Facilities Planning

LAYOUT Part I

What is facility planning?

- Facility planning exercise determines how an activity's tangible fixed assets best support achieving the activity's objectives
- In developing a layout for a system producing goods or services organisations seek to determine the best arrangement of facilities and equipment capable of satisfying anticipated demand at lowest cost.
- Facility planning is also know as layout planning, plant layout, facilities design.

Need for facility planning

- Effective facilities planning can reduce the cost of material handling. Again, good layout provides easy access to equipment maintenance and repairs thus reducing downtimes and maintenance cost
- A good facility planning enables changes or adjustment to be made to the existing layout as a result of changes in demand and technology
- A well designed layout minimizes losses in both money and manpower resulting from accident
- A good layout provides a working environment that leads to a better utilization of human resources in the organization

Objectives of facility planning

- Facility planning is a continuing activity in any organization that plans to keep abreast of development in the field.
- The following are characteristics of a good layout
  - Support organisation's mission through improved material handling, material control and good house keeping
  - Effectively utilise people, equipment, space and energy
  - Minimise capital investment
  - Be flexible and promote ease of maintenance
  - Provide for employee safety and job satisfaction

Characteristics of poor layout

- Congestion in aisles and storage areas and poor utilisation of space
- Excessive in process inventory and excessive work flow distances
- Continual production bottlenecks in some locations and simultaneous idle facilities elsewhere
- Skilled workers doing excessive unskilled work
- Long operation cycles and delivery delays
- Worker anxiety and stain
- Accidents or near accidents
- Obvious lack of production control

Purposes of re-layout

- To maximise the profitability or efficiency of operations
- Minimising safety or health hazards
- Facilitating crucial staff interaction
- Freeing up bottleneck operations and minimising interference, noise or distractions between different operational areas

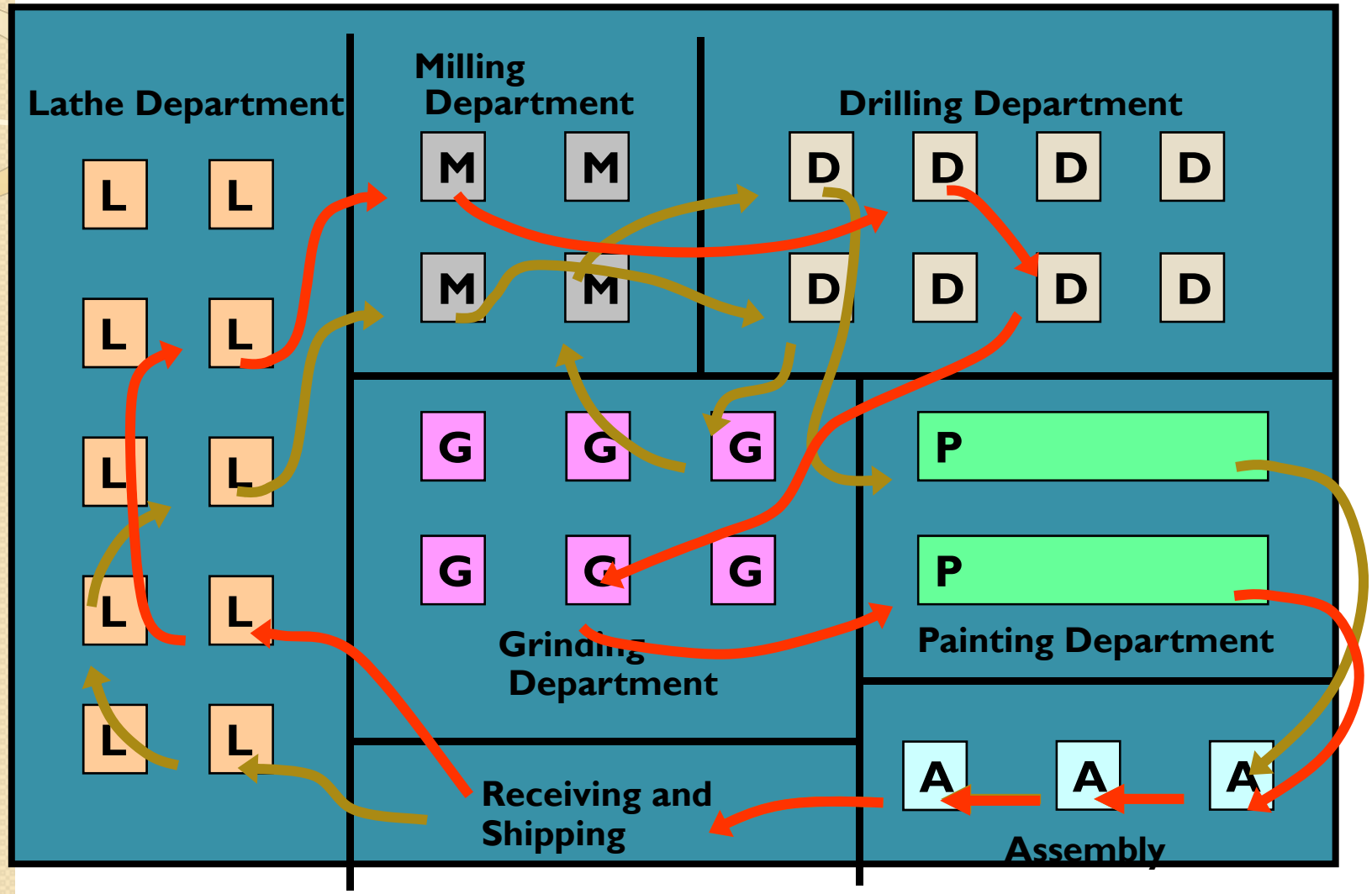
Types of layout

- Process Layout
- Product Layout
- Fixed Position Layout
- Cellular Layout
- Retail/Service Layout
- Warehouse Layout
- Office

Process Layout

- A process layout is the arrangement of facilities and equipments in groups according to function performed or in departments.

Process Layout



Advantages of process layout

- Flexibility in equipment and labor assignment (e.g. in the event of breakdown work can be assigned to another machine or new worker)
- Manufacture of parts in small batches or **job lots** and
- The production of a wide variety of parts in different sizes or forms.
- Greater incentive for groups of workers to raise level of performance and greater possibility of group incentives

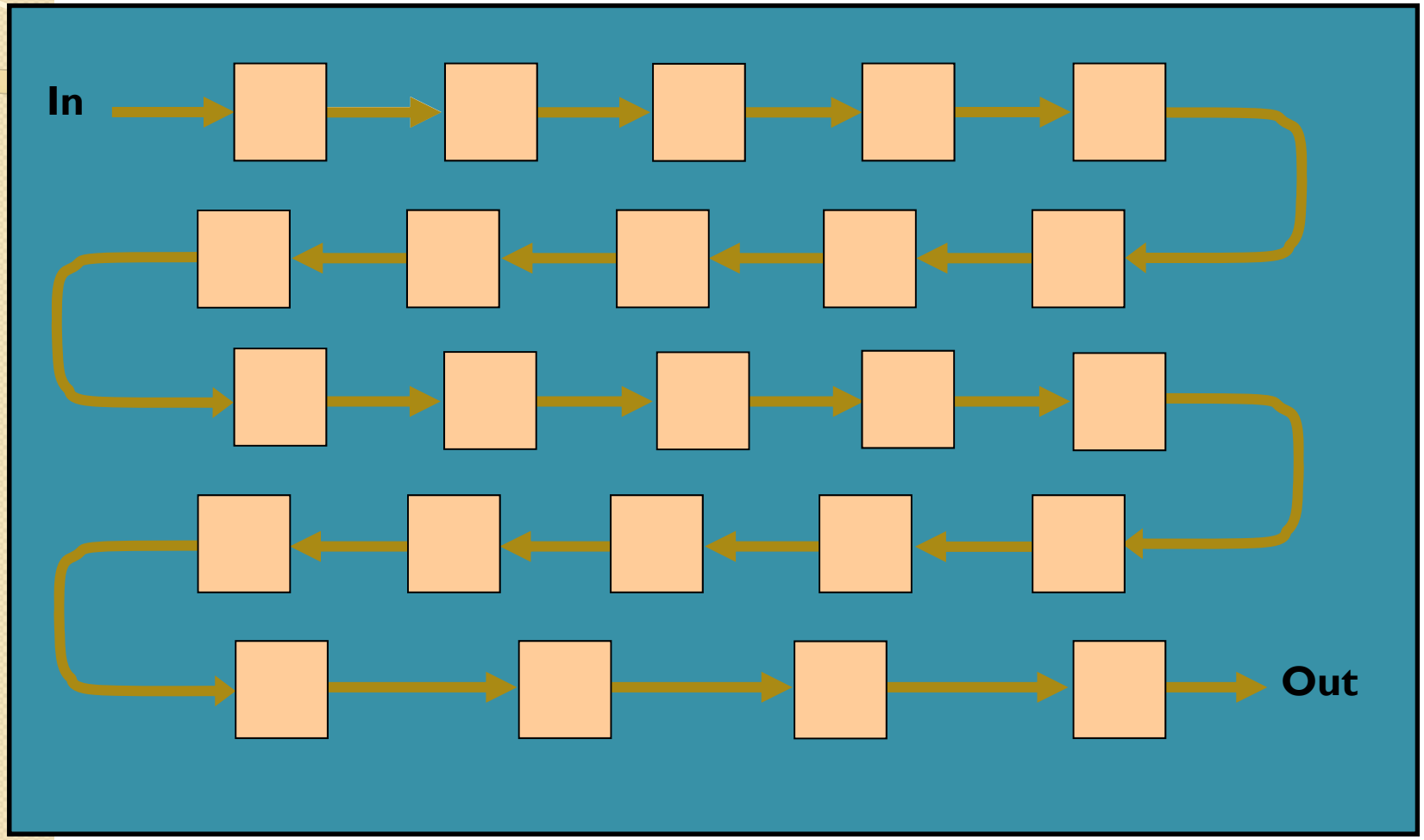
Disadvantages of process layout

- Equipments are general purpose equipment
- Orders take more time and money to move through the system because of difficulty scheduling, setups and material handling
- Labor skill requirements are higher and this increases the required levels of training and experience
- Work-in-process inventories are higher because of higher imbalances in the production process
- Higher total material handling cost

Product layout

- Is an arrangement of facilities and equipment in the same sequence as that of the operations needed to complete each unit of the product or the service offered.
- The production line is typically automated and the use such means as conveyors through a series of workstations

A Product Layout



Advantages of product layout

- Less duplication of equipment and hence lower total investment in equipment and training
- Low variable cost per unit because of high volume and standardized products
- Material handling costs are low
- Work-in-process inventories are also kept low
- Better and more efficient supervision possible through specialization
- Greater incentive to efficient individual workers

Disadvantages of product layout

- High volume is required because of high investment needed to set up the process
- Work stoppage at any one point ties up the whole operation
- Less flexibility of production

Comparison of Product and Process Layouts

	Product	Process
Description	Sequential arrangement of activities	Functional grouping of activities
Type of process	Continuous, mass production, mainly assembly	Intermittent, job shop, batch production, mainly fabrication
Product	Standardized, made to stock	Varied, made to order
Demand	Stable	Fluctuating
Volume	High	Low
Equipment	Special purpose	General purpose

Comparison of Product and Process Layouts

	Product	Process
Workers	Limited skills	Varied skills
Inventory	Low in-process, high finished goods	High in-process, low finished goods
Storage space	Small	Large
Material handling	Fixed path (conveyor)	Variable path (forklift)
Aisles	Narrow	Wide
Scheduling	Part of balancing	Dynamic
Layout decision	Line balancing	Machine location
Goal	Equalize work at each station	Minimize material handling cost
Advantage	Efficiency	Flexibility

Fixed-Position Layouts

- Typical of projects in which product produced is too fragile, bulky, or heavy to move
- Equipment, workers, materials, other resources brought to the site
- Low equipment utilization
- Highly skilled labor
- Typically low fixed cost
- Often high variable costs

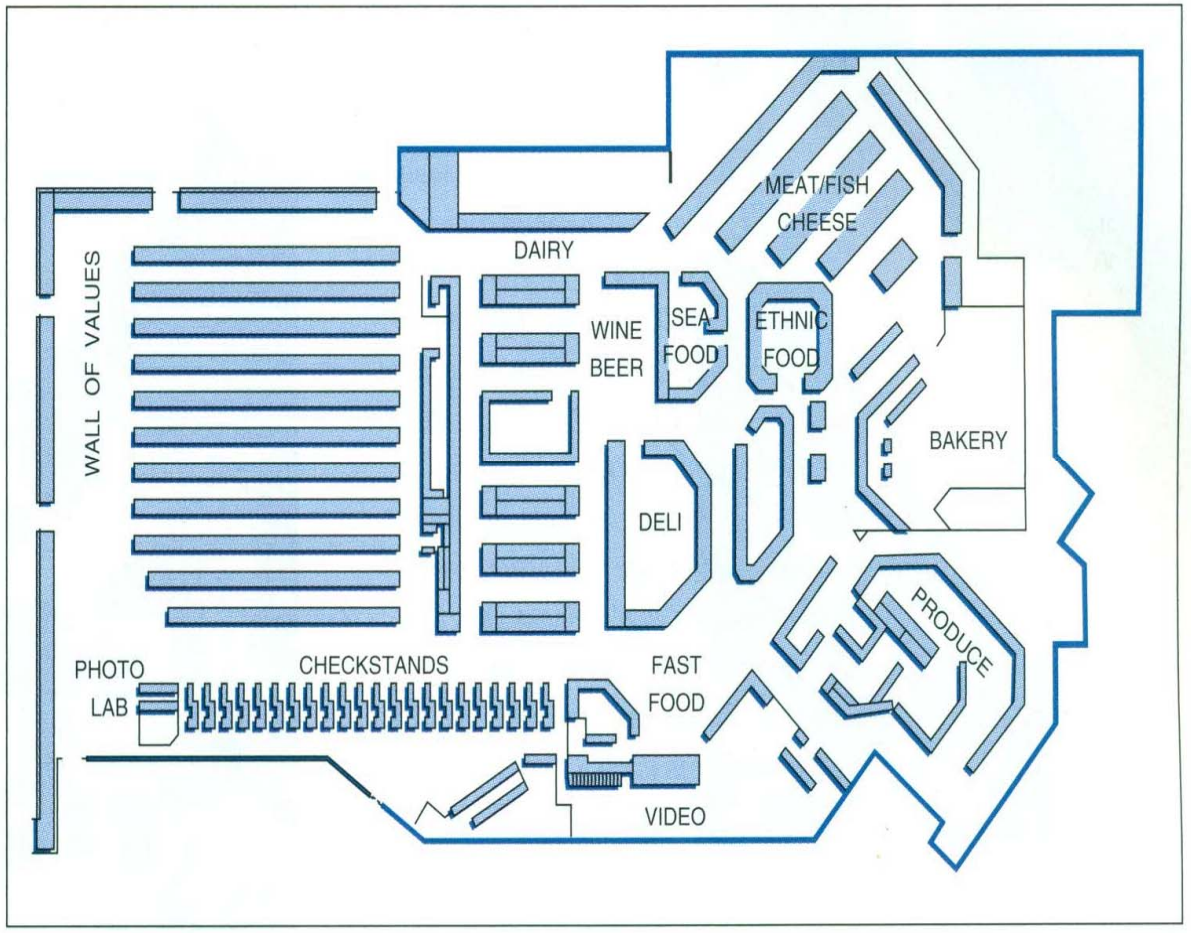
Office layout

- **Office layout**
- The grouping of workers, their equipment, and spaces/offices to provide for comfort, safety, and movement of information

- The main distinction of office layouts is the importance placed on the flow of information.
- Office layouts are in constant flux as the technological change sweeping society alters the way offices function.

RETAIL LAYOUT

Store Layout with Dairy and Bread, High-Draw Items, in Different Areas of the Store



Warehouse **layout**

- The objective of warehouse **layout** is to find the optimum trade-off between handling cost and costs associated with warehouse space.
- Consequently, management's task is to maximize the utilization of the total "cube" of the warehouse-that is, utilize its full volume while maintaining low material handling costs.
- We define *material handling costs* as all the costs related to the transaction

Warehouse layout

- A design that attempts to minimize total cost by addressing trade-offs between space and material handling.

- Automated storage and retrieval systems are reported to improve productivity by an estimated 500% over manual methods.

Developing the layouts – information needed

1. Analyse the product or products to be produced
   - Complete design drawings
   - The parts list which established those parts to be manufactured and/or purchased and which must be provided for the general plant area under consideration
   - Assembly charts indication the sequence by which the parts are combined into assemblies

Developing the layout(cont.)

2.Determine the process required to manufacture the product

- Route sheets and operations sheets must be obtained or developed for each manufactured part or assembly
- Operation process charts are prepared following the preparation of the route sheets to provide a means of combining the assembly charts and route sheet data in a single form

3. Prepare layout planning chart which includes:

- Flow process showing all operations, moves, storages and inspections
- Standard times for each operation obtained from time study or pre-determined standards

Developing layouts-(cont)

- Machine selection
- Manpower requirements for the production activity
- Machine balance and manpower balance
- Material handling load, methods and equipment requirements

4. Determine the work stations

- Layout must be developed taking into consideration machine, operator, materials and service area requirement

Developing the layouts (cont)

5. Analyse storage area requirement
6. Establish minimum aisle widths
7. Establish office requirements
8. Consider personnel facilities and services
9. Survey plant services
10. Provide for further expansion

Conventional approach for developing product layout

- Product layouts are suitable for mass production of discrete items
- Products layout are used to achieve smooth flow of large volume of highly standardised products that require repetitive processing operations
- The main issue in design of product layout is line balancing
- The process of deciding how to assign tasks to work stations on the line is referred to as line balancing
- The objective of line balancing is to obtain task groupings that represent approximately equal time requirement.

Conventional approach for developing product layout(cont)

- Perfect balance would lead to smooth flow of work
- It is difficult to achieve perfect balancing as a result of inability to obtain task groupings that have same durations
- The cycle time which is the amount of time each work station has to complete its set of task before the product moves to the next station, determines the output rate per line