

How to Lay Out a Warehouse or Distribution Center

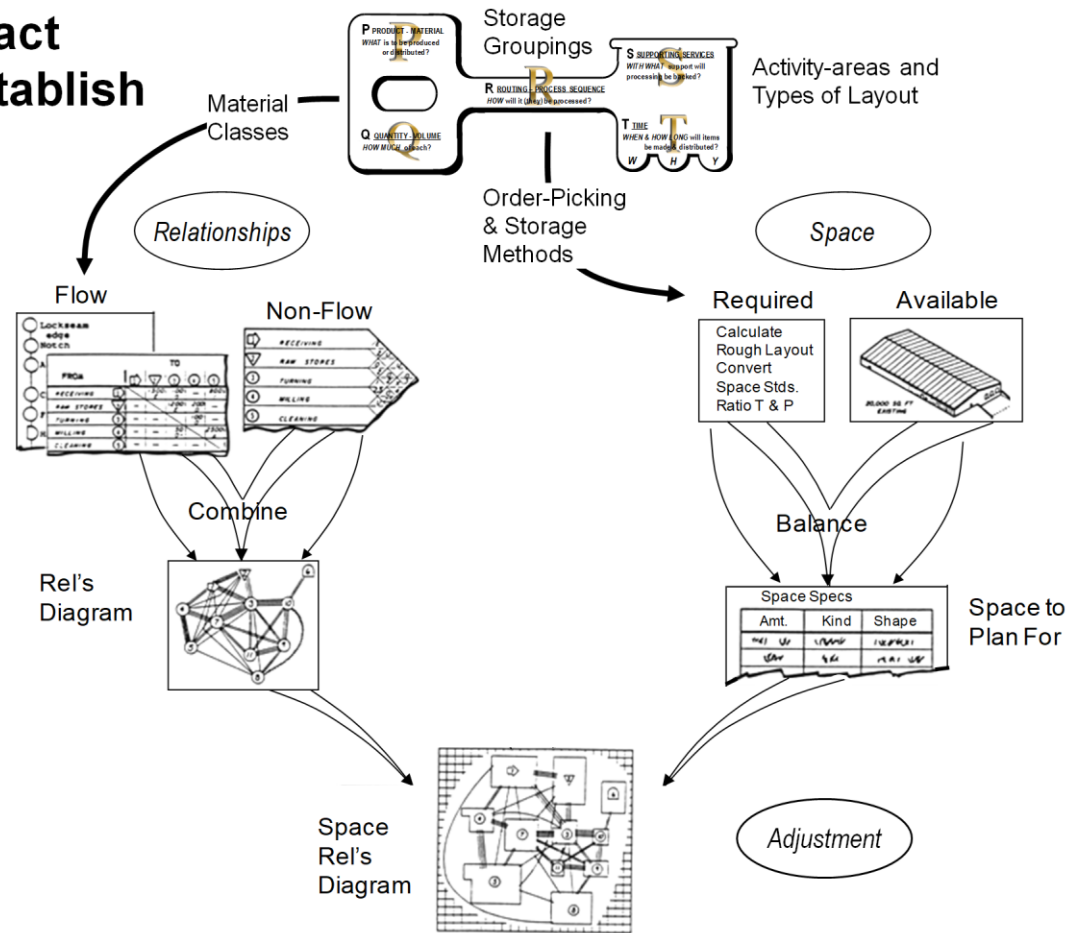


How to Develop Layout Plans

Main Points

1. In Section 1 of the SLP Pattern of Procedures, we analyzed Key Inputs P, Q and R to define storage groupings and activity-areas, considering the appropriate types of storage area layout.
2. We also defined material classes for flow analysis and the methods that will determine space required in order-picking and storage areas.
3. Section 2 of the SLP Pattern interacts relationships and space to establish a space relationship diagram.
4. Relationships are developed from flow analysis and/or recording of other-than-flow relationships.
5. Once recorded, relationships are visualized in an activity relationship diagram.
6. Space requirements are determined for each activity area by various methods.
7. The total space required is balanced against the space available (dictated by the location established in Phase I.)
8. Once balanced, space requirements are specified in amount, kind, and shape.
9. The space relationship diagram is a re-draw of the activity relationship diagram, with each area represented to scale and perhaps in any mandatory shape or dimensions.

Interact & Establish



RICHARD MUTHER & ASSOCIATES - P-2018-ppt

ALL RIGHTS RESERVED

2

Notes

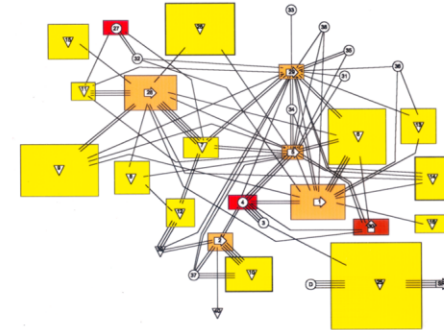
Adjusting the Ideal to the Practical

Main Points

1. The space relationship diagram is almost a layout plan.
2. Since it is derived directly from the best *Relationships* and *Space*, it therefore represents a theoretically ideal arrangement.
3. In practice the ideal is seldom usable without considerable *Adjustment*.
4. Adjusting the ideal is necessary for a variety of physical and other modifying considerations and practical limitations, the most common of which are listed here.

Modifying Considerations

- Material handling methods and equipment
- Desired flow pattern
- Placement of main aisles
- Storage methods and equipment
- Site conditions and surroundings
- Personnel requirements
- Building features
- Types of space and physical features required
- Utilities and auxiliaries
- Procedures and controls
- Shape requirements of detailed activities' layouts



Practical Limitations

- Mandatory features and requirements
- Use of existing equipment or building features
- Budgetary limitations
- Time constraints
- Codes and regulations
- Company policies and procedures
- Labor contracts

RICHARD MUTHER & ASSOCIATES - 2175-ppt

ALL RIGHTS RESERVED

3

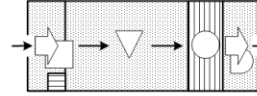
Notes

Basic Storage Facility Flow Patterns

Main Points

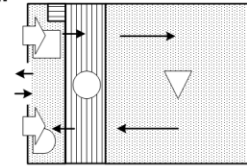
1. Warehouse and distribution center layouts exhibit the basic flow patterns shown here.
2. U-Shape is the most common since it economizes on roadways and land.
3. Each flow pattern has its benefits and appropriate uses, and each may influence the choice of material handling methods.

Straight Thru



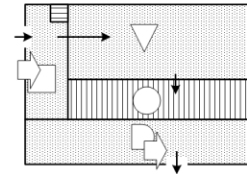
1. Minimum conflicts between putaway & picking.
2. Can receive by one mode and ship by another.
3. Easier to conveyorize picking, sorting & staging.
4. "Average" storage locations are fairly good and evenly distributed.

U-Shape or Circular



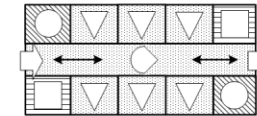
1. Minimum roads and apron outside of building.
2. High utilization of docks and equipment; share dock personnel.
3. Reduces dead-heading.
4. "Poor" storage locations are very poor, especially in "deep" buildings.

L-Shape



1. Can receive by one mode and ship by another.
2. Reduced conflicts between putaway & picking.
3. Fit with external constraints: rail, barge, and/or neighboring buildings.
4. Isolation of hazards or highly-fixed operations in the "elbow."

Comb or Spine



1. Good for drive-in, floor loading operations.
2. Appropriate for overhead of mobile crane handling in floor and ground storage.
3. "Self-service" access in public storage facilities.
4. Fits high volume bulk and unit load operations.

RICHARD MUTHER & ASSOCIATES - S-2102-ppt

ALL RIGHTS RESERVED

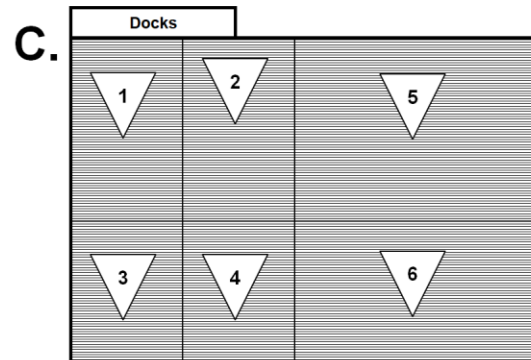
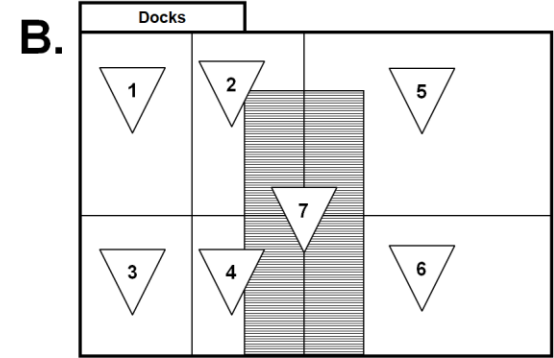
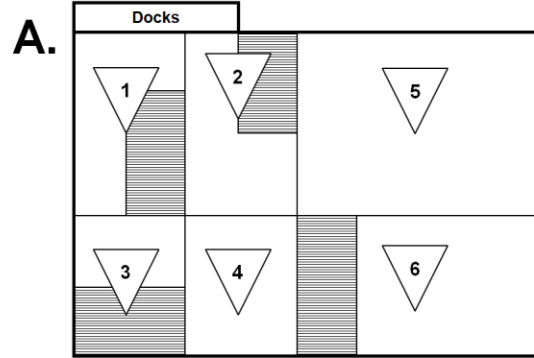
4

Notes

Adjustment for Types of Space

Main Points

- Assume that the shaded areas represent physical features such as:
 - Extra fire protection;
 - Spill containment and retention;
 - Extra lighting;
 - Distribution of utilities;
 - Temperature control;
 - Security fencing, etc.
- Which layout will likely be the least expensive to install? Why? _____
- Which layout will be the most flexible, over time? Why? _____
- The layouts above put the most popular storage zones nearest the dock, based on flow of materials. But attention to flow relationships without considering types of space may result in poor layout decisions.



RICHARD MUTHER & ASSOCIATES - S-2191-ppt

ALL RIGHTS RESERVED

Notes

Main Points

1. Some activity-areas are more difficult, costly, or disruptive to move than others.
2. These should be carefully placed in the layout with room for expansion and accessibility for future upgrades.
3. Avoid placing highly-fixed and expensive installations next to one another.
4. Buy “space insurance” by placing easily moved areas next to those that are highly-fixed.



RICHARD MUTHER & ASSOCIATES - S-2192-ppt

Fixity



ALL RIGHTS RESERVED

Notes

Questions

1. Do you see any problems or have any concerns about this rack layout?

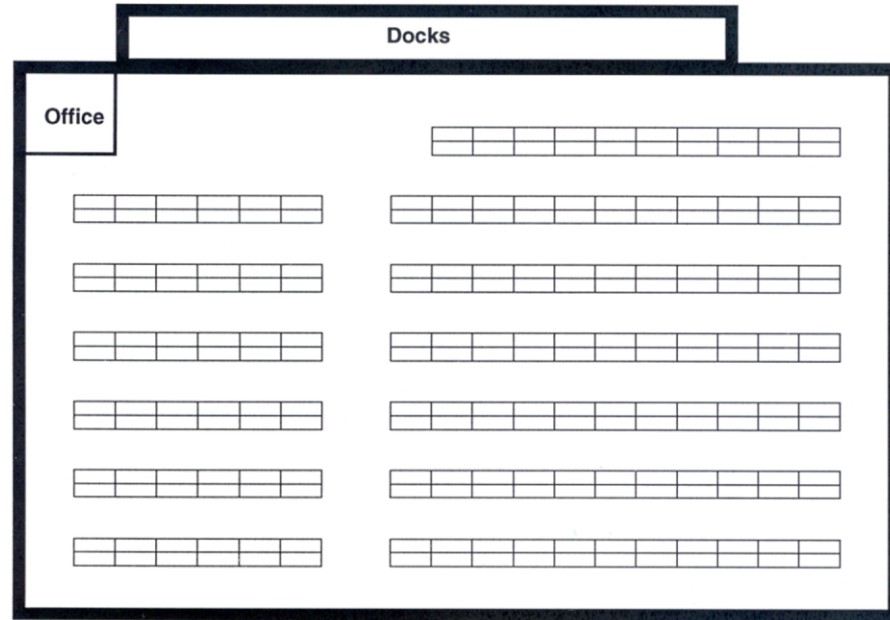
2. What should main or “cross” aisles accomplish?

3. What is the primary factor that should govern the length of storage aisles?

4. What are the considerations or factors that should govern rack and aisle orientation (direction)?

5. What is undesirable about perimeter aisles?

Layout Adjustment -- Aisles



In this warehouse layout, orders will be picked to pallets from the floor and the first tier of racks. Pickers will ride on stand-up, electric pallet trucks. Aisles are 12 feet wide to accommodate forklift putaway and replenishment of picking locations.

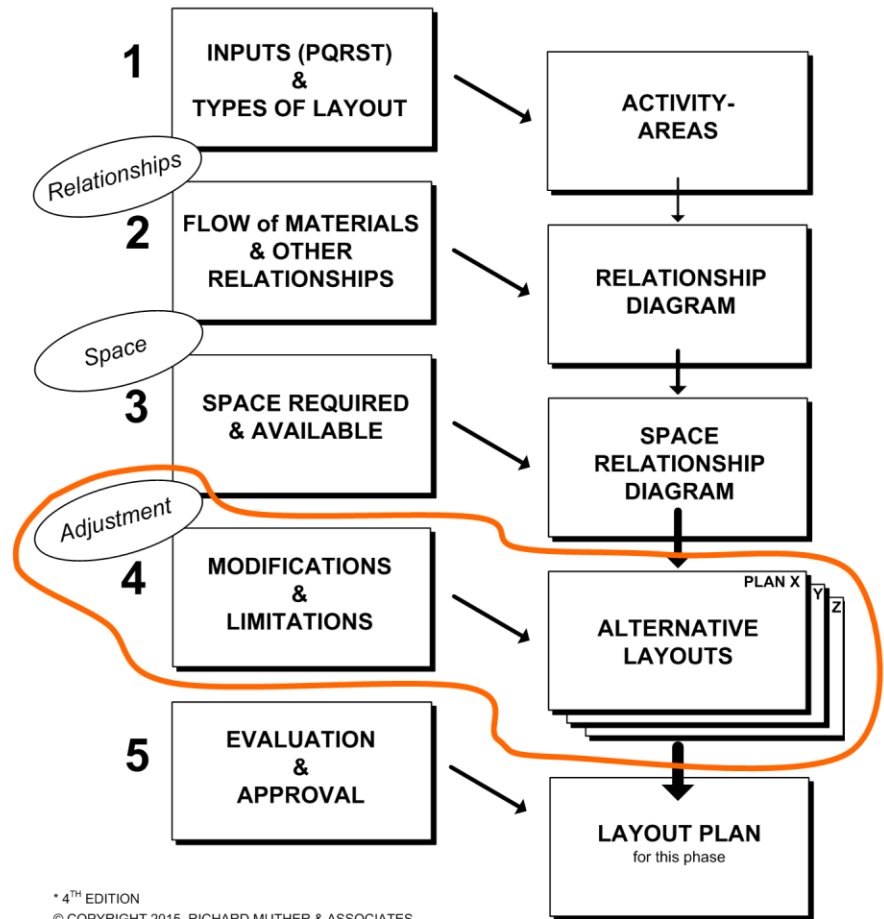
RICHARD MUTHER & ASSOCIATES – 7191-3-ppt

ALL RIGHTS RESERVED

Notes

How to assure two or more alternatives

1. Vary *flow patterns* and *flow directions* through the layout: Straight-through, U-flow, L-flow, some variation or combination.
2. Vary *dock locations*, or input and output points.
3. Vary layout and pattern of main aisles: number of, locations and orientations.
4. Moving a highly-fixed area or not.
5. Vary “anchor locations” for highly-fixed, critical or “highly-connected” activity-areas.
6. Vary the placements of key areas: to different bay, wings, floor levels or buildings, including off-site.
7. Vary the space available – its configuration or location, incl. building or area shape and use of mezzanines.
8. Centralize or decentralize support areas.
9. Combine or split key activity-areas.
10. Mirror or rotate an alternative within the space available.



Team Assignments and Templates

Actions to be explored & team assigned

Action	Team 1	Team 2	Team 3
Receiving	At rear	At front; next to office	No restriction
Shipping	At rear	At rear	At front
Mezzanine	None	Above shelves	None
Shelves	No mezzanine	With mezzaine	Vertical lifts
Racks	Sit-down truck; wide aisle	Narrow aisle	Very Narrow Aisle
Floor stack	At Receiving	At Shipping	No restriction

- Agree on options to be explored and deliberately varied among alternative plans.
- Assign specific explorations to teams. Don't allow exploration of options to be at random or by chance.



- Give sets of scaled templates to teams.
- Make sure teams do not develop minor variations of the same basic plan.
- 3 plans in same time as one with parallel teams working with same relationships.



Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
1. When adjusting the Space Relationship Diagram, which of these modifying considerations may prevent us from realizing the ideal arrangement?	A. Material handling methods, especially equipment. B. Site conditions or surroundings. C. Building features. D. Utilities and auxiliaries. E. Any of the above.	
2. When adjusting the Space Relationship Diagram, which of these practical limitations may prevent us from realizing the ideal arrangement?	A. Budgetary and time limitations. B. Codes and regulations. C. Company policies and procedures. D. Any of the above.	
3. Which of these may require adjustments to main aisles and circulatory patterns?	A. Personnel safety. B. Congestion C. Visibility. D. Type of trucks and picking equipment. E. Any of the above.	
4. Systematic Layout Planning (SLP) requires that we develop two or more good layouts that differ in some significant way.	A. True. B. False.	
5. Varying flow patterns (Straight-thru,U-shape, L-shape) is one way to generate alternatives.	A. True B. False	

Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
6. The best way to get good alternative layouts is to turn several teams loose and wait to see what they develop.	A. True. B. False.	
7. The best way to avoid overlooking a good alternative is to agree in advance on what alternatives need to be explored.	A. True. B. False.	
8. Scaled templates made of paper or card stock are helpful when teams prepare layouts.	A. True. B. False.	
9. Two or more teams working in parallel can develop multiple alternatives in the same time that one person or team would develop only one.	A. True. B. False.	