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Study of New Material Management System in Construction Sector

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Abstract – Construction is a major component, which forms 45% to 50% of the country's development activity. Construction materials and components contribute about 50% to 60% of the total value of construction. There will be some difficulty in defining construction materials. Some are exclusively used in construction and others in other industries also. Some form heavy percentage and some very minor percentage, but critical in their nature and affect the construction activity.

The management and control of inventory is a problem common to all organizations in any sector of the economy. The wealth of shareholders also lies in the warehouse. More than 60% of working capital is normally being invested in the inventory. There can be disadvantages in holding either too much or too little inventory. Therefore inventory management is primarily concerned with obtaining correct balance between two extremes.

Inventory management involves the development and administration of policies, system and procedures which will minimizes total cost relative to inventory decisions and related functions such as customer service requirement, production scheduling, purchasing etc.., Viewed in that perspective, inventory management has a broad scope and affects a great or number of activities in an Organization. For the past few years the concept of inventory system has gained more importance in our country. It is due to intense competition in the market, which has forced organizations to search for proper inventory control technique to reduce investment in inventories and thereby reducing overall cost.

In this study the study of current inventory system is carried out and by combining the different inventory system the one new inventory system developed .By comparing the cost benefit analysis between current inventory control system and new inventory system by taking suitable actual case study will be carried out

Keywords – Construction, Material Management Inventory Cost Inventory System

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I. INTRODUCTION

A) COMPLEXITIES OF MATERIALS MANAGEMENT IN CONSTRUCTION INDUSTRY:

In construction sector there are different difficulties in integrated materials management systems than in services and engineering firms. All these firms are well set and stationary. The manufacturing and services is also a well-defined item. Unfortunately, these do not happen in construction industry. Each job has its own requirement of materials, stores and spares. In many cases, the raw materials like soil, bricks, stones and aggregates are manufactures at the site itself; hence, these materials have their own problems.

Each job has its own design, specification and other materials. Each job has its own mechanization, electrical and construction equipments. The type of work that is carried out by these equipments is not similar or same. Equipment may work in soft soil in some cases and hard soil in another type or solid blasted rock the next time.

The organization set up for materials management at each site may be different. The corporate office mat have its own items for materials handling, it may be cement, steel, explosives, stores and spares which are centrally handled.

The problems of weather conditions, ideal and more working periods may be different in different jobs. This will affect the inventory control, storage and production. It may be that cement may be supplied in bags in some cases and in bulk in another the storage inadequacy has its own problems. In mechanized jobs fuel and lubricants, have their own

problems regarding proper arrangement for either storage or distribution to different points of jobs.

Another important problem is of explosives and detonators. This is an important item needing safety and protection. It needs special storage facilities, watch and ward and accountability. Supply again is a problem. Supply of these items usually is taken up by the department. Usual old types of explosives are included in the contract document. With the changing trends in materials and methodology, the construction would face greater problems. In many cases, the government takes up the responsibility of supply of embedment pipes and some stores. This require detailed planning, this detailed planning again depends on the drawing and specifications which usually never get ready in time.

There are many other problems on each job.

The above have been mentioned to make one understand the important necessity that is required to adopt integrated material management system on construction projects. There has to be proper attitude, leadership, co-ordination, co-operation and value for time. Full efforts to be taken to introduce and adopt integrated materials management on all jobs and projects and the central organization of department as well as construction agencies.

B) PRESENT SYSTEM OF MATERIALS MANAGEMENT IN THE ORGANISATION:

Having introduced the subject and having talked about the objectives of functions and complexities of construction activity, it is necessary to understand the methodology followed in the material management in the organization.

One could say that at present, there is definite awareness of materials management in many organizations. The electronic data processing system has also been introduced in many organizations. But, the overall integration of different functions is the problem that is usually faced. The organizational functions either deal with only buildings, mass housing, and industrial construction. Major civil engineering projects, has its own problems in management system of materials and has to develop proper system to suit each type of work. It is better to know the organizational set up of the material department both at the corporate office level and at site to understand the problems better and to deal with the subject matter in a logical way.

C) REVIEW OF PRESENT SYSTEM IN MAJOR PROJECTS

It is observed that the systems are not up-dated and the same old method of indenting, consolidation of indents, preparation of tender documents, receipt of tenders, preparation of tender scrutiny, decision on purchase proposal, preparation of purchase order, receipt of materials, payment to the suppliers and transport to the site are followed. Many of the above operations are not properly co-ordinated, but done by different authorities without well defined objectives.

D) LIMITATIONS OF THE SYSTEMS:

Since there is not proper planning, time schedule, shortage of details from owners, receipt of available drawings, specifications, change in the scope of work, they create more problems than the market situation

One does not work keeping in existing environment in view. The market and other administrative environments cannot be changed much. The systems are to be up-dated to get results within these environments. In any market, there is surplus and storage. There mey be particular time interval for getting a particular type of material. These all have to be kept in view. If there is a shortage of material, then, there is more need for integrated material management.

The limitations on present construction projects are said to be:

1. Absence of codification
2. Technical scrutiny of tenders
3. Tender terms and conditions
4. Inadequate delegation of financial powers
5. Flexibility of outflow
6. Correspondence and file formation
7. Inadequate follow-up action
8. Human error

Over and above these limitations, it is also said of large projects having more problems

1. Outside group pressure in purchase decisions
2. Bilateral agreement which affects particularly the construction equipments and spares
3. If there is delay by the supplier, the contract is such that no alternative arrangement can be done unless legal actions are taken
4. Proper escalations are not allowed when desired by the suppliers

The above limitations and special problems could be tackled by a proper planning of systems than the

existing ones in the construction organization, either by the department or private.

E) WHAT COULD BE DONE TO IMPROVE?

The above stated problems that are faced at projects and detailed construction of the same, the committee on cost control of river valley development, recommended the following actions to be taken on material management.

1. Inventory control cells should be created at all major projects. It should, however be ensured that all functions of material management like material planning and programming, purchasing and procurement of capital equipment, inventory control, store keeping and ware housing, material handling and transportation ect., come under a united direction and answering for efficient working.

2. In order to create awareness amongst the project engineers, they should be imparted training in the modern system and techniques of materials management and inventory control.

3. The materials and spare parts required at the project should be classified and coded in terms of their different uses.

4. A B C analysis should be carried out for separating the significant few from the relatively unimportant many for a proper inventory control.

5. Proper procedures should be laid out clearly for procurement of stores and quick payment of supplier's bills to reduce the lead time and other delays.

6. Sufficient attention should be given to efficient planning and carrying out of the store keeping functions to minimize the inventory carrying cost

7. Immediate action should be taken to dispose off the obsolete parts and scrap to reduce the inventory holding cost

8. Standardization and variety reduction should be resorted to reduce the number of items to be procured.

9. Sufficient care and thought should be given for procuring the insurance items

10. Safety stock and reorder levels should be decided carefully on the basis of past consumptions to facilitate timely replenishments.

11. Special cells in major projects should devise procedures for timely shedding of surplus spares and make a concerted effort to collect lists of requirements from projects using similar equipment and rehabilitate the spares to the maximum possible extent. They should pursue the manufacturers/suppliers also to dispose of surplus spares if no government project needs them

12. Obsolete equipment beyond economical repairs, accidented machines and spares of absolute equipment should be disposed of rather than rehabilitated. Disposal committees may be formed in the project/states for this purpose.

13. In case of purchase of spare parts by the projects from other projects, the direct demanding officers at various levels should exercise their normal powers in regards to such purchases

14. The engineer in-charge should have full powers to release equipments/spares to another project within the state and the chief engineer in-charge should have full powers to release such equipment's /spares to a project outside the state

15. The non-finalization of transfer price should not hold up transfer of equipment and spare parts from one project to another project/state

16. Data on stores available and spares required by various projects should be periodically exchanged particularly before overhauling season. This will assist not only in early acquisition of spares required but also expeditious rehabilitation of surplus spares

17. Computerization should be resorted to only at major projects and at state level in CMU's for processing the voluminous and complex data for making available prompt and accurate reports

These recommendations are for government departments. But, the basic factors apply to a construction organizations in private sector also. As a matter of fact on any project the material management is a problem of both the department and the contractor. Some of these recommendations have been implemented in many organizations.

ii. Problem Statement

1) The present system of inventory management of company consists of

predetermined order quantity and rough estimates of demand for the item. However, in practical demand and lead time is fluctuating which may causes loss to the company.

2) If we add some improvement to inventory management of the company, it will lead to improvement in construction work and reduction in inventory cost.

iii. Objectives

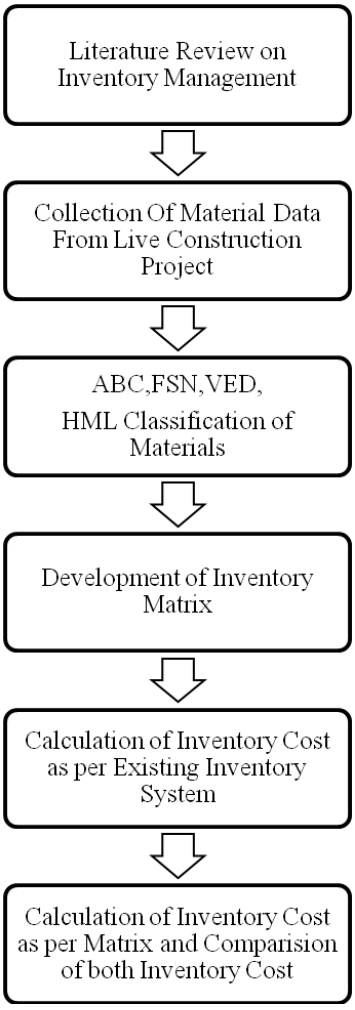
1) To study and analyze present inventory management and its control techniques of the Construction Company.

2) To classify materials using ABC, FSN, HML, VED inventory control techniques.

3) To develop matrix combining ABC-FSN-HML-VED inventory control techniques. And calculate cost as per new system.

4) To compare the inventory cost as per existing system and new system.

IV. RESEATRCH METHODOLOGY:



V. CEVELOPMENT OF MATRIX

1) A.B.C.-F.S.N.-H.M.L. Matrix

This is an example of a combination of three inventory control techniques ABC, HML, FSN. Basically, this matrix consists of parameters of this three analysis i.e. Annual usage of items, consumption rate of items and unit price of items. Following table 1shows the combination of three inventory control techniques i.e. ABC-FSN-H.M.L.For Example, AFH group consists of such materials which are 'A' class, fast moving, high priced. CNL group consists of such materials which are 'C' class, non-moving and low price. BSM group consists of 'B' class, slow moving, medium price materials.

Table 1 A.B.C.-F.S.N.-H.M.L Matrix

	H	M	L
AF	AFH	AFM	AFL
AS	ASH	ASM	ASL
AN	ANH	ANM	ANL
BF	BFH	BFM	BFL
BS	BSH	BSM	BSL
BN	BNH	BNM	BNL
CF	CFH	CFM	CFL
CS	CSH	CSM	CSL
CN	CNH	CNM	CNL

- AFH- AF class high price items.
- AFM-AF class medium price items.
- AFL-AF class low price items.
- ASH-AS class high price items.
- ASM-AS class medium price items.
- ASL-AS class low price items.
- ANH-AN class high price items.
- ANM-AN class medium price items.
- ANL-AN class low price items.
- BFH-BF class high price items.
- BFM-BF class medium price items.
- BFL-BF class low price items.
- BSH-BS class high price items.
- BSM-BS class medium price items.

- BSL-BS class low price items.
- BNH-BN class high price items.
- BNM-BN class medium price items.
- BNL-BN class low price items.
- CFH-CF class high price items.
- CFM –CF class medium price items.
- CFL – CF class low price items.
- CSH- CS class high price items.
- CSM- CS class medium price items.
- CSL- CS class low price items.
- CNH –CN class high price items.
- CNM- CN class medium price items.
- CNL – CN class low price items.

2) A.B.C.-F.S.N.-H.M.L.-V.E.D Matrix

This is final inventory matrix which is a combination of ABC-FSN-HML-VED inventory control techniques. The formed matrix has parameters of all the four inventory control techniques. The more optimized classification would get and formed matrix consists of parameters such as annual consumption of materials, unit price, its criticality, and consumption rate. From Table 2we categorized materials into two groups as follow:

1) Category I is high priority group requires the greatest attention. It contains the materials which are vital, whose annual consumption is high, which are a costly one, whose consumption rate is also high. Category I is blue background portion.

2) P -system (Periodic review system) of inventory control is used. In this system, the inventory review period and lead time are considered.

3) Category II is under moderate management and moderate attention is devoted. It contains the materials whose annual consumption is high but are least costly and slow-moving whose absence does not affect the construction work. (Yellow colored portion).

Q system (Continuous review system) of inventory control is used. In this system, only review period is considered.

Table 3: A.B.C-F.S.N-H.M.L-V.E.D Matrix

	V	E	D
AFH	AFHV	AFHE	AFHD
AFM	AFMV	AFME	AFMD
AFL	AFLV	AFLE	AFLD
ASH	ASHV	ASHE	ASHD
ASM	ASMV	ASME	ASMD
ASL	ASLV	ASLE	ASLD
ANH	ANHV	ANHE	ANHD
ANM	ANMV	ANME	ANMD
ANL	ANLV	ANLE	ANLD
BFH	BFHV	BFHE	BFHD
BFM	BFMV	BFME	BFMD
BFL	BFLV	BFLE	BFLD
BSH	BSHV	BSHE	BSHD
BSM	BSMV	BSME	BSMD
BFL	BFLV	BFLE	BFLD
BNH	BNHV	BNHE	BNHD
BNM	BNMV	BNME	BNMD
BNL	BNLV	BNLE	BNLD
CFH	CFHV	CFHE	CFHD
CFM	CFMV	CFME	CFMD
CFL	CFLV	CFLE	CFLD
CSH	CSHV	CSHE	CSHD
CSM	CSMV	CSME	CSMD
CSL	CSLV	CSLE	CSLD
CNH	CNHV	CNHE	CNHD
CNM	CNMV	CNME	CNMD
CNL	CNLV	CNLE	CNLD

3) Inventory Cost Calculation

Study of Present Inventory System and Proposed Inventory Matrix

In this, the annual cost of inventory of material has been calculated-

FOR CATEGORY –I

For the TMT bars 8MM, the calculation of Annual total inventory cost has been explained as follows:

i. Unit Cost = 50400 Rs

ii. Annual Demand (A.D) = 494.013MT

iii. Ordering Cost (O.C) = 47,880 Rs

iv. Holding Cost (H.C) = 20% of unit cost = 10,080 Rs

a) Total Inventory cost by the Present Inventory System:-

1. Predetermined Order Quantity = 68.51MT

   No. of orders per year (N) = Annual Demand (A.D.)

2. Predetermined Order Quantity (E)

$$= \frac{494.013}{68.51}$$

$$= 7.21 \approx 7$$

3. Annual Ordering Cost (AOC) = Ordering Cost × No. of Order per year

   = 47,880 × 7

   = 3,35,160 Rs.

4. Annual Holding Cost (A.H.C.) = H. C. × E.

$$= \frac{10,080 \times 68.51}{2}$$

   = 3,45,272.13 Rs.

5. Total Cost = Annual Ordering Cost (A.O.C.) + Annual Holding Cost (A.H.C.)

   Total Cost = 3,35,160 + 3,45,272.13

   Total Cost = 6,80,432.13 Rs.

b) Total Inventory Cost by the proposed Inventory Matrix-

As TMT Bar 8MM comes in Category-I, P-system of Inventory control is used.

1. Lead Time (L) = 1 Week

2. Review Period (R) = 2 Weeks

3. Standard Deviation (S.D.) = 6MT per week

4. Average Demand (D) = Annual Demand (A.D.) × (L.R.)

$$= \frac{494.01 \times 3}{52}$$

   = 28.50MT

5. Safety Stock at 99% service level (s.s.) = $\sqrt{(L+R)} \times S.D \times 3.09$

   $= \sqrt{3} \times 6 \times 3.09$

   = 32.11MT

6. Targeted Inventory (T) = Annual Demand (D) + Safety Stock (s.s.)

   = 28.50 + 32.11

   = 60.61MT

7. Order Quantity (Q) = Targeted Inventory (T) – Inventory Position

   = 60.61 – 2.00

   = 58.61MT

8. No. of order per year (Ni) = Annual Demand (A.D.)

   Order Quantity (Q)

$$= \frac{494.013}{58.61}$$

   = 8.23 = 8

VI. CONCLUSION

- The study shows that in order to exist in this growing environment industry has to seek for measures for inventory elimination. This has enabled the managers to design proper inventory management or inventory control system which would keep track of the inventories and helps to reduce them.
- The overall study reveals the need for inventory control and inventory cost reduction in the company.
- The classification of materials and various combinations of the inventory control system can be used for managing the inventory.
- Then case study was carried out of construction site in which inventory matrix and inventory cost reduction were achieved by using ABC-FSN-HML-VED analysis.
- Presently In Company the procurement of material is being carried out by predetermined ordering quantity which results in an increase in the order quantity.so there will be a rise in the annual inventory holding cost and total inventory cost.
- If the proposed inventory matrix is used in the company, then the annual saving on inventory cost will be 23011.04 Rs. Based on the results, the total cost determined by this matrix is less than that of the present

inventory control system of the company. Company can save

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