APPENDIX E

Parking Demand/Capacity Studies

Turning Your Parking Lot into a Pot o' Gold

Rethinking Shopping Center Parking Ratios to Reflect New Realities

*Hermann J. Kircher**

Abstract: *Concerns about relatively high fuel costs are likely to result in changes in driving patterns, and a shift to compact cars requiring less space to park will have a significant influence on the demand for parking areas at regional malls. Surplus parking should be identified as early as possible and alternative land uses investigated. "Free" land can be a huge incentive to intensify existing centers.*

Parking lots are a great waste of resource. The vast sea of one-level parking is not only so "yesterday" it is also "anti-green"! However, without adequate parking, no suburban shopping center can function. Solving this conundrum should be a priority for the shopping-center industry.

A likely long-term shift in the size and use of the automobile, reflecting concerns about higher fuel costs and the effect on the environment, will lead to a decline in the demand for parking space. Although there will be short-term fluctuations due to the economic cycle, it is clear that the major car manufacturers will promote smaller, fuel-efficient vehicles in the future. While it may take time for this shift to smaller cars to significantly change the stock of existing cars, multi-car families are in the meantime likely to make greater use of their smaller cars due to current economic conditions.

Compact cars obviously consume less space than standard cars, whether expressed on a cubic foot basis or a square foot basis.[1] The standard size car stall measures 9x18 feet or 162 square feet (sq ft), compared to a compact space requiring 7.5x16 feet or 120 sq ft, or some 35% less space.[2] Depending on the manufacturer, the measurements of different car-size categories fluctuate but the fundamental fact that compact cars require less space than traditional "regular" cars, not to mention minivans, sports utility vehicles (SUV) and recreational vehicles (RV) is a given.

Even in urban areas, the supply of more than minimal parking space is being questioned. In Toronto, for example, RioCan REIT President Edward Sonshine one day passed one of his properties when the stores were closed and noticed that the parking area was nonetheless full. "I thought to myself, there has to be a better use for that lot than to provide free parking for the neighborhood," he commented. Subsequently he partnered with a home builder to construct a mixed-use development on that lot.[3]

This article will focus on the "broad" picture rather than on technical details. Its purpose is to encourage some original thinking about the use of parking space. The prime targets for this discussion are regional and superregional malls, particularly those whose trade areas have evolved over the years from outlying suburbs to urban areas. Although these comments apply to a great number of centers, there are obviously exceptions for many different reasons.

New Driving Patterns

The rapid increase in the cost of fuel since the late 1990s has led to a decrease in driving, in general. According to a recent press report, Americans reduced their driving by 4-5% during the first half of 2008.[4] The sharp decline in gas prices in the second half of 2008 is not expected to reverse this trend. Demand for more fuel-efficient compact vehicles will continue to increase and will result in a decline in parking area requirements. Assuming that the current trend continues, there will be surplus parking at most regional malls, as well as at community, neighborhood and convenience shopping centers, in the very near future.

It is unlikely that bicycles will play a major role in transportation related to regional malls in the near future but any visitor to Europe will appreciate the extent to which bicycle usage can help to offset high fuel costs.[5] Nevertheless, bicycle racks can already be found at some North American malls and are now essential in downtown retail developments.

A 1981 report by the U.S. Department of Transportation predicted that by 1990 the most likely proportion of compact cars to other vehicles would be somewhere between 70% and 80%.[6] Of course this

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[1] U.S. Department of Energy at "www.fueleconomy.gov," *Frequently Asked Questions*, p. 2.
[2] Centre for Transportation Research and Education, Iowa State University, *Urban Design Standards Manual*, Chapter 12, Section 3, p.10, October 16, 2007.
[3] Terrence Belford, "More Bang for Buck, and Bucking a Trend," *The Globe and Mail*, Toronto, Ontario, July 29, 2008.
[4] *USA Today*, August 13, 2008.
[5] J. Harry Wray, *Pedal Power: The Quiet Rise of the Bicycle in American Public Life*, Paradigm Publishers, Boulder, Colo., 2008 abstract.
[6] "*The U.S. Automobile Industry, 1980*," Report to the President from the Secretary of Transportation, Office of the Assistant Secretary for Policy and International Affairs, January 1981.

prediction turned out to be wrong as a result of the rapid growth in popularity of minivans, SUVs and RVs, which were made affordable because of inexpensive gas. The expectations of the 1980s regarding the size of cars can now be resurrected with a greater degree of certainty during the next five to 10 years.

Table 11-1
Recommended Parking Ratios[a]

Center Size (GLA in Sq Ft)	Percentage of GLA in Restaurant, Entertainment, and/or Cinema Space		
	0-10%	11-20%[b]	>20%
Less than 400,000	4.0	4.0	Shared Parking[d]
400,000-599,999	4.0-4.5 sliding scale[c]	4.0-4.5 sliding scale[c]	Shared Parking[d]
600,000 and over	4.5	4.5	Shared Parking[d]

Source: ULI/ICSC *Parking Requirements for Shopping Centers,* 1999
[a] Parked cars per 1,000 sq ft of GLA.
[b] For each percent above 10%, a linear increase of 0.03 spaces per 1,000 sq ft.
[c] Recommended parking ratio increases/decreases proportionally with center's square footage.
[d] Shared parking is defined as parking spaces that can be used to serve two or more individual land.

The Meaning of Ratios

The 1999 Urban Land Institute/International Council of Shopping Centers (ULI/ICSC) study *Parking Requirements for Shopping Centers* recommended parking ratios for shopping centers in the U.S., based upon observations of parking at existing centers (see Table 11-1).[7] These ratios have been universally adopted by the industry, but their application to almost every development has not necessarily resulted in the optimum solution for specific centers.

This study also calculated parking supply ratios for centers with accumulation counts based on the number of parking spaces per 1,000 sq ft.[8] As Table 11-2 shows, parking supply exceeded demand in the survey period for all center sizes. The simple reason for this is the fact that a full parking lot was not acceptable to regional mall owners. This point of view may no longer make sense, particularly for centers where additional overflow parking is available nearby or can be secured on a seasonal basis as necessary. In few economic endeavors are demand and supply that far apart!

Some of the historic ULI/ICSC guidelines for providing adequate parking, such as gearing the parking ratio to the 20th busiest hour of the year,[9] are not only arbitrary, but may not be applicable to a typical center. The theoretical calculation is based on the premise that there is surplus parking for all but 19 hours of the average 3,000 hours that malls operate per year. In other words, the generally accepted design criteria assume that for 99.4% of opening hours, a mall will have surplus parking! Clearly, in today's environment, that may require some rethinking.

It is time for shopping-center owners and managers to review current and near-term parking requirements, including an analysis of changes in customers' driving patterns. There should be a "real-time" parking (computer) model in constant operation at a major mall, in order to review, change and revise parking supply at the earliest possible time. At what land cost does it become cost-effective to revisit structured parking requirements, while taking into account the return from complementary land uses for additional retail space, as well as for office, hotel, high density residential and institutional properties? This is a moving target and needs frequent reanalysis.

In Canada, Ivanhoe Cambridge was able to reduce parking ratios quite effectively when expanding regional malls. For example, the parking ratio at Upper Canada Mall, an enclosed regional mall in Newmarket, Ontario

Table 11-2
Parking Supply and Demand Ratios for Centers with Car Counts

Center Size (GLA in Sq Ft)	Number of Responses	Parking Ratio (Parking Spaces per 1,000 Sq Ft of Occupied GLA)	
		Supply	Demand
Less than 400,000	49	5.8	3.7
400,000-599,999	15	5.6	4
600,000-1,499,999	96	5.8	4.5
1,500,000-2,500,000	9	4.7	3.8
Total	**169**		

Source: ULI/ICSC *Parking Requirements for Shopping Centers,* 1999

[7] Urban Land Institute/International Council of Shopping Centers, *Parking Requirements for Shopping Centers*, Second Edition, Washington D.C., 1999, p. 4.
[8] Ibid., p. 4.
[9] Ibid., p. 7.

was reduced by 10% from 5.0 to 4.5 through an improved layout. Similar reductions were achieved by Ivanhoe Cambridge in other locations. An urban multi-level retail center, under development in Toronto by Riotrin Properties (Weston) will have an average parking ratio of 3.25 cars per 1,000 sq ft. These reductions in parking ratios occurred prior to the rise in fuel costs and a greater shift to compact cars.

Besides the expected reduction in driving due to higher fuel costs, consumers are likely to car-pool more often on shopping trips, thus reducing parking demand even further.[10] Shopping-center developers and owners should also review public transit options and encourage public transit agencies, vigorously if necessary, to serve the mall because that, too, would lead to a reduction in parking requirements.

Employee parking needs to be re-evaluated regularly. Can it be reduced through incentives such as public transit subsidies for employees? In some cases transit passes have proven to be an economic alternative to employee parking.[11] Can it be relocated to cheaper premises? Is there effective control on employee parking? These "old chestnuts" need to be reviewed periodically.

Based on Kircher Research Associates' experience with major retail developments, the number of parking spaces per 1,000 sq ft of gross leasable area (GLA) decreased from 5.0-5.5 to 4.0-4.5 between 1980 and 1998. Dramatic recent economic changes make further declines inevitable. In many cases, parking ratios can likely be reduced to below the current "standard" ratio without a loss of customers. How far below is the challenge for individual centers. Centers should encourage maximum use of complementary land uses such as a limited amount of office and hotel space that can be supported by shared parking.

Monetizing Surplus Parking Space

Any surplus parking space identified represents free land—the real "pot o' gold"—that can be employed to increase economic return and asset value through some alternative use. Depending on local zoning ordinances, alternative uses may require a change in zoning to increase permitted densities. Although persuading the authorities to approve a zoning change is always a challenge, it may be easier in the case of parking space than it used to be. Many municipalities recognize the need to increase densification and have adopted greater urbanization as a goal.

Nevertheless, the complexity surrounding parking requirements is well expressed by Ted Williams, Director Operational Project Planning of Ivanhoe Cambridge. "Municipalities are willing to look at reasonable arguments. However in practical terms existing centers with long-term department store leases can prove more difficult. The issue becomes a negotiating point as these department stores have parking stipulations in their leases with higher ratios than are sometimes stipulated by the municipalities."[12]

The era of absolutely free parking at suburban regional malls may be coming to an end in the near future. Any controlled-parking system can still provide free parking for real customers, for a specific number of hours, but such a system can also provide an opportunity for much greater direction of parking-space allocation, particularly by limiting employee parking, optimizing the use of prime spots and discouraging long-term parkers who are not shoppers. Furthermore, at a controlled entrance, different-sized cars can be channeled to different parking areas, thus minimizing conflicts between compact vehicles and large cars.

In the recent past, reductions in parking ratios have been achieved through the implementation of shared parking between land uses with different peak demands, such as with office space and hotels. In the future, the expected changes in travel patterns and a general reduction of vehicle sizes will create additional opportunities to revise parking standards and generate additional values through increased densities.

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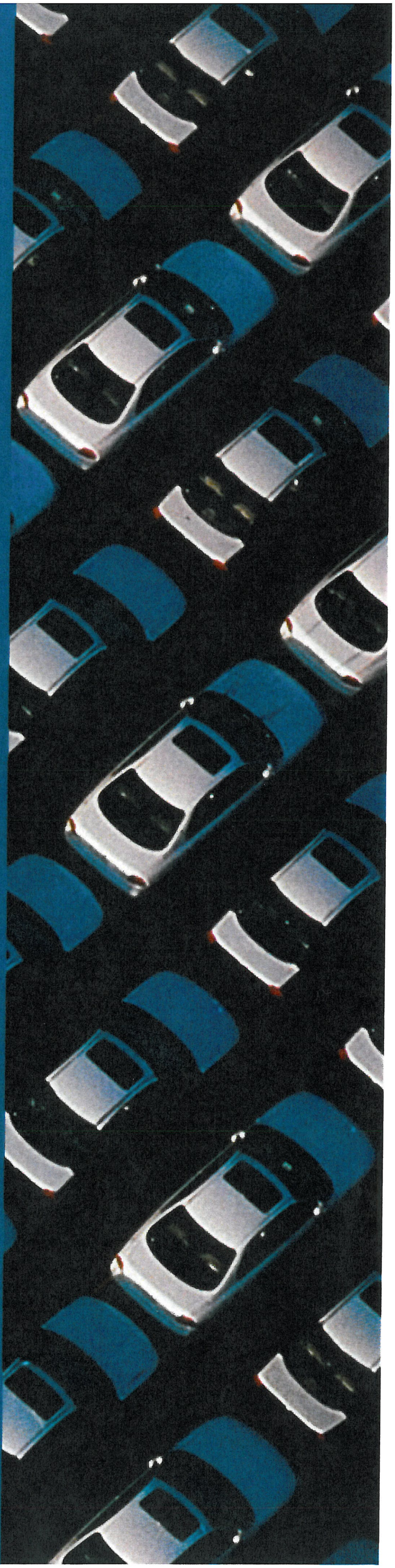
[10] U.S. Environmental Protection Agency, Development, Community, and Environment Division (1807T), *Parking Spaces/Community Places, Finding the Balance through Smart Growth Solutions*, Washington D.C., January 2006, pp. 24-25.
[11] Ibid., pp. 24-25.
[12] Communication (e-mail) from Robert Boyle of Ivanhoe Cambridge to Hermann Kircher, October 29, 2008.

Parking Requirements

for Shopping Centers

Summary Recommendations
and Research Study Report

Second Edition



Urban Land Institute

International Council of Shopping Centers

EXCERPT

CHAPTER 1

Introduction

The Changing Face of Shopping Centers

The face of the regional shopping center in the United States has been changing. Retail shopping centers are getting larger. According to the International Council of Shopping Centers (ICSC) publication *Shopping Centers Today*, in 1965, only 73 shopping centers in the United States exceeded 800,000 square feet of gross leasable area (GLA), "the total floor area designed for the tenants' occupancy and exclusive use."[1] By 1974, that number had grown to 249. In 1998, more than 714 centers exceeded 800,000 square feet. In fact, 395 centers exceeded 1 million square feet—almost twice the size of shopping centers that were once considered large.

Not only is the size of centers changing. The mix of land uses within regional shopping centers also is different today. Retail entertainment centers are becoming more common. Retail centers of all sizes contain larger proportions of restaurant service, cinema, and entertainment venues. Moreover, relatively new types of shopping centers have evolved, such as power centers, theme centers, and fashion/specialty centers.

Nearly 20 years have passed since ICSC and the Urban Land Institute collected data for their 1980 study, also entitled *Parking Requirements for Shopping Centers.* Since then, there have been a number of changes in shopper and industry characteristics that have affected parking needs. These include: increased labor force participation among women; higher levels of traffic congestion; growing specialization of the shopping center industry and the emergence of new retail formats; and the addition of entertainment to traditional centers. In light of these many changes, now is an appropriate time to update the study.

The primary goal of this current study is to recommend parking demand ratios for shopping centers in the United States, based upon observations of parking at existing centers. To achieve this objective, the study collected and evaluated data on a wide range of factors influencing travel behavior and parking demand at shopping centers. The findings were prepared in a format usable for all those interested in shopping center parking managers, owners, developers, designers, planners, and local officials.

This analysis updates two extensive studies on parking demand at shopping centers. The first study measured parking demand from 1973 to 1975 during the holiday peaks (the month of December). The results were reported in the May 1977 issue of *Urban Land.* The second study analyzed data collected in 1980; it was sponsored by ICSC and published by ULI in 1982. Data from both of these studies will be compared with data collected during the holiday shopping season of 1998.

This Report

Data for this report were collected in two parts. First, an extensive questionnaire was distributed to shopping centers across the United States. Responses to the questionnaire were received from 490 centers. Second, responding centers were asked to participate in parking accumulation counts during the 1998 holiday season. Parking counts were conducted at 169 centers.

Every effort was made to obtain a reasonable sample size for each type and size of shopping center that was analyzed. Where data are limited, a word of caution is noted. For example, a very limited amount of data was collected for factory outlet centers, power centers, and fashion/specialty centers, so parking demand was not reported. Moreover, a limited amount of parking accumulation data was collected for neighborhood and community centers. Consequently, the recommendations contained in this report err on the conservative side for neighborhood and community centers.

This study features significantly more data for regional and super regional centers, for which parking is more of an issue. Survey data indicate that 18 percent of centers with less than 400,000 square feet reported that they experienced "ten or more" days annually in which parking occupancy exceeded 85 percent. In comparison, 45 percent of centers containing 600,000 to 1,499,999 square feet reported parking occupancies that exceeded 85 percent ten or more days of the year.

Chapters 3 and 4 of this report provide detail on the methodology used. Chapter 5 describes the general data collection results. In Chapters 6 and 7, the parking ratio recommendations are presented. The results of the General Questionnaire are provided in Chapters 8 and 9. Chapter 10 summarizes a series of case studies, and the appendices include all of the survey forms, in addition to the comprehensive matrix of recommended parking ratio.

Notes

1 ULI–the Urban Land Institute, *Shopping Center Development Handbook* (Washingt D.C.: ULI–the Urban Land Institute, 198

Key Recommendations

This report presents a set of base recommendations for parking supply based on center size and makeup. An analysis of the survey data shows that these independent variables do not significantly affect the required parking supply:

- Geographic area
- Urban versus suburban setting
- Large city versus small city.

On the other hand, the amount of parking needed at a shopping center is affected by these variables:

- Proportion of restaurant, cinema, and entertainment land uses
- Percent of nonauto travel to the center
- Treatment of employee parking during shopping peaks
- Size of the center.

Adjustment factors for these variables will be discussed later in the report.

Parking Ratio Recommendations

Table 1 shows the recommended number of parking spaces per 1,000 square feet of gross leasable area (GLA).

The table located in Appendix A provides a comprehensive matrix of recommended ratios. This recommended provision of parking spaces will provide the typical shopping center with sufficient parking to serve the parking needs of customers and employees at the 20th busiest hour of the year. Moreover, these recommended ratios provide for a surplus of parking spaces during all but 19 hours of the more than 3,000 hours per year during which a shopping center is open. During 19 hours of each year, which are typically distributed over four peak shopping days, some patrons will not be able to find vacant spaces when they first enter the center. The recommended parking ratios are applicable for centers in which retail shops occupy at least 80 percent of the GLA.

The recommended parking ratios in Table 1 exclude centers in which 20 percent or more of occupied GLA is composed of restaurants, entertainment, and/or cinema space. The appropriate number of spaces for these centers should be determined using methodology such as that described in the Urban Land Institute's 1983 publication entitled *Shared Parking*. It defines shared parking as "parking spaces that can be used to serve two or more individual land uses without conflict or encroachment." Also, the data analyzed in this study suggest that for neighborhood and community centers, the recommended ratio may be as low as 3.7 spaces per 1,000 square feet of GLA provided

Table 1
Recommended Parking Ratios[a]

Center Size (GLA in Square Feet)	Percentage of GLA in Restaurant, Entertainment, and/or Cinema Space		
	0–10%	11–20%[b]	>20%
Less than 400,000	4.0	4.0	Shared parking[d]
400,000–599,999	4.0–4.5 sliding scale[c]	4.0–4.5 sliding scale[c]	Shared parking[d]
600,000 and over	4.5	4.5	Shared parking[d]

a Parked cars per 1,000 square feet of gross leasable area.
b For each percent above 10 percent, a linear increase of 0.03 spaces per 1,000 square feet should be calculated.
c Recommended parking ratio increases/decreases proportionally with center's square footage.
d Shared parking is defined as parking spaces that can be used to serve two or more individual land uses without conflict or encroachment.

that additional spaces are available for restaurants, entertainment, and/or cinema use. However, because of limited parking data from these centers, the recommended parking ratio of 4.0 spaces per 1,000 square feet from the 1980 study should still be used.

As shown in Table 1, when restaurants, entertainment, and cinema space combine to equal 11 to 20 percent of the total GLA, a linear increase of 0.03 spaces per 1,000 square feet for each percent above 10 percent should be calculated. For instance, a 300,000-square-foot center in which restaurants, entertainment, and cinema space account for 14 percent of the total GLA would require 4.12 parking spaces per 1,000 square feet.

Base Level:	**4.0 (Spaces)**
+ 4% excess restaurant, entertainment, cinema x .03 =	.12
Estimated ratio:	4.12

For recommended ratios with a sliding scale, the parking ratio increases or decreases proportionally with the center's square footage. For example, a 500,000-square-foot center with restaurant, entertainment, and cinema space constituting 10 percent or less of the total GLA would require 4.25 spaces per 1,000 square feet (halfway between the 400,000- and 599,999-square-foot ratios).

Method of Travel

The method of travel influences parking demand at a center. Employees or customers who arrive by modes of transportation other than private automobile reduce the demand for parking. The parking ratio recommendations contained in this report are for centers that are primarily auto dependent, with minimal walk-in or transit use.

Employee Parking Requirements

Parking demand for employees continues to account for approximately 20 percent of the total parking demand during the peak period. Thus, centers that require employees to park off site during the peak season could see up to a 20 percent reduction in the parking demand. However, this adjustment should be utilized with caution since centers with uncontrolled free parking often have difficulty completely enforcing employee parking.

Parking Supply Ratios

It is important in recommending parking ratios to determine the current parking supply. A series of parking supply ratios was calculated for centers with parking accumulation counts based on the number of parking spaces per 1,000 square feet. As seen in Table 2, the parking supply exceeded demand for the survey period for all center sizes. Therefore, parking demand during the design hour was not constricted by the availability of parking.

Parking Space Design

In the 1970s and 1980s, there was a trend toward smaller vehicle sizes. As stated in the 1980 *Parking Requirements for Shopping Centers*, the expectation was "that by 1990, most automobiles (60 to 95 percent) in use nationwide would be compacts." However, according to the National Parking Association (NPA), vehicles became increasingly larger in the 1990s. This trend has accelerated with the increased sales of sport utility vehicles. The NPA's last report that detailed trends in car size was published in 1996. It stated that only 39 percent of vehicles on the road were considered compact. *Dimensions of Parking*, published by ULI, provides historical automobile sales data by size of vehicle.

Given the declining number of compact vehicles, a one-size-fits-all ("universal" stall) parking space design is recommended.

Table 2
Parking Supply and Demand Ratios for Centers with Car Counts

Center Size (GLA in Square Feet)	Number of Responses	Parking Ratio (Parking Spaces per 1,000 Square Feet of Occupied GLA)	
		Supply	Demand
Less than 400,000	49	5.8	3.7
400,000–599,999	15	5.6	4.0
600,000–1,499,999	96	5.8	4.5
1,500,000–2,500,000	9	4.7	3.8
Total	**169**		

A Comparison of 1980 and 1998 Studies

The recommended parking ratios for centers under 400,000 square feet are consistent in the 1980 and the 1998 studies. However, larger centers require lower parking ratios today than those recommended in 1980. This is particularly evident in centers with 600,000 square feet or more. Table 3 compares the findings of the 1980 and 1998 studies.

Table 3
Recommended Parking Ratios: 1980 and 1998 Studies

	Parking Ratio (Parking Spaces per 1,000 Square Feet of Occupied GLA)	
Center Size (GLA in Square Feet)	**1980 Study**	**1998 Study**
Less than 400,000	4.0	4.0
400,000–599,999	4.0	4.0–4.5 (sliding scale)
600,000 and over	4.0–5.0 (sliding scale)	4.5

Note: See Table 1 explanation of sliding scale.

Study Methodology

Questionnaire

An extensive parking questionnaire was distributed to centers of varying types and sizes across the United States. The intent of the questionnaire was to determine the general parking characteristics of shopping centers, ascertain current industry parking practices, and solicit comments on the status of parking in the centers.

The General Questionnaire is presented in Appendix B and the responses in Appendix C. Nearly 500 centers responded to the questionnaire.

Parking Accumulation Counts

The questionnaire asked centers if they were willing to participate in the collection of parking accumulation data during the 1998 holiday peak. One hundred sixty-nine centers indicated a willingness to participate. A survey team was developed to conduct these accumulation counts for a specified time and date. For approximately 35 centers, these counts were obtained via aerial photographs. Detailed instructions were provided so that the data collection process would be consistent across the country. Chapter 4 explains how the time and dates for the collection of parking accumulation counts were chosen.

Of the 169 counts, 95 percent were conducted on December 12, 1998, between the hours of 1:00 p.m. and 3:00 p.m., while the remaining 5 percent were conducted on December 19 during the same hours.

Data Analysis

Responses to the questionnaires were analyzed by center size, location, and type. Cross tabulation of the responses was used to investigate the similarities and differences between the various sizes and types of centers.

In order to calculate a parking ratio, the parking count data were plotted on a graph showing center size and number of parked cars. Both linear and nonlinear regression analyses were performed on the data plots to determine the best fit of the data. A number of different groupings of the center sizes were analyzed to make sure that variation in the groupings did not change the recommended parking ratio.

The 1998 data were compared with the 1975 and 1980 survey results.

CHAPTER

Determining the 20th Highest Hour

Definition of Peak Hours

Previous studies have established the 20th highest hour of the year as the appropriate hour for determining parking requirements. *Parking Requirements for Shopping Centers,* published in 1980, gave this rationale:

> This study has selected the 20th highest hour of the year as the demand hour upon which the design of shopping center parking facilities should be based. Use of this hour as the design period will result in adequate parking for all patrons and employees during the more than 3,000 hours per year a center is open. In fact, based on this design period, it is estimated that during 40 percent of the hours of the year, over half of the available spaces will be empty. However, during 19 hours of each year, distributed over ten days, some patrons will be unable to find parking spaces immediately upon entering a center.

Designing a shopping center parking facility to accommodate parking conditions during the average hour of demand would be unacceptable, since by definition, during half of the time parking would be inadequate. However, providing sufficient parking to meet conditions generated during a center's busiest hour of the year would result in substantial excess capacity during all but one hour of the year—an unrealistic design standard for the community, the consumer, and the shopping center developer/owner. This study again recommends the 20th highest hour of the year as the appropriate standard.

Selection of Survey Day and Time

Selection of the appropriate survey day and hour required evaluation of extensive data available from a limited number of centers, responses from the questionnaires, consistency with previous studies, and industry judgment. An array of electronic counting devices makes it possible to count pedestrians at entrances and exits, vehicle traffic on entry roads, and the number of vehicles parking in paid facilities. Pedestrian or vehicle traffic data were available on a daily basis from 32 centers. Another 16 centers collected data on an hourly basis, offering around-the-clock tabulations of shopping center patrons throughout the year. An analysis of the detailed pedestrian and traffic data, shown in Appendix J, determined that the afternoon of December 12, 1998, between the hours of 1:00 p.m. and 3:00 p.m., had the best chance of approximating the 20th highest hour for the study's parking accumulation counts. This survey period also was the same as that used for the 1980 study. Although December 19th was used as a backup data collection day in the event of severely inclement weather or staff shortages, only 5 percent of the parked car data was collected on that day.

Survey Results

The base data analyzed for this study were obtained from two surveys. The first—the General Questionnaire—contained questions regarding the profile and parking characteristics of each center. The second—the Parked Car Survey—studied parked vehicles on the survey date and time selected to approximate the 20th busiest hour. The General Questionnaire was distributed to a large number of centers; the Parked Car Survey focused on fewer centers.

General Questionnaire

Initial attempts were made to select centers randomly from a database of over 3,000 shopping centers. This database was believed to be representative of shopping centers within the United States. Once the sample was selected, the survey process began. This process produced far fewer completed surveys than anticipated. Therefore, a second approach was employed.

This second approach involved eliciting the support of top management of shopping center developers. Once this top management support was established, developers selected a representative sample of their centers for inclusion in the survey. Developers were asked for a specific number of centers—typically 10 to 20 percent of their portfolio. The purpose of this sampling process was to select centers of various types located in different geographical areas. This approach produced nearly 500 completed questionnaire surveys.

Parked Car Survey

A one-time count of parked cars was conducted at 169 centers. The counts were acquired through a manual survey of the lots as well as aerial photographs taken of some centers. These counts were essential in developing parking ratios based on each center's square footage. (A parking ratio is defined as the number of parked cars per 1,000 square feet of occupied GLA.)

The Parked Car Survey had four components: the total number of on-site parking spaces; the number of vehicles that were illegally parked (including vehicles parked in areas without any striping, on grass, and in any other space outside of the marked parking spaces); the number of empty parking spaces; and the number of employee vehicles parked off site.

By adding the on-site parking capacity, the number of illegally parked cars, and the number of employees parking off site, and then subtracting the number of empty parking spaces, the total number of parked cars for each shopping center was calculated.

Definition of Center Types

The Urban Land Institute and the International Council of Shopping Centers define a shopping center as a group of retail and other commercial establishments that are planned, developed, and managed as a single property. Shopping centers are further classified for this survey into the following eight major categories:

Neighborhood center—The typical square footage for this type of center is about 30,000 to 100,000 or more. It usually includes a supermarket and/or drugstores.

Community center—Typically, this center type contains 100,000 to 350,000 square feet or more. Anchors usually consist of general merchandise stores, convenience stores, and occasionally large specialty/discount apparel stores.

Regional center—These centers have approximately 400,000 to 800,000 square feet. Department stores are the most common anchors. Regional centers customarily are enclosed.

Super regional center—Super regional centers are similar to regional centers. However, with over 800,000 square feet, they are larger than regional centers and usually have more department stores and a wider variety and assortment of stores than regional centers have.

Fashion/specialty center—At about 80,000 to 250,000 square feet or more, these centers tend to be high end and fashion oriented.

Power center—Power centers can have from 250,000 to 600,000 square feet. They usually include more category-dominant anchors, such as home improvement stores.

Theme/entertainment center—These centers, usually 80,000 to 250,000 square feet, are mainly leisure and tourist oriented.

Factory outlet center—Factory outlet centers can have anywhere from 50,000 to 400,000 square feet. Anchors at these centers typically are limited to manufacturers' outlet stores.

Response

Table 4 shows the 169 responses from the Parked Car Survey by size of center. From this data, ratios of parked cars per 1,000 occupied square feet (parking demand) were calculated.

Table 4
Centers by Size with Car Counts

Center Size (GLA in Square Feet)	Number of Responses
Less than 250,000	38
250,000–399,999	14
400,000–599,999	17
600,000–799,999	30
800,000–1,199,999	48
1,200,000 and greater	22
Total	**169**

Parking supply per 1,000 square feet of occupied GLA was also calculated.

Figures 1 and 2 show the distribution of parked car counts and questionnaire responses by center size.

Figure 1
Parked Car Counts by Center Size

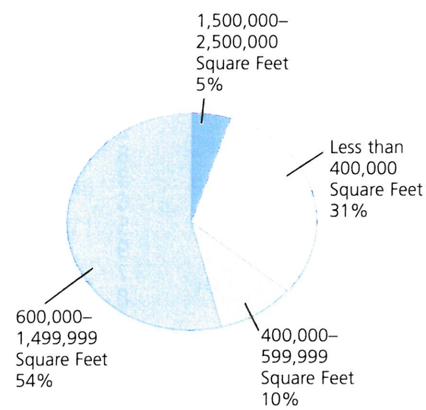
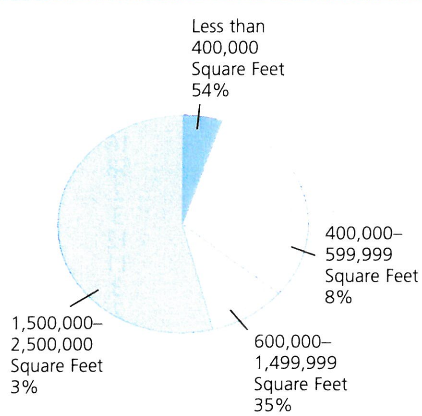


Figure 2
Questionnaire Responses by Center Size



As noted earlier, shopping centers are usually classified as specific center types based on total square footage, configuration, and store types. For this study, the respondents reported their center's square footage and type per a definition sheet included with the General Questionnaire. In most cases, the total square footage and tenant composition matched the appropriate definition. For example, most neighborhood centers had less than 100,000 square feet, with a supermarket or drugstore as the anchor tenant. Moreover, most centers classifying themselves as super regional contained more than 800,000 square feet and were anchored by department stores. However, there were a few exceptions, and in those cases the responses were edited by the consultant.

Geographic Coverage

The study is limited to shopping centers in the United States. Shopping centers from 46 states and the District of Columbia participated in the study by completing a General Questionnaire. (Alaska, Montana, North Dakota, and Wyoming had no centers that participated.) The hourly/daily counts were conducted at 32 centers in 21 states. A large number of car counts was obtained from centers in California and Texas, with 36 and 29 center surveys acquired, respectively. Arizona was represented with car counts at 11 centers, and the remaining states all had fewer than ten participants.

These responses reflect the underlying distribution of centers in those states. According to the National Research Bureau, California had 5,887 centers in 1998—nearly twice as many centers as in the next highest state, Florida, which had 3,278 centers. Texas ranked third with 2,976 centers. Table 5 shows the geographic distribution of centers participating in the study by state. A map showing the location of the participating centers is included in Appendix H.

Table 6 classifies each state and the District of Columbia into ten regions. The first column lists the number of centers from each region that completed a General Questionnaire. The next column shows each region's responses as a percentage of the total number of responses provided for all regions combined. The third column gives the actual number of existing shopping centers for each region. The final column gives each region's centers as a percentage of the total existing centers in the United States. This table shows that the geographic distribution of participating centers is virtually the same as the distribution of all centers nationwide.

Table 5
Centers Participating in General Questionnaire, Parking Accumulation Counts, and Parked Car Surveys, by State[a]

State	Participated in General Questionnaire	Completed Parking Accumulation Counts	Provided Daily Traffic Data
Alabama	13	0	0
Alaska	0	0	0
Arizona	16	11	2
Arkansas	2	1	0
California	61	37	3
Colorado	6	2	1
Connecticut	3	0	0
Delaware	1	0	0
District of Columbia	1	0	0
Florida	30	6	2
Georgia	24	5	2
Hawaii	5	0	0
Idaho	2	0	0
Illinois	18	8	0
Indiana	3	2	2
Iowa	2	0	0
Kansas	8	3	0
Kentucky	3	1	0
Louisiana	6	0	0
Maine	5	0	0
Maryland	9	4	0
Massachusetts	7	4	0
Michigan	8	3	3
Minnesota	6	4	1
Mississippi	6	0	0
Missouri	9	2	1
Montana	0	0	0
Nebraska	11	0	0
Nevada	5	4	0
New Hampshire	5	1	0
New Jersey	6	3	1
New Mexico	5	1	0
New York	20	8	1
North Carolina	18	3	1
North Dakota	0	0	0
Ohio	13	5	1
Oklahoma	5	3	1
Oregon	6	0	0
Pennsylvania	21	2	1
Rhode Island	1	0	0
South Carolina	12	1	1
South Dakota	1	0	0
Tennessee	16	5	0
Texas	58	29	3
Utah	2	1	1
Vermont	3	0	0
Virginia	12	6	2
Washington	11	2	1
West Virginia	3	1	0
Wisconsin	2	1	1
Wyoming	0	0	0
Total	**490**	**169**	**32**

a Including District of Columbia.

Table 6
Regional Distribution of Participating Centers

Region	States	Number of Centers Completing General Questionnaire	Region's Responses as % of Total Responses	Actual Number of Centers in Each Region[a]	Region's Centers as % of Total Centers
1	Connecticut, Maine, Massachusetts, New Jersey, New Hampshire, Rhode Island Vermont	30	6%	3,729	9%
2	Delaware, New York, Pennsylvania	42	9%	3,509	8%
3	District of Columbia, Maryland, North Carolina, South Carolina, Virginia, West Virginia	55	11%	4,810	11%
4	Alabama, Florida, Georgia, Mississippi, Tennessee	89	18%	7,114	16%
5	Indiana, Kentucky, Michigan, Ohio	27	6%	4,243	10%
6	Iowa, Minnesota, Montana, North Dakota, South Dakota, Wisconsin	11	2%	1,643	4%
7	Illinois, Kansas, Missouri, Nebraska	46	9%	3,271	8%
8	Arkansas, Louisiana, Oklahoma, Texas	71	14%	4,614	11%
9	Arizona, Colorado, Idaho, Nevada, New Mexico, Utah, Wyoming	36	7%	2,866	7%
10	Alaska, California, Hawaii, Oregon, Washington	83	17%	7,402	17%
	Totals	**490**	**100%**	**43,201**	**100%**

a Data for this column from ICSC, *Shopping Centers Today, 1998.*

EXCEPT

NEMO

NONPOINT EDUCATION
FOR MUNICIPAL OFFICIALS

TECHNICAL PAPER NUMBER 5

Parking Lots

By Jim Gibbons, *UConn Extension Land Use Educator, 1999*

Introduction

As more and more people own cars, more and more parking lots become necessary. Unfortunately, parking lots can adversely affect the environment as well as detract from "community character". Paved parking lots are typically designed to collect and concentrate large areas of storm water runoff, which can impact a receiving streams hydrography as well as water quality.

Paved parking lots can generate heat, raising the surrounding areas air temperature as well as the temperature of the first flush of storm water which can have significant ecological impacts. The City of Olympia Washington's Public Works Department found that parking lots account for 53% of imperviousness on a commercial site and 15% of multifamily sites. These figures are typical of most communities. Therefore careful attention to their design will go a long way toward protecting your community's water resources.

While eighty to ninety percent of all parking demands in America are met by surface parking, many view parking lots as necessary yet unattractive, even hostile places. While we need places to park cars, parking lots in summer can be flame-thrower hot and in winter, ice rink cold and slippery. Parking lots can be real or perceived danger zones, where drivers battle for choice parking spaces and pedestrians try to dodge kamikaze hits from myopic drivers. At night parking lots can become dark, desolate, Stephen King designed, landscapes harboring a rich assortment of imagined shadow lurking predators. Visually parking lots are often urban eyesores and broken tooth gaps in the Pepsodent smile of the urban streetscape.

In addition to their negative aesthetic characteristics, parking lots can also adversely impact the environment. For example, they act as heat islands greatly increasing summer temperatures. As car holding areas, they can transmit odors, noise, glare and a host of airborne pollutants. Paved parking lots seal the earth, preventing rainfall infiltration and ground water recharge. Impervious parking areas collect and convey storm water. As runoff traverses impenetrable asphalt or concrete, its' volume, velocity and pollutant loads increase, resulting in increased flooding, peak stream flows, stream channel erosion and polluted water resources.

As storm water quantity and quality is directly related to the amount of impervious cover on the landscape, water resources can be protected and enhanced by reducing impervious parking areas.

Local land use officials are charged with developing plans and regulations related to parking. This paper analyzes parking lot location, size, and design from a land planning perspective, emphasizing their potential adverse impact on water resources. Suggestions are offered as to how the imperviousness of these ubiquitous modern landscape features can be reduced.

Parking Lot Location

Parking lots are common in commercial, industrial and certain residential areas, such as apartment complexes. Often clustered in densely developed areas, parking lots may become part of a large network of interconnected impervious surfaces, collectively serving as polluted runoff storage and conveyance facilities. Parking lots may be proposed on or near fragile areas such as wetlands. Unless properly located and designed, parking lots can adversely impact water resources. Local officials should develop plans and adopt land use regulations that minimize or negate the potential environmental impacts of improperly sited impervious parking lots.

As a practical standard, parking should be located close to the building it serves. Parking is traditionally placed in the front yard of the building served, producing a common development pattern where blacktop replaces front yard landscaping. With front yard parking, side yard setbacks and controlled curb cuts are often forgotten. As a result, parking lots flow together onto the street forming massive asphalt sheets stretching door front to door front into what is commonly referred to as "strip commercial development." The macadamized landscape raincoats the earth allowing the preparation of a rich bouillabaisse of polluted runoff that is ultimately fed to unsuspecting rivers and streams.

Where parking lots are a requirement of commercial or industrial use, they should be placed at the rear of the building served. Rear parking reduces potential conflicts of cars crossing sidewalks at many points. The City of Fort Collins, Colorado in a effort to reduce the overall large scale of paved surfaces associated with big box retail development, requires that no more than 50 percent of the parking be located between the principle building and the primary abutting street. By distributing parking around a large building, walking distances from cars to the store are reduced.

Another way to reduce the amount of impervious parking exposed to rain, is to place parking underground, within the building it serves, or in multi-storied, shared parking garages.

NEMO Recommendations Regarding Parking Lot Location

- Plans of Conservation and Development should identify impervious surfaces, such as parking lots, as part of an existing land use inventory. The Plan should reference the potential and known adverse environmental impacts of impervious surfaces and recommend ways to reduce them.

- Plans of Conservation and Development should contain an "impervious cover build out analysis," showing the location and amount of imperviousness that will be generated if the community develops according to present zoning.

- Plans of Conservation and Development should make recommendations regarding the location, size, and design of future parking facilities emphasizing their potential environmental impact. Special attention should be paid to future policies regarding parking lots located near or draining to, watercourses and wetlands. The Plan should also address the issue of mass transit, garages versus surface parking, shared parking in mixed-use areas and porous versus impervious parking surfaces.

- Plans of Conservation and Development should recommend the use of porous surfaces on parking lots and other impervious surfaces as a way to improve storm water quality, control runoff volume and velocity and promote infiltration and groundwater recharge.

- Plans of Conservation and Development should review parking requirements found in local regulations and compare them to standards in other communities and national studies such as "The Parking Generation Manual," prepared by the Institute for Transportation Engineers, to determine if local standards are excessive.

- Plans of Conservation and Development should contain or recommend parking utilization studies, to see if required spaces are used. The common planning goal of "providing ample off-street parking" might be substituted with "adopting parking standards that meet actual demand."

- Communities, regions and watersheds should establish growth management policies that encourage growth in areas with infrastructure and conservation in areas deemed, unique or fragile. These policies should promote urban infilling and discourage suburban sprawl. The growth areas should contain mass transit and where feasible, require garages, shared parking or porous parking surfaces. Green areas designed to infiltrate runoff should be promoted in highly impervious urban areas.

- Communities should require rear yard parking while prohibiting parking in front and side yards. Rear yard parking prevents streetscape domination of door front to door front macadam flows. Also, consider requiring that structures be built at the street line to force rear yard parking.

- If front yard parking is permitted, limit parking and driveway coverage to no more than 50 percent of the front yard area. To avoid adjoining parking lots flowing together and eventually onto the street, maintain side yard setbacks and limit curb cuts and curb cut widths.

- To reduce the amount of impervious parking surface exposed to rain, require shared parking, parking be under or within the building served or within multi-storied parking garages.

Parking Lot Size

Few municipalities have developed formal parking policies. However, when parking regulations are reviewed two assumptions emerge:

1. Enough spaces will be supplied to meet the highest demand, and
2. Most drivers will park for free. Many planners feel these assumptions have produced too many large parking lots that accumulate and convey too much polluted runoff.

The number of off-street parking spaces and minimum parking space size required by zoning determines parking lot size. Typical zoning regulations produce surface parking that occupies 2 to 3 times more space than the floor area in the building served. A 1995 survey conducted by the city of Olympia, Washington found that over half of the city's commercial sites were devoted to parking and driveways. In her 1997 study entitled, "*The Bay Area's Love-Hate Relationship With The Motorcar*," Ellen Marie Miramontes estimates that between 30 and 40 percent of the land in a typical American downtown is consumed by parking spaces. Parking requirements for regional facilities such as shopping malls, airports and sport stadiums can generate parking lots that occupy 10 to 50 acres. Suburban shopping malls, multiplex theaters, "big box" stores and high rise apartments, are common modern land uses featuring large buildings surrounded by uninterrupted seas of asphalt or concrete parking.

Parking Spaces Required by Zoning

Research now shows that typical zoning regulations require more parking spaces than are actually utilized. For example, space utilization studies show that the common zoning standard of 4 parking spaces for every 1,000 square feet of gross floor area generates twice the number of parking spaces used. Most parking standards are based on peak hour traffic volumes or "peak hour, in peak season" demand, such as shopping during the weeks between Thanksgiving and Christmas. While the lots may be filled during this peak period, they are often greatly underutilized the rest of the year. As a case in point, from 1965 to 1981 shopping mall parking lots were designed for use at the 10th busiest hour of the year, using a standard of 6 spaces per 1,000-sq. ft. of retail space. In 1981 a study by the Council of Shopping Centers suggested shaving the standard to 4 spaces per 1,000-sq. ft. using the 20th busiest hour. Designing for the 20th busiest hour still leaves at least half of a shopping center's parking spaces vacant a minimum of 40 percent of the time. Similarly, large parking areas serving seasonal uses such as beaches, fairs, sporting events and festivals may be filled only a few days, remaining vacant the rest of the year.

Zoning traditionally requires a "minimum" number of parking spaces, allowing developers to provide more spaces, if they wish. It is this, "bigger is better" approach that has resulted in excess parking, particularly at "big box retail" sites where developers routinely build more parking spaces than required by zoning. Olympia, Washington surveys showed most land uses had more parking than required by zoning and a majority of these parking stalls were not used. Rather than relying on open-ended minimum ratios, communities should consider median parking ratios that truly reflect parking needs. If minimum ratios are kept, they should be used in conjunction with maximum ratios so developers cannot build as many spaces as they wish.

Land use officials are recognizing their regulations may generate more parking spaces than are commonly used and are interested in revising them accordingly or placing caps on the number of parking spaces permitted in certain areas. For example, Boston and Portland have set limits on the number of parking spaces that can be built in their downtowns. Boston has already reached its cap of 35,500 spaces. San Francisco limits parking to no more than 7 percent of the floor area of the building it serves.

Some states, including Connecticut, allow planning and zoning commissions to request payment in lieu of constructing off street parking spaces, where the required spaces are felt to be unnecessary or they cannot be built due to poor site conditions. Fees are based on costs of installing the usually required parking space. Collected revenue is deposited into a fund dedicated to parking or other transportation facilities.

Most zoning regulations contain "maximum lot coverage" provisions meant to regulate the size and bulk of development. Many of these regulations define coverage as, "the area occupied by buildings." A more comprehensive definition of coverage includes all impervious surfaces, such as rooftops, roads, parking areas, patios, sidewalks and compacted earth. All of these areas can contribute to increased storm water runoff and other potential adverse environmental impacts.

Another way to obtain fewer and smaller parking lots is to encourage or require shared or joint parking. Shared parking reduces the parking area for mixed uses with non-competing hours of operation such as residential units above a store or the use of church parking lots by schools. Joint parking refers to two or more multi-tenant buildings using the same parking facilities.

Parking Space Size Required by Zoning

Traditionally communities require that each parking space have minimum dimensions. A minimum stall of 10' by 20' or 9' by 18' is common. The City of Olympia, Washington has calculated that during a two-year rain event (2.8 inches in 24 hours), approximately 38 cubic feet of runoff would be generated by a 9' by 18.5' parking stall. Over the last decade the average size of cars sold in the United States has in declined. In recognition of the popularity of smaller cars, many communities are downsizing required parking space size. Los Angeles for example, permits 8'4" by 18' parking stalls. In a 1982 survey of 900 local governments, the American Planning Association found 33% of the respondents had downsized the minimum parking space size required by zoning. According to the APA survey, small car stall widths ranged from 7'6" to 8'6" with lengths ranging from 14' to 19.' The most commonly used small car dimension was 7'. 6" in width by 15' in length.

Adherence to older parking space standards results in land unnecessarily being paved. Smaller parking stalls mean less impervious coverage for the same number of parking spaces. In a 100-space parking lot, using a 112.5-sq. ft. stall, as opposed to the older 200-sq. ft. standard will reduce the lot's total paved area by 8,750 sq. ft. Palo Alto, California requires that lots with over 150 spaces have a minimum of 20% of the spaces designed for small cars.

Parking Lot Drives, Curb Cuts and Stall Arrangements

In addition to parking space standards, parking lot driveways, curb cuts and parking space arrangement influence the amount of paved area associated with parking lots. A general planning standard is to minimize the number and size driveways and curb cuts associated with parking lots. Lengths and widths of parking lot driveways should be kept as short and narrow as possible. Driveway widths of 9' for single lane drives and 18' for double lanes are often adequate. In most instances, one curb cut will adequately serve a parking lot. Where curb cut standards are disregarded, parking areas and the street become one. Phoenix, Arizona stipulates that, with the exception of safety considerations, the location of driveway curb cuts for parking lots shall not cause the removal of existing mature landscaping.
There are four common angles used to design parking space arrangement, 90°, 60°, 45° and 30°. The angle used depends on the situation and the available space. 30° and 45° parking

EXCERPT

ORANGE COUNTY GOVERNMENT FLORIDA

Orange County Parking Standards
Emerging Trends and Comparisons

January 2008

Planning
Design Group
930 Woodcock Road, Ste 224
Orlando, FL 32803

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Appendix

Introduction

Orange County contracted with Planning Design Group to review, analyze and recommend updates to the existing Orange County parking standards. The intent of work effort is to address specific deficiencies as identified by County staff. This report provides a summary of emerging trends and strategies that are being employed in areas throughout the United States that provide innovative parking solutions. This report also provides an analysis of parking standards in comparable jurisdictions for selected uses. The uses that are reviewed here were selected by Orange County Zoning and Planning Staff for deficiencies in the existing Orange County code.

Review of Literature: Emerging Trends in Parking

The following is a list of emerging trends employed in other cities and counties. The examples given are discussed in greater detail in the supporting documents included with this report and/ or in the publications included in the Works Citied Page. Implementation of these examples should be considered as part of an overall strategy and should be altered to fit the shape and size of Orange County's desires and distinctiveness.

Shared Parking

Example: Montgomery County Maryland, Berkeley California
This solution usually involves parking facilities serving multiple users or destinations. It has the most success when two locations that are close in proximity have different peak times. Churches and restaurants usually have different peak times from each other and different peak times than other land uses such as offices and retail shops. (Litman, 2006, p. 12)

Reducing Parking Requirements or Reduced Minimums

Example: Marin Affordable Housing and Financially Feasible Development Regulations
A feasibility analysis of a hypothetical urban infill project was created to show the effect of parking requirements on financial feasibility. The result was that higher density and lower parking ratios combined to improve the affordability of residential units. This study helped craft a new policy. (Metropolitan Transportation Commission, 2007, p. 28)

Example: Wilton Manors, Florida
The city utilized reduced minimum parking standards in the revitalization of a decaying shopping center. (Team, 2007, pp. 25-7)

Parking Maximums
Example: Portland, Oregon Maximum Requirements
Portland established maximum parking requirements for new development and applied parking maximums for development already in use. Parking maximums are based on distance from and availability of transit. (Metropolitan Transportation Commission, 2007, p. 28)

Variable Rate Parking Prices

Example: New York, New York

On street parking rates in the Mid-Town Commercial District were set at amounts that grow exponentially higher the more time the car is parked. This policy reduced the length of time cars were parked. (Metropolitan Transportation Commission, 2007, p. 32)

Unbundled Parking

Example: San Francisco Central Waterfront Plan

The "Plan includes the elimination of dwelling unit density restrictions, designates residential as a principally permitted use, limits retail and office uses to the first and second stories, eliminates minimum parking requirements and requires unbundled parking from the rental or sale of residential uses" (Metropolitan Transportation Commission, 2007, p. 33).

Parking Payment Technology

Example: Seattle, Washington

The city replaced single meters with multi-spaced meters. The multi-spaced meters are able to take credit cards. "…per space parking revenue with the same fee has increased 40% due to the propensity of motorists to use credit cards (62% of parking revenue) to purchase the maximum parking period allowed and avoid a parking ticket." (Metropolitan Transportation Commission, 2007, p. 36).

Parking Benefit Districts

Example: Old Pasadena Parking District

The city installed parking meters in a district that once had curb parking that was only restricted by 2 hour limits. The city spends the revenues generated from the meters exclusively on items that add value to the district such as maintaining the sidewalks, planting trees, and adding street lights. There is business community support for the use of meters because the revenue generated is spent directly on the community. Because the meters are set at a rate that allows for most of the spaces to be used but not all, there are always some available parking spaces. (Shoup, 2005, pp. 405-8)

In- Lieu Fee

Example: Orlando, Florida

Orlando requires developers to choose whether to provide parking or pay a fee in order to comply with minimum parking requirements. The city sets its fees as the equivalent of construction cost per space for municipal parking structures, exclusive of the cost of land. (Shoup, 2005, pp. 234-5)

Transit Incentive Programs

Example: Santa Clara Valley Transportation Authority Annual Pass Program
The Santa Clara Valley Transportation Authority offers Eco Passes for businesses and residential communities. Both employers and residential communities can purchase passes. The passes are sold for discounted prices. The Authority charges employers between $5 and $80 for annual passes for their employees depending on the locations and proximity to transit. The price is significantly less than the regular value for the passes. The Authority can do this in part because many commuters will not use transit even when it is at no cost to them. The impact of this program is that it increases the use of transit and reduces the necessity for parking spaces. (Shoup, 2005, p. 252)

Example: Boulder, Colorado Program
The city has employed a free Eco Pass bus program. This program is funded from parking revenues collected. Eco passes are provided to all downtown employees at an annual cost of $160,000 paid in full by parking revenues. Roughly 42% of downtown employees make use of the program which frees up parking space for tourists, clients, and customers of businesses. (Team, 2007, pp. 27-8)

Land Banking

Example: Iowa City, Iowa
"In some commercial zones in Iowa City, minimum parking requirements may be waived or relaxed, and land banking used in place of up to 30 percent of the otherwise required parking" (Development, Community, and Environment Division Environmental Protection Agency, 2006, p. 22).

Preliminary Recommendations

Some solutions are compatible with Orange County: reducing parking requirements or minimums, parking maximums, shared parking, unbundled parking, in-lieu fees, and transit incentive programs. These strategies, when used in conjunction with each other, should be looked into further as candidates for consideration. The combination of these strategies, tailored to Orange County's urban environment, may reduce the number of parking spaces while accommodating Orange County's parking needs.

Reduction in parking requirements or parking minimums is a solution that can work well in Orange County amongst the existing landscape. Precedent is set; maximums are employed for "big box" land use in Orange County. This would be relevant where there is more than adequate supply of parking spaces. Parking maximums can and should fit into the same equation. The minimums and maximums should be considered with availability of and proximity to public transit.

Shared parking is another strategy that should be considered. Shared parking makes sense in many places across the county. This is especially true at locations such as International Drive resort area, where there are many businesses that have uses that have different peak times for parking need. Many locations with different peak times are in close proximity to each other. Therefore, shared parking is a viable strategy. One common problem associated with implementing shared parking agreements is the liability issue. Because many developments in the International Drive resort area have the same owner there are opportunities for shared parking to work without the liability problem.

Bundled Parking is a strategy that can allow for tradeoffs to be made by showing the real costs of parking. For instance, if an apartment building charged rent separate from the parking cost a family could make the decision to have only one parking spot or none if they happened to not need a vehicle. This can reduce the amount of parking spaces needed by letting the market determine the need. Certainly, there most likely would not be a substantial reduction of parking spots needed, but even a small reduction can go a long way.

In-lieu fees for parking has been employed locally. Orlando sets its fees as the equivalent of construction cost per space for municipal parking structures, excluding the cost of land. Orange County may want to adopt this policy or a variation of it as part of the parking strategy. In-lieu parking fees could give developers the option of whether to pave extra parking or not.

A transit incentive program can help ease any of the burdens placed by the other pieces of the parking puzzle. By giving reduced rate or free transit passes to employees the need for parking spaces can be alleviated somewhat. The less parking spaces occupied by employees, the more parking spaces there would be available for customers. International Drive, among other areas, can be a prime contender for a transit incentive program because of its already existing efficient transit system and high volume of both employees and customers many of whom are tourists.

Another solution that may be considered is land banking. Land banking could work in areas where growth projections are inconclusive and there happens to be extra land available where it would be needed for potential future parking needs.

Finally, other solutions are not viable at this time. Solutions such as variable rate parking prices, parking payment technology, and parking benefit districts may work in the future as Orange County becomes more urbanized. These solutions are not currently recommended because a sizeable stock of "free" parking spaces is presently available.

In regards to alternative paving for parking, the data is inconclusive. While using this technology can reduce flooding and capture more storm water there are issues: the storm water may be directed the wrong way and it is expensive. Several case studies are provided in the supported documents. It is recommended that Orange County consider alternative paving in a case by case basis.

Review of Parking Standards for Other Jurisdictions

The attached matrix compares the parking requirement ratios for select uses in Orange County with other Florida counties and municipalities. The select uses are those that have been identified by Orange County for deficiencies in the current code. Additional information is provided on each use below. All standards not citied were taken directly from the applicable jurisdiction's code.

Assisted Living Facilities or ACLF

Orange County utilizes 2 spaces per bedroom. As shown on the matrix, other comparable jurisdictions consider the number of employees and/or square footage of the facility. The Institute of Transportation Engineers studies on parking for assisted living facilities indicates an average peak hour demand of .33 vehicles per dwelling unit on weekdays and .24 vehicles per dwelling unit on a Saturday. In addition to those listed in the matrix, the following were reviewed:

> Jefferson County, KY (Pop. 693,604)
> **Minimum**: 0.5 for each dwelling unit, plus 1 space for each 2 employees on maximum shift.
> **Maximum**: 1.5 spaces for each dwelling unit, plus 1 space for each employee on maximum shift. (Davidson & Dolnick, 2002, p. 92).
>
> Seattle, WA (Pop. 563,374)
> 1 space for each 4 assisted living units plus 1 space for each 2 staff members on-site at peak staffing time; plus 1 barrier-free passenger loading and unloading space; plus loading berth requirements per Section 23.54.035.

Shopping Centers

Orange County's parking requirements for shopping centers is on-par with many other jurisdictions in Florida. Most of these standards are based on demand studies that often provide an oversupply of parking. (Litman, 2006, p. 12). Some jurisdictions are utilizing parking maximums to address oversupply, especially in shopping centers. For example, Orange County recently adopted standards for Big Box development with a minimum of 4 spaces and a maximum of 5 spaces per 1,000 square feet. Alachua County is the only other Florida jurisdiction reviewed in the matrix that has utilized parking maximums. Locally, the City of Orlando utilizes parking maximums. Also, as shown below, Jefferson County, Kentucky (Louisville) uses parking maximums to address large-scale retail shopping centers. The only exception in Jefferson County is that restaurants and movie theaters are calculated independently. Interviews with planners in Alachua County and Jefferson County indicate that their adopted maximums have been accepted by the development community and are successful in limiting oversupply. (Davidson & Dolnick, 2002, p. 160)

Jefferson County, KY (Pop. 693,604)

< 400,000 sq ft of gross leasable area:

Minimum: 4 for each 1,000 sq ft of gross leasable area

Maximum: 5 for each 1,000 sq ft of gross leasable area

400,000 – 600,000 sq ft of gross leasable area

Minimum: 4.5 for each 1,000 sq ft of gross leasable area

Maximum: 5.5 for each 1,000 sq ft of gross leasable area

>600,000 sq ft of gross leasable area

Minimum: 5 for each 1,000 sq ft of gross leasable area

Maximum: 6 for each 1,000 sq ft of gross leasable area

Warehouse

Orange County's parking requirements for warehousing is addressed as either industrial or mini-warehousing. The problem arises in that certain types of warehousing in industrial areas are now automated to the point that they may have very few employees in large warehouses, requiring very different parking that other industrial uses. As shown on the matrix, other jurisdictions have addressed this concern by having a certain number of spaces per employee.

Condo-Hotel, Motel

Like Orange County, the other jurisdictions shown in the matrix address condo-hotel the same as hotels or motels. Some places have unique requirements for extended-stay hotels. Two examples are as follows:

Olathe, KS (Pop. 92,962)

1 per each 2 employees on the largest shift. 1 per each guest room or each 2 guest beds. (Davidson & Dolnick, 2002, p. 93)

Dade County, FL

1.5 for each guest room, efficiency or 1 bedroom unit; 1.75 parking spaces for each 2bed-room unit; 2 for each 3 bedroom or more unit. (Davidson & Dolnick, 2002, p. 93)

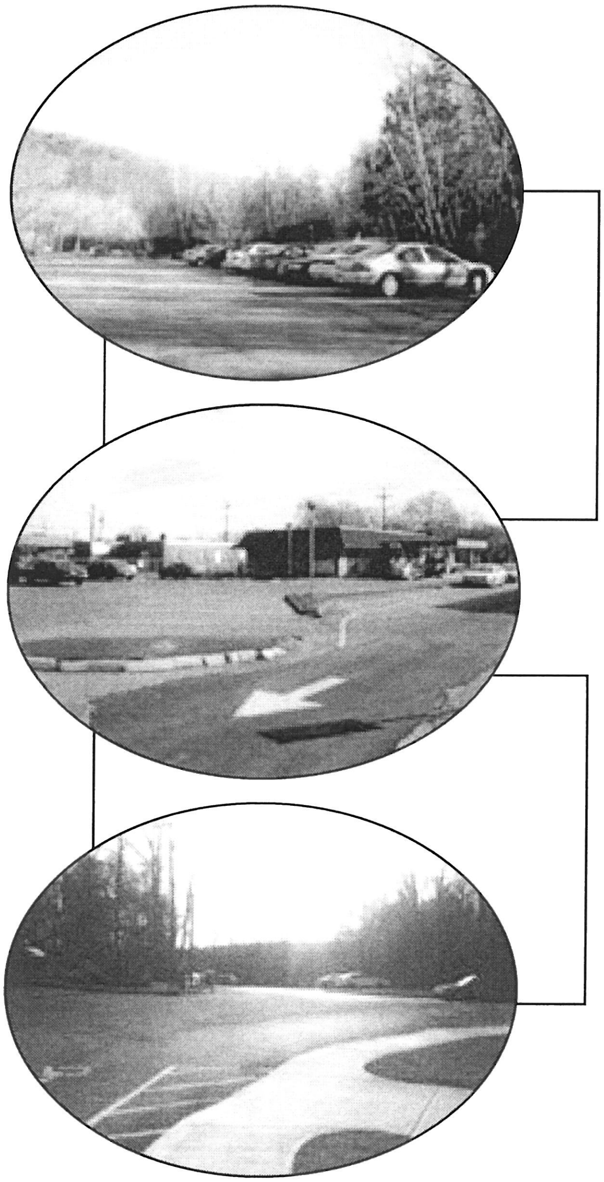
Timeshares

Of the eight Florida jurisdictions reviewed in the matrix, only Broward County has regulations specific to timeshare. The rest treat timeshare uses the same as hotel/motel. Other jurisdictions are reviewed in Table 1 below.

EXCERPT

Northwest Connecticut Parking Study - Phase II

Model Zoning Regulations for Parking
for Northwestern Connecticut



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Fitzgerald & Halliday, Inc.
72 Cedar Street
Hartford, CT 06106

September 2003

Northwestern Connecticut Parking Study – Phase II
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Appendices

INTRODUCTION

This report presents the findings of Phase II of the Northwestern Connecticut Parking Study, which has been jointly sponsored by the Northwestern Connecticut Council of Governments (NWCCOG) and the Litchfield Hills Council of Elected Officials (LHCEO). This study was funded in part by the Connecticut Department of Environmental Protection (CTDEP) through a US Environmental Protection Agency (USEPA) Clean Water Act Section 604(b) grant. This Phase II report builds upon the information and findings of the Phase I effort. The overall aim of the project has been to identify strategies to reduce the area of impervious surface dedicated to parking. The related goals of the study include:

- To reduce adverse water quality effects of contaminated runoff originating from paved parking surfaces
- To better match actual demand for parking with supply
- To minimize land consumption for paved parking
- To achieve improved overall parking lot design

Phase I, completed in 2002, compared actual parking usage with available parking supply for 10 different land uses at 42 locations in the towns that are part of the NWCCOG and LHCEO regions. The area covered by the Phase I study is shown in Figure 1. Phase I revealed that the majority of the parking lots surveyed were underutilized, indicating that parking lots are, in general, larger than needed. Phase I concluded that this excess of impervious parking area unnecessarily contributes to adverse water quality impacts. To address this issue, Phase I identified strategies to decrease the cumulative land area covered by impervious parking.

As a brief background on the parking lot-water quality relationship, when rainwater runs off parking lots and other impervious (paved/pavement-like) surfaces, it collects pollutants such as salt and petroleum products that can get carried into adjacent streams, rivers, lakes, and oceans, adversely affecting their ecological health and water quality (Otto et al 2002). Impervious surfaces seal the ground, preventing rainfall from naturally infiltrating into the soil and recharging groundwater supply. The resulting increases in surface flows contribute to increases in flooding, peak stream flows, and stream channel erosion (NEMO 2002). Scientific studies have observed that stream health noticeably decreases when impervious surfaces cover only 10 percent of a watershed, with severe water quality degradation almost certain at 30 percent impervious coverage (Arnold and Gibbons 1996).

Phase II of this study translates the findings from Phase I into practical model zoning regulations (the model) encompassing provision of parking and parking lot design for water quality management. In recognition that there is more than one possible strategy for achieving water quality improvements, the model addresses surface area (number of parking spaces), location, and the physical design/landscaping of parking lots.

Providing adequate parking to meet realistic demands and needs is important, but it is equally important to manage parking to reduce its potential adverse water quality impacts within a community and/or a watershed, and ensure that land is not covered excessively with impervious surfaces. Not only do expansive parking areas impact water quality, but they can discourage walking by creating barriers to safe, convenient walking from sidewalks, streets, or adjacent uses to a destination, thus making land use even more auto dependent. Large, poorly designed parking areas also pose safety hazards for pedestrians and bicyclists, and create undesirable and unnecessary separation of land uses and between land uses and the transportation system, undermining local vision for community character. These concerns also brought about this study.

PARKING STANDARDS: CONSIDERATIONS FOR ZONING AND DESIGN

Where Do Today's Parking Standards Come From?

One of the first questions investigated for Phase II of this study was where the current parking space requirements found in most zoning regulations come from. Available professional publications on parking were researched and queries made of several Connecticut municipalities' planning departments. Today's parking standards appear to have evolved in two ways. First, there have been some technical analyses of parking demand by institutions and organizations such as the Institute of Traffic Engineers (ITE) and the Urban Land Institute (ULI). The ULI approach is representative and it recommends that the size of parking lots for commercial uses (shopping centers) should serve the parking demand during the 20th highest (busiest) hour of all of the hours the commercial center will be open for an entire year (ULI 1999). The 20th highest hour of demand for the entire year generally falls between Thanksgiving and Christmas. This approach effectively provides adequate parking for patrons and employees for the more than 3,000 hours per year that shopping centers are commonly open. However, it results in far more parking spaces than are actually needed for most of the year or off peak times, such as the off-holiday season. In fact, the ULI estimates that using this methodology, about 40 percent of the year more than half of the parking spaces provided will be empty.

Interviews and research for this study indicate that the second manner in which parking standards have evolved is by word-of-mouth. A local government will research how many parking spaces other communities require for a variety of land uses and then, finding those most commonly used and effective, adopt requirements for its jurisdiction. Therefore, parking requirements found in most zoning regulations are not based on an empirical analysis of what any one land use will require to meet patrons' needs, but appear to have been handed down from one community to another. The historical emphasis for most parking requirements has been on guaranteeing that there is enough parking, with little or no recognition that there may be *too much* parking provided in the form of impervious surfaces. None of the 25 existing Connecticut parking regulations reviewed for this study required a developer to perform a parking demand analysis to demonstrate the anticipated parking need generated at a proposed site.

The Psychology of Parking

Although parking supply is dictated primarily by zoning, parking supply is also based in part on the psychology associated with parking availability and location. Beyond designing a parking lot to meet local regulations, a developer will design a lot based on how it will be perceived by drivers entering the site. A discussion with a development company for this study revealed that large commercial property owners want patrons not only to find easy parking in front of their businesses, but want them to perceive that there is an abundance of parking as they consider entering the site. The level of occupancy at which a parking lot is perceived to be full is referred to as the "effective supply" (*The Parking Handbook for Small Communities*, ITE, 1994). Consequently, there may be an inclination to provide excess parking in an effort to demonstrate the availability of parking to potential patrons. In village and downtown areas, there may be a desire to construct strip-type developments to provide patrons with the convenience of parking right outside their destinations.

To better support the community's quality of life, the desire to provide excess parking should be balanced against the need to develop land responsibly with respect to the natural environment and surrounding land uses. A comprehensive parking plan, such as is described in Appendix B, can help address issues related to the psychology of parking in village and downtown areas.

FLEXIBLE PARKING GUIDELINES

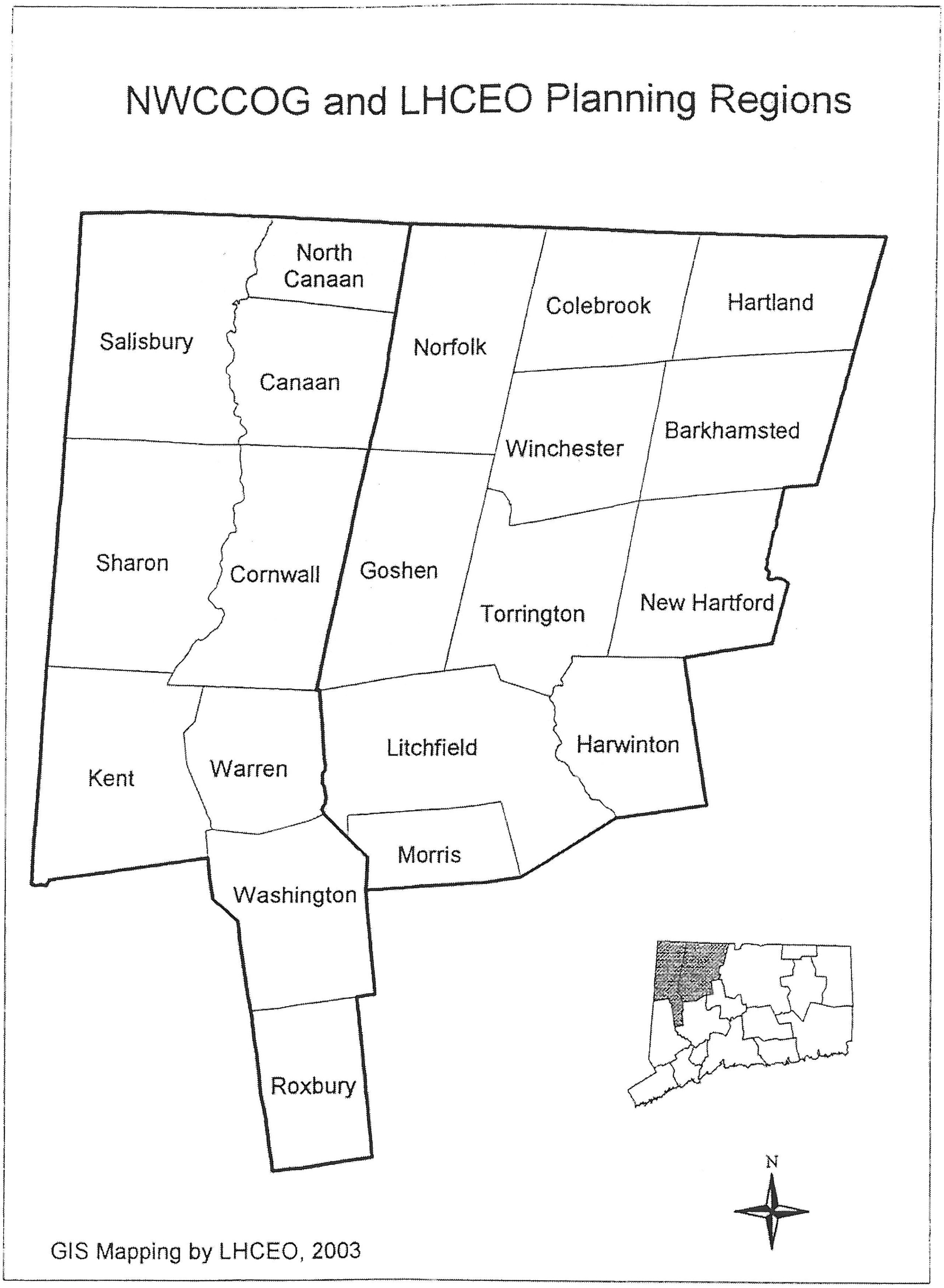
The amount of parking needed at a particular development depends in part on the type of geographic area where it is located. Phase I of this study evaluated isolated or free-standing parking lots in rural and suburban areas as well as parking lots in more densely developed village or downtown commercial areas. While it was found that there was an excess of parking for both types of lots, the clustering of uses downtown or in a village district suggests that developments in those areas may require the least on-site parking and afford the greatest opportunities for alternative parking arrangements such as shared parking and municipal parking. Consequently, parking regulations may be most flexible for new development in a village district or central business district where parking is available nearby.

The parking requirements in the local zoning regulations for a village district or downtown district should be written to allow maximum creativity and flexibility of design and provide an opportunity for a developer to work with the community to arrive at innovative parking solutions. It is notable that many downtown areas in the northwestern Connecticut communities that were studied (see Figure 1) struggle with a lack of sufficient or well-placed parking to complement the desired village character of the community and support economic development. In these instances, a parking plan would be particularly useful for providing future parking.

Creative parking options for downtowns and village districts can include:

- Provisions for shared parking (between private uses or public-private spaces)
- Provisions for payment of a fee in-lieu of parking

Figure 1: NWCCOG and LHCEO Planning Regions



- Provisions for a reduction in the number of off-street parking spaces where there is a municipally sponsored carpooling program, shuttle bus service to parking located off-site, or availability of transit stops with amenities at the proposed development.

- Provisions for a reduction in the number of off-street parking spaces where access via bicycle lanes or off-road paths and well designed pedestrian access is emphasized in design

- Provisions for parking off-site where walking to the site is safe and convenient

- Provisions for green parking lot design (design that minimizes impervious pavement and maximizes natural surfaces and landscaping)

- Requiring all parking to be behind buildings

- Encouraging the use of common driveways to access parking areas

- Encouraging the use of pedestrian alleyways to access parking located behind buildings with frontage on the street

ALTERNATE TRAVEL MODES

Though there is a need to provide ample parking for vehicles at businesses, there is also a need to consider alternate modes of travel during site planning. Not only does excessive impervious pavement have a detrimental effect on the environment, it can also deter patrons from accessing a business when using a mode of travel other than the automobile. Typically, site plans place parking in front of a proposed building, which is visible from the street. A consequence of this type of design is that people accessing the building on foot or bike need to travel further off the street through a parking lot and compete with automobiles moving around the site before reaching the building. In addition, expanses of paved parking located in front of businesses in a village district or downtown detracts from the pedestrian-scale character of the area. The model zoning regulations developed for this study discuss site layout and parking lot design that are more pedestrian and bicycle friendly.

MODEL ZONING REGULATIONS FOR PARKING

The following model language for parking requirements is intended to offer alternatives to the typical parking section used in most northwestern Connecticut zoning regulations. A typical parking section lists each use allowed by the regulations and specifies the minimum number of parking spaces required for that use based on the physical size of the associated buildings. Some zoning regulations also include a set of design standards for parking lots that call for some landscaping, set a minimum size for parking spaces, and require some stormwater drainage features. This common approach may not address the issue of too much impervious surface and a general excess of parking relative to the actual demand.

The following model regulations are intended for, and have been tailored to meet the needs and issues of the more rural northwestern region of Connecticut with many sparsely populated communities and geographically separated small towns. The language this model includes was designed to be straightforward to the greatest degree, for ease of administration, while still serving the purposes at hand. It was also developed in recognition of the fact that parking situations and the complexity of associated regulatory mechanisms can and should vary widely. While the fundamental concepts represented by the language used in this model are applicable to any community, the more quantitative components of the model, such as recommended maximum and minimum number of spaces per use, would need to be reassessed and modified if they are applied in an urban or suburban setting. An added consideration for any community adapting this model to its specific needs would be the type or form of future development it expects to face.

These model zoning requirements are based on the results of the Phase I survey as well as alternative regulations in use around the United States. A list of the regulations reviewed and additional sources of information about parking are provided in Appendix A. The model language for parking is presented in seven (7) sections (Parking Definitions, Parking Spaces, Impervious Surfaces, Fees-in-Lieu of Parking, Shared Parking, Alternate Modes, and Stormwater Management). Each section includes two columns. The right hand column provides model language that could be used to achieve the desired parking configuration. The left hand column provides an explanation of the intent of the model language and guidelines for using that regulatory approach.

Appendix B provides guidelines on how to develop a parking plan. The best way for smaller communities to manage parking is to develop an understanding of existing parking supply and demand and then develop a parking plan with a focus on the village center or central business district. A parking plan can increase the efficiency of existing parking supply, establish a system for effective enforcement of parking regulations, provide guidance to local governments in providing new parking, and aid in educating the public of parking locations or options.

The following regulations are in the form of a model. That is, the language provided is comprehensive, offering a broad range of regulatory options that can be used either individually or in concert to meet the needs of individual communities to manage parking.

Necessarily, as any community incorporates all or part of this language into it's zoning regulations, it will need to modify the section numbering system, cross reference the language with other parts of its regulations, and delete or modify elements that may be redundant or to best reflect local conditions and needs.

PARKING DEFINITIONS

Overview and Guidelines

Any time new language is added to a set of zoning regulations, it is useful to review the definitions section to ensure that new terms used in the body of the regulations are clear and not subject to wide interpretation.

The definitions offered here are the parking related terminology that appears throughout the rest of this model.

Parking Definitions:

Aisle: The driving portion of the parking area. The aisle provides access to each space.

Angled: Any parking space that is not parallel to the curb or aisle.

Bikeway: Any road, street, path, or way, which in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designed for the exclusive use of bicycles or are to be shared with other transportation modes.

Big Box Retail: Single retail sales facility that has greater than 20,000 square feet of gross floor area and is contained in a single building.

BMPs (Best Management Practices): structural, vegetative, or managerial practices designed to treat, prevent, or reduce degradation of water quality due to stormwater runoff and snow-melt.

Downtown Zone: the major business district in a community or area of highest concentration of commercial activity and often including the local government center; often referred to as the 'downtown'.

Free Standing Retail: Single retail sales facility of up to 20,000 square feet in size that is situated independently on a building lot and for which associated parking serves exclusively that facility

Gross Floor Area: The total floor area of a building.

Impervious Surface: A ground cover such as cement, asphalt, or packed clay or rock through which water cannot penetrate.

Indoor Recreation Facilities: Uses such as bowling alleys, billiard parlors, and skating rinks

Industrial Plant: Structure or complex of structures used for manufacturing, assembling, fabricating, warehousing, and related activities.

Mixed Use: A development that provides multiple compatible uses in close proximity to one another. And/or a land use pattern that seeks to increase concentrations of population and employment in well-defined areas with a mix of diverse and compatible land uses

Off-Street Parking: Parking spaces provided outside of the right-of-way of a street or highway.

On-Street Parking: Parking spaces provided within the right-of-way of a street or highway

Outdoor Recreation Facilities: Uses such as golf courses, amusement parks, miniature golf courses, and water slide parks

Parking Area: That portion of a Lot set aside, marked, posted, or intended for parking, including total of circulation areas, loading and unloading areas, parking spaces and aisles, landscaped areas, bikeways, and walkways.

Parking Stall or Space: A space in which a single car is parked.

Parking Supply: The actual number of spaces provided and legally available at a land use.

Personal Services: Establishments primarily engaged in providing services involving the care of a person or a person's personal goods or apparel. It includes uses such as barber shops, beauty salons, shoe repair shops, and dry cleaners

Pervious Surface: Ground cover through which water can penetrate at a rate comparable to that of water through undisturbed soils.

Shared Parking: When parking spaces are shared among different structures or uses, or among mixed uses, and can include properties with different owners.

Shopping Center: An area that is comprised of three or more commercial establishments, the purpose of which is primarily retail sales, that has a combined gross floor area of 20,000 square feet or more, that is owned or managed as a unit.

Sight Distance: The distance visible to a driver from his/her position to other objects or vehicles, when at a point of turning or when stopping a vehicle.

Walkway: Any path or way, which in some manner is specifically designated exclusively for pedestrian travel.

Many of the towns in northwestern Connecticut are characterized by a cohesive village center and/or a single concentrated commercial district on a state road. These areas can present unique challenges for parking that do not occur elsewhere in a predominantly rural community. Consequently, these more densely developed community areas are defined here and parking provisions specific to them are offered in subsequent sections of this model.

Village Center Zone: The traditional center of the community, typically comprised of a cohesive core of residential, civic, religious, and commercial buildings, arranged along a main street and intersecting streets.

PARKING SPACES

Overview and Guidelines

The survey conducted for Phase I of this study revealed that the majority of the parking lots surveyed were underutilized, indicating that many of the lots were larger than needed. The primary factor in the design of most parking lots today is zoning that specifies the number of spaces required in relation to building size and usage. These are typically based on the peak potential usage of a lot, representing peak demand for a very small time window in a year.

The model language offered here attempts to more closely correlate zoning requirements to the actual daily demand for parking based on the observations of the Phase I survey. (See Appendix C for more detail.) The model recognizes that many business owners also want to provide parking in excess of zoning. Therefore, it specifies a maximum number of spaces a land use can have as well as a minimum. This will enable a Planning and Zoning Commission to limit the excess impervious parking surface a developer provides as well as to ensure that adequate parking is available.

The requirements for parking spaces for the first 10 items in the list to the right were derived directly from the results of the Phase I parking study. That assessment of parking space requirements is supplemented with an additional list for other uses commonly found in northwestern Connecticut. These supplemental uses were not addressed in the Phase I survey. The number of spaces required for these supplemental uses are based on professional publications, common requirements, professional judgment, and extrapolation from the Phase I survey results.

Section PG General Parking Requirements

Section PG.1 Number of Parking Spaces

Off-street parking shall be provided and maintained in connection with the use, substantial change in use, construction, conversion, or increase in intensity of use of buildings or structures, such spaces to be provided in the following amounts per 1000 square foot (sf) of Gross Floor Area (GFA):

Land Use	Maximum	Minimum
Bank	3	2
Big Box Retail	3	2
Drive-Thru Restaurant	9	2
Free Standing Retail	3	1
General Office Building	5	2
Industrial Plant	2	1
Medical Office Building	9	2
Nursing Home	3	2
Restaurants	11	6
Small Shopping Centers	6	3
Bed and Breakfast	1.2 spaces per guest room or suite	1 space per guest room or suite
Personal Services	3	2
Day Care Centers	1 space per 4 children at max. capacity	1 space per 8 children at max. capacity
Churches and Places of Worship	1 space per 3 seats in portion of the building used for services	1 space per 5 seats in the portion of the building used for services
Museums and Libraries	2	1
Social, Fraternal Clubs and Organizations	4	3
Elementary, Middle and	1 space per 3 seats in the	1 space per 5 seats in the

This model recognizes that the Phase I survey was limited in scope in that it considered 42 parking lots across 21 towns. The language offered here is based on those survey results, which reasonably reflect general conditions in northwestern Connecticut, and best professional judgment.

High Schools	auditorium	auditorium
Hotels and Motels	1.2 space per guest room or suite	1 spaces per guest room or suite
Warehouse	1	1
Self Service Warehouse	1 space per 10 compartments	1 space per 20 compartments
Home Occupation	4 per dwelling unit plus 1.5 per non-resident employee	2 per dwelling unit plus 1 per non-resident employee
Multi-Family Residences	2.5 per dwelling unit	1 per dwelling unit
Commercial Kennel	3	1
Automotive Sales and/or Rental	3	1
Automotive Repair and/or Service	4	2
Gymnasiums, Physical Fitness Centers, Health Spas, Martial Arts Centers and Dance Studios	4	2
Indoor Recreation Facilities	5	5
Outdoor Recreation Facilities	As determined by the Commission based on a parking demand study	As determined by the Commission based on a parking demand study

For uses not listed in this section, the minimum and maximum number of parking spaces required shall be comparable to the closest other similar use as determined by the Commission.

Section PG.2 Handicapped Parking Space Requirements

The requirements for number of handicap spaces shown here are based on requirements found section 14-253a, CGS and Table 1105.1 of the State Building Code. These state requirements are also

All off-street parking areas shall include paved handicapped accessible parking spaces. Accessible parking spaces shall be at least 15 feet wide including 3 feet of cross hatch. Handicap accessible parking spaces and access aisles shall be level, not exceeding 2% slope in all directions. Handicap accessible parking *the same as those provided in guidelines of The Access Board, an independent federal agency charged with developing and maintaining accessibility requirements.*

spaces shall be provided in the following amounts relative to the total number of spaces provided in the parking area:

TOTAL PARKING SPACES IN LOT	REQUIRED ACCESSIBLE SPACES
1-25	1
26-50	2
51-75	3
76-100	4
101 –150	5
151-200	6
201-300	7
301-400	8
401-500	9
501-1000	2% of total
1001 and over	20 plus 1 for each 100 over 1000

Section PG.3 Waivers and Exceptions

Section PG.3.a Intent

While the goal of zoning regulations is to control the location and character of development, they are not intended to create a regulatory burden that will prevent property owners from all reasonable use of their land. In order to strike this balance, the regulations should include a degree of flexibility that provides for the unique characteristics of each parcel. Parking regulations are no exception. This model therefore includes mechanisms to allow the Planning and Zoning Commission to consider exceptions to the general parking requirements as long as the overall intent and purposes of the parking regulations are met.

It is the intent of these regulations that all structures and land uses be provided with a sufficient amount of off-street motor vehicle parking, while allowing for some flexibility of site design to accommodate the unique characteristics of individual properties. This section of the regulations is intended to set standards for conditions under which a waiver or exception from the general parking requirements may be allowed.

The Commission may require the submission of a parking demand analysis as part of any request for a waiver or exception from the general parking requirements.

Section PG.3.b Waivers

Except for buildings or parts of buildings used or occupied for residential use, all or part of the off-street parking requirements may be waived by the Commission where the proposed site planning, design, and construction includes the following:

1. Sufficient publicly owned parking spaces within 500 feet of the proposed development site.

layout that:

- *Is easy to understand and convenient for the user*
- *Makes efficient use of land in terms of area consumed and vehicle operations*
- *Minimizes potential conflict points between vehicles and among pedestrians, bicyclists, and vehicles*
- *Is compatible with the character of surrounding development*

The ratio of parking space angles to aisle widths and flow are drawn from The Parking Handbook for Small Communities (J. Edwards, National Trust for Historic Preservation, 1994)

The specifications in the zoning regulations for parking lot design should be accompanied by language under the section on Site Plan requirements requiring the applicant to show all proposed parking lot design features on the site plan including surface types, all parking space and aisle dimensions and slope, access drives, landscaping, stormwater management system, sidewalks, bicycle access and parking, handicap parking, loading areas, and transit stop areas.

layout options as shown in Figure 1 on Page ___ of these regulations.

PG.4.a Minimum Design Requirements

At a minimum, all parking lots shall:

1. Have a minimum stall size of 9' x 18'
2. Have rectangular parking stalls
3. Have aisle widths and parking angles in a minimum ratio as shown as follows

Parking Angle	Minimum Aisle Width	Direction of Flow
45°	12'3"	One way
50°	12'9"	One way
55°	13'3"	One way
60°	14'3"	One way
65°	15'2"	One way
70°	16'	One way
75°	24'	Two way
90°	24'	Two Way

4. Have no greater than 5% slope
5. Have a number and location of access drives compatible with traffic circulation patterns both within the site and on the abutting street system
6. Provide sufficient stacking area (area where cars may need to wait in line to exit onto the street or to enter to circulate in the parking lot) for 2 vehicles at the outbound access drives from the site
7. No parking space shall be designed to allow a vehicle to protrude or overhang a sidewalk or any landscaped area.
8. Minimize potential conflict points between pedestrians, bicycles, and motor vehicles.
9. Required off-street parking facilities shall be maintained as long as the use or structure exists for which the facilities are designed to serve.