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ENGINEERS

Review of National Trends in Parking Requirements

CRWP Low Impact Development Land Use Planning
Chagrin River Watershed, Ohio

Prepared for:
Chagrin River Watershed Partners
Willoughby, OH

December 13, 2005

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December 13, 2005 CL2004004R04

Meiring Borcherds
Chagrin River Watershed Partners
P.O. Box 229
Willoughby, OH 44096-0229

Re: Review of National Trends in Parking Requirements
CRWP Low Impact Development
Land Use Planning
Chagrin River Watershed, Ohio

Dear Mr. Borcherds:

Fuller, Mossbarger, Scott and May Engineers, Inc. (FMSM) is pleased to submit our FINAL report on the "Review of National Trends in Parking Requirements." Thank you for the opportunity to be of service to the Chagrin River Watershed Partners.

Sincerely,

FULLER, MOSSBARGER, SCOTT AND MAY
ENGINEERS, INC.

Bryon F. Ringley, P.E.
Project Manager

/jfk

Enclosures: 1

Review of National Trends in Parking Requirements

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Chagrin River Watershed, Ohio

This report was prepared by the Chagrin River Watershed Partners under award NA04NOS4190052 from the National Oceanic and Atmospheric Administration, U.S. Department of Commerce through the Ohio Department of Natural Resources, Office of Coastal Management. The statements, findings, conclusions and recommendations are those of the author(s) and do not necessarily reflect the views of the National Oceanic and Atmospheric Administration, Department of Commerce, Ohio Department of Natural Resources, or the Office of Coastal Management.

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Review of National Trends in Parking Requirements

CRWP Low Impact Development
Land Use Planning
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1. Background / Introduction

Vehicle parking is a significant source of impervious cover in the Chagrin River Watershed. This excess of impervious cover contributes to increased stormwater runoff and to the degradation of water quality. Several communities have expressed an interest in modifying their parking requirements to reduce this contributor to impervious cover. To enable these modifications to occur, a review of national trends in parking requirements was undertaken with a focus on two elements: 1) current national trends and standards for parking space and lot design, and 2) innovative solutions to reduce the amount of parking required. The information obtained through this review will be used to address modifications in the local parking codes.

The majority of communities today use generic formulas and standards to determine parking requirements. However, these generic parking requirements create excess parking spaces that consume land and resources and contribute to increased runoff and the degradation of water quality. One of the major downfalls of generic parking requirements is that they do not often take into account the mix of community-specific variables, like density, demographics, availability of non-auto transit, or the surrounding land use, all of which influence parking demand and should be reflected in local parking requirements (USEPA, 1999). Instead, many requirements are based on maximum demand for parking, which yields a surplus of parking area.

In addition to the fact that generic parking standards do not take into account local factors that determine parking demand, the standards used to determine the minimum and maximum parking needs within these generic standards are often arbitrary and based on highly scattered data. The parking demand studies used to establish these minimums do so based on an average number from a wide range of occupied parking spaces. For example, demand studies for the land use category “general office building” show a range from 0.81 to 5.76 parking spaces occupied per 1,076 square feet of gross building area (Litman, 2000). This example helps to illustrate the fact that standards based on averaging the values from such studies often result in excessive parking.

There are several additional reasons that published parking standards tend to be excessive. First, most study sites have free parking so basing parking requirements on demand studies with free parking results in standards that are too generous. Free parking generates a biased picture of parking demand. Secondly, most published demand studies are performed at relatively isolated sites because it is difficult to attribute shared parking to a particular building. As a result, suburban, automobile-dependant sites are overrepresented, resulting in standards that are excessive for urban areas, areas with multi-nodal transportation, or where parking is not free (Litman, 2000).

There are other reasons outside of the actual studies used to determine the published standards for the excess in parking capacity. Parking facilities tend to be taxed at a lower rate than if the same piece of land was used for buildings. Free or under priced parking is

often offered by businesses and municipal governments as a way to attract customers to commercial centers (Litman, 2000). Traffic engineers often use an "85th Percentile" standard when setting a standard, which means that 85 out of 100 sites will have excess capacity even during peak periods. The final reason for the excess in parking capacity has to do with the manner in which the standards are applied within the community. All too often, parking standards tend to be applied with little flexibility – variances require a significant amount of paperwork and a heavy burden of proof (Litman, 2000). From an administrative standpoint, it seems easiest and fairest to apply a single standard rather than using more flexible policies that could be subject to challenge. There are numerous professional organizations that provide recommended minimal parking requirements, but there are very few resources for developing flexible parking standards.

This paper provides an overview of the national standards and trends that have often led to the creation of excessive amounts of parking. The paper then discusses innovative solutions for addressing the pitfalls of the national standards and trends and assesses the potential for implementation of each solution based on the results of the parking survey that was undertaken in the Chagrin River watershed. The survey was sent out to each of the communities within the watershed to assess current parking space sizing and design requirements, parking lot design requirements and the actual parking need in the community. The results of the survey have been compiled into a matrix that can be found in Appendix A.

2. National Standards and Trends

Generic formulas and standards generated by entities such as the Institute of Transportation Engineers (ITE) are widely used to determine parking requirements in communities across the country. This section provides details about these standards and methodologies, with additional information regarding national standards presented in Section 3.8 Improving Parking Lot Design with the Goal of Reducing Impervious Surfaces.

Traditionally, communities have required that each parking space have minimum dimensions. A minimum stall of 10' x 20' or 9' x 18' is common (NEMO, 1999). These stall dimensions are often recommended as minimums, rather than maximums.

Required parking ratios generated by entities such as the Institute of Transportation Engineers are not based on community-specific variables and are often developed using parking demand studies that are based on scattered data. The result is an over supply of parking. The table below is widely cited throughout the literature as a means to illustrate the fact that parking requirements are often higher than they need to be. Table 1 provides examples of conventional parking requirements and compares them to average parking demand. These conventional requirements can be compared to those of the Chagrin River watershed communities (see Appendix A).

Table 1 .Comparison of Required Standards to Actual Parking Demand

Land Use	Parking Requirement		Actual Average Parking Demand
	Parking Ratio	Typical Range	
Single family homes	2 spaces per dwelling unit	1.5 – 2.5	1.11 spaces per dwelling unit
Shopping center	5 spaces per 1000 ft^2	4.0 – 6.5	3.97 per 1000 ft^2 GFA

Table 1 .Comparison of Required Standards to Actual Parking Demand

Land Use	Parking Requirement		Actual Average Parking Demand
	Parking Ratio	Typical Range	
	GFA		
Industrial	1 space per 1000 ft^2 GFA	0.5 – 2.0	1.48 per 1000 ft^2 GFA
Medical/dental office	5.7 spaces per 1000 ft^2 GFA	4.5 – 10	4.11 per 1000 ft^2 GFA

**Note: GFA = Gross floor area of a building without storage or utility spaces*
Source: Stormwatercenter.net

3. Innovative Parking Solutions

Innovative parking solutions were reviewed for their applicability for implementation in the Chagrin River Watershed as a means of addressing some of the problems resulting from the utilization of conventional standards. These innovative solutions are often referred to in the broad sense as parking management. Parking management is a general term given for one or more strategies that result in more efficient use of land devoted to parking. Parking management includes such strategies as community-based parking requirements, shared parking, in-lieu parking fees, establishing parking maximums and improving parking facility design which can include green parking design.

Parking management has many benefits including the following (Urban Design Collaborative, 2003; Victoria Transport Policy Institute, 2005):

- Enables a more efficient use of land;
- Provides improvements in air and water quality;
- Encourages other modes of travel;
- Reduces impervious surfaces;
- Improves parking lot design;
- Avoids parking spillover; and
- Enhances community character.

In light of these benefits, there are political concerns and public acceptability issues that must be considered. These issues are listed below (Urban Design Collaborative, 2003):

- Parking management poses the challenge of overcoming both the traditional assumption that society benefits from a maximum supply of free or low-priced parking, and the resistance from planning institutions and entities that are accustomed to conventional and inflexible minimum parking standards.
- Commercial and development interests are the groups most likely to put forth pressures to increase the supply of parking or increase exemptions to standards. Corporations, particularly franchise and “big box” chain stores, may potentially oppose changes to the standards, since they generally prefer large quantities of off-street parking.

- Land developers may perceive that parking management techniques applied to new developments could make it less attractive to potential tenants. Businesses may initially express concerns about shared parking.
- Initial resistance from the financing industry may affect developers' ability to construct mixed-use developments which rely on shared parking. This is due to the fact that when a developer seeks funding for a project, the lending source conducts an appraisal of the proposed site and its proposed uses. If the appraiser does not feel that adequate parking has been made available, funding will be reduced.

There are also administrative concerns associated with parking management strategies. Parking management strategies could require changing local codes to remove mandatory minimum parking space requirements and may also require the creation of more flexible parking standards (Urban Design Collaborative, 2003). Some strategies like shared parking may be difficult to administer because they require flexible standards, verification and enforcement. These issues and concerns will be further spelled out below as each individual parking management strategy is discussed in detail.

3.1. Community-Based Parking Requirements

Rather than relying on conventional standards, communities can develop refined standards based on a study of their local needs. Parking requirements can typically be reduced by 10-30% at some sites if standards in the development code reflect local parking demand (Urban Design Collaborative, 2003). Examples of the local factors that affect parking and that should be considered in developing local parking requirements include the following:

- Building/development type and size – Takes into account the specific characteristics of the project site. Parking demand is influenced by the size of the development, as well as the type of land use. Generic parking requirements take some of this into account.
- Surrounding land use mix – Considers the surrounding land uses and density to better understand parking needs and allows one to evaluate overall peak demand. This concept takes the timing of parking demand into account. On-street parking, shared parking and other solutions can be considered here.
- Population and development density – Considers the density and demographic characteristics of the people using the building, including employees, customers, residents and visitors. These factors help in projecting parking demand.
- Availability of non-auto travel modes – Takes into account the modes of transportation available to employees, visitors and residents. Proximity to public transportation, walkable neighborhoods and bicycle amenities are all factors that can reduce parking demand.

The determination of actual parking needs at the local level should include the following key process steps (Urban Design Collaborative, 2003):

1. Delineate the study area/inventory available parking spaces and land uses;
2. Review local parking regulations, identify policy issues and opportunities;
3. Determine parking characteristics;
4. Predict parking demand; and

5. Determine net parking.

There are two primary strengths of community-based parking requirements. Community-based parking requirements allow communities to decide what forms of transportation they want to encourage - pedestrian, bicycle or automobile modes of transportation. More appropriate parking helps to keep land values and housing affordable (Urban Design Collaborative, 2003).

In terms of weaknesses of community-based parking requirements, the following are provided for consideration:

- Funding constraints may limit the study to areas with known problems;
- Difficulties in predicting the effects of future land uses are a factor;
- Achieving consensus on district parking needs may be difficult due to conflicting demands by local groups such as neighborhood and business associations; and
- Ongoing monitoring is needed to ensure that with changing conditions, the local needs are still being met.

3.1.1. Implications / Potential for Implementation in Chagrin River Watershed Communities

The vast majority of the communities that returned the parking surveys reported that the process by which their parking requirements were developed was unknown, indicating that the requirements could have been taken from other communities' existing codes or published parking standards. This highlights an opportunity for utilizing community-based parking requirements. A study can be undertaken of the local parking needs, based on community-specific information, and the study results can be used to revise current parking requirements.

3.2. Shared Parking

Shared parking areas are parking areas or spaces that are used to serve two or more individual land uses. Individual land uses, either on the same site or from nearby sites form an agreement to share available parking or land developable for parking. Shared parking may be applied when land uses have different parking demand patterns and are able to use the same parking spaces/areas throughout the day. Shared parking is most effective when these land uses have significantly different peak parking characteristics that vary by time of day, day of week and/or season. Table 2 below illustrates the variation in peak parking demands and helps to highlight where shared parking agreements can be implemented.

Table 2. Variation in Peak Parking Demands

Weekday Peaks	Evening Peaks	Weekend Peaks
Banks	Auditoriums	Religious institutions
Schools	Bars and dance halls	Parks
Distribution facilities	Meeting halls	Shops and malls
Factories	Restaurants	
Medical clinics	Theaters	
Offices		
Professional services		

Source: Victoria Transport Policy Institute, 2004

3.2.1. Shared Parking Implementation

Shared parking is usually implemented by creating municipal government policy that allows and encourages it, usually requiring agreements to be made between individual facility developers and managers. There are two primary approaches to implementing shared parking: 1) contractual agreements between adjacent users, and 2) parking management districts. Under the first approach, shared parking should be encouraged as part of the review process for two adjacent uses that can demonstrate different peak parking demands. A contractual agreement must be required between sharing property owners in order to ensure the success of the shared parking arrangement and this agreement should be required in the local parking ordinance (Pierson, 2002).

A shared parking agreement should specify the following (Pierson, 2002):

- The number and location of spaces to be shared;
- The nature of the sharing arrangement, providing such details as to the limitations of sharing where necessary;
- Who is responsible for maintaining shared spaces, including striping, sealing, asphalt repair and cleaning;
- Who is responsible for utility and tax payments for the shared spaces;
- Signage requirements and restrictions;
- Enforcement procedures with special focus on monitoring and parking violations;
- Insurance requirements for the shared facilities; and
- Additional legal language that is common to contraction agreements, including indemnification, cooperation, termination, etc.

There are two shared parking agreement examples provided in Appendix B.

The second approach to shared parking is through parking management districts. A parking management district allows for the organization of a special district to oversee the entire parking supply in an area (Pierson, 2002). In a parking management district, all uses within the district would have access to all the parking spaces at any given time. The creation of a parking management district allows parking lots to be comprehensively planned and designed to serve all the businesses in the district. A parking management district allows for the creation of a centralized and consolidated parking system with effective landscaping, pedestrian circulation and lighting, rather than having numerous smaller parking lots throughout a district.

In a parking management district, each property is levied a fee, based on the assessed value of the property, which is used to support the functions of the district (Pierson, 2002). The district then bears the responsibility for parking-related maintenance, security, taxes, enforcement, signage, etc. A parking district is typically governed by an oversight committee that represents the members of the district (Pierson, 2002).

There are several keys to success for parking management districts. The first is that the focus should be placed on compact, mixed-used pedestrian-oriented commercial areas where parking has been under supplied. The second is to charge for parking, as paid

parking will encourage a greater turnover of parking spaces, which is important in an area where parking is in short supply. Lastly, on-street parking should be taken into account (Pierson, 2002). On-street parking spaces should also be managed by the district and should be metered.

There are advantages and disadvantages to parking management districts. In terms of advantages, the fee or tax placed on each property within the district can be used as part of an overall strategy to reduce total parking supply. Parking taxes can also be used to provide transportation services. In terms of disadvantages, parking management districts require a collection system, which imposes transaction costs (Litman, 2000). The taxes can be opposed by both customers and businesses and can cause competitive disadvantages to business, especially if they only apply in certain geographical areas (Litman, 2000).

3.2.2. Changes to the Zoning Code

The implementation of shared parking may require local code changes and the development of appropriate standards and practices that local officials and planners can use to evaluate, manage, and enforce shared parking arrangements (Victoria Transportation Policy Institute, 2004). Most zoning ordinances have minimum parking requirements for each individual use and on multi-use sites, the majority of zoning regulations dictate that the total parking requirement must equal the sum of the requirement for each individual use (Pierson, 2002). If a zoning code does have a sum clause such as that described above, it should not be removed because it ensures an adequate amount of parking where two adjacent uses have similar peak parking needs. Shared parking can also be encouraged by establishing shared parking brokerage services to match potential sharing partners, which can be provided by a local government agency. A local planning department can serve as a repository for information regarding shared parking opportunities so that potential developers interested in implementing shared parking can come to the department for information on available shared parking partners. Appendices 2 and 3 provide model shared parking codes and shared parking agreements. Appendix D provides a sample methodology for determining shared parking.

3.2.3. Barriers to Implementation

Shared parking requires that the following be overcome: 1) the traditional assumption that society benefits from a maximum supply of free or low-priced parking, and 2) resistance from planners and other officials that are used to inflexible minimum parking standards (Victoria Transport Policy Institute, 2004).

The following are recommended practices for shared parking as compiled by the Victoria Transport Policy Institute that can aid in addressing the barriers above:

- Establish shared procedures for implementing shared parking which specify how to calculate minimum parking requirements for different combinations of land uses, acceptable walking distances, requirements for sharing agreements, verifications and enforcement.
- Educate planning officials and developers about the potential for shared parking and procedures for implementing it.
- Provide a maximum amount of on-street parking, and public off-street parking as a substitute for private off-street parking.

- Use local planning agencies to provide shared parking matching and brokerage services.
- Ensure that there is good pedestrian access and appropriate signage for users concerning shared parking.
- Perform regular parking studies, and using feedback from shared parking users, identify problems with shared parking.
- Anticipate potential spillover problems, and provide appropriate regulations and enforcement programs to address these potential problems.

3.2.4. Incentives for Shared Parking

Incentives can be offered for shared parking that can discourage the provision of excessive parking. One incentive that can be provided is an increase in floor area ratio (FAR). For every parking space that can be eliminated on the site through a shared parking arrangement, the allowable FAR area of the building can be increased (Pierson, 2002). The increased building area can thus be expanded into the land area that would have been dedicated to the parking spaces. There can be problems that arise through the use of a FAR bonus. With any additional increase in the building area would come an associated increase in the total parking need, potentially upsetting the balance of the shared parking arrangement (Pierson, 2002). If a FAR bonus is provided as an incentive, there should be a limitation upon the amount the bonus that could be used.

A second type of incentive that can be provided in exchange for shared parking is increased flexibility in some of the development regulations. The allowable building coverage could potentially be increased or the building heights could be increased, allowing for greater flexibility in building design. However, incentives for shared parking may not be needed in all cases, because of the economic incentive for shared parking facilities. Shared parking can reduce the amount of paved parking area that a property owner or developer has to install and maintain.

3.2.5. Advantages / Disadvantages of Shared Parking

As with community-based parking requirements, there are many different advantages and disadvantages associated with shared parking. The following is a list of the advantages that a shared parking program brings about (Urban Design Collaborative, 2003; and Stein Engineering, 1997):

- Shared parking could help create incentives for more diverse land uses to locate in an area due to the fact that they would need to provide fewer parking spaces. Shared parking brings with it the potential to decrease the total number of spaces required for mixed-use developments or single-use developments in mixed-use areas.
- Businesses participating in shared parking can benefit from the “captive markets” resulting from mixed-use developments.
- Businesses participating in shared parking can also reap the benefits in the form of reduced costs of developing and maintaining parking areas.
- Shared parking captures lost value by maximizing economic efficiency of land dedicated to parking.
- Shared parking can reduce the amount of land needed for parking.

- Shared parking can create opportunities for more compact development.
- Shared parking can create more space for pedestrian circulation or more open space and landscaping.
- Reductions in the amount of surface parking provided for each land use means less impervious surface for each new development. This can leave room for swales, vegetation and other features that prevent stormwater runoff from reaching streams.
- Shared parking increases communication and coordination between individual businesses, among business districts and neighborhood residents.

There are also disadvantages associated with shared parking that are evident in the following (Urban Design Collaborative, 2003):

- Shared parking requires overcoming the assumption that society benefits from a maximum supply of free or low-priced parking.
- Shared parking may not work in areas that are homogenous, i.e., the majority of the properties draw people to the area at the same time of the day.
- There may be potential resistance from planning agencies and institutions that are accustomed to inflexible conventional minimum parking standards.
- Shared parking may result in inadequate capacity during unusual peak demand periods.
- Shared parking may be difficult to enforce due to the fact that it requires flexible parking standards as well as frequent verification and enforcement.

3.2.6. Case Studies

3.2.6.1. Portland Parking Study

A study on shared parking which has some findings and implications that can be applied to the analysis currently underway in the Chagrin River Watershed was undertaken in Portland, Oregon. The study was undertaken to document the status of shared parking in the Portland metropolitan area in light of recent efforts taken to address the impact of urban growth on air quality, traffic and other livability issues. These efforts include the Transportation Planning Rule, the Metro Functional Plan and the Ozone Maintenance Plan adopted by the Department of Environmental Quality. The Oregon Transportation Planning Rule calls for a 20% reduction in the vehicle miles traveled per capita and a 10% reduction in the number of parking spaces per capita. The Metro Functional Plan has incorporated these concepts for application at the regional level. The plan establishes both minimum and maximum parking ratios for land uses. It also prescribes more restrictive maximum parking ratios in areas that have sufficient transit service and dictates that jurisdictions must provide blended parking ratios for mixed-use developments. (Blended parking ratios are parking ratios that take into account different parking demands to reduce the number of code required parking spaces rather than simply adding together the code parking requirements for two or more land uses.) The Department of Environmental Quality has adopted an Ozone Maintenance Plan for the Portland Air Quality Management Area, which relies partially on trip reductions and parking ratio maximums. The goal of the plan is to reduce the number of times in which the area exceeds federal standards for ozone levels (Stein Engineering, 1997).

These regulatory measures were the impetus for the shared parking study which was designed to be a region-specific resource for businesses, neighborhoods, developers and jurisdictions to promote greater understanding and use of shared parking (Stein Engineering, 1997). The study involved a review of metro area parking ordinances as well as those of a few other jurisdictions known for having shared parking requirements. A draft shared model parking ordinance was developed along with a shared use agreement. The parking study involved a survey that was sent to government staff, developers and business owners. Interviews were then held to go through the survey and to discuss shared parking, the draft model ordinance and shared use agreement. The responses from the surveys and interviews are summarized below.

Government Staff Responses. Planning and transportation staff members were found to have support for the concept of shared parking, but cited a lack of resources to effectively implement shared parking programs. Staff members specifically cited the fact that the majority of their ordinances either have no shared parking provisions or the provisions are too vague or subject to very loose interpretation (Stein Engineering, 1997). Local planning staff also stated that they lack the appropriate incentives to motivate businesses and developers to take advantage of available reduced parking ratios.

Business Responses. The majority of businesses surveyed and interviewed stated that they have little involvement with or understanding of shared parking. They expressed that there is a potential concern for loss of customers in situations where a large percentage of sales come from drive-by shoppers or where long-term parking is necessary. These concerns can be alleviated through increased customer awareness, short-term parking and enforcement. Those businesses involved in shared parking stated that if people and organizations were educated about the benefits and realities of shared parking, it will become a reality (Stein Engineering, 1997).

Developer Responses. Several concerns expressed by developers dealt with the repercussions of shared parking for site plan review. Developers raised concerns such as the following: if shared parking is an option, what zoning barriers must be overcome? In the short-term, will potential tenants have concerns about perceived advantages of similar properties with higher parking ratios? Other concerns dealt with the potential for the addition of criteria to the development review process. If additional steps are added to the review process, how can the process be made to flow easily through all of the steps?

Another set of concerns raised by developers dealt with financing concerns stemming from the fact that currently, national and local financiers feel uncomfortable with projects that are different from what the industry considers standard, i.e., providing less parking (Stein Engineering, 1997). When a developer seeks funding for a project, the lending source conducts an appraisal of the proposed site and its proposed uses. If the appraiser does not feel that adequate parking has been made available, funding will be reduced.

Criteria for a Successful Shared Parking Program. Out of the surveys and interviews came the following criteria that must be present in a shared parking program in order for it to be successful (Stein Engineering, 1997):

1. Management of District Parking Supply. Parking supply must be actively managed on an individual and district level. This includes management of dedicated and shared parking, both on-street and off-street. One option to achieve this is to develop an area-wide plan which allows development to occur without frequent re-evaluation.

2. Incorporation of On-Street Parking. Through the survey it was noted that most jurisdictions do not count adjacent on-street parking towards meeting parking code requirements. This untapped strategy of utilizing existing parking is a critical way to reduce impervious surfaces.
3. Utilization of Structured Parking. The traditional parking garage is a primary example of shared parking. When parking garages are provided in a central business district, for example, they provide parking for a wide range of businesses and land uses. By utilizing structured parking, a limited surface can provide a large amount of parking spaces.
4. Availability and Utilization of Parking Demand Studies. All participants in the study agreed that the availability of accurate parking demand studies will be critical to the success of shared parking. By demonstrating actual parking needs and uses in the area, it is easier to see which land uses are likely to succeed when paired up for shared parking.
5. Addressing Site Concerns. There are several site concerns that were voiced during the study which are not thought to be major barriers to shared parking due to the ease in addressing them.
    A. Liability – Can be easily managed in shared parking arrangements through the inclusion of shared parking areas under standard business liability coverage.
    B. Location - Should be such that it is convenient to all land uses served by it.
    C. Maintenance – Must be ongoing and thorough. Maintenance concerns should be addressed through a shared parking agreement.
    D. Enforcement – Can help prevent inappropriate long-term use of spaces in a shared parking area and can also protect neighborhoods from overflow parking.
    E. Shared driveways and access management – Can be used to promote shared parking and circulation among adjacent developments. Shared driveways can be implemented if the adjoining land uses are compatible or complementary.
    F. Signage – Must be visible and must clearly convey where parking is available for each land use.

A model shared parking ordinance and a sample shared parking agreement were developed utilizing the results of this study and are included in Appendices B and C respectively.

3.2.6.2. Montgomery County, Maryland

The Montgomery County Code Zoning Ordinance includes shared parking provisions for mixed-use developments, parking reductions for transit-oriented or central business district development, and parking credits for office developments that actively participate in the county share-a-ride program and/or provide private incentives for ride-sharing.

Within the zoning code, there is a specific section dealing with mixed uses. In that section it specifies that when any land or building is under the same ownership or under a joint use agreement and is used for 2 or more purposes, the number of parking spaces is calculated by multiplying the minimum amount of parking normally required for each land use by the five time periods shown in Table 3. The number of parking spaces required is determined by totaling the resulting number in each column and the column total that generates the highest number of parking spaces will become the parking requirement.

Table 3. Montgomery County Required Shared Parking Matrix

Land Use	Weekday		Weekend		Nighttime
	Daytime (6AM-6PM)	Evening (6PM-Midnight)	Daytime (6AM-6PM)	Evening (6PM-Midnight)	Midnight-6AM
Office/Industrial	100%	10%	10%	5%	5%
General Retail	60%	90%	100%	70%	5%
Hotel, Motel, Inn	75%	100%	75%	100%	75%
Restaurant	50%	100%	100%	100%	10%
Theater, Commercial, Recreational	40%	100%	80%	100%	10%
Meeting Center	50%	100%	100%	100%	10%
Multi-family Dwellings in Commercial Districts	50%	100%	100%	100%	100%
Personal Living Quarters	50%	100%	100%	100%	100%
All Other Uses	100%	100%	100%	100%	100%

The Montgomery County parking code also provides for parking reductions for proximity to a Metrorail Station. For general retail uses, regional shopping centers, restaurants, theaters and auxiliary retail uses, a 15% reduction in the standard parking requirements if the entrance to the proposed use is located within 1,600 feet of a metrorail station entrance. There are also credits provided for residential uses. For multiple-family dwelling units, townhouses, and fourplex units, a 10% reduction in the standard parking requirement can be approved if the units are located within a central business district or transit station development area. A 5% reduction can be granted if the units are located within 1,600 feet from a metrorail station entrance.

In addition, the Montgomery County Code Parking Ordinance provides for parking credits for office developments that actively participate in the county share-a-ride program and/or provide private incentive for ride sharing. In sites within share-a-ride districts, a 15% reduction in the standard parking requirement can be granted for participation in the share-a-ride program. The owner of the development must submit a written agreement with the parking facility plan that stipulates the following conditions (Montgomery County, 1997):

- Owner or lessees with more than 25 employees must designate a person to promote the program to employees;
- Owner or lessees must reserve a sufficient number of conveniently located parking spaces to accommodate all employee carpools;
- Owner must make an annual payment to the ridesharing account of the mass transit facilities fund for basic share-a-ride services; and

- Owner must certify semi-annually that the above requirements are being met.

- If private incentives like in-house carpool promotion, reserved carpool spaces and transit pass discount programs are offered, a percentage reduction between 1 and 15% can be granted to the owner if the following is stipulated (Montgomery County, 1997):
- Owner must set aside land for a parking facility or allow for future construction or expansion of a structured parking facility, sufficient to provide additional parking spaces equal in number to the reduction granted;
- Owner must make an annual payment to the ridesharing fund for monitoring and enforcement; and
- Owner must certify semi-annually that the above requirements are being met.

Montgomery County Maryland's Department of Public Works and Transportation Parking Services implemented a system of parking management districts. The basic purpose of parking lot districts is to support the comprehensive development of the central business districts by providing, operating, and maintaining economically self-sufficient parking facilities which keep up with the needs generated by growth in the districts (Urban Design Collaborative, 2003). The emphasis of the program is on planning and defining the future role of parking as it relates to a comprehensive, mixed-use transportation system and master pans for the business districts.

In terms of the funding of the districts, each district's capital and operating expenses must be supported by revenues from that district. There are four main funding sources for the districts (Urban Design Collaborative, 2003):

- Ad Valorem tax – The parking districts are special taxing districts in which commercial properties are levied a tax in lieu of providing for their own parking needs, in accordance with the requirements stated in the zoning ordinance.
- Parking receipts – Fees and receipts are collected through the use of parking meters, through attendants and cashiers at off-street facilities, and through several permit parking programs for monthly rates or car pools.
- Enforcement revenues – Fines from ticketed violations.
- Income from investments – District funds are invested in short-term securities and interest earned is credited to the parking lot districts.

3.2.6.3. St. Paul, Minnesota

The St. Paul Minnesota zoning code states that when at least one of two or more uses has a parking deficiency and their peak parking hours do not overlap, the dual function of their off-street parking spaces can be permitted as long as peak parking hours for the uses do not overlap and the uses within the buildings do not change and require additional off-street parking. Building owners with such shared parking permits must submit an annual statement verifying the non-concurrent peak parking hours of the buildings involved with the shared parking permit and a list of uses within each building to demonstrate that there have been no changes in use that would require additional parking.

The shared parking permit applies to the following uses: office, retail, restaurant, cinema, residential and hotel. The methodology used to determine the minimum number of shared off-street spaces is the department of planning and economic development's current shared parking computer program, which is based on the Urban Land Institute's Model Shared Parking Program. The following conditions shall apply to any shared parking facility for mixed uses:

1. All requirements and conditions imposed on the shared parking facility shall be recorded on the abstracts or certificates of title of the land upon which the facility is located and on the titles and lease agreements of the uses sharing the facility and shall serve as notice to all subsequent purchasers of the existence of the shared parking facility and all requirements associated therewith.
2. Each use in the mixed use development shall be within five hundred (500) feet of the shared parking facility, measured from the nearest point of the building in which the use is located to the nearest point of the shared parking facility.
3. Parking spaces reserved on a twenty-four hour basis cannot be shared and may not be included in the minimum space requirements for the shared parking facility.
4. All uses and buildings comprising the mixed-use development, whether new or existing, must be included in determining the parking requirement.
5. All applications and plans for shared parking facilities shall be submitted for site plan review in accordance with the requirements of this code. All proposed uses for the mixed development, together with all parking spaces and access drives, shall be clearly designated on the site plan. Landscaped areas shall also be designated, and proposed tree and shrubbery plantings shall be described.
6. Parking spaces designated for the handicapped shall be provided in accordance with the provisions of the Accessibility Guidelines for Buildings and Facilities of the Americans with Disabilities Act (ADA).
7. After a shared parking facility has been approved, any subsequent change, addition or deletion in the original mixed land uses or change in intensity of such uses requiring more than five additional spaces shall require permit review and approval by the planning commission. The applicant, its successors and assigns shall certify on demand in writing to the planning administrator and zoning administrator that the mixed use development and shared parking facility continue to comply with the provisions here, the conditions of site plan approval and any covenants, agreements or bonds executed in conjunction therewith; that no substantial physical or operational changes have been made to the mixed use development or shared parking facility; and that intensification of uses has occurred.
8. The month of the year that results in the greatest demand will be used to determine the minimum number of parking spaces required. The planning commission may modify the standard assumptions (percent auto usage, patrons outside hotel, captive market retail – non-retail, and non-captive market residential) if the applicant provides proof of one or more of the following:
    A. The location within five hundred feet of the mixed-use development of other parking facilities whose peak periods of use do not conflict with those of the proposed mixed use development or which have excess parking spaces.

B. For office uses, a ride sharing program, when the applicant submits evidence that it will organize and coordinate a viable ride sharing program. The applicant may be required to submit covenants or other appropriate instruments, in recordable form, to ensure that the applicant and its successors and assigns will continue to implement the ride sharing program.

C. Reservation by the applicant by way of covenant or other instrument in recordable form of land or space within five hundred feet of the mixed use development, sufficient to provide additional parking spaces equivalent to the number of spaces being reduced for a period of not less than five years.

3.2.6.4. Coral Gables, Florida

The Coral Gables Zoning Code includes provisions for shared municipal off-street parking. The code states that shared off-street parking shall be permitted to serve two or more individual land uses at municipally owned or operated parking facilities for parking spaces required under the code, subject to the following conditions and restrictions (Coral Gables, 1998):

1. A recordable agreement for such shared use, in the form of a reciprocal easement acceptable to the Office of the City Attorney shall be filed with the Zoning Administrator and recorded with the City Clerk. The City shall be named in that agreement as one of the parties with right of enforcement.
2. An insurance policy must be obtained and furnished to the City to the satisfaction of the City Manager and City Attorney and such policy shall hold the City harmless from any and all claims or causes of action which may accrue as a result of use of premises or due to an incident or occurrence on the premises.
3. A municipal off-street parking facility required for the purpose of complying with the provisions of this Code shall not include off-street parking similarly required for another private use, unless the Parking, Planning, Public Works and Building and Zoning Directors have reviewed the application and determined that the periods of peak usage of such uses will not be simultaneous or in conflict with one another.
4. A site plan, landscape plan, lighting plan, circulation and traffic plan, peak use analysis, and written description of the proposed use of the shared facility shall be submitted by the applicant with each request for shared use approval for properties operated by not owned by the City. Only a peak use analysis and written description of the proposed use shall be required for parking facilities owned by the City.
5. Shared parking must commence within ¼ mile of the building site. Additional parking, in excess of Code requirements, shall not be subject to this distance requirement.
6. All development orders or permits covering such approval shall include the requirement that the order or permit shall be valid only so long as the conditions described in the application or the permit exist.
7. Nothing in this section shall be construed to prevent the joint use of municipal off-street parking for two or more uses if the total of such spaces, when used together, will not be less than 75% of the sum of the requirements of the various individual uses computed separately in accordance with the requirements of this Code.
8. Shared use parking approval described in this section shall not be transferable in any manner.

9. An agreement shall be executed by the parties as to the minimum maintenance requirements which shall be the sole responsibility of applicant and which failure to maintain shall result in immediate revocation of the permit herein granted.

3.2.7. Implications / Potential for Implementation in Chagrin River Watershed Communities

Several communities within the Chagrin River watershed have already implemented the concept of shared parking and others have expressed an interest in adding such provisions to their codes and ordinances. In Auburn Township, the Board of Zoning Appeals can approve shared parking for business and industrial uses if the following conditions are met: a pedestrian connection between properties exists, properties are within 200 feet of each other, and there are signs indicating the availability of the shared parking. In Bainbridge Township, two or more uses may establish a joint parking area to provide the total number of required off-street parking and loading spaces if approved by the Board of Zoning Appeals. Mayfield Village allows institutions (which include uses such as schools, public administration buildings, religious institutions, hospitals, etc.) to provide up to 50% of their required parking through shared parking in adjacent areas which are accessory to businesses and which normally have different hours of operation. The Mentor code includes provisions for collective parking. These collective parking facilities must provide at least the minimum total number of spaces required for all of the buildings or uses sharing the facilities. The Planning and Zoning Commission in Willoughby Hills can approve a development plan with a reduction in the number of spaces required if the project is a single use project or a project with more than one use for which there are varying peak demands where it can be shown that the uses can adequately be accommodated with a lesser number of parking spaces than required. Pepper Pike and Woodmere do not have codified provisions for shared parking but their Board of Zoning Appeals can approve allowances for shared parking.

3.3. In-Lieu Parking Fees

In-lieu parking fees are established by municipalities as an alternative to requiring on-site parking. With these fees, developers are able to avoid constructing parking on-site by paying the city a fee. The city then provides centralized, off-street parking (USEPA, 1999). The fees are determined by the municipality and are generally based on the cost of providing parking. Fees are set in one of two ways, either by calculating a flat fee for parking spaces not provided by a developer on-site, or by establishing development-specific fees on a case-by-case basis (USEPA, 1999). In-lieu fees are legally justified by the nexus between the fees and the cost of providing public parking spaces; therefore, cities offer this option only in situations where they are prepared to spend the fees generated to provide new public parking facilities (Shoup, 1999).

A survey of the in-lieu parking programs in 46 cities, 24 in the United States, 7 in Canada and others abroad was undertaken in the late 1990s (Shoup, 1999). The survey included the review of ordinances and supporting documents for the in-lieu programs and the interviewing of officials who administer the programs. The survey results are summarized below in three sections: 1) advantages/disadvantages, 2) how cities set the fees, and 3) issues that arise in administering the program.

3.3.1. Advantages/Disadvantages

Based on the information obtained by the survey, the following were cited as advantages of in-lieu fee programs (Shoup, 1999):

- In-lieu fee programs offer a new option to developers in meeting the parking requirements on sites where providing all of the required parking would be difficult or very expensive and can aid in reducing overall construction costs.
- In-lieu fee programs are a means of implementing shared parking. Public parking spaces allow shared use among different sites where the peak parking demands occur at different times.
- In-lieu fee programs allow for better urban design. Cities can put public parking lots and structures where they have the lowest impact on vehicle and pedestrian circulation. Less on-site parking also allows for continuous storefronts without there being gaps for adjacent surface parking lots. The potential for infill projects to be undertaken is also bolstered by in-lieu fee programs in light of the fact that the need for large sites to accommodate for on-site parking is eliminated.
- Fewer variances are required under an in-lieu fee program. Developers often request parking variances when providing the required parking would be difficult. If developers can pay rather than providing the required parking, cities do not have to grant parking variances and can therefore treat all developers consistently.
- In-lieu fees allow for the adaptive reuse of historic buildings where the new use requires additional parking that is difficult to provide.

The survey highlighted the following as disadvantages to in-lieu fee programs for parking (Shoup, 1999):

- In-lieu fee programs can result in a lack of on-site parking which can reduce a development's attractiveness to tenants and customers alike.
- There are no guarantees associated with the provision of in-lieu fee parking. Cities cannot guarantee when or where the parking spaces will be provided. To address this concern, some cities build public parking structures before receiving the in-lieu fees. In this case, the fees are then used to pay back the debt incurred to finance the structure. Other cities return the in-lieu fees if they do not provide the parking within a certain time frame. A city can also delay the collection of the in-lieu fees until the revenue is needed to construct the public parking.
- In-lieu fees will reduce the parking supply if cities provide less than one public parking space for each in-lieu fee paid. Cities may not provide one public parking space for each in-lieu fee paid, but if a city uses in-lieu fees to build public parking spaces rather than grant variances to reduce parking requirements, the in-lieu fee policy will increase the parking supply.

3.3.2. Setting In-Lieu Fees

The survey also provided details as to the two methods used to set in-lieu parking fees. The first approach involves the setting of a uniform fee for each space for all projects. The majority of the cities (37 of the 46) surveyed employ this method. Uniform fees are used due

to their certainty, simplicity and equity. Several example methodologies for setting a uniform fee are provided here. Vancouver, BC has the most sophisticated method for calculating its in-lieu fee ($9,708/space). The fee is the cost of constructing a new public parking space as measured by: 1) the land-and-construction cost per space in a public structure, minus 2) the present discounted value of the net operating income per space during the 30-year life of the structure, minus 3) the present discounted value of the residual property value of the structure, per space, after 30 years (Shoup, 1999). Lake Forest, Illinois' fee ($9,000 per space) is half the city's land-and-construction cost per space in surface lots. The fees in Mountain View, California ($13,000 per space) and Orlando, Florida ($9,883 per space) are the cities' construction costs per space in parking structures, excluding land cost.

The second approach to setting in-lieu fees is to calculate the appropriate fee per space on a case-by-case basis. The survey found that Beverly Hills utilized this approach until 1994. The in-lieu fee for a project was the estimated land-and-construction cost per space to build a nearby parking structure. The fee set per space for each project was the sum of 1) the value of 60 square feet of land within a 300-foot radius of the site, and 2) the average construction cost per space in municipal parking structures. This case-by-case approach required a land-value appraisal to estimate the cost of public parking near each project that applied to pay the fee.

A common question when considering an in-lieu fee parking program is who decides whether to provide parking or pay the fee. Most cities allow developers to choose whether to pay the fee or provide the parking, but a few cities require developers to pay the fee rather than provide the parking. Officials in the cities where the in-lieu fee was required cited several reasons for requiring developers to pay the fees. These reasons include a range of factors: to centralize parking facilities, to put more of the parking supply under public management, to encourage shared parking, discourage the production of an excessive amount of surface parking lots, to emphasize continuous storefronts, to improve pedestrian circulation, to reduce traffic congestion, and to improve urban design (Shoup, 1999).

Several examples of communities that require in-lieu fee parking are provided here. Berkley requires developers of lots fewer than 30,000 square feet to pay fees instead of providing the parking. Calgary, Alberta requires developers to provide half the required parking and to pay fees for the other half. Orlando requires developers to pay fees instead of providing the first required parking space per 1,000 square feet, and allows them to choose whether to providing parking or pay fees for the remainder of the required parking. Carmel, California and Lake Forest, Illinois require developers to pay fees in lieu of all the required parking.

3.3.3. Case Studies

3.3.3.1. Miami's Coconut Grove, Florida

Coconut Grove is a pedestrian-oriented, entertainment, dining and shopping village in southern Miami. In an effort to maintain Coconut Grove's continuous street frontage, city planners established flexible parking requirements. Developers or property owners have three choices for satisfying minimum parking requirements: 1) they can provide off-street parking, 2) they can contract spaces elsewhere, or 3) they can pay in-lieu fees (USEPA, 1999). The in-lieu fee is $10,000 per stall or payments of $50 per stall per month. Due to the combination of little space left to develop and high land costs, most property owners choose to pay the $50 per space per month fee. Since the implementation of the program in 1993, developers have opted out of 938 spaces, generating approximately $3 million in

revenues (Victoria Transport Policy Institute, 2005). The majority of those funds were used to develop a 416-space garage that has ground floor retail. Other uses of the fee-generated funding have been a $250,000 study for a downtown circulator and a $100,000 for a Parking Mitigation Project, which included landscaping and installation of traffic control devices.

3.3.3.2. Lake Forest, Illinois

Lake Forest has had an in-lieu fee policy for about 15 years. The policy was put into place due to the desire to preserve the historic character of the downtown. The fee is currently set at $22,000 per stall and all funds generated through the fee must pay for parking acquisition or development (Victoria Transport Policy Institute, 2005). The city considers the program effective and developers have responded favorably to the fee option due to the scarcity of developable land.

3.3.3.3. Jackson, Wyoming

Jackson adopted an in-lieu fee program in 1994 along with a new Comprehensive Plan and parking minimums. The in-lieu fee option came about as a response to concerns that the parking minimums would hinder economic development (Victoria Transport Policy Institute, 2005). The per-stall fee ranges from $1,000 (for up to four stalls) to $10,000 (for more than 41 stalls), dependant upon the number of stalls being opted out. The City is not required to adhere to a specific timeline or proximity of new parking, but the City is restricted to using the funds only for construction of parking. According to the City, the policy is used frequently.

3.3.3.4. Bend, Oregon

Bend's in-lieu fee policy was adopted in 1992 and was initiated due to concerns about constrained land for development. Developers have the option of constructing parking, leasing parking off-site or paying the in-lieu fee (Victoria Transport Policy Institute, 2005). The fee must go into the parking fund and can be used only to pay for parking either in or adjacent to the central business district (CBD). The fee was set very low at $510/stall and is currently under evaluation for a potential increase. The limited funds generated have become problematic in terms of expectations for the city to provide parking.

3.3.4. Implications / Potential for Implementation in Chagrin River Watershed Communities

In-lieu fee payments are a means of implementing shared parking and based on the fact that several of the communities have indicated an interest in shared parking, in-lieu fee payments could be a viable option for implementation throughout the watershed. In-lieu fee payments also discourage the creation of an excessive amount of surface parking lots. More than half a dozen communities in the watershed have reported that there is too much office and retail parking in their communities, therefore the implementation of in-lieu fee payments would provide for a means to further regulate the provision of additional parking.

3.4. Parking Maximums

Maximum rather than minimum parking standards should be established. Maximum parking limits restrict the total number of spaces that can be constructed for a particular use. Typically, a maximum number of parking spaces is based on the area of a specific land use (Urban Design Collaborative, 2003). Imposing a parking limit does several things: 1) it

encourages better use of existing facilities, 2) it forces businesses to encourage their employees and customers to use alternative travel modes, and 3) allows for more paid parking (Litman, 2000). A parking plan is the usual enabling policy for parking maximums. This plan may contain things such as formal or informal parking cap, parking code provisions such as maximums and minimums, requirements for site-specific parking plans, and other provisions (Urban Design Collaborative, 2003).

There are several requirements that must be met with respect to the successful implementation of parking maximums. Considerable administrative effort is needed to ensure that the parking maximums are accurate for the area. Periodic parking surveys, studies, plan and policy updates may be needed to make ongoing decisions about the allowed number of spaces per zone or area and what exemptions to allow (Urban Design Collaborative, 2003). Monitoring is also needed to ensure that no more than the maximum parking is provided. The actual parking requirements for the community must be determined for the various land uses in order to allow for an accurate maximum to be established.

Establishing parking maximums allows for an improved urban environment with more open space and less impervious surfaces. Parking maximums also reduce congestion and encourage attractive, pedestrian-friendly urban design. Non-automobile modes of transportation are promoted through the use of parking maximums and costs for parking construction, operation and maintenance can be reduced (Urban Design Collaborative, 2003).

There are also weaknesses associated with parking maximums. There can be potential political pressures from commercial and development interests to increase the supply or broaden exemptions (Urban Design Collaborative, 2003). Parking maximums may result in parking spillovers if mitigation and monitoring is not present. Parking maximums are dependent on many other variables making it difficult to accurately predict what the maximum should be. The availability of non-auto transit options is critical to the success of parking maximums. For parking maximums to succeed in an area, there must be accessible and frequent public transportation (Urban Design Collaborative, 2003).

3.4.1. Case Studies

3.4.1.1. Redmond, Washington

The City of Redmond implemented maximum parking limits in the early 1990's to manage growth and traffic. These requirements limit the total number of parking spaces that can be developed by land use. For example, general commercial land uses are limited to five spaces per 1,000 square feet of gross floor area (GFA), and business parks are limited to three spaces per 1,000 square feet of GLA.

3.4.1.2. Portland, Oregon

In 1975, the City of Portland set an overall cap of approximately 40,000 parking spaces downtown, including existing and new parking facilities. The cap was increased to about 44,000 spaces by the 1980's and increased again in the 1990's. The parking cap has allowed for an increase in transit usage. Portland restricts offices in the central business district to 0.7 parking spaces per 1,000 square feet and retail to 1.0 space per 1,000 square feet of net building area. These maximum limits vary according to distance from light-rail stations. For example, new office space on the light rail transit mall is allowed 0.8 spaces

per 1,000 square feet, while office space located several blocks from the transit mall is allowed 2 spaces per 1,000 square feet (USEPA, 1999).

3.4.1.3. San Francisco

San Francisco's "Transit First" policy allows parking to consume only up to seven (7) percent of a building's gross floor and new buildings must have an approved parking plan prior to receiving an occupancy permit.

3.4.1.4. Seattle

The City of Seattle allows a maximum of one parking space per 1,000 square feet of downtown office space.

3.4.2. Implications / Potential for Implementation in Chagrin River Watershed Communities

Parking maximums may not be a viable option for implementation in the Chagrin River watershed communities due to the fact that they are usually associated with larger cities with widely accessible transit options. Due to the fact that many of the communities in the Chagrin River watershed are smaller villages or townships and the transit options are fairly limited (i.e., Geauga and Portage County transit services), parking maximums would not rate highly as a mechanism for the reduction of impervious surfaces associated with parking.

3.5. Park and Ride Options and Transit Programs

Park and ride consists of parking facilities at transit stations, bus stops and highway onramps, especially those at the urban fringe, that are implemented to facilitate transit and rideshare use (Victoria Transport Policy Institute, 2005). Parking is usually free at park and ride locations or is significantly less expensive than in urban centers. Park and ride facilities can be implemented so that they incorporate the concept of shared parking. Portland has implemented shared parking at its transit stations. Portland's Tri-Met Park and Ride Policy encourages shared parking near transit stations as an efficient and cost-effective way to provide parking while simultaneously minimizing the amount of land used for parking facilities (Victoria Transport Policy Institute, 2004). Park and Ride lots are shared with apartment complexes, a regional justice center, churches and movie theaters at more than three dozen sites. Parking is free at these lots and these lots are to be used on weekdays and only by bus and light-rail riders, carpools and vanpools.

Park and ride programs are implemented to facilitate transit and rideshare use which are other mechanisms for reducing parking requirements. Park and ride programs can be associated with a variety of transit options, ranging from light-rail to commuter buses.

Several counties in Northeast Ohio have implemented transit and park and ride programs. The programs of those counties that make up the Chagrin River Watershed are highlighted below.

3.5.1. Cuyahoga County

The Greater Cleveland Regional Transit Authority (RTA) is the largest transit system in Northeast Ohio with over 100 bus routes, four rapid transit rail lines and year-round

operations. The RTA system serves more than 60 million riders each year, covers all of Cuyahoga County and connects with other county and municipal public transit systems operating in the area. (Figure 1)

The RTA bus system consists of three main types of bus routes: local buses, Express/Flyer buses, and the Community Circulators and downtown Loop buses. Local buses provide extensive service throughout the City of Cleveland and other Cuyahoga County communities. They circulate on the major avenues and boulevards and there are some that run on smaller streets as well. Express and Flyer buses provide longer distance travel with fewer stops, generally connecting Cleveland's suburbs with downtown. Express buses usually run all day and Flyers usually run only during the morning and afternoon rush hours. There is a park and ride lot located in Solon on Portz Parkway for the Express bus. The Community Circulator buses operate set circular routes within neighborhoods, such as Tremont and St. Clair-Superior. They are inexpensive and link residential areas with local shopping, services, medical facilities and RTA's local and express buses. The Loop Buses are also inexpensive and circle through Cleveland's downtown area from 6 am to 6 pm. There are two routes: the City Center Loop and the Outer Loop.

Figure 1. RTA Rapid Transit Rail Line

The RTA also has a Rapid system which is Ohio's only rail-based public transit service, operating on the Red, Blue, Green and Waterfront lines. Tower City on Public Square is the rail system's hub. The Red Line travels from Cleveland Hopkins International Airport through West Side neighborhoods to the Tower City station downtown and then eastward to Louis Stokes/Windermere Station in East Cleveland. The Green and Blue Lines connect downtown Cleveland's waterfront attractions and Tower City to Shaker Square on the east side. The lines spilt as they continue east. The Green Line follows Shaker Boulevard east

from Shaker Square and terminates at Green Road. The Blue Line travels southeast from Shaker Square and follows Van Aken Boulevard, terminating at Warrensville Center and Chagrin Roads. The Waterfront Line route takes riders through the Flats and past North Coast Harbor destinations.

3.5.2. Geauga County Transit

Geauga County's transit service is limited to a door-to-door transportation system geared towards the elderly and people with disabilities. The County currently does not have a fixed bus route or other forms of transit.

3.5.3. Lake County

LAKETRAN is the third-largest transit system in Northeast Ohio and serves Mentor, Painesville, Willoughby, Fairport Harbor, Madison and other Lake County destinations. Six fixed bus routes provide service within Lake County, Monday through Friday, and there are some buses that also operate on Saturdays. Bus stops along LAKETRAN's six fixed routes are located at major destinations and intersections and are indicated by LAKETRAN bus stop signs. The six fixed routes are listed below:

- Route 1: Painesville, Mentor, and Great Lakes Mall
- Route 2: Mentor, Willoughby, Wickliffe, Euclid
- Route 3: Mentor, Lakeshore Blvd., Shoregate
- Route 4: Madison, Painesville
- Route 5: Painesville/Fairport Circulator
- Route 6: Shops of Willoughby Hills, Shoregate, Lakeland, Great Lakes Mall via Vine Street

Four commuter routes provide rush-hour service between Lake County and downtown Cleveland. Commuter buses depart from Mentor, Madison, Willowick and Wickliffe. Park-n-Ride lots are located at the Mentor Civic Center, the Madison Village Fire Station, Lakeland Community College in Wickliffe, Eastlake Stadium, and at the Shops of Willoughby Hills. Free parking is available at all LAKETRAN lots. The five commuter routes are listed below:

- Route 10: Mentor Park-n-Ride
- Route 11: Madison, Lakeland Park-n-Ride
- Route 12: Willowick/Wickliffe Park-n-Ride
- Route 13: Wickliffe/Willoughby Hills Park-n-Ride
- Route 14: Eastlake Park-n-Ride
- New Route – Painesville Township Park-n-Ride

Dial-A-Ride is a door-to-door assisted transportation system for all Lake County residents, with a special focus on senior citizens and people with disabilities.

3.5.4. Portage County

Portage Area Regional Transit Authority offers limited service with two scheduled fixed bus routes and Dial-A-Ride service within the county for county residents. The first fixed route provides service Monday through Friday to Windham, Garrettsville, Freedom Township and Ravenna, with morning and afternoon trips available between Mantua and Ravenna. The second fixed route is the Southeast Kent Circulator, which offers service within the southeast portion of Kent. The Dial-A-Ride service applies to residents in Kent, Ravenna, Brady Lake, Franklin Township or Ravenna Township. These transit services do not benefit the Chagrin River watershed communities.

3.5.5. Implications / Potential for Implementation in Chagrin River Watershed Communities

There are existing park and ride lots and transit options in the watershed that could be integrated into local ordinances and codes in order to decrease the amount of required parking needed. For example, in Montgomery County, Maryland, parking reductions are provided for proximity to a Metrorail Station. General retail uses, regional shopping centers, restaurants, theaters and auxiliary retail uses can receive a 15% reduction in the standard parking requirements if the entrance to the proposed use is within 1,600 feet from a station entrance. In Cuyahoga County, there is an established bus and rapid system with associated park and ride lots; however, there are limited opportunities for its use in the Chagrin River watershed communities. There are two fixed bus routes that service the Mayfield area and a park and ride lot located in Solon which is geared towards commuters to downtown Cleveland. The Lake County transit system, LAKETRAN, may be the most applicable for the communities within the watershed. There are several bus routes that service the watershed communities of Mentor, Willoughby, Wickliffe and Willoughby Hills. Proximity to these stations could be used to reduce the required parking for retail uses.

3.6. Landbanking

Landbanking is a method by which developers or business owners can designate an area for future parking if the need arises, but instead of paving the area, it can be landscaped or kept as open space. Landbanking reduces impervious surface area and also eliminates the risk of future insufficient supply. Landbanking allows property owners to defer construction of required parking spaces if the minimum requirement is substantially larger than the number of spaces anticipated by the applicant. Several communities within Ohio and within the Chagrin River Watershed are looking into or have already implemented landbanking for required parking. A study completed in 2003 for Dayton, Ohio recommends that at least 75% of the required parking be constructed initially, with suitable area for construction of the remaining 25% reserved (DB Hart, 2003). In DuPage County, Illinois, landbanking of required parking is spelled out in their zoning code. Under the code, the Planning and Zoning Commission may grant a conditional permit to reduce the total number of off-street parking spaces required to be paved. Alternate parking plans are required to be submitted along with each application for a conditional use permit for landbanking. One plan must show the total number of spaces required pursuant to the code, and the other plan must show the proposed number of spaces to be provided pursuant to the conditional permit. This second plan must also show the landscaping treatment of areas proposed to be reserved for future parking requirements. DuPage County requires that as a condition of the granting of a conditional permit, the applicant must file a covenant with the City Manager that says that areas reserved for future parking shall be maintained as landscaped open space until and

unless required to be used for off-street parking pursuant to the conditional permit. See Appendix E – Sample Language for Landbanking of Required Parking.

3.6.1. Implications / Potential for Implementation in Chagrin River Watershed Communities

As with shared parking, the concept of landbanking has already been implemented by several communities within the watershed and there are communities that have shown an interest in the incorporation of landbanking in their local codes and ordinances. Auburn Township currently allows landbanking for business and industrial districts. The Board of Zoning Appeals can authorize a reduction in the number of spaces to be constructed when evidence is provided that the required number of spaces is substantially in excess of the parking needed to serve the building or use. Sufficient usable space must be reserved on the property for potential future use and must be shown on the approved plan. The Board of Zoning Appeals in Bainbridge Township also allows for landbanking of required parking. The land must be reserved as landscaped open space areas on the lot and be indicated on the site map.

3.7. Bicycle Parking Bonus

Bicycle parking and storage are important ways to provide convenience and security for cyclists at destinations but bicycle parking can also reduce automobile parking and travel demand if inadequate bike storage is currently a major deterrent to bike transportation. Effective bicycle parking requires a properly designed rack that has been placed in an appropriate location on the site. (Figure 2) A bicycle parking bonus can be provided as a mechanism for reducing required parking. For example, in St. Paul, Minnesota, the zoning code allows for a bicycle parking bonus that applies to nonresidential uses. A nonresidential use with between 5,000 square feet and 10,000 square feet of land area dedicated to parking may substitute bicycle parking for a portion of its minimum off-street parking requirement not to exceed one parking space. For nonresidential uses with more than 10,000 square feet of land area dedicated to parking, bicycle parking may be substituted for a portion of its minimum off-street parking requirement not to exceed two parking spaces. The code states that for calculation purposes, two completely enclosed and secure bicycle lockers are the equivalent of one parking space as are five spaces in a bike rack. Schaumburg, Illinois requires that the following uses install bicycle parking: retail centers, office and professional uses, restaurants, and cultural, recreational and entertainment uses.

Figure 2. Secure Bicycle Rack

3.7.1. Implications / Potential for Implementation in Chagrin River Watershed Communities

Due to the semi-rural nature of some of the communities within the watershed and the existing bike lanes and Metro Parks trail systems that help to promote biking, a bicycle parking bonus could be an option for the communities of the Chagrin River watershed to consider.

3.8. Improving Parking Lot Design with the Goal of Reducing Impervious Surfaces

Parking lot design can be improved to significantly reduce the overall parking footprint. Overall imperviousness can be reduced through the provision of compact car spaces, minimizing stall dimensions, using porous surfaces in overflow areas where feasible and incorporating bioretention areas within the design of the parking lot. Other parking lot design considerations include the angle of parking spaces provided and the parking lot driveway width, both of which are factors that can influence overall site imperviousness. These factors are discussed in detail below.

3.8.1. Compact Car Parking Spaces and Minimizing Stall Dimensions

Traditionally communities have required that each parking space have minimum dimensions. A minimum stall of 10' by 20' or 9' by 18' is common (NEMO, 1999). The City of Olympia, Washington 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 space (NEMO, 1999). Due to the fact that the average size of cars sold in the United States has declined over the past decade or so, many communities are decreasing the required parking space size. Several examples of communities with compact parking requirements are provided below:

- Sacramento County, California: minimum of 8' x 16'
- Humboldt County, California: 7.5' x 15'
- Benton County, Washington: minimum of 7.5' x 15'
- Kennewick, Washington: 7.5' x 15'
- Amherst, Massachusetts: 8' x 16'
- Elk Grove, California: 9' x 16'

These numbers above fall within the numbers obtained through a 1982 survey of 900 local governments that was undertaken by the American Planning Association (APA). This study found that 33% of the respondents had reduced the minimum parking space size in their zoning codes. 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 space dimensions were 7'6" x 15', resulting in 112.5 sq ft in area, a significant reduction from the traditional 180 or 200 sq ft in area (NEMO, 1999; Asphalt Paving Association of Iowa). In order to illustrate the reduction in impervious surface that results from the use of smaller or compact car spaces, the following example is provided. In a 100-space parking lot where 25% of the spaces are designed with compact stall dimensions (7'6" x 15') and the remaining 75% are designed with standard stall dimensions (9' x 18'), the overall paved area would be 15,000 square feet. In a 100-space parking lot with 100% of the spaces designed with standard stall

dimensions, the overall paved area would be 16,200 square feet. Thus, the lot designed with the incorporation of compact spaces provides a savings of 1,200 square feet of paved area.

More than half of the communities within the Chagrin River watershed have parking space dimensions that are consistent with the traditional minimum stall dimensions of 10' x 20' or 9' x 18'. The majority of these communities specify that the 10' x 20' or 9' x 18' stall dimensions are a minimum, rather than specifying that those dimensions are a maximum.

When compact car spaces are utilized within a parking lot, they should be grouped together in one area in order to promote their use. In the majority of communities utilizing compact car spaces, there is a maximum percentage of the parking lot that can be set aside for designation as compact. These maximums range from 25% up to 50% of the total spaces. St. Paul, Minnesota allows for up to 50% of spaces to be designed for compact cars, with dimensions of 8' x 16'. The St. Paul code dictates that compact spaces must be designated by signs with a minimum of one sign for every four compact spaces.

Currently, compact car spaces are utilized very sparingly in the watershed, highlighting an opportunity for implementation. Based on the survey results, only one community has provisions for compact car spaces within the local codes. The City of Mentor allows for compact car spaces (9' x16') to be utilized in planned shopping centers with more than 150 spaces. These lots can have 10% of the total parking designated as compact spaces.

3.8.2. Parking Lot Entrances / Aisleways

In addition to the actual parking space, parking lot driveways can also influence the amount of paved area associated with parking lots. Lengths and widths of parking lot driveways should be kept as narrow and short as possible. Driveway widths of 9 feet for single lane drives and 18 feet for double lanes are often sufficient (NEMO, 1999). As an example of a community that has implemented these reduced standards, the parking code for Amherst, Massachusetts specifies that for entrance and exit driveways for parking areas containing less than 5 spaces, the minimum width of the driveways must be 10 feet for one-way use and 18 feet for two-way use.

The Ohio Department of Transportation (ODOT) has a Roadway Design guidance manual in which there is a section dedicated to Access Control. In this section, there are driveway width standards included for several different land uses. In terms of commercial drives, the manual states that the access requirements of most commercial developments can be served by driveways having standard design characteristics. The exceptions to this rule are driveways having high traffic volumes, those being used by large vehicles, or those serving businesses which have unique traffic patterns. The width of a standard commercial drive is suggested to be a 35-foot maximum. Standards for shopping centers and industrial drives are presented in the manual to serve as a guide for the design of driveways for high volume traffic generators, such as shopping centers and industrial plants. ODOT recommends that each driveway traffic lane should have a minimum width of 10 feet, 12 feet being preferred.

The driveway widths for the communities in the watershed were specified primarily for retail, office and medical/dental uses. Those communities that did specify driveway widths provided widths for predominantly one and two-lane driveways. The most common range in terms of width for 1-lane driveways is between 12-14 feet. The widths for 2-lane driveways were more variable, ranging from 18-30 feet, but the most common was 24 feet. The widths

then for single and double lane driveways exceed those which have been cited by NEMO as being sufficient (i.e., 9 feet for single and 18 feet for double).

Another concept for consideration with respect to parking lot driveway widths is the provision of joint use driveways. In the Roadway Design Manual published by ODOT, provisions for joint driveways are included. The manual states that a jointly owned drive may be permitted upon joint application by both property owners. Junction City, Oregon is an example of a community that has provided for joint access. Under Ordinance No. 950, they allow for the establishment of joint use driveways for new commercial retail and service uses wherever feasible and requires that an easement be recorded with the deed allowing cross access to and from other properties served by the joint use driveways and cross access.

3.8.3. Angles of Parking Spaces

There are four angles used to design parking spaces: 90°, 60°, 45° and 30°. The angle used depends on the situation and the available space. (Figure 3) 30° and 45° parking are used when the overall parking area is narrow and necessitates a reduced traffic aisle width (NEMO, 1999). The tradeoff between using these angled parking spaces is the fact that these require a large amount of paved area per vehicle, approximately 252 square feet per car. The 60° space is often used due to the fact that it provides a greater ease of entering the space and backing out of the space and also due to the relatively narrow (18') traffic aisle associated with it (NEMO, 1999). The amount of paved area per car associated with a 60° parking space is approximately 217 square feet. 90° parking uses the least amount of paved area per vehicle at only 171 square feet (NEMO, 1999). The high degree of difficulty for entering and exiting this type of parking space is more suited to all-day parking, such as employee parking (Asphalt Paving Association of Iowa). Only five of the community surveys for Chagrin River watershed communities indicated that their codes include provisions for angled parking with angles specified.

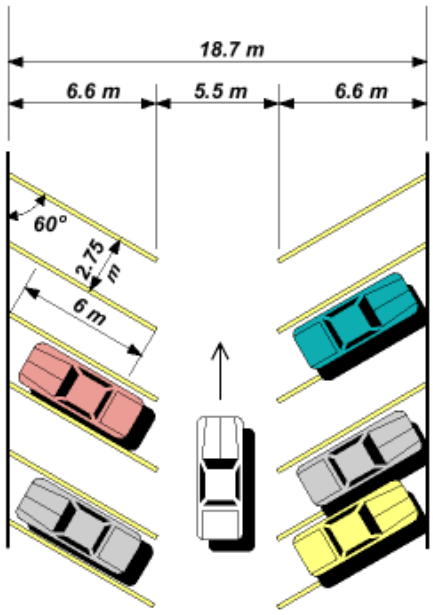

Figure 3. Parking Lot Angle

3.8.4. Incorporation of Stormwater Management Practices

3.8.4.1. Porous Pavement

Employing alternative surfaces such porous pavement is an effective way to reduce the amount of runoff generated by parking lots. Porous pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before infiltrating it into the subsoil. Porous surfaces can replace conventional asphalt or concrete in both new developments and redevelopments and are best utilized in overflow parking areas. (Figure 4)

Porous pavement provides both water quality and quantity benefits. It can reduce the amount of total suspended solids, total phosphorus, total nitrogen and metals contained in

stormwater runoff. With respect to water quantity benefits, excessive levels of runoff are avoided through the reduction in impervious surfaces.

Typical maintenance requirements for porous pavement include the following:

- Avoid sealing or repaving with non-porous materials;
- Ensure that the paving area is clean of debris (monthly);
- Ensure that the paving dewaters between storms (monthly);
- Ensure that the area is clean of sediments (monthly); and
- Vacuum sweep frequently to keep the surface free of sediment and follow by high-pressure hosing to free pores from clogging (at least 4 times a year).

Figure 4 Porous Pavement

In cold climates, there are three major concerns associated with porous pavement: 1) keeping road salt from clogging the pores of the pavement, 2) plowing may be challenging on block paver surfaces because the edge of the plow blade can catch on the edge of the blocks, damaging the surface, and 3) the infiltration of runoff below the pavement may cause frost heave. However, porous pavement has been implemented successfully in cold climates. Several examples are provided below (Lake County Forest Preserves, 2003):

- Annsville Creek Paddlesport Center, New York State Parks - The pavers were installed in November of 2001 and have encountered no problems in function. No problems have been reported in winters or with the heavy spring rains. No heaving, clogging or ponding has been reported.
- Morris Arboretum, University of Pennsylvania, Philadelphia - The parking lot has lasted for 10 years and due to the success of the lot, the Director of Programs "advocates and promotes" the use of permeable pavement. The parking lot does not heave with frost and cold temperatures. Periodically the parking lot needs to be vacuumed but overall, maintenance is not reported to be a problem.
- Walden Pond State Reservation, MA - A porous pavement parking lot was installed in 1977 to address environmental concerns and twenty years later, the pavement is still functioning and works well in the freeze-thaw environment.

3.8.4.2. Bioretention

In addition to porous pavement, there are other best management practices that can be implemented in parking lot design to reduce impervious surfaces and address nonpoint source pollution. Nonpoint source pollution from urban impervious surfaces like parking lots is a major contributor to the impairment of Ohio's streams. Parking lots collect grease, oil, antifreeze, litter and other debris which is washed into the streams following precipitation events. Detention basins are constructed to detain excess runoff from large parking lots but these off-site basins are often unattractive and do not make good use of the land (OSU Extension, 2001).

An alternative to detention basins is the integration of parking lot runoff into landscape or bioretention islands. (Figure 5) These bioretention islands are capable of treating stormwater with a combination of microbial soil processes, infiltration and evaporation which is accomplished through appropriate vegetation (OSU Extension, 2001). In contrast to the typical landscape islands that are set higher than the pavement, bioretention areas are depressed below the paved surface so that surface runoff is directed into the depressions. In many cases, the filtered runoff is collected in a perforated pipe under the bioretention island and is returned to the storm sewer system.

Figure 5. Parking Lot Bioretention Island

Bioretention islands can fit easily into a project in an urban area where land availability for traditional facilities is scarce. Existing parking lot landscaping islands can be retrofitted to incorporate bioretention. In order to maximize on the pollutant removal capabilities of the bioretention island, the island should be sized between 5% and 10% of the impervious area draining to it. Bioretention should usually be used on small sites (5 acres or less) due to the tendency to clog on larger sites. These islands require proper engineering, design and construction as well as regular maintenance. Appropriate plant choices are crucial to the long-term success of the bioretention islands. Trees must be able to withstand both drought and periodic flooding of their root systems, and they should be deep-rooted (OSU Extension, 2001). All shrubs and herbaceous plants used under trees in bioretention islands should be shade tolerant and if salting in winter occurs, salt tolerant.

The typical maintenance activities associated with bioretention facilities are outlined below:

- Remulch void areas and treat diseased vegetation (as needed);
- Water plants daily for two weeks (at project completion);
- Inspect soil and repair eroded areas/remove litter and debris (monthly);
- Remove and replace dead and diseased vegetation (twice per year);
- Add additional mulch (once per year); and
- Site should be inspected and debris removed after every major storm.

Several communities within the Chagrin River watershed have codes or ordinances with provisions related to landscaped islands which could easily be modified to include bioretention. For example, Auburn Township specifies that for any parking area that contains more than 2 rows of parking and is designated to accommodate 30 or more vehicles, not less than 10% of the parking lot area shall be planted as landscaped areas. These landscaped islands must be a minimum of 10 feet in horizontal dimensions and provide at least one shade tree. Mayfield Village also requires 10 feet wide planted islands to interrupt expansive

areas. Orange Village requires that all parking areas with more than 40 spaces shall contain planting strips or islands to interrupt the mass of paved area, aid in controlling the flow of traffic, and provide visual quality. They require a minimum of 5 square feet of landscaped area for each 100 square feet of vehicle area.

3.8.4.3. Sand Filters and Filter Strips

In small parking lots where space does not allow for landscaped islands, biofiltration of stormwater runoff can be achieved through the diversion of the stormwater runoff to a landscaped area at the perimeter of the lot. (Figure 6) This can be accomplished through sand filters and grassed filter strips located along the perimeter of the lot. Curbing can be removed from the perimeter of paved areas, allowing sheet flow of stormwater runoff into these filtering areas.

Figure 6. Parking Lot Filter Strip

A typical sand filter can be described as consisting of a sediment chamber with an associated filter bed of sand. Coarse sediments drop out in the chamber and the runoff is then spread over the sand filter bed where pollutants are trapped or strained out. There are three types of sand filters: surface, underground and perimeter. Sand filters can be applied to drainage areas of 1-10 acres and have few constraints, so they can be applied to most developed sites. Sand filters function solely in water quality improvement; they do not provide any water quantity benefits.

In terms of sand filter maintenance, the filtering capacity is of utmost importance. At least once a year, the filter should be inspected after a storm to assess the filtration capacity of the filter bed. Maintenance operations to restore the filtration capacity require the removal of the top few inches of discolored sand followed by replacement with new sand.

Filter strips are typically bands of close-growing vegetation, usually grass, that are used to treat very small drainage areas. They are very well-suited to treating runoff from small parking lots and roads. Filter strips provide both water quality and quantity benefits and the primary maintenance requirement for filter strips is mowing.

3.8.4.4. Landscaping Requirements

Landscaping can be used to treat and manage stormwater and in doing so, landscaping has several advantages over the usual underground systems (City of Portland Bureau of Planning, 2001):

- Landscaping cools the runoff and can be beneficial for streams that have problems due to increased temperature.
- Pollutants are filtered and trapped in soils and broken down by the micro-organisms found in the soil. In many cases, this soil filtration can provide adequate stormwater

treatment and can completely prevent some pollutants from entering the stormwater or combined sewer systems.

- Landscaping can increase evaporation, transpiration, and infiltration, which yields a reduction in the total amount of runoff from each storm event.
- Construction costs for the landscape approach are less than for conventional underground systems.

In terms of landscaping requirements, some communities require landscaping in all parking lots regardless of size, while others require it in minimum sized lots, where the requirements are expressed either in total area or number of parking spaces (NEMO, 1999). Suggested minimum areas of parking lots to be landscaped range from 5% to 25% of the total paved area. In a 1964 Planning Advisory Service report published by the American Planning Association, entitled "Parking Lot Aesthetics," a minimum of 10% of a parking lot's total area is recommended for landscaping. This percentage is the minimum standard used by most planners, engineers and landscape architects (NEMO, 1999).

The City of Portland adopted stormwater-related amendments to the zoning code that would integrate stormwater management into site and facility design right from the start of planning. Because parking lots provide significant opportunities for improving stormwater management, they were a focus of the amendments. The parking amendments were intended to promote the integration of stormwater management facilities into parking-lot layout, to improve the appearance of parking lots, and to reduce the cost of providing stormwater management and aesthetic benefits in parking lots (City of Portland Bureau of Planning, 2001).

Similar to the American Planning Association requirement for landscaping, the Portland amendments also dictate that 10% of all parking and loading areas should be landscaped in addition to the perimeter landscaping already required for screening (City of Portland Bureau of Planning, 2001). As defined in the Portland document, parking and loading areas include parking spaces, aisles and loading areas but exclude driveways, drive-thru lanes and fire lanes. Driveways are not included because research has shown that common driveway designs make it too difficult to provide space for the 10% landscaped area requirements in addition to the walkways and perimeter landscaping (City of Portland Bureau of Planning, 2001). BMPs such as swales, vegetative filters and bioretention facilities can all fit within 10% of a site.

The Portland parking amendments also dictate that a portion of a parking space can be landscaped instead of being paved. This will allow cars to overhang the edge of the landscaped areas (City of Portland Bureau of Planning, 2001). This measure helps to further offset the demand for additional space that is created by the increase in landscaped area requirements. The landscaped portion of the parking space can count toward the interior landscaping requirements – the 10% interior landscaping requirement (City of Portland Bureau of Planning, 2001). However, the landscaped portion of the parking space cannot count toward the perimeter landscaping requirements because the car overhangs would reduce the perimeter width. (Figure 7)

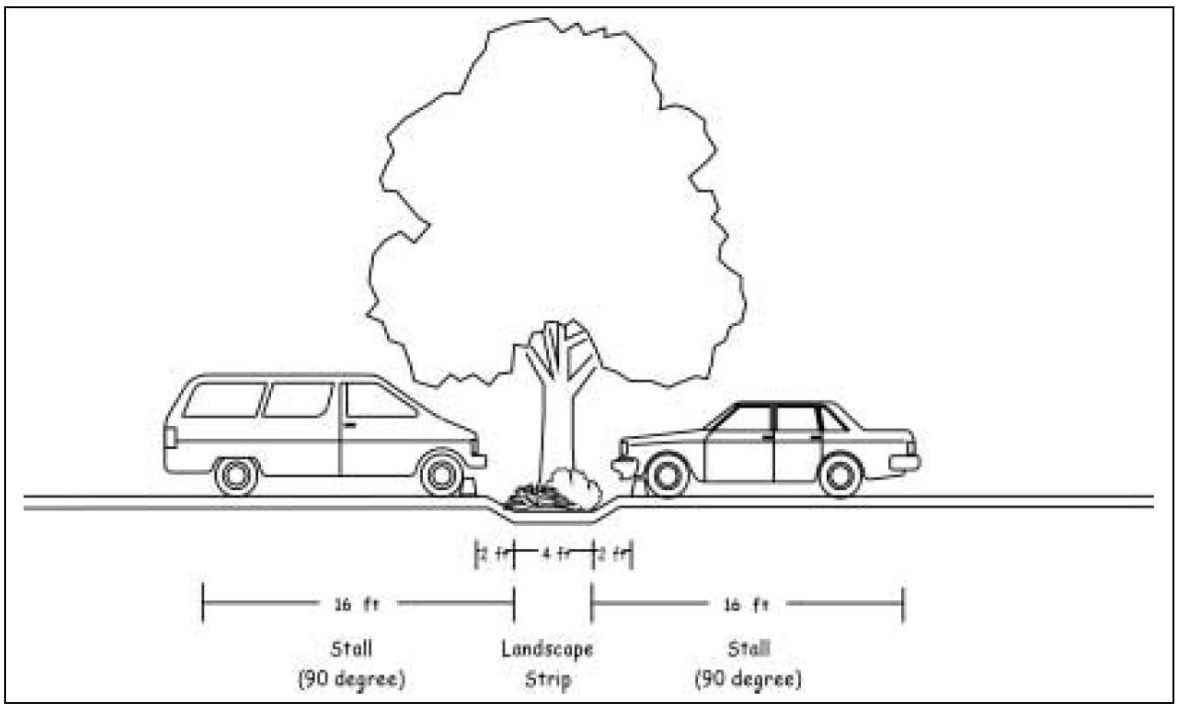

Figure 7. Landscaped Area at Front of Parking Space

In addition to specifying a certain percentage requirement for interior landscaping, specific provisions related to interior landscaping are important. The Portland parking amendments dictate that interior landscaping is required for sites with combined parking and loading areas larger than 3,000 square feet and smaller lots are exempted because this standard would be more difficult to meet in smaller lots (City of Portland Bureau of Planning, 2001). The amendments also provide specifics regarding the layout of interior landscaped areas. Two options are provided for the layout of these areas. The first option is landscape strips, which simply consists of arranging landscape strips between rows of parking stalls which has been found to provide the greatest stormwater management benefit. The distance water must flow across pavement is reduced with this configuration and by dispersing the areas of filtering and infiltration, there is a reduction in the physical demands placed on each stormwater facility, yielding a reduction in maintenance and performance problems (City of Portland Bureau of Planning, 2001). The second option deals with other landscape patterns which can be utilized in cases where parking lots have dimensions, slopes or other constraints that make landscape strips between rows of parking spaces not a possibility. These other options can include interior landscaping placed at areas at the ends of rows of parking or between parking spaces within rows of parking (City of Portland Bureau of Planning, 2001). (Figure 8 and Figure 9)

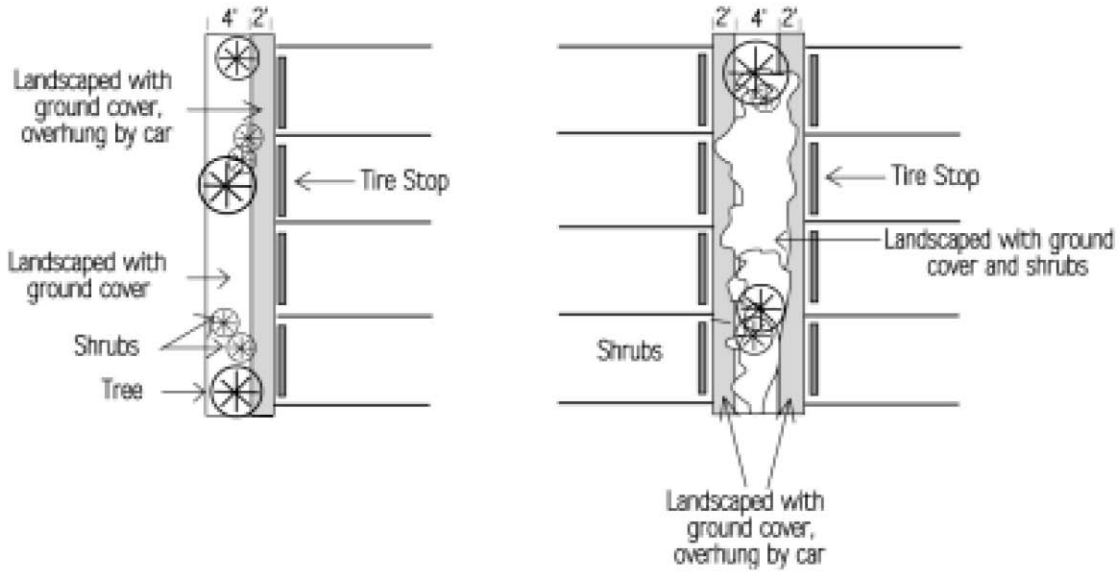

Figure 8. Landscape Strips

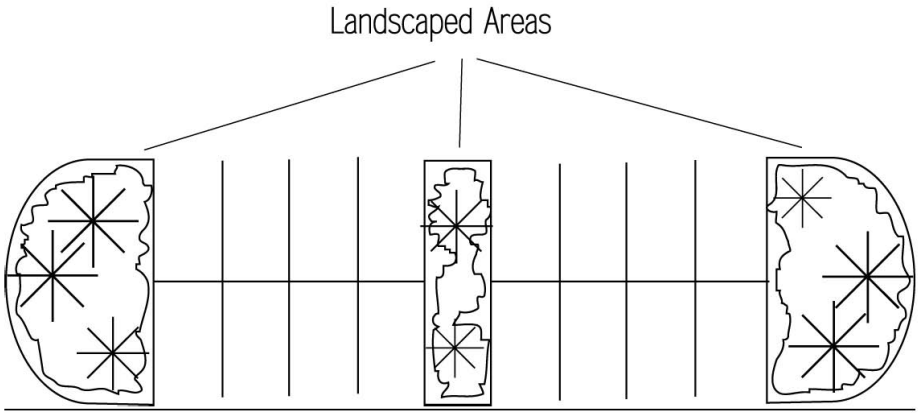

Figure 9. Other Landscape Patterns

Communities should be encouraged to review their current landscaping requirements to increase the minimums. As an example from Ohio, the City of Dayton is currently looking into increasing landscape requirements for interior parking lot landscaping to reduce the visual and environmental impact of large paved areas (DB Hart, 2003). Their current standard requires only one 40 square foot landscaped island for every 25 spaces in lots with 100 or more spaces. Lots with fewer than 100 spaces are not required to have interior lot landscaping. St. Paul, Minnesota requires that in addition to perimeter landscaping, parking lots for more than fifty cars must contain planted islands. As a minimum, one square foot of landscaped area must be provided for every ten feet of paving.

Another important point to be reviewed with respect to landscaping requirements is the actual definition of landscaping. In some codes landscaping is defined as fences or screens and other codes define landscaping as natural vegetation, including turf, shrubs, trees, and

earthen berms (NEMO, 1999). Thus the definition of landscaping can impact the net benefit of the landscaping area in reducing imperviousness, through their function as infiltration areas, etc.

Several of the communities in the Chagrin River watershed have minimal provisions for landscaping in their codes and ordinances. Some communities like Chester Township, Munson Township and Russell Township only include landscaping provisions with respect to buffer zones and screening but nothing about interior landscaping requirements. By modifying the codes and ordinances to specify a minimum percentage of the parking lot's total area for landscaping, a greater reduction in impervious area can be achieved. A focus on the provision of perimeter as well as interior landscaping should be emphasized.

4. Conclusions

After reviewing the parking codes and ordinances for a representative number of communities in the Chagrin River watershed, it is apparent that great opportunity exists for incorporation of many of the innovative solutions presented in the preceding section to reduce the impervious cover associated with parking. The following points summarize these opportunities:

- Incorporation of **community-specific factors** (i.e., building/development type and size, land use, population and development density, non-auto modes of transit) into setting local parking requirements can be a viable way to reduce the creation of excess parking as many communities do not know how their current parking requirements came to be;
- **Shared parking** and **landbanking** are concepts of interest in the watershed communities and several have already implemented these concepts;
- Incorporation of **compact parking spaces** is something that has not been done in the watershed, with the exception of Mentor, and is a relatively simple means of reducing impervious cover;
- Setting **maximum parking space dimensions** rather than specifying minimum dimensions (a minimum stall size of 10' x 20' or 9' x 18' are the most commonly cited dimensions) could also reduce impervious area as can decreasing driveway widths;
- Incorporation of **bioretention** into existing requirements for landscaped islands and **revising landscaping requirements** to require a set percentage of landscaping of the total paved area can help to offset some of the impervious surfaces;
- Incorporation of stormwater best management practices such as **sand filters** and **filter strips i**nto perimeter and interior landscaping can also help in offsetting impervious surfaces; and
- Incorporation of **porous pavement** in overflow parking areas can reduce the runoff generated by parking lots as well as decreasing impervious surfaces.

Other innovative solutions may not be applicable to the communities of the Chagrin River watershed, such as parking maximums and park and ride and transit options, due to the smaller nature of many of the communities and the lack of viable non-auto transit options.

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Appendix A

Parking Requirements Survey Results

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Parking Space Design/Size Requirements: Parking Space Dimensions	# of Spaces Required per Land Use (i.e., retail, office, medical/dental, other): Retail	Office	Medical/Dental	Multi-Family Residential	Other	Process by which requirements were developed	Provisions for Compact Car Spaces (including dimensions)
Auburn Township (Geauga Co.)	Parallel: 9x23; 45 degree: 12x19; 60 degree: 10x19; 90 degree: 9x19 (*all minimums)	Retail in completely enclosed buildings: under 2,000 sq ft - 7 spaces per 1,000 sq ft; 2,000 - 3,000 sq ft - 6 spaces per 1,000 sq ft; over 3,000 sq ft - 5 spaces per 1,000 sq ft	1 space per 350 sq ft of building floor area	6 spaces per doctor, min. 1 space per 250 sq ft of floor area, max. 1 space per 200 sq ft of floor area	N/A	Assembly hall, meeting place = spaces equal to 30% of capacity of persons; theater = 1 space per 4 seats or 1 space per 90 sq ft of entire facility; industrial = 1 space for each 2 employees plus 3 spaces for visitors	No study done	No
Aurora	200 sq ft per space	4.5 per 1000 sq ft	1 per 200 sq ft	1 per 200 sq ft	2 enclosed plus additional guest spots as determined by PC	Need code	Consultant	No
Bainbridge Township (Geauga Co.)	Min. of 9x20	1 per 250 sq ft of usable floor area	1 per 300 sq ft of usable floor area	1 per bed + 1 per 200 sq ft of usable floor area	N/A	Museums, libraries, churches, community centers = 1 space for each 6 seats plus 1 space for each 500 sq ft of usable floor area not used for seating	Unknown	No
Bentleyville								
Chagrin Falls								
Chagrin Falls Township (Cuyahoga Co.)								
Chester Township (Geauga Co.)	Min. of 10x20	1 per 250 sq ft + 1 per employee + 1 for each vehicle maintained on site	1 per 300 sq ft	1 per doctor + 1 for each 2 employees or 1 per 150 sq ft, whichever is greater	None in Twp	Varies by conditional use	Zoning Commission	No
Eastlake								
Gates Mills	9x20	1 per 200 sq ft	1 per 100 sq ft	1 per 100 sq ft	N/A	1 space per employee plus 1 space per 6 seats	Unknown	No
Highland Heights								

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Parking Lot Design Requirements								
	Provisions for Shared Parking	Parking Lot Driveway Widths					Angle of Parking Specified	Provisions for Landscaping Requirements	Provisions for Below or At-grade Landscaped Areas
		Retail	Office	Medical/Dental	Multi-family Res.	Single-family Res.			
Auburn Township (Geauga Co.)	For business and industrial uses - BZA can approve shared parking if: pedestrian connection between properties exists, properties are within 200 ft of each other, and signs indicate availability. If no overlapping hours, spaces must be equal to the greater of the applicable individual parking requirements. If overlap, spaces equal to the total of the individual parking requirements. Total can be reduced by 10% with certain criteria.	Width of access driveways: parallel = 14 ft; 45 degree = 17 ft; 60 degree = 14 ft; 90 degree = 14 ft Width of driveway aisle: parallel = 12 ft; 45 degree = 13 ft; 60 degree = 18 ft; 90 degree = 25 ft					Yes (see parking space dim.)	Perimeter and interior landscaping of parking lots - for any parking area that contains more than 2 rows of parking and is designed to accommodate 30 or more vehicles, not less than 10% of the parking lot area shall be planted as landscaped islands. Each island must be a min. of 10 ft in horizontal dimensions and provide at least one shade tree. Shrub plantings adjacent to a building along the perimeter of the lot shall not be counted as interior lot landscaping. Screening of lots along public streets - required for areas of 5 or more spaces that are visible from the street. Screening must have a min. height of 3 ft and most obscure a min. of 50% of the view of the parking area.	No
Aurora	Yes	Need code					Yes - need code	Yes - need code	No
Bainbridge Township (Geauga Co.)	Yes - 2 or more uses may establish a joint parking area to provide the total number of required off-street parking and loading spaces if approved by BZA	Areas exceeding 100 spaces: one-way traffic = min. width of access driveways and aisles is 14 ft; two-way traffic = min. width of access driveways and aisles is 24 ft			N/A	N/A	No	Yes - bare minimum	No
Bentleyville		No parking code and no commercial areas							
Chagrin Falls									
Chagrin Falls Township (Cuyahoga Co.)									
Chester Township (Geauga Co.)	No	1 lane: 12 to 18 ft; 2 lanes: 18 to 24 ft; 3 lanes: 27 to 34 ft				10-20 ft.	45 degree: 10x20; 60 degree: 10x20; 90 degree: 10x20	If lot is adjacent to a residential district or adjoins a building with dwelling units, screening is required. Screening must be 4 ft wide and can be shrubs densely planted and 6 ft in height.	No
Eastlake									
Gates Mills	No	None	None	None	None	None	No	No	No
Highland Heights									

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Other: When is parking demand highest?	Other: When are lots full?	Other: How often are lots used?	Other: Has too much or too little parking been provided?	Additional Comments
Auburn Township (Geauga Co.)	Business hours	Business hours	5 days a week	Too much has been provided for retail, office, medical/dental. Adequate parking has been provided for single-family residential and inadequate parking has been provided for government buildings.	Landbanking is allowed for business and industrial districts. Reduction in the number of spaces to be constructed may be authorized by BZA when evidence is provided that the required number of spaces is substantially in excess of the parking needed to reasonably serve the employees, patrons and other persons frequenting the property. Sufficient usable space must be reserved on the property and shown on the approved plan.
Aurora	Holidays, ballgames, community events	Depends on locations/functions, seldom full	Regularly	Adequate parking provided. Older sites are a problem as areas are redeveloped or adapted to another use.	Need to incorporate LID components into code. Lighting is a problem. Need to add permeable surfaces.
Bainbridge Township (Geauga Co.)	AM/PM rush hour	Weekends and community or private functions	N/A	Ample parking provided	Landbanking provisions - BZA can approve the construction of a lesser number of spaces than the required number. Land must be reserved as landscaped open space areas on the lot and be indicated on the map.
Bentleyville					
Chagrin Falls					
Chagrin Falls Township (Cuyahoga Co.)					
Chester Township (Geauga Co.)	Varies with parking area/use	Christmas time	Daily	Too much for retail, office, medical/dental, MF and SF residential. Churches unknown.	Often businesses exceed by a small amount. Need help on bioretention cells. Some sort of permeable pavement that is cost-effective without excessive maintenance. Underground cells could be useful if they can be cleaned/maintained without extreme cost or danger.
Eastlake					
Gates Mills	9 to 5	9 to 5	Monday - Friday		Commercial area is being completely rebuilt and the parking ordinances are being redrafted. Draft ordinance
Highland Heights					

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Parking Space Design/Size Requirements							
	Parking Space Dimensions	# of Spaces Required per Land Use (i.e., retail, office, medical/dental, other)					Process by which requirements were developed	Provisions for Compact Car Spaces (including dimensions)
		Retail	Office	Medical/Dental	Multi-Family Residential	Other		
Hunting Valley	None	N/A	N/A	N/A	N/A	N/A	Unknown	No
Kirtland	9x20	1 per 200 sq ft	1 per 200 sq ft	5 per doctor	2 per unit	Place of worship: 1 per 4 seats; Theater, gym, assembly hall: 1 per 3 seats	Unknown	No
Kirtland Hills								
Mayfield Heights								
Mayfield Village	Min. of 9.5x20 (190 sq ft)	1 per 150 sq ft	1 per 150 sq ft	1 per 100 sq ft	2.5 per unit	Restaurant 1 per 50 sq ft; Religious institutions 1 space per 3 seats	Unknown	No
Mentor	Min. of 9x18	4 per 1000 sq ft GFA	4 per 1000 sq ft GFA	7 per 1000 sq ft GFA	2.5/unit	Church, theater, clubs = 1 per 5 seats	PAS, Parking generation reports, other municipal codes	9 x 16; planned shopping centers with 150+ spaces can have 10% of the total parking designated as compact spaces
Moreland Hills								
Munson Township (Geauga Co.)	Min. of 10x20	1 per 100 sq ft of floor area	1 per 100 sq ft of floor area	1 per 100 sq ft of floor area	Not permitted unless variance	Industrial - 1 per 200 employees	Unknown	No
Newbury Township (Geauga Co.)	Min. of 10x18	6 per 1000 sq ft of floor space	3 per 1000 sq ft of floor space	1 per 3 beds or 3 per 1000 sq ft of floor space	N/A	Church = 1 space per 5 seats; club or golf course = 1 per 5 members; industrial = 1 per 2 employees on max. shift	Unknown	No

Chagrin River Watershed Partners
Parking Requirements Survey Results

		Parking Lot Design Requirements							
		Parking Lot Driveway Widths							
Partner Community	Provisions for Shared Parking	Retail	Office	Medical/Dental	Multi-family Res.	Single-family Res.	Angle of Parking Specified	Provisions for Landscaping Requirements	Provisions for Below or At-grade Landscaped Areas
Hunting Valley	No	N/A	N/A	N/A	N/A	N/A	None	Yes - need code section	No
Kirtland	No	Parking areas having a capacity of 10 spaces or less shall have at least one single lane driveway, and those having a capacity of more than 10 spaces shall have two one-lane driveways if possible, or least one two-lane driveway. No entrance or exit driveway can exceed three lanes in width. 1-lane: min. 10 ft, max. 12 ft. 2-lane: min. 18 ft, max. 24 ft. 3-lane: min. 27 ft, max. 34 ft.					No	For parking lots designed to accommodate 20 or more cars, a minimum of 5% of the parking lot shall be set aside for landscaping, developed and distributed throughout the parking lot to provide visual and climatic relief from broad expanses of pavement. Each landscaped island must be a min. of 10 feet in width. Shrub plantings adjacent to a building along the perimeter of the parking lot, or in any part of a yard, cannot be counted as interior landscaping.	No
Kirtland Hills									
Mayfield Heights									
Mayfield Village	Yes - Institutions (schools, colleges, clinics, health and medical centers for outpatient care, public administration buildings, religious institutions, hospitals) can assume that up to, but not more than 50% of their requirements may be shared in adjacent parking areas which are accessory to business establishments and which normally have different hours of operation. Contract required.	1 lane: min. 12ft, max. 14 ft 2 lane: min. 24 ft, max. 28 ft				Min. 8 ft, max. 16 ft	No	10 ft wide planted islands required to interrupt expansive areas	No
Mentor	Yes - provide min. total spaces required for all of uses sharing parking	2-way access drives = 24 ft; 1-way access drives = 20 ft			20 ft max.	20 ft max.	30, 45, 60, 90 degree	Max. number of spaces in a contiguous row. Commercial = 20; industrial = 15	No
Moreland Hills									
Munson Township (Geauga Co.)	No	1-way traffic: 14ft; 2-way traffic: 24ft	1-way traffic: 14ft; 2-way traffic 24 ft	1-way traffic: 14 ft; 2-way traffic: 24 ft	Variance req'd	12 ft	None specified	Screening by evergreen planting or moundings at least 20 ft from edge of road	No
Newbury Township (Geauga Co.)	No	15 ft for 1-way traffic; 30 ft for 2-way traffic			N/A	10 ft.	No	Yes, when non-R1 parking - landscaping is required	No

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Other				Additional Comments
	When is parking demand highest?	When are lots full?	How often are lots used?	Has too much or too little parking been provided?	
Hunting Valley	N/A	N/A		No	
Kirtland	Late afternoon times	Late afternoon times	Daily	Too much provided for retail and office; SF some are too big	Like landbanking and shared parking
Kirtland Hills					
Mayfield Heights					
Mayfield Village	Business hours	Daylight hours	5-6 days/wk	Too much provided for retail and office; too little for medical/dental	
Mentor	Thanksgiving-Christmas week	Thanksgiving-Christmas week	Unknown	Retail and office: adequate; medical/dental: too much; multi-family: too little; single-family: adequate	Shared access drives permitted with approval; 2-way parking aisles = 22 ft; 1-way parking aisles 90 degrees = 22 ft; 1-way parking aisles 60 degrees = 20 ft; 1-way parking aisles 45 degrees = 18 ft; 1-way parking aisles 30 degrees = 18 ft
Moreland Hills					
Munson Township (Geauga Co.)	Regular business hours	Never	Regular business hours	Too much retail parking; variances required for reduced office and medical/dental parking	Being a septic community may have contributed to the fact that commercial and industrial districts are not heavily developed. The need for one parking space per 100 sq ft of floor area should be directed at theaters, food stores, and large retail.
Newbury Township (Geauga Co.)	Holidays and during events	No community parking, on-site only	No community parking, on-site only	Retail - too much; office, medical/dental, SF - about right; Churches and schools - not enough	

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Parking Space Design/Size Requirements: Parking Space Dimensions	# of Spaces Required per Land Use (i.e., retail, office, medical/dental, other): Retail	Office	Medical/Dental	Multi-Family Residential	Other	Process by which requirements were developed	Provisions for Compact Car Spaces (including dimensions)
Orange	10x20	1 per 200 sq ft	1 per 200 sq ft	1 per 150 sq ft	N/A	Churches: 1 space per 300 sq ft GFA; Theaters and other places of assembly: 1 space per 3 seats at max. permitted capacity	Developed with planners; cross-section of area	No
Pepper Pike	Min. 8'6" x 20'	For retail with a combined floor area > 1,000 sq ft, 1 space per 100 sq ft of shop floor space on ground or basement floor and 1 space per 200 sq ft of flood above ground floor	1 per 200 sq ft of floor area for each floor based on outside dimensions of building at each floor level	1 space per 125 sq ft gross floor space for each floor	1.5 spaces per dwelling unit in private garage with an additional .5 space for each dwelling unit	Churches, theaters = 1 space per 2 seats	Unknown	No
Russell Township (Geauga Co.)	10x20	1 space per 200 sq ft of GFA	1 space per 200 sq ft of GFA	1 space per 200 sq ft of GFA	N/A	1 space per 200 sq ft of GFA	Unknown	No
Solon								
South Russell	9 ft wide and at least 180 sq ft	Under 2000 sq ft = 7 per 1000 sq ft; 2000-3000 sq ft = 6 per 1000 sq ft; over 3000 sq ft = 5 per 1000 sq ft	1 per 300 sq ft	Under 2000 sq ft = 7 per 1000 sq ft; 2000-3000 sq ft = 6 per 1000 sq ft; over 3000 sq ft = 5 per 1000 sq ft	2 per dwelling unit + garage space	Churches: 1 per 500 sq ft	Based on all hours	No
Waite Hill								
Wickliffe								
Willoughby								
Willoughby Hills	9x20, 180 sq ft	1 per 250 sq ft	1 per 300 sq ft	1 per 200 sq ft	2 per unit, 1 under cover	N/A	Consultant 4-05	No
Woodmere	9x20, 180 sq ft						Unknown	No

Chagrin River Watershed Partners
Parking Requirements Survey Results

		Parking Lot Design Requirements							
		Parking Lot Driveway Widths							
Partner Community	Provisions for Shared Parking	Retail	Office	Medical/Dental	Multi-family Res.	Single-family Res.	Angle of Parking Specified	Provisions for Landscaping Requirements	Provisions for Below or At-grade Landscaped Areas
Orange	No	1 lane: min. 12 ft, max. 14 ft; 2 lanes: min. 20 ft, max. 24 ft; 3 lanes: min. 30 ft; max. 36 ft					Not found	All parking areas with more than 40 spaces shall contain planting strips or islands to interrupt the mass of paved area, aid in controlling the flow of traffic, and provide visual quality. Min. of 5 sq ft of landscaped area must be provided within the parking area for each 100 sq ft of vehicle area.	No
Pepper Pike	Yes, not in code but at BZA and Planning Commission	No min. width	No min. width	No min. width	No min. width	No min. width	None	None	No
Russell Township (Geauga Co.)	No	No min. width	No min. width	No min. width	No min. width	No min. width	None	Yes - buffer zone. When adjacent to residential property, min. of 15 ft buffer zone must be maintained from any building, parking area, or	No
Solon									
South Russell	No	None - Village Engineer specifies parking lot requirements. Code specifies the following for access drives: 1 lane = 12 ft min and 14 ft max; 2-lane = 20 ft min and 24 ft max; 3-lane = 30 ft min and 36 ft max					No	Commercial lot landscaping must be approved by landscape architect	Yes
Waite Hill									
Wickliffe									
Willoughby									
Willoughby Hills	Yes - PZC can approve a development plan with a reduction in the number of spaces required if: the project is a single use project or a project with more than one use for which there are varying peak demands and it can be shown that the uses can adequately be accommodated with a lesser number of parking spaces than required. Binding agreement required for shared parking.	Width of entrance and exit lanes: min. 9 ft and max. 12 ft per lane and can't exceed 36 ft. Entrances and exits limited to 2 lanes, except where one driveway provides the sole access to the property and serves as entrance and exit, then it shall be limited to 3 lanes.					Parallel: 9x23, 45 degree: 9x20, 60 degree: 9x20, 90 degree 9x20	Yes	No
Woodmere	No but BZA allowances						Yes	Yes	

Chagrin River Watershed Partners
Parking Requirements Survey Results

Partner Community	Other: When is parking demand highest?	Other: When are lots full?	Other: How often are lots used?	Other: Has too much or too little parking been provided?	Additional Comments
Orange					Drive aisles providing direct access to spaces shall be a min. of 24 ft wide and those that don't provide access to individual spaces shall be a min. of 20 ft wide
Pepper Pike	End of the day	End of the day	All day	Retail and office - adequate	Want landscaping in code in addition to shared parking and landbanking
Russell Township (Geauga Co.)	Business hours	Varies	Only during business hours	Too much parking provided for retail	
Solon					
South Russell	8am-6pm	11am-2pm; 5pm-11pm	7 days/week 7am-2:30am	No	
Waite Hill					
Wickliffe					
Willoughby					
Willoughby Hills	Dependent upon land use	Dependent upon land use	All the time	Good amount for all uses	Width of parking aisle: 18 ft for 45 degree, 20 ft for 60 degree, 22 ft for 90 degree, 12 ft for parallel
Woodmere	End of the day	No specific time	All the time	Too much for office, rest okay	Need shared parking in code. Code doesn't look at parking variances.

Appendix B

Model Shared Parking Ordinances

Appendix Model Shared Parking Ordinance - Provisions

1. Shared Parking: Definition

Shared parking may be applied when land uses have different parking demand patterns and are able to use the same parking spaces/areas throughout the day. Shared parking is most effective when these land uses have significantly different peak parking characteristics that vary by time of day, day of week, and/or season of the year. In these situations, shared parking strategies will result in fewer total parking spaces needed when compared to the total number of spaces needed for each land use or business separately. Land uses often used in specific shared parking arrangements include office, restaurants, retail, colleges, churches, cinemas, and special event situations. Shared parking is often inherent in mixed-use developments, which include one or more businesses that are complementary, ancillary, or support other activities. General parking lots and/or on-street parking that is available for patrons of nearby businesses/commercial districts is another form of shared parking.

2. Intent of Ordinance

This section explains the regulatory background of federal, state and regional initiatives for reducing parking. This ordinance is designed to help cities and counties meet these objectives.

The State's Transportation Planning Rule requires reducing vehicle miles of travel and parking spaces per capita throughout the metropolitan area. It is a means as a means of responding to transportation and land use impacts of growth and providing other alternatives to auto oriented trips. The Metro Growth Concept calls for more compact development to encourage more efficient use of land, promote non-auto trips, and protect air quality by reducing vehicle trips per capita and parking spaces. Title 2 of the Urban Growth Management Functional Plan, which is the mechanism for early implementation of the Growth Concept, mandates new minimum and maximum parking ratios region wide. In addition, the Department of Environmental Quality's federally mandated Ozone Maintenance Plan contains the Employee Commute Options rule requiring a 10% reduction in employee vehicle trips for all employers with fifty or more employees at a worksite

One of the strategies to achieve these objectives is to have more compact urban development. This requires that each use of land be carefully reviewed for more efficient and complementary forms of development. Dedicated parking areas for individual uses, especially when provided in new developments, can result in less efficient land usage, lower floor to site area ratios, and more environmental/water quality impacts.

Excessive parking also has implications for other transportation modes. In areas where transit is provided or other non-auto modes (i.e. walking and biking) are convenient, less space devoted to parking allows better accessibility and mobility for all modes. Shared parking is a strategy that can significantly reduce the amount of land devoted to parking while providing a sufficient number of spaces and encouraging compact land development.

3. Application of Shared Parking

This section defines when shared parking requirements would apply. Specific criteria are proposed, which appear in bold, and it is intended that each jurisdiction consider what values would be appropriate..

A. Applicants for new developments or **significant redevelopment*** of site(s) shall examine the feasibility of using shared parking arrangements . *(Significant redevelopment could be defined as increasing building size or land uses so that the site's trip generation and/or parking demand would increase by a certain percentage similar to (2) below.)*

B. Shared parking arrangements shall be considered when the number of parking spaces requested by the developer/applicant is more than **10*** percent higher or more than **10*** spaces higher than the **minimum** number of parking spaces required by Code for a site, whichever is more.

Overall, jurisdictions may wish to consider the following:

1) In Central City, Town Centers, Regional Centers, Station Communities, and Main Streets, particularly in areas designated Zone "A" in Metro's Urban Growth Management Functional Plan, the requirements for shared parking should be more **stringent***. The intent is to maximize efficient and complimentary land uses in these zones.
2) In some situations, new land uses or redevelopment of sites could provide less than the minimum code requirements of dedicated parking. This should be allowed with the director's approval if they occur in business districts with adequate parking supply and/or when the development is an ancillary use to an adjacent major use where the patrons or users will be the same.

Factors evaluated to establish shared parking arrangements should include operating hours, seasonal/daily peaks in parking demand, the site's orientation, location of access driveways, transit service, accessibility to other nearby parking areas, pedestrian connections, distance to parking area, availability of parking spaces, cooperation of adjacent owners).

**** Terms, values, and criteria that need to be defined by the jurisdiction are marked with an asterisk and are in bold text.***

4. Calculation of Parking Spaces Required with Shared Parking

This section presents a general description of determining the number of parking spaces required with shared parking as well as a detailed sample calculation. A jurisdiction may want to include the example in their ordinance or as a reference handout.

The minimum number of parking spaces for a mixed use development or where shared parking strategies are proposed shall be determined by a study prepared by the applicant following the procedures of the Urban Land Institute Shared Parking Report, ITE Shared Parking Guidelines, or other approved procedures. A formal parking study may be waived for small developments where there is established experience with the land use mix and its impact is expected to be minimal. The actual number of parking spaces required shall be based well-recognized sources of parking data such as the ULI or ITE reports. If standard rates are not available or limited, the applicant may collect data at similar sites to establish local parking demand rates. If the shared parking plan assumes use of an existing parking facility, then field surveys shall be conducted to determine actual parking accumulation. If possible, these surveys should consider the seasonal peak period for the combination of land uses involved.

The applicant shall determine the minimum number of parking spaces required for shared parking arrangements or mixed use developments by the following the following example procedures:

> *An example will follow each step based on a mixed-use development containing a 40,000 GSF Office Building and a 5,000 GSF Restaurant. For all base code requirements, Metro's adopted Minimum Parking Requirements, from Table 2 of the Growth Management Functional Plan are used. This example also relies on the hourly parking demand rates for these two uses published in the ULI Dimension of Parking Report.*

Step 1. Determine the number of parking spaces that should be provided for each land use separately in parking codes by multiplying the park code requirements by the Gross Square Feet (GSF) of each individual use and then sum the results. That is, parking required = parking rate x GSF of development.

> *Example: Referring to Metro's rates, minimum parking requirement for offices is 2.7 spaces per 1,000 GSF, and for restaurants is 15.3 per 1,000 GSF.*
>
> *Parking for offices = 2.7 x 40,000/1,000 = 108 spaces*
> *Parking for restaurant = 15.3 x 5,000/1,000 = 77 spaces*
> ***Combined 108 + 77 = 185 spaces***

Step 2. Based on the hourly variation in parking demand, determine the peak parking demand for the combined demand of all the uses in the development. Standardized data such as from the ULI Parking Report or the Study of Peak Parking Space Demand performed in the metro Portland area for the Oregon Department of Environmental Quality should be used to estimate hourly variations. Field studies can also be performed on similar land uses within the jurisdiction to establish the hourly variation patterns. This analysis may be needed for both weekdays and weekends, depending on the type of uses involved, and may need to consider seasonal peak periods.

Example: Table 1 shows the various hourly parking demand rates for offices and restaurants (columns 2 and 4) from ULI data. These rates were multiplied by GSF of each development to determine the number of parking spaces needed each hour during a typical weekday. The hourly parking demands for this example are shown in Figure 1. Below is the combined peak parking demands for several critical hours during the day:

Combined Demand for Office peak hour at 11AM:
Office= 3.0 spaces/1,000 GSF, Restaurant = 6.0/1,000 GSF
*Combined Demand= (3.0 x 40) + (6.0 x 5) = 120 + 30=**150 spaces***

Combined Demand for Restaurant peak hour at 7PM:
Office= 0.2 spaces/1,000 GSF, Restaurant = 20.0/1,000 GSF
*Combined Demand= (0.2 x 40) + (20.0 x 5) = 8+100=**108 spaces***

Peak Demand for Combined Uses at 1PM:
Office=2.7 spaces/1,000 GSF, Restaurant =14.0/1,000 GSF
*Combined Demand= (2.7x 40) + (14.0 x 5)= 108 + 70 = **178 spaces***

Peak Hour Parking Demand for Combination of Uses= 178 spaces

Table 1: Weekday Hourly Parking Demand Ratios for Office Buildings And Restaurants (Source: ULI, *Shared Parking* , 1983)

Hour of Day	Office Parking Demand per 1,000 GSF	*40,000 GSF Office*	Restaurant Parking Demand per 1,000 GSF	*5,000 GSF Restaurant*	*Total Spaces Needed to Meet Combined Demand*
(1)	(2)	(3)	(4)	(5)	(6)
10 AM	3.0	120	4.0	20	140
11AM	*3.0*	*120*	6.0	*30*	*150*
12 noon	2.7	108	10.0	50	158
1 PM	***2.7***	***108***	***14.0***	***70***	***178***
2 PM	2.9	116	12.0	60	176
3 PM	2.3	92	12.0	60	152
4 PM	2.3	92	10.0	50	142
5 PM	1.4	56	14.0	70	126
6 PM	0.7	28	18.0	90	118
7 PM	*0.2*	*8*	*20.0*	*100*	*108*
8 PM	*0.2*	*8*	*20.0*	100	108

Step 3. Compare the calculations of the two steps above, and the lesser of the two peak parking demands shall be used as the minimum number of parking spaces that need to be provided.

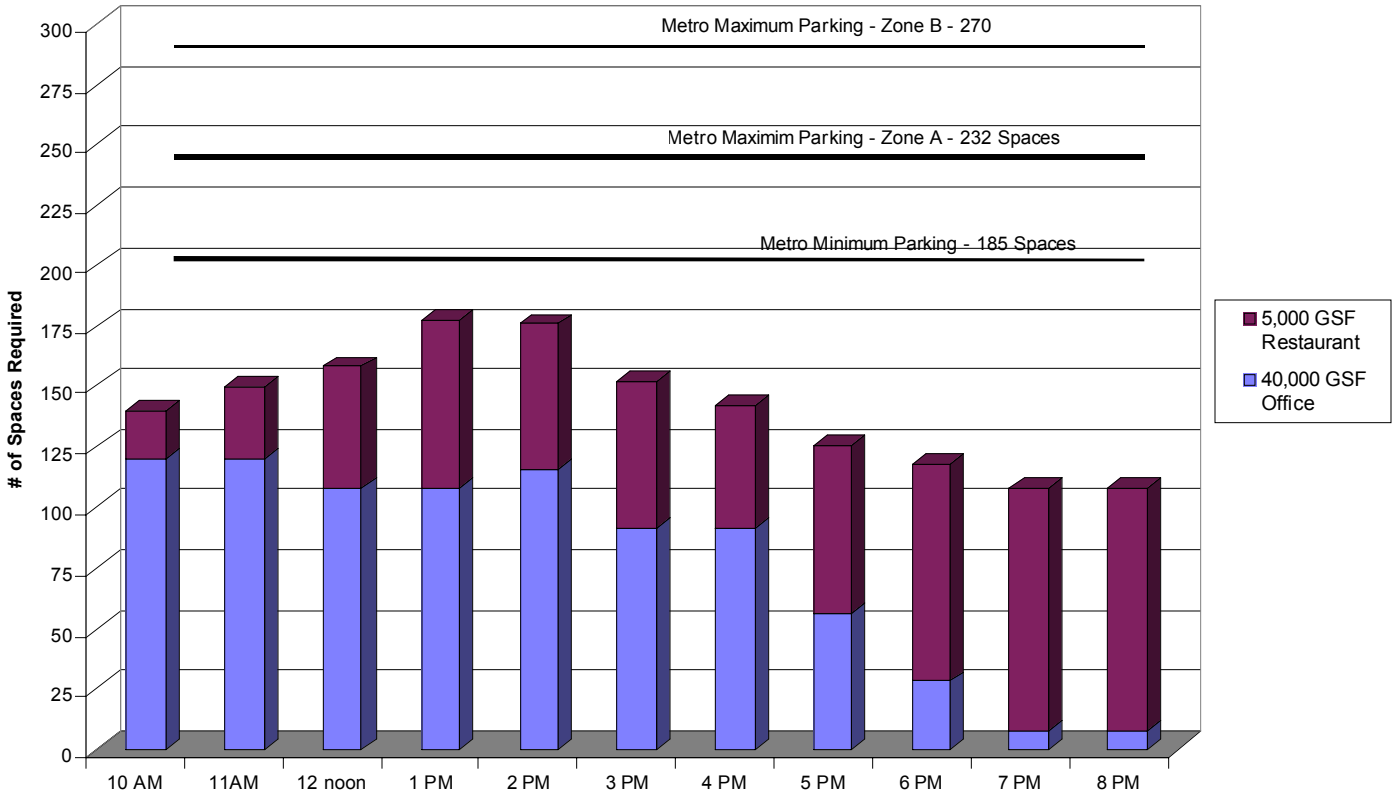
Example:
Minimum Parking Required by Metro Title 2 rates from Independent calculations for two uses *185 spaces*
Peak Hour Parking Needs with Shared Parking *178 spaces*
Net Savings 7 spaces

Table 2 shows the above comparison as well as comparing the number of spaces needed with shared parking with the number of spaces are allowed under Metro's Functional Plan's Maximum Parking ratios for Zone A and Zone B. This comparison reveals that a shared parking arrangement could save as many as 101 parking spaces. The effect of shared parking for this example is also shown in Figure 1.

Table 2 – Combined Parking Requirements from Metro, *Urban Growth Management Functional Plan* (11/96)

Metro Codes	Office Code Req.	*40,000 GSF Office*	Restaurant Code Req.	*5,000 GSF Restaurant*	*Total Required*	*Total Demand*	*Net Savings*
Minimum	2.7	*108*	15.3	*77*	***185***	*178*	***7***
Maximum - Zone A	3.4	*136*	19.1	*96*	***232***	*178*	***54***
Maximum - Zone B	4.1	*164*	23	*115*	***279***	*178*	***101***

Figure 1 - Parking Comparison – Shared Parking Demand versus Code Requirements



5. Distance to Parking Spaces and Pedestrian Connection Requirements

*This section describes the maximum distances between land uses and parking spaces that would make them eligible to be classified as shared parking spaces/areas.**

The closer shared spaces are to the land uses they serve, the more likely the arrangement will be a success. Shared spaces for residential units must be located within **300** feet of dwelling unit entrances they serve. Shared spaces at other uses must be located within **500** feet of the principal building entrances of all sharing uses. However, up to **20** percent of the spaces may be located greater than **500** feet but less than **1,000** feet from the principal entrances. Clear, safe pedestrian connections must be provided. Pedestrian should not be required to cross an arterial street except at a signalized intersection along the pedestrian pathway. Up to **50** percent of nonresidential spaces may be provided at greater distances if dedicated shuttle bus or van service is provided from a remote parking facility.

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* While each jurisdiction is responsible for defining and establishing their own criteria, the following values in bold reflect the values in the majority of the ordinances that were reviewed during this project.

6. Captive Market Parking Requirements

This section sets criteria for the special situation where a use is ancillary to an immediately adjacent larger business and is likely to generate little, if any, vehicle trips or parking demand on its own during the peak periods.

For uses that are considered ancillary to a larger business, no additional parking may be required. Examples of this case include a coffee or snack shop within an office or hotel development, a copy/package store within a business park or redevelopment of small retail uses in a large business district. Parking requirements for similar ancillary uses may be reduced to account for the likely cross patronage among the adjacent uses located within a maximum walking distance of ***500**** feet. Parking requirements may be reduced up to ***90**** percent as appropriate.

7. Agreement Between Sharing Property Owners

For large shared parking arrangements, jurisdictions are encouraged to require formal shared parking agreements that are recorded with the jurisdiction.

If a privately owned parking facility is to serve two or more separate properties, a legal agreement between property owners guaranteeing access to, use of, and management of designated spaces is highly recommended. (See Model Shared Parking Agreement)

8. Shared Parking Plan

A jurisdiction may require that a shared parking plan be submitted. This could be included in the site plan and landscaping plan information most jurisdictions already require for parking areas or as a separate document. If so, this shared parking plan could include one or more of the following:

A. Site plan of parking spaces intended for shared parking and their proximity to land uses that they will serve.
B. A signage plan that directs drivers to the most convenient parking areas for each particular use or group of uses (if such distinctions can be made).
C. A pedestrian circulation plan that shows connections and walkways between parking areas and land uses. These paths should be as direct and short as possible.
D. A safety and security plan that addresses lighting and maintenance of the parking areas.

APPENDIX B (Continued) – Model Shared Parking Ordinances

Source: Victoria Transport Policy Institute, 2004

Introduction
Cumulative parking requirements for mixed-use occupancies or shared facilities may be reduced where it can be determined that the peak requirements of the several occupancies occur at different times (either daily or seasonally). The submittal requirements for a parking reduction request vary according to the method used to determine the parking reduction. The reduction methods and accompanying submittal requirements are outlined in this section. In all cases, a shared parking operations plan must be prepared to the satisfaction of the Department of Planning showing that parking spaces most conveniently serve the land uses intended, directional signage is provided if appropriate, and pedestrian links are direct and clear. On-street parking spaces wholly adjacent to the property may be included in the required minimum.

Three methods for determining a parking reduction are as follows:

A. Intermittent or Seasonal Nonconflicting Uses

(1.) When required parking reductions are predicted as a result of sharing between intermittent or seasonal uses with nonconflicting parking demands (e.g. a church and a bank), then the reduction can be considered for approval by the Planning Commission without demand calculations or a parking study. Individual spaces identified on a site plan for shared users shall not be shared by more than one user at the same time.

(2.) If a privately owned parking facility is to serve two or more separate properties, then a "Shared Parking Agreement" shall be filed with the City of Fayetteville for consideration by the Planning Commission. Unless explicitly stated to the contrary, the property owner of the parking facility accepts responsibility for operating, maintaining and accepting liability for personal injury and property damage.

B. Parking Occupancy Rate Table
When the parking reduction has been shown to be feasible by using the demand calculations as determined by Table 3, Parking Occupancy Rates, the applicant shall submit a parking demand summary sheet showing the process for calculating the reduction as outlined in this section. (Note: The default rates from the Table 3, Parking Occupancy Rates are set to include a small "safety margin" of parking beyond that minimally needed to serve an average peak demand. Therefore a local study of parking demand may yield a greater reduction in parking required.)

(1.) The minimum number of parking spaces that are to be provided and maintained for each use shall be determined based on standard methods for determining minimum parking supply at a particular site.

(2.) The gross minimum number of parking spaces shall be multiplied by the "occupancy rate" as determined by a study of local conditions (or as found in Table 3), for each

use for the weekday night, daytime and evening periods, and weekend night, daytime and evening periods respectively.

(3.) The gross minimum numbers of parking spaces for each of the purposes referred to for each time period shall be added to produce the aggregate gross minimum numbers of parking spaces for each time period.

(4.) The greatest of the aggregative gross minimum numbers of parking spaces for each period shall be determined.

Table 1. Parking Occupancy Rates

Uses	M-F	M-F	M-F	Sat. & Sun.	Sat. & Sun.	Sat. & Sun.
	8am-5pm	6pm-12am	12am-6am	8am-5pm	6pm-12am	12am-6am
Residential	60%	100%	100%	80%	100%	100%
Office/ Warehouse /Industrial	100%	20%	5%	5%	5%	5%
Commercial	90%	80%	5%	100%	70%	5%
Hotel	70%	100%	100%	70%	100%	100%
Restaurant	70%	100%	10%	70%	100%	20%
Movie Theater	40%	80%	10%	80%	100%	10%
Entertainment	40%	100%	10%	80%	100%	50%
Conference/Convention	100%	100%	5%	100%	100%	5%
Institutional (non-church)	100%	20%	5%	10%	10%	5%
Institutional (church)	10%	5%	5%	100%	50%	5%

This table defines the percent of the basic minimum needed during each time period for shared parking.

C. Local Parking Study

When the parking reduction has been shown to be feasible by using a local parking demand analysis, the following three items must be submitted:

(1.) A parking demand analysis prepared by a qualified parking or traffic consultant, a licensed architect, city planner, or urban planner or civil engineer, which substantiates the basis for granting a reduced number of spaces. A local parking study shall be subject to the approval of the Director of Planning and Planning Commission. The study shall take into account the following three factors:

(a.) Existing parking surveys. Parking surveys shall determine parking occupancy rates of morning, afternoon and evening peaks on the seven different days of the week. The seven days of observation may take place over the span of two consecutive, typical weeks. In the case of new construction or addition of new uses, the surveys shall observe another circumstance with similar mixed uses. A combination of similar circumstances may be necessary to cover all the proposed land uses. The approximate square footages of the various land uses of the specimen projects shall be compared to the proposed project to allow the ratios of uses to be rated accordingly. In the case of an enlargement, or substitution of existing uses, the surveys shall document the occupancy rates of the existing parking facility.

(b.) Proximity and convenience factors. The following factors may influence the Planning Commission's approval of the parking reduction figures:

- Distance between sharing uses and the parking facility
- Pedestrian connections among sharing uses and the parking facility
- Vehicular connections
- Whether parking will be paid
- Location--proximity to the CBD and general development density.
- Proximity to major transit corridors or stations.
- Special trip reduction programs, such as subsidized vanpooling, transit, shuttle or telecommuting
- Need for any reserved parking spaces. (Parking spaces to be shared cannot be reserved for specific uses or individuals except during off-peak hours.)

(c.) Captive market parking requirements. Parking requirements for retail, restaurant, hotel, convention and conference uses may be reduced where it can be determined that some portion of the patronage of these businesses comes from other uses (e.g., employees of area offices patronizing restaurants) located within a maximum walking distance of 500 feet. Parking requirements may be reduced up to 90 percent as appropriate. Whenever practical, such a reduction should be supported by surveys at similar establishments.

(2.) A covenant must be executed guaranteeing that the owner will provide the additional spaces directly or by payment of in-lieu fees if the City, upon thorough investigation of the actual use of parking spaces at the building within two years of initial occupancy, recommends to the Planning Commission that the approved reduction be modified or revoked. Said covenant shall meet the same requirements for covenants set forth in other sections of this document. The City must document insufficient parking supply by showing occupancy rates over 98 percent for a least two consecutive hours on at least three separate days within a single month.

(3.) Fee of guarantee. The owner shall pay a fee which will be applied towards the cost of a parking study of actual parking accumulation to be carried out within one to two years of occupancy.

(4.) Exception: The covenant guaranteeing either additional spaces or payment of in-lieu fees (2. above) and the fee for follow-up parking study (3. above) may be waived when the Planning Commission will certify that previous experience of similar shared parking projects indicates it is unlikely a serious deficiency would result.

D. Covenants

When a covenant between parties is required by this Ordinance, the following standards shall apply:

(1.) Be executed by the owner of said lot or parcel of land the parties having beneficial use thereof.

(2.) Be enforceable by either of the parties having beneficial use thereof, or both.

(3.) Be enforceable against the owner, the parties having beneficial use and their heirs, successors and assigns, or both.

(4.) Be first duly recorded in the Office of the Recorder of Deeds.

E. Parking Lot Location Standards

The location of all required and non-required parking lots with five or more spaces shall meet the location requirements below. All conditional uses hereunder shall be granted by the Planning Commission in accordance with Chapter regulations governing applications of conditional uses; procedures.

(1.) Permitted Locations by Right. Parking lots shall be located within the same zoning district as the use they serve. Required parking lots for uses allowed by right within a zoning district are allowed as a use by right in the same zoning district.

(2.) Permitted Locations as a Conditional Use. Remains the same.

(3.) Off-Site Locations. If off-street parking cannot be provided on the same lot as the principal use due to existing buildings or the shape of the parcel, parking lots may be located on other property not more than 600 feet distant from the principal use, subject to conditional use approval by the Planning Commission. Parking spaces serving residential units must be located within 300 feet of the dwelling unit entrances they will serve whether they are off or on the site. Clear, safe pedestrian connections must be provided, requiring no crossing of an arterial street except at a signalized intersection along the pedestrian pathway.

When Parking Requirements Must be Met

Parking requirements shall be met at the time any building or structure is erected, enlarged, or increased in capacity, changed in use, or an applicable outdoor use is established or enlarged. In mixed-use developments, or developments affected by co-operative agreements between different uses on neighboring properties, changes in use will require a parking demand analysis using Table 3 or a Local Parking Study to demonstrate the change in parking demand patterns. A forecast deficiency greater than 10% must be met by the construction of additional parking spaces, payment of in-lieu fees, or support of shuttle service or other trip reduction program satisfactory to the city. If a parking study results in a forecast deficiency of less that 10%, no covenant or guarantee payment is required.

Maximum Number Allowed

Parking lots may contain up to 20% more spaces than the required minimum. Any additional spaces above 20% shall be allowed only as a conditional use and shall be granted in accordance with City zoning governing applications of conditional uses; procedures, and upon the finding that additional spaces are needed.

Appendix C

Model Shared Parking Agreements

APPENDIX C – Model Shared Parking Agreements

Source: Stein Engineering, 1997

This Shared Use Agreement for Parking Facilities, entered into this ____ day of _____, between _____, hereinafter called lessor and _____ herein after called lessee.

In consideration of the covenants herein, lessor agrees to share with lessee certain parking facilities, as is situated in the City of _____, County of _____, and State of _____, herein called the facilities, described as:

[Include legal description of location and spaces to be shared here, and as shown on attachment 1.]

The facilities shall be shared commencing with the _____ day of _____, _____, and ending at 11:59 p.m. on the _____ day of _____, _____, for [insert negotiated compensation figures, as appropriate]. [The lessee agrees to pay at [insert payment address] to lessor by the _____ day of each month [or other payment arrangements].]

Lessor hereby represents that it holds legal title to the facilities.

The parties agree:

1. Use of Facilities

This section should describe the nature of the shared use (exclusive, joint sections, time(s) and day(s) of week usage.

Sample Language: [Lessee shall have exclusive use of the facilities. The use shall only be between the hours of 5:30 p.m. Friday through 5:30 a.m. Monday and between the hours of 5:30 p.m. and 5:30 a.m. Monday through Thursday.]

2. Maintenance

This section should describe responsibility for aspects of maintenance of the facilities. This could include cleaning, striping, seal coating, asphalt repair and more.

Sample Language: [Lessor shall provide, as reasonably necessary asphalt repair work. Lessee and Lessor agree to share striping, seal coating and lot sweeping at a 50%/50% split based upon mutually accepted maintenance contracts with outside vendors. Lessor shall maintain lot and landscaping at or above the current condition, at no additional cost to the lessee.]

3. Utilities and Taxes

This section should describe the responsibility for utilities and taxes. This could include electrical, water, sewage, and more.

Sample Language: [Lessor shall pay all taxes and utilities associated with the facilities, including maintenance of existing facility lighting as directed by standard safety procedures.]

4. Signage

This section should describe signage allowances and restrictions.

Sample Language: [Lessee may provide signage, meeting with the written approval of lessor, designating usage allowances.]

5. Enforcement

This section should describe any facility usage enforcement methods.

Sample Language: [Lessee may provide a surveillance officer(s) for parking safety and usage only for the period of its exclusive use. Lessee and lessor reserve the right to tow, at owners expense, vehicles improperly parked or abandoned. All towing shall be with the approval of the lessor.]

6. Cooperation

This section should describe the communication relationship.

Sample Language: [Lessor and lessee agree to cooperate to the best of their abilities to mutually use the facilities without disturbing the other party. The parties agree to meet on occasion to work out any problems that may arise to the shared use.]

7. Insurance

This section should describe insurance requirements for the facilities.

Sample Language: [At their own expense, lessor and lessee agree to maintain liability insurance for the facilities as is standard for their own business usage.]

8. Indemnification

This section should describe indemnification as applicable and negotiated. This is a very technical section and legal counsel should be consulted for appropriate language to each and every agreement.

No sample language provided.

9. Termination

This section should describe how to (or if this agreement can be terminated) and what the post-termination responsibilities are.

Sample Language: [If lessor transfers ownership, or if part of all of the facilities are condemned, or access to the facilities is changes or limited, lessee may, in its sole discretion terminate this agreement without further liability by giving Lessor not less than 60 days prior written notice.]

Upon termination of this agreement, Lessee agrees to remove all signage and repair damage due to excessive use or abuse. Lessor agrees to give lessee the right of first refusal on subsequent renewal of this agreement.

10. Supplemental Covenants

This section should contain any additional covenants, rights, responsibilities and/or agreements.

No sample language provided.

Source: Atlanta Regional Commission, 2003

Parking License Agreement

This Parking License Agreement (the "Agreement") is entered into this 21st day of February 2002 between U.S. Bank National Association ("U.S. Bank") and Greater Brooklyn Business Association (GBBA) and the Brooklyn Action Corp. (BAC) ("Lessees").

WHEREAS, Lessee is desirous of obtaining a license for use of all parking spaces in the parking lot located at 3230 SE Milwaukie Ave., Portland, OR (the "Parking Lot") as further set forth herein.

NOW THEREFORE, in consideration of the mutual covenants contained herein the parties hereto agree as follows:

1. Term of Agreement. This agreement shall commence on March 1, 2002, and shall continue thereafter on a month to month basis, and may be terminated by either party at any time provided, however, that the terminating party provides the other party with at least thirty (30) days advance written notice.

2. Premises. Subject to the terms, covenants and conditions contained herein, U.S. Bank grants to Lessee the right to use, in common with others, all parking spaces in the Parking Lot as identified in Exhibit A attached hereto (the "Premises").

3. Use of Premises. The Premises shall be used solely for the parking of automobiles for use by Lessee and its employees and for no other purpose. Such exclusive use shall be limited to the hours of 6:00 p.m. through 8:00 a.m. Monday through Friday, and unlimited use on Saturday and Sunday.

4. License Payments. Lessee shall pay U.S. Bank a license fee equal to $__ per stall, per month for a monthly total of $__, which shall be payable on the first day of each month during the term of this agreement, in advance, in lawful money of the United States, without demand, reduction or offset to U.S. Bank Corporate Properties at SDS 12-1717, P.O. Box 86, Minneapolic, MN 55486-1716.

5. Non-assignment. Lessee's interest herein shall not be assigned, transferred, or granted to any other party.

6. Default. In addition to the termination rights provided herein, U.S. Bank may immediately terminate this Agreement without notice in the event that Lessee defaults on any terms or conditions of the Agreement. In the event Lessee defaults on any terms or condition of this Agreement, U.S. Bank may physically remove any persons, personal property and/or vehicles of Lessee, its employees, customers or guests remaining on the Premises. Said removal shall be at the expense of Lessee.

7. Alterations. Lessee shall not alter, improve, or in any way change or modify the contour or appearance of the Premises. Lessee is responsible for security and clean up related to its use of the Premises. Any damage done to the Premises during any use of the Premises by Lessee or its employees shall be repaired at Lessee's sole cost and expense to its original condition, or if necessary, replaced.

8. Indemnity. Lessee agrees to indemnify U.S. Bank and hold U.S. Bank harmless from and against any losses, damages or claims, including attorney fees and costs incurred by U.S. Bank for any damage to the Premises arising out of the use of the Premises by Lessee, its customers, invitees, employees, contractors or agents. The terms of this section will survive the termination of this Agreement.

9. Liability. At all times during the term of this Agreement, Lessee shall maintain at its own cost and expense, a policy of commercial general liability insurance, including contractual liability covering its obligations under this Agreement, with a minimum coverage of $1,000,000 per occurrence and not less than $2,000,000 annual aggregate as to the Premises. In addition to Lessee, the policy shall also name U.S. Bank as an additional insured. Such insurance shall be purchased from an insurance company licensed to do business in California, with an A.M. Best rating of not less than A-X, and shall be placed with such company and upon such forms, as U.S. Bank shall approve. Lessee shall promptly provide U.S. Bank with a certificate of insurance as evidence of the above insurance, which shall provide that the insurer will give U.S. Bank at least thirty (30) days written notice prior to any cancellation, non-renewal or material change in coverage.

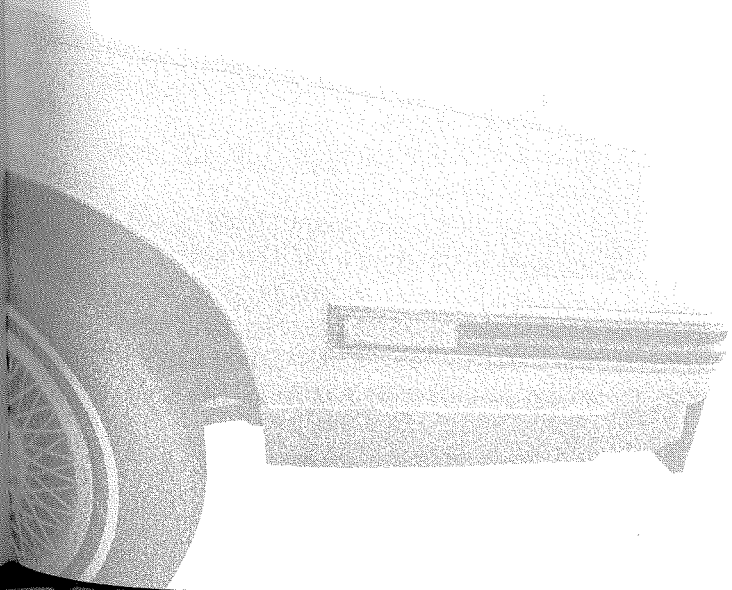
10. U.S. Bank Not Responsible. U.S. Bank shall not be liable for any losses, damages, or claims of Lessee, or its customers, invitees, employees, contractors or agents of Lessee arising out of the use of the above licenses or the use of the Premises. This Agreement shall not constitute a bailment nor shall it create the relationship of bailor and bailee. U.S. Bank shall have the right to post notices of non-responsibility on or about the Premises. Lessee shall reimburse U.S. Bank for the costs of such notices and their installation within 10 days after receiving U.S. Bank's invoice.

Appendix D

Sample Methodology for Determining Shared Parking

METHODOLOGY FOR DETERMINING SHARED PARKING

The survey results demonstrated that a reduction in the number of parked vehicles occurs as a result of shared parking. The data were sufficiently consistent to indicate that a quantitative basis for estimating the demand for shared parking does exist. Based upon the findings of the survey, a methodology was developed to determine parking demand for the conditions typically found in a mixed-use development. This methodology is universal in its application and flexible enough to incorporate adjustment factors as necessary to suit specific policies, programs, and market conditions.



THE METHODOLOGY

The methodology involves four basic steps that may be applied, with appropriate background information, to an existing or proposed project. Exhibit 25 illustrates the organization and flow of work. The basic flow of work begins with a review of the development plan and proceeds through the four steps (and subtasks) to an estimate of demand for shared peak parking. In support of these activities, input from other analyses may be added. They could include an additional data base to refine or modify unit parking factors or other characteristics and market analyses.

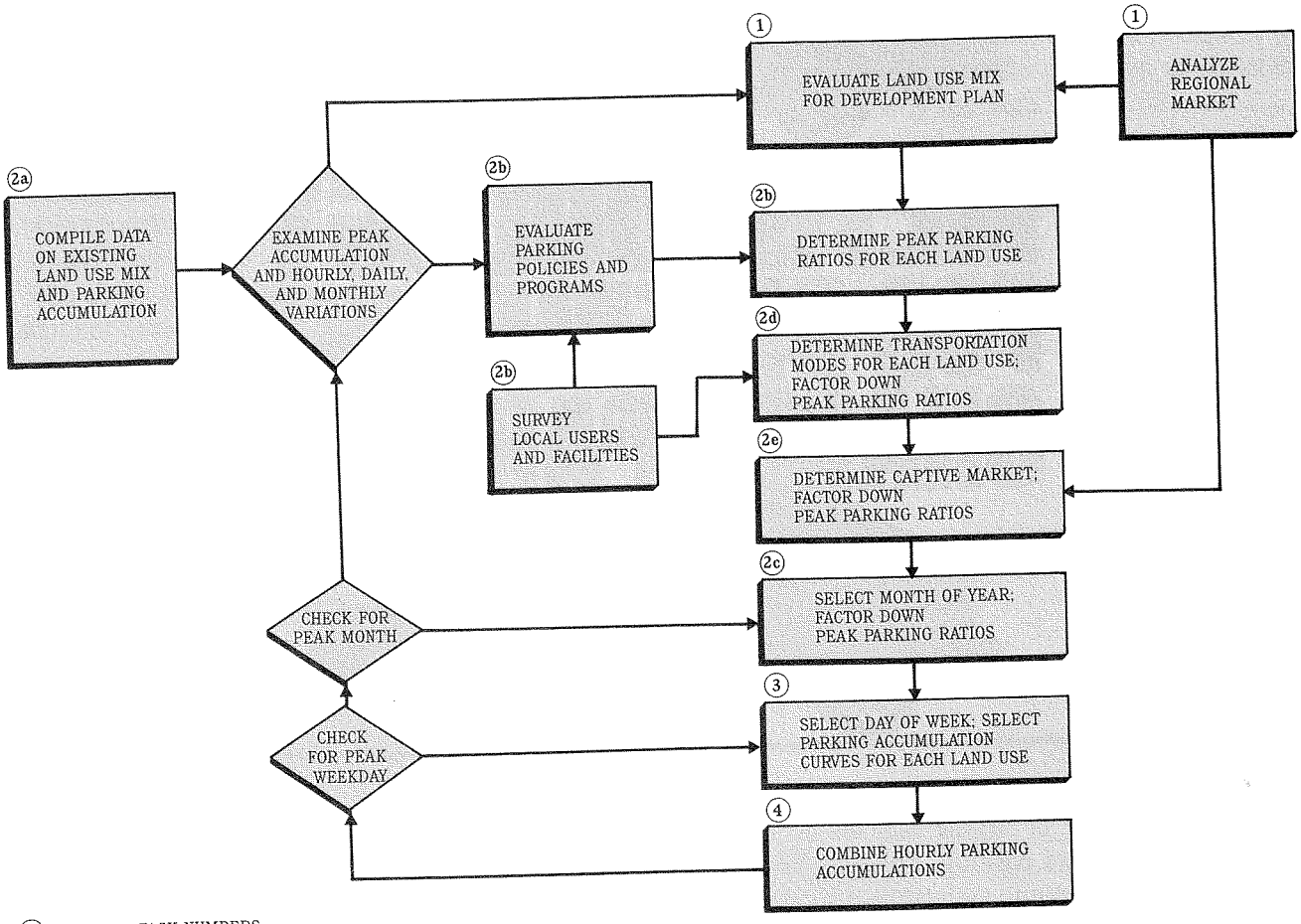
The methodology is designed to be sequential, but it can be used in an iterative fashion to test the impact of alternative development plans, assumptions, or policies.

STEP 1: INITIAL PROJECT REVIEW

An analysis of shared parking deals with more detailed issues and relationships than traditional analyses of parking demand. Knowledge of the site and intended land use therefore becomes more important. In addition to square footage or other measurements

EXHIBIT 25

SHARED PARKING METHODOLOGY



(0) STEP AND TASK NUMBERS

of land use, it is necessary to describe both the physical and anticipated functional relationships between the land uses. While the physical relationships concern the basic physical layout and organization of facilities—for example, vertical or horizontal projects, distances between land uses, surrounding uses, proximity to transportation and other parking facilities—functional relationships concern the intended character and type of land uses and how the project will work. For example, in a project that includes retail, hotel, and office space, retail facilities may be clearly oriented to hotel guests, office workers, or other "captive persons," or to external shoppers. Early in the planning process for a development, the information describing relationships between land uses may not be available. If not, a set of assumptions and/or alternative development scenarios should be identified for the analysis. A checklist of questions dealing with these assumptions is as follows:

- What is the square footage by use (or number of hotel rooms and theater seats)?
- If a hotel is included, will banquet rooms and convention facilities be available?
- If meeting rooms and convention facilities are provided, what are the intended concept for programs and the intended audience?
- What is the assumed market support for any retail or entertainment space?
- If a cinema is included, how many theaters will it have? What type of programs will be scheduled? What are the assumptions regarding show times?
- If residential space is included, will any parking constraints be observed (reserved parking, for example)?

STEP 2: ADJUSTMENT FOR PEAK PARKING FACTOR

This step produces an appropriate set of peak parking demand factors. They represent the number of parking spaces needed per unit of land use or other parameter. To determine the factors, the following subtasks are necessary.

Verification of Land Use and Selection of Parking Parameters. The land uses described for the project in step 1 define the specific set of peak parking factors needed for the analysis of parking demand. The parameter for each factor should be verified. Generally, square feet of floor space or rooms or dwelling units would be used; however, other variables might be more appropriate for certain unique activities.

Specifically, the following information must be verified:

- Verify that occupied GLA is to be used, including or excluding common areas.
- Convert convention facilities to equivalent square feet if capacity per person is used in the building program (15 square feet per person may be used if another density factor is not available).

Selection of Parking Factors. A preliminary value should be selected or determined for the set of peak parking factors. Information could be drawn from three sources: (1) parking factors suggested by the study (see exhibit 26), (2) validated experience of the developer or other local authorities, or (3) new parking field surveys. It is essential to know what season or time of year and mode of travel are represented in the specific source for factors. This information should be described in terms of month of year (by land use) and approximate percent of nonauto use (that is, percent of person-trips made by modes other than auto).

Adjustment for Season. For demand analyses, all parking factors need to reflect the same "design condition." Typically, the 30th highest hour has been used for highway projects. Similarly, for development analyses, the appropriate design period must be selected; that is, the peak season for each land use must be determined, based on developer's data, another source, or study results (see exhibit 27).

However, because the design month frequently is different for each land use in a multiuse development, trial and error may be required to determine which month produces the maximum aggregate parking demand. The intent of the exercise is to recognize the "aggregate effects" of seasonality. This concept is the same as that used to determine the impact of daily peaks.

Using the quantity for each land use, test calculations (parking demand factor multiplied by floor space) are made to identify the controlling land use. On this basis, a design month can be selected. Each

EXHIBIT 26

REPRESENTATIVE PEAK PARKING DEMAND FACTORS

Land Use	Unit	Weekday	Saturday
Office	Parking spaces per 1,000 sq. ft. GLA	3.00	0.50
Retail (400,000 sq. ft.)	Parking spaces per 1,000 sq. ft. GLA	3.80	4.00
Retail (600,000 sq. ft.)	Parking spaces per 1,000 sq. ft. GLA	3.80	5.00
Restaurant	Parking spaces per 1,000 sq. ft. GLA	20.00	20.00
Cinema	Parking spaces per seat	0.25	0.30
Residential	Parking spaces per dwelling unit[a]	1.00	1.00
Hotel			
Guest room	Parking spaces per room	1.25[b]	1.25[b]
Restaurant/lounge	Parking spaces per 1,000 sq. ft. GLA	10.00	10.00
Conference rooms	Parking spaces per seat[c]	0.50	0.50
Convention area	Parking spaces per 1,000 sq. ft. GLA[c]	30.00	30.00

[a]Per one auto owned per dwelling unit.
[b]Factored up to 100 percent auto use from the 80 percent auto use indicated in exhibit 13.
[c]Used by nonguests; the given rates thus are upper bounds, which are very rarely achieved.

EXHIBIT 27

REPRESENTATIVE MONTHLY VARIATIONS AS PERCENTAGE OF PEAK MONTH

Month	Office	Retail	Restaurant	Cinema	Residential	Hotel Rooms Weekday	Hotel Rooms Saturday	Hotel Conference	Hotel Convention
January	100%	65%	80%	90%	100%	90%	65%	100%	20%
February	100	65	75	70	100	90	70	100	40
March	100	70	90	50	100	95	80	100	80
April	100	70	90	70	100	95	85	100	80
May	100	70	95	70	100	95	85	100	100
June	100	75	100	100	100	100	90	100	100
July	100	75	100	100	100	100	100	100	50
August	100	75	85	70	100	100	100	100	50
September	100	75	80	80	100	95	90	100	70
October	100	75	80	70	100	95	90	100	70
November	100	80	80	50	100	85	80	100	40
December	100	100	90	50	100	85	65	100	20

parking factor is then adjusted to the same month. For example, if December is selected as the design month for a mixed-use project, the retail factor would be the normal peak, but the hotel factor would be factored to a value less than its seasonal peak.

Adjustment for Mode of Transportation Used. Just as the parking demand factors must be adjusted to the same season, they must also be adjusted to reflect the mode of transportation used. The recommended approach is a twofold change. First, available peak parking demand factors are adjusted upward to reflect 100 percent auto use. Second, these parking factors for 100 percent auto use are adjusted downward to reflect the expected conditions at the development project being analyzed. For the typical suburban project where transit is not available, the second modification is not needed. However, for downtown projects in urban areas where transit may be used for 10 to 60 percent of the trips, this correction is significant.

The source for data about transportation modes may be specific transportation surveys or transportation data available from planning studies for the urban area. The latter choice requires an assessment of the information's applicability to a specific site.

Adjustment for Captive Market. This adjustment is optional because the effects of a captive market are difficult to identify. Without this adjustment, the demand estimate for shared parking would probably be too conservative.

The existence of the captive patron relationship is identified by surveys of employees, visitors, and patrons as well as by parking surveys. Captive markets could be large enough to significantly lower parking demand. The data might indicate a widely ranging relationship that may not be predictable, however. They might be analyzed in a "what if" sense to test the possible impacts. Assuming a representative value of captive market support could reduce parking factors for retail or entertainment uses. An alternative would be to undertake a specific market analysis. This analysis would include a site-specific assessment of the potential for captive market support.

STEP 3: ANALYSIS OF HOURLY ACCUMULATION

This step produces an estimate of hourly parking accumulations for each land use during a typical weekday or weekend day (Saturday). The results of this step identify the shape of hourly accumulation curves for five basic land uses. The curves were reasonably consistent for a wide range of surveyed sites

EXHIBIT 28

REPRESENTATIVE HOURLY ACCUMULATION BY PERCENTAGE OF PEAK HOUR

	Office		Retail		Restaurant		Cinema	Residential (non-CBD)		Residential (CBD)	Hotel					
											Guest Room		Restaurant/Lounge		Conference Room	Convention Area
Hour of Day	Weekday	Saturday	Weekday	Saturday	Weekday	Saturday	Daily	Weekday	Saturday	Daily	Weekday	Saturday	Weekday	Saturday	Daily	Daily
6:00 a.m.	3%	—	—	—	—	—	—	100%	100%	100%	100%	90%	20%	20%	—	—
7:00 a.m.	20	20%	8%	3%	2%	2%	—	87	95	95	85	70	20	20	—	—
8:00 a.m.	63	60	18	10	5	3	—	79	88	90	65	60	20	20	50%	50%
9:00 a.m.	93	80	42	30	10	6	—	73	81	87	55	50	20	20	100	100
10:00 a.m.	100	80	68	45	20	8	—	68	74	85	45	40	20	20	100	100
11:00 a.m.	100	100	87	73	30	10	—	59	71	85	35	35	30	30	100	100
12:00 Noon	90	100	97	85	50	30	30%	60	71	85	30	30	50	30	100	100
1:00 p.m.	90	80	100	95	70	45	70	59	70	85	30	30	70	45	100	100
2:00 p.m.	97	60	97	100	60	45	70	60	71	85	35	35	60	45	100	100
3:00 p.m.	93	40	95	100	60	45	70	61	73	85	35	40	55	45	100	100
4:00 p.m.	77	40	87	90	50	45	70	66	75	87	45	50	50	45	100	100
5:00 p.m.	47	20	79	75	70	60	70	77	81	90	60	60	70	60	100	100
6:00 p.m.	23	20	82	65	90	90	80	85	85	92	70	70	90	90	100	100
7:00 p.m.	7	20	89	60	100	95	90	94	87	94	75	80	100	95	100	100
8:00 p.m.	7	20	87	55	100	100	100	96	92	96	90	90	100	100	100	100
9:00 p.m.	3	—	61	40	100	100	100	98	95	98	95	95	100	100	100	100
10:00 p.m.	3	—	32	38	90	95	100	99	96	99	100	100	90	95	50	50
11:00 p.m.	—	—	13	13	70	85	80	100	98	100	100	100	70	85	—	—
12:00 Midnight	—	—	—	—	50	70	70	100	100	100	100	100	50	70	—	—

involving office, regional retail, and residential facilities (see exhibit 28). Nonroom-related hotel activities and entertainment uses varied significantly, however. If site-specific data are not available for these two land uses, survey results could be used.

Accumulation curves are then estimated for each land use, based on the selected hourly values described in terms of the percent of maximum design-day parking demand expected at every hour during the day. The parking demand factor (step 2) multiplied by quantity of land use (step 1) produces an estimate of peak parking demand. This value multiplied by each hourly percentage produces an estimate of parking demand for every land use component by hour of day.

STEP 4: ESTIMATE OF SHARED PARKING

The hourly parking demand for each land use is merged to estimate overall shared parking demand for a proposed project. This step is simply the hour-by-hour addition of parking demand for each use to estimate the aggregate accumulation. As noted previously, the method described above should be used for weekday and Saturday conditions to test for the controlling value.

SAMPLE USE OF THE METHODOLOGY

The following sample situation has been devised to demonstrate the use of the recommended methodology.

1. *Objective:* To estimate the peak parking requirements for a proposed mixed-use development.
2. *Plan:* The proposed development has the following components:
   - Office = 400,000 square feet GLA
   - Retail = 300,000 square feet GLA
   - Hotel = 500 rooms plus 5,000 square feet of restaurant and conference facilities with 200-seat capacity.
3. *Location:* The project will be located in the downtown of a medium-size urban community whose regional population is approximately 1.5 million.
4. *Mode split:*[17] Based on surveys conducted at existing developments in the downtown, it is estimated that 75 percent of employees and patrons and 50 percent of hotel guests will use autos. The number of persons per auto is assumed to be typical (1.2 for employees, 1.8 for patrons, 1.4 for hotel guests).

[17] "Mode split" refers to the percentage of people at a site who use a particular mode of transportation, with the total of all modes equaling 100 percent.

5. *Captive market:* Based upon regional market surveys, it is estimated that 15 percent of all retail patrons will be office employees within the development. It is also estimated that 50 percent of the hotel restaurant patronage will be generated *outside* the development.

The unadjusted peak parking demand ratios (see Appendix C) for the component land uses are as follows:

- **Weekday**
  Office: 3.0 parking spaces per 1,000 square feet GLA
  Retail: 3.8 spaces per 1,000 square feet GLA
  Hotel rooms: 1.25 spaces per room
  Hotel restaurant: 10.0 spaces per 1,000 square feet GLA
  Hotel conference rooms: 0.5 space per seat
- **Saturday**
  Office: 0.5 parking space per 1,000 square feet GLA
  Retail: 4.0 spaces per 1,000 square feet GLA
  Hotel rooms: 1.25 spaces per room
  Hotel restaurant: 10.0 spaces per 1,000 square feet GLA
  Hotel conference rooms: 0.5 space per seat.

Factoring each ratio by the estimated percentage of auto use yields the following adjusted ratios:

- **Weekday**
  Office: $3.0 \times 0.75 = 2.25$ parking spaces per 1,000 square feet GLA
  Retail: $3.8 \times 0.75 = 2.85$ spaces per 1,000 square feet GLA
  Hotel rooms: $1.25 \times 0.50 = 0.63$ space per room
  Hotel restaurant: $10.0 \times 0.75 = 7.5$ spaces per 1,000 square feet GLA
  Hotel conference rooms: $0.5 \times 0.75 = 0.38$ space per seat
- **Saturday**
  Office: $0.5 \times 0.75 = 0.38$ parking space per 1,000 square feet GLA
  Retail: $4.0 \times 0.75 = 3.0$ spaces per 1,000 square feet GLA
  Hotel rooms: $1.25 \times 0.50 = 0.63$ space per room
  Hotel restaurant: $10.0 \times 0.75 = 7.5$ spaces per 1,000 square feet GLA
  Hotel conference rooms: $0.5 \times 0.75 = 0.38$ space per seat.

The ratio for retail parking demand also should be factored for market synergy for a weekday, when office employees are present:

Retail (weekday): $2.85 \times (1 - 0.15) = 2.42$ spaces per 1,000 square feet GLA.

The survey data on the captive market in this instance do not estimate the possible synergistic effect resulting from hotel guests' patronage of the retail facilities. To be conservative, therefore, this effect is assumed to be negligible. However, the unadjusted demand ratio for the hotel restaurant (10 spaces per 1,000 square feet GLA) already is based on a typical 50 percent patronage by nonguests. Another very conservative assumption is that the hotel conference facilities are fully used by nonguests.

Next, the ratios for each component land use need to be factored according to the month of the year during which the overall peak parking accumulation would be greatest. In some instances, the peak month for a weekday may not be the same as the peak month for a Saturday. In that case, only by trial and error can the condition (that is, combination of day and month) for peak parking demand be determined. In this instance, however, a tedious trial-and-error analysis can be avoided by an inspection of the relative size of each component land use and the relative differences in peak daily and monthly demands.

Based on the monthly values in Appendix C, the contribution of the hotel components to overall parking demand remains the same on a weekday and a Saturday of a given month. Thus, for a given month, the condition for overall peak parking demand depends only upon the relative size of the retail and office components. Since the office component is large relative to the retail component, it is most likely that the peak condition will occur on a weekday rather than on a Saturday.

The monthly office demand will remain constant, the monthly retail demand will peak during December, and the monthly hotel components will peak during the summer. Based on an inspection, however, the relative contribution of retail parking demand to total project parking demand during December (compared with that of hotel parking demand during the summer) is much larger.

The peak parking demand at the entire development will therefore most likely occur on a weekday in December. The peak parking demand may then be estimated by conducting an hourly parking accumulation analysis using the following weekday ratios, adjusted to the month of December:

Office: $2.25 \times 1.00 = 2.25$ spaces per 1,000 square feet GLA

Retail: 2.42 × 1.00 = 2.42 spaces per 1,000 square feet GLA
Hotel rooms: 0.63 x 0.85 = 0.54 space per room
Hotel restaurant: 7.5 × 0.93 = 6.98 spaces per 1,000 square feet GLA[18]
Hotel conference rooms: 0.38 × 1.00 = 0.38 space per seat.

An hourly parking accumulation analysis, using the above ratios and the hourly values from Appendix C, reveals that the peak accumulation for the combined land uses would be 1,809 cars, occurring at 2:00 p.m. This result is revealed only by calculating the accumulation for each hour of the day. The calculation for 2:00 p.m. would be as follows:

Adjusted Peak Ratio × Floor Area × 2:00 p.m. Value (Appendix C)/Peak Value (Appendix C)

For each land use, the calculations are as follows:
Office: 2.25 × 400 × (2.9 ÷ 3.0) = 870 spaces
Retail: 2.42 × 300 × (3.7 ÷ 3.8) = 707 spaces
Hotel rooms: 0.54 × 500 × (0.5 ÷ 1.0) = 135 spaces
Hotel restaurant: 6.98 × 5 × (7.2 ÷ 12.0) = 21 spaces
Hotel conference rooms: 0.38 × 200 × (0.5 ÷ 0.5) = 76 spaces
870 + 707 + 135 + 21 + 76 = 1,809 total spaces.

Because the proposed development will be in a downtown area, this weekday parking demand of 1,809 cars must be assessed relative to the existing surpluses and deficiencies in the supply of parking spaces within walking distance of the development.

As an additional demonstration of the use of this method, four of the test cases included in exhibit 24 have been selected for refined analysis. Exhibits 29, 30, 31, and 32 indicate the results for projects 10, 14, 16, and 17, respectively. The findings indicate refined estimates of peak parking demand, including any assumptions used concerning the adjustments for season, mode of transportation, or captive market.

Project 10. By adjusting the restaurant to the October seasonal factor, and by using a 50 percent captive portion for the hotel restaurant and 50 percent hotel occupancy for the day (indicated by survey data), the shared parking estimate is 638 spaces. This number compares closely to actual parking. Further, this analysis assumes that the conference facilities were not being significantly used on the day of the analysis.

Project 14. By adjusting the restaurant use to an October condition, using the captive market relationship of 10 percent for the restaurant (based on the surveys), and selecting an office factor of 2.3 spaces per 1,000 square feet, the estimated demand would be 1,776 spaces. This number is reasonably comparable to the actual count, but the analysis suggests that further surveys of the project are needed. The use of a lower peak factor needs further verification. It is possible that some of the demand may use off-site parking.

Project 16. By reflecting a seasonal factor for the retail use (75 percent for July) and using a 50 percent captive market factor for the restaurant, the estimate of shared parking is 600 spaces, which agrees with observed counts. The captive factor seems reasonable, given the isolated nature of the project.

Project 17. By reflecting a small but significant use by transportation other than auto (11 to 12 percent) for the three uses (as indicated by the survey) and a seasonal adjustment for the cinema (to December), and by expecting 1.50 persons per car for retail space, the shared parking estimate is 3,054 spaces, which compares closely to the actual count.

These comparisons indicate that the method can produce parking demand estimates that replicate existing conditions. Clearly, detailed data are needed. However, rationalization based on sound assumptions can be used to develop the estimates as well. The simplicity of the methodology allows parametric analysis to test wide variations in input data.

[18]This calculation represents the weighted average between the restaurant and hotel guest factors for December, as 50 percent of patrons are guests.

EXHIBIT 29

APPLICATION OF RECOMMENDED METHODOLOGY TO TEST CASE NUMBER 10

(Office/hotel)

Hour	Office	Retail	Restaurant	Cinema	CBD Residential	Non-CBD Residential	Hotel Room	Hotel Conference	Hotel Convention	Totals[a]	Observed
WEEKDAY											
6:00 a.m.	16	0	0	0	0	0	136	0	0	152	—
7:00 a.m.	107	0	1	0	0	0	151	0	0	259	—
8:00 a.m.	338	0	3	0	0	0	136	0	0	477	—
9:00 a.m.	499	0	5	0	0	0	121	0	0	625	—
10:00 a.m.	537	0	10	0	0	0	91	0	0	638	594
11:00 a.m.	537	0	15	0	0	0	76	0	0	628	576
12:00 Noon	483	0	25	0	0	0	76	0	0	584	511
1:00 p.m.	483	0	35	0	0	0	76	0	0	594	552
2:00 p.m.	521	0	30	0	0	0	76	0	0	627	594
3:00 p.m.	499	0	30	0	0	0	76	0	0	605	570
4:00 p.m.	414	0	25	0	0	0	91	0	0	529	—
5:00 p.m.	252	0	35	0	0	0	121	0	0	408	—
6:00 p.m.	124	0	45	0	0	0	136	0	0	305	—
7:00 p.m.	38	0	50	0	0	0	136	0	0	224	—
8:00 p.m.	38	0	50	0	0	0	151	0	0	239	—
9:00 p.m.	16	0	50	0	0	0	151	0	0	217	—
10:00 p.m.	16	0	45	0	0	0	151	0	0	212	—
11:00 p.m.	0	0	35	0	0	0	136	0	0	171	—
12:00 Midnight	0	0	25	0	0	0	136	0	0	161	—
SATURDAY											
6:00 a.m.	0	0	0	0	0	0	136	0	0	136	—
7:00 a.m.	18	0	1	0	0	0	151	0	0	170	—
8:00 a.m.	54	0	2	0	0	0	136	40	0	231	—
9:00 a.m.	72	0	3	0	0	0	121	100	0	295	—
10:00 a.m.	72	0	4	0	0	0	91	100	0	266	259
11:00 a.m.	90	0	5	0	0	0	76	100	0	270	306
12:00 Noon	90	0	15	0	0	0	76	100	0	280	281
1:00 p.m.	72	0	23	0	0	0	76	100	0	270	312
2:00 p.m.	54	0	23	0	0	0	76	100	0	252	259
3:00 p.m.	36	0	23	0	0	0	76	100	0	234	290
4:00 p.m.	36	0	23	0	0	0	91	100	0	249	—
5:00 p.m.	18	0	30	0	0	0	121	100	0	269	—
6:00 p.m.	18	0	45	0	0	0	136	100	0	299	—
7:00 p.m.	18	0	48	0	0	0	136	100	0	301	—
8:00 p.m.	18	0	50	0	0	0	151	100	0	319	—
9:00 p.m.	0	0	50	0	0	0	151	100	0	301	—
10:00 p.m.	0	0	48	0	0	0	151	40	0	239	—
11:00 p.m.	0	0	43	0	0	0	136	0	0	178	—
12:00 Midnight	0	0	35	0	0	0	136	0	0	171	—

[a]Numbers may not add exactly because of rounding.

EXHIBIT 30

APPLICATION OF RECOMMENDED METHODOLOGY TO TEST CASE NUMBER 14

(Office/hotel/entertainment)

Hour	Office	Retail	Restaurant	Cinema	CBD Residential	Non-CBD Residential	Hotel Room	Hotel Conference	Hotel Convention	Totals[a]	Observed
WEEKDAY											
6:00 a.m.	41	0	0	0	0	0	160	0	0	202	—
7:00 a.m.	276	0	8	0	0	0	178	0	0	462	—
8:00 a.m.	869	0	21	0	0	0	160	40	0	1,090	—
9:00 a.m.	1,283	0	41	0	0	0	142	100	0	1,567	—
10:00 a.m.	1,380	0	83	0	0	0	107	100	0	1,670	1,498
11:00 a.m.	1,380	0	124	0	0	0	89	100	0	1,693	1,438
12:00 Noon	1,242	0	207	0	0	0	89	100	0	1,638	1,138
1:00 p.m.	1,242	0	290	0	0	0	89	100	0	1,721	1,243
2:00 p.m.	1,339	0	248	0	0	0	89	100	0	1,776	1,333
3:00 p.m.	1,283	0	248	0	0	0	89	100	0	1,721	1,318
4:00 p.m.	1,063	0	207	0	0	0	107	100	0	1,476	—
5:00 p.m.	649	0	290	0	0	0	142	100	0	1,181	—
6:00 p.m.	317	0	373	0	0	0	160	100	0	950	—
7:00 p.m.	97	0	414	0	0	0	160	100	0	771	—
8:00 p.m.	97	0	414	0	0	0	178	100	0	789	—
9:00 p.m.	41	0	414	0	0	0	178	100	0	733	—
10:00 p.m.	41	0	373	0	0	0	178	40	0	632	—
11:00 p.m.	0	0	290	0	0	0	160	0	0	450	—
12:00 Midnight	0	0	207	0	0	0	160	0	0	367	—
SATURDAY											
6:00 a.m.	0	0	0	0	0	0	160	0	0	160	—
7:00 a.m.	60	0	8	0	0	0	178	0	0	246	—
8:00 a.m.	180	0	12	0	0	0	160	40	0	393	—
9:00 a.m.	240	0	25	0	0	0	142	100	0	507	—
10:00 a.m.	240	0	33	0	0	0	107	100	0	480	190
11:00 a.m.	300	0	41	0	0	0	89	100	0	530	190
12:00 Noon	300	0	124	0	0	0	89	100	0	613	171
1:00 p.m.	240	0	186	0	0	0	89	100	0	615	163
2:00 p.m.	180	0	186	0	0	0	89	100	0	555	158
3:00 p.m.	120	0	186	0	0	0	89	100	0	495	122
4:00 p.m.	120	0	186	0	0	0	107	100	0	513	—
5:00 p.m.	60	0	248	0	0	0	142	100	0	551	—
6:00 p.m.	60	0	373	0	0	0	160	100	0	693	—
7:00 p.m.	60	0	393	0	0	0	160	100	0	714	—
8:00 p.m.	60	0	414	0	0	0	178	100	0	752	—
9:00 p.m.	0	0	414	0	0	0	178	100	0	692	—
10:00 p.m.	0	0	393	0	0	0	178	40	0	611	—
11:00 p.m.	0	0	352	0	0	0	160	0	0	512	—
12:00 Midnight	0	0	290	0	0	0	160	0	0	450	—

[a]Numbers may not add exactly because of rounding.

EXHIBIT 31

APPLICATION OF RECOMMENDED METHODOLOGY TO TEST CASE NUMBER 16

(Office/retail/entertainment)

Hour	Office	Retail	Restaurant	Cinema	CBD Residential	Non-CBD Residential	Hotel Room	Hotel Conference	Hotel Convention	Totals[a]	Observed
WEEKDAY											
6:00 a.m.	12	0	0	0	0	0	0	0	0	12	—
7:00 a.m.	81	6	5	0	0	0	0	0	0	91	78
8:00 a.m.	255	13	11	0	0	0	0	0	0	280	312
9:00 a.m.	377	31	23	0	0	0	0	0	0	430	420
10:00 a.m.	405	50	45	0	0	0	0	0	0	500	480
11:00 a.m.	405	64	68	0	0	0	0	0	0	537	492
12:00 Noon	365	72	113	0	0	0	0	0	0	549	516
1:00 p.m.	365	74	158	0	0	0	0	0	0	596	600
2:00 p.m.	393	72	135	0	0	0	0	0	0	600	528
3:00 p.m.	377	70	135	0	0	0	0	0	0	582	492
4:00 p.m.	312	64	113	0	0	0	0	0	0	489	516
5:00 p.m.	190	59	158	0	0	0	0	0	0	406	378
6:00 p.m.	93	61	203	0	0	0	0	0	0	356	336
7:00 p.m.	28	66	225	0	0	0	0	0	0	319	—
8:00 p.m.	28	64	225	0	0	0	0	0	0	318	—
9:00 p.m.	12	45	225	0	0	0	0	0	0	282	—
10:00 p.m.	12	24	203	0	0	0	0	0	0	238	—
11:00 p.m.	0	10	158	0	0	0	0	0	0	167	—
12:00 Midnight	0	0	113	0	0	0	0	0	0	113	—
SATURDAY											
6:00 a.m.	0	0	0	0	0	0	0	0	0	0	—
7:00 a.m.	14	4	5	0	0	0	0	0	0	22	—
8:00 a.m.	41	8	7	0	0	0	0	0	0	55	—
9:00 a.m.	54	23	14	0	0	0	0	0	0	91	—
10:00 a.m.	54	35	18	0	0	0	0	0	0	107	—
11:00 a.m.	68	59	23	0	0	0	0	0	0	149	—
12:00 Noon	68	66	68	0	0	0	0	0	0	201	—
1:00 p.m.	54	74	101	0	0	0	0	0	0	229	—
2:00 p.m.	41	78	101	0	0	0	0	0	0	220	—
3:00 p.m.	27	78	101	0	0	0	0	0	0	206	—
4:00 p.m.	27	70	101	0	0	0	0	0	0	198	—
5:00 p.m.	14	59	135	0	0	0	0	0	0	207	—
6:00 p.m.	14	51	203	0	0	0	0	0	0	267	—
7:00 p.m.	14	47	214	0	0	0	0	0	0	274	—
8:00 p.m.	14	43	225	0	0	0	0	0	0	281	—
9:00 p.m.	0	31	225	0	0	0	0	0	0	256	—
10:00 p.m.	0	31	214	0	0	0	0	0	0	245	—
11:00 p.m.	0	8	191	0	0	0	0	0	0	199	—
12:00 Midnight	0	0	158	0	0	0	0	0	0	158	—

[a]Numbers may not add exactly because of rounding.

EXHIBIT 32

APPLICATION OF RECOMMENDED METHODOLOGY TO TEST CASE NUMBER 17

(Office/retail/entertainment)

WEEKDAY

Hour	Office	Retail	Restaurant	Cinema	CBD Residential	Non-CBD Residential	Hotel Room	Hotel Conference	Hotel Convention	Totals[a]	Observed
6:00 a.m.	5	0	0	0	0	0	0	0	0	5	—
7:00 a.m.	31	170	0	0	0	0	0	0	0	201	—
8:00 a.m.	98	383	0	0	0	0	0	0	0	481	480
9:00 a.m.	144	894	0	0	0	0	0	0	0	1,038	859
10:00 a.m.	155	1,448	0	0	0	0	0	0	0	1,603	1,499
11:00 a.m.	155	1,853	0	0	0	0	0	0	0	2,007	1,818
12:00 Noon	139	2,066	0	117	0	0	0	0	0	2,322	1,858
1:00 p.m.	139	2,129	0	237	0	0	0	0	0	2,506	1,998
2:00 p.m.	150	2,066	0	237	0	0	0	0	0	2,453	1,938
3:00 p.m.	144	2,023	0	237	0	0	0	0	0	2,404	1,758
4:00 p.m.	119	1,853	0	237	0	0	0	0	0	2,209	1,698
5:00 p.m.	73	1,682	0	237	0	0	0	0	0	1,992	1,499
6:00 p.m.	36	1,746	0	293	0	0	0	0	0	2,075	1,439
7:00 p.m.	11	1,895	0	293	0	0	0	0	0	2,199	1,718
8:00 p.m.	11	1,853	0	353	0	0	0	0	0	2,217	1,558
9:00 p.m.	5	1,299	0	353	0	0	0	0	0	1,657	519
10:00 p.m.	5	681	0	353	0	0	0	0	0	1,040	320
11:00 p.m.	0	277	0	293	0	0	0	0	0	570	—
12:00 Midnight	0	0	0	237	0	0	0	0	0	237	—
SATURDAY											
6:00 a.m.	0	0	0	0	0	0	0	0	0	0	—
7:00 a.m.	5	140	0	0	0	0	0	0	0	145	—
8:00 a.m.	15	280	0	0	0	0	0	0	0	296	—
9:00 a.m.	21	841	0	0	0	0	0	0	0	861	—
10:00 a.m.	21	1,261	0	0	0	0	0	0	0	1,282	—
11:00 a.m.	26	2,101	0	0	0	0	0	0	0	2,127	2,008
12:00 Noon	26	2,382	0	117	0	0	0	0	0	2,524	2,381
1:00 p.m.	21	2,662	0	237	0	0	0	0	0	2,919	2,611
2:00 p.m.	15	2,802	0	237	0	0	0	0	0	3,054	2,812
3:00 p.m.	10	2,802	0	237	0	0	0	0	0	3,049	2,869
4:00 p.m.	10	2,522	0	237	0	0	0	0	0	2,769	2,410
5:00 p.m.	5	2,101	0	237	0	0	0	0	0	2,343	—
6:00 p.m.	5	1,821	0	293	0	0	0	0	0	2,120	—
7:00 p.m.	5	1,681	0	293	0	0	0	0	0	1,980	—
8:00 p.m.	5	1,541	0	353	0	0	0	0	0	1,900	—
9:00 p.m.	0	1,121	0	353	0	0	0	0	0	1,474	—
10:00 p.m.	0	1,121	0	353	0	0	0	0	0	1,474	—
11:00 p.m.	0	280	0	293	0	0	0	0	0	574	—
12:00 Midnight	0	0	0	237	0	0	0	0	0	237	—

[a]Numbers may not add exactly because of rounding.

APPLICATIONS TO PLANNING AND DESIGN

Because the methodology estimates potential parking requirements for specific mixed-use developments, it can be used as evidence for a zoning procedure and as a development design tool. Use in zoning procedures is significant because of the parking standards currently used in most urban areas. In many cases, the shared parking analysis will indicate lower parking requirements.

For programming development, the process has several applications. First, the decision to develop a combined land use project is largely determined on the basis of market research and certain physical design constraints like site conditions and building height. The proposed floor areas of each land use of the development plan translate into a peak parking accumulation, using the shared parking methodology. The time of day (or in some instances, the day of week or season of year) at which the peak parking accumulation occurs is not always obvious without using the proposed methodology. As the nature of the demand distribution is directly related to the relative sizes of the component land uses, not only will the methodology define a combined land use peak parking requirement, which is less than the sum of the individual land use peaks, but it will also identify periods of time during which parking facilities are significantly underused. This knowledge may present an opportunity to revise the development plan to increase the marginal size of a component land use without a corresponding marginal increase in the size of parking infrastructure.

This feature can best be described by referring to exhibit 21 (p. 37), which illustrates an office/hotel mixed-use development. The peak shared parking demand for this case would be 1,445 spaces and would occur on a weekday morning; in the evening, the demand would be about 500 spaces. Because 1,445 parking spaces would be provided to serve the midday peak, more than 900 of these spaces would be vacant after 7:00 p.m. and on Saturdays. If the relative quantities of office and hotel space were adjusted, it is possible that the use of parking space could be more equalized. Although these criteria alone may or may not define an optimal development program, the opportunity exists to identify when use of parking space would be at maximum efficiency. This consideration could be an important one for planning the development.

Estimating shared parking demand should take place during planning and design to better use parking infrastructure.

Second, the methodology could be used to evaluate certain policies and programs aimed at reducing parking demand. Some policies and programs are feasible and attractive only in mixed-use projects. For example, mixed-use projects sometimes make transit use more viable because the need to use an automobile, once on the site, is reduced. Conversely, mixed-use projects generate more trips, encouraging better transit service. Some policies and programs that could be evaluated more effectively with this shared parking methodology are staggered work hours, variable retail and entertainment activity hours, and carpooling programs.

Appendix E

Sample Language for Landbanking of Required Parking

Appendix E – Sample Language for Landbanking of Required Parking

Source: Washington State Department of Transportation, 1999

Arlington, Washington
Adjustment of Parking Supply

1) Definition: An adjustment to parking requirements is a specific agreement between a property owner and the City's Responsible Official that the number of spaces actually needed for a specific building or use is, or will likely be, less than otherwise required due to the site-specific circumstances such as provision for shared parking or provision for alternative transportation reduction actions. The petitioner for an adjustment must agree to provide a "Land Bank" (an area of land or the right to the use of land set aside for possible future development of a surface lot or parking structure) so that if circumstances prove that more parking is required, it can be added.
2) Procedure: In specific instances set forth in this Section, the Responsible Officer may approve a reduction in the required parking spaces. Applications for such a reduction must be submitted in writing accompanied by the following:
    a. Landbank provision: A site plan showing how the additional number of spaces otherwise required could subsequently be provided on the site. The additional parking area shall maintain all required yards, setbacks and driveways for subject property and shall meet all requirements of this code. The additional parking areas may be provided in a surface lot or structured facility, as determined in a surface lot or structured facility, as determined by the city to be practical, feasible, and compatible with the site plan for the use.

Issaquah, Washington
Delay of Installation: Reserved Parking

A. Purpose and Intent: The purpose of reserved parking is to:

1) Provide less "paved and striped" parking than the minimum required, given documentation by the applicant which indicates a lower parking demand for the specific site or use; and
2) Provide landscaping in lieu of remaining parking which would be converted into "paved and striped" parking if site/use conditions change. The intent of reserved parking is to permit less impervious surface until conversion to parking is deemed necessary.

Provide less "paved and striped" parking than the minimum required, given documentation by the applicant which indicates a lower parking demand for the specific site or use; and

Provide landscaping in lieu of remaining parking which would be converted into "paved and striped" parking if site/use conditions change. The intent of reserved parking is to permit less impervious surface until conversion to parking is deemed necessary.

Source: Auburn Township Zoning Code

4A.09 Off-Street Parking Requirements

(5) Land Banking for Parking Spaces: The land banking of parking area may be authorized by the Board of Zoning Appeals, in the same manner as any other variance to the Zoning Resolution per the following conditions:

a. Reduction in the number of parking spaces to actually be constructed may be authorized by the Board of Zoning Appeals when the applicant can show, through such evidence as may be acceptable to the Board, that the required number of parking spaces set forth in Article 4A.09(b) is substantially in excess of the parking needed to reasonably serve the employees, patrons and other persons frequenting the subject property. The Board shall determine the number of parking spaces to actually be constructed as may be appropriate, in its opinion, based on the evidence submitted.
b. Sufficient usable space shall be reserved upon the subject property for the future construction of such additional spaces as may be necessary to accommodate any differential between the number of spaces to actually be constructed as part of the proposed project and the number of spaces required by the Zoning Resolution unless specific variance thereto has been granted. The reservation of said space, and the purpose therefore, shall be shown upon the approved plan and shall be component of any future submittal involving the subject property.
c. The property deed shall be revised and re-recorded to include a deed restriction setting forth the area to be land banked and a clear statement of the purpose thereof, and binding any future assigns or heirs to said restrictions and any other conditions as may be required by the Board in associated with this variance. A certified copy of the recorded deed with said restrictions shall be provided to the Board of Zoning Appeals and the Zoning Inspector within sixty days of the Boards action to approve this variance.