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# Inventory Control Techniques in Material Management

**Rohan J. Madgi[1], Prof. Shashank U. Vanakudari[2]**

*[11]M.TECH student, Civil Engineering Dept, Jain College of Engineering, Karnataka, India.*
*[2]Assistant Professor, Civil Engineering Dept, Jain College of Engineering, Karnataka, India.*

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**Abstract -** In any infrastructure projects the major constituent is the material where in it involves more than 60% of the total cost of project, poor planning and control of material, lack of material when needed, poor identification of material, re-handling and inadequate storage cause losses in productivity and overall delays that can indirectly increase total project cost. Effective management of the material could reduce the total cost involved in the project. This paper describes about the importance of material management and of the different inventory control techniques that could be applied in order to make effective material management in the infrastructure projects. This study of the material management in different infrastructure projects and analyze the material handling process undertaken by the company and applying inventory control techniques like ABC analysis along with EOQ analysis etc. to achieve the desired results and suggest the best suitable techniques.

***Key Words*: Inventory, HML Analysis, EOQ Analysis.**

## 1. INTRODUCTION

Building materials constitute a major cost component for a construction project. Efficient material management and inventory control strategies are at the top and help in achieving the cost reduction goals. It is extremely essential for smooth running of construction work. A proper plan for raw materials, handling, storage, issuance, and recording purchases is considered as part of inventory management. Investments are very much in investment, investment in the majority of investment companies. Therefore, a proper plan of purchase, handling, conservation and accounting should be formed in an effective inventory management system.

The term inventory means stock for products alternately a rundown of merchandise. Inventory means a stock of tangible assets or goods, it can be stock of completed products prepared for sale, raw materials organized for manufacturing, work in progress and consumables, spare, store etc. A correct arrangement for purchasing, conservation, usage and recording is to be viewed as an element of inventory management. Stock administration acknowledges what to be purchased, how to be purchased, the extent to which it should be purchased, starting with the place it should be purchased, the place to store and the point when to utilize it for construction.

Material management is characterized with providing the correct material which is required at the construction site at correct time it involves identifying, arranging, procuring and storing of the materials. The reason for inventory supervision is to keep stocks over such an approach that there is no overstocking which means deficient of liquidity or under loading which brings about stoppage for work. In early days, material administration was not of greater significance as the materials were purchased depending on their requirement and availability of money. As the years passed proper plan and control techniques were developed for the smooth flow of the construction activities, minimize the waste, completion of project within specified time frame and to reduce the overall cost of the project. Techniques such as EOQ analysis, ABC analysis, S-curve analysis, VED analysis, HML analysis etc. were developed for quantity and quality analysis.

### 1.1 OBJECTIVES

- To rationalize the inventories control techniques with the help of HML analysis to avoid the delay of materials.
- To measure economic order quantity for the selected items & to minimize the total inventory cost.
- To offer suitable suggestions for the improvement of inventory control practices & to
  Minimize the wastage.

### 1.2 LITERATURE REVIEW

Literature review is usually done to understand the topic, identification of the problem and the suitable suggestions given by various researches in their paper. Various researches carried out in the material management and inventory management is studied to know the problems faced in the industry across the world. It helps to find out the different possible solution that we can obtain from literature study and understand its meaning from the below listed papers.

**Ujjavala Patel et.al May** in this contemplate the author has discussed about the current material management practices as well as inventory techniques. In order to maintain the inventory at optimum level technique such as EOQ analysis were performed. It is thus concluded that by implementing the above mentioned techniques.

**P. Ezhilmathi et.al May** in this paper the qualitative data in regards to deviation is designed and actual materials. In the second phase of the paper the problems of the stock out were overcome. The outcome of this study reveals that the total cost of the project is reduced by using EOQ analysis.

**Deepak M.D et.al July** in this research the author has discussed about the material management principles and practices. Project expense difference occurs when there is no proper material management. Thus a procedure is constructed to arrange materials by EOQ investigation.

**Aditya A. Pande et.al May** material management is condemnatory part of the construction industry. A properly execution of material management can successfully bring out the flow of materials which leads to improve planning , increase labour productivity ,and minimize project costs. In this paper materials constitute major part of the project that is around 52% of total cost so timely available of material results in completion of the project.

**Minal p chaudhari et.al February** material management is procedure to give correct material at correct position at correct moment in correct number. To diminish amount of project. Company has troubles in procurement and holding of the raw materials not for completed products. In this paper analysis is done to improve management of inventory in the company, by adopting this analysis it would result in effective utilization of economic resources and helps to get better inventories.

## 2. METHODOLOGY

Material management techniques symbolize the operational aspect. Many techniques of material management are in practice. Techniques are adopted according to the firm's convenience. Some of the techniques are:

1. ABC Analysis

2. VED Classification

3. SDE Classification

4. High, Medium and Low Classification.

5. FSN Classification

6. SOS Analysis

7. XYZ Analysis

8. GOLF Analysis

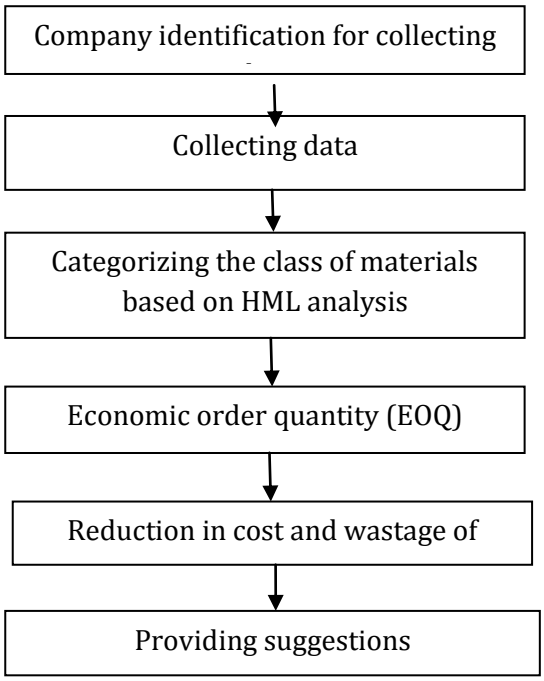
9. Economic Order Quantity

10. Minimum-Maximum Technique

11. Two-bin Technique

Among the various techniques listed above, HML and EOQ analysis has been adopted in this work. This technique is chosen as it mainly focuses on categorizing items based on their varying impact on the overall project cost.

The following flowchart represents the schematic process routed.




### 2.1 HML ANALYSIS

- The HML analysis is same as ABC analysis only differentiation is instated of the usage value, the usage of price criteria is considered. It is based on Pareto rule or the 80/20 law.
- In this analysis classification is based on percentage on the HML analysis
  - H-class item*:* These are the costly item and are generally 10-15% of total item.
  - M-class item*:* These items are low cost item as compared to H class items, this are generally 20-25% of total item.
  - L-class item*:* These items are low class item and generally 60-70% of total items.

The procedure of HML analysis:

- List of required materials should be prepared with their unit cost and their annual consumption should

be obtained. Prepare the list of items and calculate their unit cost, annual demand and annual usage.

- The materials listed should arranged starting from materials from highest cost
- Catergioes the materials as per HML classification.
- Represent it in graphical from.

### 2.2 ECONOMIC ORDER QUANTITY (EOQ):

a) The formula is written as:

$$Q = \sqrt{\frac{2*D*S}{H}}$$

Q= the EOQ order quantity.

D=annual order of the product in. This is the Total quantity of the Material procured by the company.

S= product order cost. The flat fee charged for production of order and is self-sufficient of Q. This is obtained by calculations done.

H= Holding is portion of product cost, considering 5% of the per unit Rate.( This Rate is considered low comparatively, Since the materials is procured for various projects and precast yard having a exclusively excess storage area)

### 2.3 CALCULATION OF ORDERING COST

The Data obtained from the company reflects the annual expense for the financial year 2016-17. The expense shown in the table is inclusive of cost of ordering and the discount in some case. The ordering cost is found out by eliminating the cost of material. Total Quantity (A), Expense (B), No of orders (F) are obtained from primary Data

| Material Description | UOM | Total Quantity | Expense (Rs) | Moving Avg of rate (Rs) | Total Cost of Material (Rs) | Additional cost (Rs) | No. Of order | Ordering cost per order (Rs) |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4=(1*3) | 5=(2-4) | 6 | 5/6 |
| CONCRETE M50 GRADE | M3 | 5289 | 20657660 | 3870 | 20468430 | 189230 | 35.26 | 5366.72 |

### 2.4 CALCULATION OF HOLDING COST

Holding cost is considered to be 5% of the unit cost of the material. This is significantly lower since the material is procured for various projects and precast yard having a exclusively excess storage area.

### 2.5 ECONOMICAL ORDER QUANTITY

The EOQ is calculated as below,

Example: 1) Concrete M50 grade

D= Total quantity (5289 $M^3$)

S= Ordering cost per order (5366.72)

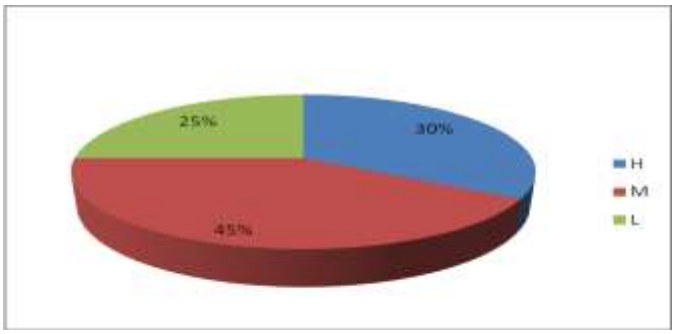
H= holding cost (193.5)

$$EOQ = \sqrt{\frac{2*5289*5366.72}{193.5}}$$

= 541.7 $m^3$

### 2.6 RESULTS AND DISCUSSION

**Results of HML Analysis**




**Results of EOQ Analysis**


- The total number of times placing the order can be reduced such that documentation, processing and time can be saved i.e. Total number of orders as per EOQ =1574 Total number of times ordered by company =8919.
- By applying Economic order quantity analysis to the materials, the inventory cost of Rs.20, 24,529 can be saved.

## 3. CONCLUSIONS

- The study makes us to understand there is no proper material management practice adopted by the company which is leading to increase total inventory cost and delay of material.
- Based on HML Analysis.

| Particulars | H | M | L |
|---|---|---|---|
| Control | High | in-between | Short |
| Requirement | short | in-between | High |
| Check | Tight | in-between | No |
| Safety stock | High | short | Rare |

- The total number of times placing the order can be reduced such that documentation, processing and time can be saved i.e. Total number of orders can be saved around 75%.
- By applying Economic order quantity analysis to the materials, the inventory cost around 4% can be saved.
- Also by knowing the demand of usage of materials, we can determine the reordering level by keeping some amount of safety stock such that there will be continuous supply of material and no delay of work.

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