

CHAPTER

Location Strategies

DISCUSSION QUESTIONS

1. FedEx's key location concept is the central hub concept, with Memphis selected for several reasons, including its being in the middle of the country and having very few hours of bad weather closures.
2. The major reason for U.S. firms to locate overseas is often lower labor costs, but as this chapter and Chapter 2 suggest, there are a number of considerations.
3. The major reason foreign firms build in the U.S. is to satisfy the demand for foreign goods in the United States while reducing transportation cost and foreign exchange risk; in addition, U.S. locations allow foreign firms to circumvent quotas and/or tariffs.
4. *Clustering* is the tendency of firms to locate near competitors.
5. Different weights can be given to different factors. Personal preferences are included.
6. The qualitative approach usually considers many more factors, but its results are less exact.
7. Clustering examples in the service sector include fast-food restaurants, shoe and jewelry stores in a shopping mall, and theme parks.
8. *Factors to consider when choosing a country:*
 - Exchange rates
 - Government stability (political risk)
 - Communications systems within the country and to the home office
 - Wage rates
 - Productivity
 - Transportation costs
 - Language
 - Tariffs
 - Taxes
 - Attitude towards foreign investors/incentives
 - Legal system
 - Ethical standards
 - Cultural issues
 - Supplies availability
 - Market locations
9. *Factors to consider in a region/community decision:*
 - Corporate desires
 - Attractiveness of region
 - Labor issue
 - Utilities
 - Environmental regulations
 - Incentives
 - Proximity to raw materials/customers
 - Land/construction costs
10. Franchise operations may add new units per year; Exxon, McDonald's and Wal-Mart add hundreds of units per year, almost a daily location decision. For such organizations, the location decision becomes more structured, more routine. Perhaps by repeating this process they discover what makes their strategic locations decisions successful.
11. Factors affecting location decisions: labor productivity, foreign exchange, changing attitudes toward the industry, unions, employment, zoning, pollution, and taxes.
12. The center of gravity method assumes that cost is directly proportional to both distance and volume shipped. For service facilities, revenue is assumed to be directly proportional to proximity to markets.
13. *Locational break-even analysis* three steps:
 - Step 1: Determine fixed and variable cost for each location.
 - Step 2: Plot the costs for each location, with costs on the vertical axis of the graph and annual volume on the horizontal axis.
 - Step 3: Select the location that has the lowest total cost for the expected production volume.
14. The issue of weight or volume gain and weight or volume loss during processing is important, and supports the manufacturing side of the saying (weight loss during mining and refining, for example, suggests shipping after processing). But JIT may be more easily accomplished when suppliers are clustered near the customer. And some services (such as Internet sales) can take place at tremendous distances without sacrificing close contact.
15. Besides low wage rates, productivity should be considered also. Employees with poor training, poor education, or poor work habits are not a good buy. Moreover, employees who cannot or will not reach their place of work are not much good to the organization.
16. Service location techniques: regression models to determine importance of various factors, factor rating method, traffic counts, demographic analysis of drawing area, purchasing power analysis of area, center-of-gravity method, and geographic information system.
17. The distributor is more concerned with transportation and storage costs, and the supermarket more concerned with proximity to markets. The distributor will focus more on roads, overall population density (store density), while the supermarket will focus

more on neighborhood affluence, traffic patterns, etc. The distributor will be concerned with speedy and reliable delivery, the super-market with easy access. Both will have concerns over attitudes and zoning. Both will need access to similar labor forces; both will need similar measures of workforce education, etc. Many other comparisons can be drawn.

18. This is a service location problem, and should focus on revenues, not costs. Customer traffic, customer income, customer density, are obvious beginning points. Parking/access; security/lighting, appearance/image, rent, etc (see Table 8.6) are other important variables.

CRITICAL THINKING EXERCISE

Location wars are a major issue in the U.S. today. Almost every community is seeking new jobs, especially from foreign firms like Mercedes. As Mercedes was definitely coming to the U.S. anyway, the bidding wars are nonproductive from a central economy perspective. There are many implications to the local citizenry, especially because they pay the bills if the financial successes predicted are not accurate. Votes are usually not taken as these decisions are made by the political leaders of the community. Objective economic analysis on the incentives versus benefits might limit the giveaways.

ACTIVE MODEL EXERCISE

ACTIVE MODEL 8.1 Center of Gravity

1. What is the total weighted distance from their current old and inadequate warehouse in Pittsburgh?

318,692

2. If they relocate their warehouse to the center of gravity by how much will this reduce the total weighted shipping distance?

By 18,663 – from 318,692 to 300,029.

3. Observe the graph. If the number of shipments from New York doubles, how does this affect the center of gravity?

The center of gravity moves North and East.

4. The center of gravity does not necessarily find the site with the minimum total weighted distance. Use the scrollbars to move the trial location and see if you can improve (lower) the distance.

64, 97 with a total weighted distance of 299, 234 (using Solver).

5. If you have SOLVER setup in Excel, from Excel’s main menu use, Tools, Solver, Solve in order to see the best answer to the previous question.

64, 97 with a total weighted distance of 299, 234.

END-OF-CHAPTER PROBLEMS

8.1 Where: Six laborers each making \$3 per day can produce 40 units.

Ten laborers each making \$2.00 per day, can produce 45 units.

Two laborers, each making \$60 per day, can make 100 units.

(a) Cambodia = $\frac{6 \times \$3}{40} = \$0.45/\text{unit}$

(b) China = $\frac{10 \times \$2.00}{45} = \$0.44/\text{unit}$

(c) Montana = $\frac{2 \times \$60}{100} = \$1.20/\text{unit}$

China is most economical, assuming transportation costs are not included.

8.2 Cambodia \$0.45 + \$1.50 = \$1.95

China \$0.44 + \$1.00 = \$1.44

Montana \$1.20 + \$0.25 = \$1.45

China is most favorable, but Montana is almost tied.

8.3 Thailand: 2,000 baht/200 = 10 baht/unit,
if \$1 = 10 baht ⇒ \$1/unit

India: 2,000 rupees/200 = 10 rupees/unit,
if \$1 = 8 rupees ⇒ \$1.25/unit

Sacramento (U.S.A.): \$200/200 = \$1/unit

Select either Thai or U.S. company.

8.4 If India had a tariff of 30%, then making the items in India is \$0.05 less than importing them from anywhere.

8.5 Crestwood is best.

Factor	Site		
	Maitland (weight × score)	Crestwood (weight × score)	Northside Mall (weight × score)
Land space	18	21	24
Land costs	10	20	7.5
Traffic density	10	16	12
Neighborhood income	7.5	10.5	6
Zoning laws	8	2	9
Totals	53.5	69.5	58.5

8.6 Atlanta = 0.4(80) + 0.3(20) + 0.2(40) + 0.1(70) = 53

Charlotte = 0.4(60) + 0.3(50) + 0.2(90) + 0.1(30) = 60

Charlotte is better.

8.7

Factor	Philadelphia (weight × score)	New York (weight × score)
Customer convenience	17.5	20
Bank accessibility	8.0	18
Computer support	17.0	15
Rental costs	13.5	8.25
Labor costs	8.0	5.0
Taxes	9.0	5.0
Totals	73.0	71.25

ILA should locate in Philadelphia.

8.8

Factor	Location								
	Present Location Wgt			Newbury Wgt			Hyde Park Wgt		
1	40	0.30	12	60	0.30	18.00	50	0.30	15.0
2	20	0.15	3	20	0.15	3.00	80	0.15	12.0
3	30	0.20	6	60	0.20	12.00	50	0.20	10.0
4	80	0.35	<u>28</u>	50	0.35	<u>17.50</u>	50	0.35	<u>17.5</u>
	Total Points 49			Total Points 50.50			Total Points 54.5		

It appears that Hyde Park represents the best alternative.

8.9 (a) The weighted averages are:

Akron	81.5
Biloxi	80.0
Carthage	87.5
Denver	76.0

Factor	Weight	Akron		Biloxi		Carthage		Denver	
		Score	Weight × Score	Score	Weight × Score	Score	Weight × Score	Score	Weight × Score
Labor Availability	0.15	90	13.5	80	12.0	90	13.5	80	12.0
Tech. School Quality	0.10	95	9.5	75	7.5	65	6.5	85	8.5
Operating Cost Land & Construction	0.30	80	24.0	85	25.5	95	28.5	85	25.5
Ind. Incentives	0.15	60	9.0	80	12.0	90	13.5	70	10.5
Labor Cost	0.20	90	18.0	75	15.0	85	17.0	60	12.0
	<u>0.10</u>	75	<u>7.5</u>	80	<u>8.0</u>	85	<u>8.5</u>	75	<u>7.5</u>
	1.00		<u>81.5</u>		<u>80.0</u>		<u>87.5</u>		<u>76.0</u>

(b) Carthage is preferred (87.5 points) in the initial scenario.

Factor	Weight	Akron		Biloxi		Carthage		Denver	
		Score	Weight × Score	Score	Weight × Score	Score	Weight × Score	Score	Weight × Score
Labor Availability	0.15	90	13.5	80	12.0	90	13.5	80	12.0
Tech. School Quality	0.10	95	9.5	75	7.5	65	6.5	85	8.5
Operating Cost Land & Construction	0.10	80	8.0	85	8.5	95	9.5	85	8.5
Ind. Incentives	0.15	60	9.0	80	12.0	90	13.5	70	10.5
Labor Cost	0.20	90	18.0	75	15.0	85	17.0	60	12.0
	<u>0.30</u>	75	<u>22.5</u>	80	<u>24.0</u>	85	<u>25.5</u>	75	<u>22.5</u>
	1.00		<u>80.5</u>		<u>79.0</u>		<u>85.5</u>		<u>74.0</u>

(c) In the second scenario, all four scores fall to smaller values, Carthage more than the others, but it is still firmly in first place. All scores are smaller because all sites had operating cost scores better than labor cost scores. When labor cost takes on the higher weight, the lower scores have more influence on the total.

The new scores are:

Akron	80.5
Biloxi	79.0
Carthage	85.5
Denver	74.0

8.10

Location A			
Factor	Weight	Rating	Weighted Score
1	5	100	500
2	3	80	240
3	4	30	120
4	2	10	20
5	2	90	180
6	3	50	150
Total weighted score:			1210

Location B			
Factor	Weight	Rating	Weighted Score
1	5	80	400
2	3	70	210
3	4	60	240
4	2	80	160
5	2	60	120
6	3	60	180
Total weighted score:			1310

Location C			
Factor	Weight	Rating	Weighted Score
1	5	80	400
2	3	100	300
3	4	70	280
4	2	60	120
5	2	80	160
6	3	90	270
Total weighted score:			1530

Based on the total weighted scores, Location C should be recommended.

Note that raw weights were used in computing these weighted scores (we just multiplied “weight” times “rating”). **Relative weights** could have been used instead by taking each factor weight and dividing by the sum of the weights (i.e., 19). Then the weight for factor 1 would have been $5/19 = 0.26$. Location C would still have been selected.

8.11

	Weight	Taiwan	Thailand	Singapore
Technology	0.2	4	5	1
Level of Education	0.1	4	1	5
Political/Legal	0.4	1	3	3
Social	0.1	4	2	3
Economic	0.2	3	3	2
Weighted Average		2.6	3.1	2.6

Thailand rates highest (3.1).

8.12 Given the factors and weightings presented, the following table suggests that Great Britain be selected.

Factors	Great				
	Holland	Britain	Italy	Belgium	Greece
1 Stability of government	5	5	3	5	4
2 Degree to which the population can converse in English	4	5	3	4	3
3 Stability of the monetary system	5	4	3	4	3
4 Communications infrastructure	4	5	3	4	3
5 Transportation infrastructure	5	5	3	5	3
6 Availability of historical/cultural sites	3	4	5	3	5
7 Import restrictions	4	4	3	4	4
8 Availability of suitable quarters	4	4	3	4	3
	<u>34</u>	<u>36</u>	<u>26</u>	<u>33</u>	<u>28</u>

8.13 If English is not an issue, as illustrated in the following table, Great Britain, Holland, and Belgium should all be considered further.

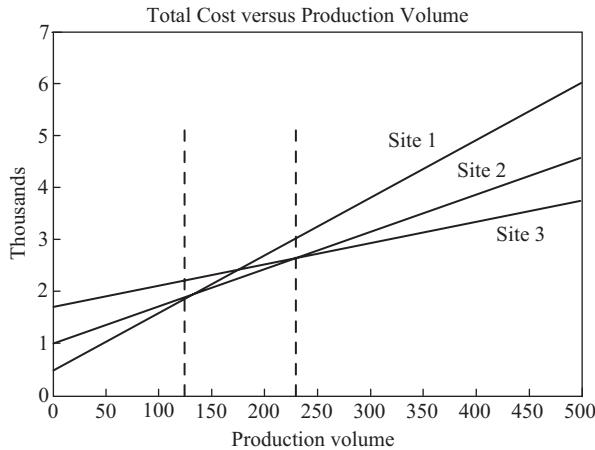
Factors	Great				
	Holland	Britain	Italy	Belgium	Greece
1 Stability of government	5	5	3	5	4
3 Stability of the monetary system	5	4	3	4	3
4 Communications infrastructure	4	5	3	4	3
5 Transportation infrastructure	5	5	3	5	3
6 Availability of historical/cultural sites	3	4	5	3	5
7 Import restrictions	4	4	3	4	4
8 Availability of suitable quarters	4	4	3	4	3
	<u>30</u>	<u>31</u>	<u>23</u>	<u>29</u>	<u>25</u>

8.14

Germany:	$0.05(5) + 0.05(4) + 0.2(5) + 0.2(5) + 0.2(1) + 0.1(4) + 0.1(1) + 0.1(2) = 3.35$
Italy:	$0.05(5) + 0.05(2) + 0.2(5) + 0.2(2) + 0.2(4) + 0.1(2) + 0.1(4) + 0.1(3) = 3.45$
Spain:	$0.05(5) + 0.05(1) + 0.2(5) + 0.2(3) + 0.2(1) + 0.1(1) + 0.1(4) + 0.1(1) = 2.7$
Greece:	$0.05(2) + 0.05(1) + 0.2(2) + 0.2(5) + 0.2(3) + 0.1(1) + 0.1(3) + 0.1(5) = 3.05$

Italy is highest.

- 8.15** (a) Chicago = $16 + 6 + 7 + 4 = 33$
 Milwaukee = $10 + 13.5 + 6 + 3 = 32.5$
 Madison = $12 + 12 + 4 + 2.5 = 30.5$
 Detroit = $14 + 6 + 7 + 4.5 = 31.5$
 All four are quite close, with Chicago and Milwaukee almost tied. Chicago has the largest rating, with a 33.
- (b) With a cutoff of 5, Chicago is unacceptable because it scores only 4 on the second factor. Only Milwaukee has scores of 5 or higher on all factors.
- 8.16** (a) The following figure indicates the volume range for which each site is optimal.



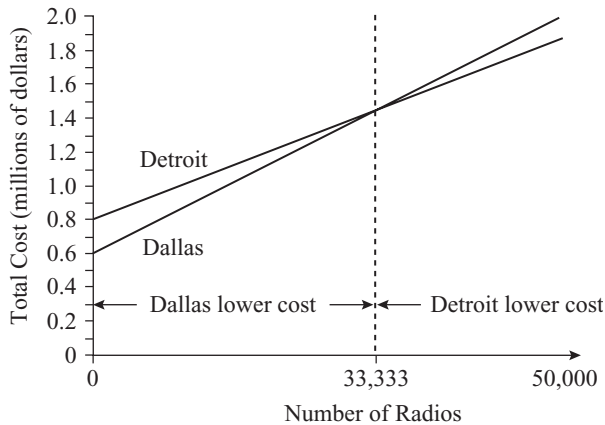
Site 1 is optimal for production less than or equal to 125 units.

Site 2 is optimal for production between 125 and 233 units.

Site 3 is optimal for production above 233 units.

(b) For 200 units, site 2 is optimal.

- 8.17** See the figure below.



$$\text{cost}(\text{Dallas}) = \text{cost}(\text{Detroit})$$

$$FC(\text{Dallas}) + Q \times VC(\text{Dallas}) = FC(\text{Detroit}) + Q \times VC(\text{Detroit})$$

$$\$600,000 + \$28Q = \$800,000 + \$22Q$$

$$\$6Q = \$200,000$$

$$Q = \$200,000 / \$6$$

$$Q = 33,333$$

- 8.18** Local Supplier = \$2.20 each
 Process A = $6,000 + 0.95x$
 Process B = $10,000 + 0.45x$
 Process C = $12,000 + 0.30x$

$$\text{Local} - \text{A}: 2.20x = 6,000 + 0.95x \Rightarrow x = 4,800$$

$$\text{A} - \text{B}: 6,000 + 0.95x = 10,000 + 0.45x \Rightarrow x = 8,000$$

$$\text{B} - \text{C}: 10,000 + 0.45x = 12,000 + 0.30x \Rightarrow x = 13,333$$

So the local supplier is best from 0 to 4,800 units. A is best from 4,800 to 8,000 units; B is best from 8,000 to 13,333 units; and C is best above 13,333 units.

8.19 (a) $\text{Profit}_{\text{Bonham}} = -800,000 + (29,000 - 14,000)X$
 $= -800,000 + 15,000X$

$$\text{Profit}_{\text{McKinney}} = -920,000 + (29,000 - 13,000)X$$

$$= -920,000 + 16,000X$$

Crossover is where $\text{Profit}_{\text{Bonham}} = \text{Profit}_{\text{McKinney}}$;
 or $-800,000 + 15,000X = -920,000 + 16,000X$
 Crossover is at 120 units.

(b, c) McKinney is preferable beyond 120 units, Bonham below 120 units.

(d) Bonham has break even at about 53 units; McKinney about 58, so both are beyond break even at the crossover.

- 8.20**

$$C_x = \frac{5 \times 5 + 6 \times 10 + 4 \times 15 + 9 \times 5 + 7 \times 15 + 3 \times 10 + 2 \times 5}{5 + 10 + 15 + 5 + 15 + 10 + 5}$$

$$= \frac{335}{65} = 5.15$$

$$C_y = \frac{10 \times 5 + 8 \times 10 + 9 \times 15 + 5 \times 5 + 9 \times 15 + 2 \times 10 + 6 \times 5}{5 + 10 + 15 + 5 + 15 + 10 + 5}$$

$$= \frac{475}{65} = 7.31$$

The proposed new hub should be near (5.15, 7.31).

- 8.21**

$$C_x = \frac{3 \times 9.2 + 3 \times 7.3 + 5 \times 7.8 + 3 \times 5.0 + 3 \times 2.8 + 3 \times 5.5 + 3 \times 5.0 + 3 \times 3.8}{26}$$

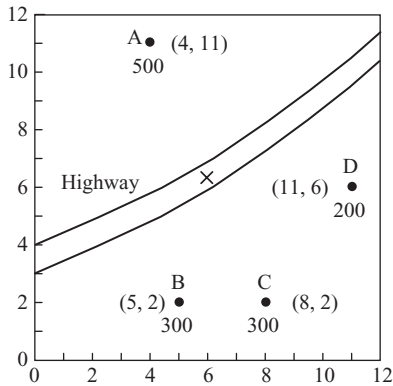
$$= \frac{154.8}{26} = 5.95$$

$$C_y = \frac{3 \times 3.5 + 3 \times 2.5 + 5 \times 1.4 + 3 \times 8.4 + 3 \times 6.5 + 3 \times 2.4 + 3 \times 3.6 + 3 \times 8.5}{26}$$

$$= \frac{113.2}{26} = 4.35$$

The distance-minimizing location is at (5.95, 4.35). This minimizes distance traveled, but is "straight line," which does not reflect realities of highway routes. It does not consider rivers, bridges, and other geographical impediments. Consider placing the office as near the center of gravity as possible and still be on or near a major highway. Students who overlay this onto a map of Louisiana should recognize that Baton Rouge would be an ideal location.

8.22



A (North Park)	(4, 11)	500
B (Jefferson)	(5, 2)	300
C (Lincoln)	(8, 2)	300
D (Washington)	(11, 6)	200
		<u>1300</u>

$$C_{\hat{x}} = \frac{(500 \times 4) + (300 \times 5) + (8 \times 300) + (11 \times 200)}{1300} = \frac{8100}{1300} = 6.23$$

$$C_{\hat{y}} = \frac{(11 \times 500) + (2 \times 300) + (2 \times 300) + (6 \times 200)}{1300} = \frac{7900}{1300} = 6.08$$

New middle school to serve 4 elementary schools.
Other considerations:

- Safety—pedestrian bridge
- Space for school and grounds
- Traffic
- Availability of land and its price

8.23

C_x = x coordinate of center of gravity

$$C_x = \frac{[25(2,000) + 25(5,000) + 55(10,000) + 50(7,000) + 80(10,000) + 70(20,000) + 90(14,000)]}{[2,000 + 5,000 + 10,000 + 7,000 + 10,000 + 20,000 + 14,000]}$$

$$C_x = \frac{4,535,000}{68,000} = 66.6$$

$$C_y = \frac{[45(2,000) + 25(5,000) + 45(10,000) + 20(7,000) + 50(10,000) + 20(20,000) + 25(14,000)]}{[2,000 + 5,000 + 10,000 + 7,000 + 10,000 + 20,000 + 14,000]}$$

$$C_y = \frac{2,055,000}{68,000} = 30.22$$

The center of gravity is (66.69, 30.22).

8.24 If we make East and South negative:

	Weight/ trips	x-coord.	y-coord.	X multiplied	Y multiplied
nw	60	20.0	50.0	1,200.0	3,000.0
ne	40	-15.0	30.0	-600.0	1,200.0
sw	50	10.0	-40.0	500.0	-2,000.0
se	100	-25.0	-10.0	-2,500.0	-1,000.0
Total	250			-1,400.0	1,200.0
Weighted average				-5.6	4.8

This means 5.6 East and 4.8 North is the best location.

8.25 (a) Weighted scores

British International Airways					
Milan	Rome	Genoa	Paris	Lyon	Nice
3415	2945	3425	3155	3970	3660
Munich	Bonn	Berlin			
3425	3915	3665			

So, for part (a) the top three cities become: Lyon is best (3970), Bonn is second (3915), and Berlin is third (3665).

(b) Weighted scores with hangar weights modified

British International Airways					
Milan	Rome	Genoa	Paris	Lyon	Nice
3215	2825	3345	2795	3730	3460
Munich	Bonn	Berlin			
3065	3555	3585			

So, for part (b) the top three cities become: Lyon is best (3730), Berlin is second (3585), and Bonn is third (3555).

(c) German cities reweighted on financial incentives

British International Airways			
Weighted Score	Munich	Bonn	Berlin
	3320	3810	3840

Yes, increasing the financial incentive factors to 10 for the three German cities of Munich, Bonn, and Berlin changes the top three cities to: Berlin (3840), Bonn (3810), and Lyon (3730).

INTERNET HOMEWORK PROBLEMS*

(found on our website at www.prenhall.com/heizer)

8.26 To aid in this analysis, we assign a rating to each "grade".

Grade	Rating
A	4
B	3
C	2
D	1

*These internet homework problems were found in our previous edition at: 8.26(was 8.5); 8.27(was 8.7); 8.28(was 8.11); 8.29(was 8.13); 8.30(was 8.15); 8.31(was 8.17); 8.32(was 8.19); 8.33(was 3.5); 8.34(was 3.6).

and to each “factor”:

Factor	Rating
Rent	1.00
Walk-in	0.90
Distance	0.72

and compute overall ratings for each location:

$$\text{Downtown rating} = \frac{1 \times 1.0 + 3 \times 0.90 + 3 \times 0.72}{2.62} = 2.24$$

$$\text{Shopping mall rating} = \frac{2 \times 1.0 + 4 \times 0.90 + 4 \times 0.72}{2.62} = 3.24$$

$$\text{Coral Gables rating} = \frac{4 \times 1.0 + 1 \times 0.90 + 2 \times 0.72}{2.62} = 2.42$$

If you do not divide by the sum of the weights, the respective ratings are 5.86, 8.48, and 6.34. The shopping mall receives the highest rating using this site selection approach.

8.27

$$\text{Downtown rating} = \frac{9 \times 9 + 6 \times 8 + 2 \times 5 + 8 \times 5 + 2 \times 4}{31} = 6.03$$

$$\text{Suburb A rating} = \frac{7 \times 9 + 6 \times 8 + 5 \times 5 + 4 \times 5 + 9 \times 4}{31} = 6.19$$

$$\text{Suburb B rating} = \frac{6 \times 9 + 8 \times 8 + 6 \times 5 + 5 \times 5 + 6 \times 4}{31} = 6.35$$

Suburb B has the highest rating, but weights should be examined using sensitivity analysis, as the final ratings are all close.

8.28

$$\text{Site 1 factor rating} = \frac{70 \times 10 + 85 \times 10 + 70 \times 25 + 80 \times 20 + 90 \times 15}{80} = \frac{6250}{80} = 78.125$$

$$\text{Site 2 factor rating} = \frac{60 \times 10 + 90 \times 10 + 60 \times 25 + 90 \times 20 + 80 \times 15}{80} = \frac{6000}{80} = 75.0$$

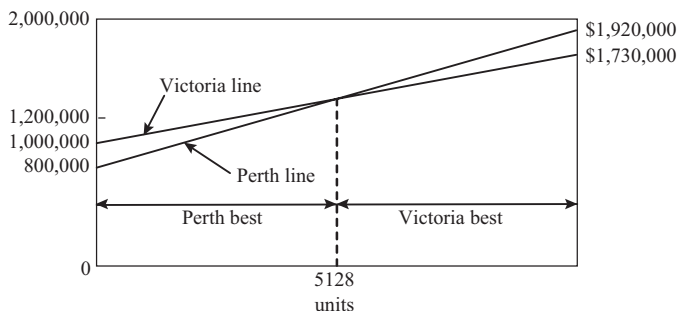
$$\text{Site 3 factor rating} = \frac{85 \times 10 + 80 \times 10 + 85 \times 25 + 90 \times 20 + 90 \times 15}{80} = \frac{6925}{80} = 86.56$$

$$\text{Site 4 factor rating} = \frac{90 \times 10 + 60 \times 10 + 90 \times 25 + 80 \times 20 + 75 \times 15}{80} = \frac{6475}{80} = 80.94$$

Site 3 has the highest rating factor, 86.56, and should be selected.

8.29

(a)



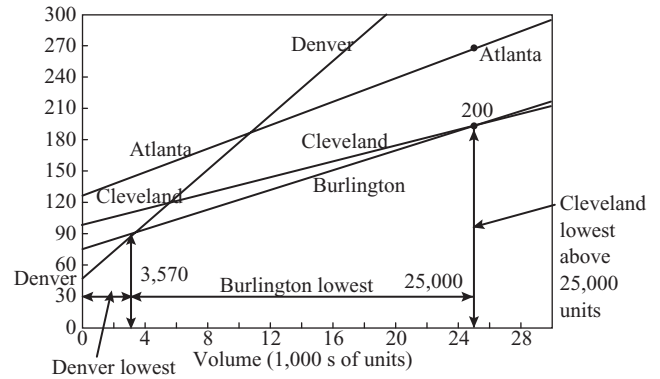
$$1,000,000 + 73X = 800,000 + 112X$$

$$200,000 = 39X \text{ or } X = 5,128$$

(b) For 5,000 units, Perth is the better option.

8.30

(a)



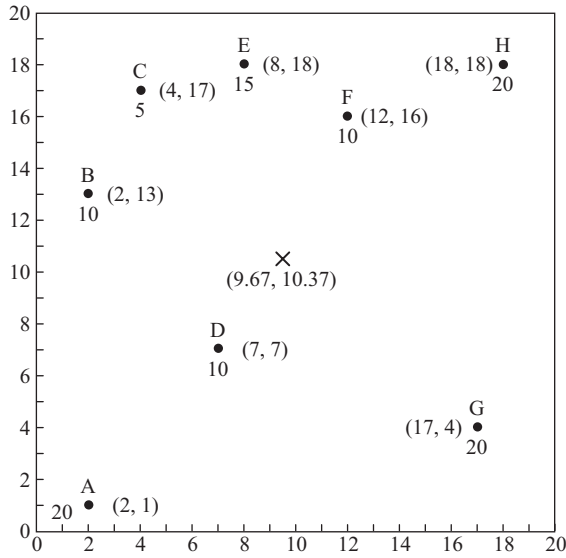
The total cost equations are:

- Atlanta: $TC = 125,000 + 6 \times x$
- Burlington: $TC = 75,000 + 5 \times x$
- Cleveland: $TC = 100,000 + 4 \times x$
- Denver: $TC = 50,000 + 12 \times x$

(b) Denver is preferable over the range from 0–3,570 units. Burlington is lowest cost at any volume exceeding 3,570, but less than 25,000 units. Atlanta is never lowest in cost. Cleveland becomes the best site only when volume exceeds 25,000 units per year.

(c) At a volume of 5,000 units, Burlington is the least-cost site.

8.31



City	Map Coordinates	Shipping Load
A	2, 1	20
B	2, 13	10
C	4, 17	5
D	7, 7	20
E	8, 18	15
F	12, 16	10
G	17, 4	20
H	18, 18	20
		120

$$C_x = \frac{2(20) + 2(10) + 4(5) + 7(20) + 8(15) + 12(10) + 17(20) + 18(20)}{(20 + 10 + 5 + 20 + 15 + 10 + 20 + 20)}$$

$$= \frac{1160}{120} = 9.67$$

$$C_y = \frac{1(20) + 13(10) + 17(5) + 7(20) + 18(15) + 16(10) + 4(20) + 18(20)}{(20 + 10 + 5 + 20 + 15 + 10 + 20 + 20)}$$

$$= \frac{1245}{120} = 10.37$$

8.32

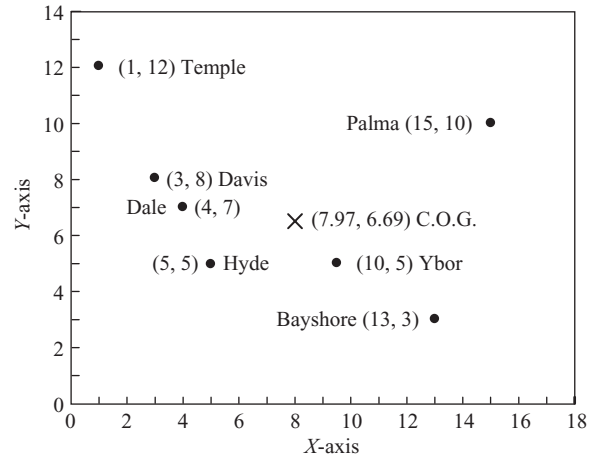
$$C_x = \frac{10 \times 3 + 3 \times 3 + 4 \times 2 + 15 \times 6 + 13 \times 5 + 1 \times 3 + 5 \times 10}{3 + 3 + 2 + 6 + 5 + 3 + 10}$$

$$= \frac{255}{32} = 7.97$$

$$C_y = \frac{5 \times 3 + 8 \times 3 + 7 \times 2 + 10 \times 6 + 3 \times 5 + 12 \times 3 + 5 \times 10}{3 + 3 + 2 + 6 + 5 + 3 + 10}$$

$$= \frac{214}{32} = 6.69$$

The proposed new facility should be near (7.97, 6.69).



8.33 With equal weights of 1 for each of the 15 factors:

	Total	Average
Spain	39	2.60
England	52	3.47
Italy	50	3.33
Poland	41	2.73

England is the top choice.

8.34 With weights given, the result became:

- Spain 2.55
- England 3.55
- Italy 3.30
- Poland 2.80

England remains the top selection.

1 CASE STUDY**SOUTHERN RECREATIONAL VEHICLE COMPANY**

1. Evaluate the inducements offered Southern Vehicle Company by community leaders in Ridgecrest, Mississippi.

The inducements offered Southern Recreational Vehicle Company are not unusual. Such inducements are offered in anticipation of the benefits to be derived from the relocation decision. Among the more common financial inducements is an arrangement under which a community development firm will purchase a plant facility and lease it to a company on a long-term basis. Whenever financial inducements are extraordinary, management should realize that there must be something undesirable about locating in that community.

2. What problems would a company experience in relocating its executives from a heavily populated industrialized area to a small, rural town?

A major problem in relocation decisions is the reluctance of executives to move from industrialized, heavily populated areas to small, rural towns. Often, the educational, recreational, and cultural opportunities are lacking. In addition, residential housing, shopping facilities, medical facilities, and adequate police and fire protection play an important role in the decision of executives to relocate.

3. Evaluate the reasons cited by Mr. O'Brian for relocation. Are they justifiable?

Matters of economics are certainly justifiable reasons to relocate. If a firm can generate more revenue, operate more efficiently, and experience lower costs at another site, relocation should certainly be considered. However, the allegation that the union forced unreasonable demands on the company should be seriously questioned. Concessions and provisions are bargained; they are not forced on either the company or the union.

4. What responsibilities does a firm have to its employees when a decision to cease operations is made?

Whenever the management of a firm decides to cease operations in a given location, it has the responsibility to aid its employees in finding suitable employment in that community. Such assistance can take various forms, including personal contacts with other employers and personal recommendations. In addition, the employer has a responsibility to notify its employees of the decision as soon as it has been finalized in order to give each worker ample time to find employment elsewhere. Finally, severance pay should be considered in an attempt to alleviate financial hardships on workers who have been unsuccessful in their attempts to find employment elsewhere. If the company has more than 500 employees, closing to avoid unionization is illegal.

2 CASE STUDY**THE AMBROSE DISTRIBUTION CENTER**

One approach is to calculate total costs for two small facilities, and compare that to the total cost of one large facility. This will have two versions—one for actual tonnage, and one for “all stores alike.” The only relevant cost elements are fixed costs and transportation costs. The variable costs are actually constant; that is, they have the same sum whether for one large or two small facilities (the same value of merchandise moves through either solution).

Two small facilities, actual tonnage. The Oklahoma DC would be located at (9.487, 3.585). That would require 2511.122 distance units. Thus transportation cost is $2511.122 \times 40 \times \$2 = \$200,889.76$. The Texas DC would be located at (9.430, 1.267), and would require 3179.236 distance units. Transportation cost for the Texas DC would be $3179.236 \times 40 \times \$2 = \$254,338.88$. Summing transportation costs and fixed costs, the two small DCs would cost \$4,455,228.64 per year.

One large facility, actual tonnage. This center would be located at (9.4596, 2.4652) and would necessitate 7767.13 distance units. Transportation costs would be $7767.13 \times 40 \times \$2 = \$621,370.4$. Total annual cost is \$4,221,370.40

One large center is cheaper than two small centers, when actual tonnage per store is used in the calculations.

Treating all stores alike. The solution shows that an Oklahoma DC requires 5.7166 total distance units per ton. Transportation costs for Oklahoma are $5.7166 \times 40 \times 600 \times \$2 = \$274,396.80$. The Texas DC requires 7.0971 distance units per ton, or \$340,660.80. Adding facility costs, the two-center approach costs \$4,615,057.60

A single DC serving all ten equally-sized stores requires 16.4012 distance units per ton, which leads to transportation costs of \$787,256.60. The total cost of a single center is \$4,387,256.60. One center is cheaper than two. The lower transportation costs of the two small DCs do not compensate for the lower fixed costs of the one large plant.

Other considerations: The solutions above concern only cost; they do not consider transport time. The one-center solution will necessitate longer delivery times on average; that might have a bearing on perishable deliveries (but this chain has no perishables to stock). Actual travel distances are not straight line; available routes are less direct. Thus the actual miles traveled will be greater than the idealized solution. Finally, the decision-makers must consider the geography of the country in North Central Texas and Southern Oklahoma. The Red River is the common border of the two states, and crossings are limited to the highway bridges that exist. Two of the three considerations here weigh against one large facility, and add further support to the cost-based decision to build two small facilities.

Oklahoma, Small, Equal

Location Results	One Center or Two-A Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Ada	1.	9.7	3.5	9.7	3.5
Ardmore	1.	9.	2.4	9.	2.4
Durant	1.	10.1	2.1	10.1	2.1
McAlester	1.	11.	4.	11.	4.
Norman	1.	8.5	4.4	8.5	4.4
Total	5.	48.3	16.4	48.3	16.4
Average		9.66	3.28		
Weighted Average				9.66	3.28
Median	3.			9.7	3.5

Oklahoma, Small, Unequal

Location Results	One Center or Two-A Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Ada	600.	9.7	3.5	5,820.	2,100.
Ardmore	300.	9.	2.4	2,700	720.
Durant	250.	10.1	2.1	2,525.	525.
McAlester	400.	11.	4.	4,400.	1,600.
Norman	750.	8.5	4.4	6,375.	3,300.
Total	2,300.	48.3	16.4	21,820.	8,245.
Average		9.66	3.28		
Weighted Average				9.487	3.5848
Median	1,150.			9.7	3.5

Texas, Small, Equal

Location Results	One Center or Two-B Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Denton	1.	9.	0.7	9.	0.7
Greenville	1.	10.7	0.5	10.7	0.5
Paris	1.	11.5	1.5	11.5	1.5
Sherman	1.	9.8	1.4	9.8	1.4
Wichita Falls	1.	6.9	1.9	6.9	1.9
Total	5.	47.9	6.	47.9	6.
Average		9.58	1.2		
Weighted Average				9.58	1.2
Median	3.			9.8	1.4

Texas, Small, Unequal

Location Results	One Center or Two-B Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Denton	200.	9.	0.7	1,800.	140.
Greenville	500.	10.7	0.5	5,350.	250.
Paris	300.	11.5	1.5	3,450.	450.
Sherman	600.	9.8	1.4	5,880.	840.
Wichita Falls	550.	6.9	1.9	3,795.	1,045.
Total	2,150.	47.9	6.	20,275.	2,725.
Average		9.58	1.2		
Weighted Average				9.4302	1.2674
Median	1,075.			9.8	1.4

Distance Table (Air/Straight line)

	Center
Ada	0.2236
Ardmore	1.1
Durant	1.2594
McAlester	1.5212
Norman	1.6125
Total	5.7166
Weighted Total	5.7166

	Weighted Center
Ada	0.2293
Ardmore	1.281
Durant	1.6064
McAlester	1.569
Norman	1.2801
Total	5.9657
Weighted Total	2,511,122

Distance Table (Air/Straight line)

	Center
Denton	0.7658
Greenville	1.3208
Paris	1.9433
Sherman	0.2973
Wichita Falls	2.7699
Total	7.0971
Weighted Total	7.0971

	Weighted Center
Denton	0.7121
Greenville	1.4837
Paris	2.0828
Sherman	0.3928
Wichita Falls	2.6081
Total	7.2795
Weighted Total	3,179,236

Large, Equal

Location Results	One Center or Two-C Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Ada	1	9.7	3.5	9.7	3.5
Ardmore	1	9	2.4	9	2.4
Denton	1	9	0.7	9	0.7
Durant	1	10.1	2.1	10.1	2.1
Greenville	1	10.7	0.5	10.7	0.5
McAlester	1	11	4	11	4
Norman	1	8.5	4.4	8.5	4.4
Paris	1	11.5	1.5	11.5	1.5
Sherman	1	9.8	1.4	9.8	1.4
Wichita Falls	1	6.9	1.9	6.9	1.9
Total	10	96.2	22.4	96.2	22.4
Average		9.62	2.24		
Weighted Average				9.62	2.24
Median	5			9.7	1.9

Distance Table (Air/Straight line)

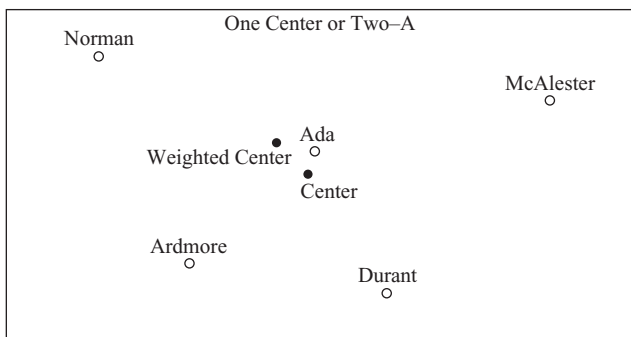
	Center
Ada	1.2625
Ardmore	0.6403
Denton	1.6601
Durant	0.5
Greenville	2.0479
McAlester	2.2365
Norman	2.4331
Paris	2.0204
Sherman	0.8591
Wichita Falls	2.7412
Total	16.4012
Weighted Total	16.4012

Large, Unequal

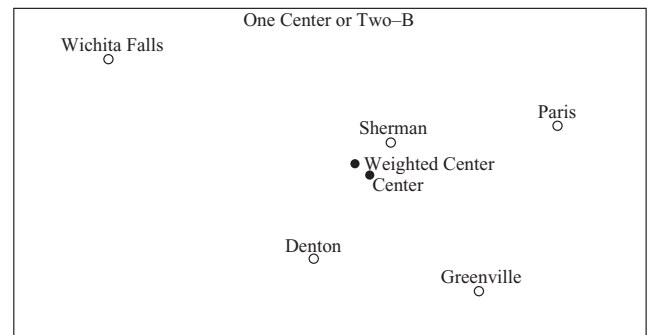
Location Results	One Center or Two-C Solution				
	Weight/# trips	x-coord	y-coord	X multiplied	Y multiplied
Ada	600	9.7	3.5	5,820	2,100
Ardmore	300	9	2.4	2,700	720
Denton	200	9	0.7	1,800	140
Durant	250	10.1	2.1	2,525	525
Greenville	500	10.7	0.5	5,350	250
McAlester	400	11	4	4,400	1,600
Norman	750	8.5	4.4	6,375	3,300
Paris	300	11.5	1.5	3,450	450
Sherman	600	9.8	1.4	5,880	840
Wichita Falls	550	6.9	1.9	3,795	1,045
Total	4,450	96.2	22.4	42,095	10,970
Average		9.62	2.24		
Weighted Average				9.4596	2.4652
Median	2,225			9.7	2.1

	Weighted Center
Ada	1.0624
Ardmore	0.4641
Denton	1.824
Durant	0.7372
Greenville	2.3239
McAlester	2.1746
Norman	2.1597
Paris	2.2572
Sherman	1.1183
Wichita Falls	2.6212
Total	16.7426
Weighted Total	7,767.13

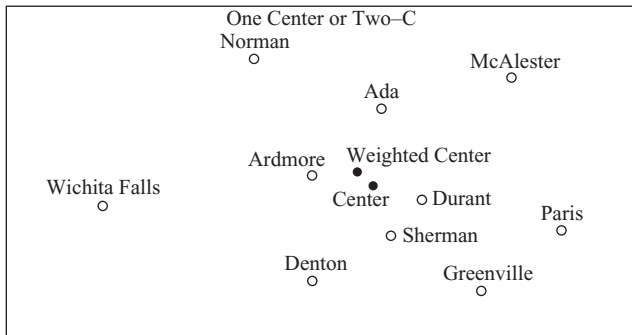
Location, Small DC in Oklahoma



Location, Small DC in Texas



Location, Large DC for ten stores



VIDEO CASE STUDY

WHERE TO PLACE HARD ROCK'S NEXT CAFE

1. The attached report details the information that Munday collects and analyzes about each site. As such, it provides the answer to the first question.
2. Site selection, as seen in the report, is very much a science. Even though Munday can “get a feel” for the location by walking, eating, and drinking (the subjective part of the evaluation), the objective part involves a tremendous amount of information.
3. Expansion is the lifeblood of any global organization. Good decisions mean a 10–20 year cash flow. Bad ones mean a 10-plus year commitment to a money-losing location.
4. Hard Rock considers political risk, crime, currency, and other factors in location decisions abroad. In Russia and Columbia, corruption is so endemic that a local partner, who can understand and handle these issues, is a necessity.

HARD ROCK CAFÉ STANDARD MARKET REPORT (OFF SHORE)

Executive Summary

Introduction

- Purpose
- Product Type (e.g. franchise or company owned, cafe, hotel, casino)
- Overview of City/Market (e.g. set context) including history, macro-economic summary

Demographics (Local, City, Region SMSA or equivalent)

- Population (Trend analysis if possible)
 1. Number
 2. Age
 3. Households
 4. Average Household Income
- Economic Indicators (Trend analysis if possible)
 1. Cost of Living Index (compared to National average)
 2. Unemployment
 3. Size of Workforce
 4. Employment by sector
 5. Major employers

HARD ROCK REPORT (CONT'D)

Visitor Market

- Tourism/Business Visitor (Trend analysis if possible)
 1. Number
 2. Origins
 3. Length of Stay
 4. Average Spend
 5. Size of Party
 6. Reasons for Visit
 7. Frequency of Repeat Visits
 8. Seasonality
 9. Method of Transportation
- Hotels (Trend analysis if possible)
 1. Hotel Room Inventory
 2. Occupancy Rates (Annual and Monthly for seasonality)
 3. Room Rates
 4. Function Room Demand
 5. Recent Development
 6. Future Development
- Convention Center (Trend analysis if possible)
 1. Size
 2. National Ranking
 3. Days Booked per annum
 4. Attendance
 5. Future Bookings
 6. Expansion Plans
 7. Major Conventions

Attractions

- Entertainment (Including location, seats, attendance)
 1. Theaters (Including Live Performance Space)
 2. Cinemas (including IMAX)
 3. Theme Parks
 4. Zoo/Aquarium
 5. Historic Sites
- Sports (Capacity, Annual Attendance, Location, Age of Facility etc)
 1. Soccer
 2. Rugby
 3. Baseball
 4. Minor Leagues
- Retail (Size, Tenants, Visitors, Seasonality)
 1. Regional Shopping Centers
 2. Discount Shopping Centers
 3. Shopping Districts

Transportation

- Airport
 1. Age
 2. Passengers Annually
 3. Airlines (Indicate Hub City)
 4. Direct Flights
- Rail
- Road
- Sea/River

HARD ROCK REPORT (CONT'D)

Restaurants (A Selection of restaurants in key areas of the target market)

1. Name
2. Location
3. Type
4. Seats
5. Age
6. Estimated Gross Sales
7. Average check
8. Size of Bar
9. Outside Dining Facilities

Nightclubs (A Selection of clubs/casinos etc. in key areas of the target market)

1. Name
2. Location
3. Type
4. Seats/capacity
5. Age
6. Estimated Gross Sales
7. Average check
8. Size of Bar
9. Music type (e.g. live/disco/combination)

Real Estate Market Overview

1. Introduction
2. Retail Rents
3. Recent Developments
4. Future Developments

HRC Comparable Market Analysis

1. Identify comparable existing HRC markets
2. Explain similarities (e.g. regional population, visitors, hotel rooms, seasonality etc.)
3. Prepare city P&L spreadsheet analysis

Conclusion

1. Estimate of Gross Food & Beverage Revenue for market in General with backup and comparables
2. Estimate of Gross Merchandise Revenue for market in General with backup and comparables
3. Preferred locations
4. Sizzle (How will we make ourselves special in this market?)

INTERNET CASE STUDIES*

1 CONSOLIDATED BOTTLING: A

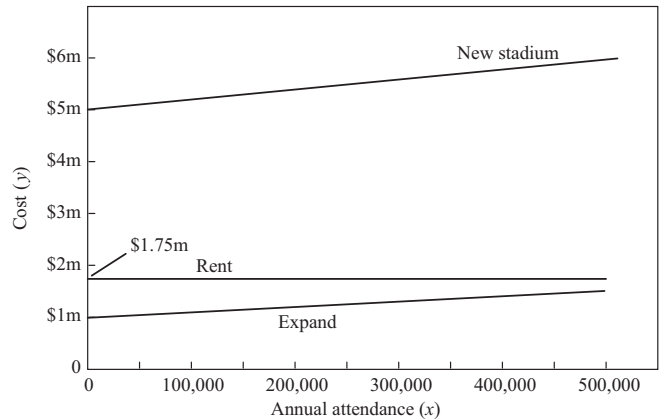
In this center-of-gravity analysis, we compute that the *unweighted* (by volume) center of all plants is at (38.83°, 96.17°), while the center of all plants *weighted by volume* is at (37.75°, 95.6°). Both are very close to Kansas City (38°, 95°). Even if Consolidated is not restricted to a city in which it has a plant, Kansas City is a good choice.

*Solutions to cases that appear on our Internet home page (www.prenhall.com/heizer).

2 SOUTHWESTERN UNIVERSITY'S LOCATION DECISION

1. The five factors appear reasonable. Many others could be included, such as potential parking or concession revenue, parking, long-term potential.

2. Option 1 Expand $y = \$1,000,000 + \$1x$
- Option 2 New stadium $y = \$5,000,000 + \$2x$
- Option 3 Rent $y = \$1,000,000 + \begin{matrix} \$750,000 \\ \uparrow \\ \$10 \times 15,000 \text{ students} \times 5 \text{ games} \end{matrix} + \$1x$



3. Based on the survey data, rating “comfort” and “national image” as 1s, “convenience” as a 2, and “cost” and “guaranteed availability” as 4s, the results (using $A=4, B=3, C=2, D=1, F=0$ for grades):

	Sum of Rating's (Weighted Averages in parenthesis)		
	Existing Site	New Site	Dallas Cowboy Site
Students	36 (3)	21 (1.75)	35 (2.92)
Boosters	34 (2.83)	23 (1.92)	47 (3.92)
Faculty/Staff	43 (3.58)	23 (1.92)	35 (2.92)

Students are almost neutral between the existing site and the Dallas site. Boosters strongly prefer Dallas. Faculty/staff strongly prefer the existing site. No group ranks the new site near campus as their first or second choice.

4. The expansion of the existing stadium appears preferable even at annual attendance of 500,000 fans.

5. Gardner used the factor rating method to rate the constituency responses. This was appropriate for evaluating the qualitative values. He should consider weighting the criteria as the administration did ultimately.