

# **How to Lay Out a Warehouse or Distribution Center**



## **Overview of SLP**

# The Phases of Planning Any Project

## Main Points

1. All projects pass through the four general phases shown here. Layout and facilities planning projects are no exception.
2. Only the two “interior phases” (II and III) involve the preparation of plans.
3. Phase I is one of preparing to plan.
4. Phase IV is one of acting upon the plan(s) prepared in Phases II and III.

Number	Name	Basic Action	The Result
I	Orientation	See it whole.	The problem in its environment, clearly understood.
II	Overall	Plan it sound.	The solution in principle.
III	Detail	Make it real.	The solution in detail.
IV	Do/Act	Follow it through.	The plan accomplished.

## **Phase Description**

- |     |   |
|-----|---|
| I   | Identification and understanding of the total project – its objectives, its opportunities, its constraints, scope and parameters.                               |
| II  | Development of a total overall plan such that in principle the plan is fundamentally sound and well integrated.   |
| III | Development of the parts, sub-areas, sub-plans, and/or sub-systems so that each is realistic, fair, and tied-in with the other parts and with the overall plan. |
| IV  | Take the action necessary to get the plan(s) (of II and III) approved, executed, installed or accomplished.   |

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## Notes

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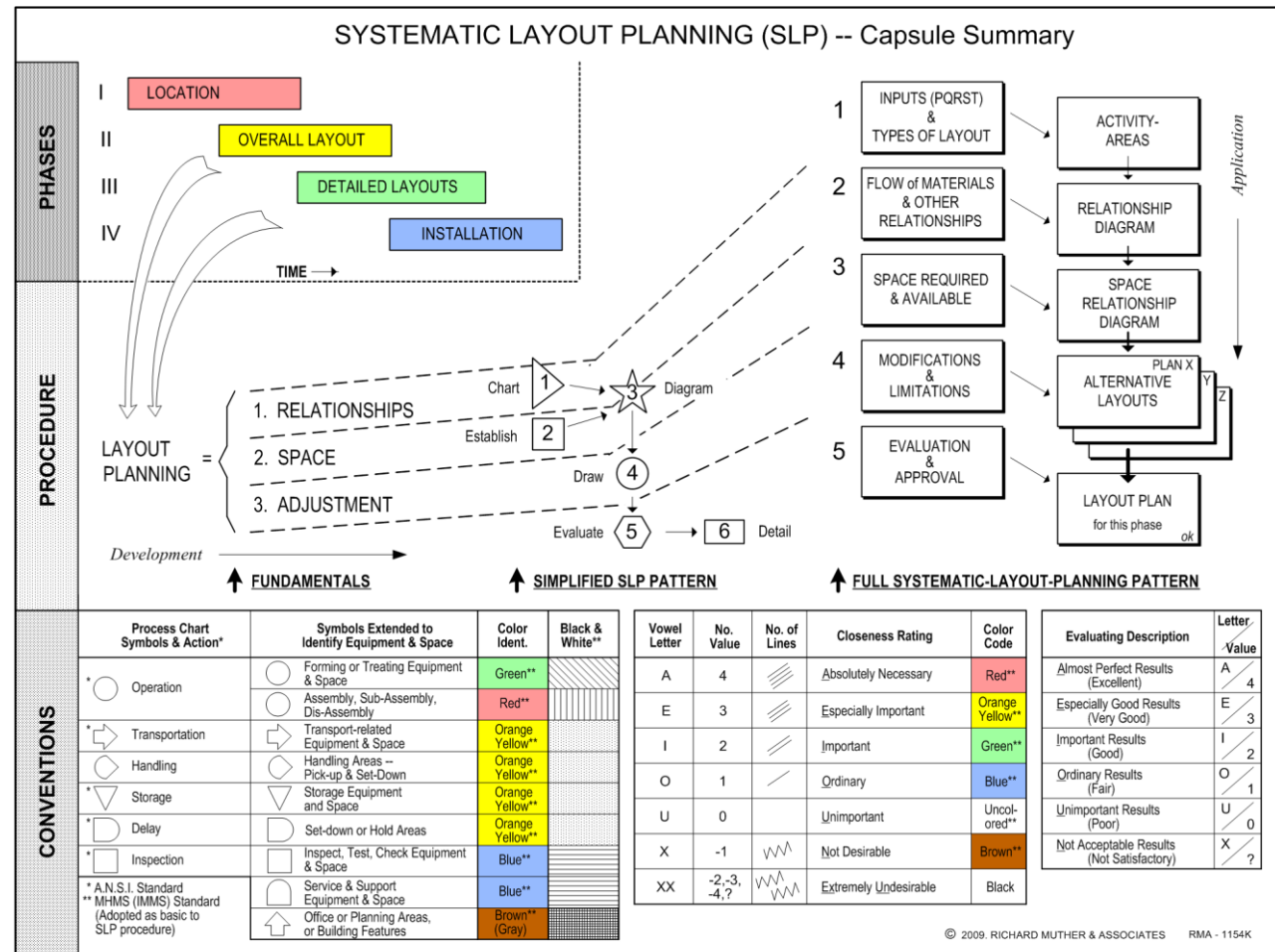
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## Main Points

1. Systematic Layout Planning (SLP) is an organized, universally-applicable approach to any layout planning project.
2. SLP consists of:
  - Framework of Phases
  - Pattern of Procedures
  - Set of Conventions
3. SLP was first published in the 1960 by Richard Muther. It is widely taught, has been translated into nine languages, and is used throughout the world.



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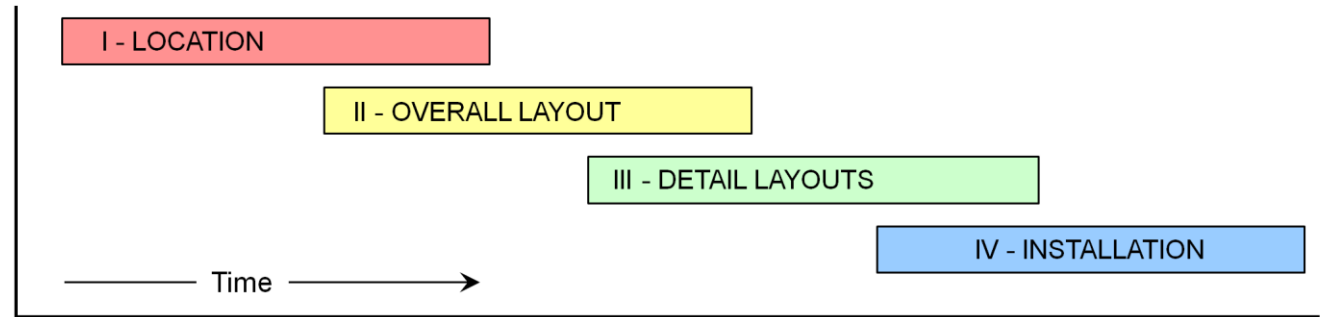


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# The Phases of Systematic Layout Planning

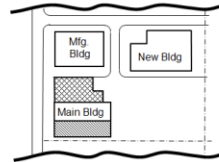
## Main Points

1. As each project runs its course – from initial stated objective to installed physical reality – it passes through four sequential and phases. For best results, the phases should overlap.
2. Phase I and Phase IV are frequently not part of the layout planner's specific role and are often performed by others. In a sense, they “frame” the strictly planning phases II and III.
3. Phase I considers situations and conditions *outside* our problem area, over which we may have little or no control. Yet these “externals” may influence or constrain our plans in Phases II and III.



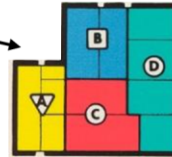
### Phase I:

Establish the location of the area to be planned. Determine space available and surrounding influences.



### Phase II:

Plan the arrangement of activity-areas and departments. Define main aisles.



### Phase III:

Plan the arrangement of specific machinery and equipment, ready to install.



### Phase IV:

Prepare drawings and specifications; obtain and install equipment; train workers; follow through.



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## Main Points

1. Layout plans are always influenced by the layout's location and surroundings, including the configuration and condition of available buildings and land.
2. In this illustration, the existing location already has a layout and a number of costly-to-change features.
3. The eventual *adjustment* of the ideal arrangement into practical alternatives will have to address these features – either adjusting to them, or changing them to accommodate a new layout..
4. At the other extreme, the planners may have little restrictions beyond points of access to a new property.



### **Existing “Brownfield”:**

- Fire sprinklers in racks
- Wire guidance in floor
- Air conditioning ducts
- Lighting
- Docks established

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## **Phase I - Location & Building Considerations**

### **New “Greenfield”**



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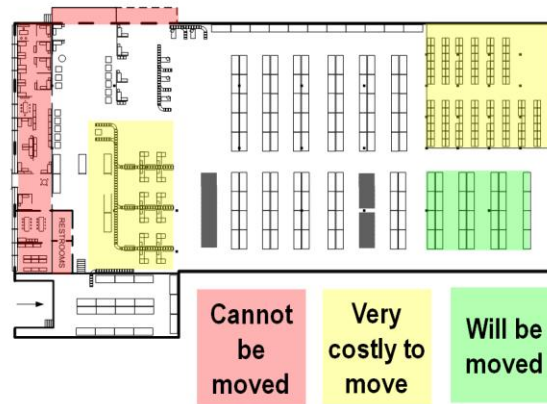
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## Main Points

1. Many layouts and planning situations contain “monuments” -- things that are highly fixed and cannot or will not be moved.
2. In warehouses and distribution centers, commonly fixed areas or features include:
  - Docks, ramps, grade doors, personnel doors
  - Office blocks
  - Mechanized systems: conveying, sortation...
3. Less fixed but still desirable not to move are sprinkled racks and mezzanines.
4. It is good practice in Phase I – Location – to identify those features or areas that *must* remain in their current locations, or *should* remain and the reasons therefore.
5. Color-coding “red” for cannot be moved and “yellow” for “rather not move” is a good way to get everyone’s awareness and agreement before planning any rearrangement.
6. It is also helpful to identify areas that must move or are already planned to be moved, or removed from the layout. Coloring these “green” will help planners and approvers to be aware of these decisions already made.

## Current Layout – “Fixity”



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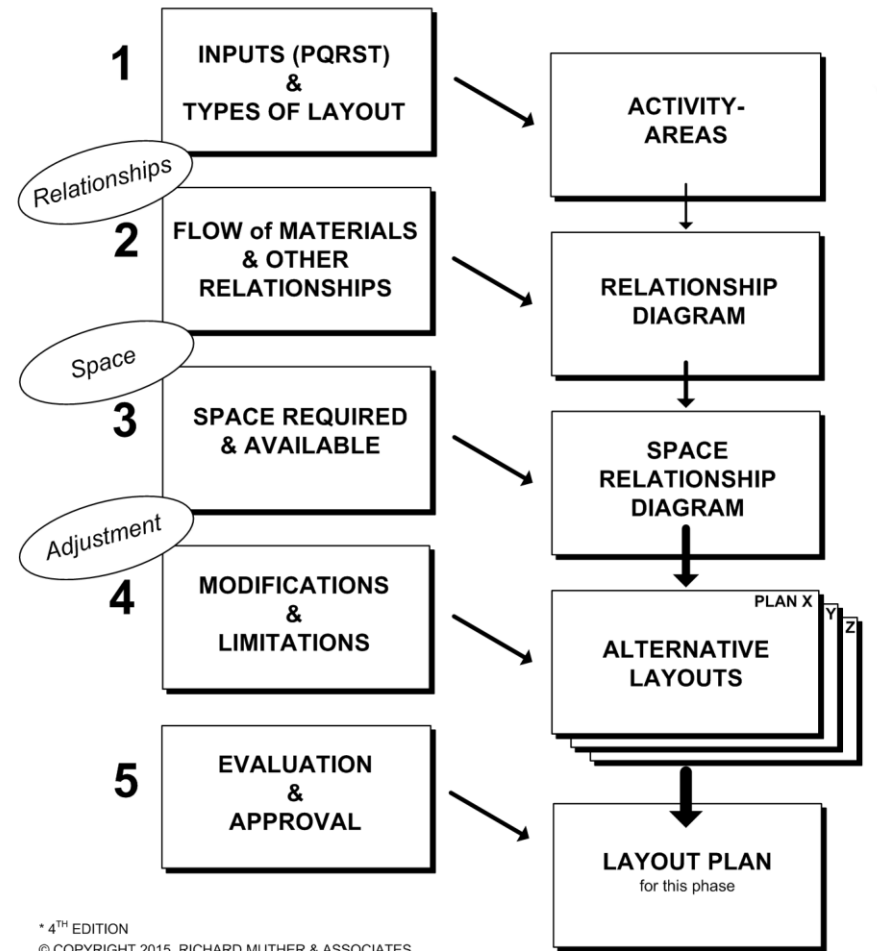
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## Main Points

1. The SLP Pattern of Procedures is a five-section series of procedures resting squarely of the three fundamentals of *relationships, space* and *adjustment*.
2. The Pattern applies to both Phase II, Overall Layout, and Phase III, Detail Layouts.
3. The left-hand boxes of the pattern represent data collection and analysis.
4. The right-hand boxes represent synthesis and output of results.
5. The SLP Pattern requires that two or more alternatives be developed and evaluated before a plan is approved.
6. The more complicated the problem, the more useful and time-saving this pattern becomes.

## Systematic Layout Planning Pattern\*



\* 4<sup>TH</sup> EDITION  
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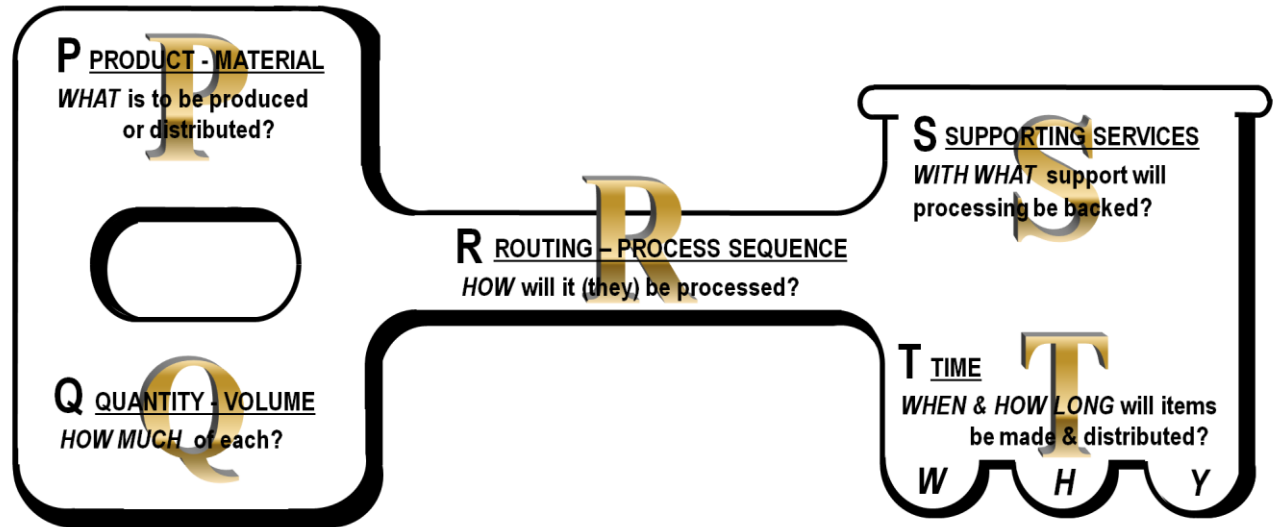
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## Main Points

1. Facilities planning requires five types of key input data.
2. For ease of recall, the five key inputs are designated by the five-letter sequence: P-Q-R-S-T. These stand for:
  - *Products* (or materials or services)
  - *Quantities* (sales volumes & inventory)
  - *Routing* (or processes of necessary operations)
  - *Supporting Services* (for people, processes and information systems)
  - *Timing* (operating hours, seasons, urgency...)
3. The facilities planner must collect data from others for each of the five key inputs.
4. When collecting data, be sure to challenge its correctness and underlying assumptions, especially regarding “R” the routing or process.
5. This act of challenging is symbolized by the letters W-H-Y on the teeth of the key.

# Key Inputs



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## Notes

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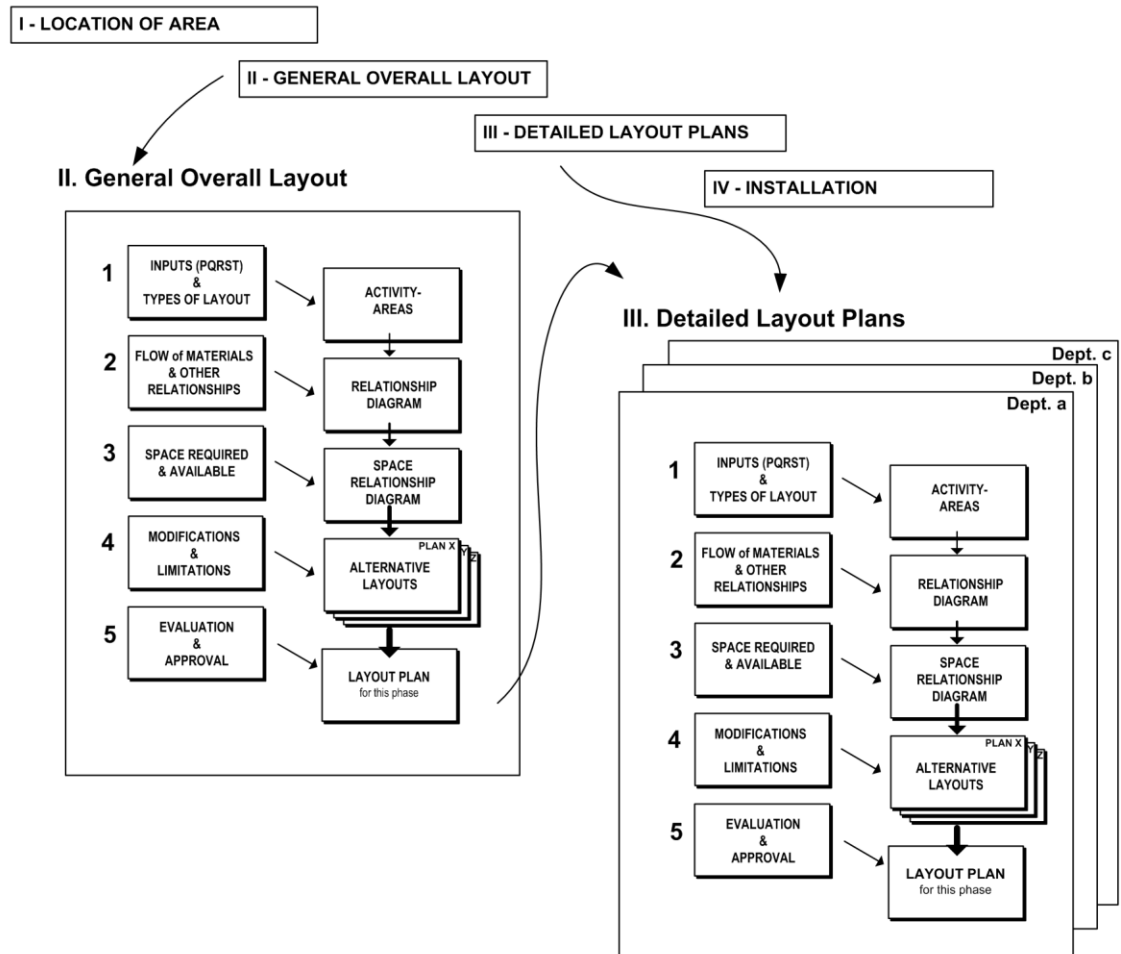
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## Main Points

1. The SLP Pattern of Procedures applies to both Phase II, General or Overall Layout, and Phase III, Detailed Layout Plans. That is, the same steps are followed although the degree of application will be different in the two phases.
2. Phase II is devoted to planning the sizes and arrangement of areas or departments in the layout.
3. Phase III is devoted to arranging machinery and equipment within each area or department in the overall plan.
4. With its overlapping phases and repeating pattern of procedures, SLP enables the planner to tackle problems of any size or complexity.

## The Pattern Repeats



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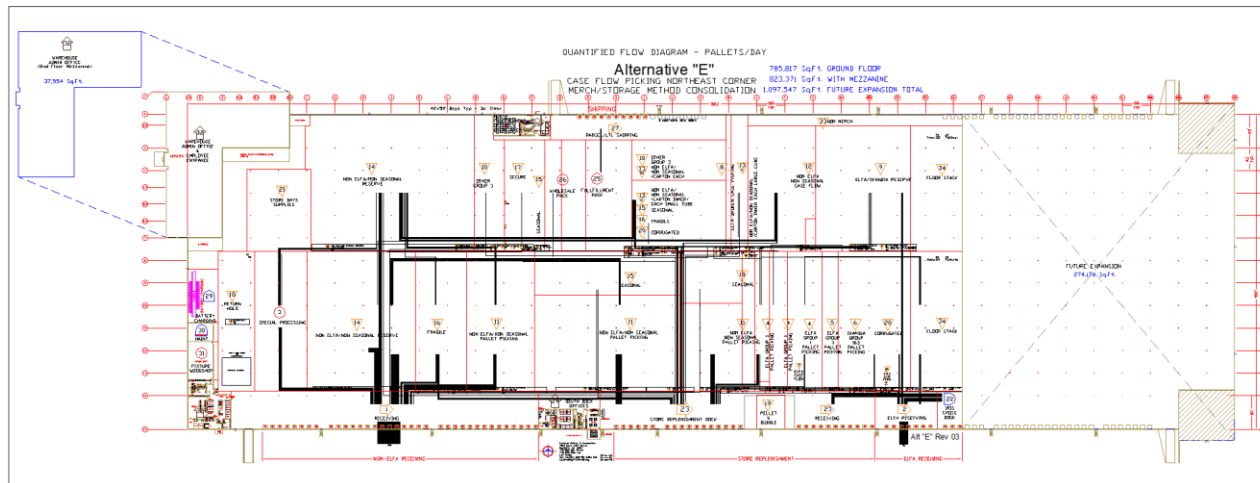
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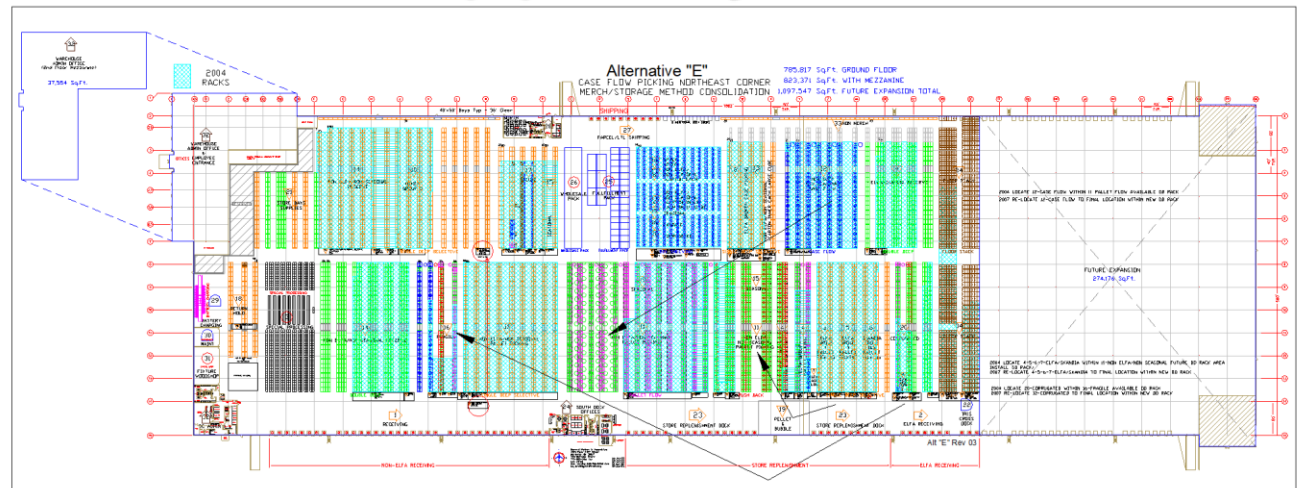
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# From Overall to Detail Layout

## Phase II Overall Block Plan with Flow Paths



## Phase III Detailed Equipment Layout



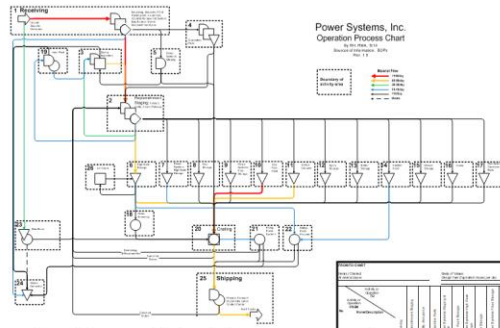
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## SLP Phase II

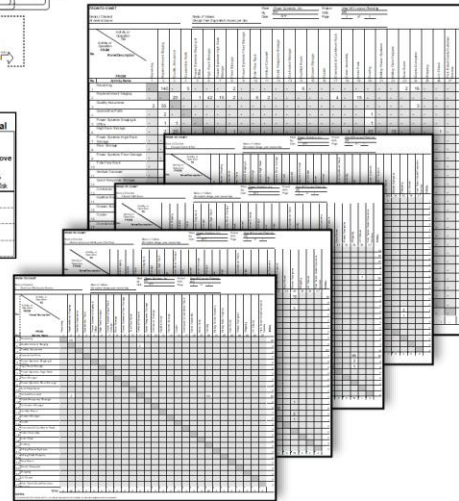
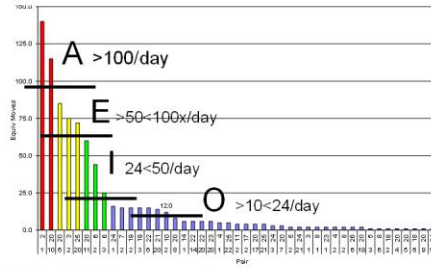
## 1. Activity-Areas

- 2 Recycling
- 3 Repelment Staging
- 3 Quality Assurance
- 4 Quarantine Pails
- 5 Power Systems Staging & Office
- 6 High Rack Storage
- 7 Power Systems High Rack Storage
- 8 Floor Storage
- 9 Power Systems High Rack Storage
- 10 Tote Flow Rack
- 11 Vertical Carousel
- 12 Quick Response Storage
- 13 Contractor Storage
- 14 Haul at Room
- 15 Drawer Storage
- 16 Cooler
- 17 Overized & Cantilever Rack
- 18 Order Assembly
- 19 Inner Pack
- 20 Crating
- 21 Kilnng Power Systems
- 22 Kilnng Flat Projects
- 23 Saw Room
- 24 Waste Dumpster
- 25 Shipping
- 26 UI Check
- 27 Pick Ticket Desk/Customer Service
- 28 Battery Charging
- 29 Air Compressor
- 30 Mechanical/Electrical Telephone
- 31 Car Parking
- 32 Employee Entrance
- 33 Office
- 34 Restroom/Locker Rooms
- 35 Breakroom
- 36 3-D Service Parts Center

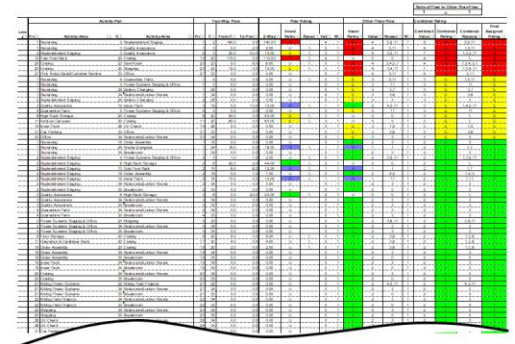
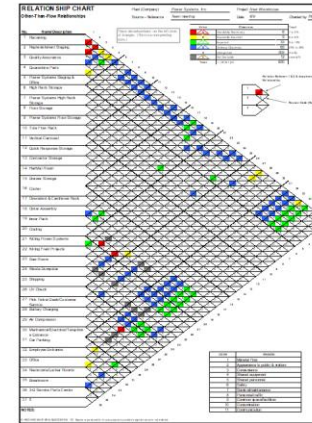


## 2a. Flow of Materials

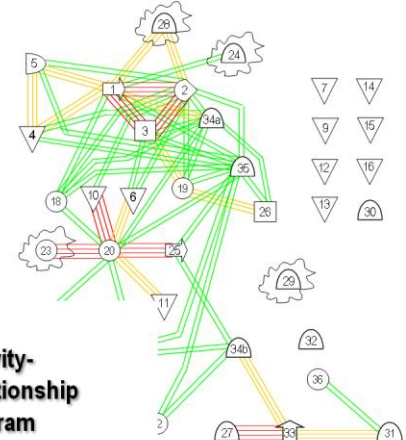
Equivalent Movement Factors by Class of Material	
Material Classes	Equivalent Value per Move considering Payload Time & speed, Effort, Risk
a Small, hand-liftable parts (Kardex)	1.00
b Medium sized, hand-liftable parts (Tote Flow)	1.00
c Pallets & Pallet Boxes	1.00
d Oversized Crates & Pipe	2.00



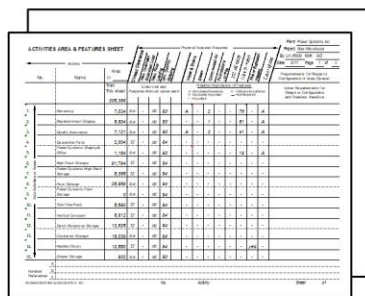
## 2b. Other Relationships



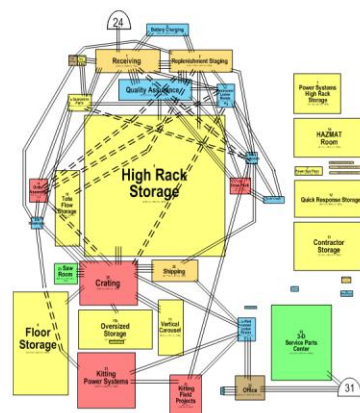
### 2c. Combined Flow & Other



**2d.**  
**Activity-Relationship Diagram**



### 3a. Space Requirements



### 3b. Space Relationship Diagram



#### 4. Alternative Layouts

## EVALUATING ALTERNATIVES

Part

Power Systems, Inc.

Project

Line Identification

Date 6/11

Prepared by \_\_\_\_\_ Date \_\_\_\_\_

Reviewed by \_\_\_\_\_ Date \_\_\_\_\_

### EVALUATING CRITERIA

<input type="checkbox"/> Financial Profitability	<input type="checkbox"/> Customer Retention
<input type="checkbox"/> Sales Volume Growth	<input type="checkbox"/> Management
<input type="checkbox"/> Investment Results	<input type="checkbox"/> Quality Control

### Description of Alternatives:

Enter a serial prefix identifying each alternative.

- A Supply side along south side. Combined side along north and south.
- B All operational areas at least one.
- C All operational areas at least one.
- D All operational areas at least one.
- E All operational areas at least one.
- F All operational areas at least one.
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- W All operational areas at least one.
- X All operational areas at least one.
- Y All operational areas at least one.
- Z All operational areas at least one.

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### FACTOR / CONSIDERATION

1	Effect of material flow
2	Effect of supervision & visual requirements
3	Appearance and housekeeping
4	Flexibility for changing priorities and activities
5	Flexibility for new business
6	Employee convenience
7	Esthetic appearance
8	Operational congestion
9	Efficiency of employee production
10	Capital requirements
11	Capital requirements
12	Capital requirements
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Enter a serial prefix identifying each alternative.

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## 5. Evaluation, Selection & Approval

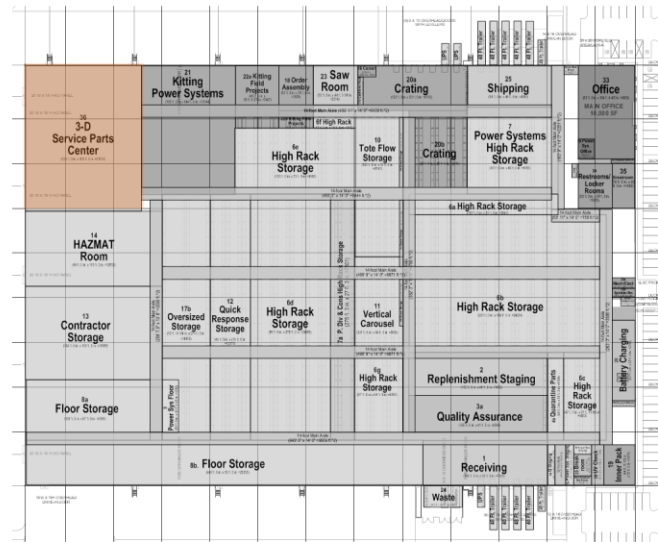
# SLP Phase II Documents & Outputs

<b>Pattern of Procedures Section Number</b>	<b>Key Document(s); Must do</b>	<b>Other potentially useful documents; Do if helpful</b>	<b>Form of Output</b>
1 Activities	P-Q Analysis	<ul style="list-style-type: none"> <li>• P-Q Data Sheet</li> <li>• Checklist of splitting or combining factors</li> </ul>	List of Activity-Areas
2 Relationships	Relationship Chart	<ul style="list-style-type: none"> <li>• Operation Process Chart</li> <li>• Multi-product Process Chart</li> <li>• From-To Chart or Move Summary</li> <li>• Distance-Intensity Plot</li> <li>• Relationship Survey</li> </ul>	Activity Relationship or Flow Diagram
3 Space	Activity Areas and Features Sheet	<ul style="list-style-type: none"> <li>• Survey of current space assigned</li> <li>• Machinery &amp; Equipment Area &amp; Features Sheet</li> <li>• Office Layout Requirements Data</li> <li>• Space Requirements – Converting form</li> </ul>	Space Relationship Diagram
4 Adjustment	Block Layout Drawings	<ul style="list-style-type: none"> <li>• Scaled and grid-lined templates of activity-areas</li> </ul>	Alternative Layouts
5 Evaluation	Evaluation of Alternatives	<ul style="list-style-type: none"> <li>• Cost estimates and comparisons</li> </ul>	Selected Overall Layout



## Main Points

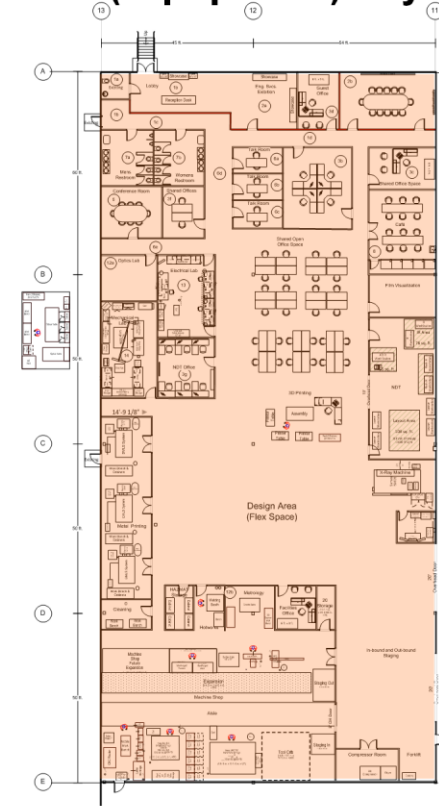
1. The distinction between block and detail layout is essential in Systematic Layout Planning (SLP).
2. The purpose of block layout planning is to rapidly explore several significantly different ways to arrange the total space available – often an entire building or floor, or a large department that has sub-areas within it. This assures that the best overall arrangement is selected.
3. The purpose of detail layout planning is to arrange equipment within the chosen block plan.
4. Detail layout is time-consuming and wasted when its overall arrangement is rejected. By approving a block plan first, time spent on details is well-spent.
5. Equipment layouts tend to draw reviewers into the details, where they may overlook block-level alternatives.
6. The best equipment layout may not overcome inefficiencies caused by a poor block plan. For this reason, SLP devotes an entire phase to assuring that the best overall plan has been selected.
7. In practice, block and detail planning overlap. Some detail layout must be done during block planning to assure that sufficient space and adequate overall dimensions have been provided for each block activity-area.



Above is an overall or block layout for a service parts distribution center. The layout at right is a detail layout of machinery and equipment for one of the “blocks”: the 3-D Service Parts Center.

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## Overall (Block) Layout and Detail (Equipment) Layout Plan



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## Notes

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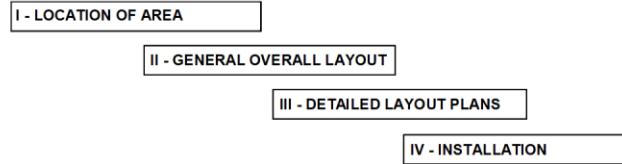
# SLP Phase III Documents & Outputs

<b>Pattern of Procedures Section Number</b>	<b>Key Document(s); Must do</b>	<b>Other potentially useful documents; Do if helpful</b>	<b>Form of Output</b>
1 Activities	P-Q Analysis	<ul style="list-style-type: none"> <li>• Operation process chart</li> <li>• Flow process chart</li> <li>• Line balance</li> <li>• Multi-product process chart</li> </ul>	List of Activity-Areas
2 Relationships	Relationship Chart	<ul style="list-style-type: none"> <li>• Line-feeding flow chart</li> </ul>	Activity Relationship or Flow Diagram or both
3 Space	Activity Areas and Features Sheet	<ul style="list-style-type: none"> <li>• Machinery &amp; Equipment Area &amp; Features Sheet</li> <li>• Office Layout Requirements Data</li> </ul>	Space Relationship Diagram
4 Adjustment	Equipment Layout Drawings	<ul style="list-style-type: none"> <li>• Scaled equipment templates</li> <li>• Models and renderings</li> <li>• Elevation drawings</li> </ul>	Alternative Layouts
5 Evaluation	Evaluation of Alternatives	<ul style="list-style-type: none"> <li>• Cost estimates and comparisons</li> </ul>	Selected Detail Layout(s)

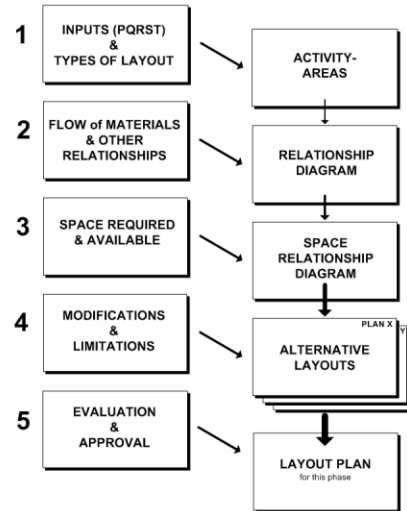
# Which Procedures to Use?

## Main Points

1. In Phases II and III, the planner follows a pattern of procedures to arrive "at alternative layouts.
2. In large projects, the planner uses the full SLP pattern in Phase II to develop an overall layout.
3. In Phase III of large projects he may repeat the full pattern for each department in the overall layout; or, if the departments are small and simple enough, he may use the simplified pattern instead.
4. For very small projects, the planner can combine Phases II and III into the shorter Simplified SLP pattern.
5. Use the full pattern for:
  - large, complex projects.
  - significant materials or paperwork flow
  - multi-story and multi-building
  - general overall layout (Phase II)
  - Large, complex detailed layouts (Phase III)
6. Use Simplified SLP for:
  - small, simple projects
  - little or no materials or paperwork flow
  - single floor, few fixed or unusual features
  - detailed layouts (Phase III) of large projects where full SLP is used in Phase II.

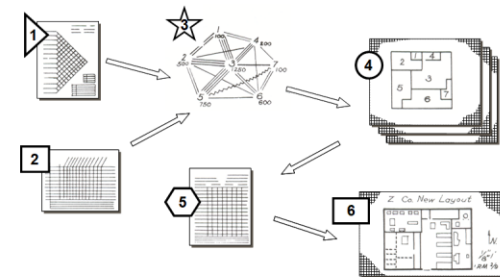


## FULL SYSTEMATIC LAYOUT PLANNING PATTERN



Repeats in Phases II and III of large, complex projects.

## SIMPLIFIED SLP PATTERN



Combines Phases II and III into a six-step procedure for small areas or otherwise simple projects.

Alternative to full pattern in Phase III of large projects.

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## Notes

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# Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
1. How many phases does SLP use to describe a layout planning project?	A. Three B. Four C. Five	
2. In the Location phase, we determine:	A. How much space is available B. Monuments and external or surrounding conditions that may influence our layout C. Both of the above.	
3. For best results, the SLP phases should overlap.	A. True. B. False.	
4. The Systematic Layout Planning (SLP) Pattern of Planning Procedures	A. Has five sections, beginning with inputs and ending with and approved layout. B. Rests on the three fundamentals of Relationships, Space & Adjustment. C. Produces a key document and defined output for each section. D. Produces two or more alternative plans for formal evaluation. E. Applies to both overall (Phase II) and detail (Phase III) planning. F. All of the above.	

# Summary

- SLP is a complete method for planning and executing layout planning projects.
- SLP consists of:
  - *Framework of Project Phases*
  - *Pattern of Planning Procedures*
  - *Set of conventions*
- The SLP planning procedures are executed once to arrive at an overall or block layout; then repeated as needed to plan the details within each area or block.
- Each step in the SLP Pattern of procedures has a key document and defined output.
- A six-step Simplified SLP procedure may be used for small projects, or for detail planning within departments and small areas of a larger plan.