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AN EMPIRICAL CASE STUDY OF MATERIAL MANAGEMENT IN RESIDENTIAL PROJECT

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Abstract – *"An empirical case study of Material Management in Residential* ***Project****"is an attempt made on studying and assessing the material management principlesand practices in a residential project.The objective of the present study is to understand about the problems occurring in theorganization because of improper application of material management. In constructionproject operation, often there is a project cost variance in terms* ***of the material,equipment's,*** *manpower, subcontractor, overhead cost, and general condition. Material is the main component in construction projects. Therefore, if the material management is notproperly managed it will create a project cost variance. Project cost can be controlled by taking corrective actions towards the cost variance. Therefore a methodology is made to classify the materials by ABC analysis and these materials are identified and are taken up to measure the variations involved by S-Curve analysis.*

Key Words:Material Management, ABC (Always Better Control) Classification,S-Curve analysis.

1. INTRODUCTION

Materials management is a management process where coordination, supervision and execution of the tasks are related with the flow of materials in and out of an organization. Material management deals with principles and practices which effectively optimizes cost of materials used in the project. Material management is the line of responsibility which begins with the selection of suppliers and ends when the material is delivered to its point. [1].

The ABC analysis is a basic analytical management tool. It is popularly known as *Always Better Control*. This technique classifies the material item based on the Annual Usage Value (AUV) in order to determine its priority among plenty of material items.The ABC analysis is a tool for identifying material items that has a significant impact on overall inventory cost. ABC analysis helps in rationalizing the number of orders and reduce the overall inventory even though overall purchase orders are the same, the average inventory can be reduced substantially. The ABC analysis suggests that inventories of an organization are not of equal value. Thus, the inventory is grouped into three categories (A, B, and C) in order of their significance [2].

S-Curves are an important project management tool. The progress of work against time is very well indicated by S-Curve. S-Curve model indicates progress of quantities of work against time that throws a lot of light on the state of the project. They allow the progress of a project to be tracked visually over time, and form a historical record of what has happened to date. It is also a toll to enlighten us with understanding of the project and its progress. The reasoning over the S shaped graph produced by the cumulative expenditure of parameters (material cost) against time and it represents the project path. This analysis is carried for comparison of planned and actual cost for material items. S-curve provides at a glance view of project performance in terms of cost and time. Analysis of S-curves allow project management team to quickly identify project growth, slippage, and potential problems that could adversely impact the project if no remedial action is taken.

2. LITERATURE REVIEW

AnushaRajendran K. (2011)[3] this research describes about the Material Coding and Material Requirement Planning implemented on a residential project. It also gives emphasis on improving the material storage efficiency in the project site. The study does not include the study of non-consumable items and the work has been carried out for a limited duration. The outcome of the work does not provide the rigorous study of each and every item of the project, but only few major items is considered for the analysis.

Khyomesh V. Patel &Chetna M. Vyas (2011)[4] the study shows the prolific and cost efficient material management practices that are essential in construction industry. The research indicates that construction materials constitute about 70% of the total costfor a typical construction

project. Proper management principles and practices are required for this component which will improvise the productivity and cost efficiency of the project and thereby helping the timely completion of the project. The study also highlights about one of the major problems in delaying construction projects is poor materials and equipment management. This study depicts the need for a centralised material management team where a proper co-ordination between the site and the organization is essential. The results indicates that the organisations using proper material management system are seen to have increased their overall efficiency by 35%.

Ashwini R. Patil and Smita V. Pataskar (2013) [5] made the study which shows the effective planning of materials before the execution of the project. It also gives emphasis on inventory control technique like ABC analysis. This paper also explores the current practices of Material Management and the study is conducted in two phases, First phase gives the Qualitative information regarding deviation in planned and actual materials in terms of S curve analysis using MSP tool and reasoning over the deviation is essential to know the effect of material planning before execution of project. Various causes on the S curve analysis have been given in terms of problems. These major reasons of variations are grouped, classified and discussed. It also highlights factors for maintaining material stock in a shorter duration of time. To maintain an optimum level of inventory, inventory control technique like ABC analysis is carried out in second phase of study to overcome the problems.

3.RESEARCH METHODOLOGY

3.1 ABC Analysis

The grouping of all materials used in production into materials which require the highest attention, materials which require medium attention and materials which require the least attention such that the control mechanism be focused on selective class of materials is called selective inventory control. Literally, thousands of items are kept in inventory. Periodic reviews of inventories of items have to be taken under for effective inventory control. An equally critical analysis of all items is very expensive and time consuming. Material classification with reference to a particular function under examination is the solution. Among the methods that are available for the purpose of classification, ABC analysis is most commonly used. This method is very well suited for the construction industry and are also being used very widely. The organization was not following any of the control techniques for the particular project.

3.1.1 Methodology Adopted for ABC analysis:

1. List all the client free issue consumable materials items used in the project along with unit price and quantity consumed annually.
2. Compute the Annual Usage Value (AUV) of each material item.
3. Arrange the items in the ranking order of AUV and compute the cumulative percentage units consumed and cumulative percentage of AUV for each item.
4. Graph is plotted between cumulative percentages of unit's vs cumulative percentages of items.

3.2 S-Curve analysis

Material management is not just a concern during the monitoring stage in which construction is taking place. For variation observed between the planned and actual material consumption S-curve analysis is formulated. The deviations of the quantities is produced by the cumulative expenditure of certain parameters (Material cost) against time and it is the representation of project path. This analysis is carried for comparison of planned and actual cost for Class A material items.

3.2.1 Methodology Adopted:

1. The Class A material items used in the project plan period is considered from the material classification of items (ABC analysis).
2. The cost variance is computed for these material items which is given by [6],

Cost Variance = (BCWP – ACWP) .....[1]

Where, BCWP – Budgeted Cost of Work Performed and ACWP – Actual Cost of Work Performed.

3. Cost Performance Index is calculated using the formula [6],

Cost Performance Index = BCWP/ACWP ..... [2]

4. These variations of Class A material items used in the project plan period is considered along with planned and actual consumption of material items as a function of cost.
5. Compute the cumulative planned and cumulative actual cost of Class A materialitems for the same period.
6. Graph is plotted between the cumulative planned and cumulative actual costs of Class A material items for the same period.
7. A graph showing S-Curve for the Class A material items is plotted.

4.RESULTS AND DISCUSSIONS

4.1 ABC analysis

From the ABC analysis following conclusions can be made,

- Class A materials – 4 items (70% of AUV)
- Class B materials – 9 items (25% of AUV)
- Class C materials – 20 items (5% of AUV)

Class A materials constitute of Concrete, Steel and Vitrified tiles. These materials itemsare taken up for further study [7], [8].

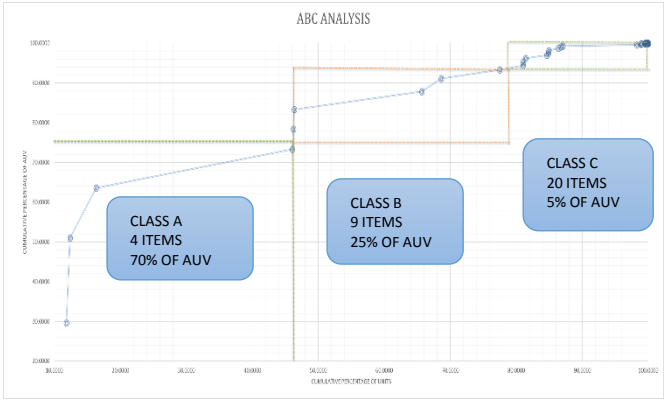

Figure 1: ABC analysis

4.2 S-Curve analysis

The Cost variance and the Cost Performance index for the Class A materials is as shown in the table below.

RMC - M20 Grade					
Sl No.	Period	Planned Cost (BCWP	Actual Cost (ACWP)	Cost Variance (BCWP-ACWP)	Cost Performance Index (BCWP/ACWP)
1	Jan-15	2762960	2736393	26567	1.010
2	Feb-15	3190346	3159669	30676	1.010
3	Mar-15	920987	912131	8856	1.010
4	Apr-15	2672667	2646968	25699	1.010
5	May-15	3190346	3159669	30676	1.010

Table 1: Cost variance and Cost Performance Index for Concrete

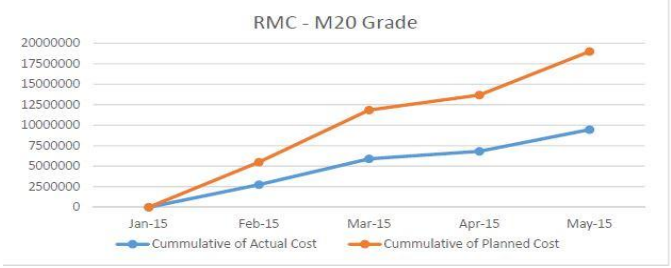

Figure 2: S-Curve analysis for Concrete

Rebar Steel TMT 8mm - FE500					
Sl No.	Period	Planned Cost (BCWP	Actual Cost (ACWP)	Cost Variance (BCWP-ACWP)	Cost Performance Index (BCWP/ACWP)
1	Jan-15	1671067	1641864	29203	1.018
2	Feb-15	1856741	1824293	32448	1.018
3	Mar-15	835533	820932	14602	1.018
4	Apr-15	1485393	1459434	25958	1.018
5	May-15	1856741	1824293	32448	1.018

Table 2: Cost variance and Cost Performance Index for Steel

Figure 3: S-Curve analysis for Steel

Tiles Vitrified 600mm x 600mm Polished					
Sl No.	Period	Planned Cost (BCWP	Actual Cost (ACWP)	Cost Variance (BCWP-ACWP)	Cost Performance Index (BCWP/ACWP)
1	Jan-15	1303968	1217037	86931	1.071
2	Feb-15	1825555	1703852	121704	1.071
3	Mar-15	1043174	973629	69545	1.071
4	Apr-15	521587	486815	34772	1.071
5	May-15	521587	486815	34772	1.071

Table 3: Cost variance and Cost Performance Index for Vitrified tiles

Figure 4: S-Curve analysis for Vitrified tiles

The S - Curve graph of Class A materials plotted between cumulative of planned cost and cumulative of actual cost is

as shown in Figure 2 for Concrete, Figure 3 for Steel and Figure 4 for Vitrified tiles.

From Table 1, Table 2 and Table 3 the Cost Variance values for the Class A materials is positive. Itindicates the project has a cost under run i.e. the cost incurred is less than the plannedor budgeted cost.

Further, the Cost Performance Index value is 1.010 for RMC M20 grade, 1.018 forRebar steel TMT 8mm-Fe500 and 1.071 for Vitrified tiles (600mm*600mm – polished)where the index values are greater than 1 indicating a favourable performance of thematerial items in the project. And has a better cost efficient condition in the project.

The S – Curve graphs which are obtained from the plots,Figure 2 for Concrete, Figure 3 for Steel and Figure 4 for Vitrified tiles indicates thatthere is a certain variation between planned and actual cost. The first important observation is that the variation is less at initial stage. Secondly as the project progresses with the period of time the variation between planned cost andactual cost against time also increases.

6. CONCLUSIONS

From the above study made, we can conclude that materials for the project, which is a very important resource if properly managed and handled can vary the cost of the project to a large extent, especially Class A material items. If strictly followed the measures to handle the materials properly and efficiently for a construction project, it can reduce the total material cost of the project.

The Cost Variance values for the Class A materials is a tool to measure the profit and it has a positive value. It indicates the project has a cost under run i.e. the cost incurred is less than the planned or budgeted cost. The variations in each month will account for the entire project plan period. Greater the variations in cost of materials more will be overall cost of materials. It has a direct bearing on the project cost. The variation in cost among Class A materials is of prime importance and affects the overall cost of the project.

The Cost Performance Index values for Class A materials are greater than 1 indicating a favourable performance of the material items in the project. And has a better cost efficient condition in the project. The cost of materials have been optimized effectively indicating the under budget condition of the materials.

The S – Curve graphs which are obtained from the plots graphs indicates thatthere is a certain variation between planned and actual cost. These costs is less atinitial stage. This S Curve analysis recognize that there is too much increase in material cost during actual execution.

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