UNIT – II

PLANT LAYOUT

INTRODUCTION AND MEANING OF PLANT LOCATION:

WHAT IS PLANT LOCATION?

Plant location refers to the **choice of region and the selection of a particular site** for setting up a business or factory.

But the choice is made only after **considering cost and benefits** of different alternative sites. It is a strategic decision that cannot be changed once taken. If at all changed only at considerable loss, the location should be selected as per its own requirements and circumstances. Each individual plant is a case in itself. Businessman should try to make an attempt for optimum or ideal location.

Plant location or the facilities location problem is an important strategic level decision-making for an organisation. One of the key features of a conversion process (manufacturing system) is the efficiency with which the products (services) are transferred to the customers. This fact will include the determination of where to place the plant or facility.

The selection of location is a key-decision as large investment is made in building plant and machinery. It is not advisable or not possible to change the location very often. So an improper location of plant may lead to waste of all the investments made in building and machinery, equipment.

Before a location for a plant is selected, long range forecasts should be made anticipating future needs of the company. The plant location should be based on the company's expansion plan and policy, diversification plan for the products, changing market conditions, the changing sources of raw materials and many other factors that influence the choice of the location decision.

The purpose of the location study is to find an optimum location one that will result in the greatest advantage to the organization.

WHAT IS AN IDEAL LOCATION?

An ideal location is one where the cost of the product is kept to minimum, with a large market share, the least risk and the maximum social gain. It is the place of maximum net advantage or which gives lowest unit cost of production and distribution. For achieving this objective, small-scale entrepreneur can make use of location analysis for this purpose

Locational analysis is a dynamic process where entrepreneur analyses and compares the appropriateness or otherwise of alternative sites with the aim of selecting the best site for a given enterprise. It consists the following:

LOCATIONAL ANALYSIS

1) **Demographic Analysis:**- It involves study of population in the area in terms of total population (in no.), age composition, per capita income, educational level, occupational structure etc.

2) **Trade Area Analysis:**- It is an analysis of the geographic area that provides continued clientele to the firm. He would also see the feasibility of accessing the trade area from alternative sites.
3) **Competitive Analysis:**- It helps to judge the nature, location, size and quality of competition in a given trade area.
4) **Traffic analysis:**- To have a rough idea about the number of potential customers passing by the proposed site during the working hours of the shop, the traffic analysis aims at judging the alternative sites in terms of pedestrian and vehicular traffic passing a site.
5) **Site economics:**- Alternative sites are evaluated in terms of establishment costs and operational costs under this. Costs of establishment is basically cost incurred for permanent physical facilities but operational costs are incurred for running business on day to day basis, they are also called as running costs.

SELECTION CRITERIA

The important considerations for selecting a suitable location are given as follows:

- Natural or climatic conditions.
- Availability and nearness to the sources of raw material.
- Transport costs-in obtaining raw material and also distribution or marketing finished products to the ultimate users.
- Access to market: small businesses in retail or wholesale or services should be located within the vicinity of densely populated areas.
- Availability of Infrastructural facilities such as developed industrial sheds or sites, link roads, nearness to railway stations, airports or sea ports, availability of electricity, water, public utilities, civil amenities and means of communication are important, especially for small scale businesses.
- Availability of skilled and non-skilled labour and technically qualified and trained managers.
- Banking and financial institutions are located nearby.
- Locations with links: to develop industrial areas or business centers result in savings and cost reductions in transport overheads, miscellaneous expenses. Strategic considerations of safety and security should be given due importance.
- Government influences: Both positive and negative incentives to motivate an entrepreneur to choose a particular location are made available. Positive includes cheap overhead facilities like electricity, banking transport, tax relief, subsidies and liberalization. Negative incentives are in form of restrictions for setting up industries in urban areas for reasons of pollution control and
- Decentralization of industries.
- Residence of small business entrepreneurs want to set up nearby their homelands

WHAT ARE FACTORS THAT GOVERN PLANT LOCATION?

A plant is a place where men, money, machinery and equipment etc.., are brought together for manufacturing products. Plant location plays a vital role in the organization.

Governing factors:

1. Nearness to raw material.
2. Transport facilities.
3. Nearness to markets.
4. Availability of Labor.
5. Availability of fuel and power.
6. Availability of water.
7. Climatic conditions.
8. Financial and other aids.
9. Land
10. Community attitude.
11. Presence of related industries.
12. Existence of hospitals marketing centres, schools, banks, post offices, clubs etc..,
13. Local byelaws, taxes, building ordinances, etc.
14. Housing facilities.
15. Facilities for expansion.
16. Security.

1. **Nearness to raw material:**

This is one of the factor that influence plant location. The plant must be located very nearer to raw material. The raw material can be easily available to the plant. It will reduce the cost of transportation of raw materials from the vendors end to the plant. When the supplier of raw material is near the facility, then the immediate supply of the raw materials will be available.

2. Transport facilities:

This is also one of the factor that influence plant location. Transportation plays a vital role in transporting finished goods from manufacturing unit to market centres.

Money is spent in transporting raw material as well as finished goods, depending on the size of a raw materials and finished goods a suitable method of transportation such a road, rail, water or air is selected & accordingly plant location is decided. The cost of transportation must be fairly small compared to the total cost

3. **Nearness to markets:**

The plant must be located nearer to the markets. If it is located nearer to markets, the transportation charges can be minimized.

4. **Availability of Labor:**

The plant should be located where the labor force is available in plenty. Labor force plays a vital role in production.

5. **Availability of fuel and power:**

   The plant should be located where the fuel and power is available in sufficient. Power and fuel plays a vital role in production.

6. **Availability of water:**

   The plant should be located where the availability of water is in sufficient.

7. **Climatic conditions:**

   The plant should be located where the climate is congenial. Climate also play a vital role in production.

8. **Financial and aids:**

   The plant should be located where the financial institutions and support is in sufficient. Finance is the life blood of an organization. Adequate financial resources are necessary to produce goods.

9. **Land:**

   The plant should be located where the topography of land is good. Earth quakes floods etc.., may create so many problems.

10. **Community attitude:**

    The plant must be located in the place where the local community attitude is fine. The local community and their attitudes may influence the plant.

11. **Presence of related industries:**

    The plant must be located in the place where related industries are present. If there are related industries mutual help and cooperation may exit.

12. **Existence of hospitals marketing centres, schools, banks, post offices, clubs etc:**

    For the future benefits of the staffs and their family.

WHAT IS PLANT LAYOUT, EXPLAIN THE PRINCIPLES AND TYPES OF LAYOUTS?

The concept of plant layout has great significance in industrial organizations. Today every organization is giving much importance to plant layout. The success of an organization is also based on its plant layout. “The systematic arrangement of men, machinery and equipment in a given plant area. So, as to achieve maximum production with minimum cost is called plant layout”. It means keeping the machinery and equipment with in a given plant area. It can be defined as the process of determining a spatial location for the creation of physical production facilities suitable to manufacture a product.

Layout involves determining the space requirement for the facilities and arranging them in a manner to ensure steady flow of operations with minimum overall cost. In order words, a layout is a floor plan for arranging the desired facilities, machinery and equipment in an optimum locations so as to permit the

quickest flow of materials and manpower at the lowest cost and with the least amount of in process handling from receipt of raw material to shipment of finished products.

Since, a layout once made cannot be changed/modified easily and without incurring considerable cost on one hand and disrupting the operations on the other hand, layout decisions are strategic decisions. Hence, layout has to be considered at the time of planning a new venture. A good layout should result in comfort, convenience, better appearance, safety, efficiency and profits. A poorly planned layout causes congestion, disruption in flow of man and/or materials, accidents, delays, rejections leading to frustration and inefficiency. In a production unit layout includes factory design that is layout of workshop, raw material stock yards, finished goods stores, generator, compressor room etc.

For example In hospitals it involves fixing the location of wards, operation theatre, out-patient departments, canteen, doctors and nurses duty rooms etc. At another level layout planning involves layout of different machines, work stations etc., in the shop floor and patient's beds, drug store, doctors and nurses seats and other facilities in a hospital ward.

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.

VARIOUS TYPES OF PLANT LAYOUT:

The pattern of plant layout is based on number of products (P) and production quantity (Q). The various types of plant layouts are as follows:

(a) Product Layout (or Line Layout)

(b) Process Layout (or Functional Layout)

(c) Combination Layout

(d) Fixed Position Layout

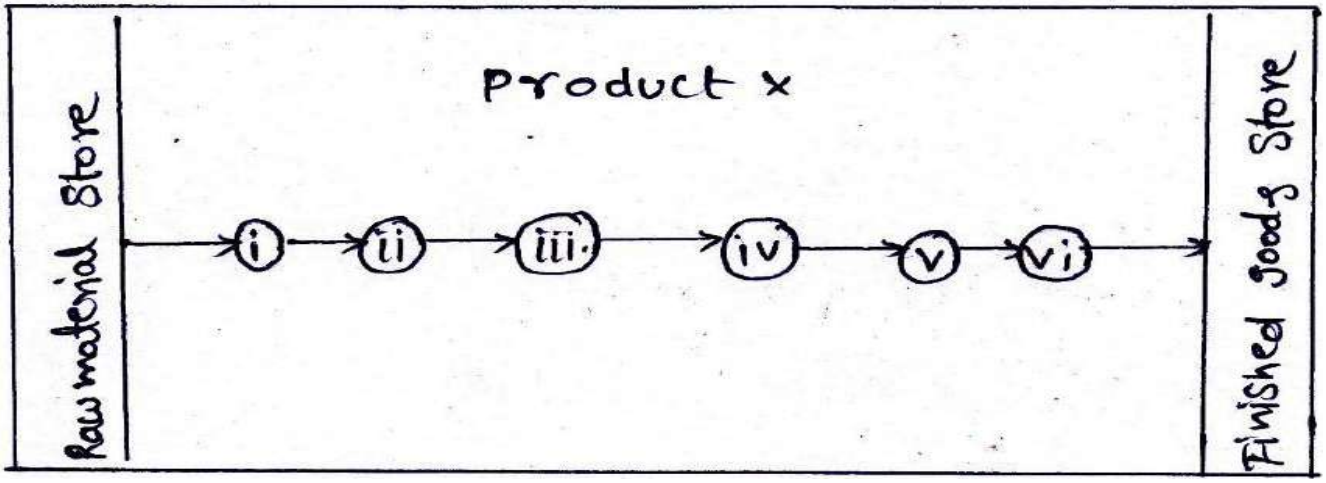
(a) PRODUCT LAYOUT (OR LINE LAYOUT):

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 arrange 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.

The following chart shows the production of commodity 'X' and its operations it requires six operations.

i. Drilling
ii. Boring
iii. Grinding
iv. Milling
v. Reaming
vi. Inspection.



ADVANTAGES:

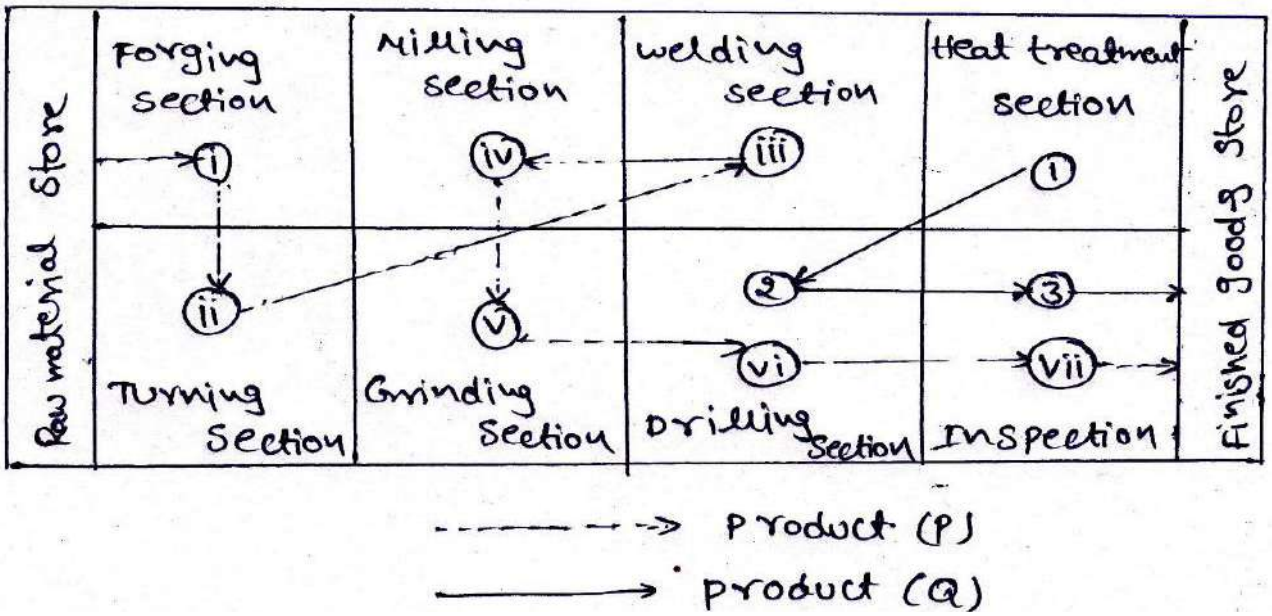
a. Faster and greater production.
b. Lower cost of material handling.
c. Easy monitoring.
d. Effective use of resources.
e. Team work benefits.
f. Maximum production with minimum cost.
g. Smooth and continuous work flow.
h. Product completes in lesser time.
i. Better coordination.
j. Simple production planning and control.
k. Less in process inventory.
l. Less space requirements for the same volume of production.

DISADVANTAGES:

a. Little flexibility.
b. Discontinuity in production lightly.
c. Monitoring each worker made difficult.
d. Use capital outlays.
e. Threat of duplication.

1. Process layout:

It is also called functional layout. If the layout is designed for different products and for different processes, it is said to be called process layout. In this case the machinery and equipment is arranged in a separate sections. For different products and for different operations. For example there are two products P and Q to be produced. For producing two products different types of machinery and processes to be followed. The process layout can be understood with the help of the following chart.



Advantages:

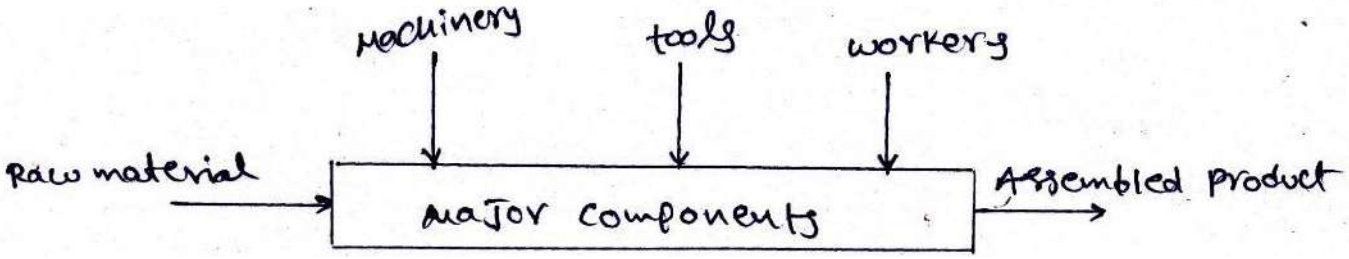
a. Maximum utilization of resources.
b. Flexibility.
c. Continuity.
d. Interesting to workers.
e. Easy to monitoring.
f. Convenient to workers.

Disadvantages:

a. Higher material handling cost.
b. Larger production cycle.
c. Monitoring may be complex.
d. Higher inspection cost.
e. Higher wagible.

2. Fixed layout:

If the layout is designed in a fixed position it is said to be called fixed layout. Here the material components remains stationary. Men, machinery tools … Etc. are brought to that location and assembled e product. Generally we can observe this type of layouts in large projects.



Advantages:

a. Does not involve large investment.
b. High degree of flexibility.
c. Workers find it very interesting.

Disadvantages:

a. Material handling cost will be very high.

b. At times the resources may be under-utilized.

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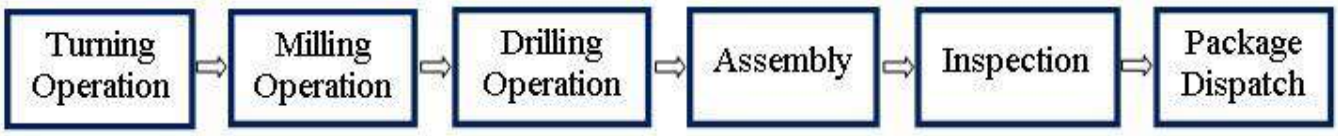
Product layout is depicted below:



ADVANTAGES:

1. Reduced material handling cost due to mechanized handling systems and straight flow
2. Perfect line balancing which eliminates bottlenecks and idle capacity.
3. Short manufacturing cycle due to uninterrupted flow of materials
4. Simplified production planning and control; and simple and effective inspection of work.
5. Small amount of work-in-progress inventory
6. Lesser wage cost, as unskilled workers can learn and manage production.

DISADVANTAGES:

1. Lack of flexibility of operations, as layout cannot be adapted to the manufacture of any other type of product.
2. Large capital investment, because of special purpose machines.

3. Dependence of whole activity on each part; any breakdown of one machine in the sequence may result in stoppage of production.
4. Same machines duplicated for manufacture of different products; leading to high overall operational costs.
5. Delicate special purpose machines require costly maintenance / repairs.

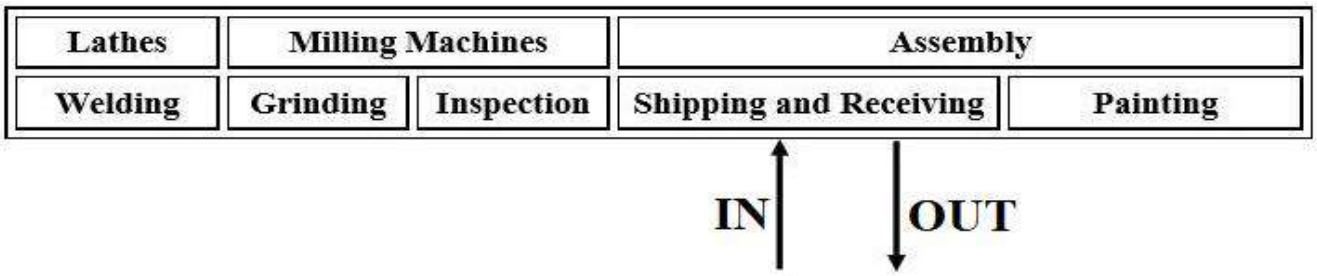
PRODUCT LAYOUT IS SUITABLE IN THE FOLLOWING CASES:

1. Where one or few standardized products are manufactured.
2. Where a large volume of production of each item has to travel the production process, over a considerable period of time.
3. Where time and motion studies can be done to determine the rate of work.
4. Where a possibility of a good balance of labour and equipment exists.
5. Where minimum of inspection is required, during sequence of operations.
6. Where materials and products permit bulk or continuous handling by mechanical parts.
7. Where minimum of set-ups are required.

B) 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:



ADVANTAGES:

1. Greater flexibility with regard to work distribution to machinery and personnel. Adapted to frequent changes in sequence of operations.
2. Lower investment due to general purpose machines; which usually are less costly than special purpose machines.
3. Higher utilisation of production facilities; which can be adapted to a variety of products.
4. Variety of jobs makes the work challenging and interesting.
5. Breakdown of one machine does not result in complete stoppage of work.

DISADVANTAGES:

1. Backtracking and long movements occur in handling of materials. As such, material handling costs are higher.
2. Mechanisation of material handling is not possible.
3. Production planning and control is difficult
4. More space requirement; as work-in-progress inventory is high-requiring greater storage space.
5. As the work has to pass through different departments; it is quite difficult to trace the responsibility for the finished product.

PROCESS LAYOUT IS SUITABLE IN THE FOLLOWING CASES, WHERE:

1. Non-standardised products are manufactured; as the emphasis is on special orders.
2. It is difficult to achieve good labour and equipment balance.
3. Production is not carried on a large scale.
4. It is difficult to undertake adequate time and motion studies.
5. It is frequently necessary to use the same machine or work station for two or more difficult operations.
6. During the sequence of operations, many inspections are required.
7. 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.

C) 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.

D) 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.

PRINCIPLES OF PLANT LAYOUT:

The main principles of plant layout are:

1. Minimizing per unit cost.

2. Optimizing quality.
3. Effective use of manpower, machinery, equipment and space.
4. Employee's convenience, safety and comfort.
5. Realization of production targets with in a stipulated time period.
6. Achieving organizational goals in most efficient and effective manner.
7. To achieve maximum production with minimum cost.

WHAT IS MEANT BY PLANT MAINTENANCE?

A plant is a place where men, money, material, machinery, equipment …Etc are brought together for manufacturing products.

Plant maintenance:

Keeping the plant in good working condition to achieve maximum production with minimum cost by minimizing breakdowns is called plant maintenance. Today in modern industry equipment and machinery is a very important part of the total productive effort than was the case years ago. More over with the development of special purpose and sophisticated machines equipment and machinery cost a lot more money and therefore idle and down time becomes much more expensive.

Objectives of plant maintenance:

1. To minimize production breakages.
2. To keep the plant in good working condition.
3. Optimum utilization of machine capacity.
4. Optimum utilization of plant capacity.
5. To prevent accidents.
6. To provide security and safety to workers.

Importance of plant maintenance:

1. The importance of plant maintenance varies with that type of plant and its production.
2. Equipment breakdown leads to an inevitable loss of production. If a piece of equipment goes out of order inflow production factory, the whole line will soon come to a halt. Other production lines may also stop unless the initial fault is cleared.
3. An improperly maintained plant will sooner require expertize and frequent repairs, because with the passage of time. All machines facilities buildings wear out and need to be maintained to function properly.
4. Plant maintenance place a prominent role in production management. Because plant break down creates problems such as loss in production time, rescheduling of production spoilt materials failure to recover over headed.

To avoid all the above difficulties and problems proper maintenance of plant is essential.

DISCUSS ABOUT PREUENTIVE AND BREAKDOWN MAINTENANCE?

Preventive maintenance:

Preventive maintenance means maintaining the plant to prevent accidents. The main principle of preventive maintenance is that prevention is better than cure. It tries to minimize the problems of breakdown maintenance. It is a stich in time procedure. It locates weak spots in all equipment provides them regular inspection of the minor repairs there by reducing the danger of unanticipated break down.

Preventive maintenance involves the following aspects:

1. Periodic inspection of equipment and machinery.
2. To uncover conditions that lead to production break down and harmful depreciation.
3. Up keep of plant equipment to correct such conditions while they are still in a minor stage.

Objectives of preventive maintenance:

1. To minimize the possibility of unanticipated production interruption breakdown by locating and condition which may lead to it.
2. To maintain the value of equipment and machinery by periodic inspection repairs over hauls.
3. To make plant equipment and machinery always available and ready for use.
4. To maintain the optimum productive efficiency of the plant equipment and machinery.
5. To maintain the operational accuracy of the plant equipment.
6. To achieve maximum production at minimum repair cost.
7. To reduce the work content of maintenance jobs.
8. To ensure safety of life and limbs of the workmen.

Departments responsible for preventive maintenance:

1. Production departments.
2. Maintenance department.
3. A separate division of inspectors, crafts and supervisors. The above departments and persons are responsible for preventive maintenance.

Where to start preventive maintenance:

One should not apply preventive maintenance to the entire plant at once. This program should be built up in pieces when one piece is finished, start the next. The entire preventive maintenance program hangs on inspectors and their related duties of adjustments and repairs.

Machine Number	Machine Description	1	2	3	4	5	6	7	8	9
1201	lathe				C					O
162	Shaper		C					O		
980	Surface grinder			F						
650	Milling					F				

weekly PM schedule

C – Clean

O – Overhauling

F – Functional check

DISCUSS ABOUT BREAKDOWN MAINTENANCE?

It implies that repairs are made after the equipment is out of order and it cannot perform its normal function any longer.

Ex: an electric motor will not start a belt is broken.

Under such conditions production department calls on the maintenance department to rectify the defect. The maintenance department checks into the difficulty and makes the necessary repairs. After removing the fault maintenance engineers do not attend the equipment again until another failure brake down occurs. This type of maintenance may be quite justified in small factories.

Typical causes of equipment break down:

- Failure to replace worn out parts.
- Lack of lubrication.
- Neglected cooling.
- Indifference towards minor faults.
- External factors.
- Indifference towards equipment vibrations, unusual sounds, equipment getting too much heated up etc..,

Disadvantages:

- Excessive delays in production.
- Reduction of output.
- Faster plant deterioration.
- Increased chances of accidents and less safety to both workers and machines.

- More spoilt material.
- Direct loss of profit.

EXPLAIN THE QUANTITATIVE TECHNIQUES FOR OPTIMAL DESIGN OF LAYOUTS?

The concept of plant layout have great significance in industrial organizations. The systematic arrangement of men, material, machinery equipment in a given plant area. So as to achieve maximum production with minimum cost is known as plant layout.

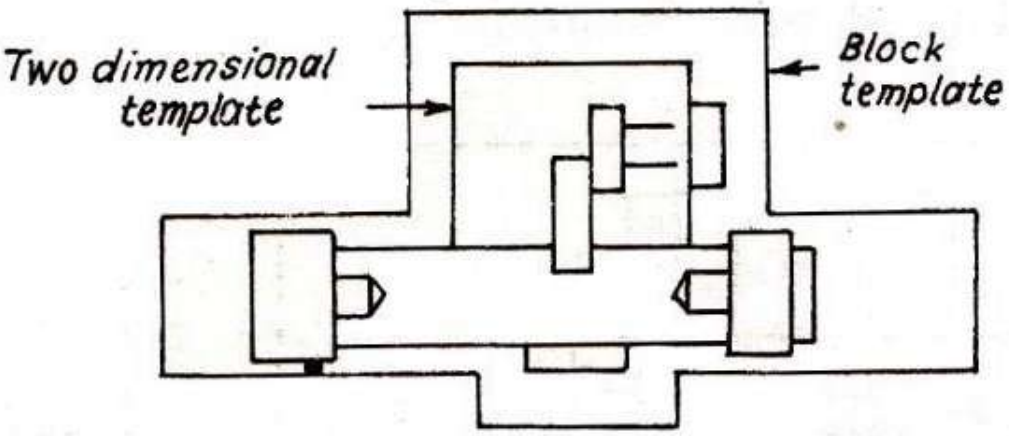
Quantitative techniques:

There are so many. They are process flow chart. There show how different component parts assembled in sequence of operations to form such assembles which in term lead to finished products. This chart how different parts can produce.

METHODS OF PIANT AND FACTORY LAYOUTS:

A layout furnishes details of the building to accommodate various facilities (like workers, material, machinery, etc.). In addition, it integrates various aspects of the design of a production system. The information required for plant laying out includes, dimensions of work places, sequence of operations, flow pattern of materials, storage space for raw material, in-process inventory and finished goods, offices, aisles, toilets, etc. During different development stages of a layout the following methods may be used.

1) **Process Flow Charts:** They show, how different component parts assemble, in sequence of operations to form sub-assemblies which in turn lead to assemblies (finished products).
2) **Material Movement Patterns:** The flow pattern of materials-in-process is traced and layout is built around it.
3) **Layout Analogues.** They cover two-dimensional cut outs or templates and three-dimensional models.
   a. **Templates or 2-D model:** They are used to develop plant layout. They are two-dimensional or block templates made up of cardboard, coloured paper or celluloid. They are made to scale (a typical scale being 1/50) and are placed on the scaled outline plan of the building. Templates or cut outs show the plan of the various facilities and the building. They show the actual floor space utilization. The templates can be placed and attached with a tape either on a board or on a cross-hatched surface or on a graph paper and thus being known as Graphic Technique.



Two-dimensional and block template.

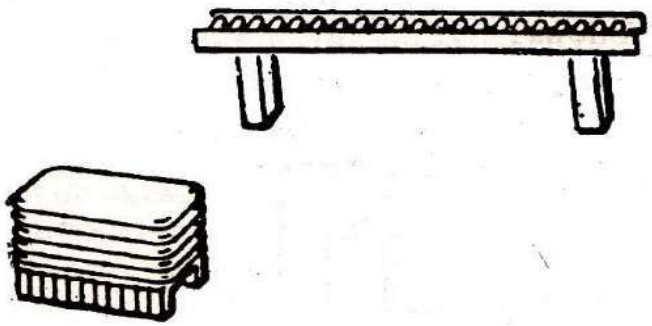
Advantages of Two-Dimensional Templates

1. They are the least costly.
2. They can be readily interpreted and followed by technical hands.
3. Duplicate copies can be made.

Disadvantages

1. Non-technical persons find it difficult to grasp the clear picture.
2. Overhead facilities cannot be visualized.

b. Three Dimensional Models: They are scale models of a facility and, more near to the real situation as, besides length and width they show the height of a facility also. Models are especially suitable for persons who are not familiar with plant layout practice. Models are made up of wood or die cast plastic. They show minor details and can be mounted on a thick plastic sheet acting as the floor plan. Models are used mainly to develop floor plans and elevations. Models can be made for production machines, workers, material handling equipment's or any other facility.



Advantages of Three-Dimensional Models:

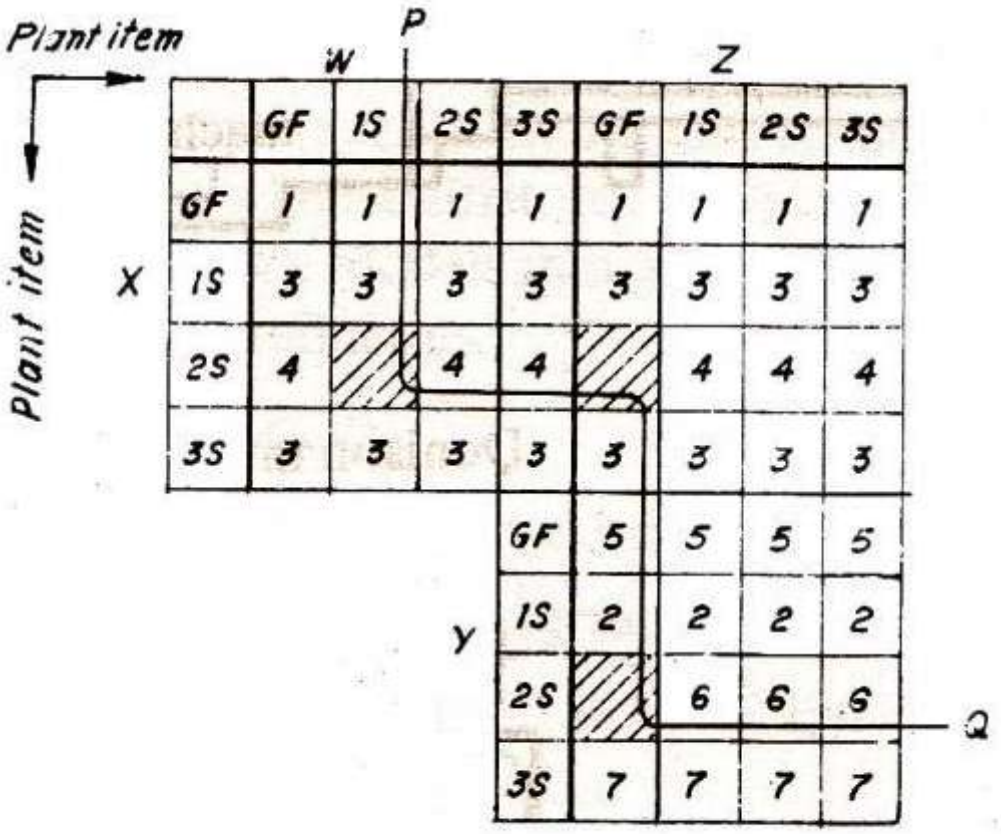
1. Layout is easier for the lay men to understand.
2. Layout can easily be explained to management.
3. Models can be shifted easily and quickly to study operational arrangements.
4. Overhead structures can be easily checked.

5. They convey more or less a real situation.

Disadvantages:

1. They require more storage area.
2. They are expensive.

4) **The Correlation Chart:** It involves drawing a grid with rows presenting alternative solutions (See Fig). Plant items can be ground floor, first floor or other floors of a multi-storey building. After the grid has been drawn the next step involves applying the constraints and objectives of layout. For example, the constraints to the layout may be that, (1) X cannot be done on ground floor (G.F.), (2) Y cannot be performed on first storey (1S). Similarly there can be objectives, (3) W should be done on second storey, and so on there are other objectives (4), (5), etc. Constraints and objectives are then applied to the squares. When a constraint stops an item going into a square, then in that square the number of that constraint is marked. After that the objectives or preferences are applied.



Correlation chart.

5) **Travel Chart:** A travel chart as the name suggests is a chart or record of the amount of travel by the material in-process while going from machine to machine or from one department to another. The amount of travel depends upon the frequency of movements between sections or departments. A travel chart helps improving the existing plant layout.

The

Following example will explain in a travel chart:

Existing plant layout showing the locations of various departments (A to F) is given in Fig. 4.11.

A	**B**	**C**
D	**E**	**F**

2nd Step: Movements A to B are 20;

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Fig. 4.11. *Ist Step* : (Existing layout).

2nd step : Movements *A* to *B* are 20 ; *B* to *A*, *10* ; *B* to *C*, 15 ; *A* to *F*, 25 ; *C* to *D*, 30 ; *D* to *C*, 50 ; *D* to *F*, 40 ; *E* to *F*, 10 and *F* to *E*, 15.

3rd step : A square grid is drawn and the various movements are marked.

FROM / TO	A	B	C	D	E	F
A		10				
B	20					
C		15		50		
D			30			
E						15
F	25			40	10	

Fig. 4.12 *3rd step.*

FROM / TO	A	B	C	D	E	F
A						
B	30					
C		15				
D			80			
E						
F	25			40	25	

Fig. 4.13. *4th step.*

4th step : Fig 4.12 is simplified by combining movements like *A* to *B* (20) and *B to A* (10) which involve same distance and therefore total movements $B \rightleftarrows A = 20 + 10 = 30$.

The simplified travel chart (*See* Fig. 4.13) shows the movements as follows :

$A \rightleftarrows B = 30$

$B \rightleftarrows C = 15$

$C \rightleftarrows D = 80$

$A \rightleftarrows F = 25$

$D \rightleftarrows F = 40$

$E \rightleftarrows F = 25$

According to these figures maximum number of movements are between departments *C* and *D*, hence in the plant layout these two departments should be side by side. The next lesser number of movements are between *D* and *F*, hence *D* and *F* should also lie closer to each other and so on. As a result the existing plant layout can be modified as follows :

C	D	A
E	F	B

Fig 4.14. Modified Layout.

Departments *C* and *D* (80), *D* and *F* (40) , *A* and *B* (30), *A* and *F* (25), *E* and *F* (25) are closer to each other whereas *B* and *C* which have minimum number of movements (*i.e.*, 15) between them are away from each other.

A travel chart is advantageous because it brings out the relative importance of having different pairs of departments close to each other but it gives an optimum linear arrangement which may not be always required.

(6) **Load Path Matrix Method.** The method aims at reducing the transportation of in-process inventory from section to section. Like travel chart it also helps deciding the position of one department in relation to the other. The ultimate purpose is to modify the existing layout or the preliminary plant layout made by other techniques. The departments having mass flow of material or goods are placed close to each other. The following example will illustrate the method.

*Kgs of material moved per day.

FROM / TO	A	B	C	D	E	F
A		10				
B			15			
C	20 *			20		
D	40				25	5
E			28			
F					15	

Fig. 4.15 From–to matrix constructed from the actual given data. (*Step 1*).

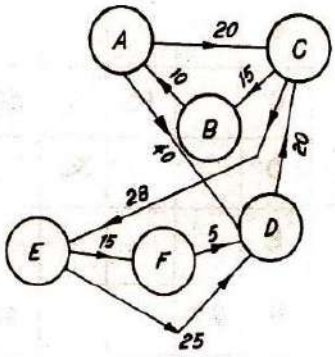

Fig. 4.16. (*Step 2*).

From the matrix (step 1) a diagram (*See* Fig. 4.16) is made showing the locations of different departments and the amount of material flowing among various departments (like *A, B, C,* etc.). Line joining *AC* shows that 20 kg. of material moves per day from department *A* to department *C* and so on. It can be seen that 40 kgs. of material while going from *A* to *D* passes *B*. If *D* department is brought in place of *B* then 40 kgs (*i.e.*, maximum) of material will move comparatively less distance. Similarly, material movements from *C* to *E* and *E* to *D* can be considered . The aim is to reconstruct this sequence diagram so that bigger loads travel small distances.

Step 3. Trial and error method can be used in order to modify the sequence diagram of step 2 and a comparatively better sequence diagram is drawn in Fig. 4.17. This has been obtained by placing those departments close to each other which involve movements of larger amounts of materials.

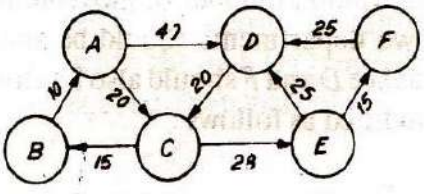

Fig. 4.17. Modified sequence diagram.

FACTORY BUILDING

Introduction

- After the plant location has been selected and plant layout decided upon, the next step is to construct plant or factory building to house and protect employees, equipments, tools, machinery, materials, etc.
- The factory building is the primary tool required to carry on production and into which all other production tools, processes and mechanisms must fit.
- *A good factory building*

(*i*) helps performing different operations most effectively ;

(*ii*) reduces material handling costs ;

(*iii*) minimizes production cycle time ;

(*iv*) reduces bottlenecks, stoppages and interruptions

(*v*) increases plant flexibility and efficiency ;

(*vi*) lowers down the maintenance costs ;

(*vii*) increases equipment and employees' safety ; and

(*viii*) has good appearance and provides healthy and pleasant working conditions.