Perancangan
Tata Letak Fasilitas

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Layout Problems

• Design or Optimization?
Aesthetics
Aesthetics
Aesthetics
Aesthetics
Aesthetics
Aesthetics
Aesthetics
Aesthetics
Facility Layout Process

• Combination of art and engineering
• Many techniques available
  – Muther’s SLP Approach (1973)
  – Optimization based approaches
Apple’s Plant Layout Procedure

1. Procure the basic data
2. Analyze the basic data
3. Design the productive process
4. Plan the material flow pattern
5. Consider the general material handling plan
6. Calculate equipment requirements
7. Plan individual workstations
8. Select specific material handling equipment
9. Coordinate groups of related operations
10. Design activity interrelationships
11. Determine storage requirements
12. Plan service and auxiliary activities
13. Determine space requirements
14. Allocate activities to total space
15. Consider building types
16. Construct master layout
17. Evaluate, adjust, and check the layout with the appropriate persons
18. Obtain approvals
19. Install the layout
20. Follow up on implementation of the layout
Reed’s Plant Layout Procedure
1. Analyze the product or products to be produced
2. Determine the process required to manufacture the product
3. Prepare layout planning charts
4. Determine workstations
5. Analyze storage area requirements
6. Establish minimum aisle widths
7. Establish office requirements
8. Consider personnel facilities and services
9. Survey plant services
10. Provide for future expansion
Systematic Layout Planning

- **Phase I** - Determination of the location of the area where departments are to be laid out
- **Phase II** - Establishing the general overall layout
- **Phase III** - Establishing detailed layout plans
- **Phase IV** - Installing the selected layout
Systematic Layout Planning

1. Flow of materials
2. Activity Relationships
3. Relationship Chart
4. Space Requirements
5. Space Available
6. Space Relationship Diagram
7. Modifying Considerations
8. Practical Limitations
9. Develop Layout Alternatives
10. Evaluation

Source: John S. Usher class notes
Systematic Layout Planning

- **P**  Product: Types of products to be produced
- **Q**  Quantity: Volume of each part type
- **R**  Routing: Operation sequence for each part type
- **S**  Services: Support services, locker rooms, inspection stations, and so on
- **T**  Timing: When are the part types to be produced? What machines will be used during this time period?
Figure 4.1 A pictorial representation of the SLP technique

Systematic Layout Planning in phase. The pattern of procedures followed to plan the General Overall Layout is essentially repeated to plan the Detailed Layout Plan—once for each area or department involved. This pattern fits into the framework of four phases as Phases II and III.

Source: Reprinted by permission from Muther (1973)
SLP IN ACTION

Figure 4.2  Four phases of the SLP technique

Source: Reprinted by permission from Mather (1973)
EXAMPLE OF SYSTEMATIC LAYOUT PLANNING (SLP) – PHASE II

Art Printing Co.* overall (block) layout for a proposed new layout in an existing building (office area not included in the project)

* fictitious name

1 – Activity-Areas
2 – Relationship Chart of Activity-Areas (based on combined flow & service relationships)
2 – Flow of Materials Analysis
2 – Relationship Diagram
2 – Space Requirements
2 – Space Relationship Diagram
3 – Alternatives based on Modifying Considerations and Practical Limitations
5 – Evaluating Alternatives

Selected Layout Plan Phase II – Overall Block Layout

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Sample relationship diagram
SIMPLIFIED SYSTEMATIC LAYOUT PLANNING....

Instructions for Applying SIMPLIFIED SYSTEMATIC LAYOUT PLANNING

1 – Chart the Relationships
2 – Establish Space Requirements
3 – Diagram Activity Relationships
4 – Draw Space Relationship Layouts
5 – Evaluate Alternative Arrangements
6 – Detail the Selected Layout Plan

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Special Considerations in Office Layout

• Minimizing distance traveled by employees
• Permitting flexibility so that the current layout can be changed, expanded or downsized easily
• Providing a safe and pleasant atmosphere for people to work in
• Minimizing capital and operational costs of the facility
Operations Review

- Is the company outgrowing available space?
- Is the available space too expensive?
- Is the current building not in the proper location?
- How will a new office layout affect the organization?
- Are office operations too centralized or decentralized?
- Does the office structure support the strategic plan?
- Is the office layout in tune with the company's image?
Cubicles layout
Albany International Airport layout
Operations Review for MortAmerica, Inc.

- Is there a significant increase in mortgage lending operations of MortAmerica, Inc.?
- Are the costs of leasing and refurbishing interior space too high?
- Is there a problem with the current location? For example:
  - There is not enough space for expansion
  - Major attorneys’ offices, other related financial institutions and restaurants, are not located within a reasonable distance of MortAmerica, Inc.
  - Adequate parking space is not available
  - Traffic is too congested
- Will a change in office location improve business?
SLP for MortAmerica, Inc.

- Evaluation
- Planning
- Site selection
- Design and layout
SLP for MortAmerica, Inc.

- Review current space utilization
- Determine space projections
- Determine level of interaction between departments
- Identifying special consideration
## Current and Future Space Requirements

<table>
<thead>
<tr>
<th>Department Name</th>
<th>Current/Future Requirements</th>
<th>Categories of Employees and Number in Each Category</th>
<th>Gross Space, 150% of Net Space</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Current space/employee</td>
<td>Senior Executive 150</td>
<td>Senior Staff 100</td>
</tr>
<tr>
<td>Customer Service (CS)</td>
<td>Number of employees 1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>150</td>
<td>400</td>
</tr>
<tr>
<td>Mortgage processing/marketing (MP/M)</td>
<td>Future space/employee 120</td>
<td>10</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Number of employees 6</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>720</td>
<td>75</td>
</tr>
<tr>
<td>Credit check (CC)</td>
<td>Future space/employee 200</td>
<td>100</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Number of employees 2</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>400</td>
<td>1,000</td>
</tr>
<tr>
<td>Operations Audit (O/A)</td>
<td>Future space/employee 250</td>
<td>200</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Number of employees 10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>277</td>
<td>200</td>
</tr>
<tr>
<td>Top management (TM)</td>
<td>Future space/employee 250</td>
<td>200</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>Number of employees 15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>1,250</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Future space/employee 250</td>
<td>200</td>
<td>100</td>
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<tr>
<td></td>
<td>Number of employees 5</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Current total space/category</td>
<td>1,250</td>
<td>400</td>
</tr>
<tr>
<td></td>
<td>Future space/employee 250</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>
## Current and Future Space Requirements

<table>
<thead>
<tr>
<th>Support service area</th>
<th>Current net space</th>
<th>Current gross space 150% of net space</th>
<th>Future net space</th>
<th>Future gross space 150% of net space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copying/Printing Area (C/P)</td>
<td>300</td>
<td>450</td>
<td>465</td>
<td>700</td>
</tr>
<tr>
<td>File Storage Room (FS)</td>
<td>300</td>
<td>450</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td>Customer Waiting Lounge (CW)</td>
<td>300</td>
<td>450</td>
<td>800</td>
<td>1200</td>
</tr>
<tr>
<td>Conference Rooms (CR)</td>
<td>500</td>
<td>750</td>
<td>1000</td>
<td>1500</td>
</tr>
<tr>
<td>Employee Break Room (EBR)</td>
<td>200</td>
<td>300</td>
<td>850</td>
<td>1275</td>
</tr>
<tr>
<td>Rest Rooms (RR)</td>
<td>200</td>
<td>300</td>
<td>500</td>
<td>750</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1800</strong></td>
<td><strong>2700</strong></td>
<td><strong>3695</strong></td>
<td><strong>5545</strong></td>
</tr>
</tbody>
</table>
## Relationship diagram for MortAmerica, Inc.

<table>
<thead>
<tr>
<th>Area</th>
<th>E</th>
<th>I</th>
<th>O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer service (CS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortgage processing (MP)</td>
<td>E</td>
<td>I</td>
<td>O</td>
</tr>
<tr>
<td>Credit check (CC)</td>
<td>I</td>
<td>E</td>
<td>O</td>
</tr>
<tr>
<td>Closing/underwriting (C/U)</td>
<td>O</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Top Management (TM)</td>
<td>O</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Operations/audit (O/A)</td>
<td>O</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Copying/printing (C/P)</td>
<td>A</td>
<td>O</td>
<td>U</td>
</tr>
<tr>
<td>Files storage (FS)</td>
<td>A</td>
<td>U</td>
<td>U</td>
</tr>
<tr>
<td>Customer waiting (CW)</td>
<td>U</td>
<td>I</td>
<td>U</td>
</tr>
<tr>
<td>Conference room (CR)</td>
<td>U</td>
<td>U</td>
<td>X</td>
</tr>
<tr>
<td>Employee break room (EBR)</td>
<td>X</td>
<td>A</td>
<td>X</td>
</tr>
<tr>
<td>Rest rooms (RR)</td>
<td>I</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Activity relationship diagram for MortAmerica, Inc.
Space relationship diagram for MortAmerica, Inc.
Pre-architectural layout for MortAmerica, Inc.
Engineering design approach

1. Identify the problem
2. Gather the required data
3. Formulate a model for the problem
4. Develop an algorithm for the model and solve it
5. Generate alternative solutions, evaluate, and select
7. Implement the solution
8. Continuously review after implementation
OSHA, ADA and Local Codes
OSHA, ADA and Local Codes
<table>
<thead>
<tr>
<th>Organization</th>
<th>Showers</th>
<th>Lavatories</th>
<th>Water Closets</th>
<th>Water Fountain</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restaurants</td>
<td>-</td>
<td>1 per 200</td>
<td>1 per 75</td>
<td>1 per 500</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Arenas (capacity more than 3000)</td>
<td>-</td>
<td>1 per 200 (male); 1 per 150 (female)</td>
<td>1 per 120 (male); 1 per 60 (female)</td>
<td>1 per 1000</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Churches</td>
<td>-</td>
<td>1 per 200</td>
<td>1 per 150 (male); 1 per 75 (female)</td>
<td>1 per 1000</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Schools</td>
<td>-</td>
<td>1 per 50</td>
<td>1 per 50</td>
<td>1 per 100</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Airports</td>
<td>-</td>
<td>1 per 750</td>
<td>1 per 500</td>
<td>1 per 1000</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Factories</td>
<td>Section 411</td>
<td>1 per 100</td>
<td>1 per 100</td>
<td>1 per 1000</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Hospitals</td>
<td>1 per 15</td>
<td>1 per room</td>
<td>1 per room</td>
<td>1 per 100</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Prisons</td>
<td>1 per 15</td>
<td>1 per cell</td>
<td>1 per cell</td>
<td>1 per 100</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Hotels</td>
<td>1 per room</td>
<td>1 per room</td>
<td>1 per room</td>
<td>-</td>
<td>1 service sink</td>
</tr>
<tr>
<td>Dormitories</td>
<td>1 per 8</td>
<td>1 per 10</td>
<td>1 per 10</td>
<td>1 per 100</td>
<td>1 service sink</td>
</tr>
</tbody>
</table>
REFERENCES
