

Study of Material Management Techniques on Construction Project

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Abstract

Materials management is a critical component of the construction industry. As such, organizations need to understand the effects of proper materials management techniques on the effectiveness of project execution. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labor productivity, better schedules, and lower project costs. Materials management is an important function in order to improve productivity in construction projects. It is defined materials management functions which include planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory, and material distribution. In this project we have prepare scheme of material management in The construction industry for building project also conducting survey of industry and determine the various format for construction material management. As well as talk over the tracking system of material management in the industry and also discuss the software technology developed for proper management.

1. Introduction

1.1 Overview of Material Management

Construction material constitutes a major cost component in any construction project. The total cost of installed material may be 50% or more of the total cost. The goal of material management is to ensure that the materials are available at their point of use when needed hence, efficient procurement of material represents a key role in the successful completion of the work. Materials management is a critical component of the construction industry. As such, organizations need to understand the effects of proper materials management techniques on the effectiveness of project execution. Extensive literature and reports deplore the lack of efficiency and productivity in the construction industry. Too often, construction projects suffer from delays, budget overruns, and claims. A properly implemented materials management program can achieve the timely flow of materials and equipment to the jobsite, and thus facilitate improved work face planning, increased labor productivity, better schedules, and lower project costs.

Tracking materials and components on construction projects implies primarily two different sets of requirements for positional accuracy; in both cases, identification is also required. When the delivery and receipt of materials to a construction site are tracked, it suffices to determine their location in the supply chain, e.g., a fabrication shop, or a constructor's laydown yard. However, after delivered to the site, the location of materials needs to be tracked with better positional accuracy. For example, though requisite materials may be known to be within a constructor's lay down yard; each item needs to be physically found in order to be issued to crew workers for installation. Such positional accuracy may also facilitate automatic determination of whether a certain material item is in close proximity to its appropriate handling equipment and by inference, whether it is being handled by the equipment. Tracking materials thus helps ascertain the basic construction activities being performed with the equipment.

It is important for the contractor to consider that there may be significant difference in the date that the material was requested or date when the purchase order was made, and the time at which the material will be delivered, thus material management is a key of project management. "Material management is defined as the process to provide right material at right place at right time in right quantity so as to minimize the cost of project". Material management is concerned with the planning, identification, procuring, storage, receiving and distribution of material. The responsibility of Material management department for the flow of material from the time the material is ordered, received, and stored until they are used is the basic responsibility of material management. Materials represent a major expense in construction, so minimizing procurement cost improves opportunities for reducing the overall project cost.

1.2 Purposes of Material Management

- Efficient material planning
- Buying or purchasing

- Procuring and receiving
- Storing and inventory control
- Stock and waste control
- Supply and distribution of material
- Quality assurance
- Good supplier and customer relationship
- Improved departmental efficiency
- Reduce the cost of project
- Time saving
- Achieve economy in project

To fulfil all these purposes, it is necessary to establish harmony and good co-ordination between all the employees of material management department and this department should have good co-ordination with the other departments of the organization to serve all production centers.

1.3 Process of Material Management

Material management process initiates from need generated from site then this information conveyed to store department and material is ordered in the store, indent is generated. Vendor selection is to be carried out for the least value and best items. Materials are received at store department and inspection is carried out.



Figure 1: Process of Material Management

2. Outline of Research Work

- ▶▶ **Aim:** The aim of this research is to Scheme of Material Management for Construction Site and by applying the inventory control technique so as to analyze the effect of material management on constructions projects. Also gaining a stronger research design and achieving more valid and reliable findings.
- ▶▶ **Objectives:** Objectives which have covered in this project study are as follows:
 - i. To Compare Planned Vs. Actual material consumption using MSP software then to find the problems in planning, purchasing, procurement & to suggest remedies regarding the material management.
 - ii. S Curve Analysis is used for comparison of planned and actual cost of construction material
 - iii. Reasoning over S curve Analysis.
 - iv. Apply inventory control technique so as to minimize the total cost of inventory
- ▶▶ **Research Methodology:** The research approach, which is the combination of both the qualitative and quantitative methodologies were adopted in this research. This research has the advantage of gaining a stronger research design and achieving more valid and reliable findings. As such, semi-structured interview, questionnaire survey and literature reviews were the methodologies conducted to carry out the objectives of the research. Accordingly, it is believed that a deeper and more detailed quality of information could be obtained with interview opted as the methodology instrument whereas questionnaire survey could cover a broad range of the study in fulfilling both objectives. The experimental analysis consists of theories and practical consideration of the concepts. Therefore the work can be classified as site management, inventory controlling, purchasing procedure, cost ,and procurement and tracking etc. Basically this research is divided in two parts such as first one Qualitative analysis & second Quantitative analysis. Qualitative analysis: This analysis is carried out using MSP software for analyzing planned and actual material consumption through S curve analysis. Reasoning over the deviations curve is the s shaped graph produced by the the cumulative expenditure of certain parameters (man-hours cost) against time and it is the representation of project path. This analysis is carried for comparison of planned and actual cost for material.
- ▶▶ **Quantitative Analysis:** This study mainly focuses on Inventory Control techniques which includes ABC analysis, EOQ analysis ABC Analysis. The ABC inventory control technique is based on the principle that a small portion of the items may typically represent the bulk of money value of the total inventory in construction process, while a relatively large number of items may from a small part of the money value of stores. The money value is ascertained by multiplying the quantity of material of each item by its unit price. The items “A” Category – 5% to 10% of the items represent 70% to 75% of the money value. “B” Category – 15% to 20% of the items represent 15% to 20% of the money. “C” Category – The remaining number of the items represent 5% to 10% of the money value. The relative position of these items show that items of category A should be under the maximum control, items of category B may not be given that much attention and item C may be under a loose control.
- ▶▶ **EOQ analysis:** The EOQ refers to the order size that will result in the lowest total of ordering and carrying costs for an item of inventory. If a firm place unnecessary orders it will incur unneeded order costs. If a firm places too few order, it must maintain large stocks of goods and will have excessive carrying cost.

3. Report On Present Investigation

3.1 : S curve Analysis

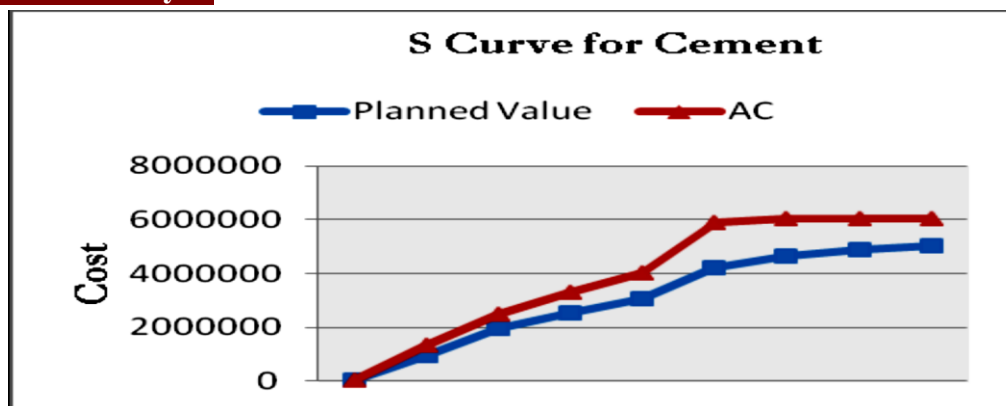


Figure 2: S Curve for Cement

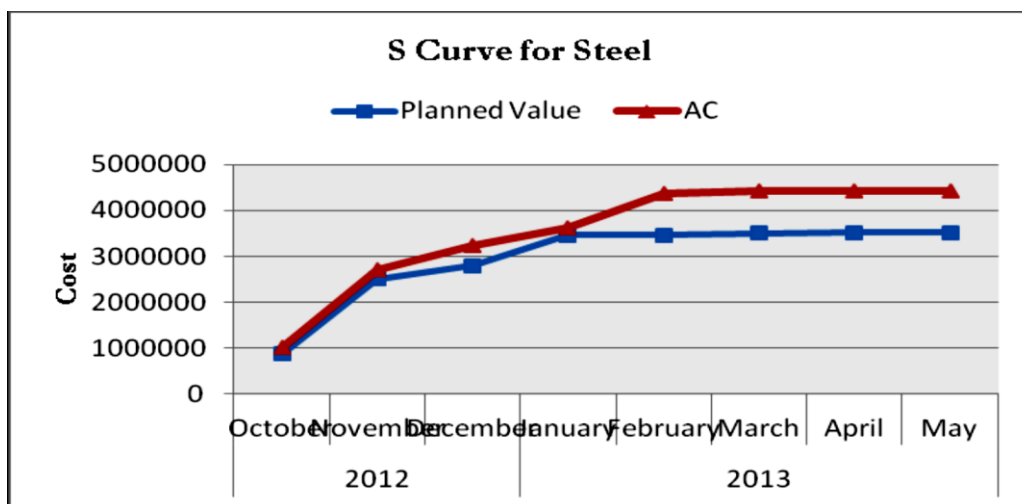


Figure 3 : S Curve for Steel

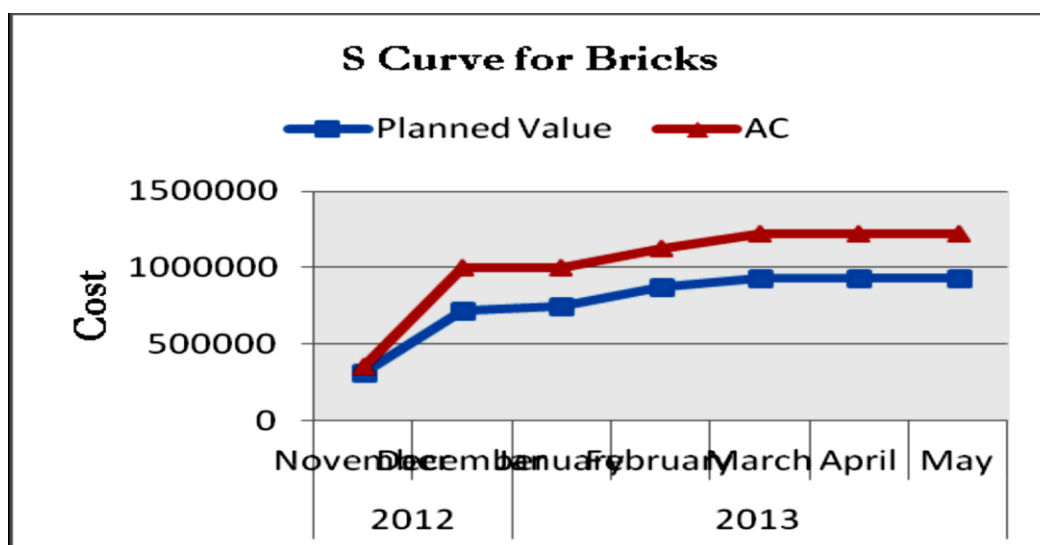


Figure 4: S Curve for Bricks

Above graphs shows the comparison of cumulative cost of planned actual material. This cost is less at initial stage. This S curve Analysis recognize that there is too much increase in material cost while actual execution. Though this is small project but material management aspect never differs whether it is small or big.

3.2 Result From Quantitative Analysis EOQ Analysis

In this study EOQ analysis is performed on Cement, Reinforcement Steel, Bricks, Sand & Aggregate. While performing EOQ analysis Ordering Cost & Inventory Carrying Cost is assumed for each material with practical execution procedure of construction. Inventory carrying cost incurred for maintaining the inventory, This includes Cost of Storage, Insurance taxes, Deterioration & obsolescence this calculates in %. **Inventory Carrying Cost = 26% Economic Order Quantity is calculated by following formula,**

$$Q = \frac{\sqrt{2 * Co * S}}{\sqrt{Cu * I}}$$

where,

Co = Ordering Cost, S = Total Consumption Cu = Cost of Item I = Inventory carrying Cost

Table 2 :EOQ Analysis

Name of Material	Annual requirement	EOQ	No. Of orders	Frequency Of ordering	Total cost of Inventory using EOQ in lacs
CEMENT	15000	512	30	15	43.5
STEEL	130 MT	14	10	21	58.5
BRICKS	190000 CUM	18500	11	27	15
SAND	1213 CUM	35	37	8	10
AGGREGATE	268 CUM	20	13	18	25

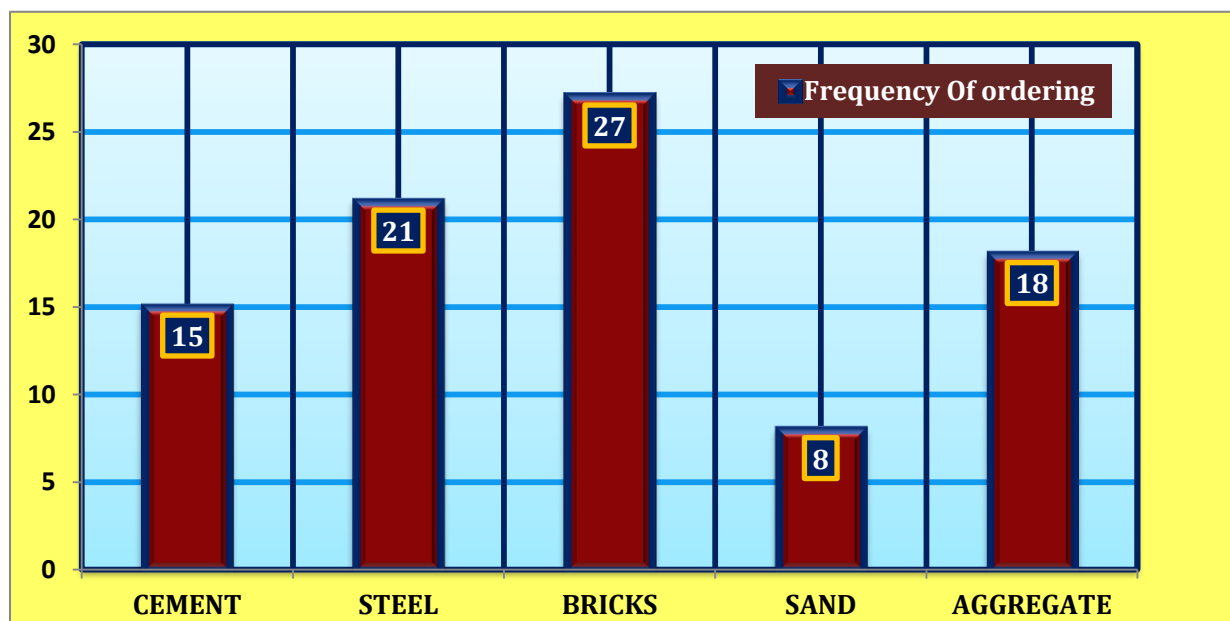


Figure 5: Graph Name of Material Vs Frequency Of ordering

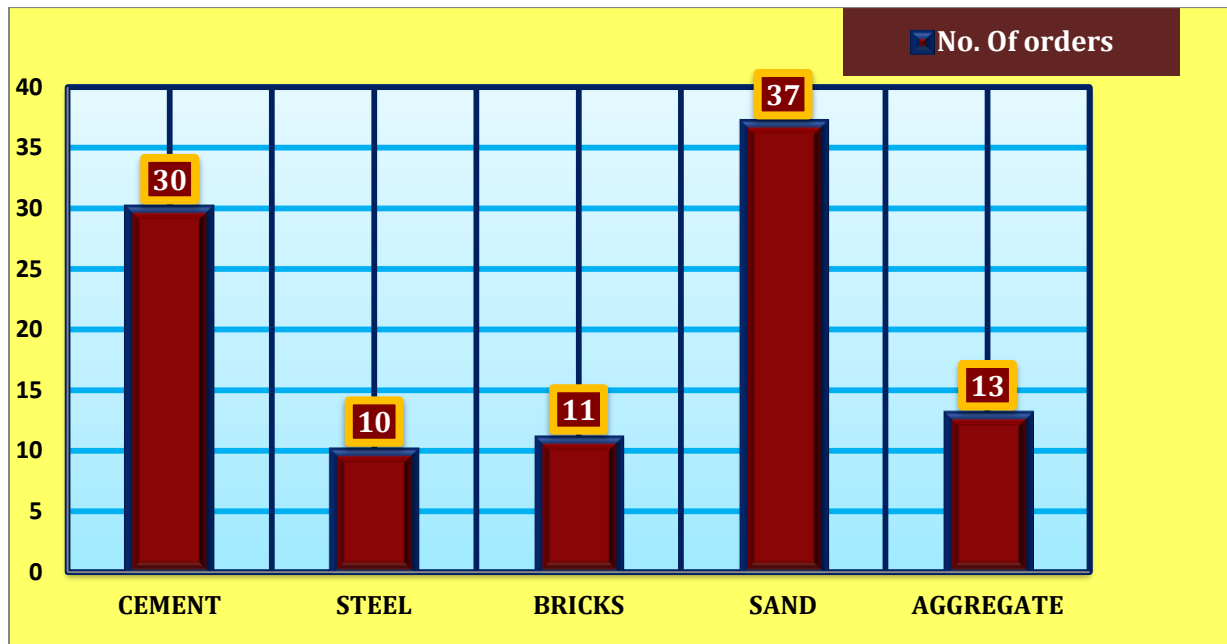


Figure 6: Graph Name of Material Vs. No. Of orders

4. Analytical Findings

4.1 S Curve Analysis

It is concluded that major causes of variations are as following:

- Due to unavailability of RCC Design drawings this causes problems to contractor to work out accurate actual quantities.
- Due to deviation in Items it will effect on material procurement and finally affects the total project budget.
- If the tender is quoted accurately so that non-tender will not arises because basic rate of material fluctuate day to day leading to increase in cost. Instead of quantities that item should be quoted as Rate only item so it is profitable to contractor & Client.
- Due to uneven geographical conditions in case soling extra depth of excavation to be considered.

4.2 EOQ Analysis

- After EOQ analysis for cement it is concluded that economic order quantity which is 506 Bags & frequency of ordering 15days which has overcome the problems of Stock out successfully over the actual Site stock records.
- For B class material such as sand and aggregate on site material are ordered as per requirement because of space availability they could not maintain stock as per EOQ.
- After performance of EOQ on sand & Aggregate it can be concluded that those material does not gives satisfactory results because ordering frequency after EOQ was 8 days & 18 days but actually on site demand is as per daily requirement
- The Total cost of inventory after adoption of EOQ analysis is less than without adopting EOQ.

5. Conclusion

Construction material constitutes a major cost component in any construction project. The total cost of material may be 52% of total cost; so that it is important for contractor to consider that timely availability of material is potential cause of successful completion of project.

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