

6.4: Facility Layout

Layout refers to the way in which organizations position their equipment, departments, or workcentres. Having an effective layout can streamline production activities, eliminate wasted or redundant movement and improve safety. The general types of layouts are: a fixed position layout, a process layout (functional), a product (line) layout, and a cellular layout, which is considered a hybrid. Other common layouts include office layouts, retail layouts, and warehouse layout.

Fixed Position Layout

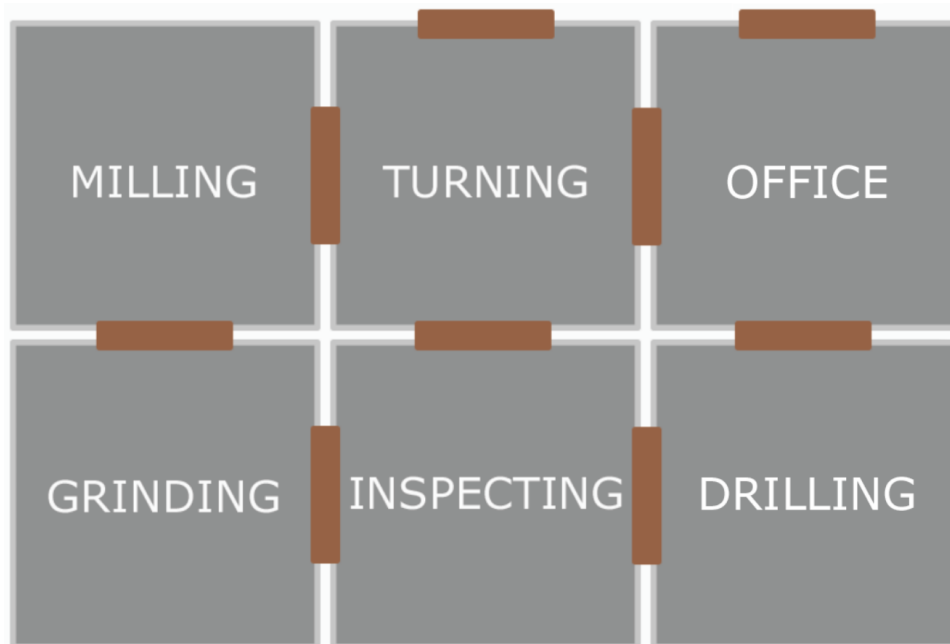
When producing a product that is not easily able to be moved, it may require that the worker, their tools and equipment are brought to the site where the production is taking place. This is a common layout in manufacturing a building, a ship or performing repairs to major equipment.

A process layout is a layout in which departments, equipment, or workcentres are arranged according to their function. In a manufacturing environment, all of the milling machines may be in one area or “department,” the lathes may be in another area, and the drilling machines all in another area. This layout is also common in services. In a department store, similar goods are arranged together such as footwear, jewelry, and housewares. At a hospital, cardiology is in one area, maternity in another location, and pediatrics elsewhere. The specific dedicated equipment and skilled practitioners work in each of these areas.

An advantage to a process layout is that equipment tends to be quite general-purpose. If one particular piece of equipment breaks down, it will not halt the entire process. This type of process gives flexibility to handle a variety of products or customers. It is ideal for job shops or small batch manufacturing.

A disadvantage of a process layout is that a particular product will likely have to travel from department to department to get the set of processes completed. This often leads to lots of material handling and movement of goods throughout the facility. A flexible material-handling system is needed such as forklifts. Inventory will sit in each area waiting for its turn to be processed. This waiting inventory is referred to as **queue**. When examining the total throughput time of jobs through the system, it is often discovered that each order spends much more time waiting in queue than it does actually being processed. For that reason, this type of layout is generally very inefficient. A major consideration in a process layout is to ensure that departments with a large amount of interaction are located nearby one another.

Below is an example of a machinery plant with a process layout:



Product (Line) Layout

These are used in businesses that use assembly lines or production lines. If the product has high volume an assembly line might be the best option. The equipment in these types of layouts are often very capital intensive and are laid out according to the

progressive steps of the process. Each work station is located along the line and may consist of a worker with equipment, or robots. Often each work station is adding components (assembly line) or modifying a product (production line). It is important to note that it is not necessarily a straight line, often assembly lines zig zag or are in a shape to use the maximum amount of space available. Some services may use a line layout, such as preparing hospital meals, or a cafeteria line. Due to considerable cost involved with setting up an assembly line, a large volume of product needs to be produced. Demand that is steady and consistent is ideal.

The goods produced in a line layout are generally very standardized, and the work processes are also highly standardized. Each product follows the same set of steps so that a fixed path material handling system is used such as a conveyor belt. This conveyor belt may be manual or automatic. It may operate at a pre determined speed, or it may be worker paced. It may run continuously or pulsed. The speed of the conveyor will determine the amount of product that will be produced per shift.

In contrast to a process layout a product layout is very efficient. There are a number of reasons for this.

1. Because of the division of labour and the repetition, there is less variability in the work performed
2. There is no build up of inventory, and no waiting. When completed at one work station, the job automatically moves to the next workstation. Only the inventory that is in process is in the system. Goods tend to be shipped when they are completed.
3. Due to the material handling system, goods move quickly and not very far.
4. Changeovers are not necessary so very little time is lost in changing between products.

It is important that assembly lines are balanced. The amount of time required at a preceding work station should be relatively similar to the amount of time required at the following work station.

Challenges in a product (line) layout include:

1. The fact that the line may be susceptible to shut downs if there are equipment malfunctions so preventative maintenance is critical. Preventative maintenance involves the inspection and replacement of any parts that have a high probability of failures, as well as holding ample spare parts in stock and having a detailed maintenance schedule for each piece of equipment.
2. Training and job rotation are critical activities to make sure employees are capable of completing the work tasks and that there are multiple people that can work at each individual job
3. With repetitive standardized jobs, it is critical that good ergonomic job design is performed. Organizations that ensure the health, safety and comfort of their employees reap rewards in terms of the quality of work they receive from employees.

Here is a fun video; see Rick Mercer on the Assembly line in GM Oshawa:



Cellular Layout

Cellular layouts are considered a “hybrid” type of layout because it includes characteristics of both a Process layout and a product (line) layout. It is very common that a business may have multiple product lines, with far too much variety in order to take advantage of one assembly line. Often these businesses may have been using a process layout, with all of the associated product movement and waiting times. An alternative that became popular beginning in the late 1980s is the Cellular layout type. This type of production layout is still heavily utilized today.

This type of layout begins with the company performing a thorough analysis of their products and deciding which products are similar to one another and often share common geometry and processing requirements in terms of equipment, machinery,

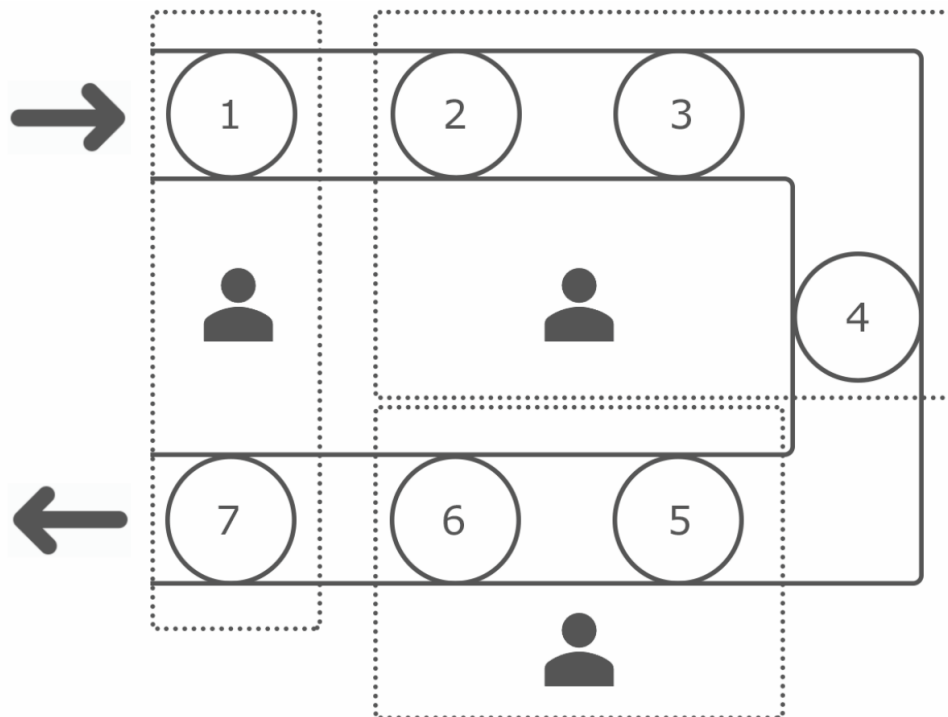
technology and employee skills. These products are grouped together and manufactured in a work cell. This is referred to as group technology.

Each work cell will contain a unique set of equipment to manufacture this family of parts in an assembly line type of layout. The equipment is laid out in a U shape with equipment located close together so jobs do not have to move very far.

Advantages of a cellular layout include:

1. Reduced set up times for each piece of equipment because each machine is making products that are very similar, often set-ups are very fast or non-existent.
2. Speed is greatly enhanced because batches can now be small and goods that enter the system will continue until they are complete. Small batches means fast run times and short wait times.
3. Inventory investment is now reduced due to small batch sizes enabled because of the low set up times required.
4. Quality is enhanced because employees work only within that cell on a narrow range of products. Cross training of employees ensures good and thorough knowledge of the entire production process.
5. Employee morale is improved due to working as part of a team that has responsibility for the throughput and quality of the cell. The U-shaped design heightens collaboration among workers.
6. Less floor space is required due to machines being placed close together and less movement of product.

An example of a U-shaped layout can be found below:



Here is a video on cellular manufacturing:



Other Layouts

Office Layout: In 2020 office spaces are a great deal different than in generations past. Floor space per employee has dropped significantly. There is far less worry about the flow of paperwork than in the past. Often employees are grouped according to the tasks they perform and the work teams they participate in. Workspaces now tend to be more flexible with less paper and less furniture to hold files and documents. Many organizations put more emphasis on having comfortable spaces for collaboration. Layouts are much more open concept with lower partitions to improve visibility of the workspace.^[1]



Retail Layout: The overall goal when laying out a retail location is to try and maximize the amount of sales per square foot in the facility. This is done by careful study of traffic patterns in the store in order to try and maximize the amount of product to which each customer is exposed. That is why you will often find the milk at the far end of the store causing customers the need to walk past all other departments to reach it.

Warehouse Layout: Effective warehouse layout aims to make effective use of the total volume of space contained in the building. The relationship between the receipt of incoming goods, the storage space and the picking, packing and shipping of outbound goods is carefully analyzed. An important consideration is the placement of inventory items in order to minimize distance goods and employees are need to travel. Many warehouses have special holding requirements such as freezers, cold storage and high security areas.

1. Lashbrooke, B. (2019). This Is The Hottest Trend In Office Design Right Now, Retrieved on November 21, 2019, from <https://www.forbes.com/sites/barnaby.../#5c26abb87787> ↵

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