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Analysis of Factors Influencing for Material Wastage & Quality Management in Construction Project

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ABSTRACT: The construction industry is one of the industries through which physical development of nation is achieved, and it is truly the locomotive of the national economy. The more resources, engineering, labour, materials, equipment, capital, and market exchange are provided through this industry to the national economy. The increasing complexity of infrastructure projects and the environment within which they are constructed place greater demand on construction managers to deliver projects on time, within the planned budget and with high quality. The successful execution of construction projects and keeping them within estimated cost and prescribed schedules depend on a methodology that requires sound engineering judgment. To the dislike of owners, contractors and consultants, however, many projects experience extensive delays and thereby exceed initial time and cost estimates. Therefore, improving construction efficiency by means of timeliness would certainly contribute to cost savings for the country as a whole. Efforts directed to time effectiveness were associated with managing time and materials, which in this study were approached via investigating time and material wastages of construction projects.

KEYWORDS: Construction, Infrastructure, Material Wastage, Budget, Methodology

I. INTRODUCTION

Quality management in construction is the process of ensuring a construction project meets its requirements and standards. It's a critical part of the construction process, and can help improve safety, reduce costs, and increase customer satisfaction.

Here are some aspects of quality management in construction:

Quality standards

- Inspections
- Quality processes.
- Quality control
- Quality management software
- Gantt charts

Many factors contribute to large proportion in making many problems in construction industry, which usually related to time and material wastages. Delay of project and material wastages in Western Maharashtra Region is one of most important problems at construction management field. In addition, research and studies in this field in India are few compared to worthy expected results. Despite the importance and the significance of the construction sector in India, it is noted that the parties of project (owner, consultant, and contractor) don't give the time and material wastages the importance at the evaluation at the end of project.

Here are some factors which contribute to problems in construction industry:

- Large number of workers in comparison to the number of projects (the large number of unemployed labour in Western Maharashtra region)
- Shortage of materials in markets;

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- Continued increase in material prices;
- Dependency on donor countries to get the fund of implemented projects in Western Maharashtra region.



Figure 1 C & D Waste Generators

II. STATE OF DEVELOPMENT

Delay and material wastage are persistent and critical challenges in the construction industry, significantly impacting project cost, time, and overall quality. These issues are prevalent across various regions and project scales, necessitating a comprehensive understanding of their causes and mitigation strategies.

Abdul Hameed et al. (2023) examined quality performance challenges in Afghanistan's construction sector, identifying constraints such as poor logistics, lack of skilled labor, and inadequate regulation enforcement. Their findings emphasize the importance of early detection of project limitations and suggest that regular audits can enhance performance.

Surabhi Anant Patil et al. (2022) focused on customer satisfaction and operational quality, suggesting that aligning construction practices with client expectations is critical. They advocate for integrated logistics and quality checks at each phase to minimize errors and delays.

Ghaleb J. Sweis et al. (2021) studied material wastage in Jordan, identifying key contributors such as design changes, rework due to labor errors, and poor site layout. Their research underscores that managing waste can prevent time and cost overruns and improve overall project performance.

Andualem E. Yadeta et al. (2019) analyzed material wastage in Ethiopia using the Relative Importance Index (RII) and found that labor mistakes, poor on-site control, and use of low-quality materials were dominant factors. Their study recommends targeted training and better supervision.

V. P. Vipin et al. (2019) highlighted that 50-60% of construction costs are material-related. Their research pointed to unclear role definitions as a major issue affecting material management. Effective role clarity and better planning were identified as key solutions.

T. O. Adewuyi et al. (2015) explored material waste in Nigerian construction sites, with reworks, design changes, and inefficient cutting practices being major contributors. The study found a high consensus among stakeholders and emphasized coordinated waste management strategies.

Construction & Demolition Waste in India:

Construction and Demolition (C&D) waste in India is composed of a wide variety of materials that are generated during the construction, renovation, and demolition of buildings and other infrastructure. These wastes can be broadly classified into **major** and **minor components**, each varying in their material properties, recycling potential, and environmental impact.

Major Components:

- 1. Cement Concrete Predominantly from RCC structures, flooring, and structural elements.
- 2. Bricks Sourced from masonry walls and other structural/non-structural components.
- 3. **Cement Plaster** Found in surface finishes and interior walls.





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- 4. Steel Extracted from reinforced concrete, door and window frames, stair railings, and other support structures.
- 5. Rubble Miscellaneous broken pieces of concrete, bricks, and stones.
- 6. Stone Includes marble, granite, sandstone used in finishing and decorative elements.
- 7. Timber/Wood Mostly from old buildings, used in doors, windows, roofing, and furniture.

Minor Components:

- 1. Conduits Iron and plastic used for electrical and plumbing installations.
- 2. Pipes Galvanized iron, plastic, and other variants used in water supply and drainage systems.
- 3. Electrical Fixtures Includes copper/aluminium wiring, switches, insulation, and wooden battens.
- 4. **Panels** Wooden or laminated used in interiors and partitions.
- 5. Other Materials Such as glazed tiles, glass panes, sanitary ware, etc.

According to Figure 2 and Table 1 (Shrivastava & Chini, 2000), the percentage distribution and tonnage of these materials were analyzed to understand the scale and potential of C&D waste recycling in India. Their study provided a detailed breakdown of material composition, aiding policymakers and waste management authorities in designing recycling strategies.



Figure 2 Different constituents of C & D Waste

Table 1 Quantity of various constituents generated per year C&D waste estimation

Constituent	Million Tonnes/Yr
Soil, Sand and gravel	4.20 to 5.14
Bricks and masonry	3.60 to 4.40
Concrete	2.40 to 3.67
Metals	0.60 to 0.73
Bitumen	0.25 to 0.30
Wood	0.25 to 0.30
Others	0.10 to 0.15

Various studies have been done to estimate the quantity of C&D waste in India. Pappu, Saxena et al presented 14.5 million tonnes/year C&D waste in India. CPCB estimated quantum of solid waste generation in India to be to the tune of 48 million tonnes per annum for year 2000, out of which waste from construction industry accounted for about 12 to 14.7 million tonnes , Singhal and Pandey presented the growth in municipal solid waste in India. This Fig can be used for rough estimation of C&D waste based on assumption that C&D waste is estimated to be 25-30% of municipal solid waste

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Figure.3 Municipal Solid Waste generation in India

Therefore, from Table 1 total C&D waste generated in year 2000 was approximately 13-15 million tonnes. Comprehensive study for C&D waste estimation was done by TIFAC. **Construction Waste Management in India**

III. SITE SELECTION

Project finishing on time and absence of material wastages are considered the most important factors of successful projects, which help to decrease problems for all parties and give new chances to construct another related project. It also helps to increase the Profits and development of construction industry. Material wastages is also considered a big problem, which hinders project's progress, since it decreases the contractor profit leading to huge losses leaving the project in a big trouble. Despite meticulous planning and execution, quality issues can and do arise, leading to delays, cost overruns, and even safety hazards. Here are eight common quality issues encountered in construction and engineering, along with their causes, effects, and potential solutions. Below mentioned are the details of Mumbai Coastal Road Project:

Project Title	Mumbai Coastal Road Project (South) Package – I.
Project Site Location	Mumbai
Customer	Mcgm
Genearal Consultant	Aecom Asia Company Limited
Project Management	Louise Berger International
Consultant	
Contractor	Larsen & Toubro Construction.

Table 1 Details of Mumbai Coastal Road Project



Figure 4 Actual Project Photo

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IV. CONCLUSION

- Key findings indicate that major contributors to material wastage include rework due to non-compliance with specifications, inefficient cutting practices, unclear roles and responsibilities among stakeholders, and a lack of onsite supervision and material control. Despite the use of modern project management techniques and reputed contractors and consultants, the project still faced issues related to coordination, resource planning, and quality assurance. Furthermore, while construction and demolition (C&D) waste constitutes a major portion of solid waste in India—with estimates ranging from 13 to 15 million tonnes annually—its management and recycling remain limited, particularly in large-scale infrastructure projects like the Mumbai Coastal Road.
- A critical gap identified is the lack of project-specific studies focusing on the integration of quality management systems with material waste control measures in urban coastal infrastructure projects. There is also insufficient localized data and analysis on the reuse potential of C&D waste materials and the practical challenges faced during their application on-site. Moreover, current research does not adequately capture the influence of real-time quality monitoring tools and workforce training on reducing material wastage. These gaps underline the need for targeted studies that not only assess the causes of material waste but also propose actionable strategies for embedding quality management deeply into every stage of project execution.

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