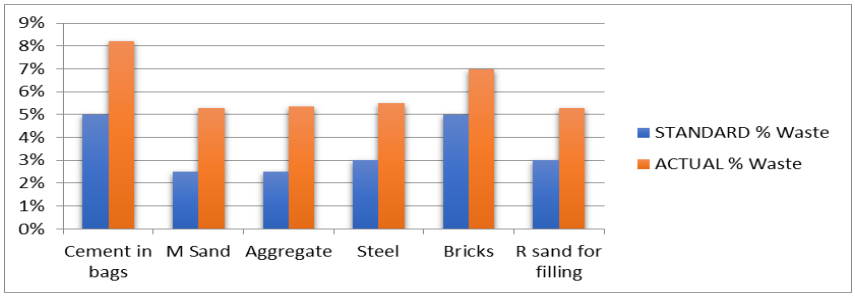
Chart 4.1.1 stage by stage actual waste%



4.1.2 COMPARISON CHART OF STANDARD AND ACTUAL WASTE

Materials	Quantity	Actual waste %	Total Quantity
Cement	3350bags	8	3618 bags
M Sand	13700cft	5.30	14426cft
Aggregate	13550cft	5.35	14275cft
Steel	49 kg	5.5	52
Brick Blocks	182000 nos	7	194740

Chart 4.2.1comparison chart of standard and actual waste



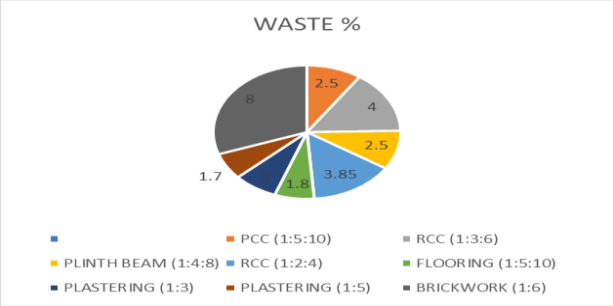
4.2 SITE 2

Table 4.2.1 stage by stage actual waste %

WORK PROCESS	WASTE %
PCC (1:5:10)	4
RCC (1:3:6)	6
PLINTH BEAM (1:4:8)	4
RCC (1:2:4)	4.5
FLOORING (1:5:10)	2

PLASTERING (1:3)	3
PLASTERING (1:5)	2
BRICKWORK (1:6)	10

Chart 4.2.1 stage by stage actual waste %



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Brick Blocks	182000 nos	9	194740

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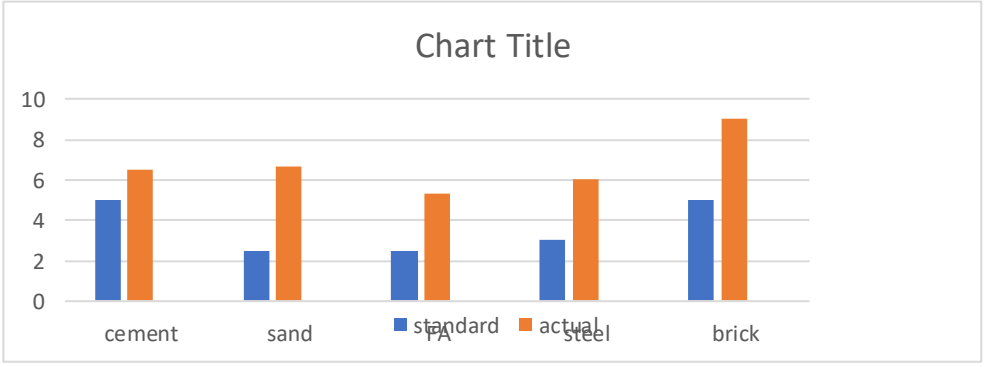


4.3 SITE 3

Table 4.3.1 stage by stage actual waste%

WORK PROCESS	WASTE %
PCC (1:5:10)	4
RCC (1:3:6)	6
PLINTH BEAM (1:4:8)	2.5
RCC (1:2:4)	4.5
FLOORING (1:5:10)	2
PLASTERING (1:3)	3
PLASTERING (1:5)	2
BRICKWORK (1:6)	3.25

Chart 4.3.1 stage by stage actual waste%

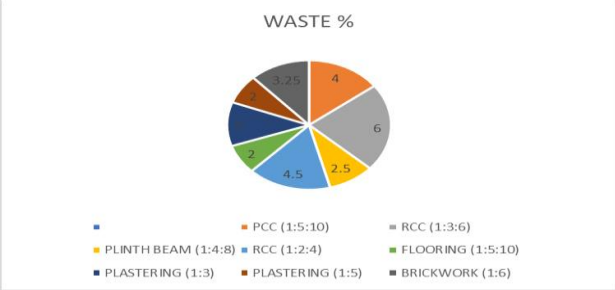
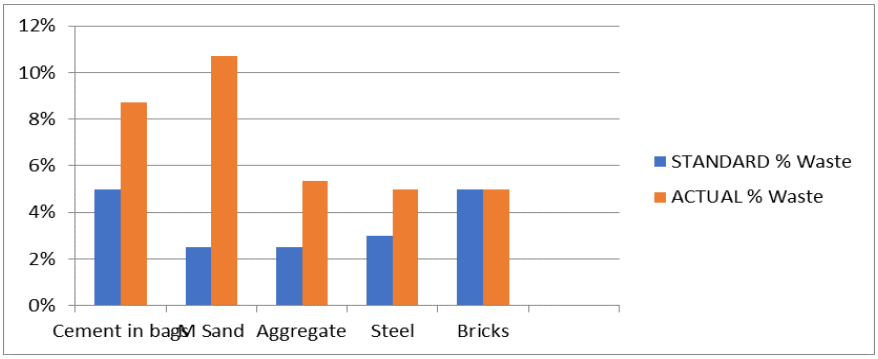


Table 4.3.2 comparison chart of standard and actual waste

Materials	Quantity	Actual waste %	Total Quantity
Cement	2016.3	6	2145
M Sand	5929.7	7.5	6410.5
Aggregate	2925.01	2.5	3000.02
Steel	23.98	4.05	25.765
Brick Blocks	29981	2.5	30750

Chart 4.3.2 comparison chart of standard and actual waste



5. SOURCES AND CAUSES

These are the possible Sources and Causes of Construction Waste. From the questionnaire survey I can able to find the sources and causes which contributes highly of generation of waste on site.

There are four main Reason of Construction Waste:

1. Design and Documentation
2. Operational
3. Materials storage and handling
4. Procurement of material

5.1 Design and Documentation

1. Lack of attention made to product dimensional coordination
2. Variations in the design as the project is being built
3. Detailing in the drawings is complicated.
4. Drawings with insufficient information

5. At the start of the project, the contract documents were incomplete.
6. Low-quality products are chosen.
7. Client's last-minute request (resulting in rework)
8. Mistakes and blunders result from a lack of communication.
9. The design and construction of a building may overlap.

5.2 Operational

1.Traders' or operatives' mistakes
2.Negligence-related accidents
3.Subsequent deals wreak havoc on the work that has already been done.
4. Incorrect material was used, necessitating replacement.
5. Due to poor planning, the required quantity is unknown.
6. Delays in communicating with the contractor about the types and sizes of supplies to be used
7.Misconfigured equipment.
8. Unfavorable weather.
9. The item was placed in an inconvenient location.
10. Interaction between specialists is poor.
11. The project team's and labourers' unfriendly attitudes

5.3 Materials Storage And Handling

1. Transport equipment is overloaded.

2. Use of the incorrect mode of transportation
3. Poor on-site storage method Poor handling
4. Use whatever material is closest to the work area.
5. Theft
6. On-site material damage and waste due to the cutting of uneconomical shapes
7. Unnecessary on-site inventory, resulting in waste.

5.4 procurement of material

1. Errors in ordering (eg., ordering significantly more or less)
2. Products that were purchased but did not meet the specifications
3. Unsuitability of materials delivered to the job site Substitution of a more expensive material (with an unnecessary better performance)
4. Price changes in materials

6. RECOMMENDATIONS TO MINIMIZE WASTE

Form this questionnaire is part of study aimed at exploring waste minimization measures in construction projects. This questionnaire seeks to gather information from respondents based on their expertise knowledge to identify precise needs in the Indian construction industry in terms of waste minimization. Collected data from more than 30 companies.

RECOMMENDATIONS

1. On-site recycling of some waste items
2. Construction management approaches that are effective
3. Construction workers training Good cooperation between the shop and the construction crews to minimise over-ordering
4. Construction equipment that is more efficient
5. Supervisory vigilance
6. On-site material storage that is appropriate
7. Operation just-in-time
8. Deliveries should be scheduled as soon as possible.
9. Observance of standardised measurements
10. Workers' attitudes regarding material handling have shifted.
11. Personnel are educated and trained on how to deal with a variety of situations on a regular basis.
12. Verifying that the materials given are of the correct quality and quantity
13. Employing competent labourers
14. During batching, accurate material measurement is essential.

7. CONCLUSION

Building trash production on construction sites is a major issue in many nations. Several studies have been conducted across the world to look at the trash created by building sites. Building waste, poor site management, and a lack of waste reduction knowledge are all typical at Indian construction sites. Calculating the quantity of trash created is necessary in order to develop methods for reducing construction waste on the job site. This research provides a better knowledge of how construction trash is generated on the job site. Cement, sand, aggregates, steel, and bricks are the most common construction trash. Construction waste creation has been recognised as well as its typical uses and sources. To reduce the amount of trash generated on the job site, suggestions for reducing construction waste are provided.

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