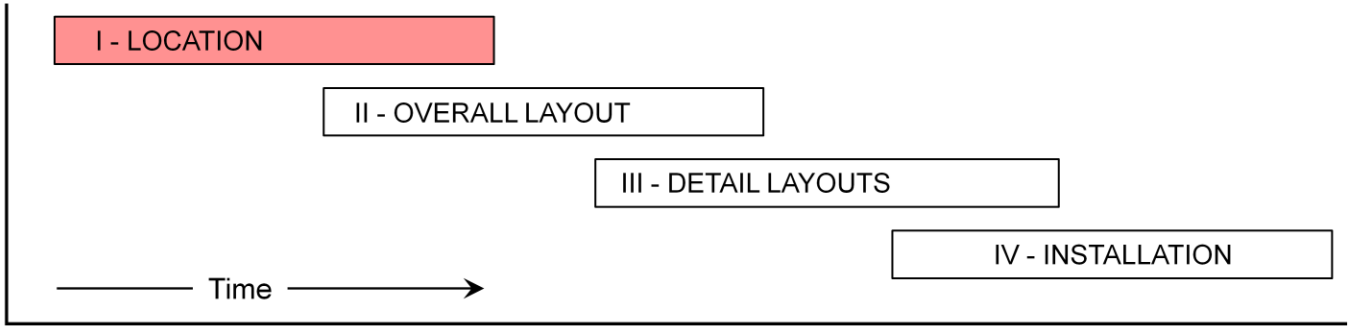
Systematic Layout Planning (SLP)

Site Location & Selection

Main Points

1. Every layout project has a Phase I – Location. But the meaning of "location" varies based upon the scope of the project.
2. At one extreme is the location of a new site in a new region; at the other, the location of a machine or activity within a small area of the existing facility.
3. In between, are site planning, building and floor layout, from the total site and building down to departments, cells, and stations.
4. Each needs an initial phase – no matter how brief – to become familiar with the space available and its surroundings, and any dominant features or considerations that may influence the layout.
5. Even when making layouts for speculative facilities on sites not yet chosen, the planner must make some basic assumptions about the nature of the site and location.

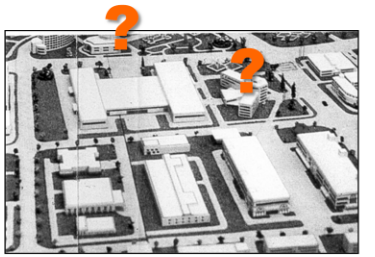
Meaning of Phase I Location varies by project



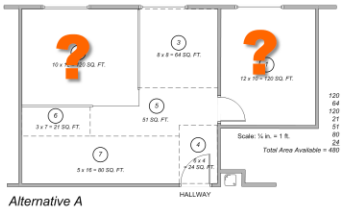
Phase I:

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

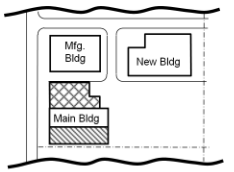
- Region & site



- Building or floor within a site



- Room or position within a floor



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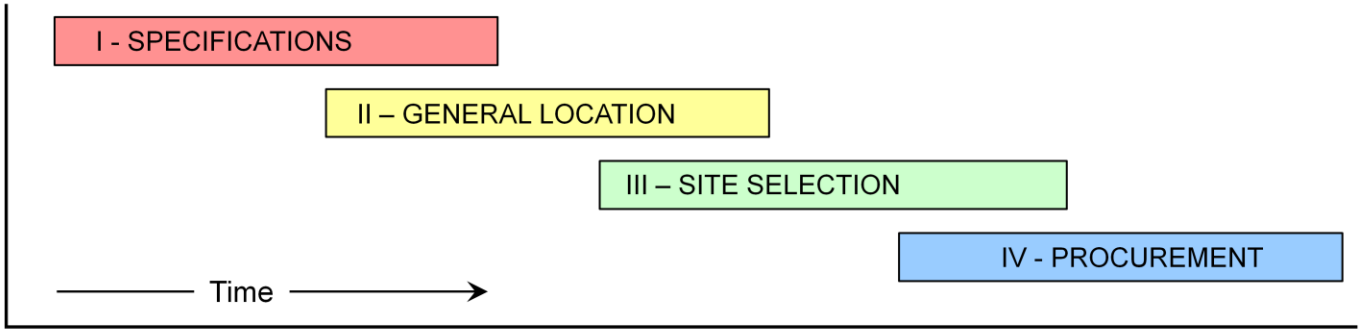
Notes

Main Points

1. Location projects break down into the four phases shown here.
2. The four phases should overlap. Finding out what differences exist among communities may lead to some adjustments in specifications. For this reason, cursory reviews of communities or regions should begin before the final specifications are written.
3. Similarly, there is no point in considering a community that contains no suitable sites.
4. Phases II and III both involve search activity. Both follow common procedures to arrive at selected locations.
5. Location projects typically require two groups. A top management group sets objectives, reviews progress and makes or approves final selection. A middle management group writes the specifications, gathers information and makes recommendations.

The Phases of Site Location & Selection



Phase I:

Establish what is wanted: Proximities to customers & suppliers, capacities short- and long-range, features and surroundings…

Phase II:

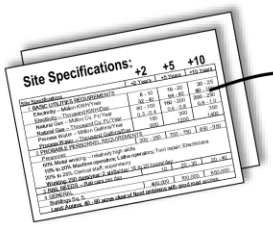
Select the general region or community. Compare costs, intangible features and characteristics, and availability of suitable sites.

Phase III:

Analyze and select the specific site. Compare costs and suitability for intended layout and operations.

Phase IV:

Procure the site through negotiations, lease or purchase.



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Notes

Main Points

1. When choosing a new region or community be sure to think about all the relevant factors.
2. This general checklist contains the most important considerations.
3. Note that some can be compared in terms of cost. Others can be compared in some numerical way. But some factors are purely intangible and must be subjectively rated for each alternative.

Location Specification Factors

I. Transportation
   A. Desired modes & service
   B. Acceptable/low costs

II. Labor Supply
   A. Skills & availabilities
   B. Union laws
   C. History
   D. Acceptable/low costs

III. Sourcing & Services
   A. Proximities, Availabilities
   B. Lead times, response times

IV. Power & Utilities incl. Datacomm

V. Environmental regulations & permits

VI. Government & Taxation
   A. On inventory & property
   B. On income
   C. Fees
   D. Incentives

VII. Community Features
   A. Population (size, composition)
   B. Housing (types, costs)
   C. Education (types, quality)
   D. Health & Welfare
   E. Culture & Recreation
   F. Retail shopping
   G. Police (crime) & fire
   H. General business climate
   I. Meeting facilities; hotels
   J. Attractiveness to key personnel

VIII. Specific Site Features
   A. Space & configuration
   B. Location & zoning
   C. Site conditions, incl. soil
   D. Transportation & accessibility
   E. Power & utilities
   F. Existing buildings
   G. Legal factors

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Notes

Main Points

1. In practice, most location planners put their specifications into a spreadsheet and then fill it with corresponding information about each site.
2. Note that candidate sites are at least identified before the location is chosen. This may require site visits or not if photos and videos are available through the Internet.
3. Quantifiable attributes can usually be obtained without site visits. But to understand differences on intangible factors, visits are usually essential.

Location & Site Specifications

Location:
- Accessibility
- Proximities
- Zoning

Site & Building:
- Areas
- Height
- Configuration
- Utilities
- Office

Financials:
- Price
- Sale/lease
- Incentives

Savannah — Candidate Properties

Norfolk — Candidate Properties

Baltimore — Candidate Properties

SELECTION FACTORS	Martin Bldg Belcamp, MD 21017	First Industrial Lansdowne MD 21227	Crest Business Park Baltimore, MD 21224	Top Quality Foods Salisbury, MD 21801
Location				
Distance From Port (miles)	26.5	7	5	115
Location w/in 5 Miles of Interstate	1.2 miles I-95	0.1 - I-695	0.7 - I-695	87 miles I-97
Rail Spur Access	CSX Nearby	CSX Spur	6 Doors, Canton	NS
Zoning Classification	Industrial	Industrial	Industrial	Industrial
Land Area (15-36 Acres)	20	28	35	16
Building				
Construction Date	1988	1960	1950	?
Floor Area (160-190K sq. ft. min.)	181,000	240,000	465,000	309,276
Clear Height (20 ft min; 25 ft preferred)	22	28	60	10 to 30
Floor Thickness (6" Reinforced Concrete)	?	?	?	6
Column Spacing	35 x 35	25 x 50	90 x 45	30 x 40
Building Length (600 ft desired)	440+	?	?	?
Dock Doors (12-22+)	1-Expandable	19	4	6 to 12
Drive-In Doors	0-Expandable	0	71	2
Electrical (300,000 KWhr/Month)	480-3PH	BGE	2000 Amps	5200 Amps
Gas (14,000 Mcf/Month)	BGE	BGE	BGE	6"
Water (333,000 Gallons/Month)		Public	8" Main	4-Wells
Waste Water Capabilities - Hydraulic Oil in Wash Bay	?	?	?	?
Cranes	No	No	100 ton	Yes
Office Space (9,000 min)	7,000	?	17,000	?
Previous Use	Import Vehicle Prep	Grocery Distribution	Steel Service Center	Beef Processing Plant
Financial				
Asking Price	$9,400,000	N/A	N/A	$1,950,000
Asking Price per Square Foot	$51.93	N/A	N/A	$6.30
Lease Rate (Rent $ per SF)	?	$4.50	$3.75	$2.50
On Market Since	5/5/2005	8/1/2005	9/1/2002	8/24/2004
Notes	Nice bldg, large paved lot	Food Grade Bldg Expandable	Old Building, Fair Location	Poor Building, Marginal Location
Availability	Jan or Jul, 2007			
Incentives	State Enterprise Tax Zone	State Enterprise Tax Zone	State Enterprise Tax Zone	State Enterprise Tax Zone

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Notes

Main Points

1. The nine steps or procedures listed here are repeated – once to choose the general location, and again to evaluate and select a final site within the chosen community or region.
2. Note that site visits are in the middle of the sequence.
3. Be sure to decide in advance if you are visiting on a confidential basis, without identifying your company, or if you can be public about your interests.
4. Going public may expose your senior executives and organization to questions, sales pitches, and explanations that they are not yet ready to handle.

Location Planning Procedures

repeated for General Location & Site Selection

1. Transportation studies
2. Review of published information and data
3. Preliminary screening
4. Establish local contacts
5. Field visits
6. Economic analysis
7. Intangible considerations
8. Negotiations
9. Final evaluation & selection

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Notes

Measurable Objectives for Location & Site Selection

Main Points

1. Choosing a new location and/or site will be personal and emotional for many people involved in the decision and throughout the organization.
2. Given the many subjective factors and evaluations that will be made, it helps to quantify and measure site differences wherever possible.
3. Getting the data for measurement will be extra work and may be impractical, but there is usually value in trying.

Community

SELECTING A COMMUNITY	
Typical Objectives	**Possible Factors to Measure**
• Low material supply cost	– Cost per unit of raw material – Annual inbound freight costs
• Low distribution cost	– Delivered cost per unit – Annual outbound freight costs
• Adequate labor supply	– Number of potential workers within given commuting distance – Unemployment rate – Days lost to strikes
• Low labor cost	– Average hourly wages by category – Fringe benefits – Average workweek and
• Mild climate	– Degree-days by month – Average monthly temp – Average monthly humi
• Adequate community services	– Hospital beds per thous – Fire classification

Specific Property

SELECTING A SPECIFIC SITE	
Typical Objectives	**Possible Factors to Measure**
• Proximity to labor force	– Commuting times to given points – Concentration of workers
• Adequate site size	– Useable acres
• Proximity to community services	– Response and driving times
• Proximity to utility services	– Distance to connecting points – Costs to hook-up, per service
• Frequency of transport service	– Pickups, switches per day – Latest pickup times
• Low land cost	– Cost per acre

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Notes

Main Points

1. Transportation costs are a useful starting point and central to most location decisions.
2. To obtain the relevant costs, the planner must contact a cross- section of potential carriers and ask for rate quotes.
3. Do not assume that all transport costs are a function of distance. Quoted rates may be influenced by a carrier's current routes and backhauls, fuel surcharges, and their financial situation.

Transportation Rate Quotes

Inbound Transportation Rate Quotes

All Rates are for non-overweight, non-oversized, non-hazardous commodities

	SE Motor Freight	JAX Haulers	ABC	Martin Express	Carolina	Distance in Miles per Round trip	Lowest $/Mile Round trip	Savings - Lowest vs. Highest Quote
Charleston to Fairfax								
Container Rate	$ 300		$ 550	$ 350	$ 375			
Fuel Surcharge (%)	20%		31%	25%	22%			
Total Container Rate	**$ 360**	**$ 700**	**$ 721**	**$ 438**	**$ 458**	180	$ 2.00	**50%**
Flatbed Rate					$ 480			
Fuel Surcharge (%)					22%			
Total Flatbed Rate		**$ 700**	**NA**	**NA**	**$ 586**	180	$ 3.25	**16%**
Charleston to Augusta								
Container Rate	$ 375		$ 550	$ 460	$ 420			
Fuel Surcharge (%)	20%		31%	25%	22%			
Total Container Rate	**$ 450**	**$ 800**	**$ 721**	**$ 575**	**$ 512**	312	$ 1.44	**44%**
Flatbed Rate					$ 545			
Fuel Surcharge (%)					22%			
Total Flatbed Rate		**$ 800**	**NA**	**NA**	**$ 665**	312	$ 2.13	**17%**
Savannah to Fairfax								
Container Rate	$ 275		$ 550		$ 300			
Fuel Surcharge (%)	20%		30%		22%			
Total Container Rate	**$ 330**		**$ 715**	**NA**	**$ 366**	174	$ 1.90	**54%**
Flatbed Rate								
Fuel Surcharge (%)								
Total Flatbed Rate				**NA**	**NA**	174	$ 3.31	**NA**
Savannah to Augusta								
Container Rate	$ 375		$ 550		$ 375			
Fuel Surcharge (%)	20%		30%		22%			
Total Container Rate	**$ 450**		**$ 715**	**NA**	**$ 458**	266	$ 1.69	**37%**

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Notes

Main Points

1. Field visits will verify and add to published data on wages, taxes, land costs, utility costs and other economic factors.
2. These data, together with transportation studies, should be sufficient to identify the locations with the lowest costs and highest profit potential.
3. The categories here are usually sufficient to reach a sound decision. But beware of trends and consider likely long-term costs.

Economic Analysis

1. Transportation – inbound and outbound.
2. Labor – costs adjusted for local fringe benefits, holidays, sick leave, absenteeism and productivity, turnover, and prevailing labor laws.
3. Taxes – all kinds at all levels.
4. Land and Construction or Rent
5. Utilities – power, water, fuel, waste.
6. Telecommunications – voice and data.
7. Financing – incl. interest rates, allowances and concessions.

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Notes

Intangible Considerations

Main Points

1. The weighted-factor method is an organized way to compare the intangible features of various locations.
2. Each consideration or factor is given a weight from 10 to 1, indicating its relative importance.
3. Alternatives are rated as to their performance on each factor – here using a vowel-letter code: A, E, I, O, U and X. Corresponding values are: 4, 3, 2, 1, 0 and -1.
4. Rating is done with letters to remind of the subjectivity involved and the imprecise nature of the comparisons.
5. Weight x point value of the rating = Factor score. These are totaled to find the winning location.
6. One needs a 12% to 15% spread to be sure of a winner.
7. Costs should be compared in a separate economic analysis.

Community

EVALUATING ALTERNATIVES

Plant *Art Printing, Inc.*
Project *Branch Plant General Location* Date *6-8*

Weights set by *B. Day* Tally by *H. Lee*
Ratings by *Loc. Team* Approved by

EVALUATING DESCRIPTION			
A	Almost Perfect	O	Ordinary Results
E	Especially Good	U	Unimportant
I	Important Results	X	Not Acceptable

Description of Alternatives:
Enter a brief phrase identifying each alternative.
A. *Newark*
B. *Cherry Hill*
C. *Wilmington*
D. *Norristown*
E.

FACTOR / CONSIDERATION	WT.	RATINGS AND WEIGHTED RATINGS A	B	C	D	E
1 *Adequate transport service*	2	E 6	E 6	E 6		
2 *Accessibility from corporate HQ*	8	A 32	A 32	I 16		
3 *Adequate labor supply*	6	E 18	E 18	O 6		
4 *Good labor climate*	10	U 0	O 10	O 10		
5 *Adequate sites available*	6	A 24	A 24	U 0		
6 *Prestigious location in customers' minds*	1	I 2	E 3	U 0		
7 *Adequate business facilities & services*	3	E 9	E 9	E 9		
8 *Adequate community facilities & services*	4	E 12	E 12	E 12		
Totals		103	114	59		

Reference Notes:
a.
b.
c.
d.
e.
f.

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EVALUATING DESCRIPTION			
A	Almost Perfect	O	Ordinary Results
E	Especially Good	U	Unimportant
I	Important Results	X	Not Acceptable

Specific Property

EVALUATING ALTERNATIVES

Plant *Art Printing, Inc.*
Project *Branch Plant Site Selection* Date *6-12*

Weights set by *B. Day* Tally by *H. Lee*
Ratings by *Loc. Team* Approved by

EVALUATING DESCRIPTION			
A	Almost Perfect	O	Ordinary Results
E	Especially Good	U	Unimportant
I	Important Results	X	Not Acceptable

Description of Alternatives:
Enter a brief phrase identifying each alternative.
A. *Mainroads -- Bldg. 3*
B. *Westgate*
C. *Westgate*
D. *Atlantic*
E. *Buckstone*

FACTOR / CONSIDERATION	WT.	RATINGS AND WEIGHTED RATINGS A	B	C	D	E
1 *Proximity to work force*	8	E 24	E 24	E 24	E 24	I 16
2 *Proximity to business facilities & services*	6	E 18	A 24	A 24	I 12	E 18
3 *Suitability of building and site*	10	A 40	A 40	A 40	E (a) 30	A 40
4 *Compatibility with surroundings*	7	A 28	A 28	A 28	A 28	E 21
5 *Expandability*	9	I 18	A 36	I 18	E 27	E 27
6 *Proximity to Philadelphia airport*	2	U 0	I 4	I 4	O 2	U 0
7 *Ease of start-up supervision*	5	U 0	A 20	A 20	A 20	E 15
8 *Proximity to New York truck routes*	3	E 9	I 6	I 6	U 0	A 12
9						
Totals		137	182	164	143	149

Reference Notes:
a. *No building available; will build to suit by 12-10*
b.
c.
d.
e.
f.

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- Weighted Factors
- Rated Performance
- Weights x ratings = Scores

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Notes

Main Points

1. Layout plans are always influenced by the layout's location and surroundings, including the configuration and condition of available buildings.
2. On large plant layout projects, it is good practice in Phase I – Location – to mark up a plan or aerial view of the site, highlighting existing conditions and features that should be considered in the plan.
3. In this illustration, a large plant comprises numerous structures with configurations. These have been color coded on a satellite photo. Each will lend itself to particular uses.
4. The eventual *adjustment* of the ideal arrangement into practical alternatives will try to take advantage of these configurations and conditions.
5. Smaller projects under-roof are similarly influenced by their locations and surroundings.

Phase I - Location & Building Considerations

High Bay Areas

Outbuildings of limited use

2nd Floor Areas

Congested Yard & Truck Apron

Potential New Dock

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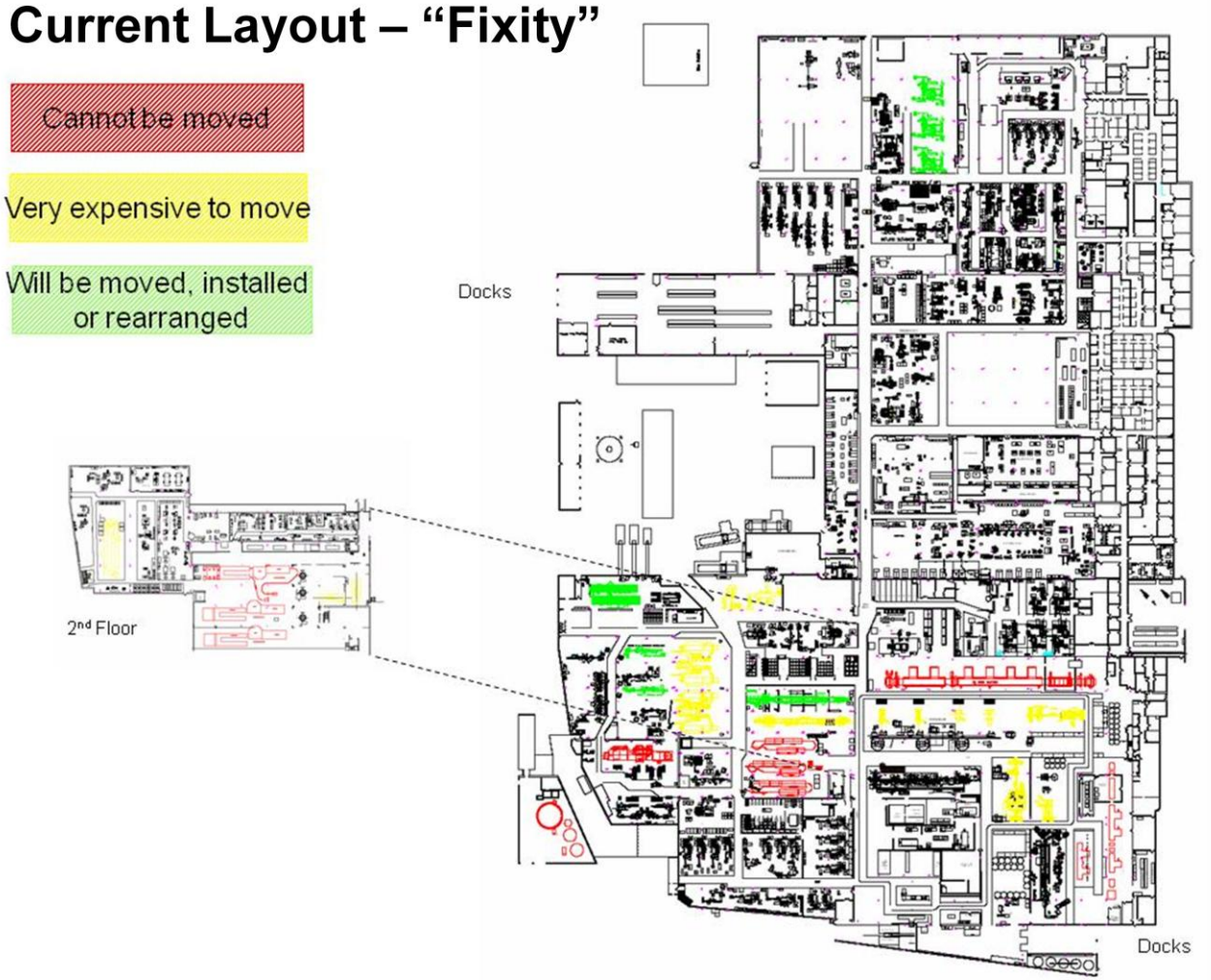
Notes

Main Points

1. Many layouts and planning situations contain "monuments" -- things that are highly fixed and cannot or will not be moved.
2. It is good practice in Phase I – Location – to identify those pieces of equipment or areas that *must* remain in their current locations, or *should* remain and the reasons therefore.
3. 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.
4. 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.

Phase Current Layout – "Fixity"



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Notes

Main Points

1. Even when considering multiple locations within a building, it is wise to write down and weight what is wanted in the ideal location.
2. This example shows requirements for locating an expanded blending area in an existing plant.
3. The list states "What is wanted."
4. Requirements are filled in; their importance to the project is weighed; and each prospective location available can then be rated against this list of specifications to select the most suitable.
5. This is similar to the factor analysis method of evaluating alternative layouts.

Location Specifications within a Site or Building

LOCATION SPECIFICATIONS

Plant	*Zurich A*	Project	*Expand Blending Area*
By	*R. L. Egli*	With	*J. Habich*
Date	*7/6*	Sheet	*1* of *2*

Requirements of Location (What is wanted from area to be laid out)	Importance	Location A *2-4/A-C On 2nd Floor New Wing*	Location B *Shed beside Lubricant Storage Building*	Lo
1 Size				
4000 square meters	*9*			
Expansion possibility to 7500	*7*			
2 Condition				
Second (or 3rd) Floor	*3*			
Basically rectangular (can be 1:4 proportions)	*3*			
Concrete Floor 880kg/M^2 Min.	*8*			
4.8 Meters clear overhead	*5*			
3 Relationships				
Above Filling Department	*2*			
Near Aging & Holding Tanks	*10*			
4 Contacts				
Normal Water; Electrical	*10*			
Drains to Filter Beds	*8*			
Special Air Ventilation needed	*5*			
5 Surroundings				
Keep out sunlight	*8*			

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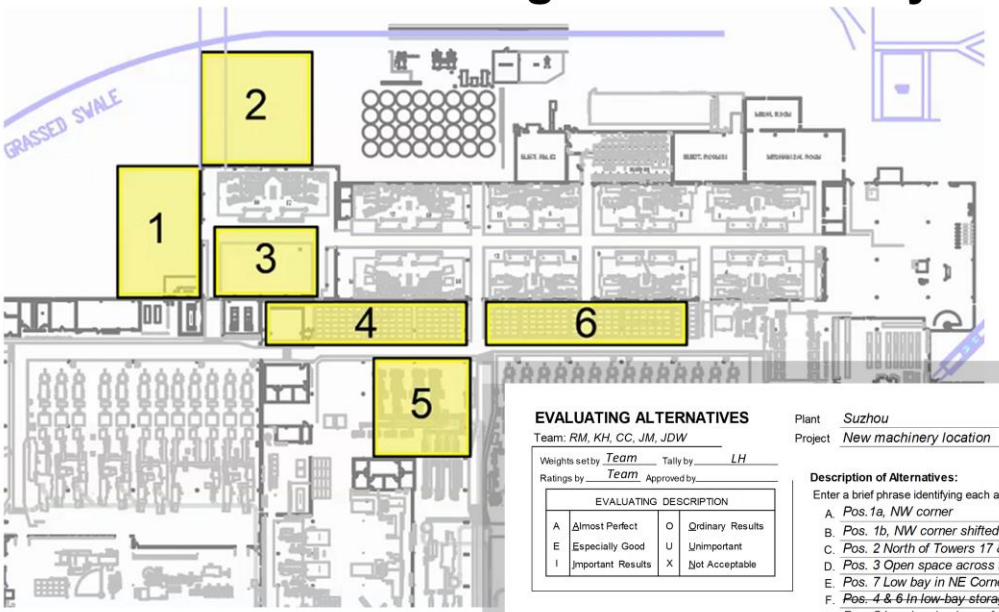
Notes

Main Points

1. Example of Phase I – Location – finding the best location for machinery in an existing plant.
2. Six locations where new machinery could be installed are evaluated with the weighted-factor method.

Locating New Machinery



EVALUATING ALTERNATIVES

Team: *RM, KH, CC, JM, JDW*

Weights set by *Team* Tally by *LH*

Ratings by *Team* Approved by

EVALUATING DESCRIPTION			
A	Almost Perfect	O	Ordinary Results
E	Especially Good	U	Unimportant
I	Important Results	X	Not Acceptable

Plant *Suzhou*

Project *New machinery location* Date *3/27*

Description of Alternatives:

Enter a brief phrase identifying each alternative.

A. *Pos. 1a, NW corner*
B. *Pos. 1b, NW corner shifted north to avoid cooling towers*
C. *Pos. 2 North of Towers 17 & 19*
D. *Pos. 3 Open space across from 17 & 19*
E. *Pos. 7 Low bay in NE Corner next to Maintenance*
F. ~~*Pos. 4 & 6 In low-bay storage rack areas*~~
G. ~~*Pos. 5 Low bay in place of #26 – 28*~~

FACTOR / CONSIDERATION	WT.	ALTERNATIVE A (1a)	B (1b)	C (2)	D (3)	E (7)	F (4&6)	G (5)
1 *Disruption to production during construction*	10	E 30	A 40	A 40	O 10	O 10	X	X
2 *Construction & crane access*	5	A 20	A 20	A 20	E 15	I 10	X	X
3 *Capital cost (relative)*	8	O 8	I 16	I 16	A 32	I 16		
4 *Material flow to/from (Proximity to storage and next operation)*	5	I 10	I 10	O 5	I 10	A 15		
5 *Demo/Prep*	4	O 4	A 16	A 16	E 12	U 0		
6 *Future expandability*	8	A 32	A 32	A 32	U 0	A 24		
7 *Preserve options for material storage*	6	A 24	E 18	E 18	U 0	E 21		
Totals		128	152	147	79	96	0	0

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Notes

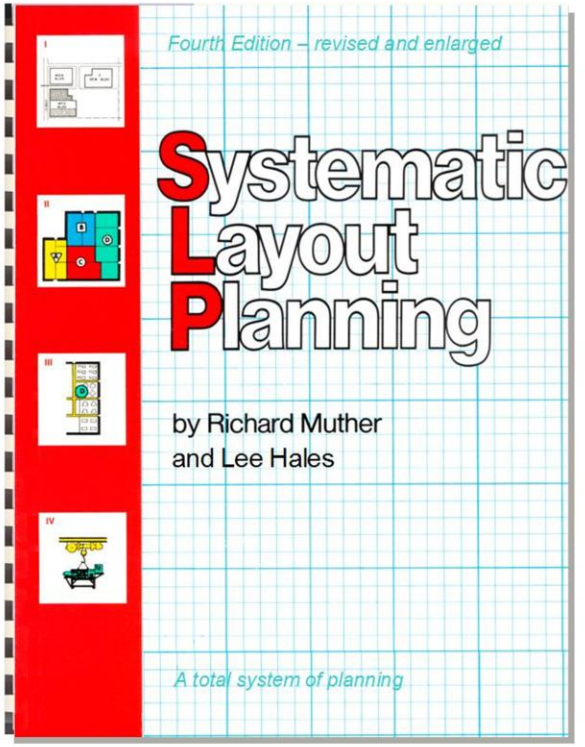
Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
1. In Systematic Layout Planning (SLP), the meaning of Phase I – Location depends upon the scope of the project.	A. True. B. False.	
2. Location may refer to	A. Selecting a region or a site. B. Agreeing on an area to be planned within a current site or building. C. Either A or B, depending upon on the project situation.	
3. Site location and selection can be approached as a four-phase project.	A. True B. False.	
4. When planning for rearrangement of an existing building or area, Phase I – Location includes the identification of fixed features or "monuments" that must remain in their current locations.	A. True B. False	
5. The weighted-factor method of evaluating alternatives is useful when comparing and selecting locations and sites.	A. True B. False	

Summary

- Every layout project begins with a location – actual, proposed or assumed.
- Location determines the amount of space available.
- Locations have features, conditions and characteristics that should be reviewed for their likely influence on the layout.
- Locations have surroundings with their own characteristics and conditions that may also influence the layout.
- On projects broad in scope, such as finding a new site in a new region, Phase I Location may require months of research and decision-making.
- On small projects, such as rearranging a small department or work cell, Phase I Location may require no more than a few minutes of discussion.

Supplemental Reading



For more depth on this topic, see Chapter 14

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