

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

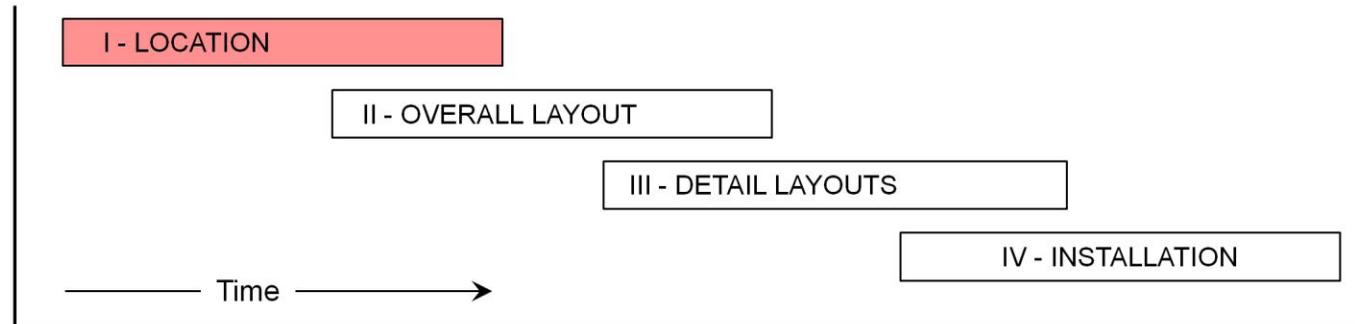
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## **Site Location & Selection**

**Main Points**

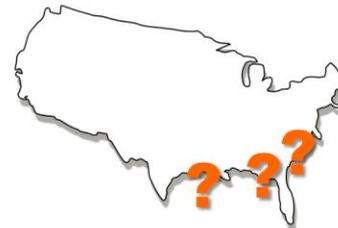
1. Every layout project has a Phase I – Location. But the meaning of “location” varies based upon the scope of the project.
2. At one extreme is the location of a new site in a new region; at the other, the location of a machine or activity within a small area of the existing facility.
3. In between, 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

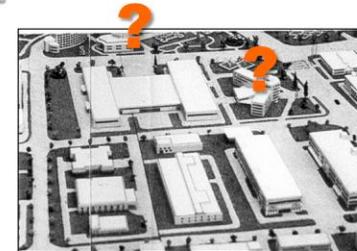


**Phase I:**

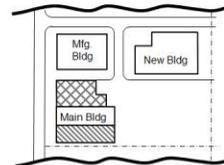
Establish the location of the area to be planned. Determine space available and surrounding influences.



- Region & site



- Building or floor within a site



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- Room or position within a floor

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**Notes**

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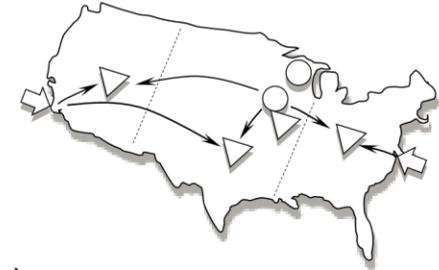
# Network Planning

## Main Points

1. Supply chain and logistical networks consist of locations – suppliers, plants, warehouses, and customers – and the transportation routes or lanes between them. Planning such networks typically requires strategic decisions about and operations.
2. Decisions not made on the basis of analysis become assumptions and policies by default.
3. Network planning seeks to maximize the company's profits or minimize costs subject to relevant constraints and important intangible considerations. Planning also validates future strategies and prepares for various contingencies.
4. The cost of poor network decisions can be high and generally increases as companies grow, more products are added, and their networks become more complex.

## Strategic Facilities Decisions

1. How many plants and warehouses?
2. Size and capacity of each?
3. Where should they be located?



## Related Operational Decisions (Facility mission)

1. Which customers will be served and from which locations?
2. Which products will be made or distributed at which locations, and in what quantities?
3. How much inventory will be held at which locations?
4. Which products will be made internally and which sourced from outside?
5. Which suppliers will be used and for what items?
6. What modes of transportation will be used between locations?
7. What will be the hours and days of operation?

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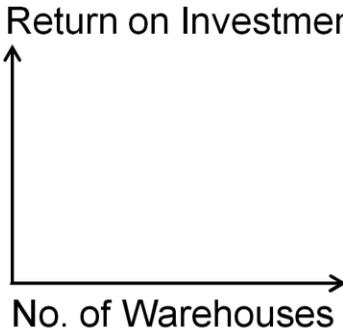
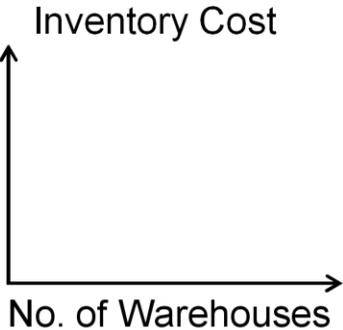
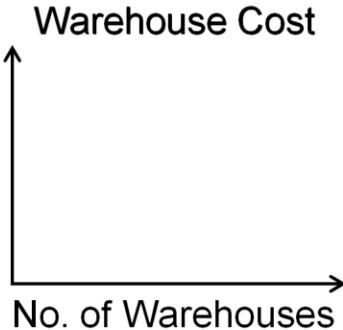
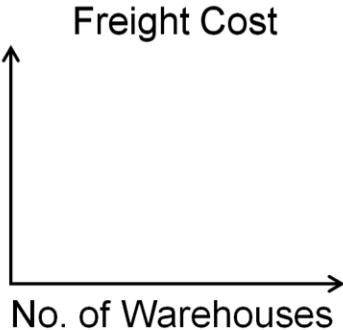
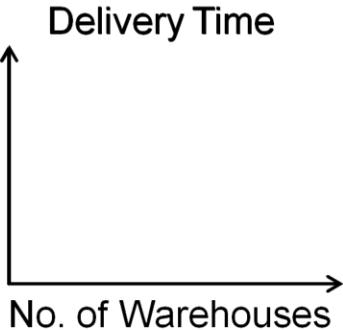
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# Number of Warehouses and their Consequences

**Exercise**

As the number of warehouses in any distribution network increases, please indicate the effect on each of the considerations shown here. Draw the graph that you would expect for each consideration.



**Notes**

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# Typical Networks & Strategies

## Main Points

1. Some networks are simple and straightforward to configure. They require only one or a handful of locations, the selection of which is fairly clear and often obvious.
2. At the other extreme are networks comprising dozens to hundreds of warehouses that can be placed in many possible locations.
3. Clearly the techniques used to plan simple and complex networks will be different.

Type of business	Number of U.S. DCs & Warehouses	Stocking levels to point of consumption	Where located	Strategic considerations
Automobile manufacture (purchased parts)	1 per assembly plant	1	Within minutes of the plant	Transportation time and cost
Expensive surgical instruments	1 plus service parts	1	At plant; service at air express hub, possibly 3PL	Overnight shipment Inventory investment
Major airline (service parts)	1 major, a few minor	1 or 2; central and "line" station	Overhaul base and significant overnight line stations.	Quick response Minimize inventory
Imported apparel (sell to retail trade)	1 to 3	1	Near container ports	Transportation cost, Inventory allocation
Specialty retailer	1 to 3	1	Central to store locations	Missed sales Transportation costs Inventory investment
Automotive service parts (retail)	10 to 60	2 to 3	Central to a region or group of stores; Can be in outlying towns to major metro areas or regions.	Missed sales Transportation cost Inventory investment Warehouse labor cost
Soft drinks	Several hundred	1 to 3	Population centers; hubs at bottling plants.	Missed sales Cost; return on capital Freshness

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**Main Points**

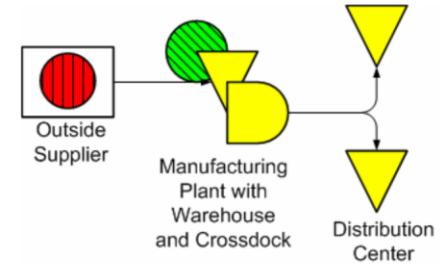
1. From the classical theory of network optimization, every “problem” is represented by nodes (locations) and arcs (transportation lanes or flows).
2. Modeling is done with specialized software, ranging from simple and inexpensive to complex and costly.
3. Most modeling software uses the CPLEX algorithm for mixed-integer linear programming. This algorithm optimizes – meaning it seeks to maximize or minimize an objective function subject to constraints.
4. The objective function is typically defined to minimize costs of interest, or to maximize profits. Most modeling software has a three-part structure:
  - a. User interface to enter and view data and results.
  - b. Mid-layer where mathematical equations are formulated.
  - c. Optimization engine which solves the problem as formulated.
5. Modeling software does not typically consider intangible factors or consequences of network planning decisions. Factors such as risk or ease of implementation, or flexibility must be addressed by a larger and more comprehensive and systematic planning procedure.

# Network Modeling & Optimization

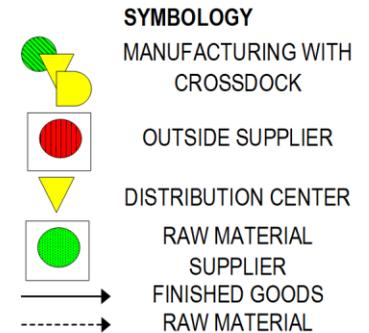
$$\begin{aligned} & \text{Min Cost} \sum_i \sum_j C_{ij} X_{ij} \\ \text{st} & \sum_i X_{ij} - \sum_k X_{jk} = b_j \forall j \in N \end{aligned}$$

**HOW TO READ THIS FORMULA:**

- Minimize flow (x) cost (c)
- between all pairs (ΣΣ)
- of network locations (i’s and j’s),
- subject to (st)
- the conservation constraint that
- all flows into any location (X<sub>ik</sub>) must be accounted for,
- either as outflows (X<sub>jk</sub>)
- or as quantities remaining (b<sub>j</sub>)
- at each (∀) location,
- where j is a type of (∈) number N,
- either integer or real – to require only whole locations or to permit a fractional result.



NODES = Locations  
ARCS = Transportation Lanes



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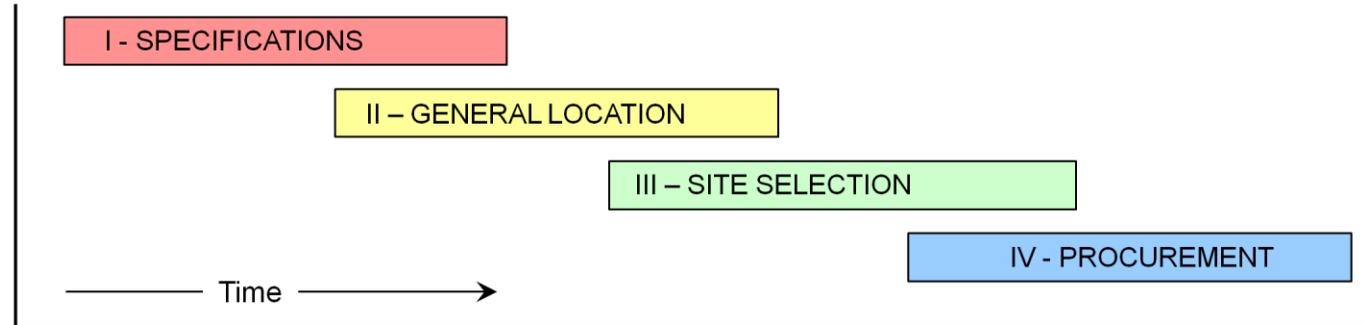


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# The Phases of Site Location & Selection

## 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.



### Phase I:

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



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### 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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# Location Specification Factors

## 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.

## 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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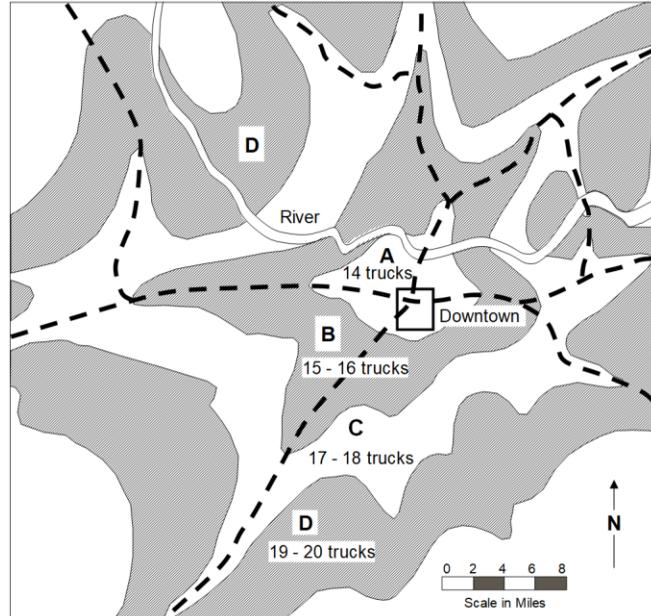
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## Main Points

1. Transportation and labor are two critical factors when locating warehouses and distribution centers.
2. With transportation, the planner is typically concerned with travel time and cost, and with the dependability of travel times.
3. In the illustration at left, the number of delivery trucks has been estimated for a potential new warehouse in one of four zones: A, B, C or D. The difference in number of trucks, and thus transport cost, is significant. Of course, labor, land, taxes, utilities and other expenses must also be considered.
4. With labor, the planner is typically concerned with availability, turnover, hourly cost or wages, and productivity.
5. In the illustration at right, management is concerned about retaining long-time employees when moving to a new site and has mapped their residences as a consideration.
6. These are each simplistic looks at a single site location factor. But may give enough insight to help make a decision.
7. Studies looking concurrently at multiple variables and with special conditions are best performed with various forms of linear programming and using network modeling software. A method for planning and executing such modeling studies is described in the booklet: *Simplified Systematic Network Planning* by Chandrashekar Natarajan and Lee Hales, VDM Verlag Dr. Müller.

## Transportation & Labor

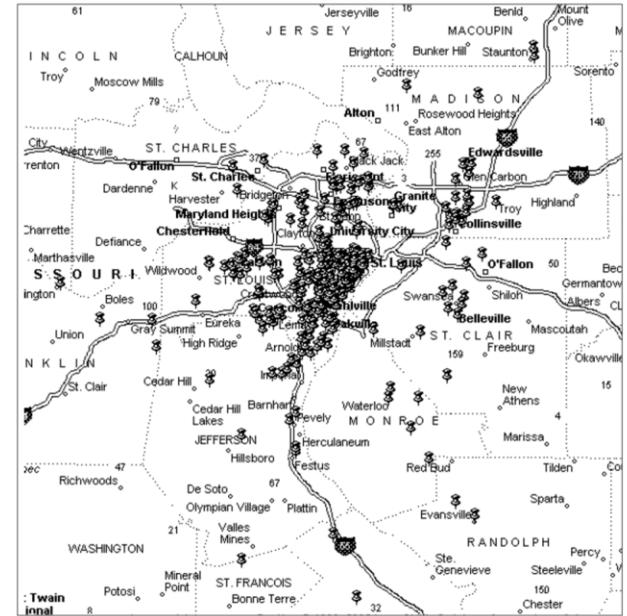


Number of delivery trucks needed for a new warehouse if located in zone A, B, C or D. Determined using distances and average travel speed between potential warehouse locations, freight terminals (inbound travel) and existing customer locations to be served (outbound travel). The trucking time per day to each of the freight terminals or shopping centers is:

$$T = N * (L + (2D/V))$$

where:  
 T = Trucking time per day (hours)  
 N = Number of trips per day  
 L = Loading and unloading time per trip (hours)  
 D = Distance between warehouse and freight terminal or shopping center (miles)  
 V = Average travel speed (miles per hour) on this route

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Map of current employee residences.

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# Location & Site Specifications

## 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:

- Accessibility
- Proximities
- Zoning

### Site & Building:

- Areas
- Height
- Configuration
- Utilities
- Office

### Financials:

- Price
- Sale/lease
- Incentives

Savannah	Candidate Properties			
Norfolk	Candidate Properties			
Baltimore	Candidate Properties			
	Martin Bldg	First Industrial	Crest Business Park	Top Quality Foods
	Belcamp, MD 21017	Lansdowne MD 21227	Baltimore, MD 21224	Salisbury, MD 21801
<b>SELECTION FACTORS</b>				
<b>Location</b>				
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
<b>Building</b>				
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
<b>Financial</b>				
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

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**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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# Measurable Objectives for Location & Site Selection

## Community

SELECTING A COMMUNITY	
Typical Objectives	Possible Factors to Measure
<ul style="list-style-type: none"> <li>• Low material supply cost</li> </ul>	<ul style="list-style-type: none"> <li>– Cost per unit of raw material</li> <li>– Annual inbound freight costs</li> </ul>
<ul style="list-style-type: none"> <li>• Low distribution cost</li> </ul>	<ul style="list-style-type: none"> <li>– Delivered cost per unit</li> <li>– Annual outbound freight costs</li> </ul>
<ul style="list-style-type: none"> <li>• Adequate labor supply</li> </ul>	<ul style="list-style-type: none"> <li>– Number of potential workers within given commuting distance</li> <li>– Unemployment rate</li> <li>– Days lost to strikes</li> </ul>
<ul style="list-style-type: none"> <li>• Low labor cost</li> </ul>	<ul style="list-style-type: none"> <li>– Average hourly wages by category</li> <li>– Fringe benefits</li> <li>– Average workweek and</li> </ul>
<ul style="list-style-type: none"> <li>• Mild climate</li> </ul>	<ul style="list-style-type: none"> <li>– Degree-days by month</li> <li>– Average monthly temperature</li> <li>– Average monthly humidity</li> </ul>
<ul style="list-style-type: none"> <li>• Adequate community services</li> </ul>	<ul style="list-style-type: none"> <li>– Hospital beds per thousand</li> <li>– Fire classification</li> </ul>

## Specific Property

SELECTING A SPECIFIC SITE	
Typical Objectives	Possible Factors to Measure
<ul style="list-style-type: none"> <li>• Proximity to labor force</li> </ul>	<ul style="list-style-type: none"> <li>– Commuting times to given points</li> <li>– Concentration of workers</li> </ul>
<ul style="list-style-type: none"> <li>• Adequate site size</li> </ul>	<ul style="list-style-type: none"> <li>– Useable acres</li> </ul>
<ul style="list-style-type: none"> <li>• Proximity to community services</li> </ul>	<ul style="list-style-type: none"> <li>– Response and driving times</li> </ul>
<ul style="list-style-type: none"> <li>• Proximity to utility services</li> </ul>	<ul style="list-style-type: none"> <li>– Distance to connecting points</li> <li>– Costs to hook-up, per service</li> </ul>
<ul style="list-style-type: none"> <li>• Frequency of transport service</li> </ul>	<ul style="list-style-type: none"> <li>– Pickups, switches per day</li> <li>– Latest pickup times</li> </ul>
<ul style="list-style-type: none"> <li>• Low land cost</li> </ul>	<ul style="list-style-type: none"> <li>– Cost per acre</li> </ul>

### 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.

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### Notes

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# Transportation Rate Quotes

## 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.

<b>Inbound Transportation Rate Quotes</b>								
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
<b>Charleston to Fairfax</b>								
Container Rate	\$ 300		\$ 550	\$ 350	\$ 375			
Fuel Surcharge (%)	20%		31%	25%	22%			
<b>Total Container Rate</b>	<b>\$ 360</b>	<b>\$ 700</b>	<b>\$ 721</b>	<b>\$ 438</b>	<b>\$ 458</b>	180	\$ 2.00	<b>50%</b>
Flatbed Rate					\$ 480			
Fuel Surcharge (%)					22%			
<b>Total Flatbed Rate</b>		<b>\$ 700</b>	<b>NA</b>	<b>NA</b>	<b>\$ 586</b>	180	\$ 3.25	<b>16%</b>
<b>Charleston to Augusta</b>								
Container Rate	\$ 375		\$ 550	\$ 460	\$ 420			
Fuel Surcharge (%)	20%		31%	25%	22%			
<b>Total Container Rate</b>	<b>\$ 450</b>	<b>\$ 800</b>	<b>\$ 721</b>	<b>\$ 575</b>	<b>\$ 512</b>	312	\$ 1.44	<b>44%</b>
Flatbed Rate					\$ 545			
Fuel Surcharge (%)					22%			
<b>Total Flatbed Rate</b>		<b>\$ 800</b>	<b>NA</b>	<b>NA</b>	<b>\$ 665</b>	312	\$ 2.13	<b>17%</b>
<b>Savannah to Fairfax</b>								
Container Rate	\$ 275		\$ 550		\$ 300			
Fuel Surcharge (%)	20%		30%		22%			
<b>Total Container Rate</b>	<b>\$ 330</b>		<b>\$ 715</b>	<b>NA</b>	<b>\$ 366</b>	174	\$ 1.90	<b>54%</b>
Flatbed Rate								
Fuel Surcharge (%)								
<b>Total Flatbed Rate</b>				<b>NA</b>	<b>NA</b>	174	\$ 3.31	<b>NA</b>
<b>Savannah to Augusta</b>								
Container Rate	\$ 375		\$ 550		\$ 375			
Fuel Surcharge (%)	20%		30%		22%			
<b>Total Container Rate</b>	<b>\$ 450</b>		<b>\$ 715</b>	<b>NA</b>	<b>\$ 458</b>	266	\$ 1.69	<b>37%</b>

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## 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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**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.

# Intangible Considerations

## 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		
<b>Totals</b>		<b>103</b>	<b>114</b>	<b>59</b>		

Reference Notes:  
 a. \_\_\_\_\_ d. \_\_\_\_\_  
 b. \_\_\_\_\_ e. \_\_\_\_\_  
 c. \_\_\_\_\_ 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 Ave*  
 E. *Buckston*

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 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						
<b>Totals</b>		<b>137</b>	<b>182</b>	<b>164</b>	<b>143</b>	<b>149</b>

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

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

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**Notes**

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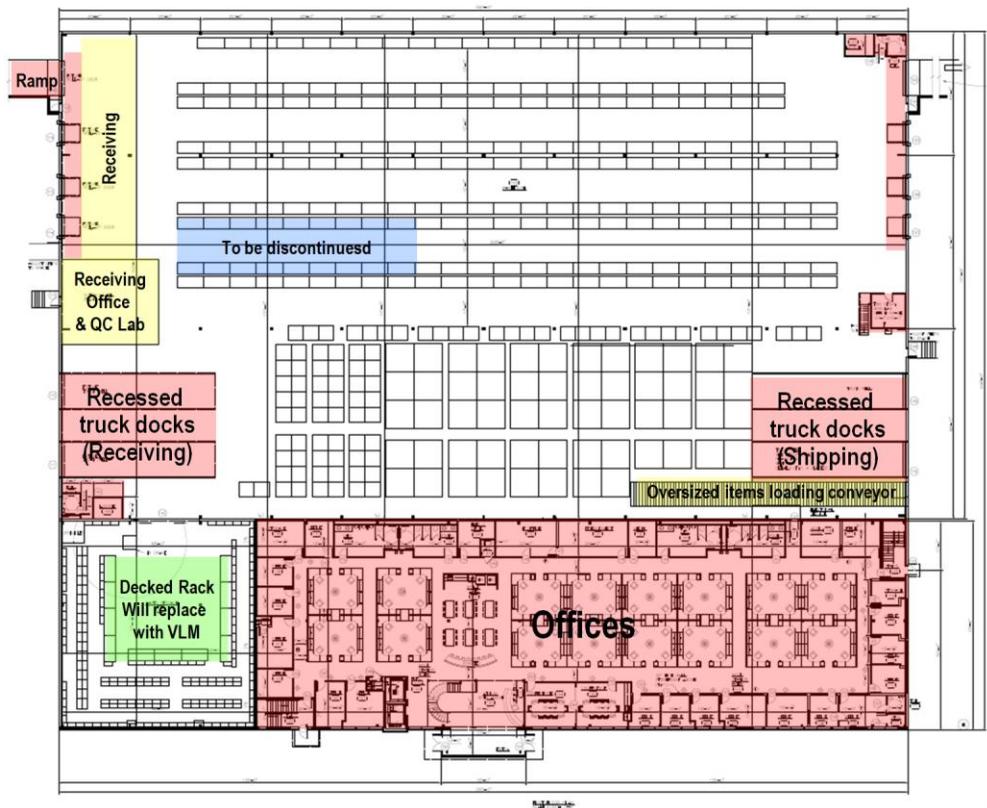
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**Main Points**

1. Many layouts and planning situations contain “monuments” -- things that are highly fixed and cannot or will not be moved.
2. It is good practice in Phase I – Location – to identify those building features, 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 “should 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 reconfigured in some way. Coloring these “green” will help planners and approvers to be aware of these decisions already made. Areas that will be vacated can be colored “blue.”
5. In this example, direction of flow can still be reversed if desired, but Receiving would have to switch with Shipping. The best layout opportunities are likely limited to zoning – changing where material groups are stored.

# Phase I Current Layout – “Fixity”

- Cannot be moved
- Should not be moved
- Will be moved
- Will be removed



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**Notes**

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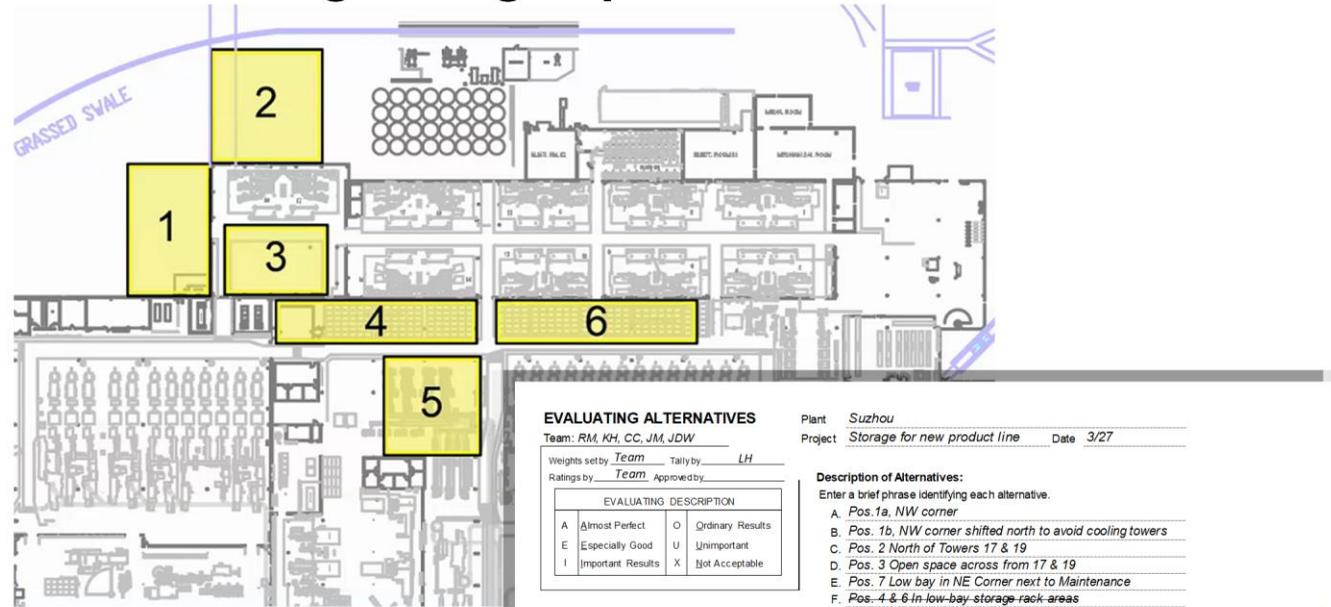


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## Main Points

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

# Locating Storage Space for a New Product



### EVALUATING ALTERNATIVES

Team: RM, KH, CC, JM, JDW

Plant: Suzhou

Project: Storage for new product line Date: 3/27

Weights set by: Team Tally by: LH

Ratings by: Team Approved by:

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

#### Description of Alternatives:

Enter a brief phrase identifying each alternative.

- Pos. 1a, NW corner
- Pos. 1b, NW corner shifted north to avoid cooling towers
- Pos. 2 North of Towers 17 & 19
- Pos. 3 Open space across from 17 & 19
- Pos. 7 Low bay in NE Corner next to Maintenance
- Pos. 4 & 6 In low-bay storage rack areas
- 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 during construction	10	E 30	A 40	A 40	O 10	O 10			
2 Construction 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	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 future AS/RS	6	A 24	E 18	E 18	U 0	E 21			
<b>Totals</b>		<b>128</b>	<b>152</b>	<b>147</b>	<b>79</b>	<b>96</b>	<b>0</b>	<b>0</b>	

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## Notes

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# 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 rearrangement projects of a limited scope, Phase I Location may require no more than a few minutes of discussion.