R.C.Patel College Of Engineering & Polytechnic, Shirpur

Department of Civil Engineering

Course Title- Construction Management **Course Code -** 313010

Programme Name -Civil Engineering **Semester-**Third

Unit	Title	COs	Learning hours	R Level	U Level	A Level	Total Marks
III	Material Management	CO3	02	0	0	0	0

Unit III : Material Management

3.1 Material Management : Introduction

- Material management is the process of planning, storing, controlling and using materials efficiently in a project or industry.
- It is important that right material available at right place, at right time, and in the required quantity.

Functions of Material Management :

1) Material planning
- Estimates the quantity and type of materials required for a Project.
- Ensures materials are available at the right time.

2) Purchasing
- It is Ensures that good quality material purchased at reasonab -le rate.

3) Receiving and Inspection.
- checks the quatity and quality of material received.
- Material will be variefy ~~for~~ project specifications.

4) storage
- Maintain proper arrangement for easy identification.
- Stores materials safely to prevent damage, theft, or deterioration.

5) Inventory Control
- Maintains optimum stock levels.
- Avoids both storages and excess stock.

6) Material Handling
- Move or transport material safely from one place to another.
- Reduces material damage and handling costs.

7) Issue and distibution.
- It will be uninterrupted work progress.

8) Record keeping
- Maintains records of receipts, issues and stock balances.

9) Disporal of surplus materials.
- Identifies unused, damaged materials.
- Arrange their sale / reuse / or disposal.

10) Cost control
- Reduce material wastage and unnecessary expenses.
- Improve overall project economy.

objectives of Material Management:

1) Maintain steady flow of supply:
The flow of material will be stedy to albieve production. Any disturbance in material will be affect cost of production.

2) Achieve economy cost: Achiere economy in materials by adopting cost reduction techniques such as value analysis variety reduction, CIT, MRP etc.

3) Quality consistency: qudlity of material achieve by providing right materials of right quality.

4) Reduction in inventory investment.

5) Improved Corporate image: Improve coporate image by improving good buyer-seller relations.

6) Record keeping: Maintain good record of purchase Stores, traffic etc.

7) Conservation of material.

8) Elimination of wastage.

9) Good Record.

Inventory Control :

Inventory → Inventory means the stock of materials, tools, spare parts, and other items kept in a store for future use.

Importance of Inventory

1) Prevents shortage of materials
2) Avoids delay in construction work.
3) Helps in smooth project execution
4) Maintain a balance between supply and demand.

Types of Inventory →

1. Raw Materials - Cement, steel, sand, aggregates, etc.
2. Work in progress Materials - Materials currently being used.
3. Finished Goods - Completed products ready for use.
4. Maintenance Materials - Spare parts and repair items.

Inventory control →

Inventory control is the process of maintaining the optimum quantity of materials in stock to avoid both shortage and excess storage.

objectives →
1) Reduce inventory cost.
2) Prevent overstocking
3) Avoid material shortages.
4) Ensure proper use of resources.

Methods of Inventory Control.

1) EOQ (Economic order quantity)
2) ABC Analysis
3) VED Analysis
4) JIT (Just in Time)

*) A-B-C Analysis:

ABC analysis is a method of classifying materials according to their annual consumption value.

It divides 3 categories,

A items = Most valuable items.

B items = Less valuable then 'A' and more valuable than 'B'

C items = Least valuable items as compared to A and B.

Steps involved in ABC Analysis

1) Prepare list of the items and estimate their annual consumption.
2) Find out unit cost of each item.
3) Find out annual consumption in rupees by multiplying each annual consumption by its unit cost.
4) Arrange items in the descending order of their annual usage starting with highest annual usage to Smallest one.
5) Calculate cumulative annual usages and cumulative usage percentages.
6) Plot a graph of cumulative usage percentages against cumulative item percentages and Separate them into, A, B & C categories.
7) Decide the policies of control for the three categories.

Example:

Material	Annual Usage value (₹)	category
Steel	50,00,000	A
Cement	20,00,000	A
Paint	1,50,000	B
Pipes	1,00,000	B
Nails	50,000	C
Stationery	10,000	C

EOQ (Economic Order Quantity)

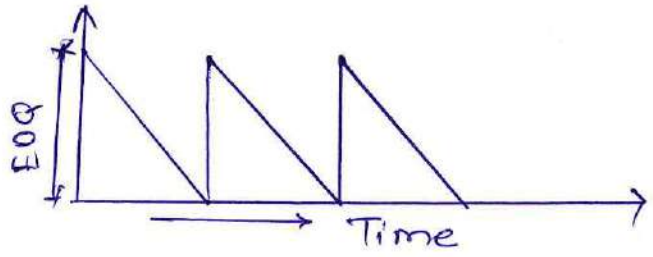
EOQ is the ideal quantity of material that should be ordered at one time to minimize ordering and storage costs.

Purpose

- Reduce inventory cost.
- Avoid frequent ordering.
- Maintain sufficient stock.

Types of EOQ

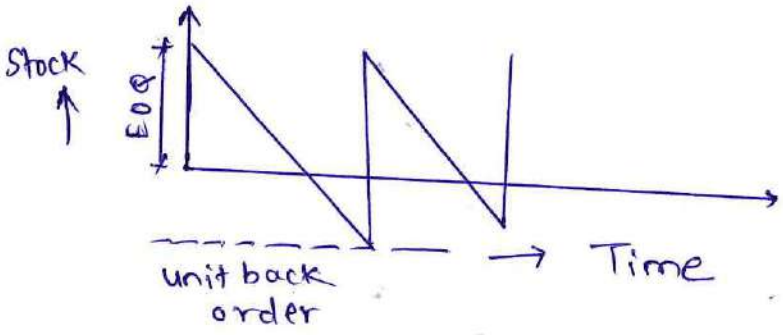
There are different EOQ models. The most classical model was proposed by Wilson in 1928. It is known as EOQ



Assumptions of EOQ module

1) Replenishment is instantaneous

2) No shortage is allowed if assumption is relaxed.



3) Price per unit is fixed irrespective order size.

EOQ Model

- Basic EOQ Model with infinite replenishment rate
- EOQ Model with finite replenishment rate
- EOQ Model with planned backlogging
- EOQ Model quantity discounts.

Inventory cost (Indirect costs)

Inventory costs can include the following three cost.

1. Processing or ordering cost.

It consist of:

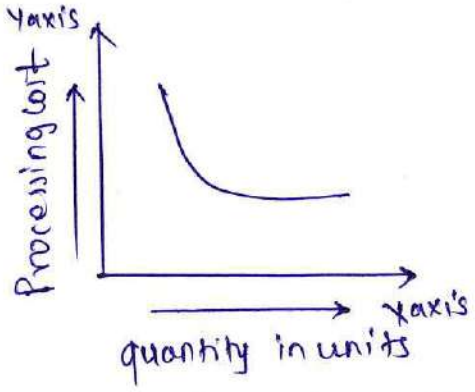
i) cost of processing the requisition
ii) cost of receiving the material
iii) cost of delivery of material.
iv) cost of material storing.

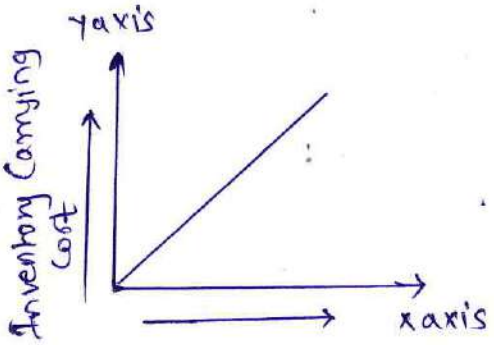
2. Inventory Carrying cost

i) Loss of interest on capital involved in inventory.
ii) Cost required to store the material.
iii) Handling during storage and issue.
iv) Cost of insurance, deterioration, damage depreciation, obsolescence, taxes if any.

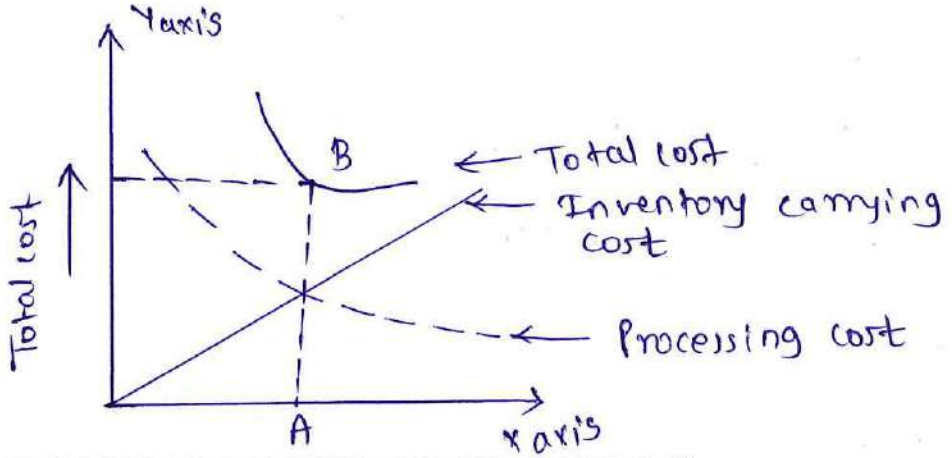
3. Stock out cost

- Inventory cost is also called direct cost includes the cost of material and acquisition costs.
- Processing cost will be inversely proportional to the quantity ordered and purchased.





- Inventory carrying cost is directly proportional to the quantity of material.
- Total inventory cost is therefore the sum of processing cost and inventory carrying cost variation of total cost w.r.t quantity.



$$\text{Total cost } \{ C_T = \frac{C_o S}{Q} + \frac{Q C_u I}{2} \}$$

= ordering cost + Inventory carrying cost

where,

C_T = Total cost

C_o = Ordering cost per order in ₹

C_u = Unit cost of commodity

S = Annual Consumption of the item

Q = order quantity

I = Inventory carrying cost as a % average inventory investment.

$$Q_{optimum} = \sqrt{\frac{2 C_o S}{C_u I}}$$

Example:

Yearly requirement of cement by a large firm is 300 bags. The cost of a bag of cement is 300/- lead time is one month and the ordering cost per order is 200/- Assume the annual carrying cost for inventory is 20% of average inventory management. Find EOQ and total inventory cost.

Given → $S = 300$,

$C_p = C_o = 300$ - ordering cost $i = 20\% = 0.2$ - Inventory carrying cost

$C_u = 300$/- unit cost.

1. $EOQ = \sqrt{\frac{2 S C_o}{C_u \times i}} = \sqrt{\frac{2 \times 300 \times 200}{300 \times 0.2}} = \underline{44.72}$

$\simeq 45$ Nos.

2. Inventory carrying cost,

$$= \left(\frac{S}{q} \times (P)\right) + \left(\frac{q}{2} \times (u \times i)\right)$$

$$= \left(\frac{300}{45} \times 200\right) + \left(\frac{45 \times 300 \times 0.20}{2}\right)$$

$$= 1333.33 + 1350$$

$$= \text{RS. } 2683.33$$

3) VED Analysis →

VED analysis classifies materials based on their importance to operations.

- Vital (V) - very important material
  - shortage can stop work completely.

  Ex. cement, steel etc.

- (E) Essential : Important materials.
  - Work can continue for a short time without it.

  Ex. Paints, fittings etc.

- (D) - Desirable:- Less important materials
  - shortage does not seriously affect work.

  Ex - decorative items etc.

4) Just in Time (JIT) Strategy

Materials are purchased and delivered only when they are needed.

Features → 1) Minimum inventory
2) Frequent deliveries
3) Reduced storage space
4) Close coordination with suppliers.

Store Management

Store management is the systematic process of receiving, storing, Protecting & issuing materials in a store.

Objectives

1) Safe storage of materials
2) Easy identification of materials
3) Prevention of loss and theft
4) Proper record keeping.

Functions of store management

1) Receiving materials
2) Inspection of materials
3) Storage & preservation
4) Issuing materials
5) Maintaining records
6) Stock verification.

Records Related to Store Management:

1) Goods Received Note (GRN)
   A record prepared when materials are received in the store.
2) Bin card
   A card kept with the material showing quantity and value of materials.
3) Store Ledger
   A detailed record showing quantity and value of materials.
4) Material Requisition slip
   A document used to request materials from the store.
5) Issue voucher
   A record prepared when materials are issued from the store.
6) Stock Register
   A record showing available stock of all materials.

3.2 Rebar Management

Rebar is a steel bar used inside concrete to increase its strength. Concrete is strong in compression but weak in tension.

- Rebar helps concrete resist tensile forces and prevents cracking.

Common types of Rebar:

1) Mild steel Bars
2) Deformed (Ribbed) Bars
3) TMT (Thermo Mechanically Treated) Bars
4) Epoxy-coated Bars
5) Stainless steel Bars

Wastage of steel on site

Steel wastage is the loss of steel due to improper handling, cutting, storage, or planning during construction work.

Causes of steel wastage

1) Incorrect cutting of bars
2) Poor planning of reinforcement work
3) Improper storage causing rust & damage.
4) Use wrong bar length.
5) Excessive cutting and bending errors.

Preventive Measures to Avoid steel Wastage

1 Proper planning:
Prepare bar bending schedules before cutting steel.

2. Accurate Measurement:
Measure carefully before cutting reinforcement bars.

3) Proper storage:
Store steel on raised platforms away from moisture.

4) Skilled Workers:
Use trained workers for cutting and bending operations.

5) Reuse of offcuts:
small leftover pieces can be used in secondary reinforcement works.

6) Regular Supervision
Monitor steel usage daily.

7) Proper transportation.
Avoid damage during loading, unloading and transportation.

8) Maintain Records:
Keep records of steel received, used and remaining stock.

Fabrication of Rebar

Rebar fabrication is the process of cutting, bending & shaping steel bars according to structural drawings.

Advantages:

1) Reduces site work
2) Saves time
3) Improves accuracy
4) Reduces steel wastage.

Transportation of Rebar

Moving fabricated steel bars from the fabrication yard to the construction.

Benefits

1) faster site installation.
2) Reduced handling time.
3) Better organization of materials.

Understanding Rebar Drawings

A detailed drawings that show the size, shape, spacing, location & arrangement of reinforcement bars in a structure.

Information shown in Rebar drawings

1) Diameter of bars (eg 10, 12, 16 mm)
2) Length of bars
3) spacing between bars
4) Number of bars required.
5) Bending details.
6) Position of reinforcement in beams, columns, slabs & footings.