

Cost Control Techniques for Material Management

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Abstract— Construction materials constitute a large portion of the total cost in construction projects. It may account for 50-60% of the total project cost. Material management includes finding the availability, proper selection, procurement, inventory management and effective usage of materials at right time. In this inventory management is one of the single largest components to improve the productivity, cost efficient of a project and help to ensure timely completion of the project. On preparing inventory chart and analyzing the cost estimate, the proper cost control over material procurement have been achieved to avoid surplus expenditure and better field material control.

Keywords: Inventory, Cost, Material Management

I. INTRODUCTION

The inventory management is of maintaining an adequate supply of something to meet an expected demand pattern for a given financial investment. This could be raw materials, work in progress, finished products, or spares and other indirect materials. Inventory is one of the indicators of management effectiveness on the materials management front. Inventory turnover ratio (annual demand/ average inventory) is an index of business performance. Inventory management deals with the determination of optimal policies and procedures for procurement of commodities. Since it is quite difficult to imagine a real work situation in which required material will be made available at the point of use instantaneously, maintaining inventories becomes almost necessary. Before doing the inventory management for building the following basic information must be studied. The project site must be analysed completely for the stock management. The work progress must be known and the interlocking activities of various works must be known in detailed manner. For this inventory management, the project has been done for the upcoming construction work of the residential building. In this project the inventory management is done for this residential building by analysing the site situation, quantity surveying according to the drawing, preparing the Microsoft Project scheduling, studying the interlocking activities. Creation of inventory chart is the final form of this inventory management project.

A. Scope

In construction industry one of the big problems is project delay due to material shortages. To overcome this problems, material should be procured at correct time and dumped at correct place. The basic purpose of inventory holding stocks in a material flow system are to double successful stage of following system is important purpose of inventory

Main scope of the project is try to avoid the over dump and correct procurement of the material for building works at right time. This can be done with the help of inventory management. In this inventory system, the required

amount of building material is calculated by detailed study of plan. The whole inventory management chart is classified into different dates for easy work flow. So the required amount of materials for different works is released according to it. It also increase the efficiency of work and it will flow continuously without any barrier.

Supervisor can easily understand the inventory chart, quantity of materials needed for the work and purchase of the materials is done according to it. Over dumping of materials occupies more land and amount will be released earlier. With the help of inventory chart the over dumping is avoided.

B. Objective:

- 1) To obtain efficient material planning.
- 2) To get smooth flow off supply and distribution of material.
- 3) To maintain quality assurance.
- 4) Developing skill of worker in material management.
- 5) To achieve economy in the construction.
- 6) Buying or purchasing order.

II. METHODOLOGY

- Site selection
- Analysis of site condition
- Study of plan
- Schedule type - Phase I
- Quantity calculation
- MSP scheduling
- Analysis of interlocking activities
- Inventory chart preparation
- Work based type – Phase II
- Cost analysis – Budget preparation
- Comparing planned with actual
- Analysing the deviation

- 1) Site selection: Site selection is a key factor for project. The site must be easily accessible for all construction activities and must fulfil the requirements of the function of the building.
- 2) Analysis of site condition: Site condition must be analysed completely before doing the construction activity. Site is situated in rural area and the material availability (lead distance) also analysed. Free space around the construction land is effectively used for store and stock management purpose.
- 3) Study of plan: For inventory management quantity calculation is important, Study of plan is also important. Plan and cross section of individual levels must be completely studied for quantity calculation. Vetted cross section and plans are used for quantity calculation.
- 4) Working method: The inventory management is done by any one of the following methods given below.

- Based on schedule of works
- Based on works involved
- a) Based on schedule of works
It means work progress will be processed according to the previously prepared schedule. Schedule must be prepared for the work progress. Inventory management can be carried on the basis of scheduling of the project.
- b) Based on works involved Inventory management can be carried on the basis of works involved in the construction activity. This project is based on this type. For this type what are the activities involved must be ordered in the correct manner. And the interlocking activities are completely ordered.

5) Quantity calculation

For material calculation, quantity calculation is the first component to know

Main scope of the project is try to avoid the over dump and correct procurement of the material for building works at right time. This can be done with the help of inventory management. In this inventory system, the required amount of building material is calculated by detailed study of plan. The whole inventory management chart is classified into different the volume of work for different quantities of different works.

- 7) MSP scheduling To get better scheduling our projects and levelling our resources Microsoft Project (MSP) is used. The tasks, milestones are components that can be scheduled, cost estimated, monitored and controlled using this.
- 8) Analysis of interlocking activities Inventory chart is prepared on the basis of work type, for this different interlocking of activities and activities ordered in a specified manner (i.e. Form substructure to roof level work) must be known.
- 9) Inventory chart preparation Chart is the form of output, easily understandable by everyone. Therefore chart preparation is final output of the project. Based on activities, scheduled duration and materials the final inventory chart is prepared.

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.

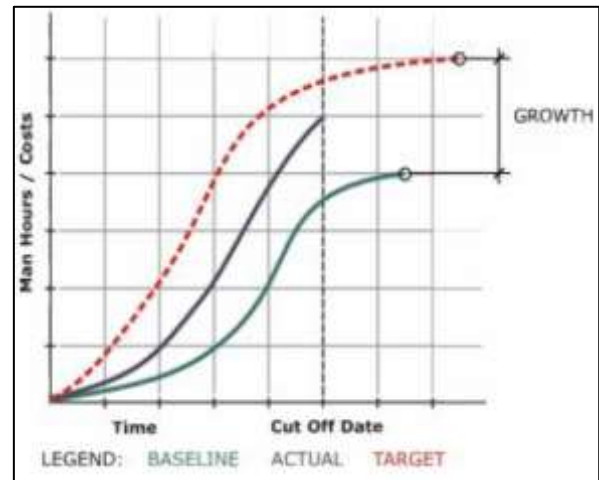


Fig. 1: S Curve Analysis

III. PRINCIPLE OF INVENTORY MANAGEMENT

Materials inventory management is important, as materials constitute a large amount in construction costs. This is because the poor inventory management can affect not only to the increase in costs, but also contribute to schedule and project delays. Therefore, those engaged in inventory should have an awareness of the interlocking activities contained in the process.

Inventory control is essential to provide flexibility in operating a system. It is important to business because, it reduces cost while aiding customer relations, which permits smooth operation of production and utility process of the firm. Inventory management is that aspect of current assets management, which is concerned with maintaining optimum investment in inventory and applying effective control system so as to minimize the total inventory cost.

Basic inventories decisions are two types.

- The inventory item is empty and to fill again
- How much of an item to order when the inventory of that item is to be filling again.

Inventory should not be performed without considering the design and construction schedule of a project. It is essential that procurement will be considered as a grand plan involving a number of stages. The construction industry is how maturing to recognize the need and importance of the inventory.

Procurement is next step of the inventory. Inventory defines when and where the material is need as per plan or design according to interlocking activities. Inventory is normally performed at several levels and it will depend on the interlocking. activities. If we not known the interlocking activities entire system lead to delay of the fore coming activities.

Different functional managers of an organization may view inventory from different points, leadings to conflicting objectives. This calls for an integrated system approach to planning of inventories so that conflicting objectives can be scrutinized to enable the system to operate at minimum total inventory - related-cost- explicit costs such as purchase price as well as implicit costs such as carrying, shortage, transportation and inspection costs.

A. Inventory Planning

- Production planning requires purchase and inventory planning decisions for an organization to control expenses and finances.
- To get the purchase benefits, discounts, reduced transportation and ordering cost the bulk purchase may be economical. Inventory of such materials are stored for longer time.

IV. MICROSOFT PROJECT (MSP) SCHEDULING

The construction project owner or clients have given the finish date of the project to be completed before that we have a chance to plan for it. This is why we need to get better scheduling our projects and levelling our finite resources. The tool that is most widely used is Microsoft Project (MSP) it applies in project scheduling and resource levelling. In this we can able to fix the units of resources or we have to fix the duration of the project.

Most organisations have a hierarchical structure to break down the work. Typically, it looks like the Stage, Phase, Task, and Milestone. This is a way to organise and define the total scope of the project by decomposing the work to be done into tasks that the project team can execute and create the required deliverables. The tasks, milestones are components that can be scheduled, cost estimated, monitored and controlled. A network diagram is used to show dependencies in a graphical form. MSP generates network diagram automatically.

MSP helps in utilising the resource constantly throughout the project. Ensures the resource is not over allocated. It helps the project manager to avoid delays caused by the bad allocation. MSP can automatically level resource based on resource calendar, task, dependencies, constrains.

B. Abstract of Cost Using Conventional Building Material

Sr. No.	Description of work	Quantity	Unit	Rate/Unit	Amount
1.	Clay Bricks	12730	Nos.	10	127300
2.	River Sand(For Brick Work)	6.68	M ³	10500	70140
3.	River Sand (For Plastering)	2.24	M ³	11000	24640
4.	Granite Flooring	73.30	M ²	270	19791
	Sub Total				241871
	Add 5% Contingencies				12093.55
	Total				253964.55
	Round off				0.45
	Grand Total				253965

C. Abstract of Cost Using Cost Effective Building Materials

Sr. No.	Description of work	Quantity	Unit	Rate/Unit	Amount
1.	Fly Ash Brick	12730	Nos.	8	101840
2.	M Sand (For Brick Work)	6.68	M ³	6500	43420
3.	P Sand (For Plastering)	2.24	M ³	8000	17920
4.	Ceramic Flooring	73.30	M ²	205.2	15041.16
	Sub Total				178221.16
	Add 5% Contingencies				8911.05
	Total				187132.21
	Round off				0.79
	Grand Total				187133

We can delay certain task, assign different resources, change the task dependencies, add task, remove task, material requirements etc.,

From this MSP scheduling, analysing of activities and their scheduling can be done. According to their scheduled duration, material resources procurement sheet is prepared finally analysing the deviation from the planned to the actual.

A. Details of the Project

The plot size for the project is 116.11 M³ or 1250 Ft² Accordingly the building has been laid in the centre of the plot leaving ample space on all the sides for land scaping and pathways for cars and for parking. General layout details are shown in table

Area of Built Up	116.12 M ²
Plot Details	Front – Main road Left & right side – Private residential buildings Rear
Number of floors	G+1
Type of construction	Duplex

Table 1: Plot Details

Conventional Building Materials	Cost Effective Building Materials
Clay Bricks	Fly Ash Brick
River Sand (For Brick Work)	M Sand
River Sand (For Plastering)	P Sand
Granite Flooring	Ceramic Flooring

Table 2: Conventional building material used

D. Total reduction in cost

The total reduction in cost by using cost effective building material is Rs 66832/-

V. ANALYSIS ON COST

- 1) 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.
- 2) 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.

VI. CONCLUSION

Inventory management deals with material procurement. From this study how to do an inventory management for building structure is known. Where there may be deviations occur during construction, due to the quantities calculated are as per drawings but during execution many deviations occurs on site. The main factors to be considered during the chart preparation are the site condition and the interlocking activities. While considering these activities the inventory chart is more effective. Inventory chart based on activates is basic chart for site engineers and management people to schedule the material procurement and allocate the cost according to it, to avoid surplus expenditure spend for the material. The construction techniques are most use in now a day. They are alternative materials are low cost as compare to old like Fly ash brick, M Sand, P Sand and Ceramic tile.

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