

CONSTRUCTION MATERIALS MANAGEMENT ON PROJECT SITES

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Abstract - This paper is written to fill a void created by the absence of proper materials management on construction sites. To managing a productive and cost efficient site efficient material management is very essential. Research has shown that construction materials and equipment may constitute more than 70% of the total cost for a typical construction project. Therefore the proper management of this single largest component can improve the productivity and cost efficiency of a project and help ensure its timely completion. One of the major problems in delaying construction projects is poor materials and equipment management. This paper describes the main results of survey carried out in Ahmedabad that investigated the material management of 3 well-known builders of Ahmedabad.

KEY WORDS: Construction Materials, Cost control, Materials Management

INTRODUCTION

Materials management is a process for planning, executing and controlling field and office activities in construction. The goal of materials management is to insure that construction materials are available at their point of use when needed. The materials management system attempts to insure that the right quality and quantity of materials are appropriately selected, purchased, delivered and handled on site in a timely manner and at a reasonable cost. Materials management is the system for planning and controlling all of the efforts necessary to ensure that the correct quality and quantity of materials are properly specified in a timely manner, are obtained at a reasonable cost and most importantly are available at the point of use when required. Thus Materials management is an important element in project management. Materials represent a major expense in construction, so minimizing procurement costs improves opportunities for reducing the overall project costs. Poor

materials management can result in increased costs during construction. Efficient management of materials can result in substantial savings in project costs. If materials are purchased too early, capital may be held up and interest charges incurred on the excess inventory of materials. Materials may deteriorate during storage or get stolen unless special care is taken. Delays and extras expenses may be incurred if materials required for particular activities are unavailable. Ensuring a timely flow of materials is an important concern of material management. For effectively managing and controlling materials, the performance of materials management should be measured. A performance measure calculates the effective working of a function. These performance measures may differ from system to system. The measures divide the materials management system in parts and make the working of the system more efficient. When joined, the measures make the complete materials management system.

LITERATURE REVIEW

Material management can be defined as a process that coordinates planning, assessing the requirement, sourcing, purchasing, transporting, storing and controlling of materials, minimizing the wastage and optimizing the profitability by reducing cost of material. Building materials account for 60 to 70 percent of direct cost of a project or a facility, the remaining 30 to 40 percent being the labour cost.

Components of material management are:

- Material estimation, budgeting, planning and programming.
- Scheduling , purchasing and procurement
- Receiving and inspection.
- Inventory control, storage and warehousing
- Material handling and transport
- Waste management

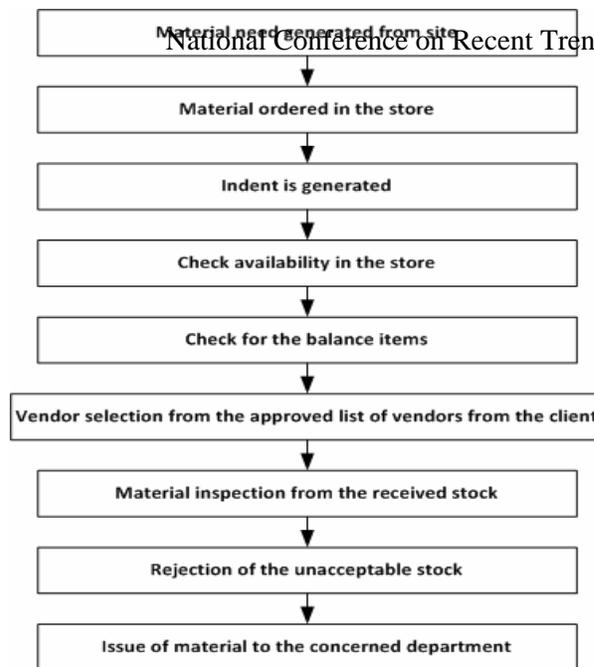


Fig.1 Process of Material Management

- Make and Buy Decisions
- Coding and Classification of Materials
- Forecasting and Planning

PROJECT MANAGEMENT

Special training sessions should be arranged on site to update the workers regarding the latest techniques. Plant and machinery should be updated regularly in order to avoid any break down. Workers and contractors should be guided for correct methodology to execute a particular task. Regular check should be kept on planning so as to overcome any error. Proper supervision should be done on site to improve the level of workmanship. Taylor (1913) pointed out that the economic losses caused by material waste are smaller than those related to the inefficiency of human work. Ford (1927) also suggested that human work should be the focus of waste convention since the value of materials depends, to a great extent, on the work that has been spent on them. Berliner B. says project control in many companies is based mostly on financial performance measures, which tend to be backward focused and do not make it easy to trace operational costs.

BENCHMARKING PROCESSES

According to Agarwal Anil (NICMAR, Pune) benchmarking processes and techniques can be applied to develop benchmarks for wastage control of building materials. After selection of project, the following steps are adopted. Work out estimates of quantities of materials required either from the first or final drawings. From site records/ accounts records, actual quantities of material consumed is obtained. Interviews are held with project managers and owners concerned to collect other related information.

PLANNING

The most commonly used basis for planning things out for the project is the BOQ prepared by the client. Companies may have two major levels in planning- micro and macro level. Time, cost, material and labour are the four major types of planning undertaken on sites. The planning should be revised as frequently as possible in order to monitor whether work is progressing as planned.

PURCHASING

According to Ninad Shah and Manish Dave Purchasing procedure can be described as below:

- Step 1 – Material Indent
- Step 2 – Enquiry to Vendors
- Step 3 – Vendor Comparison
- Step 4 – Vendor Selection and Negotiations
- Step 5 – Purchase Order
- Step 6 – Vendor Evaluation

RECEIVING

According to Sundersan, M. the receipt system can be divided into:

OBJECTIVES OF MATERIALS MANAGEMENT

- Efficient materials planning
- Buying or Purchasing
- Procuring and receiving
- Storing and inventory control
- Supply and distribution of materials
- Quality assurance
- Good supplier and customer relationship
- Improved departmental efficiency

To fulfill all these objectives, it is necessary to establish harmony and good co-ordination between all the employees of material management department and this department should have good co-ordination with the other departments of the organization to serve all production centers.

FUNCTIONS OF MATERIALS MANAGEMENT

The functions of materials management are discussed below:

In order to fulfill the objectives of materials management as stated above to meet the basic objectives and goals, the functions of the materials management are also categorized as primary and secondary functions.

(I) Primary Functions

To meet the primary objectives, the primary functions of the materials management are given as follows:

- Materials Requirements Planning (MRP)
- Purchasing
- Inventory Planning and Control
- Ascertaining and Maintaining the Flow and Supply of Materials
- Quality Control of Materials
- Departmental Efficiency

(II) Secondary Functions

- Standardization and Simplification

1. Receipt from outside suppliers
2. Receipts from internal divisions.

System of receipt starts even before the material reaches the site. The three documents that should be dispatched are copy of purchase order, supplier's advice document and the consignment note. This enables the Stores manager to organize and plan for clearances of materials.

For receipt from internal divisions, usually transfer notes and return to stores documents are used.

INSPECTION

Inspection can happen in two ways

1. Pre- dispatch inspection
2. Inspection on site

It is the responsibility of the inspector to inspect all materials delivered to the site prior to their being used in the work. It is desirable to perform inspection of materials or fabricated products prior to their delivery at site. E.g.: precast members. The inspector shall have rights to reject faulty material and have it removed from site. With respect to manufactured goods, the quality requirements should be specified in the purchase order.

Methods of Inspection

There are three methods of inspection:

1. Visual
2. Tactile
3. Statistical

STACKING AND STORAGE

Types of physical storage system on site vary according to the space availability and company practices. Industrial guidelines are also taken into consideration for the stacking and storage of particular materials. Materials are most often classified as per the comfort level of working of the workers. Basic categories followed are civil, electrical, plumbing, finishes, construction chemicals, miscellaneous. The materials are also often stacked as per the specification of the vendor or manufacturer.

Relevant IS Codes (IS: 4082: recommendations on stacking and storage of construction materials at site) specifications are also followed. E.g. : As per IS : 4082,

1. The materials should not be affected by impurities or atmospheric agencies.
2. Materials like cement should must be stored in covered sheds and stacked on timber raised platforms.
3. Reinforcing bars should be stacked yards away from moisture to prevent rusting and also away from oil and lubricants. Bars of different classification, sizes and lengths should be stored separately to facilitate issues.

ISSUING MATERIAL

According to Sundersan, M. issues can be divided into

1. Issues to consuming departments
2. Issues to outside suppliers for processing or conversion.

Issuing on site does not happen in the case of all construction materials. In the case of sand or aggregate, the materials are consumed as and when required corresponding

to the progress of the project. For other materials, issues are based on production programmes. Based on this and the bill of materials, work orders are printed, listing for each material, quantity to be issued against each component requiring that material. This automatically controls consumption.

INVENTORY CONTROL

Sundersan, M. defines inventory as "The sum of the value of raw materials, fuel and lubricants, spare parts, maintenance consumables at any given point of time."

CASE STUDY

Name of the organization	BEIL (Bakeri)	Savvy infrastructure	JMC
Designation	Store keeper, Project Managers	Purchase manager, Project Managers	Store keeper, Project Managers
Types of work undertaken by the company	Residential, Commercial buildings etc.	Infrastructure projects, commercial buildings etc.	Infrastructure projects, commercial buildings etc.
Year of establishment	1959	1991	1990
Head office	Ashram Road, Ahmedabad	S.G. Highway, Ahmedabad	Ambavadi, Ahmedabad

By collecting data for materials management through a questioner from above mentioned well known companies of Ahmedabad following are problems in materials management.

Phase 1: Materials Identification

Problem	Description
Undefined scope	No good definition of what is wanted
Lack of communication	Lack of communication between parties involved
Incomplete drawings	Plans are not completed and details are missing
Lack of conformance to requirements	What is wanted by the customer is not what is prepared
Nonstandard specifications	Use of specifications that are not commonly used
Incomplete / ineffective meetings	Issues not resolved during meetings
Difference between plans and specifications	Don't communicate exactly what is wanted to suppliers

Not determining when and what materials are needed	
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Phase 2: Vendor Selection

Problem	Description
Uncontrollable bid list	Have too many suppliers and too little information
Incomplete proposals	Suppliers do not include all documents required
Time spent in investigating non qualified suppliers	

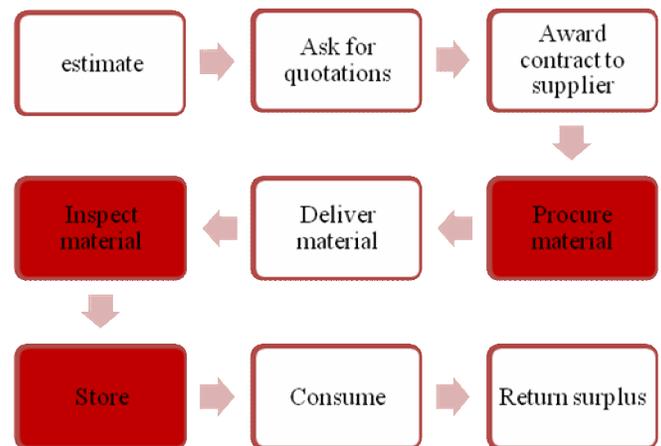
Phase 3: Procurement Problem

Problem	Description
Availability of material	
Availability of quantity	
Matching price to competitor's price	Price reduction to match competitor's price
Late deliveries	Materials are not delivered as per schedule
Late or incorrect submittals	
Poor communication	Lack of communication between parties
Lack of conformance to requirements	What is wanted is not what is prepared
Unrealistic delivery dates	Delivery dates impossible to meet
Vague stated requirements	Lack of communication
Re handling of materials	Materials to be moved from one place to another
Storage of materials	Storage areas are limited or are far from working area
Theft	
damaging	Damage during handling or other conditions

Phase 4: Construction Phase

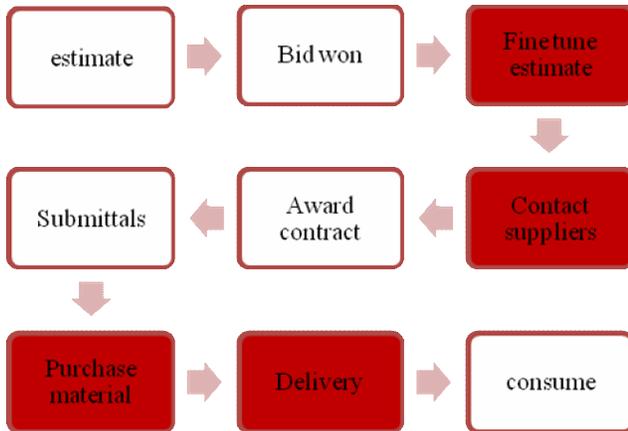
Problems	Description
Incorrect type of material delivered	There are differences in material ordered and delivered
Incorrect sizes delivered	
Incorrect quantities delivered	
Keeping track of material	Don't know where materials are at a certain period of time
Rehandling of material	
Storage of material	
Loss of material	
Damage	
No supplier QA	No quality assurance from supplier
Poor communication	
Receiving, handling and storage of unused materials	

Material management flow – Contractor A



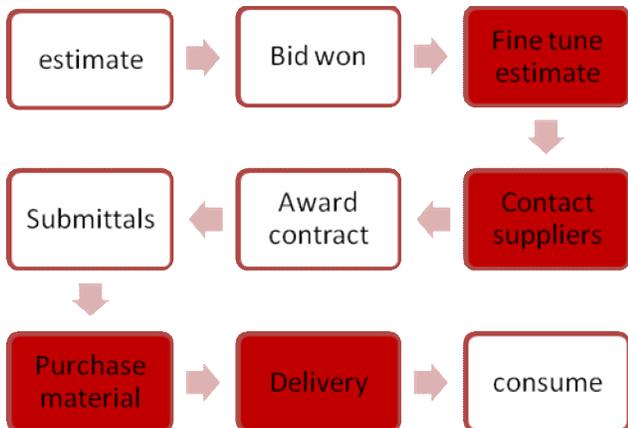
1. PM is in charge of all the releases based on schedule
2. Store keeper coordinates with PM directly if problems arise and PM contacts vendor
3. Materials stored on site directly till the time they are consumed, no proper storage facility.

Material management flow – Contractor B



1. PM revises estimate and creates a list of detailed quantities for materials
2. PM clarifies scope along with purchase department on site, no involvement of the head office
3. Buying less than estimated
4. Delivery to site directly.
5. No automation, lack of proper MIS, lack of co-ordination with other projects.

Material management flow – Contractor C



1. Purchase department and stores department working as two entities, requirement of a co-ordinating authority
2. No temporary purchase orders created as cushion

3. In house MIS present, co-ordinating with central stores department.

CONCLUION

- There should be a centralised material management team co-ordination between the site and the organization.
- Proper control, tracking and monitoring of the system is required.
- Awareness and accountability should be created within the organization
- There is a need of an efficient MIS integrating all aspects of material management.
- Firms employing proper material management system are seen to have increased their overall efficiency by 35%.

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