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Critical Analysis of Material Wastage Standards for Construction Projects

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Abstract — Development of infrastructural facilities is accompanied by construction, remodeling and demolition of buildings, roads, bridges, flyover, subways, runways, factories and other similar establishments. Construction industry consumes huge amount of natural resources and often generates large quantities of construction waste. A Construction waste consists of unwanted material produced directly or indirectly by the construction industries. This includes inert and non-biodegradable building materials such as concrete, plaster, wood, metal, broken tiles, bricks, masonry, insulation, nails, electrical wiring, and repair, as well as waste originating from the site. These wastes are heavy, having high density, very often occupy considerable storage space. In general, a very high level of waste is assumed to exist in construction. In construction, Material, Manpower, Money Machine plays a crucial role. Depending on the type of a construction project, Building materials account for 60 to 70% of the project cost. Observational research has shown that this can be as high as 10 to 15% of the materials that go into a building, a much higher percentage than the 2.5-5% usually assumed by quantity surveyors and the construction industry.

During the last few years, enormous growth in infrastructure found, by wide range of diversity construction organization. This produces a large range of waste, created at all the stages of construction right from site preparation, demolition to final product. Minimizing the waste and optimizing the profitability is possible by reducing cost of material with proper planning, scheduling, purchasing, procurement, receiving, inspecting, handling, storing and warehousing.

The purpose of this project is to study the sources of material wastage and to suggest the possible way to optimize it. The objectives of the study included the identification of sources and causes of material wastes on construction sites, and identification of barriers to successful

implementation of wastage minimization and finding out deviations between actual material wastages on site and allowable standards considered by quantity surveyors for estimation. Only materials wastages on constructions sites are considered for this study because these materials are derived from natural resources and recharge of such resources is not possible.

The main tools for the collection of data included questionnaires, interviews and site observations. The target population for the data collection included project peoples of building construction organizations on construction projects in MIDC Kagal Kolhapur and MIDC Chakan Pune. Suitable computer software and statistical techniques is employed to analyse data obtained. Mean score rankings, standard deviations, were adopted to analyse data.

Keywords – Construction material wastage, introduction, definition, material waste, needs for study, objective, methodology,.

1. Introduction - Infrastructural development is mainly depending on redeveloping and dismantling of structures, paths, connectors, railway tracks, docks and harbors, airports, industries and other similar structures. Considerable amount of natural resources are gets consumed on construction projects. Construction projects always generate huge quantities of wastes. Construction waste gets produced directly or indirectly on construction projects. These includes materials like tor steel, structural steel, timber materials, sand, metal, cement, bricks, sheets, aluminum, tiles, nails, binding wires, electrical materials, paints, plumbing materials etc. To store such wastage materials required considerable large space. Wastage occurs on construction projects are in the terms of man, machinery and materials. It is generally found that, 60% to 70% construction project cost is due to materials and remaining 30% to 40% is executing cost due to labors. It is also observed that actual wastages occur on construction sites is about 10% to 20% depending on structures. Actual wastages occurring on site is found considerable high than 2% to 5% considered by estimators during project cost estimation. If actual wastages exceeds beyond assumed limits then projects will face losses and if actual wastages lays bellow assumed limits then projects will run in profit. To keep construction project profitable there is needs to provide proper attention on wastages of materials on site. In India construction sector generates huge amount of employment and performs second largest economy after agriculture. Controlling the waste and increasing profitability on construction site is possible with proper identifying the causes and sources of materials wastages on site and taking suitable control action at suitable time on it. Wastage can be also minimized with proper material planning, maintaining material schedule,

timely purchasing and timely receiving, quality inspecting, proper handling, proper storing and warehousing. In order to maintain equally opportunities in market, building constructions organizations should needs to deliver speed, quality, and economy to customer. Manufacturing industries are achieved this goal by reducing wastage by adopting new waste reduction techniques. But construction industry still facing lot of problems in achieving results as controlling waste is major issue. Wastage can occurs at any stage of building constructions. It may occur through design, purchasing, and material handling and at time of operation etc. Construction industry also puts impact on other industry as it provides basic infrastructures. Reducing wastage in construction industry will also help achieving speed and economy to other dependent industry. This study purposes to study the causes, sources of material wastage, wastage minimizations, and barriers to reduce wastage and to suggest the possible way to optimize it.

2 Definition of waste – Waste is any non-wanted entity on construction sites, which does not add any value to the project in terms of man, materials, and money. Waste is exists in the form unavoidable waste or natural waste and avoidable waste. For natural waste, its minimization cost required is much extra than economy created. And for avoidable waste, cost required to reduce it is less than economy produced. Materials wastages occur on construction sites at any stages from design to final production through execution. Causes responsible to generate materials wastages on construction projects are.

1) Design and documentation,
2) Procurement of materials
3) Construction materials handlings and storage,
4) Operational factor and residual left

For this study, only materials wastage at the construction stage of building is considered. This is due to following two main reasons as:

1) In construction projects, materials occupies 60% to 70% cost of total projects.
2) The raw material required for building construction is obtained from natural resources and recharging of such resources is not possible.

Materials waste - Materials waste is anything of unwanted materials developed during building construction, like unwanted structures and rejected materials, extra ordered and received on site, discarded on site etc. Construction material wastage is the gap between amounts of materials received on site and gets utilized on site. Material waste also consists, except earth materials, excess materials removed from site or dumped on same site for filling other than its specific required use. Material wastages happens on construction site is due to

faulty design and documentations, poor method of purchasing,

Materials control on site, utilizing nonstandard methods of operations and residue left etc.

3. Needs for study - It is observed that 5% to 20% of material wastage occurs on construction sites against the total material purchased on site. To maintain customer satisfaction in market, construction organizations must needs to provide speed, quality and economy in product to satisfy customer. Therefore the construction industries must needs to deliver product and service at minimum possible rate to customer to remain in business. To achieve minimum cost in constructions, industry must accept value of wastage minimization.

4. Objectives of the study – To help achieve the purpose, main objectives were sets are

1) To identify and rank the sources, causes of the materials wastage on projects.
2) To identify the barriers to minimize the materials wastage on construction projects.
3) To find out the deviations between actual materials wastage generations against standard considered through case studies and site visits.
4) To suggest the possible solutions for identified causes of the materials wastage on construction projects.

5. Methodology - Following methodology is used for the study proposed work,

1) A detailed review of the literatures related to the topic of this dissertation is performed and the questionnaires are developed based on the literatures findings.
2) The objective of identifying the sources and causes of the materials wastage on construction projects is achieved through site visits and questionnaires surveys.
3) A structured questionnaire surveys and site visits are carried out to identify the barriers to minimise the materials wastage on construction projects.
4) Site visits and case studies are carried out to study the deviations between actual materials wastage generations against standard considered for selected construction projects at 5 stars MIDC Kagal-Kolhapur and Chakan MIDC, Pune.
5) The data collected is coded in to the suitable software (like MS office software, SPSS16) and suitable statistical techniques are used to analyse the data. (Like – one sample t-test, mean scores, factor analysis, average significant score, coefficient of variation etc.)
6) Feasible solutions based on results obtained are given to minimize the materials wastage on construction projects.

6. Study process - This study involves mainly following process.

1) Determination of objective and scope of study work.
2) Determination of study design.
3) Review of the literature.
4) Site visits and collections of data.
5) Data analysis.
6) Discussion of results.
7) Proposal of frame work.
8) Conclusion and recommendations.

7. Scope of study. - This study covers only materials wastage on running constructions projects. In this study the major materials considered are steel, cement, mortar, concrete timber, and blocks. The study concentrated on the flow activities of these materials (storage and handling). Questionnaires survey and interviews of construction peoples are carried out to collect the data. Construction peoples include, site supervisors, engineers, architects, consultants, store and accounts purchase peoples, foreman's etc. The study carried out on selected construction sites in Kagal, MIDC Kolhapur and Chakan, MIDC Pune, due to site accessibility and availability of contacts. These sites are mainly engaged in construction of industrial buildings, offices and development works.

8. Practical implications. - The study seeks to have positive implications on sites are,

1) The results will enable building organizations to improve construction quality, speed, economy and efficiency through the utilization of the measures presented to remove barriers in the utilization of waste management.
2) Minimizing materials waste will help increasing profitability, improves company performance, increases value of customers, increases life of natural resources, reduces pollutions, etc.

9. Outline of thesis - This study is consists with following five chapters,

1) Chapter one explains the definition of waste, need for study, objectives, study methodology, study process, scope and practical implication.
2) The second chapter reviews literature on the waste, minimization of wastage, benefits of the waste reduction and difficulties to using of waste reduction.
3) Chapter three consists the methodology that is used throughout the study. The structure of the questionnaires, the methods adopted to evaluate the data.
4) Chapter four explains results, discussions, which are evaluated from the data.
5) Chapter five concludes the overall study and recommendations for future research.

10. Conclusion – This chapter introduced the thesis. In this chapter, introduction, background, definition of waste with material waste, needs for study, objective for study, methodology, and study process, scope of the study, practical implications and outline of thesis are presented.

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