

## **Plant Layout: Concept, Objectives, Principles and Type**

Concept of Plant Layout:

The concept of plant layout may be described as follows:

Plant layout is a plan for effective utilisation of facilities for the manufacture of products; involving a most efficient and economical arrangement of machines, materials, personnel, storage space and all supporting services, within available floor space.

More defines plant layout as follows:

“Plant layout is a plan of optimum arrangement of facilities including personnel, equipment’s, storage space, material handling equipment and all other supporting services along with the decision of best structure to contain all these facilities.”

Points of comment:

Certain useful observations on the concept of plant layout are as follows:

Plant layout is very complex in nature; because it involves concepts relating to such fields as engineering, architecture, economics and business management.

Most of managers now realize that after the site for plant location is selected; it is better to develop the layout and build the building around it – rather than to construct the building first and then try to fit the layout into it.

Objectives/Advantages of Plant Layout:

Following are the objectives/advantages of plant layout:

Streamline flow of materials through the plant

Minimise material handling

Facilitate manufacturing progress by maintaining balance in the processes

Maintain flexibility of arrangements and of operation

Maintaining high turnover of in-process inventory

Effective utilisation of men, equipment and space

Increase employee morale

Minimise interference (i.e. interruption) from machines

Reduce hazards affecting employees

Hold down investment (i.e. keep investment at a lower level) in equipment.

Principles of Plant Layout:

While designing the plant layout, the following principles must be kept in view:

Principle of Minimum Movement:

Materials and labour should be moved over minimum distances; saving cost and time of transportation and material handling.

Principle of Space Utilization:

All available cubic space should be effectively utilized – both horizontally and vertically.

Principle of Flexibility:

Layout should be flexible enough to be adaptable to changes required by expansion or technological development.

Principle of Interdependence:

Interdependent operations and processes should be located in close proximity to each other; to minimize product travel.

Principle of Overall Integration:

All the plant facilities and services should be fully integrated into a single operating unit; to minimize cost of production.

Principle of Safety:

There should be in-built provision in the design of layout, to provide for comfort and safety of workers.

Principle of Smooth Flow:

The layout should be so designed as to reduce work bottlenecks and facilitate uninterrupted flow of work throughout the plant.

Principle of Economy:

The layout should aim at effecting economy in terms of investment in fixed assets.

Principle of Supervision:

A good layout should facilitate effective supervision

Principle of Satisfaction:

A good layout should boost up employee morale, by providing them with maximum work satisfaction.

Principles of Plant Layout-at a Glance

Types of Plant Layout:

Two basic plans of the arrangement of manufacturing facilities are – product layout and process layout. The only other alternative is a combination of product and process layouts, in the same plant.

Following is an account of the various types of plant layout:

Product Layout (or Line Layout):

In this type of layout, all the machines are arranged in the sequence, as required to produce a specific product. It is called line layout because machines are arranged in a straight line. The raw materials are fed at one end and taken out as finished product to the other end.

Special purpose machines are used which perform the required jobs (i.e. functions) quickly and reliably.

Product layout is depicted below:

Product Layout

Reduced material handling cost due to mechanized handling systems and straight flow

Perfect line balancing which eliminates bottlenecks and idle capacity.

Short manufacturing cycle due to uninterrupted flow of materials

Simplified production planning and control; and simple and effective inspection of work.

Small amount of work-in-progress inventory

Lesser wage cost, as unskilled workers can learn and manage production.

Disadvantages:

Lack of flexibility of operations, as layout cannot be adapted to the manufacture of any other type of product.

Large capital investment, because of special purpose machines.

Dependence of whole activity on each part; any breakdown of one machine in the sequence may result in stoppage of production.

Same machines duplicated for manufacture of different products; leading to high overall operational costs.

Delicate special purpose machines require costly maintenance / repairs

Suitability of product layout:

Product layout is suitable in the following cases:

Where one or few standardized products are manufactured.

Where a large volume of production of each item has to travel the production process, over a considerable period of time.

Where time and motion studies can be done to determine the rate of work.

Where a possibility of a good balance of labour and equipment exists.

Where minimum of inspection is required, during sequence of operations.

Where materials and products permit bulk or continuous handling by mechanical parts.

Where minimum of set-ups are required.

Process Layout (or Functional Layout):

In this type of layout, all machines performing similar type of operations are grouped at one location i.e. all lathes, milling machines etc. are grouped in the shop and they will be clustered in like groups.

A typical process layout is depicted below:

A Typical Process Layout

Advantages:

Greater flexibility with regard to work distribution to machinery and personnel. Adapted to frequent changes in sequence of operations.

Lower investment due to general purpose machines; which usually are less costly than special purpose machines.

Higher utilisation of production facilities; which can be adapted to a variety of products.

Variety of jobs makes the work challenging and interesting.

Breakdown of one machine does not result in complete stoppage of work.

Disadvantages:

Backtracking and long movements occur in handling of materials. As such, material handling costs are higher.

Mechanisation of material handling is not possible.

Production planning and control is difficult

More space requirement; as work-in-progress inventory is high-requiring greater storage space.

As the work has to pass through different departments; it is quite difficult to trace the responsibility for the finished product.

Suitability of process layout:

Process layout is suitable in the following cases, where:

Non-standardised products are manufactured; as the emphasis is on special orders.

It is difficult to achieve good labour and equipment balance.

Production is not carried on a large scale.

It is difficult to undertake adequate time and motion studies.

It is frequently necessary to use the same machine or work station for two or more difficult operations.

During the sequence of operations, many inspections are required.

Process may have to be brought to work, instead of "vice-versa"; because materials or products are too large or heavy to permit bulk or continuous handling by mechanical means.

© Combination Layout:

In practice, plants are rarely laid out either in product or process layout form. Generally a combination of the two basic layouts is employed; to derive the advantages of both systems of layout. For example, refrigerator manufacturing uses a combination layout.

Process layout is used to produce various operations like stamping, welding, heat treatment being carried out in different work centres as per requirement. The final assembly of the product is done in a product type layout.

Fixed Position Layout:

It is also called stationary layout. In this type of layout men, materials and machines are brought to a product that remains in one place owing to its size. Ship-building, air-craft manufacturing, wagon building, heavy construction of dams, bridges, buildings etc. are typical examples of such layout.