

A Review Paper on Construction Material Management on Project Site by EOQ Analysis

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Abstract— The efficient procurement of material represents a key role in the successful completion of the work. Poor planning and control of material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in labour productivity and overall delays that can indirectly increase total project cost. Effective management of materials can reduce these costs. In construction industry the problem of exceeding the overall estimated budget often arises and it seems quite challenging to be precise all the time. Its need to overcome such problems for that the proper use of inventory control or material planning is needed which is achieved by inventory management. In any construction project the working capital consist of 60 to70% material cost of the total cost of the project. The EOQ analysis can sort out the materials management problem in construction area and reduce the construction cost by the timely order of the construction materials. The main tools for the collection of data include questionnaires, and site visit to identify the annual requirement of the construction materials while various literature studies were also helpful in review of material management in construction projects.

Keywords: Material Management, Cost Control, Construction Materials, Planning

I. INTRODUCTION

Construction is second largest economic activity in India, next only to agriculture. The amount of money invested in and the jobs provided by construction industry are much larger than any other industry in India. Construction plays a critical role in all development sectors like agriculture, irrigation, energy, transportation, communication, manufacturing, housing, civil infrastructure and social services. The scope and volume of the construction industry can be directly linked with size and population of the country. In India, the construction industry employs a very large workforce probably next only to agriculture. Thus, the construction industry is an important industry for economic development. In Construction Industry the problem of exceeding the estimated budget often arises and it seems quite difficult to be precise all the time. To overcome such problems the use of proper inventory control or material planning is needed which is achieved by inventory management. In any construction project the working capital of the material comprises of 60-70% of the total cost of the project. The EOQ analysis is useful in avoiding the wastage in construction material. One of the very important sections that should specify in the construction project management is managing and minimizing wastage of construction materials at construction projects. The successful execution of construction projects within given cost, time and quality, good handling of construction materials on construction site requires systematic planning and controlling of the

construction works. Using EOQ analysis we can decrease 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.

II. PURPOSE OF MATERIAL MANAGEMENT

The Purpose of material management is to assure that the right material are in the right place and are in the right quantity when needed.

III. OBJECTIVE OF MATERIAL MANAGEMENT

The following are the main objectives of materials management are as given below:-

- Efficient material planning
- Stock and waste control
- Quality assurance
- Improved departmental efficiency
- Reduce the cost of project
- Time saving
- Achieve economy in project

IV. METHODOLOGY

This research is based on the two types of data collection sources such as Primary source and Secondary source

Primary Source: Primary resource are gives pre idea about research. It also gives theoretical & practical concept. This data is collected from the various researched journals and with the help of internet.

Secondary Source: Secondary data are collected through questionnaire survey in Rajouri division of Jammu and Kashmir as well as Nagpur and Amravati division of Maharashtra state.

A. Questionnaire Design

A questionnaire survey was designed based on the objectives of the study, which is management of construction material on site. A questionnaire survey was developed to get the opinion and understanding from the experienced respondents regarding to the construction management problems.

Questionnaire have the following questions.

- 1) Annual requirement of Cement on construction project site.
- 2) Annual requirement of Steel on construction project site.
- 3) Annual requirement of Bricks on construction project site.
- 4) Annual requirement of Sand on construction project site.

5) Annual requirement of Aggregate on construction project site.

B. Data Analysis by EOQ Method

In this research Data analysis done with the help of following points as given below:-

- 1) Visit in local market to get the appropriate prices of construction materials.
- 2) Find out the value of value of Q (Economic Order Quantity) from the formulae of EOQ analysis as given below.
- 3) Find out the no of orders per year (based on EOQ).
- 4) Find out the frequency of ordering per year.
- 5) Find out the Total cost
- 6) Now find out the difference between Economic cost (with EOQ) and general cost (without E)

Sr.No	Material	Total Quantity Required for a year
1	Cement	11760 Bags
2	Sand	1320 Cum
3	Aggregate	7890 Cum
4	Stone	990 Cum
5	Steel	3.9 Metric Ton

Table 4.1: Material Quantity required for Project

Name of material	Annual Requirement	Without EOQ Order Quantity	No of Orders	Frequency of ordering
Cement	11760 Bags	80	147	9
Sand	1320 Cum	9	147	3
Aggregate	7890 Cum	9	877	1
Stone	990 Cum	9	110	4
Steel	3.9 Metric Ton	1.3	3	122

Table 4.2: Data collected from Project Without EOQ analysis

1) Data Analysis for Cement with EOQ Analysis
EOQ analysis for cement:-

$$EOQ = \sqrt{\frac{2 * S * Co}{Cu * i}}$$

Where

S = Annual Requirement = 11760 Bags

Co = Cost of Ordering. = Rupees 1600

Cu = Item's cost. = 450 Rupees per bag

i = Carrying inventory cost = Assume 30 % = 0.3

$$EOQ = \sqrt{\frac{2 * 11760 * 1600}{450 * 0.3}} = 527.97 \text{ Bags} = 528 \text{ Bags}$$

$$\text{No. of orders} = \frac{\text{Annual requirement}}{EOQ} = \frac{11760}{528} = 23 \text{ Orders in year}$$

$$\text{Duration of order} = \frac{\text{No of days in a year}}{\text{No. of orders}} = \frac{365}{23} = 16 \text{ Days}$$

$$\begin{aligned} \text{Cost of one order} &= (EOQ * Cu) + Co \\ &= (528 * 450) + 1600 \\ &= 239200 \text{ Rupees} \end{aligned}$$

$$\begin{aligned} \text{Total cost (including material and order cost)} &= \text{Cost of one order} * \text{No of orders} \\ &= 239200 * 23 \\ &= 5501600 \text{ Rupees} \end{aligned}$$

So total Total cost (including material and order cost) for cement by EOQ analysis=Rs 5501600

Now without EOQ data analysis for Cement provided by Project Authority

$$\begin{aligned} \text{Cost of one order} &= (\text{without EOQ order quantity} * Cu) + Co \\ &= (80 * 450) + 1600 \\ &= 37600 \text{ Rupees} \end{aligned}$$

$$\begin{aligned} \text{Total cost (including material and order cost)} &= \text{Cost of one order} * \text{No of orders} \\ &= 37600 * 147 \\ &= 5527200 \text{ Rupees} \end{aligned}$$

So Total cost (including material and order cost) for cement by EOQ analysis=Rs 5527200

As we see in calculation EOQ analysis data amount for cement is less than without EOQ analysis so the difference is given below

$$5527200 - 5501600 = \text{Rupees } 25600$$

So if we adopt EOQ formula for cement than we can save Rupees 25600

Same Procedure are follow for remaing material.

V. RESULT AND DISCUSSION

The study on EOQ analysis is performed on Cement, Steel, Bricks, Sand and Aggregate. While performing EOQ analysis ordering cost and Inventory cost is assumed for all materials with practical execution procedure of construction. Inventory carrying cost incurred for inventory maintenance, Cost of Storage is include Insurance taxes, Deterioration & obsolescence this calculate in %. Inventory Carrying Cost = Economic Order Quantity is calculated as given below:-

A. Result Analysis for Project

Name of material	Annual Requirement	Order Quantity	EOQ	No of Order	Frequency of ordering in days
Cement	11760 Bags	528 Bags	528	23	16
Sand	1320 Cum	261 Cum	261	6	61
Aggregate	7890 Cum	689 Cum	689	12	32
Stone	990 Cum	267 Cum	267	4	92
Steel	3.9 Metric Ton	1 Metric Ton	1	4	92

Table 6.1.1: Summary of EOQ analysis for Project

Name of materials	Without EOQ analysis annual price in rupees	EOQ analysis annual price in rupees	Difference between EOQ and without EOQ annual price in rupees
Cement	5527200.00	5501600.00	25600.00
Sand	1719900.00	1128600.00	591300.00
Aggregate	9471600.00	5025600.00	4446000.00
Stone	1089000.00	555600.00	533400.00
Steel	198000.00	204000.00	-6000.00
Overall Total	18005700.00	12415400.00	5590300.00

Table 6.2.2: Comparison of EOQ analysis and without EOQ analysis annual amount

VI. CONCLUSION

- After EOQ analysis for materials, it is concluded that Economic Order Quantity and frequency of ordering has overcome the problem of stock out successfully over the actual site stock record.
- Also the total cost of inventory after adoption of EOQ analysis is less than without adopting EOQ.
- EOQ analysis gives better result for all the materials i.e Cement, Sand, aggregate, Stone except Steel.
- When we apply EOQ on steel for both the Projects then we conclude that the annual amount of steel with EOQ analysis is greater than the annual amount of steel without EOQ analysis. So in that case our EOQ analysis is fail in this case.
- It is conclude that if we apply EOQ analysis on the above projects then we can save 32% of total project cost for project
- So, EOQ analysis gives better result for the projects

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