

- 14.6. The hunt is on: Rich's 11-year-old daughter Alexandra is going to give him an introductory trombone concert later in the day, and he wants to purchase earplugs before then. Three stores in the vicinity sell earplugs: EarsPlus, 10 minutes away; ICantBelieveYouBoughtHeraTrombone, 15 minutes away; and KidNoise, 20 minutes away. According to the gravity model, what is the probability Rich will go to each store?
- 14.7. The people in census tract 013411 spend \$100,000 in local dress shops, those in census tract 013443 spend \$80,000, and those in track 013422 spend \$200,000. Consider only two dress shops: Ralph's and Lulu's. The travel time from each shop to each area is in Table 14.11. Adapt the gravity model to determine how much will be spent at each shop.
- 14.8. An area wishes to find a fire-fighting strategy that balances cost and response time. Table 14.12 presents a travel time matrix for 11 locations. Any of the locations may be used for a fire station.
- If the desired response time is 19 minutes, how many stations are needed and where should they be located? (Hint: Adapt equations [14.2], [14.3], and [14.4] and the associated Excel file on the text CD-ROM.)
 - Determine a trade-off curve. Find out what the worst response time would be if only two fire stations could be built, then three stations, then four stations.
6. What are the basic assumptions underlying the gravity model of demand?
7. What is meant by the phrase *mathematically represent a service area* when forming a plan for a network to deliver services?
8. Mixed integer linear programming is presented as a solution technique for the warehouse location problem. Heuristics are also commonly used. If linear programming provides optimal solutions, why are any other techniques used?

Table 14.11 Data for Problem 14.7

Store	Track 013411	Track 013443	Track 013422
Ralph's	10 minutes	30 minutes	20 minutes
Lulu's	15 minutes	20 minutes	20 minutes

Table 14.12 Data for Problem 14.8

	1	2	3	4	5	6	7	8	9	10	11
1		39	49	46	45	48	15	24	21	25	26
2	39		13	10	11	12	40	15	20	18	15
3	49	13		3	5	3	35	29	35	30	28
4	46	10	3		2	5	33	26	32	27	25
5	45	11	5	2		3	30	29	34	29	27
6	48	12	3	5	3		33	32	37	32	30
7	15	40	35	33	30	33		33	32	26	28
8	24	15	29	26	29	32	33		3	8	5
9	21	20	35	32	34	37	32	3		6	7
10	25	18	30	27	29	32	26	8	6		3
11	26	15	28	25	27	30	28	5	7	3	

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CASE STUDY

Regression-Based Site Selection at La Quinta Hotels⁴

The old adage that says the three most important aspects of real estate are "location, location, location," is especially true in the transient hotel business. The physical site is an essential attribute of a new hotel. No amount of marble in the foyer can bring customers to a poor location, and a good location could profit under mediocre management.

Unfortunately, considerable disagreement can still arise over which sites are better than others. Everyone could agree that a Death Valley Hotel probably would be a poor choice, but it is difficult to determine exactly what makes for a good choice. To be considered beyond the most preliminary investigation, each potential site must have a number of positive aspects. Historically, selecting a site for new La Quinta Inns proved to be decidedly more art than science. Although objective data could be gathered, sifting through the data and finding a good site still requires "gut feel." And everyone's gut feel is a little different. With more difficult economic times and increased industry capacity squeezing La Quinta's profits in early 1987, location decisions required more scrutiny.

La Quinta decided to try a new approach to selecting sites: using regression analysis of the current performance of their installed inn base to determine sites for new inns. The first test of the approach would be to select a site in the growing Dallas market.

The La Quinta Hotel Chain

Sam Barshop started Barshop Motel Enterprises, Inc., in 1962. In 1972, Barshop Motel Enterprises, Inc., became La Quinta Motor Inns, Inc. (LQM), with 30 inns and started to expand rapidly. La Quinta grew steadily over the next decade, and by 1987 owned or operated 191 inns in 29 states (Table 14.13). LQM locations are centered in Texas, but LQM expanded throughout the Southeast, Southwest, and Midwest, employing 5,800 people, and showed a profit in the 10 years 1977-1987 (Table 14.14).

4. Source: This case is based on the work of Sheryl Kimes and James Fitzsimmons, "Selecting Profitable Hotel Sites at La Quinta Motor Inns," *Interfaces*, 20(2), 1990, pp. 12-20. Information regarding the company background and the site location project for La Quinta Motor Inns, Inc., was obtained from published reports, but the proposed Dallas expansion is fictitious.

Table 14.13 *La Quinta Owned, Operated or Licensed Inns*

ALABAMA Birmingham Huntsville (2) Mobile Montgomery Tuscaloosa	ILLINOIS Champaign Chicago (3) Moline	OHIO Columbus	Texas City Tyler Victoria Waco Wichita Falls
ARIZONA Phoenix (2) Tucson	INDIANA Indianapolis (2) Merrillville	PENNSYLVANIA Pittsburgh	UTAH Salt Lake City
ARKANSAS Little Rock (4)	KANSAS Lenexa Wichita	SOUTH CAROLINA Charleston Columbia Greenville	VIRGINIA Hampton Virginia Beach
CALIFORNIA Bakersfield Chula Vista Costa Mesa Fresno Irvine Sacramento San Bernadino San Diego Stockton Vista	KENTUCKY Lexington	TENNESSEE Knoxville Memphis (3) Nashville (2)	WASHINGTON Seattle
COLORADO Colorado Springs Denver (7)	LOUISIANA Baton Rouge Bossier City Lafayette Monroe New Orleans (5) Sulphur	TEXAS Abilene Amarillo (2) Austin (4) Beaumont Brazosport Brownsville College Station Corpus Christi (2) Dallas/Ft.Worth (12) Eagle Pass El Paso (3) Harlingen Houston (12) Killeen La Porte Laredo Longview Lubbock Lufkin Midland Nacogdoches Odessa San Angelo San Antonio (11) Temple Texarkana	WYOMING Casper Cheyenne Rock Springs
FLORIDA Deerfield Beach Ft. Myers Jacksonville (3) Miami Orlando Pensacola Pinellas Park Tallahassee (2) Tampa (2)	MICHIGAN Kalamazoo	RODEWAY INN San Antonio	
GEORGIA Atlanta (6) Augusta Columbus Savannah	MISSISSIPPI Jackson	ROYAL INN Houston	
	MISSOURI St. Louis	LICENSED LA QUINTA INNS	
	NEBRASKA Omaha	ARIZONA Flagstaff	
	NEVADA Las Vegas Reno	FLORIDA Orlando	
	NEW MEXICO Albuquerque (3) Farmington Santa Fe	OHIO Cincinnati Dayton	
	NORTH CAROLINA Charlotte (2)	TEXAS Corpus Christi Denton Fort Worth Galveston McAllen	

Motor inns operated and licensed by La Quinta are positioned in the mid-price, limited service segment of the lodging industry, between luxurious "full service" motor inns and "budget" motels. La Quinta Inns appeal to guests who desire simple rooms and convenient locations and whose needs do not include banquet facilities, meeting rooms, in-house restaurants, cocktail lounges, and room service. Specifically, La Quinta attempts to cater to the frequent business traveler.

Table 14.14 *Selected Financial and Operational Data for La Quinta Inns*

	(\$ millions)										
	1987*	1986	1985	1984	1983	1982	1981	1980	1979	1978	1977
Revenue	\$177	179	160	137	113	103	83	62	48	39	30
Net operating income	\$32	44	40	39	37	NA	NA	NA	NA	NA	NA
Net earnings	\$4.1	5.8	9.0	12.8	13.5	12.3	8.6	6.4	4.9	3.7	2.5
Long-term debt	\$382	394	313	297	243	190	140	119	87	66	54
Total assets	\$623	621	541	504	404	324	229	179	131	97	78
Inns owned or licensed	191	176	157	138	129	112	103	90	78	68	63
Rooms owned or licensed (in thousands)	24.1	22.0	19.6	17.0	15.9	13.6	12.3	10.6	9.1	7.8	7.1

*1987 financial results estimated. All other data as of fiscal year end May 31.

A customer survey in 1981 showed that 83% of La Quinta's guests were business travelers, approximately 80% were regular customers who stayed at La Quinta an average of 10 times a year and approximately 80% of whom visited a local site within 4 miles of the hotel. The main reasons cited by customers for staying at La Quinta were convenient locations, clean rooms, courteous service, and reasonable rates.

Although La Quinta does not provide any food service at its inns, aside from a continental breakfast offered in its lobbies, it locates adjacent to restaurants or provides funds for construction of adjacent restaurants. La Quinta holds an ownership interest in 87 restaurants operated by third parties, such as Denny's or JoJos.

La Quinta's typical inn is located along an interstate highway or major traffic artery convenient to businesses, contains 100 to 175 guest rooms, provides 24-hour front desk and message service, same-day laundry service, a swimming pool, and in-room color televisions with "Showtime." La Quinta Inns are typically of masonry construction with a distinctive Spanish Colonial architecture.

Individual inns are usually managed by married couples who live on the premises. On a typical day shift they supervise one housekeeping supervisor, eight room attendants, two laundry workers, two general maintenance persons, and a front desk sales representative. LQM fully owns about half of the inns that bear its name (Table 14.15). Some inns are 50% partnerships, others are just managed by La Quinta. For nine La Quinta inns, only the La Quinta name was licensed, with no managerial direction from corporate headquarters. For the licensed and managed inns, LQM provides chain services such as bookkeeping, national advertising, and "telQuik," a national reservation system.

Table 14.15 *Ownership of La Quinta Inns*

	1987	1981
La Quinta inns owned by LQM		
Owned 100%	88	33
Owned 52-80%	7	5
Owned 50% ^a	<u>54</u>	<u>44</u>
	149	82
Inns of other names owned by LQM	2	7
Total company owned and operated	151	89
La Quinta inns managed by LQM ^b	31	0
La Quinta inns licensed to others ^c	<u>9</u>	<u>14</u>
	191	103

^a Prudential Insurance has been a joint venture partner since 1971 and was a 50% partner in 28 inns and 16 restaurants in both 1981 and 1987. Metropolitan Life Insurance was a 50% partner in three inns and two restaurants in 1981 and eight inns and four restaurants in 1987.

^b LQM sold 31 inns it owned 100% to La Quinta Motor Inns Limited Partnership in fiscal 1987. The sale improved cash flow, increased borrowing capacity, and allowed recognition of real estate appreciation.

^c Licensing of the La Quinta name ceased in 1977. Since fiscal 1981, the company purchased five inns from licensees.

The mid-price, limited service lodging industry is highly competitive, and La Quinta competes directly with other lodging establishments in all locations. Each of the inns competes with other major chains as well as with other hotels, motels, motor inns, and other lodging establishments not affiliated with any major chain. There is no small number of competitors that are dominant in the industry.

Site Selection at La Quinta

La Quinta considers the selection of sites for its inns to be among the most important factors in its business. Sites are chosen for guest convenience and are generally readily accessible to and visible from interstate highways and major traffic arteries. Other major site criteria include proximity to office centers, the central business district, commercial and industrial concentrations, medical and educational complexes, regional shopping malls, military bases, and airports. La Quinta's expansion strategy is guided by the concepts of (1) clustering, or building multiple inns in the same metropolitan area; (2) adjacency through locating new inns within approximately 300 miles of existing properties; and (3) filling in, or moving into smaller cities (populations less than 100,000) within existing market areas.

Eight people provided input in the site selection process: four site evaluators physically toured each potential site and gathered information. Robert Moore, Executive Vice President and Chief Development Officer, Thomas Neilon, Vice President of Real Estate, and the Director of Marketing Research evaluated the data and opinions of the site evaluators and expressed opinions of their own. The company president, CEO, and chairman of the board, Sam Barshop, exercised the final say in all site selections.

Unfortunately, the key variables consulted by all those involved in site evaluation were based on "experience" and "gut feel." Everyone agreed that being close to a university, military base, hospital, or downtown led to additional guests at the hotel. What was less definitive was the relative worth of each of these factors. For example, what was better, a site within 1 mile of a moderately large military base or within 3

miles of a large university? The relative weighting of these factors was based strictly on intuition.

Site Selection by Regression

La Quinta desired a less haphazard approach to site selection. Further, the current process was both costly and produced too many disagreements, and the risk of choosing a poor site became more costly in the last half of the 1980s due to the weakening of the Texas economy.

For assistance in selecting sites, Barshop turned to the business school at the University of Texas, Austin. LQM and UT-Austin had a comfortable relationship, with both the president of the university and the business school dean sitting on the LQM board of directors.

The project was supervised by Professor James Fitzsimmons and performed by a doctoral student, Sheryl Kimes. After interviewing the eight individuals involved in site selection, Ms. Kimes compiled a list of the factors they thought affected the success of a La Quinta inn (Table 14.16).

Although site selection committee members may disagree on which characteristics are more important for a successful hotel, they all agreed that the profitability of a hotel was based on proximity to local attractions. Because of the presumed dependence of profitability on known factors, Ms. Kimes decided to use regression analysis to model profitability and use the list of factors in Table 14.16 as the independent variables.

Determining the dependent variable seemed more difficult than determining the independent variables. Exactly what is the appropriate measure for a "good" hotel? After discussion with the site selection committee, three candidates emerged that seemed plausible.

1. *Occupancy*. Occupancy is the ratio of average rented rooms to total rooms. It is a widely used statistic in hotel administration.
2. *Profit*. The bookkeeping methods used allowed each inn to be a profit center, so profit data were available.
3. *Operating margin*. Operating margin is a percentage measure that consists of adding depreciation and interest expenses to the profit of an inn and dividing by the total revenue.

The economics of the preceding few years whipsawed the profitability of the hotel industry in oil-producing states. Due to the turbulent economic environment, the project developers decided to gather data for two different years: a good year, 1983, and a poor year, 1986. Because of the unprofitability of new inns and the expense of data gathering, data were collected only on a group of 56 mature inns. (Data can be found on the text CD-ROM.)

Dallas Expansion

The first test of utilizing regression for location analysis was to determine an appropriate location for expansion in the Dallas market. The population and real estate prices in the Dallas area were increasing rapidly. Dallas was touted as one of the top cities in the nation to do business in and the northern suburb of Plano was considered a boomtown due to the surge in population and corporate headquarters. Twelve inns were already in place and doing well in the Dallas/Ft. Worth metroplex.

The six candidate sites for expansion in Dallas were as follows:

- A. *Dallas—Downtown*. The corner of Houston and Young Streets, three blocks from the convention center and two blocks from the Trinity River.

Table 14.16 Variables Considered

Category	Name	Description
Competitive	PRICE	Room rate for the inn (\$/night)
	RATE	Average competitive room rate (\$/night)
	RMS1	Hotel rooms within 1 mile
	RMSTOTAL	Hotel rooms within 3 miles
	ROOMSINN	Rooms in La Quinta Inn
Demand generators	CIVILIAN	Civilian personnel on base
	COLLEGE	College enrollment
	HOSP1	Hospital beds within 1 mile
	HOSPTOTL	Hospital beds within 4 miles
	HVYIND	Heavy industrial employment
	LGTIND	Light industrial acreage
	MALLS	Shopping mall square footage
	MILITARY	Military personnel
	OFC1	Office space within 1 mile (in 000)
	OFCTOTAL	Office space within 4 miles (in 000)
	PASSENGR	Airport passengers enplaned daily
	RETAIL	Scale ranking of retail activity (0 poor, 10 excellent)
	TOURISTS	Annual tourists (in 000)
Demographic	TRAFFIC	Traffic count (traffic/hour)
	VAN	Airport van (1 yes, 0 no)
	EMPLYPCT	Unemployment percentage
	INCOME	Average family income
	POPULACE	Residential population
Market awareness	STATE*	State population per inn
	URBAN*	Urban population per inn
	AGE	Years inn has been open
Physical	NEAREST	Distance to nearest inn
	ACCESS	Accessibility (0 poor, 10 excellent)
	ARTERY	Major traffic artery (1 yes, 0 no)
	DISTCBD	Distance to downtown (miles)
Success measures	SIGNVIS	Sign visibility (0 poor, 10 excellent)
	OCC_83	Occupancy rate in 1983 (percentage)
	OCC_86	Occupancy rate in 1986 (percentage)
	PROFIT_83	Profit in 1983 (\$ in 000)
	PROFIT_86	Profit in 1986 (\$ in 000)
	OP_M_83	Operating margin in 1983 (percentage)
	OP_M_86	Operating margin in 1986 (percentage)

*Variables not included in data set

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- B. *Dallas—Oak Lawn*. 3000 Oak Lawn Avenue, located in a large retail shopping area.
- C. *Dallas—Fair Park*. 3500 Cullum Boulevard, across from Fair Park, a large complex that holds a football stadium (the Cotton Bowl), the Starplex Amphitheatre, various exposition halls, and hosts the state fair.

- D. *Dallas—Southern Methodist University*. Near Mockingbird and McMillan Streets, one block from the eastern border of the Southern Methodist University campus.
- E. *Coppell—DFW Airport*. 1000 Sandy Lake Road, on property currently owned by Marriott but not yet built on.
- F. *Plano—Legacy*. 5200 Legacy Drive in an area with a mostly finished office park near the offices of Electronic Data Systems, Texas Instruments, Raytheon, and other similar firms.

Purchase and development costs differ mildly for each of the potential sites. The data for each location are contained on the text CD-ROM.

It was clear that the data from the 56 mature inns could be analyzed and put to use. What was not clear was the role any regression output should play. Should "gut feel" augment any regression model, or vice versa? Should the model be used to pick a site or just to eliminate poor choices? What were the strategic and tactical considerations that could not be modeled in a regression?

Questions

- Which of the three success measures is appropriate? (Use both intuitive and data-driven arguments.)
- Are the variables considered (Table 14.16) appropriate for the decision at hand? What other variables might you want to consider?
- Determine appropriate predictors of operating margin through correlation and regression analysis. Comment on the variables both in and not in your predictive model.
- How should your model be used in site selection?
- Make recommendations concerning the Dallas expansion.