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# Optimization of Material Cost through Inventory Control Techniques

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**Abstract** - *"Optimization of material cost through inventory control techniques" is an attempt made on assessing the materials management practices in the construction project. The main objective of the present work is to analyze the problems occurring at the construction site because of improper application of materials management and to optimize the inventory cost through inventory control techniques. The current research paper represents a case study of identifying the different inventory control techniques for Krishna Bridge Site, Karad and Ghod Bridge Site, Shirur. Therefore a methodology is made to classify the materials by Always Better Control (ABC) analysis and High Medium Low (HML) analysis and these materials are identified and are taken up for the Economic Order Quantity (EOQ) analysis. The relevant data is collected through the field visits and semi-structured interview is conducted with project managers, site engineers, site workers, etc. to obtain the data related to material's quantity, quality and their unit price. The results of the study showed significant improvement and cost optimization at the bridge construction sites. The study also suggested that planning and procurement of materials should be based on ABC analysis, HML analysis and EOQ analysis according to their requirement. This real case study will help the Krishna Bridge Site and Ghod Bridge site to maintain proper control and proper management of inventories.*

***Key Words***: Materials management, Inventory control, Cost control, ABC analysis, HML analysis, EOQ analysis.

## 1. INTRODUCTION

According to Soni et al. (2016), the materials used in a project represent 50% to 60% of the cost of the work, so minimizing the procurement cost of material can improve opportunities for reducing the project cost. Hence, materials management becomes very important aspect of the construction industry.

It is observed that common problems related to materials management on the construction site include; failure to order materials on time, delivery at the wrong time, over ordering of materials, wrong arrival of materials, etc. So, it has become necessary to study materials management in the construction industry. RathinaKumar et al. (2018) found that often construction projects suffer from cost overrun and time overdue and these issues can be avoided by properly implementing material management which ensures the timely flow of materials to the site which in turn increases the labor productivity and reduces overall cost of the project. Effective management of the materials at the site could reduce the total cost involved in the project. For this, the assessment of problems occurring at the Bridge construction site is evaluated through different inventory control techniques. In Bridge construction projects there are various materials in use that can be classified differently by their consumption, unit price, importance, requirement, etc. In this paper, ABC classification is used to categorize the materials based on their annual consumption value, so that the materials representing a major portion of the cost i.e. Class A material can be managed with extra care. HML classification is based on the unit price of the item which shows that High Priced items should not be ordered more than required quantity. EOQ analysis is used to balance the inventory holding cost and ordering cost also, to avoid the stock out and overstock problems.

## 2. LITERATURE REVIEW

The work done by Madgi and Vanakudari (2018) revealed that in any infrastructure project the major constituent is the material which is 60% of the total cost of a project. It is observed that the factors which affect the total project cost are poor planning and control of material, lack of availability material when needed, poor identification of material, re-handling and inadequate storage for material, etc. so, by identifying these factors by effective materials management system could reduce the total cost involved in the project.

Another work done by Wilfred et al. (2015) examined the problems occurring in the construction firm because of improper implementation of the materials management system. The author explained that the greater the variations in the cost of materials more will be the overall cost of materials and it has a direct impact on the overall cost of a project. This variation can be identified by ABC analysis. The author found that the cost among Class A materials is of prime importance and affects the overall cost of the project.

Another research carried out by Dhoka and Choudary, (2013) explores the use of ABC classification for optimizing the inventory. This study focuses to check whether some assumptions of ABC analysis are taken for granted. The author found that improperly done ABC analysis lead to serious inventory management issues such as maximum inventory investment, maximized the direct cost associated with inventory, etc.

According to RathinaKumar et al. (2018), the major aspects of materials management are materials planning and inventory control. The methodology used by the author is classifying the inventory by ABC analysis, S-Curve analysis and EOQ analysis. To maintain sufficient stock in inventory and to overcome stock-out problems, ABC and EOQ analyses are performed. ABC and EOQ analysis is also performed to protect the materials in the inventory against damages and to reduce inventory holding costs. The author found that adoption of these simple inventory control techniques results in less inventory expenditure.

Shet and Narwade (2016) attempted the study on various functions of materials management. The author identified these functions with an estimation of material requirement, procurement, inventory control, storage, disposal of surplus material and scrap. The author found that material procurement in advance or delay, can affect the project cost, quality and time of the project so, it has become necessary to get material at the right cost, at the right quality, at the right place and at the right time. Men and machinery become ideal if the material is not available at the right time due to this delay occur and ultimately overall cost of the project increases. This can be prevented by using inventory control techniques such as ABC analysis, VED analysis and SDE analysis. The author has given the criteria for these techniques like; ABC analysis is based on inventory value of material, VED analysis gives priority to the utility of material and SDE analysis gives the availability of the material in the local market.

An extensive study of literature has been carried out in the area of materials management. From the literature review, it is understood that materials management at construction sites requires further research to find some feasible solutions to control the total project cost. The use of simple inventory control techniques is one of the solutions to reduce total project cost. From the literature study, it is found that very few construction projects are well planned before implementation and projects are always affected by time overrun and cost overrun due to several reasons one of them is poor materials management at the site. So, this research paper is an attempt to find a technique to control the inventory cost and procurement of materials before the actual execution of work.

From the literature survey, it is observed that the research carried out through inventory control techniques and for materials management is limited to residential projects only. Very few studies are carried out on infrastructure projects. So, the Bridge construction projects are selected as a case study for the research work.

## 3. METHODOLOGY

The current study aims are to develop a standard system of materials management for two sites, the first site is the Krishna Bridge Site, Karad and the second site is Ghod Bridge Site, Shirur. The required data for this study is collected from a Project Manager and Site Engineers. The data is collected with the help of interviews also, physical verification of the items on the ongoing site is performed by conducting field visits. Then the raw data is transformed into the required information. After the data collection, with the help of Spreadsheets, the analysis is performed. Following Figure 1 gives the overall methodology adopted for this study.

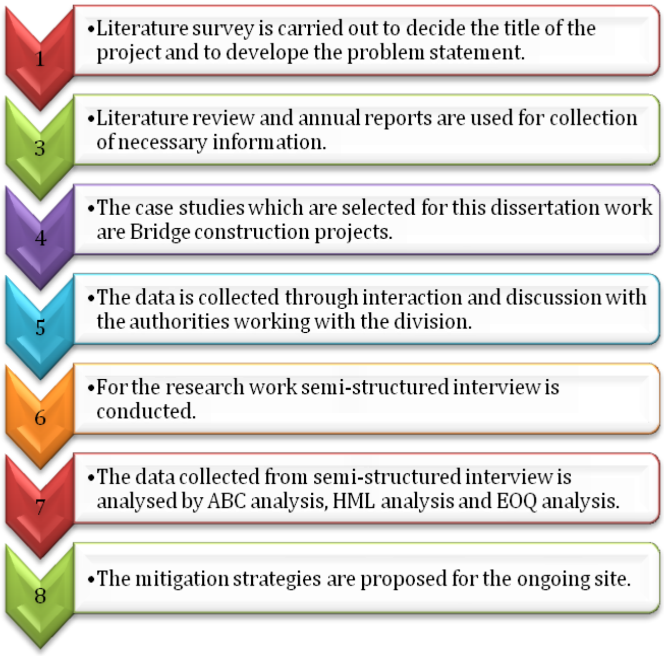


**Fig. -1:** Flow chart of methodology

### 3.1 Selection of a case study

To investigate the materials management at a construction site and to study the inventory control techniques for cost optimization, two infrastructure construction projects are selected as a case study. The details of these case studies are shown in following Table 1.

**Table - 1:** Details of case studies

| Content | Case study - I | Case study - II |
|---|---|---|
| Name of the project | Krishna Bridge, Karad | Submersible Bridge, Ghod |
| Location | Karad, Dist. Satara | Shirur, Dist. Pune |
| Main contractor | Kalyan Raj Desai | P.W. East Division |
| Date of commencement | October 2018 | March 2020 |
| cost of project | 22 Crore | 522.30 Lakhs |
| Type of bridge | PSC Box Girder | Submersible bridge |
| Type of foundation | Pile foundation | Open foundation |
| Type of superstructure | PSC box girder | RCC solid slab |
| Type of substructure | Semicircular solid piers | RCC solid piers |
| Total length of bridge | 320 m | 130 m |
| Span length | 40 m | 10 m |

### 3.2 Analysis of site

The main challenge faced by the construction industry is the trouble of delay and cost overruns due to improper materials management at construction sites. Hence, the present study is focused on the factors affecting inventory cost at the Krishna Bridge site and Ghod Bridge site. There is no proper system for the procurement of construction materials at the Krishna Bridge, Karad. Also, the contractor does not follow any inventory control techniques for construction materials. Contractors are following traditional ways for inventory management using their past experience. Orders are placed without calculating the EOQ and checking safety stock. Hence, unpredictable problems like cost and time overrun are faced by the contractor and site workers because of the ineffective inventory management at the site. The analysis of different inventory control techniques in this present study can result in overcoming these problems. The results obtained from those techniques are further described.

## 4. DATA ANALYSIS AND DISCUSSION

In data analysis and discussion, the results of the data are presented, analyzed and discussed. The analysis of different inventory control techniques is performed with the help of Spreadsheets. Those Spreadsheets are user-friendly and can be used for analysis of similar projects. It also discusses the current practices of materials management and the application of inventory control techniques on selected case studies. One of the most common and effective approaches is ABC analysis and then HML analysis. EOQ analysis is used for finding out the order quantity of materials. The application and the results of these techniques on selected case studies are further discussed.

### 4.1 ABC analysis for Case Study-I (Krishna Bridge Site)

#### 4.1.1 Illustrations

As the objective of the study is to control and optimize the inventory cost hence, the ABC analysis has been done using collected data. For the ABC classification process, a total 60 materials are selected from the actual site. Calculation of data and analysis is done in Spreadsheets. After calculations, the results are interpreted in tabular formats and graphs.
The items are classified based on the steps mentioned below;

1. Prepare the list of items and calculate their unit price, annual demand, annual usage and percentage of annual usage.
2. Arrange the items in the descending order of their annual usage.
3. Calculate cumulative of annual usage and then categorize the inventory item.
4. Plot the graph based on "cumulative of annual usage" and then categorize the inventory items.

#### 4.1.2 Results

An analysis of the annual consumption value is shown in Table 2 and corresponding plots are illustrated in Figure 2. Table 2 shows that 70% of the total annual consumption values are due to 26% of the total number of items are considered under category A. So, there should be a high level of inventory that must be maintained. 25% of the total annual consumption value is from nearly 35% of the total number of items are considered under category B since they should have moderate control over its inventory. 5% of the total annual consumption value is from more than 39% of the total number of items are considered under category C. This category amounts to only 5% of its total volume hence, it requires less control. The results from the ABC analysis as shown in Table 2 has represented what level of control should be imposed on a different category of materials.

**Table - 2:** Summary of ABC analysis

| Class | Number of items | % of items | % of total consumption value |
|---|---|---|---|
| **A** | 11 | 26 | 70 |
| **B** | 15 | 35 | 25 |
| **C** | 34 | 39 | 5 |

From a total of 60 items, 11 items as shown in Table 2 and Figure 2 are categorized in Class A, 15 items are categorized in Class B whereas 34 items are categorized in Class C. Cement, HT Strands, Trestles and steel of all sizes except 12 mm and 20 mm are categorized in Class A. Other materials such as Bearings, Aggregates, RMC, Murum, Crush sand, etc. are fall in Class B items.

- Graph for ABC Distribution is illustrated in Figure 2.

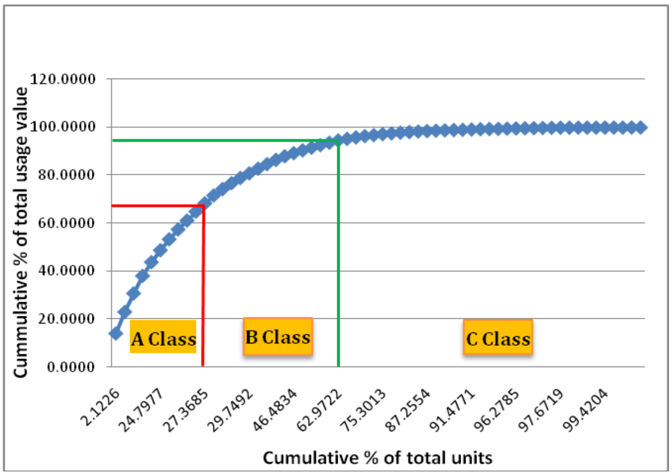


**Fig. - 2:** ABC Distribution Curve

### 4.2 HML analysis for Case Study-I (Krishna Bridge Site)

#### 4.2.1 Illustrations

In HML analysis, the total 60 materials are categorized into 'H', 'M' and 'L' categories based on their unit cost in Excel Spreadsheets. In HML analysis, cut-off lines are fixed by the management to classify the inventory items. In the present analysis, the cut-off-lines are based on their unit cost such as,

- H - class items - (H>48000) Rs.
- M - class items - (48000>M>5000) Rs.
- L - class items - (L<5000) Rs.

The items are classified based on the steps mentioned below;

1. Prepare the list of items and calculate their unit cost, annual demand, annual usage and percentage of unit cost.
2. Arrange the items in the descending order of their unit cost.
3. Calculate cumulative of unit cost and then categorize the inventory item.
4. The cut off lines are then fixed by the company for deciding H, M and L categorize.
5. Plot the graph based on "cumulative of unit cost" and then categorize the inventory items.

#### 4.2.2 Results

The following Table 3 shows that about 8% of the items are classified as 'H' items which contribute towards 21% of the annual consumption. Further 17% of the items are classified as 'M' items which contribute towards 32% of total annual consumption. The remaining 75% of items are classified as 'L' items which contribute towards 47% of the total annual consumption. (Refer to Table 3). From HML analysis, it has been found that High Priced items such as HT Strands, Reinforcement steel should be checked more frequently than low priced items such as Sand, Aggregate, Murum, Pipes, Shuttering plates, Nut bolts, Binding wire, etc.

**Table - 3:** Summary of HML analysis

| Category | Annual demand | % of annual demand | Annual usage | % of annual usage |
|---|---|---|---|---|
| **H** | 5 | 8.3333 | 15854443.5 | 21.2339 |
| **M** | 10 | 16.6667 | 24036405.8 | 32.1920 |
| **L** | 45 | 75.0000 | 34774916.5 | 46.5741 |
| **Total** | 60 | 100.0000 | 74665765.8 | 100.0000 |

➢ Graph for HML Distribution is illustrated in Figure 3.

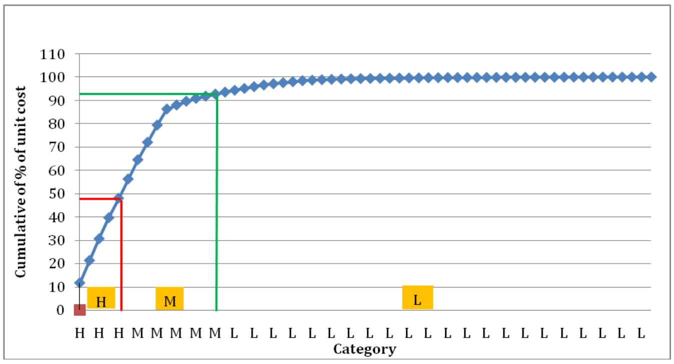


**Fig. - 3:** HML Distribution Curve

Figure 3 depicts a graphical representation of the cumulative percentage of unit cost. HML distribution shown in Figure 3 represents, among the selected 60 items of the bridge site, 5 items are considered in the 'H' category, 10 items are considered in the 'M' category and the remaining 45 items are considered in the 'L' category.

### 4.3 EOQ analysis for Case Study-I (Krishna Bridge Site)

#### 4.3.1 Illustrations

While performing EOQ analysis, ordering cost and inventory carrying cost is assumed and collected from the site data with practical execution procedure of construction activities. Ordering cost includes telephone costs and transportation costs whereas inventory carrying cost includes inventory maintenance, cost of storage, insurance taxes, deterioration and obsolescence. In this study, EOQ analysis is performed on A-Class materials and calculations are done in Spreadsheets.

#### 4.3.2 Results

The EOQ and the number of orders purchased per year have been calculated for the A-Class components are shown in Table 5 and Figure 4. The calculated EOQ has been compared with the number of units of each component purchased i.e. order quantity in the organization which is shown in Table 5. It is found that there is a variation in the calculated EOQ and the current ordering policy of the organization. This is because the employees at the site place order often when the demand arises without determining EOQ.

Take an example for cement, as per the current ordering policy of the organization gives 130 cement bags per order for construction activities (Refer Table 5). Due to this order, carrying costs and inventory costs increases. But after applying EOQ analysis on cement bags, optimal order quantity is obtained which is 893 units (Refer Table 5). At this order, a firm can minimize the ordering and carrying costs. Also, organizations can minimize the number of orders for cement bags from 152 to 22 (Refer Figure 5). This EOQ analysis will help the manager to avoid the problems of overstock and minimizes the ordering cost.

**Table - 4:** Calculated EOQ and current ordering policy of an organization

| Sr. No. | Material description | Calculated EOQ | Current Ordering policy of organization |
|---|---|---|---|
| **1** | M40 | 109 | 28 |
| **2** | Cement | 893 | 130 |
| **3** | Steel (16 mm) | 19 | 5 |
| **4** | M35 | 68 | 23 |
| **5** | Steel (10 mm) | 15 | 7 |
| **6** | HT Strands | 12 | 6 |
| **7** | Steel (32 mm) | 15 | 6 |
| **8** | Steel (25 mm) | 12 | 7 |
| **9** | Trestles | 44 | 20 |
| **10** | Shuttering plates | 75 | 21 |
| **11** | M30 | 39 | 13 |

➢ Following Table 5 shows total cost of inventory after adoption of EOQ analysis is less than without adopting EOQ.

**Table - 5:** Comparison of cost with EOQ analysis and without EOQ analysis

| Sr. No. | Material description | Total cost (Without EOQ) | Total Cost (With EOQ) | Difference between without EOQ and with EOQ |
|---|---|---|---|---|
| 1 | RMC M40 | 10616133 | 10533044.47 | 83088.52573 |
| 2 | Cement (OPC 53 grade) | 6771600 | 6734832.237 | 36767.76254 |
| 3 | STEEL 16 mm | 5943775 | 5901484.726 | 42290.27395 |
| 4 | RMC M35 | 5547679.2 | 5496075.207 | 51603.99253 |
| 5 | STEEL 10 mm diameter | 4354372 | 4364717.991 | -10345.99092 |
| 6 | HT Strands | 3410560 | 3811967.645 | -401407.6455 |
| 7 | STEEL 32 mm diameter | 4140315 | 3488661.158 | 651653.8423 |
| 8 | STEEL 25 mm diameter | 4175100 | 3121733.117 | 1053366.883 |
| 9 | Trestles (1.2m to 5m) | 2844250 | 2810184.573 | 34065.42739 |
| 10 | Shuttering Plates | 2865816 | 2798351.392 | 67464.60818 |
| 11 | RMC M30 | 2668494 | 2603525.661 | 64968.33865 |
| 12 | **Overall total cost** | **53338094.2** | **51664578.18** | **1673516.018** |

- From table 5, it is concluded that EOQ analysis gives better results for all the materials except Steel (10 mm dia.) and HT Strands.
- After applying EOQ on steel and HT strands, it is concluded that the total cost incurred with steel and HT strands with EOQ analysis is greater than the total cost incurred without EOQ analysis (Refer Table 5). So in that case our EOQ analysis fails.
- Table 5 indicate that after applying EOQ analysis on the Krishna bridge, the total cost of Class-A items has been decreased by 4.13%.

➢ Following Figure 4 shows number of orders with and without EOQ analysis.

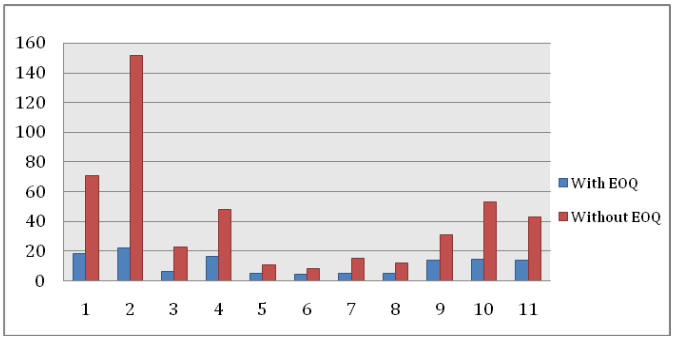


**Fig. - 4:** No. of orders in EOQ analysis

From Figure 4, it is observed that if the organization follow the EOQ analysis then the number of orders for materials will be minimized as compared to without EOQ analysis. Ultimately this will reduce the overall inventory cost.

## 4.4 ABC analysis for Case Study - II (Ghod Bridge site)

### 4.4.1 Illustrations

For the ABC classification process, total 43 materials are selected from the actual site. The calculations of data and analysis are done in spreadsheets.

### 4.4.2 Results

The results of the ABC classification as shown in Table 6 shows that 80% of the total annual consumption values are due to 15% of the total number of items are considered under category A. So, there should be a high level of inventory must be maintained. 15% of the total annual consumption value is from nearly 33% of the total number of items are considered under category B. Since they should have moderate control over its inventory. 5% of the total annual consumption value is from more than 52% of the total number of items are considered under category C. This category has very less annual consumption hence, it requires less control. A total of 43 items, 8 items as shown in Table 6 and Figure 5 are categorized in Class A, 13 items are categorized in Class B whereas 22 items are categorized in Class C. Cement, HT Strands, Fe 500 steel and aggregate are categorized in Class A. Other materials such as Bituminous concrete, RMC, Expansion joint, Murum, Granular sub-base, etc. are fall in Class B items.

**Table - 6**: Summary of ABC analysis

| Category | Number of items | Cumulative % of total items | Cumulative % of total consumption value |
|---|---|---|---|
| **A** | 8 | 15 | 80 |
| **B** | 13 | 33 | 15 |
| **C** | 22 | 52 | 5 |

➢ Graph for ABC Distribution is illustrated in Figure 5.

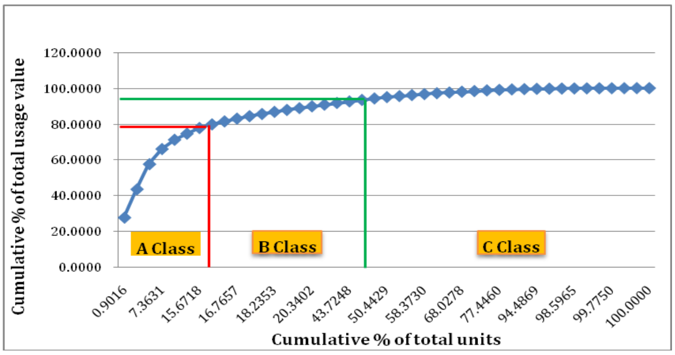


**Fig. - 5:** ABC Distribution Curve

Figure 5 graph for ABC Distribution shows that 80 % (75-80% standard) of the items are from A category in the organization, 15% (10-20% standard) of items are from B category in the organization and 5% (below 10% standard) of items are from C category. It is clear that the organization follow ABC analysis for inventory control, but still, they can improve their inventory management.

### 4.5 HML analysis for Case Study - II (Ghod Bridge site)

#### 4.5.1 Illustrations

A total 43 materials are selected for the HML analysis and the calculations carried out in the spreadsheets. In the present analysis, the cut-off-lines are based on the unit cost of material and given by the organization such as,

- H - class items - (H>44000) Rs.
- M - class items - (44000>M>5100) Rs.
- L - class items - (L<5100) Rs

#### 4.5.2 Results

From Table 7, it has been found that about 5% of the items are classified as 'H' items which contribute towards 35% of the annual consumption. Further 14% of the items are classified as 'M' items which contribute towards 25% of total annual consumption. The remaining 81% of items are classified as 'L' items which contribute towards 40% of the total annual consumption.

**Table - 7:** Summary of HML analysis

| Category | Annual demand | % of annual demand | Annual usage | % of annual usage |
|---|---|---|---|---|
| **H** | 2 | 4.6512 | 14949480 | 35.3119 |
| **M** | 6 | 13.9535 | 10458476.15 | 24.7038 |
| **L** | 35 | 81.3953 | 16927600.66 | 39.9844 |
| **TOTAL** | 43 | 100.0000 | 42335556.81 | 100.0000 |

From Table 7 and Figure 6, it is found that among the selected 43 items from the Ghod Bridge site, 2 items are found High Priced, 6 are found to be Medium Priced items and 35 are found to be Low Priced items. This analysis will help the manager to give a relative importance to items according to their unit price.

➢ Graph for HML Distribution is illustrated in Figure 6.

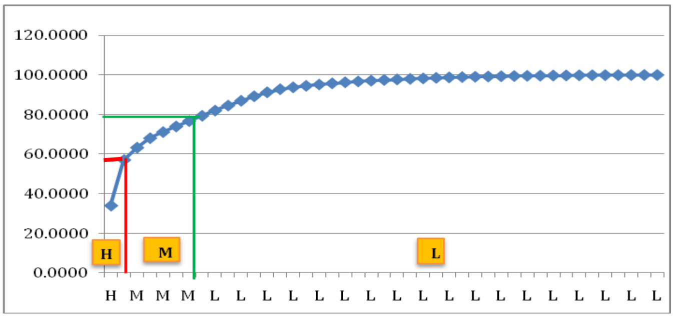


**Fig. - 6:** HML Distribution Curve

From the HML analysis, it is observed that High Priced items such as HT Strands and TMT Fe500 bars should be checked more frequently than Low Priced items such as bearing pads, sand, aggregate, murum, PVC pipes, admixtures, nut bolts, binding wire etc.

### 4.6 EOQ analysis for Case Study - II (Ghod Bridge site)

#### 4.6.1 Illustration

At the Ghod bridge site, incomplete data is obtained regarding EOQ analysis because of their privacy policy. The data relating to the current ordering policy of material is not obtained from the Ghod Bridge site. Hence, the cost comparison between EOQ analysis and without EOQ analysis is not possible. The calculation of only total cost with EOQ analysis has been done for the Bridge site.

#### 4.6.2 Results

As shown in Table 8, after conducting EOQ analysis on cement and steel, it is concluded that economic order quantity which is 100 Bags and 25 MT respectively and frequency of order which is 39 days and 42 days respectively which has overcome the problems of stock out successfully. After the performance of EOQ on RMC M40 and RMC M30, it is found that the frequency of order is 44 days and 36 days respectively (Refer Table 8) but on the actual site, demand is as per daily requirement. Hence, it can be concluded that those material does not give satisfactory results.
The purchase of bulk amount of inventories lead to wastage of inventory. It could be controlled the inventory cost of steel, H.T. strands, cement, RMC, aggregate and bearings by purchasing only the optimum order quantity of materials as shown in Table 8.

**Table - 8:** Summary of EOQ analysis

| Sr. No | Material description | Optimum Order Quantity | No. of orders | Order cycle in days |
|---|---|---|---|---|
| **1** | TMT Fe 500 | 25 | 9 | 42 |
| **2** | H.T. strands | 16 | 5 | 72 |
| **3** | Cement | 100 | 9 | 39 |
| **4** | RMC M40 | 64 | 8 | 44 |
| **5** | RMC M30 | 40 | 10 | 36 |
| **6** | Bituminous wearing coat | 16 | 8 | 47 |
| **7** | Aggregate 13.2 mm | 132 | 11 | 33 |
| **8** | Elastomeric bearing | 20 | 3 | 127 |

From Figure 7, it is concluded that the organization should obtain its inventory requirements by placing orders as shown in Figure 7 with EOQ analysis. This reduces the ordering costs and saves on costs related to transportation, packing, documentation, billing, etc.

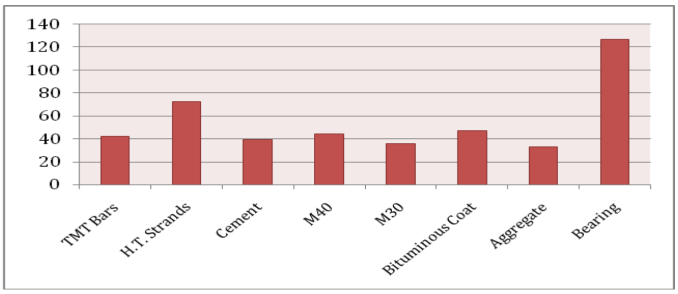


**Fig. - 7:** Name of material Vs frequency of ordering

## 5. CONCLUSIONS

- From the study, it is observed that construction sites selected for the case study do not follow inventory control techniques. Materials used on the site are ordered through the experience without calculating EOQ and checking safety stock. Due to which problems such as shortage of stock, overstock, cost overrun and delay of a project are faced by the managers because of an ineffective inventory management system. To increase the efficiency of the system, the use of inventory control techniques such as ABC analysis, HML analysis and EOQ analysis is suggested.
- In ABC analysis, it is observed that 11 items and 8 items fall under the A category,15 items and 13 items fall under the B category, 34 items and 22 items fall under the C category for the Krishna Bridge site and Ghod Bridge site respectively. At the construction site, less attention is given to trestles, shuttering plates and bearings which are A-Class items and also, they have high annual usage. Since there is the greatest potential to reduce cost by controlling only A-Class material.
- For both the case study results from HML analysis is not satisfactory because there is a large gap in the prices of the H category and M category. Also, very few items fall under H category like in the case of Krishna Bridge, only 5 items falls under H items and for Ghod Bridge, only 2 items fall under H items. Hence, organizations need to improve HML analysis for inventory control. It is recommended that High Priced items i.e. HT Strands and Steel for Krishna Bridge and HT Strands and TMT Fe 500 for Ghod Bridge should be checked more frequently than Low Priced Items.
- After analyzing the results for the Krishna Bridge site, it is found that with their current procurement system for materials, the company's order cost was high due to frequent ordering. If the company proceeds with the implementation of EOQ, it would decrease the total cost of Class-A items by 4.13%. But for materials steel and HT strands, EOQ analysis fails because the total cost incurred with steel and HT strands with EOQ analysis is 8176685.636 Rs. which is greater than the total cost incurred without EOQ analysis which is 7764932 Rs.
- For the Ghod Bridge site, it is concluded that by adopting EOQ, we can control the inventory cost for steel, H.T. strands, cement, RMC, aggregate and bearings by purchasing only the optimum order quantity of materials.
- From the study, it is observed that the organization may use a simple inventory control technique that is equally economical instead of using costly software for inventory management.

### 5.1 Limitations

- This research study does not include the study of non-consumable material items.
- Detail study about all the material was not possible because of a time constraint.
- Due to the restriction of some departments as per company policy, 100% of authenticated data from the site is not available.
- Cost comparison with EOQ analysis and without EOQ analysis for the Ghod Bridge site was not done due to the non-availability of data regarding the cost of the material.

### 5.2 Future scope

- This study recommends further study in introducing new technologies such as RFID, ICT and Bar Coding for material tracking and management.
- In this research work, only three types of inventory control techniques have been analyzed. Further study can be taken place to analyze other inventory control techniques such as SDE analysis, VED analysis, XYZ analysis, FSN analysis and JIT. Also, there is scope for sensitivity analysis in EOQ calculations.

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