INVENTORY MANAGEMENT OF LARGE MEDIUM AND SMALL SCALE CONSTRUCTION SITE BY CARRYING OUT ABC ANALYSIS IN RELATION TO EOQ AND S-CURVE

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Abstract- Materials management is an important component of the construction industry. Thus, organizations need to understand the effects of proper material management techniques on the effectiveness of the project. A material management program is implemented correctly to achieve timely flow of materials and equipment to the jobsite, and thus facilitate improved work planning the face, improved labour productivity, better schedules and lower project costs. Material is a big burden in development, so as to minimize procurement costs increase opportunities to reduce overall project costs. If the materials have to be bought too early, the capital can be raised and the cost of interest on excess supplies. This paper deals with the identification of selective inventory control techniques and the development of a framework for assessing a wide range of materials management techniques. In the end, the framework has been developed that can be used for future research in this area. Construction materials are a major cost component in the development of each project. The total cost of materials installed may be 50% or more of the total cost. Material is a huge cost in development. Delays and costs may be incurred if the material required for a particular activity. Ensure timely flow of materials is an important concern of materials management. The objective of the materials management is to ensure that materials are available at their point of use when needed then, efficient procurement of materials represent a key role in the successful completion of the construction work. The main objective of this project to find variations in vs Actual planned material costs through the analysis of the a-b-c and e-o-q and apply the material inventory management so as to minimize stock problems and minimize the total cost of residential construction projects. For this study we consider residential building construction SP construction Pune the abc analysis procedures for inventory control framework that was first used to distinguish the most important thing and following several economic order quantity (eoq) of each item produced to find the supplies they show independent state. Utilization of this model will help the association to determine the optimal number of items of the order within one year and when to put the new request for each item.

Keywords- Material Management, Carrying Out ABC Analysis, EOQ Analysis,S-Curve.

1. INTRODUCTION

1.1 GENERAL

Materials management is a system for planning and controlling all necessary efforts to ensure that the right quality and quantity of the correct material is determined in a timely manner, be obtained at a reasonable cost and most importantly provided at the point of use when needed. Thus the materials management is an element imp in project management. Materials management requires the right mix of technical and commercial expertise, which operates within the appropriate framework and organizational structure which is good if provide the most efficient and effective demanded it. Increasingly, the technique is being applied selectively to all functions in materials management to achieve an efficient method to reduce inventory costs. Materials management is the main business functions responsible for the coordination of planning, sourcing, purchasing, moving, storing, and controlling the material optimally so as to provide pre -decided services to customers at minimum cost. Thus the materials management is an important element in project management. The materials on a project can represent anything from 50% to 60% of the cost of the work, thus minimizing procurement costs increase opportunities to reduce overall project costs.

1.2 PROCESS OF INVENTORY MANAGEMENT AND CONTROL

Inventory management and control refers to the planning for the optimal amount of material at all stages in the production cycle and develop techniques that will ensure the availability of supplies planned. Here are four steps involved in the process:

1. **Determination of optimum inventory levels and procedures of their review and adjustment**: It is a significant step but a difficult one. Too much inventory results in locking up of working capital accompanied by increased carrying costs (but reduced ordering costs). Excess inventories, however, guarantee uninterrupted supply of materials and components, to meet production schedules and finished goods to meet customers demand. Too less of inventory releases working capital for alternative uses and reduces carrying costs and increases ordering costs. But there is the risk of stock out costs.

2. Determination of the degree of control that is required for the best results: The second aspect of inventory management is to decide just how much control is needed to realize the objectives of inventory management. The difficulty is best overcome by categorization of inventory on the basis of value. Popularly called the ABC categorization, this approach is useful in deciding the degree of control. 'A' class items are 'high' in value but 'low' in quantity, 'C' class inventories are the opposite of 'A' group i.e. 'high' in quantity and 'low' in value. In between are the 'B' group stocks which are more or less equal in quantity and value proportion to the total inventory. Tight control is exercised on 'A' category items through

accurate records of receipts and issues and by co-ordination of incoming shipments with production managements.

3. **Planning and design of the Inventory control system**: An inventory system provides the organizational structure and the operating policies for maintaining and controlling goods to be inventoried. The system is responsible for ordering and receipt of goods, timing the order placement, and keeping track of what has been ordered, how much, and from whom.
4. **Planning of the Inventory control organization:** It is yet another important aspect of inventory management because choosing the panel to control is very difficult.

1.3 ECONOMIC ORDER QUANTITY: Economic order quantity is the level of inventory that minimizes the total inventory holding costs and ordering costs. It is one of the oldest classical production scheduling models. The framework used to determine this order quantity is also known as Wilson EOQ Model or Wilson Formula. The model was developed by F. W. Harris in 1913. But still R. H. Wilson, a consultant who applied it extensively, is given credit for his early in-depth analysis of the model.

1.4 OBJECTIVES OF THE STUDY

1. To study the present practices of materials management for construction area
2. To select the Qualitative analysis technique such as Always Better Control (ABC) and Quantitative Approach like Economic Order Quantity.
3. To apply and analysis ABC and EOQ technique on site and analyze the material performance.
4. To keep up the sufficient stock of raw material and Control investment in inventories and give helpful suggestion for Future work.

1.5 NEED OF STUDY

The need of material management is to assure that the right materials are in the right place, in the right quantities when needed. The purpose of inventory management is to ensure availability of materials in enough quantity as and when required and also to minimize investment and reduced the overall project cost of inventories

2. INVENTORY MATERIAL MANAGEMENT

2.1 INTRODUCTION

Material management is defined as "The coordination of planning, sourcing, purchasing, moving, storing and controlling materials in an optimum manner so as to provide a pre decided service to the customer at a minimum cost." Materials management is a concept having its definite organization to plan and control all types of materials, its supply, and its flow from raw stage to finished stage so as to deliver the product to customer as per hire requirements in time. It involves different functions like materials planning and controlling, purchasing, stores and inventory control. The materials requirements planning, purchasing, inventory planning, storage, inventory control, materials supply, transportation and materials handling are the activities of materials management.

2.2 FUNCTION OF MATERIAL MANAGEMENT

The major functions of material management are identified as:

1. Materials Planning and controlling: This involves estimation of the requirement of individual materials, preparing Material cost, determine levels of inventories and scheduling.
2. Purchasing: This involves planning, organizing and directing the purchase of all types of materials.
3. Stores and inventory control: This involves physical control of materials, optimizing of useless and damage materials through timely disposal and well-organized handle of materials, maintenance of store records, proper location and stocking of materials etc.
4. Planning of transportation in the most economical way for the incoming and outgoing of the materials.
5. To generate the coordination between various departments.

2.3 OBJECTIVES OF MATERIAL MANAGEMENT:

The main objective of material management is to reduce the cost of the material that is to be incurred on materials and to increase the profit of organization the objectives are as follows:

• Right quality of materials in required quantity at an appropriate cost from proper place with right terms and condition so as to remove the expenditure on materials.

1. By preferring latest techniques, economy is to be achieved.
2. Reduction in investment through scientific inventory control.
3. Efficiently materials planning.
4. Purchasing or Buying.
5. Procuring .Receiving.
6. To inventory control.
7. For storing • Supplying & distribution of materials.
8. For quality control.
9. For the good supplier and customer relationship.
10. To take make or buying decisions.
11. To prepare the specification and standardization of materials.
12. For determine demand and quality of material requirements.
13. For handling of materials • Smooth flow of materials.

2.4 IMPORTANCE OF MATERIALS MANAGEMET:

The management of the materials plays vital role for the successful completion of a project control of the materials management is a very important for every firms in the material management different materials account for a big part of product and cost of project. Cost represent by material fluctuates and comprise between 20 to 50 % of the total cost of project and sometimes more many study concluded that materials account for around 50 to 60 % of the cost of project.

2.5 SCOPE OF MATERIALS MANAGEMENT:

Materials Management can be defined as that function that responsible for the Coordination of planning, sourcing, purchasing, moving, storing, and controlling of materials in optimum way so as to provide service for the customer, at a pre-decided level at a minimum cost.

2.6 ADVANTAGES OF MATERIALS MANGEMENT:

1 Better controlling of material.
2 Better quality control.
3 Materials will be on site when needed and in the required quantities.
4 Reduction of stock.
5 Good relation with supplier.
6 Site storage reducing.
7 Saving on purchases.
8 Reduction in transportation cost.
9 Minimum prices and better delivery conditions for purchased materials.
10 More flexibility.
11 Improvements on project schedule.
12 Minimized in duplicate orders.
13 Good cash flow management.

2.7 MATERIAL REQUIREMENT PLANNING:

Planning of the material is a scientific way of assuring the requirements of raw materials, equipment, machinery and components that are required for meeting the resource requirement of a project within the overall financial investment policies of a construction company. Planning of material is a function sub system in the overall planning activity.

2.7.1 OBJECTIVE OF MATERIAL REQUIREMENT PLANNING

• To ensure that all material of components are available for the construction activity.
• To maintain optimum inventory level but also ensure right quantity of materials is available at the right time to produce right quantity of final products.

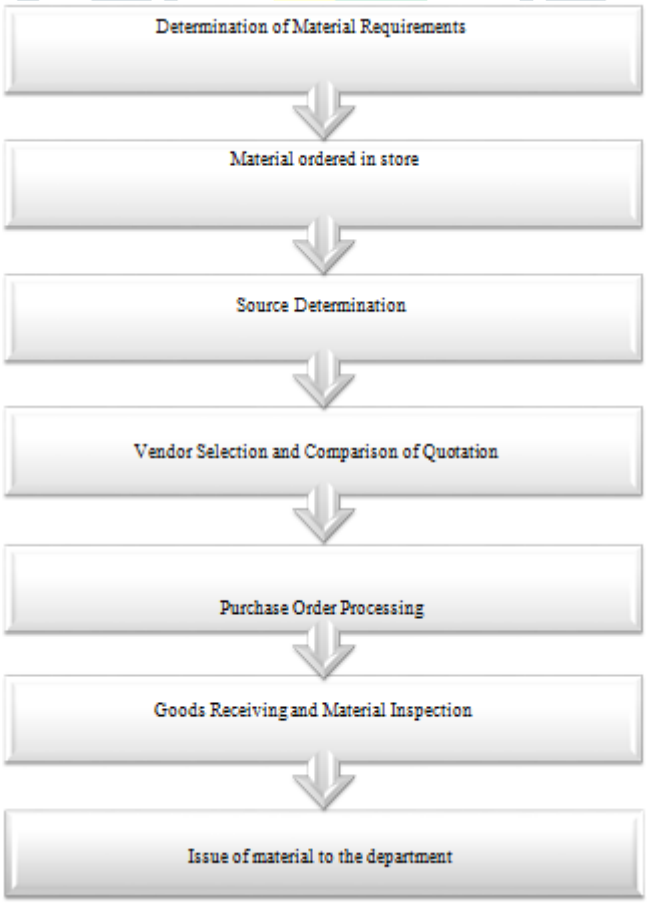


Fig 2.1 Material Management process for Construction Site

3. LITERATURE REVIEW

The review of existing literature in the field of Material Management which helps in capturing both conceptual and research based studies.

Abramovitz and Modigliani et al. (1957) they highlighted the connection between capability utilization as well as inventory investment. Existing inventory of inventories was likely to change to the desired quantities. Hence the adjustable, existing inventory of inventories , was necessary to be badly associated with the preferred inventory. The end result was that there's good relation of all the ratio of inventory to product sales as well as inventory investment. High ratio of stocks to product sales in the past indicates necessity of higher amounts of inventories before and promising excessive buy of inventories in the present time too. **(1)**

Krishna Murthy et al. (1964) Study was aggregative and also managed inventories of the private sector of Indian economic climate like an entire for the period 1948 61. This particular analysis used product sales to represent need for the item and also suggested the benefits of accelerator. Short term rate of interest had been discovered to be considerable. **(2)**

R.S. Chadda et al. (1964) Study was created on inventory management methods of Indian businesses. The analysis recommended program of contemporary scientific inventory management methods as activities research. These contemporary medical methods furnish possibilities for all the businesses, Companies are able to reduce the investment of theirs in inventory but there's constant flow of output. He argued that industrially advanced nations, USA, like, were interested in building extremely advanced mathematical versions as well as methods for modernizing as well as redefining the present resources of inventory investment. **(3)**

National Council of Applied Economic Research (NCAER) et al. (1966) Conducted a report in 1966 about working capital management of 3 industries specifically cement, sugar and fertilizer. This particular analysis mostly dedicated to ratio analysis of structure, financing and utilization of working capital for the time of 1959 to 1963. The study reveals that inventory constituted a significant component of working capital i.e. 74.06 per dollar in the high sugar industry followed by cement market (63.1 %) as well as fertilizer market (59.58 %). It was noticed that listing had not handled properly. Up to now as the utilization of working capital was fertilizer, cement, and concerned business had better implementation of working capital. The sugar business had substantial build-up of stocks so we had ineffective utilization of working capital greatly. **(4)**

Krishnamurty and Sastry et al. (1970) It's probably the most thorough research on manufacturers' inventories. They utilized the CMI information and also the consolidated balance sheet information of public restricted businesses posted by the RBI, to analyse every one of the main elements, such as the raw materials, finished and goods-in-process foods, for twenty one industries with the time ranging from 1946 62. The study was a period sequence 1 although there was several inter industry cross section analyses that have been carried through in the evaluation. The Accelerator represented by change of product sales, short-term interest and bank finance rate was discovered to become a crucial determinant. The utilisation of prosperous capability as well as cost anticipations had also been discovered to be applicable in the research. **(5)**

George et al. (1972) It was the analysis on cross section analysis of balance sheet information of fifty two public restricted businesses because of the time of 1967 seventy. Accelerator, external and internal finance variables have been viewed in the formulation of formulas for raw materials such as goods-in-process inventories. Nevertheless, formulas for done products inventories conceive just output adjustable. Deliberation was provided on external finance variables and accelerator. **(6)**

Mishra et al. (1975) It's the analysis of 6 main public sphere enterprises. He realized that (i) inventory constitutes the most crucial element of working capital of public enterprises (ii) performance of working capital money used within receivables is awfully lower in the selected companies and also (iii) In most devices both today's assets as well as the fast ratios are higher compared to the standards of theirs. Enterprises require appropriate command on receivables. **(7)**

Lambrix and Singhvi et al. (1979) Adopted working capital cycle procedure in working capital management, additionally recommended that investment in working capital could be enhanced and money flows could be raised by decreasing time frame of bodily flow beginning from the receipt of raw material to the shipment of finished products, i.e. inventory management, and also by enhancing the conditions as well as conditions where firm offers items in addition to receipt of money. **(8)**

Lal et al. (1981) He learned Modi Steels Limited as a case study, his analysis concentrated on inventory control. He originated an unit which will include price varying in inventory management; previous cost variable in catalogue wasn't considered in that organization. The evaluation suggested stable policies , that will take care of external and internal factors, ultimately it'd aid in earning effective working capital control. **(9)**

Farzaneh et al. (1997) Presented a mathematical model, to help the businesses in the decision of theirs to change from EOQ to JIT purchasing policy. He defines JIT as "to produce and provide done foods only soon enough being available, sub-assemblies only in time to be assembled in products & bought substance only in time to be converted into fabricated parts". He highlights the EOQ design concentrates on reducing the inventory fees instead of reducing the inventory. Under the perfect problem wherein all of the circumstances satisfy, it's economically better off to select the JIT with the EOQ since it leads to purchase price, buying price. **(10)**

4. RESEARCH METHODOLOGY

4.1 INTRODUCTION:

Research in common word refers to a search for the knowledge, information. Also can define as a scientific and systematic search for information on a specific topic . In short the search for knowledge through objective and systematic method of finding a solution to a problem is research. The aim of research is to discover answer to queries through the application of scientific process.

In this research the present material management practices are investigated. Material management is not just a concern during the observing stage in which construction is taking place. Choice about material procurement may also be required during initial planning and scheduling phase. Secondly, during execution, inventory control technique should be observed periodically so as to maintain the flow of material to avoid the delays.

4.2 RESEARCH PROCESS:

Material management process begins from the need generated from site then information conveyed to store, department and material are ordered in store and the indent is generated. This research process consists of a series of actions and steps essential to carry out research effectively. The fig 2 shown the well clarifies a research process adopted in this research work

Fig 4.1 Research process

4.3 OBJECTIVES OF RESEARCH:

The purpose of the research is collecting the various material data of the material from our residential construction project site. The main purpose of project is to the existing common practices in construction projects and applies the inventory control technique so as to analyse the effect of material management on our construction site of project.

4.4 QUALITATIVE ANALYSIS TECHNIQUES:

Qualitative Analysis techniques are working for the inventory control .Inventory techniques represent the operations aspects of inventory management and help to understand the objective of inventory management and its control many techniques for inventory control are in use and it depends on the policy of the firm, product, the techniques most commonly used are as under.

4.4.1 Always Better Control (ABC) Analysis: A.B.C. analysis is a systematic technique of controlling all different items of inventory. According to this method only those items are considered and given more consideration which are significant from business point of view. Also provide a way of identifying categories for stock that will require different management and handling when carrying an A-B-C (Always better control) analysis. Inventory items are value by cost of item multiplied by quantity issued in period with results then ranked and results are then grope typically into three groups. These groups called ABC codes. A-B-C analysis is a technique of controlling different items of inventory. Many items are in inventories. But all items are not equally important. Based on this method, only those items are more important which is significant for inventories. Based to this method all items are classified in three categories like A, B, C.

A, B, C.

'A' class' inventory will typical contain item that account 80% of the overall value or 20% of the overall items.
'B class' inventory will take around 15% of the overall value or 30% of the overall items
'C class' inventory will account the remaining 5% or 50% of the overall items.
The ABC classification method sis an analysis of a range of objects, such as finished products, items lying in inventory, customers into three categories. It is a system of classification and the method commonly categorizes inventory into three classes with each class having a different management control related: A - outstandingly important classes; B - of average importance classes; C – relatively unimportant class as a basis for a control system.

A items:

It is hardly found that 5-15% of items account for 70-80% of the total money consumed on materials. These items need detailed and rigid control and also need to be stocked in smaller quantities. These items should be procured frequently, the quantity per occurrence being small. A better approach would be to enter into a contract with the manufacturers of these items and have their supply in staggered lots according to production program of the buyer. This, however, will be possible when the demand is steady. Otherwise, the inventory can be kept at a minimum by frequent ordering.

B items:

These items are usually 30% of all items and represent 15% of the total spending on the materials. These are intermediate items. The control on these items need not be as detailed and as rigid as applied to C items.

C items:

There are frequent (as 50–60% of the total items), inexpensive (signify hardly 5–10% of the total expenditure on materials) and hence insignificant (not require close control) items. The procurement for these items is exactly the reverse of the A‟ items. C items should be procured infrequently and in sufficient quantities. This enables the buyer to avail discount in the price.

This analysis class the entire range of materials keep in stock in three categories – A,B, and C based upon their annual consumption value known as "annual usage value." Annual usage value for this item is the annual monetary value of consumption which can be computed by the following relationship:

Annual usage value = annual consumption in units × unit purchase price

ABC analysis, we arrange the annual usage value of items in the descending order with the maximum usage value at the top. A cumulative graph as shown in Fig. 3 is then obtained this data using

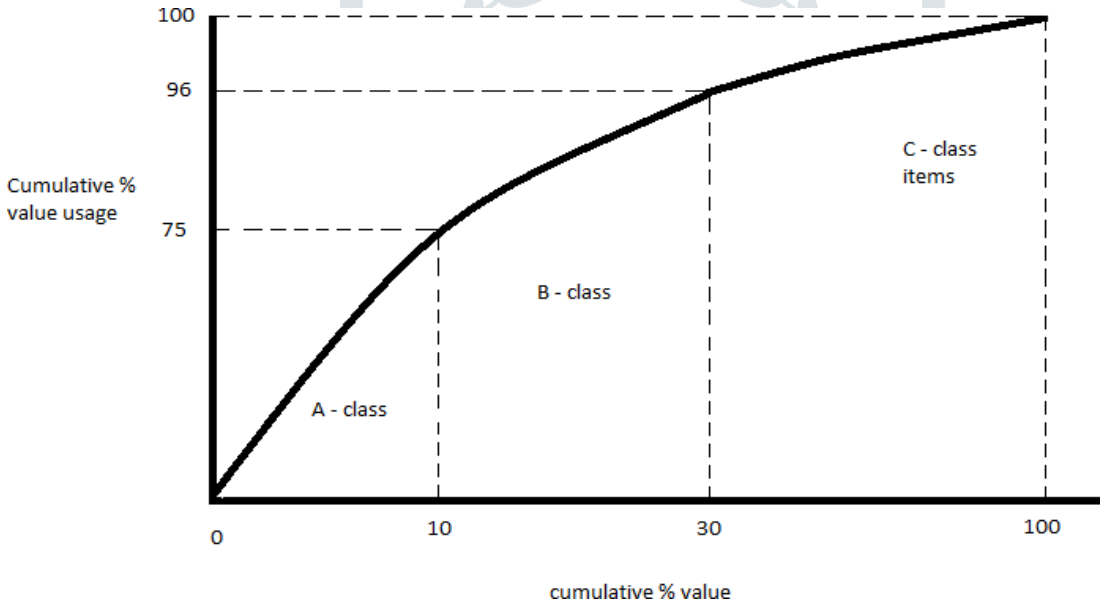


Fig 4.2 ABC analysis curve

Conducting ABC Analysis:

To conduct ABC analysis, following steps is necessary:

1. Make the list of items and evaluation their annual consumption (units).
2. Determine unit value (or cost) of all item.
3. Multiply each annual consumption by its unit value (or cost) to get its annual consumption in rupees (annual usage).
4. Arrange items in the descending order of their annual usage starting with the highest annual usage down to the least usage.
5. Analyse cumulative annual usages and express the same as cumulative usage percentages. Also express the number of items into cumulative item percentages.
6. Graph cumulative usage percentages along cumulative item percentages and separate the items into A, B and C categories.
7. To divide items into A, B and C categories, first some items which contribute between 70 –75% of cumulative usage can be considered as A category, next some items which together with A category items separated earlier contribute between 80 – 90% of cumulative usage can be considered B- category and remain over items can be taken as a C – category.

Advantages of ABC Analysis:

1. It ensures a closer and a better control over each items , which are having a sizable investment in there.
2. Profitable channel of investment.
3. Reduces inventory-carrying cost.
4. It enables the relaxation of control for the „C‟ items and thus makes it possible for a sufficient buffer stock to be created.
5. Reduce overall cost and better handling of each items.

4.5 QUALITATIVE APPROACH METHOD:

4.5.1 ECONOMIC ORDER QUANTITY (E-O-Q):

The meaning of the EOQ is the order of quantity that optimizes the overall cost and cost of ordering. Determining how much to order in a continuous system is the Economic Order Quantity (EOQ) model. The function of the EOQ model is to determine the optimal order size that reduces total inventory costs.

THE BASIC EOQ MODEL:

The basic EOQ model is a formula for finding the optimum order size that reduces the sum of carrying costs and cost of the ordering. The model formula is based under a set of simplifying assumptions, as follows:

- Demand is known with certainty and is constant over time.
- No shortages are allowable.
- Lead time for the receipt of orders is constant.
- Order quantity is received all at once

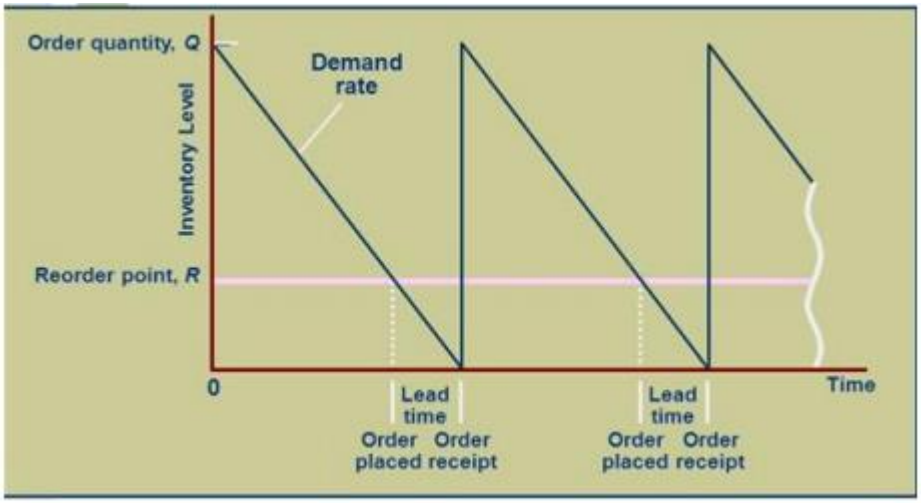


Fig. 4.3 Inventory Order Cycle

These basic model assumptions are reflected in Fig.4 which defines the continuous inventory order cycle system essential in the EOQ model. An order quantity, Q, is received and is used up over time at a constant rate. When the inventory level decreases to the reorder point, R, a new order is placed; a period of time, referred to as the lead time, is required for delivery. The order is received all at once just at the moment when demand reduces the entire stock of inventory Q the inventory level reaches O so there will be no shortages. This cycle is constantly repeated for the similar order quantity, reorder point, and lead time.

The economic order quantity is the order size that reduces the sum of carrying costs and cost of ordering. These two costs react inversely to each other. As the order size increases, fewer orders are required; causing the ordering cost to decline, but the average amount of inventory on hand will increase, resulting in an increase the carrying costs. So, in effect, the optimal order quantity describes a compromise between these two inversely related costs.

EOQ: THEORY AND FORMULA:

The most well-known results in the inventory control area may be the classical Economic Order Quantity (EOQ) formula. This simple rule has had and still enormous no of practical applications. The EOQ is essentially an accounting formula that determines the point at which the combination of cost of order and holding costs as least. The result is the most cost-effective quantity to order.

The basic Economic Order Quantity (EOQ) formula is as follows:

$$\textbf{EOQ} = \sqrt{\frac{2(Annualusage \in units)(Ordercost)}{(Annualcarringcostperunit)}}$$

Assumptions of the Model:

1. Demand rate is known and is constant with linear reduction of stock level.
2. Prime time is known and constant.
3. Entire lot of size Q arrives at one go (instantaneous replenishment or infinite replenishment rate). 4. Shortages are not allowed.
5. The cost of carrying inventory and ordering costs are known and are time invariant.
6. Unit purchase price is constant and is independent of order size. (No quantity discounts are available.)
7. Ordering cost is independent of the order quantity. 8. Inventory cost is linear function of the inventory level.

COST COMPONENTS:

ANNUAL USAGE AND DEMAND

Expressed in units this is generally the easiest part of the equation.

ORDER COST

This is the sum of the fixed costs that are incurred each time an item is ordered. These costs are not related with the quantity ordered, but mainly with physical activities required to process the order. For purchases items these would comprise the cost to enter the Purchase Order and/or Requisition, any approval steps, the cost to process the receipt, incoming inspection, invoice handling and vendor payment, and in some cases a portion of the inbound freight may also be included in order cost. It is important to understand that these are costs related with the frequency of the orders and not the quantities ordered.

CARRYING COST (INVENTORY HOLDING COSTS): Also called Holding cost, carrying cost is the cost associated with having inventory on hand. It is primarily made up of the costs related with the inventory investment and cost of storage. For the purpose of the EOQ calculation, if the cost does not change based upon the quantity of inventory on hand it should

not be included in carrying cost. In the EOQ formula, carrying cost is denoted as the annual cost per average on hand inventory unit. Below are the primary components of carrying cost.

BEHAVIOR OF EOQ SYSTEM

1. The amount ordered every time an order is placed is fixed.
2. A function of this type system is the two bin system.
3. As demand of the inventoried item occurs, the inventory level drops.
4. When ordered quantity is received, inventory level growths.
5. A continual inventory accounting system is usually related with this type of method.

LIMITATION OF EOQ:

1. Rate of usage varies maximum in many cases.
2. Cost analysis on the basis of which the formula is developed is merely notional rather than actually is some cases.
3. With practice unit cost of procurements of an item varies, lead times are inexact and also requirement or demands of inventory items are not perfectly predictable in advance.

4.6 ANALYSIS WORK AND DATA COLLECTION:

Analysis of work shall be carried out within the scope of the study and between the selected respondents of the material. This data will be divided into respondents and data will be collected through these residential building projects. By these analyses the perceptions of respondents with respect to Material management and reducing the average inventory will be fixed.

5. RESULT AND DISCUSSION

5.1 STAKE HOLDER DETAIL

Name of the organization	S P CONSTRUCTION PUNE
Year of Establishment	2015
Location	Karve Nagar SM tower near Jigamata chowk pune.
Structural Engineer	Mr.Rahul Kumar
Project Manager	Mr.Vivek Mangude
Elevation and Concept	Mr.Rohit Yadav
Architect Engineer	Mrs. Rishita Lunawat
Name of Contractor	Mr. Shailesh Jagtap
Type of Work	2 BHK Residential Project
No. of Floors	G+10

5.2 LIST OF MATERIAL FOR CALCULATION:

The various list of material for carrying out qualitative analysis technique like ABC (Always Better Control) and also using the qualitative approach EOQ (Economic Order Quantity) for calculation is as follows

Table 5.1 List of Materials

Bulk Materials	Ceramic/Glazed Tiles	Doors/Window
1. Cement 2. Sand 3. Aggregate 4. Steel 5. Binding Wire 6. Wood 7. Cement	1. Ceramic tiles 2. Vitrified Tiles 3. Black granite	1. Main door 2. Bed Room Door 3. Toilet Door 4. Kitchen Yard 5. Terrace Door 6. Glass main door 7. Drawing room window 8. Bed room window 9. Kitchen window 10. Ventilation window

Table 5.2 List of Materials

Plumbing/Sanitary & kitchen cabinets	Electric items
1. Wall Mixture 2. Water closet 3. Kitchen sink 24*18*9 inch 4. Wash basin 5. Kitchen wash bib cock 6. Shower 7. Angal cock 8. Washbasin bib cock 9. Faucet- 10. Faucet-2 11. Sink coupling 12. Pipe 13. Waste pipe 14. Sink waste coupling	1. Light point 2. 5AMP Switch & 3. Socket 4. AC ON/OFF Switch 5. Fan Point+ Regulator 6. 15 AMP Socket 7. Looped 8. Telephone Point 9. T.V Cable Point 10. Door Bell Point 11. Single phase board

5.3 DATA COLLECTION FOR ALWAYS BETTER CONTROL (ABC) ANALYSIS:

In this Always Better Control (ABC) Analysis various material data Collection for the project . In this various material data from drawings, check daily report of material, and list out various material quantities for the project. In this table.3 shows a list out category of material and how many material items conducted for our residential project.

Table 5.3 Description of Material

Sr no.	Items and Description	Total Items
1.	Bulk Material	7
2.	Ceramic Tiles	3
3.	Doors	6
4.	Windows	5
5.	Plumbing/Sanitary and Kitchen Cabinets	14
6.	Electric items	10
Total items		**45**

The numbers shown in Table5.4, which data collection of bulk material for ABC Analysis in our project

Table 5.4: Bulk Materials for Residential Building

Sr. No	Material Description	Unit	Total Receipt Qt	Rate (INR)
1	Cement opc	BAG	23000	270
2	Cement ppc	BAG	22200	250
3	TMT Bar 8 mm Dia-Fe 415	KG	10500	28.00
4	TMT Bar 10 mm Dia-Fe 415	KG	8400	28.30
5	TMT Bar 12 mm Dia-Fe 415	KG	2800	29.30
6	TMT Bar 16 mm Dia-Fe 415	KG	10500	31.20
7	TMT Bar 20 mm Dia-Fe 415	KG	22400	32.00

8	River sand	TON	340700	900
9	Fine sand	TON	2505.6	660
10	Cement cube	M3	598.202	3000
11	Binding wire	KG	23000	60
12	Wood	KG	72000	42
13	Aggregate	TON	5629.7	500

The number shown in Table .5.5, which data collection of Tiles for ABC Analysis in our Project

Table 5.5: Tiles for Residential Building

Sr. No	Material Description	Unit	Total Receipt Qt	Rate (INR)
1	Ceramic Tiles	FT2	16420	237
2	Vitrified Tiles	FT2	141700	400
3	Black Granite	FT2	1620	110

The number shown in Table5.6, which data collection of Doors & Windows for ABC Analysis in our project

Table 5.6: Doors and Windows for Residential Building

Sr. No	Material Description	Unit	Total Receipt Qty	Rate (INR)
1	Main Door	1	78	10000
2	Bed Room Door	2	36	7000
3	Toilet Door 750mm×2300mm	2	36	4000
4	Kitchen yard Door 850mm×2300mm	1	18	4000
5	Terrace Door 1050mm×2050mm	1	1	5000
6	Ground floor glass door (1000*2100)	2	2	20000
7	Drawing room window1800*1800	1	18	5400
8	Kitchen window 600*1200	1	18	1600
9	Master bedroom650*1200	2	36	1600
10	Bed room window (1800*1800)	1	18	5400
11	Bed room-2(1200*1200)	1	18	4000

5.4 DATA ANALYSIS BY ALWAYS BETTER CONTROL (ABC) TECHNIQUE

Table 5.7: Always Better Control (ABC) Analysis of Bulk material

Sr. No	Material Description	Unit	Total Receipt Qty	Rate (INR)	Annual Usage	Total Annual Usage	Annual Usage	Items	Items	Rank	Category
					(INR)	(%)	Cumulative (%)	(%)	Cumulative (%)		
1	Cement opc	BAG	23000	270	6210000	14.34	14.34	7.69	7.69	2	A
2	Cement ppc	BAG	22200	250	5550000	12.81	27.15	7.69	15.38	3	A
3	TMT Bar 8 mm Dia-Fe 415	KG	10500	28.00	294000	0.67	27.82	7.69	23.07	11	B
4	TMT Bar 10 mm Dia-Fe 415	KG	8400	28.30	237720	0.54	28.36	7.69	30.76	12	B
5	TMT Bar 12 mm Dia-Fe 415	KG	2800	29.30	82040	0.20	28.56	7.69	38.45	13	B
6	TMT Bar 16 mm Dia-Fe 415	KG	10500	31.20	327600	0.75	29.31	7.69	46.14	10	C
7	TMT Bar 20 mm Dia-Fe 415	KG	22400	32.00	316800	1.65	30.96	7.69	53.83	9	C
8	River sand	TON	340700	900	3066300	7.08	38.04	7.69	61.52	4	B
9	Fine sand	TON	2505.6	660	1653696	3.82	41.82	7.69	69.29	7	B
10	ement cube	M3	598.202	3000	179406	41.44	83.03	7.69	76.90	1	A
11	inding wire	KG	23000	60	1380000	3.20	86.5	7.69	84.59	8	C
12	Wood	KG	72000	42	3024000	7.00	93.5	7.69	92.28	5	C
13	Aggregate	TON	5629.7	500	281485	6.50	100		99.97	6	A
					4290306 6	100					

The number shown in Table 5.7, which Always Better Control (ABC) Analysis of Summary of Bulk material which number show that different category, class A, class B, Class C Bulk material total Annual Usage in the residential project.

Table 5.8: Summary of Tiles ABC Analysis

Classification	No. of Items	Percentage of Items	Total Annual Usage (Percentage)	Annual Usage (INR)
Class A	2	66.66	99.7	60571540
Class B	--	--	-	-
Class C	1	33.33	0.30	178200
Total	3	100	100	60749740

Discussion

From table 5.8, we can show that the class A items total percentage items 66.66% and total annual usage is 99.70% of the high consumption. The class C items total percentage items 33.33% and total annual usage is 0.30% of the least control.

Table 5.9: Summary of Electric items ABC Analysis

Classification	No. of Items	Percentage of Items	Total Annual Usage (Percentage)	Annual Usage (INR)
Class A	**4**	**40**	**74.38**	**365800**
Class B	**3**	**30**	**19.90**	**97200**
Class C	**3**	**30**	**5.72**	**27900**
Total	**11**	**100**	**100**	**492400**

DISCUSSION

From table 5.9, we can show that the class A items total percentage items 40% and total annual usage is 74.38% of the high consumption. The class B items total percentage items 30% and total annual usage is 19.90% of the medium consumption. The class C items total percentage items 30% and total annual usage is 5.72% of the least control.

5.5 DATA COLLECTION OF ECONOMIC ORDER QUANTITY (EOQ)

In this Economic Order Quantity (EOQ) Analysis deals with the various material data collection for the current running project In this table 5.10 shows a list out Bulk material and how much Annual Demand per year in material items conducted for residential project.

5.10 Material Description for Economic Order Quantity (EOQ)

Sr. No	Material Description	Unit	Rate(INR)	Annual Demand (Per year}	Annual Order Cost (INR)	Annual Holding Cost	Annual Holding Cost Per Unit (INR)
1.	Cement OPC	BAG	270	6210000	130	15%	40.50
2.	Cement PPC	BAG	250	5550000	130	15%	37.50
3.	TMT Bar 16mm	KG	31.20	327600	100	15%	4.68
4.	River Sand	TON	750	3066300	130	15%	135
5.	Cement Block	M3	3000	17946060	60	10%	300
6.	Coarse Aggregate	TON	500	2814850	120	15%	75

5.6 DATA ANALYSIS BY ECONOMIC ORDER QUANTITY (EOQ) : The number shown in Table 5.11, which major bulk material data analysis by Economic Order Quantity (EOQ) in the residential project.

5.11 Data Analysis by Economic Order Quantity (EOQ)

Sr. No	Material Description	Unit	Rate(INR)	Annual Demand (Per year}	Annual Order Cost (INR)	Annual Holding Cost	Annual Holding Cost Per Unit (INR)	EOQ	No of Order	Order Cycle
1.	Cement OPC	BAG	270	6210000	130	15%	40.50	122	19	20
2.	Cement PPC	BAG	250	5550000	130	15%	37.50	124	18	21
3.	TMT Bar 16mm	KG	31.20	327600	100	15%	4.68	212	5	74
4.	River Sand	TON	750	3066300	130	15%	135	29	12	31
5.	ement Block	M3	3000	17946060	60	10%	300	16	38	10
6.	Coarse Aggregate	TON	500	2814850	120	15%	75	43	14	28

5.7 TOTAL MATERIAL ANNUAL DEMAND PER YEAR ORDER CYCLE BY ECONOMIC ORDER QUANTITY (EOQ) THE NUMBER SHOWN IN

Table 5.12, which cement material Annual Order Cycle in year with or Without the use of Economic Order Quantity Approach.

Cement OPC Order Cycle			
	No of Total Order	**Demand (Per 1 Order)**	**Order Cycle (Days)**
Without Use EOQ	**7**	**329**	**52**
With Use EOQ	**19**	**122**	**20**

5.8 CEMENT OPC ORDER CYCLE WITHOUT EOQ

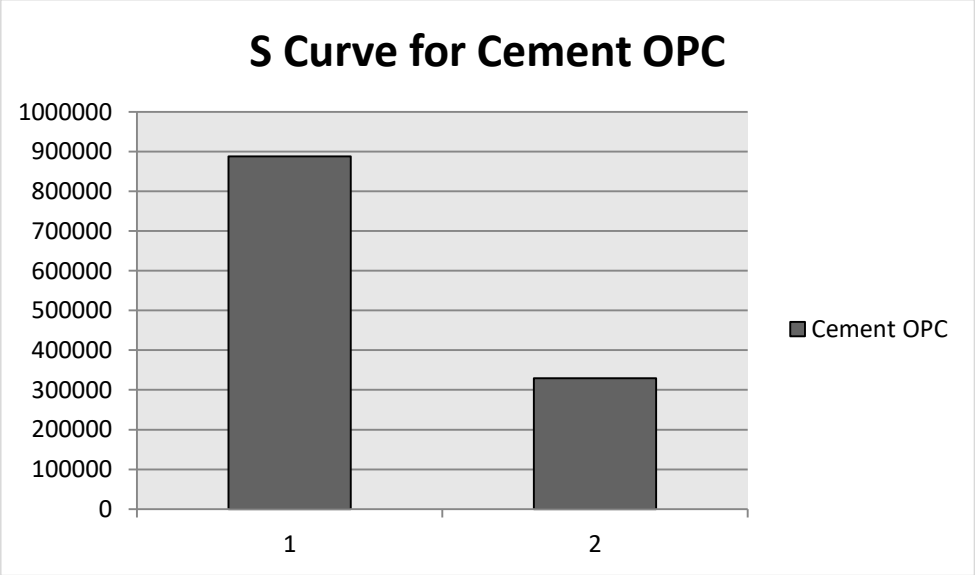
As per Table 5.12 shown that in cement OPC Order cycle without the use of EOQ No. of total order per year 7, per 1 order demand 329 bags and 52 day interval order in Cement per year and with the use of economic order quantity calculation No.of total order per year 19, and demand per 1 order 122 bags, every 20 day interval order in cement per year The number shown in Table 5.13, which Cement PPC material Annual Order Cycle in year with Or without the use of Economic Order Quantity Approach.

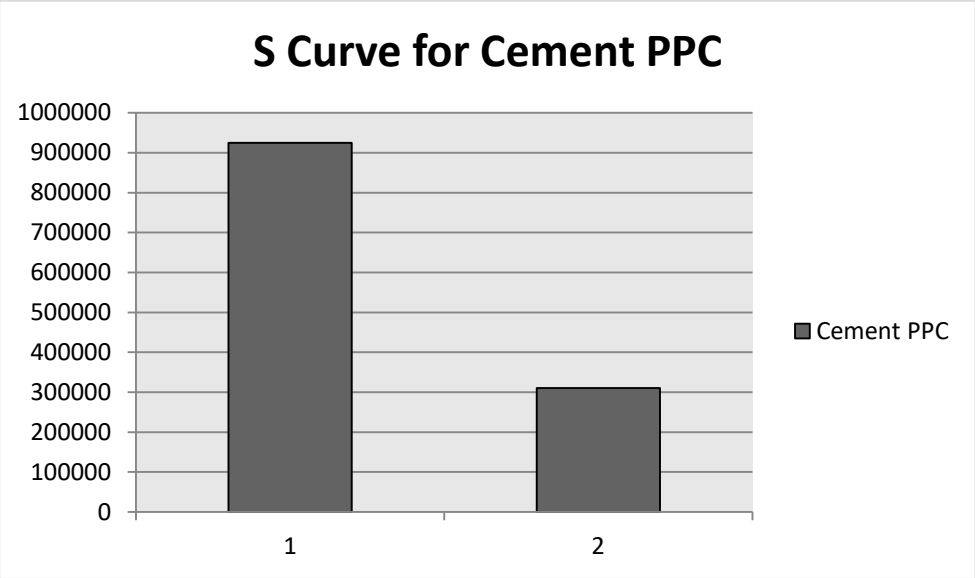
Table 5.13 Cement PPC Order Cycle in EOQ

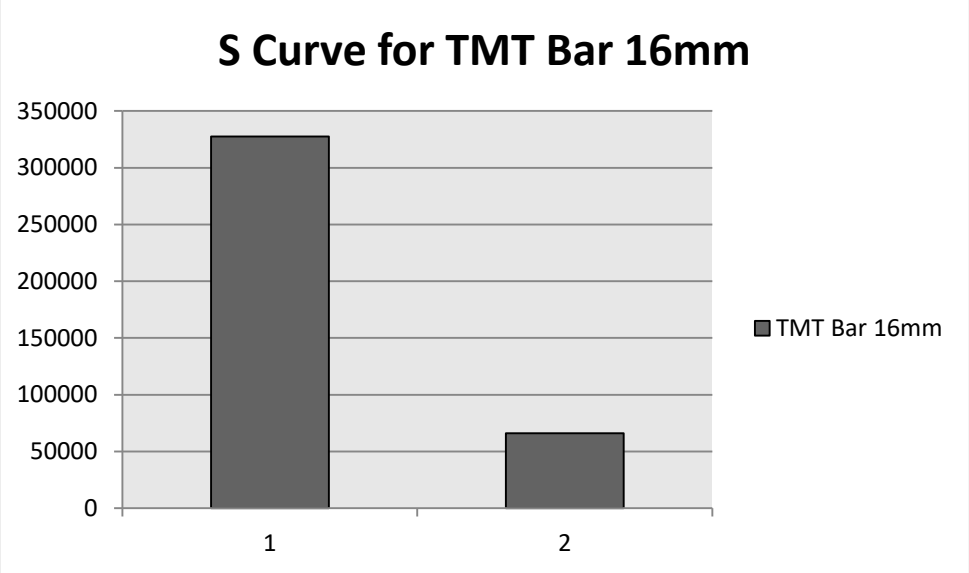
Cement PPC Order Cycle			
	No of Total Order	**Demand (Per 1 Order)**	**Order Cycle (Days)**
Without Use EOQ	**6**	**370**	**60**
With Use EOQ	**18**	**124**	**21**

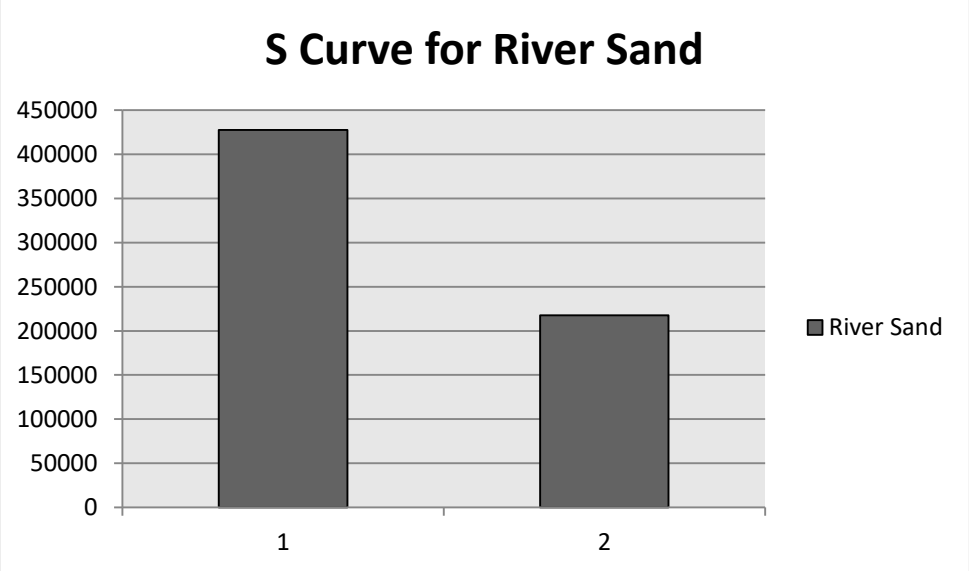
As per Table. 5.13 shown that in cement PPC Order cycle without the use of EOQ No. of total order per year 6, per 1 order demand 370 bags and 60 day interval order in Cement per year and with the use of economic order quantity calculation No.of total order per Year 18, and demand per 1 order 124 bags, every 21 day interval order in cement per year.

5.10. S-Curve analysis of the given data S-curve analysis is essential tool in project management, where the comparison between the planned activity and actual activity can be compared, and analysis is made to track down factors affecting the progress and minimize them.[13] In this study we use the planned cost from EOQ analysis and Actual cost for each floor of a G+10 floor is considered for analysis of each inventory, and troubleshoot is done to reduce the cost and time. For this analysis we choose the top 5 inventory item, and rest can be calculated using the same way.




S Curve for Cement PPC
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
1
2
Cement PPC


S Curve for TMT Bar 16mm
350000
300000
250000
200000
150000
100000
50000
0
1
2
TMT Bar 16mm


S Curve for River Sand
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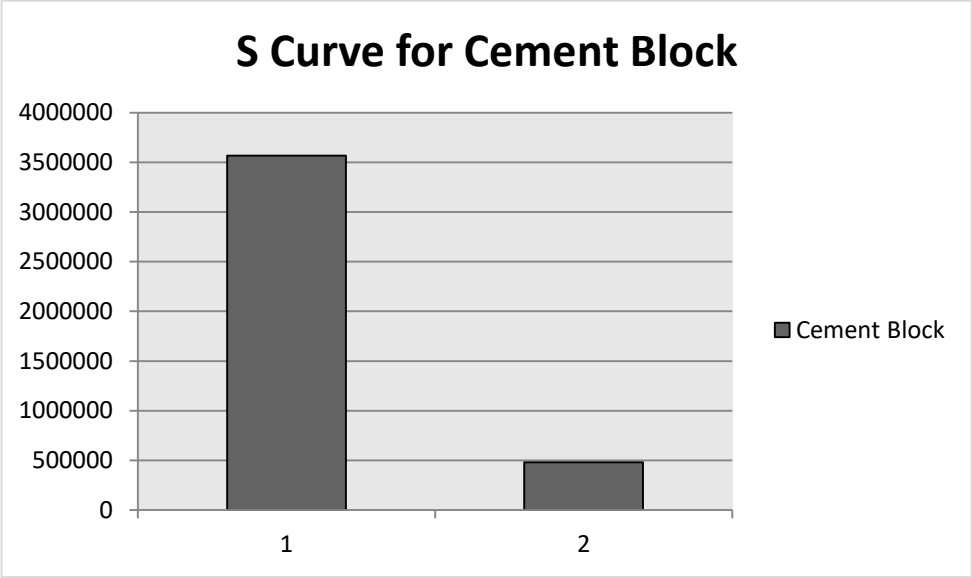
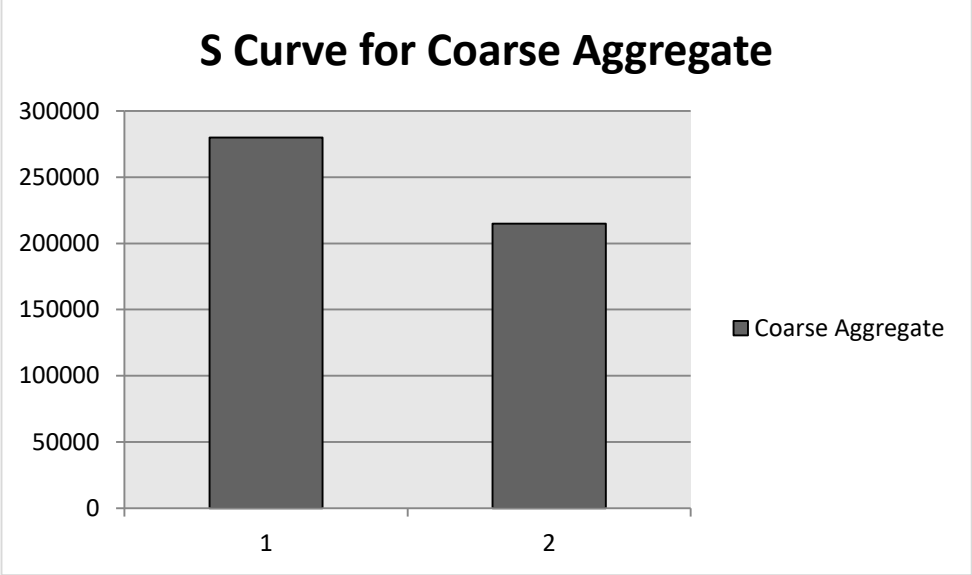
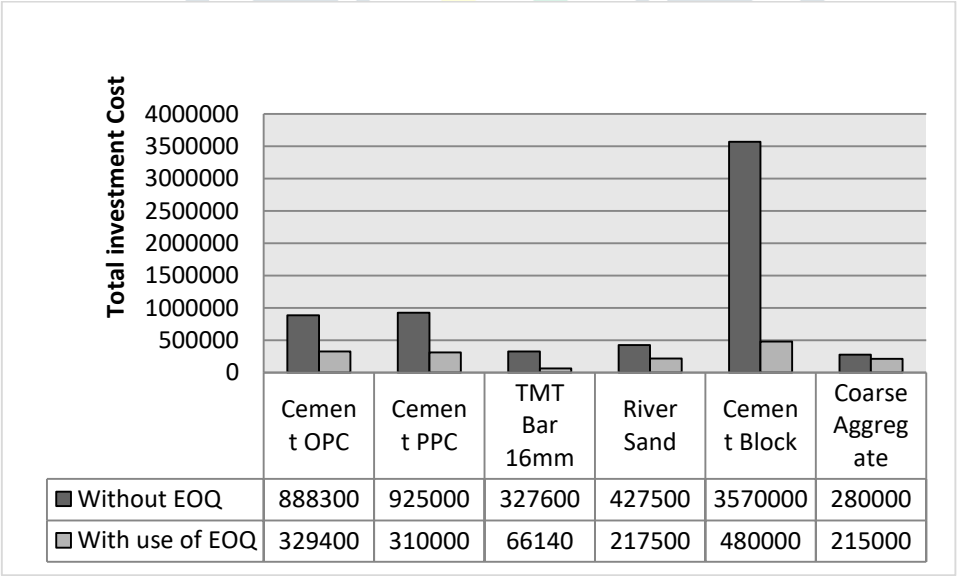
400000
350000
300000
250000
200000
150000
100000
50000
0
1
2
River Sand







5.28 Total Investment Cost with Use EOQ Vs. Without Use EOQ Chart

CONCLUSION

From the site investigation by applying ABC & EOQ in SP CONSTRUCTION PUNE following conclusion are drawn ABC analysis is kind of method, which provides the means for classifying those items that make the largest effect on a company's overall inventory cost performance ABC classification to identify and define the safety stocks, which is a protection so that does not lack of material as well as stocks average, maximum and minimum, so as to assess the amount necessary to avoid a lack of raw material and without any accumulation in inventory. Total investment cost of the material which widely used in SP CONSTRUCTION in Case study 1 without use of EOQ is Rs. 7381170 & with use of EOQ is Rs. 2285250 also with using of EOQ cost saving in material is 70 %. Total investment cost of the material which widely used in SP

CONSTRUCTION Case study 2 without use of EOQ is Rs. 83736580 & with use of EOQ is Rs. 44647030 also with using of EOQ cost saving in material is 50 %. By applying ABC analysis we can easily classified the material which requires more investment & by using EOQ we can easily control or reduce the total investment cost of the material. The inventory control technique by adopting proper material management system large amount of cost can be reduced in large projects and that saved cost can be used in some small project as our country already running short money. In the material management the main important factors are planning, assessing the requirement, sourcing, purchasing, transporting, storing, and controlling of materials, minimizing the wastage and optimizing the profitability by reducing cost of material. Failure in managing site inventory will result in cost overrun, delays in project completion and reduce overall project performance. In the material management also observe the major factors of poor inventory control are Improper management of time, cost and manpower. Inventory is the major part of their 25% cost of total production there is a need for inventory control by way of reducing cost and optimum utilization of materials stock is very high level.

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