

Facilities layout assignment



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They involve long term commitments, which mistakes difficult to overcome. *

They have significant impact on the cost and efficiency of operations. Types

of Layout 2. Office Layout 3. Retail Layout 4. Warehouse Layout 5. Fixed

Position Layout 6. Process Oriented Layout 7. Work-cell Layout 8. Product

Oriented Layout Because only few of these seven classes can be modeled

mathematically, layouts of physical facilities are still something of an art.

However, a good layout requires determining the following: * Material

handling equipment * Capacity and space requirements * Environment and

aesthetics * Flows of information * Cost of moving between various work

areas * Office Layouts * The grouping of workers, their equipment, and

spaces/offices to provide comfort, safety and movement of information. *

The main distinction of office layout is the importance placed on the flow of

information. * Typically, it is in the state of instant flux due to frequent

technological changes. Even movements of information are widely

electronic, conventional flow of information still plays a major role in the

organization. Managers therefore examine both communication patterns,

separation needs and other conditions affecting employees' effectiveness.

Relationship Chart This chart prepared tort an office to product designers

indicates that chit marketing officer must be: * Near the designer's area *

Less near the secretary and central files * Not at all near the copy center and

accounting departments. Three Physical and Social Aspects 2.

Proximity 3. Privacy 4. Permission Two Major Trends 1 . Information

technology – allows increasing layout flexibility by moving information

electronically and allowing employees to work offside. 2. Dynamic needs for

space and services – modern firms create dynamic needs or space and

services * Retail Layouts * An approach that addresses flow, allocates space and responds to customers' behavior by trying to expose them with as many products as possible. * The main objective is to maximize profitability per square foot of floor space. Five ideas are helpful in determining the overall arrangement of many stores: * Locate high-draw items around the periphery of the store * Use prominent locations for high-impulse and high-margin items * Distribute power items to both sides of an aisle and disperse them to increase viewing of other items * Use end-aisle locations * Convey mission of store through careful positioning of lead-off department * Computerized program are available to assist managers in evaluating the profitability of various merchandising plans for hundreds of categories: this technique is known as category management. An addition, slotting is one of the controversial issue in retail layout. Slotting is when manufacturers pay fees to retailers to get the retailers to display (slot) their product. Not demanding such fees removes the barrier to entry small companies usually face.

Serviceable – the physical surroundings in which a service takes place, and how they affect customers and employees. To provide good service layout, a firm considers three elements: 1. Ambient conditions -background characteristics such as lighting, sound, smell and temperature. . Spatial Layout and Functionality -involve customer circulation path planning, aisle characteristics (width, direction, angle and shelf spacing) and product grouping. 3. Signs, Symbols and artifacts -characteristics of building design that carry social significance (carpeted areas of a department store encourages shoppers to slow down and browse. * Warehouse Layouts * A design that attempts to minimize total cost by addressing trade-offs between space and material handling. Its objective is to optimize trade-offs between

handling costs and costs associated with warehouse space * Maximize the total “ cube” to the warehouse - utilize I TTS tulle volume while maintaining low material handling costs (all cost related to the transactions such as incoming and outgoing rainspout, storage, equipment, people, supervision, insurance and depreciation) * A warehouse storing few unique items lends itself to higher density than a warehouse storing variety of items. * An important component of warehouse layout is the relationship between the receiving/unloading area and shipping/loading area. Cross-docking’s avoiding the placement of materials or supplies in storage by processing them as they are received for shipment. It requires both tight scheduling and accurate inbound product identification. * Random docking is used in warehousing to locate stock whenever there is an open location. It typically requires automatic identification systems (Axis) and effective information systems. Computerized random stocking systems often include the following task: 1 . Maintain list of open locations 2. Maintain accurate records 3. Sequence items to minimize travel, pick time 4. Combine picking orders 5.

Assign classes of items to particular areas * Customizing using warehouse to add value to a product through component modification, repair, labeling, and packaging. It is particularly a useful way to generate competitive advantage in markets where products have multiple configurations. * Fixed-position Layouts Layout in which the product or project remains stationary and workers, materials and equipment are moved as needed. Examples are ship, a highway, a bridge and an operating table in a hospital operating room. * The technique for addressing the fixed-position layout are complicated by three factors: 1. Limited space at site 2.

Different materials required at different stages of the project 3. Volume of materials needed is dynamic * Because problems with fixed-position layouts are so difficult to solve well onsite, an alternative strategy is to complete as much of the project as possible offsite product oriented facility. Here are the three versions of fixed position layout * A house built via this layout would be constructed onsite, with equipment, materials and workers brought to the site. * A service example of this layout is an operating room; the patient remains stationary on the table and medical personnel and equipment are brought to the site. In shipbuilding, there is limited space next to this layout. Shipyards call these loading areas platens, and they are assigned for various time periods to each contractor. * Process-oriented Layouts Layout that deals with low-volume, high-variety production in which like machines and equipment are grouped together * Its big advantage is its flexibility in equipment and labor assignments. It is also especially good for handling the manufacture of parts in small batches, or Job lots, and for the production of a wide variety of parts in different sizes or forms. Its disadvantage is that, scheduling can be difficult and setup, material handling, and labor costs can be high. Figure 9. 3 an emergency room process layout showing the routing of two patients. * When designing a process layout, the most common tactic is to arrange department or work centers that minimize the cost of material handling. Material handling cost in this approach depends on: number of loads (or people) moving between centers and distance loads (or people) move between centers. * Materials handling cost in this approach depends on : 1 .

Number of loads to be moved between departments 2. Distance -related costs of moving loads between departments * Cost is assumed to be a function of distance between departments. The objective can be expressed as follows: wherein total number of work centers or departments individual departments number of loads moved from department I to department J C_{ij} = cost to move a load between department I and department J This layout strategy tries to minimize the loads, or trips, times distance-related costs. Illustrative Example: Arrange six departments in a factory to minimize the material handling costs.

Each department is 20 x 20 feet and the building is 60 feet long and 40 feet wide. Step 1: Construct a " from-to matrix" *the high flows between 1 and 3 and between 3 and 6 are immediately apparent, therefore departments 1 and 6 should be closer together. Step 2: Determine the space requirements Step 3: Develop an initial schematic diagram *this shows that 100 loads also move weekly between Assembly and the Machine shop. Those departments might be closer together to minimize the flow of parts in the factory.

Step 4: Determine the cost of this layout $cost = \sum_{i,j} L_{ij} C_{ij} = 100(\$50) + 200(\$200) + 40(\$40) + 30(\$30) + 50(\$50) + 10(\$10) + 40(\$40) + 100(\$100) + 50(\$50) = \$570$ *for this problem, the cost of moving load between adjacent departments is estimated to be \$1 and for nonadjacent department is \$2 e. G. " 1 and 3" = $100 \times \$2 = \200 Step 5: Try to improve the layout = $\$50 (1 \text{ and } 6) + \$100 (1 \text{ and } 6) + \$20(1 \text{ and } 6) + \$60(2 \text{ and } 3) + \$50(2 \text{ and } 4) = \$480$ *notice how Assembly and Machine Shop are now adjacent. Testing stayed close in the machine also.

Step 6: Prepare a detailed plan *there are still many potential arrangements. This layout can still be improved. We may not find the optimal solution and may have to be satisfied with reasonable one. * Work cell Layouts * An arrangement of machines and personnel that focuses on making a single product or family of related products. * In manufacturing environment, group technology identifies products that have similar characteristics for particular cells Work cells can be reconfigured as product designs or volume fluctuates * The advantages of work cell are: 1 .

Reduced work-in-process inventory 2. Less floor space required 3. Reduced raw material and finished goods inventories 4.Reduced direct labor cost 5. Heightened sense of employee participation 6. Increased equipment and machinery utilization 7. Reduced investment in machinery and equipment *

The requirements of cellular production includes: 1 . Identification of families of products 2. A high level of training, flexibility and empowerment of employees 3. Being self-contained, with its own equipment and resources 4.

Test (Pokka-yoke) at each station in the cell Work cells has at least 5 advantages over assembly lines and process facilities 1. Because tasks are grouped, inspection is often immediate, 2. Fewer workers are needed, 3. Workers can reach more of the work area, 4. The work are can be more efficiently balanced, 5. Communication is enhanced. U Shape Work cells *

After placing the equipment in appropriate sequence, the next task is to staff and balance the work cells.

This involves two steps. * Total work time available Units required Determine the take time -pace(frequency) of production unit necessary to meet

customer orders: Take time = * Total operation time required Take time
 Workers required - Determine the number of operation required Sample
 Problem: 600 Mirrors per day required Mirror production scheduled for 8
 hours per day From a work balance chart total operation time = 140 seconds
 Take time = $(8 \text{ hrs} \times 60 \text{ min}) / 600 \text{ units} = 48 \text{ seconds}$ workers
 Required = $140 / 48 = 2.92$ * Work balance chart is also valuable for
 evaluating the operation times in work cells. * It can help identify bottleneck
 operations. * Focused Work center - a permanent or semi-permanent
 product-oriented arrangement of machines and personnel. * Focused Factory
 -a facility designed to produce similar products or components. * Product-
 oriented Layouts * It is organized around products or families of similar high -
 volume, low products. The assumptions are that: * Volume is adequate for
 high equipment utilization * Product demand is stable enough to justify high
 investment in specialized equipment * Product is standardized or
 approaching a phase of life cycle that justifies investment * Supplies of raw
 materials and components are adequate and of uniform quality * The types
 of this layout are fabrication and assembly lines * Fabrication * Builds
 components on a series of machine Machine paced and requires mechanical
 engineering changes to facilitate balancing. Assembly Lines * It puts the
 fabricated parts together at a series of workstations * Paced by work task *
 Balanced by moving task from one individual to another. * Both types of lines
 must be balanced so that the time to perform the work at each station is the
 same. * The objective of the product-oriented layout is to minimize
 imbalance in the fabrication or assembly line. The main advantages of this
 layout are: * The low variable cost per unit usually associated with high
 volume, standardized problem * Low material handling cost Reduced work-

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in-process inventories * Easier training and supervision * p roughing * The disadvantages of product layout are: * The high volume required because of the large investment needed to establish the process * Work stoppage at any one point ties up the whole operation * A lack of flexibility when handling a variety of products or production rates.

Assembly Line Balancing * It is usually undertaken to minimize the imbalance between machines or personnel while meeting required output from the line. * Starts with the precedence relationships among the activities -that is, the sequence in which various asks must be performed. *Mcdonald's assembly line balancing Boeing wants to develop a precedence diagram for an electrostatic wing component that requires a total assembly time of 66 minutes. Boeing determines that there are 480 productive minutes of work available per day.

Furthermore, the production schedule requires 40 units of the wing component be completed as output from assembly line each day. It now wants to group the task in the workstation. Step 1: Determine the cycle time -maximum time that a product is allowed at each station. Step 2: Calculate theoretical minimum number of workstations. Fractions are rounded to the next highest whole number. Cycle time? production time available per day
 Units required per day ? $480 / 40 = 12$ minutes per unit Minimum no Of work
 meantime for task ' cycle time = $65/12 = 5.2$ or 6 stations Step 3: Balance the line by assigning specific tasks to workstations Procedure for balancing the line Identify the master list of tasks Eliminate those tasks that have been assigned 2. Eliminate those tasks whose precedence relationship has not been satisfied 3. 4. Eliminate those tasks for which inadequate time is

available in the workstation 5. Use one of the line-balancing “heuristics” described in table above.

Simple Balancing Procedure *The solution in step 1 and step 2 shows one solution that does not violate the sequence requirements and that groups tasks into six one-person stations. To obtain this solution, activities with the most following tasks were grouped and moved into workstation to use as much of the available cycle time of 12 minutes as possible. *This is a reasonably well-balanced assembly line. The second and third workstations use 11 minutes and the fourth workstation groups three small tasks and balanced refectory at 12 minutes.

The fifth and sixth station has 1 and 2 minutes idle time per cycle, respectively. Total idle time for this solution is 6 minutes per cycle. *Increase efficiency may require that some tasks be divided into smaller elements and reassigned to other tasks. This facilitates a better balance between workstations and means higher efficiency. Sources: * Render, B. , & Headquartered September 15, 2013, from * Render, B. , & Higher, J. (2011). Layout Decision. In Operations Management (10th De.). John Wiley, Singapore: Person Education South Asia Pvt Ltd.