

# Material Management Effectiveness

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**ABSTRACT** – Material transfer is concerned with how best to move material from one place of the production process to another. Effective and necessary material transfer activities to accelerate production to distribution activities. Material handling includes various components to keep the supply chain running. The effectiveness of material handling can be realized if it follows the basic principles and all regulations are carried out by the relevant parties.

Keywords: material management, production, distribution, efficiency.

## A. MATERIAL HANDLING

Material handling is a tool used to carry out the movement, storage and control of certain goods, objects or loads. In general, material handling is used in the logistics and construction industry sectors. This handling has various components that work to keep activities in the factory or construction running.

Material handling includes the basic operations associated with the movement of bulk, packaged and individual products in semi-solid- or solid-state equipment manually or automatically within the confines of production, fabrication, processing or individual supply. Material handling can be defined as the function associated with the preparation, placement and positioning of materials to facilitate movement or storage. Another meaning can be expressed as the art and science that involves the movement, handling and storage of materials during different stages of production. Therefore, material handling is an integral part of the process to reduce costs and production cycle times.

The flow of the use of material handling usually starts when the stock is in the warehouse until then the material handling tool is used to move the goods to the storage area. Then from the storage area, the material handling equipment brings it to the preparation place in the order that it is ready to be distributed.

## B. GOALS AND PRINCIPLES

Efficiency is paramount when designing a material handling system. Efficient logistics is a necessity when reacting and planning customer and warehouse requirements because the material handling process of incoming inventory is as important as the outgoing process. Four important variables in material handling:

- Movement: moving the product from one place to another. For example, using a forklift to move products from a warehouse to a delivery truck.
- Time: how long the product lasts in storage, how long it takes inventory until delivery.
- Quantity: how many products can be stored in the specified space.
- Space: how much space is allocated or available.

However, there are several objectives of material handling, namely:

- Minimize material handling costs.
- Minimize delays and interruptions by providing the right amount of material and at the right time.
- Increase the productive capacity of production facilities by utilizing capacity and increasing productivity effectively.
- Safety in material handling through improving working conditions.
- Maximum utilization of material handling equipment.
- Prevention of material damage.
- Reduce investment in the inventory process.

In addition to the objectives, there are several principles in material handling, namely

- Planning principle: All handling activities must be planned.
- System principle: Plan a system that integrates as many handling activities as possible and coordinates the entire scope of operations (receiving, storage, production, inspection, packing, warehousing, supply and transportation).
- The principle of space utilization: Make optimal use of the space.

- d. Unit load principle: Increase in quantity, size, weight of load handled.
- e. Gravity principle: Utilize gravity to move material anywhere.
- f. Material flow principle: Planning the sequence of operations and equipment setup by optimizing material flow.
- g. Simplification principle: Reduce or eliminate unnecessary movement and/or equipment.
- h. Safety principle: Provide safe handling methods and equipment.
- i. Mechanization principle: Use mechanical or automated material handling equipment.
- j. Standardization principle: Standardization of methods, types, sizes of material handling equipment.
- k. Principle flexibility: Use methods and tools that can perform a variety of tasks and applications.
- l. Equipment selection principle: Consider all aspects of materials, transfer methods that can be utilized.
- m. Deadweight principle: Reduce the ratio of deadweight to payload on mobile equipment.
- n. The principle of motion: Equipment designed to transport materials must be constantly in motion.
- o. Idle time principle: Reduce labor idle time.
- p. Maintenance principle: Plan preventive maintenance or scheduled repair of all material handling equipment.
- q. Obsession principle: Replace obsolete methods/equipment for efficient and improve operations.
- r. Capacity principle: Use equipment to help reach its full capacity.
- s. Control principle: Use equipment to improve production control, inventory control and other handling.
- t. Performance principle: Determining the efficiency of handling performance in terms of cost per unit handled which is the main criterion.

### **C. EQUIPMENT SELECTION**

The selection of Material Handling equipment is an important decision as it affects the cost and efficiency of the handling system. The following factors should be taken into account when selecting material handling equipment as follows:

#### **a. Material Properties**

Material properties include solid, liquid or gas, and size, size and weight are important considerations for equipment use and brittle,

corrosive or toxic materials will imply the material handling method to be chosen.

#### **b. Building Layout and Characteristics**

The layout itself will indicate the type of production operation (continuous, intermittent, fixed position or group) and may indicate some equipment items that will be more suitable than others. Floor and room capacities also help in selecting the best material handling equipment.

#### **c. Production Flow**

Equipment such as conveyors or chutes can be used successfully if the flow is fairly constant between two fixed positions which is unlikely to change and vice versa if the flow is not constant and its direction changes occasionally from one point to another because several products are produced simultaneously then mobile equipment such as trucks are an option.

#### **d. Cost Consideration**

Several cost elements need to be considered when comparisons are made between different items of equipment all capable of handling the same load. Initial investment costs and operation and maintenance are the main costs that must be considered.

#### **e. Nature of Operation**

The choice of equipment also depends on the nature of the operation such as whether the handling is temporary or permanent, whether the flow is continuous or intermittent and the material flow pattern is vertical or horizontal.

#### **f. Engineering Factor**

Equipment selection also depends on engineering factors such as door and ceiling dimensions, floor area, floor conditions and structural strength.

#### **g. Equipment Reliability**

The reliability of equipment and supplier reputation and after-sales service also plays an important role in selecting material handling equipment.

### **D. SYSTEM EVALUATION**

The effectiveness of a material handling system can be measured in terms of the ratio of the time used in handling to the total time used in production. Cost effectiveness can be measured by the costs incurred per unit weight handled. Some other indices that can be used to evaluate the performance of a handling system are listed below.

Equipment utilization ratio is an important indicator for assessing a material handling system. This ratio can be calculated and compared with similar or the same companies over a certain period of time. To find out the total effort required for moving materials, it is necessary to calculate the Materials Handling Labor ratio (MHL) as follows:

$$MHL = \frac{\text{Personnel assigned to materials handling}}{\text{Total operating work force}}$$

The direct labor handling loss ratio is:

$$DLHL = \frac{\text{Material handling time lost of labour}}{\text{Total direct labour time}}$$

The movement operations ratio calculated after dividing the total number of movements by the number of productive operations indicates whether workers experience a lot of movement due to poor routes. However, the efficiency of material handling mainly depends on the following factors:

- a. efficiency of material handling methods for handling unit weights over unit distances,
- b. layout efficiency which determines the distance through which materials are to be handled,
- c. utilization of handling facilities, and
- d. handling speed efficiency.

Therefore, an effective material handling system relies on adjusting layout and equipment to suit specific needs. When large volumes have to be moved from a limited number of sources to a number of destinations, fixed line devices such as rollers, belt conveyors, overhead conveyors and cranes will be preferred but for increased flexibility a variety of line equipment will be preferred.

#### **E. INSTRUCTIONS FOR EFFECTIVE USE OF MATERIAL HANDLING EQUIPMENT**

Guidance on design and cost reduction in material handling systems:

- a. Since material handling does not add value but increases production cycle times, eliminate it then ideally there should be no handling at all.
- b. The operations are sequential so that the handling is unidirectional and smooth.
- c. Uses gravity because it results in conservation of power and fuel.

- d. Standardization of handling equipment for interchangeability of use, better utilization of handling equipment and lower holding of parts.
- e. Routine preventive maintenance program for material handling equipment to keep downtime to a minimum.
- f. The flexibility and adaptability of the equipment should be taken into account to ensure that investment in special purpose handling equipment is kept to a minimum.
- g. The weight of the unit load must be maximum so that each 'handling trip' is productive.
- h. Aspects of work studies, such as the elimination of unnecessary movements and process combinations should be considered when installing a material handling system.
- i. Non-productive operations such as slinging, loading, etc., should be kept to a minimum through proper design of handling equipment.
- j. Store locations as close as possible to the factories that use the ingredients. This avoids handling and minimizes investment in material handling systems.
- k. The application of Operation Research techniques such as queuing can be very effective in making optimal use of material handling equipment.
- l. Security aspect. The system designed must be simple and safe to operate.
- m. Avoid wasting movement.
- n. Ensure proper coordination through wise equipment selection and training.

#### **F. RELATIONSHIP BETWEEN LAYOUT AND MATERIAL HANDLING**

Material handling is a very important activity in production activities and is closely related to the layout planning of production facilities. Good layout ensures minimum material handling and eliminates repetition by:

- a. A systematic plant layout will minimize handling.
- b. A good layout ensures minimum travel for workers thereby increasing production time and eliminating hunting and travel time.
- c. Space is an important criterion. Factory layout integrates all movement of labor, material through well designed layout with material handling system.
- d. A good factory layout helps build an efficient material handling system so that material handling is shorter, faster and more economical. Good layout reduces material recoil, worker movement and effectiveness in manufacturing.

Ultimately, every worker involved in material handling must follow the company's safety rules and procedures. They must know and comply with all company regulations regarding material handling and safety such as wearing proper personal protective equipment, focusing, maintaining caution and reminding each other among workers. Material handling activity is an unproductive activity, because in this activity the material does not get a change in shape or change in value, so that it will actually reduce ineffective activities and look for the smallest material handling costs. However, accidents that occur in the workplace will only increase costs and harm the company.

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