PAS Essential

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Parking Solutions

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American Planning Association

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Modern Approaches to Parking Management

Davidson, Michael and Fay Dolnick, eds. 2002. "The Dynamics of Off-Street Parking." In *Parking Standards*. Planning Advisory Service Report No. 510/511. Chicago: American Planning Association.

- Overview of reducing parking requirements through strategies including shared parking, maximum parking standards, downtown parking standards, and bicycle parking. PAS subscribers can access the rest of the report at http://www.planning.org/pas/reports/subscribers/parking.htm .

Litman, Todd. 2009. "Parking Management Best Practices: Making Efficient Use of Parking Resources." *Zoning Practice*, June.

- Analysis of various strategies to maximize the efficient use of parking resources. Includes Q&A with author.

Maryland, State of. 2002. "Parking Management" and "Parking Design." Chapters 2 and 3 in *Driving Urban Environments: Smart Growth Parking Best Practices*. Governor's Office of Smart Growth.

- Looks at limiting parking supply and managing parking demand, and discusses a number of parking design best practices.

Mukhija, Vinit and Donald Shoup. 2006. "Quantity versus Quality in Off-Street Parking Requirements." *Journal of the American Planning Association*, 72(3): 296–308. Published by Taylor & Francis, Ltd., www.informaworld.com

- Focusing on the importance of parking quality, not quantity, this article offers five parking-related strategies planners can use to improve urban design.

Shoup, Donald. 2006. "The Practice of Parking Requirements." *Zoning Practice*, January.

- Provides overview of how planners set parking standards; describes some of the problems with the traditional approach. Includes Q&A with author.

U.S. Environmental Protection Agency, Development, Community, and Environment Division. 2006. "Beyond Generic Parking Requirements," "The Costs of Parking," and "Innovative Parking Alternatives." Pages 6-33 in *Parking Spaces / Community Places: Finding the Balance through Smart Growth.* Washington, D.C.: U.S. Environmental Protection Agency.

- Discusses problems with inflexible parking requirements and looks at innovative solutions.

Shared Parking

Capitol Region Council Of Governments. 2002. "Shared Parking – Fact Sheet." In *CRCOG Best Practices Manual*. Prepared by Abeles Phillips Preiss and Shapiro.

- Describes two approaches to promoting shared parking: through contractual agreements between adjacent uses and through parking management districts.

Metro. 1997. "Model Shared Parking Ordinance – Provisions" and "Model - Shared Use Agreement for Parking Facilities." Appendices A and B in "Shared Parking in the Portland Metropolitan Area." Prepared by Stein Engineering.

- Model shared parking ordinance and model shared use agreement for parking facilities.

Marya Morris, general editor. 2009. "Model Shared Parking Ordinance." Chapter 4.10 in *Smart Codes: Model Land-Development Regulations.* Planning Advisory Service Report Number 556. Chicago: American Planning Association.

- Model shared parking ordinance.

Victoria Transport Policy Institute. 2007. "Shared Parking." In *Online TDM Encyclopedia*. Victoria, British Columbia: Victoria Transport Policy Institute.

- Explains conditions that facilitate successful shared parking arrangements; contains model code for shared parking.

San Diego (CA), City of. 2009. "Shared Parking Agreement."

- Example of shared parking agreement form.

Marshall (PA), Township of. 2008. *Zoning*. Article 1900, Section 208-1902.B. Shared Parking.

- Includes schedule of percentages for time periods by which parking requirements can be reduced in calculating shared parking requirements.

Sussex (DE), County of. 2008. *County Code*. Chapter 115, Article XXII, Section 115-165(B). Joint Use and Off-Site Facilities – Shared Parking.

- Authorizes reduction in required parking spaces with shared parking; provides standards.

Tumwater (WA), City of. 2009. *Municipal Code*. Title 18, Chapter 18.50, Section 18.50.090. Shared and Combined Parking Facilities**.**

- Defines and provides provisions for shared parking.

Parking In-Lieu Fees

Davis (CA), City of, Community Development Department. 2004. *Staff Report: Resolution Amending the Parking In-lieu Fees for the Central Commercial and Mixed-Use Zoning Districts.* January 28.

- Recommended amendments to existing in-lieu of fee program.

Bend (OR), City of. 2004. "Parking In Lieu of Fee."

- Describes revised in-lieu of fee structure and policy.

Corvallis (OR), City of. 2007. *Council Policy Manual*. Policy Area 7, CP 02-7.15. Fee-in-Lieu Parking Program for Parking-Related Improvements.

- Establishes fee-in-lieu program for downtown districts; sets fee at $4,000 per space.

Friday Harbor (WA), Town of. 2009. *Zoning Code*. Section 17.68.050. Waiver of Requirements.

- Establishes fee in lieu of parking requirements and Parking Improvement Fund; sets fee of $13,500 per space.

Juneau (AK), City of. 2006. "Fee In Lieu of Parking." Memorandum to Assembly Lands Committee from Ben Lyman, Planner, Community Development Department and Rorie Watt, Chief CIP Engineer, Engineering Department. February 1.

- Staff report on 2004 fee-in-lieu ordinance. Current version of code included.

Scottsdale (AZ), City of. 2009. *A Resolution of the City of Scottsdale, Maricopa County, Arizona…Establishing the Payment, Fee and Fee Adjustment Procedures for*

In-Lieu Parking Credit(s) as Provided by the Parking Section of the City of Scottsdale Appendix B Basic Zoning Ordinance. Resolution No. 7847. Adopted February 24.

- Resolution setting in-lieu parking fee of $11,862.54 per space.

Woodland (CA), City of. 2008. "Report to Mayor and City Council: Ordinance Adding Downtown Parking Standards, Establishing Parking District Boundaries and In-Lieu of Parking Fee." February 5.

- Suggestions for setting a parking in-lieu fee. See full Downtown Parking District ordinance below.

Parking Requirement Reductions and Exemptions

Austin (TX), City of, and American Legal Publishing Corporation. 2009. *City Code*. Chapter 25-2, Subchapter E, Section 2.4. Parking Reductions.

- Allows parking reductions for protecting trees or providing carsharing vehicles.

Bend (OR), City of. 2008. *Development Code*. Chapter 3, Section 3.3.300.D, Vehicle Parking Standards for On-Site Requirements - Exceptions and Special Standards for Parking.

- Provides for up to 10% reduction in required parking spaces for activities including providing bicycle parking or transit facility/amenities.

Grand Rapids (MI), City of. 2008. *City Code*. Part 2, Title V, Chapter 61, Article 10, Section 5.10.05. Reductions in Parking Requirements.

- Parking requirements may be reduced up to 50% based on location near transit, parking spaces reserved for alternative vehicles or bicycle, parking in lieu of fees, or shared parking agreements.

Gresham (OR), City of. 2008. *Development Code*. Article IX, Section 9.0853. Exceptions to Minimum Parking Space Standards.

- Provides parking waivers of 10% for items including bike parking and proximity to light rail stations; for existing uses, allows owner to replace up to 10% of parking spaces with landscaping, pedestrian facilities, or bicycle parking.

Milwaukee (WI), City of. 2008. *Zoning Ordinance*. Subchapter 4, Section 295-403, Subsection 2. Parking – Adjustment to Number Required. Number of Parking Spaces.

- Allows parking reductions for off-site parking, on-street parking, shared parking, public transit proximity. Shared parking required where feasible.

Minneapolis (MN), City of. 2009. *Code of Ordinances*. Title 20. Chapter 541. Article IV. Reducing Off-Street Parking Requirements.

- Parking reductions provided for shared parking, shared vehicles, proximity to transit, valet parking, and bicycle parking.

Salt Lake (UT), City of. 2009. *City Code*. Title 21A, Section 21A.44.040. Transportation Demand Management.

- Strategies to encourage nonmotorized transportation and relating parking requirements to the local land use transportations system, including bicycle parking requirements, carpooling incentives, and special minimum and maximum parking for certain districts.

Scottsdale (AZ), City of. 2009. *Revised Code*. Appendix B, Article IX, Section 9.104. Programs and Incentives to Reduce Parking Requirements.

- Provides credit for on-street parking, bicycle parking facilities, joint parking improvement projects, shared parking, and downtown overlay district parking program.

Seattle (WA), City of. 2009. *Land Use Code*. Subtitle III, Division 2, Chapter 23.54, Section 23.54.020. Parking Quantity Exceptions.

- Provides parking exceptions for landmark structures, transit proximity, provision of alternative transportation, shared parking, and carshare vehicle parking.

Downtown District Special Parking Requirements

Auburn (WA), City of, and Code Publishing. 2009. *City Code*. Title 18, Section 18.29(H). DUC Downtown Urban Center District – Parking Ratios.

- Exempts smaller retail and restaurant uses from parking requirements; allows for various reductions and in-lieu parking fees.

Austin (TX), City of, and American Legal Publishing Corporation. 2009. *City Code*. Title 25, Chapter 25-6, Article 7, Division 5, Section 25-6-591. Parking Provisions for Development in the Central Business District (CBD) and a Downtown Mixed Use (DMU) Zoning District.

- Waives off-street parking requirements for uses located in historic structures or uses occupying less than 6,000 SF; reduces general minimum and maximum requirements by 20% and 60%, respectively.

Crystal Lake (IL), City of. 2009. *Unified Development Ordinance*. Section 4-200.5. Off-Street Parking and Loading – Parking in the Downtown District.

- Allows for blanket 30% reduction in required parking spaces as well as in-lieu-of parking fees.

San Jose (CA), City of. 2009. *Zoning Ordinance*. Chapter 20.70, Part 4. Downtown Off-Street Parking Requirements.

- 15% reduction given for TDM program, 50% reduction for mixed-use projects, exempts additions of smaller size or to historic buildings from additional parking requirements.

Scottsdale (AZ), City of. 2009. *Revised Code*. Appendix B, Article IX, Section 9.108. Special Parking Requirements in Districts – Downtown Overlay (DO) District (parking in-lieu only) and Downtown (D) Districts.

- Provides for parking in-lieu-of fees, FAR bonus for underground and on-site structure parking, and shared parking.

Tucson (AZ), City of. *Land Use Code*. Article 3, Division 3. Section 3.3.6.1. Motor Vehicle and Bicycle Parking Requirements - Exceptions - Downtown Redevelopment District.

- Exempts certain expansions from additional parking requirements; requires bicycle parking; provides reduction as incentive for public amenity provision.

Woodland (CA), City of. 2009. *Zoning Ordinance*. Article 23, Section 25-23-15. Off Street Parking and Loading – Downtown Parking District.

- Provides for special parking requirements for certain uses, parking waivers, shared parking, in-lieu parking fees, and off-site parking for residential uses.

Green Parking Lot Design

Gibbons, Jim. 1999. "Parking Lots." Nonpoint Education for Municipal Officers (NEMO) Technical Paper Number 5.

- NEMO (stormwater management best practice education organization) guidelines for sustainable parking lot design.

San Mateo [CA] Countywide Water Pollution Prevention Program. 2009. "Design Strategies for Green Streets and Parking Lots." Chapter 2 in *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*.

- Extremely detailed guidebook for green street and parking lot design and implementation. Provides both site layout and stormwater facility strategies.

Toronto (ON), City of, Planning Department. 2007. "Design Guidelines." From *Design Guidelines for 'Greening' Surface Parking Lots.* Council approved draft.

- Design guidelines for reducing urban heat island effect and reducing stormwater runoff.

Permeable Pavement

Metropolitan Area Planning Council [Boston]. n.d. "Low Impact Development Fact Sheet: Permeable Paving." Massachusetts Low Impact Development Toolkit.

- Comprehensive overview of permeable paving benefits, concerns, types, and design standards.

Pennsylvania Department of Environmental Protection. 2006. "BMP 6.4.1: Pervious Pavement with Infiltration Bed." Pages 7 – 26 in *Pennsylvania Stormwater Best Management Practices Manual,* Chapter 6, Structural BMPs.

- Information on, applications of, and technical specifications for porous pavements.

Fort Wayne (IN), City of. 2007. *Zoning Ordinance*. Sections 157.140-144. Off-Street Parking.

- Use of permeable paving discussed in sections 157.141(F), 157.142(B). Parking reduction incentive given for permeable pavement use.

Herndon (VA), Town of. 2009. *Town Code*. Chapter 78, Article V, Section 78-500.3(k)(4). Parking Alternatives – Standards for Alternative Materials.

- Provides standards for porous parking area surfacing materials use.

Nags Head (NC), Town of. 2009. *Town Code*, Chapter 48, Article V, Sections 48-162, 48-163, 48-168. Off-Street Parking and Loading Standards.

- Allows for various porous paving systems for parking and loading areas.

Bicycle Parking

Durango (CO), City of. 2008. *Code of Ordinances*. Title 27, Article 10, Section 10-2-4. Bicycle Parking Spaces.

- Standards for minimum number and design of bicycle facilities; allows for conversion of existing automobile parking spaces into bicycle spaces.

Gresham (OR), City of. 2008. *Development Code*. Article IX, Section 9.0830. Bicycle Parking Design Standards.

- Design standards include location and access, rack types and space dimensions.

Folsom (CA), City of. 2008. *Municipal Code*. Title 17. Chapter 17.57, Section 17.57.090. Bicycle Parking Facilities.

- Provides requirements for different use districts and brief design standards.

Minneapolis (MN), City of. 2009. *Code of Ordinances*. Title 20. Chapter 541. Article III, Section 541.180. Specific Off-Street Parking Requirements – Bicycle Parking.

- Provides standards for short-term and long-term bicycle parking spaces, and sets specific requirements for downtown district developments.

Mountain View (CA), City of. 2008. *City Code*. Chapter 36. Article XII-A, Division A36.37, Section A36.37.100. Bicycle Parking Standards.

- Standards for class I (long term employee parking) and class II and III (short term parking) bike facilities, and shower/changing room requirements for high-employment businesses.

Modern Approaches to Parking Management

The Dynamics of Off-Street Parking

At the end of World War II, only a small percentage of U.S. cities had zoning ordinance provisions for off-street parking. This percentage increased greatly during the 1950s and 1960s, and eventually to a point where the overwhelming majority of urban and suburban communities require a minimum supply of off-street parking for new developments. In general terms, public officials have sought to minimize externalities created by development—costs not borne by those who are responsible for the development. In particular, off-street parking standards are an attempt to minimize spillover parking on public streets and to ensure safe and efficient movement of traffic by requiring that the supply of parking at the site of the development is adequate to meet demand.

Although the link is not always well understood, parking and transportation are inseparable. While the American Public Transit Association (2002) has found that the number of people using public transportation during a typical weekday has increased 20 percent since 1995, motor vehicle use continues to expand. U.S. Department of Transportation (2002) figures verify that the number of registered motor vehicles in the United States has increased much faster than the rate of population growth over the past several decades. At the same time, the average vehicle is being driven

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more miles annually. These figures show that Americans have developed a seemingly insatiable appetite for mobility. Of course, vehicles require a place to be stored at the end of each trip. A number of development projects dedicate as much or more land area to parking area than to building area.

It's important to recognize that there are a variety of stakeholders in decisions about off-street parking requirements (e.g., developers, business owners and their employees and patrons, community residents, and the general public, all of whom have an interest in mobility and in an attractive physical environment where automobile traffic is not overwhelming and the air is clean to breathe). The amount of parking provided for the range of land uses in a community is an important link between land use, transportation, design, and environmental quality. Not only is thought given to matching the amount of off-street parking required by municipal zoning codes to the actual parking demand, but planners and policy makers increasingly pay attention to the ways in which an excess supply of free or inexpensive parking influences demand and creates externalities. Some studies (Municipality of Metropolitan Seattle 1992; Willson 1992; Willson 1995) indicate that many communities have created parking standards that require developments to build parking spaces far in excess of demand, even given the continuing growth of automobile ownership and use. For example, a Seattle study, *1991 Parking Utilization Study*, found that the average parking supply exceeded average demand by 30 percent at 36 office and industrial sites located in noncentral business district suburban locations in the Seattle area.

Business owners and land developers must balance the expense of providing off-street parking with their desire to ensure that patrons and employees have easy vehicular access to the site. The amount of parking provided varies widely from one development to the next, even among developments sharing similar characteristics. While some choose to minimize the supply of off-street parking, others oversupply parking to the extent that many spaces are rarely used. Some business owners consider visible excess parking a necessary perk for employees and a welcome mat that makes potential patrons aware that there is no shortage of parking serving the business.

In terms of the larger picture, there has been an increasing body of literature during the past decade that examines the relationship between the built environment and transportation choices. The landmark LUTRAQ (Making the Land Use, Transportation and Air Quality Connection) demonstration project (1000 Friends of Oregon 1997) is one example. The project analyzed the differences between conventional suburban development and transit-oriented development scenarios in the western portion of the Portland, Oregon, metropolitan area. The study found that the LUTRAQ scenario, based on transit-oriented development, could result in a variety of transportation demand benefits, including a 4 percent reduction in auto ownership rates and fewer vehicle trips per household each day.

Much recent parking literature argues that excessive parking supply discourages alternative modes of transportation, reduces density, increases the cost of development, creates an uninviting built environment, and degrades the natural environment (e.g., by increasing polluted stormwater runoff into area water bodies, increasing air pollution by inducing automobile travel, and contributing to urban heat islands). While benefits may accrue from minimizing the amount of off-street parking, downsizing minimum parking requirements may be a tricky proposition in many communities due to the feared impact on other community objectives.

THE BASIS FOR ZONING CODE PARKING REQUIREMENTS

Purpose statements found in municipal zoning codes can provide some guidance regarding the rationale behind off-street parking requirements. However, most simply have statements such as, "The provisions of this chapter have been established to ensure that adequate off-street parking is provided to meet the parking needs of uses located within the city." Some codes, such as Pittsburgh's, make a point of mentioning flexibility in the purpose statement of its off-street parking chapter, as follows:

> **Purpose.**
> The purpose of these regulations is to:
> - allow flexibility in addressing vehicle parking, loading, and access issues;
> - present a menu of strategies to solve parking issues rather than parking space requirements;
> - maintain and enhance a safe and efficient transportation system that is consistent with environmental goals and clean air; and
> - ensure that off-street parking, loading, and access demands associated with new development will be met without adversely affecting other nearby land uses and surrounding neighborhoods. (Article 6, Section 9.14.01, amended August 24, 2000)

Determining the appropriate amount of off-street parking that should be required by a municipal zoning ordinance, like many aspects of planning, is part art and part science—and is done within a political context. When municipal officials write or rewrite their off-street parking provisions, the list of sources consulted is often short and has remained largely the same for years. Many rely on the Institute of Transportation Engineers (ITE) for information related to parking demand generated by various land uses. Some zoning codes state that, when an individual land use is not covered in the city's off-street parking chapter, ITE standards apply. Despite the fact that ITE's information may be the most extensive quantitative data readily available for purchase, ITE cautions that much of the information is based on studies conducted in locations where few transportation alternatives exist and / or are based on studies with a very small sample size (ITE 1987). [*Editor's note*: The Parking Council of ITE had a new version of the trip generation manual in press at the time this PAS Report was in final production. Readers should consult the new manual, which, we are told, is quite different in its approach.]

Donald Shoup, chair of the Urban Planning Department at UCLA, has noted that parking demand studies are generally conducted in an environment where off-street parking is provided without a direct fee (i.e., areas outside of downtown, where fees are almost always charged). Using these studies to determine minimum requirements means that such requirements are based on the demand for parking at a price of zero, which leads to a vicious circle of an oversupply of "free" (but subsidized by somebody) parking virtually everywhere in the metropolitan landscape (Shoup 1999).

The most popular method for determining off-street parking requirements may be to borrow from the ordinances of other communities. To a large degree, it's difficult to fault this approach. APA would not be publishing this report if it thought that borrowing standards from other cities—or at least having an awareness of the range of standards that exist—was an unacceptable approach. When APA's Planning Advisory Service (PAS) receives inquiries related to off-street parking standards, PAS provides subscribers with ordinances, studies, and guides such as this one.

Adoption of another jurisdiction's standards, without consideration of local socioeconomic standards, comprehensive plan, political environment,

the input of the citizens for the community, and legal review according to state enabling legislation, among other issues, may result in standards that just do not fit. Further, the most popular standards are often derived from ITE information, the limitations of which are noted above.

A number of PAS Reports and other APA publications provide useful discussions of parking standards—in some as the central topic (e.g., *Off-Street Parking Requirements*, PAS Report 432, and *Flexible Parking Requirements*, PAS Report 377) while in others as an integral issue linked to other popular planning topics (e.g., *Creating Transit-Supportive Land-Use Regulations*, PAS Report 468, and *The Transportation/Land-Use Connection*, PAS Report 448). ITE (1995) has produced a model ordinance for shared parking. In addition to APA and ITE, other available sources of information include model recommendations from the National Parking Association (1992), the Urban Land Institute (1999), and the Eno Foundation (Weant and Levinson 1990).

Transportation and parking consultants are sometimes hired to assist in determining parking standards. These consultants often provide analysis of parking issues within a particular geographic subset of a community, such as the downtown or a particularly busy commercial district. Although such studies are usually independent and authoritative, it's important to realize they may include certain assumptions (about expectations related to transit use, for example) not necessarily consistent with a community's long-term vision.

Perhaps the most effective way to analyze demand is to get out in the community to look around and record information. When you obtain information about parking occupancy in existing facilities, ask questions about the inevitability (or lack thereof) of similar conditions for future development. In an APA 2001 audio conference, "Effective Community Parking Standards," one expert recommended that communities closely examine their off-street parking standards every five to 10 years.

OTHER RELEVANT FACTORS RELATED TO DRAFTING OFF-STREET PARKING REQUIREMENTS

The Comprehensive Plan

As with any zoning code provision, off-street parking requirements should be consistent with the goals of a community's comprehensive plan. A community might review its comprehensive plan provisions related to transportation, land use, environmental quality, and design when drafting off-street parking standards to ensure a good "fit" between requirements and plan objectives.

Politics

Zoning code provisions are developed within a political context. Elected officials sensitive to complaints about parking "problems" may be reluctant to revise off-street parking requirements to more closely meet average demand or to meet objectives related to, for example, transit use, air quality, and stormwater management. Advocates for change may need to educate voters about the effect of off-street parking requirements on community character. With public support will come political support.

Administration of Regulations

Off-street parking requirements can be difficult to administer. To avoid setting expectations that cannot be met, consider the amount of staff and staff time available for administration when drafting the requirements. Also consider the process for calculating flexible parking require-

ments (e.g., shared parking determinations, discussed in detail below). If the resources to implement the process are not available, review the process and simplify it to match the resources. Without effective administration and enforcement, regulations can be a political lightning rod and generate litigation.

Reuse of Buildings

Many codes recognize that requiring different levels of off-street parking for a variety of commercial uses may lead to problems when new uses attempt to move into buildings that were tailored to different commercial uses. For example, a 5,000-square-foot retail building may be constructed to the requirement of one space per 400 square feet of gross floor area, requiring 13 spaces. If a subsequent tenant would like to convert the building to an office use, a parking standard of one space per 300 square feet would result in a requirement of 17 spaces, thus not allowing for office use without securing additional parking or granting a variance. Portland, Oregon, specifically refers to this issue in its code, as follows:

> **Minimum Required Parking Spaces**:
> A. Purpose
> The purpose of required parking spaces is to provide enough on-site parking to accommodate the majority of traffic generated by the range of uses which might locate at the site over time. Transit-supportive plazas and bicycle parking may be substituted for some required parking on a site to encourage transit use and bicycling by employees and visitors to the site. The required parking numbers correspond to broad use categories, not specific uses, in response to this long-term emphasis.

There may be an inherent tension or contradiction between the desire to have off-street parking requirements that closely approximate the parking demand for each individual land use and the desire to ensure that buildings may be easily adapted to house a variety of different uses.

ZONING CODE PROVISIONS THAT RESPOND TO AND/OR INFLUENCE PARKING DEMAND

What follows is an overview of a range of strategies communities have adopted that go beyond standard minimum parking requirements. Many of these strategies recognize and respond to unique factors associated with different parts of the community in question (e.g., commercial strips, downtown districts).

Mixed-Use Development and Shared Parking

The overall number of parking spaces serving multiple uses in close proximity to one another may be significantly reduced through shared parking arrangements. Sharing parking allows more efficient use of land compared to providing dedicated parking spaces for each use. Carefully crafted shared parking arrangements between two or more uses can reasonably meet peak demand, particularly in mixed-use areas or on mixed-use or multiple-use sites. The Victoria Transport Policy Institute (2002) notes that shared parking is also most appropriate where:

- a specific parking problem exists;
- land values and parking facility costs are high;
- clustered development is desired;
- traffic congestion or vehicle pollution are significant problems; and
- adding pavement is undesirable.

Shared parking arrangements recognize that various uses have different peak operating hours. A common example is shared parking between restaurant and office uses. The parking lot may be heavily used by office employees and visitors in the daytime, while the restaurant patrons may park in the lot after most weekday office users have left and on weekends. If the restaurant is open during the day, it may benefit from lunch-time use by office employees while generating little additional daytime parking demand. In addition to efficient sharing of parking spaces and reduced development costs, transportation system benefits may result from a reduction in the number of office employees driving off-site for lunch.

In determining the amount of parking required for mixed-use or multi-use developments, many zoning codes contain provisions such as the following from Minneapolis: "Where there are two or more separate principal uses on the site, the required parking and loading for the site shall be the sum of the required parking and loading for each use, except as otherwise specified in this chapter." Additional provisions, however, allow as-of-right parking reductions based on shared parking arrangements. The following procedure is used in Minneapolis to reduce the overall number of spaces for shared parking arrangements.

> **541.190. Shared Parking . . .**
>
> 1. Computation. The number of shared spaces for two (2) or more distinguishable land uses shall be determined by the following procedure:
>
> a. Multiply the minimum parking required for each individual use, as set forth in Table 541-1, Specific Off-Street Parking Provisions, by the appropriate percentage indicated in Table 541-2, Shared Parking Calculations, for each of the six (6) designated time periods.
>
> b. Add the resulting sums for each of the six (6) columns.
>
> c. The minimum parking requirement shall be the highest sum among the six (6) columns resulting from the above calculations.
>
> d. Select the time period with the highest total parking requirement and use that total as the shared parking requirement.
>
> 2. Other uses. If one (1) or all of the land uses proposing to make use of shared parking facilities do not conform to the general land use classifications in Table 541-2, Shared Parking Calculations, as determined by the zoning administrator, then the applicant shall submit sufficient data to indicate the principal operating hours of the uses. Based upon this information, the zoning administrator shall determine the appropriate shared parking requirement, if any, for such uses.
>
> 3. Process. An application for shared parking shall be submitted on a form approved by the zoning administrator, as specified in Chapter 525, Administration and Enforcement.

Variations of this format are found in zoning codes in a variety of communities.

Table 541-1 is shown below. In addition, I am providing an example of how a shared parking agreement between three uses would be calculated. Those three uses are:

1. a 10,000-square-foot retail building,
2. a 6,000-square-foot office building, and
3. a restaurant with 1,000 square feet of public area.

The Minneapolis Zoning Code requires:

1. 20 parking spaces for the retail building,
2. 7 spaces for the office building, and
3. 20 spaces for the restaurant.

These figures are derived from the Minneapolis code, which outside of the city's downtown area requires one parking space per 300 square feet of gross floor area in excess of 4,000 square feet for retail and office buildings. It also requires parking equal to 30 percent of the capacity of persons in the public area of restaurants, where the capacity of persons is based on the building code allowance of one person per 15 square feet of area. In other words, the code would require that the three uses have a total of 47 parking spaces without a shared parking arrangement. I have not factored in other allowed parking reductions (e.g., providing bicycle parking or an on-site transit shelter).

The greatest sum shown in Table 2 is 41, which becomes the overall parking requirement for the three uses. Thus, the shared parking arrangement allows this particular development or combination of developments to

TABLE 1.
SHARED PARKING CALCULATIONS
(Table 541-1 from the Minneapolis, Minnesota, code)

General Land Use Classification	Weekdays			Weekends		
	1:00 a.m.–7:00 a.m.	7:00 a.m.–6:00 p.m.	6:00 p.m.–1:00 a.m.	1:00 a.m.–7:00 a.m.	7:00 a.m.–6:00 p.m.	6:00 p.m.–1:00 a.m.
Office	5%	100%	5%	0%	15%	0%
Retail sales and services	0%	100%	80%	0%	100%	60%
Restaurant (not 24 hr)	20%	70%	100%	30%	75%	100%
Residential	100%	60%	100%	100%	75%	95%
Theater	0%	60%	100%	0%	80%	100%
Hotel Guest rooms Restaurant lounge (in hotel)	100%	55%	100%	100%	55%	100%
Conference rooms	0%	100%	100%	0%	100%	100%
Religious institution	0%	25%	50%	0%	100%	50%

TABLE 2.
THE RESULTS OF
SHARED PARKING CALCULATIONS

General Land Use Classification	Weekdays			Weekends		
	1:00 a.m.–7:00 a.m.	7:00 a.m.–6:00 p.m.	6:00 p.m.–1:00 a.m.	1:00 a.m.–7:00 a.m.	7:00 a.m.–6:00 p.m.	6:00 p.m.–1:00 a.m.
Office	0.35	7	0.35	0	1.05	0
Retail sales and services	0	20	16	0	20	12
Restaurant (not 24 hr)	4	14	20	6	15	20
Total	**4**	**41**	**36**	**6**	**36**	**32**

provide six fewer parking stalls than would normally be required. The code assumes that, for the combination of these particular uses, the greatest demand for parking will take place between the hours of 7:00a.m. and 6:00p.m.

Some municipalities, rather than prescribing a particular formula or table governing shared parking, give discretion to city staff to approve shared parking arrangements based on individual circumstances, parking studies, or estimated peak operating times provided by applicants. Some outline specific criteria that must be met in order to share required parking spaces. Bellevue, Washington, for example, uses these guidelines for uses outside its downtown:

> **Shared Use of Parking.**
>
> The following provisions apply outside the Downtown Districts:
>
> 1. General. The Director of Planning and Community Development may approve shared use of parking facilities located on separate properties if:
>
> a. A convenient pedestrian connection between the properties exists; and
>
> b. The properties are within 1,000 feet of each other; and
>
> c. The availability of parking for all affected properties is indicated by directional signs as permitted by Chapter 22B.10 BCC (Sign Code).
>
> 2. Number of Spaces Required.
>
> a. Where the uses to be served by shared parking do not overlap their hours of operation, the property owner or owners shall provide parking stalls equal to the greater of the applicable individual parking requirements.
>
> b. Where the uses to be served by shared parking have overlapping hours of operation, the property owner or owners shall provide parking stalls equal to the total of the individual parking requirements. If the following criteria are met, that total is reduced by 10 percent:
>
> i. The parking areas share a property line; and
>
> ii. A vehicular connection between the lots exists; and
>
> iii. A convenient, visible pedestrian connection between the lots exists; and
>
> iv. The availability of parking for all affected properties is indicated by directional signs, as permitted by Chapter 22B.10 BCC (Sign Code).
>
> 3. Documentation Required. Prior to establishing shared use of parking, the property owner or owners shall file with the King County Division of Records and Elections and with the Bellevue City Clerk a written agreement approved by the Director of Planning and Community Development providing for the shared parking use. The agreement shall be recorded on the title records of each affected property.

(Bellevue uses somewhat more lenient standards in its downtown.)

Keeping track of shared parking arrangements can be an administrative challenge. Informal shared parking arrangements also often exist outside the official regulatory structure, particularly in large, densely populated cities. Where such arrangements are done "officially," subsequent changes in land uses frequently will trigger the need for more parking than was provided when a shared parking arrangement was initially approved. Some cities (e.g., Los Angeles, Schaumburg, Illinois, through its transportation demand management ordinance) encourage land banking space for future parking needs when approving a shared parking arrangement in order to accommodate evolving use of the property or properties in question. Al-

though this space provides a safety valve to prevent an eventual shortage of parking, such an approach may diminish the benefits associated with the shared parking arrangement by effectively limiting the development potential of the site.

If the uses that share parking are not located on the same parcel, the zoning ordinance should contain provisions governing off-site parking (e.g., limitations on the distance between a use and its off-site parking). The distance that off-site parking may be from the use or uses served may vary depending on the type of use or destination in question, pedestrian infrastructure, and the regional climate.

Maximum Parking Standards

Some communities, in addition to requiring a minimum amount of off-street parking, limit the amount of parking that may be provided for individual uses. Although this practice has become more widespread during the past decade, maximum standards are not currently found in most zoning codes. Communities that incorporate maximum standards range in size and character. They include San Antonio, Texas; Jefferson County (Louisville), Kentucky; Gresham, Oregon; Seattle, Washington; and San Francisco, California. And some cities, like those mentioned in the following paragraphs, do not establish set standards. Rather, they create formulas for determining maximums.

Parking maximums have been particularly prevalent in the Northwest due in part to state and regional goals or mandates. If the number of communities using such codes is any indication, however, more planners and policy makers nationwide believe that maximum standards are as important as minimum standards—if not more so. Shoup (1999b), although not espousing maximum parking standards, suspects that planners will some day look back and see minimum parking requirements as a terrible mistake. He believes minimum requirements are "observe, ambiguous, and cumbersome," and impede progress toward important social, economic, and environmental goals. Parking maximums have been used most extensively in downtown areas, but they also can be an effective tool for communities interested in managing stormwater, increasing densities, and meeting transportation demand management objectives throughout the community.

Combined with parking minimums, maximum standards create a parking range. Maximum standards generally come in three forms. Some communities, as with typical minimum requirements, set a ratio per number of square feet of building area. Pittsburgh, for example, sets a maximum off-street parking ratio of one space per 175 square feet of retail sales and services, while the city's minimum requirement for such uses is one space per 500 square feet beyond the first 2,400 square feet. (No parking is required for the first 2,400 square feet.) Thus, for a new 5,000-square-foot retail building in Pittsburgh, five off-street parking spaces are required and no more than 29 could be provided—a fairly wide range.

In Redmond, Washington, the Neighborhood, Retail and General commercial zones are allowed a maximum of five spaces per 1,000 square feet of floor area for most uses and a minimum of four per 1,000 square feet. In a 5,000-square-foot building, 20 spaces would be required and the cap would be 25. Redmond is an example of a suburban community that has used maximum requirements effectively.

A second method for regulating the maximum number of spaces is to base the maximum on the minimum. For example, the Draft Unified Development Ordinance in Helena, Montana, requires the following:

Maximum Number of Parking Spaces Required.

The maximum number of off-street parking spaces for any building or use shall not exceed the amount determined as follows:

1. Parking lots of more than twenty and less than fifty-one spaces. Parking lots may not have more than one hundred twenty percent (120%) of the number of spaces identified in Table 15-C, not including accessible spaces, unless a minimum of twenty percent (20%) of the parking area is landscaped in accordance with the standards of this chapter.
2. Parking lots of fifty one spaces or more. No more than one hundred ten percent (110%) of the number of spaces required as identified in Table 15-C of this chapter, not including accessible spaces, are permitted.

Based on Helena's minimum parking requirement for retail uses of 4.1 spaces per 1,000 square feet of gross floor area, a 5,000-square-foot retail store would be required to provide 21 spaces and could provide no more than 25 spaces (unless 20 percent of the parking lot is landscaped)—a very narrow range. (Note that maximum standards of 125 or 150 percent of the minimum are more prevalent and provide a somewhat wider range.) Generally, communities with minimum parking requirements that are set particularly low (i.e., below typical demand) might consider higher maximum standards (e.g., 150 or 200 percent of the minimum) when using this method.

A third method is a limit on the overall number of parking spaces in a particular geographic area. Cambridge, Massachusetts, uses parking maximums as part of comprehensive set of strategies to reduce automobile dependence (Millard-Ball 2002). The Cambridge zoning ordinance, for example, states that "the total number of parking spaces serving non-residential uses in the North Point Residence District shall not exceed 2,500 spaces, allocated to each lot in the district at a rate of 1.2 spaces per 1,000 square feet of lot area." Cambridge also uses the more popular approach of setting parking maximums for many individual land uses.

Some communities offer automatic exceptions to maximum parking standards if certain objectives are met. For example, San Antonio, Texas, which incorporates maximum standards for an extensive number of uses in its zoning code, exempts structured parking and parking located on pervious pavement. The pervious pavement exemption is subject to standards that describe the underlying soil permeability, level of the water table, the slope of the lot, and maintenance of the lot (e.g., sweeping and washing).

A note of caution: maximum standards that are set particularly low may result in spillover parking that could erode support for such standards. On-street parking restrictions accompanying maximum standards are one way of dealing with this issue, though such restrictions are also controversial in many places. Resident-only parking restrictions are often both a response to and a source of friction between the wishes of area residents, who like having on-street parking available for themselves and their guests, and businesses and institutions that rely on the ability of their patrons to find places to park. Time will tell whether maximum standards completely replace minimum requirements as concern continues to rise about traffic congestion, low-density development, and the environmental consequences of automobile dependence.

Downtown Parking Standards

In recent years, a number of communities without a traditional downtown have attempted to create such a place. Parking in downtown areas is complex and subject to a variety of competing interests. For example, the needs of businesses that rely on the availability of short-term parking are sometimes af-

fected by commuters who occupy parking spaces from 8:00 a.m. to 5:00 p.m. Constantly adding to the downtown parking supply should not be the sole solution to solving real or perceived downtown parking "problems." Doing so, in fact, is likely to work against goals aimed at improving air quality, reducing traffic (or at least reducing the rate of increase of traffic congestion), and increasing transit use. When parking demand in a downtown area increases substantially, there are only a limited number of ways to increase the traffic carrying capacity of downtown streets as well, some of which, such as elimination of on-street parking, are not necessarily desirable.

Levinson (1982), as cited by Barr (1997), suggests that a review of downtown parking strategies should begin with consideration of the following points:

- What are the community development, environmental, and transportation goals for downtown and the surrounding areas?
- What basic policies underline formation of plans and options?
- Which range of parking options are meaningful in relation to: existing parking facilities and street systems; downtown development patterns and intensities; origins, destinations and approach routes of parkers; transit service capabilities; and environmental and energy constraints?
- How can parking serve as a catalyst for desired development?
- Should parking be provided for all who want to drive downtown, or should it be rationed in some specific manner?
- What balance should be achieved between parking located on the outskirts of downtown and parking located along express transit stops in outlying areas?
- What are the effects of parking on the location and design of public transport routes, stations, and terminals?

Although this report focuses on zoning requirements, such requirements are only one piece of the downtown parking puzzle (as the above points suggest). Signage, pricing, location, design, supply, metering of on-street parking, and long-term employee parking versus the availability of short-term parking for retail customers are also issues to be considered.

Morrall and Bolger (1996) conducted quantitative research and concluded, "The proportion of downtown commuters using public transport is inversely proportional to the ratio of parking stalls per downtown employee." The size of a downtown, the mix and intensity of land uses, and the availability of transportation alternatives and commercial or public parking facilities combine to form a unique environment that many zoning ordinances recognize through particularly low parking requirements and, in some cases, maximum requirements.

No minimum off-street parking requirements exist for nonresidential uses in many downtown areas, particularly in large cities (e.g., Portland, Oregon; Boston; Massachusetts; Columbus, Ohio; San Diego, California). The Parking and Access section of the Portland, Oregon, Central City Plan District contains regulations intended to "implement the Central City Transportation Management Plan by managing the supply of off-street parking to improve mobility, promote the use of alternative modes, support existing and new economic development, maintain air quality, and enhance the urban form of the Central City." It includes no *minimum* parking standards for nonresidential uses in the core area of the downtown. *Maximum* parking requirements for office uses range from 0.7 to 2.0 spaces per 1,000 square feet of new net building area in the core.

Among medium-size downtowns, parking requirements vary widely. In the Central Business District Zone in Grand Rapids, Michigan, (pop. 197,000) parking is required at a rate of one space for each 1,000 square feet of gross floor area for nonresidential buildings and hotels. Off-street parking is not required for any building constructed prior to January 1, 1998, however, or for new buildings and cumulative additions to existing buildings with a gross floor area of 10,000 square feet or less.

> **CBD Parking**
>
> **Required Automobile Parking**
> Off-street parking space as required herein shall be provided for all buildings and structures and for additions to existing buildings or structures. The number of spaces required for all uses shall be one space for each 1,000 square feet of gross floor area for all non-residential buildings and hotels, and one space per dwelling unit for all dwellings.
>
> **Required Bicycle Parking**
> Bicycle parking shall be provided in conjunction with new automobile parking facilities. Any new facility providing parking for more than fifty (50) automobiles, shall provide bicycle parking at a rate of one bicycle parking space for each forty (40) automobile spaces, with a minimum of six (6) spaces. In lieu of providing bicycle parking within the parking facility, the owner may provide bicycle parking at an alternate location well suited to meet the needs of potential users. Public parking facilities designed to provide remote employee parking on the fringe of the district shall be exempt from this requirement.

Madison, Wisconsin (pop. 208,000), and Richmond, Virginia (pop. 198,000), do not have parking requirements in most or all of their downtown districts; they do, however, negotiate all parking needs through a transportation management ordinance.

Communities with small downtowns vary widely in their management of downtown parking. Some have chosen to develop parking programs focused on public parking lots that serve the downtown area. In Holland, Michigan, for example, a community with 27,000 residents and a traditional downtown of approximately eight square blocks, "All businesses located in the C-3 Central Business District shall be deemed participants in a community parking program and shall be exempt from parking requirements herein specified. For any additional residential use created, additional parking areas shall be provided in accordance with the requirements set forth herein" (Section 39–52).

Distinctions Based on the Type of Commercial District

In addition to special regulations for downtown parking, some communities choose to provide distinct parking requirements based on the type of commercial district rather than delineating citywide requirements for each particular land use. (In some cases communities use overlay districts—see below.) The basic premise is that a commercial district serving a particular neighborhood will draw patrons from a relatively small market area, increasing the chances that many will arrive via walking, for example, while districts that allow uses drawing from a regional market may require more parking per square foot of floor area for the same use.

Cambridge, Massachusetts, offers an example of differentiating between districts; its regulations provide that the parking requirements vary "according to the type, location and intensity of development in the different zoning districts, and to proximity of public transit facilities." For example, the minimum parking requirement for general retail establishments varies from one space per 500 square feet, one space per 700 square feet, and one

space per 900 square feet, depending on the type of zoning district. Maximum standards in Cambridge vary by district as well.

Portland, Oregon, does not require off-street parking in several of its commercial zoning districts (e.g., Mixed Commercial/Residential zone, Storefront Commercial zone, and the Office Commercial 1 zone). Where parking is required, the city makes distinctions based on the scale of development allowed in the district and, in some cases, the residential density of the surrounding area. There are no minimum parking requirements associated with uses in the Neighborhood Commercial 1 zone, which "is intended for small sites in or near dense residential neighborhoods." Off-street parking is required for uses in the Neighborhood Commercial 2 zone, which "is intended for small commercial sites and areas in or near less dense or developing residential neighborhoods." Off-street parking requirements are generally less in the Neighborhood Commercial 2 zone than in another level of commercial activity, the General Commercial zone, which "is intended to allow auto-accommodating commercial development in areas already predominantly built in this manner and in most newer commercial areas."

The Role of Overlay Districts

Overlay districts can be an effective tool for incorporating unique parking requirements that recognize and foster unique characteristics associated with particular areas in a community.

Minneapolis has several overlay districts that incorporate special parking requirements. The Pedestrian Oriented Overlay Districts, scattered throughout the city, include maximum parking standards and restrictions on the location of parking facilities. The Downtown Parking Overlay District prohibits new commercial parking lots in the downtown area and limits the size of new accessory surface parking lots to no more than 20 spaces.

Greensboro, North Carolina, uses unique parking standards in its East Market Street Pedestrian Scale Overlay District. One purpose of the overlay district is to "modify the image of the corridor, moving away from the existing vehicular-oriented thoroughfare to an image which is attractive to pedestrian access and use." The parking regulations in the overlay district include the following:

> **Parking Credits and Exceptions:**
>
> i. In all areas, on-street parking spaces on the right-of-way between the two side lot lines of the site may be counted to satisfy the minimum off-street parking requirements.
>
> ii. Where parking is available off-site within 400 feet of the front entry to the building, and that parking is owned or controlled under a permanent and recorded parking encumbrance agreement for use by the occupants or employees on the site, said parking may be counted to satisfy the off-street parking requirements.
>
> iii. In those portions of the Overlay District with underlying zoning of GB, GO-H and HB and which are occupied as a retail use, all parking located behind the front setback of the building shall be double-counted so that each such parking space behind the front setback shall be counted as if it were two (2) spaces available to satisfy the off-street parking requirements for such retail use.
>
> iv. Where it can be demonstrated through a documented parking study that the demand for parking of the combined uses of two (2) or more buildings can be satisfied with the shared and jointly accessible off-street parking available to those buildings, then a special exception to these parking requirements may be granted by the Board of Adjustment to satisfy the minimum parking requirements.

The Richmond, Virginia, zoning code includes a very extensive description of the rationale underlying its Parking Overlay Districts:

> Pursuant to the general purposes of this chapter, the intent of Parking Overlay Districts is to provide a means whereby the City Council may establish overlay districts to enable application of appropriate off-street parking requirements to business uses located within areas of the City characterized by a densely developed pedestrian shopping environment in close proximity to residential neighborhoods. The districts are intended to recognize that, due to several factors, business uses located in such areas typically generate lower demands for privately maintained off-street parking spaces than are reflected in the requirements generally applicable in the City and set forth in Section 32-710.1 of this chapter.
>
> Parking requirements within Parking Overlay Districts are designed to reflect the factors that result in lower parking demand in such areas. These include: a function similar to that of a shopping center, resulting in a high proportion of multipurpose trips by patrons; considerable walk-in trade due to proximity to residential areas and employment centers; significant numbers of employees that walk to work due to proximity to living areas; availability of public transportation; and many older buildings which have been adapted from other uses and tend to be less efficient than newer special purpose buildings. It is also intended that each Parking Overlay District reflect the supply of public parking spaces within the district by providing for further reduction in the parking requirements in direct proportion to available public parking.
>
> Parking Overlay Districts are intended to complement the UB Urban Business District and to be applied principally to those areas within such district which possess the factors enumerated above, but may also be applied independent of the UB District to other areas where such factors exist within other specified districts.

Bicycle Parking

A number of communities recognize how bicycle travel can reduce vehicular parking demand. Overall, less than 1 percent of all trips in the U.S. are bicycle trips. Since 48 percent of all trips in the U.S. are shorter than three miles, many believe the potential for increasing utilitarian bicycle travel is great (Pucher and Schimek 1999). The extent to which bicycle travel can substitute for automobile travel may depend on demographics, climate, and the availability of the infrastructure to accommodate bicycle use, including bicycle parking. U.S. communities that have the highest level of bicycle use tend to be midsize cities with a large student population, such as Gainesville, Florida; Madison, Wisconsin; Boulder, Colorado; and Davis, California. The presence of a major university need not be a prerequisite to making a serious effort to encourage bicycle travel as a legitimate form of daily transportation.

PAS Report 459, *Bicycle Facility Planning* (Pinsoff and Musser 1995), covered a wide range of bicycle infrastructure and regulation issues. The report included the following general guide that suggested minimum bicycle requirements for a variety of uses.

A number of communities have chosen to institute minimum bicycle parking requirements, while some also allow for a reduction in the number of required automobile spaces when bicycle parking is provided. (See Table 3.)

In Davis, California, considered by many to be the preeminent bicycling community in the U.S., "the number and location of all bicycle parking spaces shall be in accordance with the community development director

TABLE 3.
BICYCLE PARKING SPACE REQUIREMENTS

Type of Establishment	Minimum Number of Bicycle Parking Spaces
Primary or Secondary School	10% of the number of students, plus 3% of the number of employees
College or University Classrooms	6% of the number of students, plus 3% of the number of employees
Dorms, Fraternities, and Sororities	1 space per 3 students
Shopping Mall	5% of the number of automobile spaces
Commercial Street	1 space per 3,000 sq. ft. of commercial space
Sport and Recreational Center	12% of the number of automobile spaces
Office Building	10% of the number of automobile spaces
Government Building	10% of the number of automobile spaces
Movie Theater or Restaurant	5-10% of the number of automobile spaces
Manufacturing Plant	4% of the number of automobile spaces
Multi-Unit Housing	1 space per 2 apartments
Public Transit Station	20 spaces minimum
Other Land Uses	5-10% of the number of automobile spaces

General Notes: A minimum of 2 spaces are required for all new qualifying developments. After the first 50 spaces are provided, parking requirements shall be reduced by half.

Source: Pinsoff and Musser (1995).

TABLE 4.
A SAMPLE OF BICYCLE PARKING REQUIREMENTS

City	Bicycle parking required
Cambridge, Massachusetts	One space for every 10 automobile spaces for most uses. In multifamily residential buildings, one space or locker must be provided for each unit.
Iowa City, Iowa	For every seven (7) bicycle parking spaces required for commercial uses the required number of off-street parking spaces for other vehicles may be reduced by one (1) space, up to a maximum of two (2) spaces if those spaces are used for bicycle parking.
Grand Rapids, Michigan	In the city's downtown, one bicycle parking space must be provided for every 40 automobile spaces, with a minimum of six bicycle spaces, in conjunction with any parking facility with more than 50 automobile spaces.
Santa Cruz, California	a. Commercial; Industrial, Office, Retail, Service: 2 +15% of auto parking requirement b. Multi-Family Residential (3 or more units): 1 space per unit c. Public, or Commercial Recreation: 35% of auto parking d. Schools: 1 space per 3 students e. Park and Ride Lots and Transit Centers: 35% of auto parking f. Lodging: 1 space per 5 units

or his/her designee" (California Air Resources Board 1998). Multifamily residential buildings are required to provide two bicycle spaces per dwelling unit. The city has an extensive network of bike routes and other bicycle infrastructure.

Table 4 offers a small sample of bicycle parking requirements from communities in different regions of the country.

Many of the ordinances include design and location standards for required bicycle parking that dictate, for example, bicycle rack styles, a minimum distance from building walls, and visibility and accessibility of the parking.

Transit Allowances

Offering off-street parking reductions based on proximity to public transportation is an increasingly popular approach. These reductions may serve to encourage transit ridership and, more generally, development in corridors or nodes that are well served by bus or rail. (Reduced parking requirements related to superior transit access are inherent in some of the other code provisions discussed in this chapter, such as reduced parking requirements in downtown areas.)

Minneapolis allows a 10 percent parking reduction for multifamily residential dwellings "if the proposed use is located within 300 feet of a transit stop with midday service headways of 30 minutes or less in each direction." For all other uses, "the minimum parking requirement may be reduced 10 percent if the use provides an adequate sheltered transit stop within the development, as determined by the city engineer."

Transit stops are one of the off-street parking reduction alternatives allowed in the Pittsburgh zoning code:

> **Transit Stops**
>
> The Zoning Board of Adjustment shall be authorized, in accordance with the Special Exception provisions of Sec. 922.07, to permit the incorporation of transit stops as a means of satisfying the otherwise applicable off-street parking standards, provided the following conditions are met:
>
> 1. The transit stop shall be designed to be a station or waiting area for transit riders, clearly identified as such, and open to the public at large;
> 2. The transit stop shall be designed as an integral part of the development project, with direct access to the station or waiting area from the development site;
> 3. The transit waiting area or platform shall be designed to accommodate passengers in a covered waiting area, with seating for a minimum of 20 persons, shall include internal lighting, and shall include other features which encourage the use of the facility, such as temperature control within the waiting area or the inclusion of food vendors;
> 4. The maximum reduction in the number of parking spaces shall be no more than 20 percent of the total required spaces;
> 5. The Zoning Board of Adjustment shall request a report and recommendation from the Planning Director on the planning aspects, and the potential impacts of the proposed reduction in parking through the provision of a transit facility;
> 6. The transit stop shall be maintained by the developer for the life of the development project.

Communities with Transportation Demand Management (TDM) ordinances often incorporate transit access in the ordinance as a way to justify parking reductions and/or limit a development's impact on the city and

regional transportation infrastructure. Such ordinances may also cover bicycle parking, preferential carpool parking, pricing incentives for parking, employer subsidies of employee transit passes, and on-site access for employees to transit passes and schedules. For a thorough examination of TDM in theory and practice, see PAS Report Number 477, *Transportation Demand Management*.

Residential Parking Requirements

The amount of parking required for residential uses is, almost without exception, expressed as a ratio related to the number of dwelling units. Requirements typically range from one to two required spaces per unit. Some communities make distinctions based on whether the dwelling is in a multi- or single-family building. Others make further distinctions based on the number of bedrooms in multifamily units, the location of the units in the community, or whether the units serve senior, low-income, or other special populations that are less likely to own automobiles. In Jefferson County, Kentucky, for example, single-family dwellings and duplexes must provide one parking space per dwelling unit. While multifamily dwellings located in the Traditional Neighborhood and Traditional Marketplace Corridor Form Districts must also provide one space per dwelling unit, multifamily dwellings elsewhere must provide 1.5 spaces per dwelling unit. Senior citizen or retirement facilities have a lower requirement of one space for every two dwelling units and one space for every two employees "on maximum shift." As regards residential parking requirements overall, Litman (1999) notes that communities should be mindful of the impact standards may have on housing affordability; specifically, he says 'planners can play a role in encouraging developers to 'unbundle' the cost of housing from the cost of parking sot hat those who use residential parking spaces are the people who pay for it."

A Note about Variances

A majority of communities allow parking reductions through a variance process. Although there are advantages to examining parking requirements on a case-by-case basis, doing so may result in inconsistency from one project to the next. And for communities that act "by the book" on variances, reducing parking requirements may be a stretch given that many codes, based on state enabling legislation, require that variances must be based on factors unique to the characteristics of a particular parcel, rather than a blanket juridictional charge.

SUMMARY

A community's parking policies and regulations have a great deal of influence on how that community will evolve over time. This chapter has covered the requirements and rationale related to off-street parking in a sample of communities varying in size and regional location. The body of this PAS Report presents the requirements of many communities that have dealt with the complex issues outlined above. The off-street parking puzzle includes a wide range of additional pieces not addressed in this chapter, including fees in lieu of parking (Shoup 1999a), parking cash-out policies (Kodama et al. 1996), federal policies on off-street parking (FTA 2002), size and stall dimensions (NPA 1992), and adaptive reuse of that do not conform with current parking requirements (Beaumont 1993). The relationship between land use and transportation is becoming increasingly complicated at the city, regional, and national levels with many communities facing high land values, the high cost of transportation infrastructure, and the heavy use of such infrastructure. Those communities that look for in-

novative ways to manage off-street parking—a key link between land use and transportation—may be best prepared to tackle these problems.

LIST OF REFERENCES

American Public Transit Association. 2002. "Number of People Using Public Transportation." (www.apta.com/stats/ridership/people.htm).

Barr, M. 1997. *Downtown Parking Made Easy.* New York: Downtown Research & Development Center.

Beaumont, C. 1993. "Flexible Parking Codes for Older Downtowns." *Planning Advisory Service Memo.* November.

California Air Resources Board. 1998. *Improving California Air Quality, Through Increased Bicycling—Fact Sheet (*www.arb.ca.gov/planning/tsaq/bicycle/factsht.htm).

FTA (Federal Transit Administration), U.S. Department of Transportation. 2002. "Getting Started with Commuter Choice—America's Way to Work, A Checklist." (www.fta.dot.gov/library/policy/cc/gs.htm)

ITE (Institute of Transportation Engineers). 1987. *Parking Generation*. 2d ed. Washington, D.C.

_____. 1995. *Shared Parking Planning Guidelines*. Washington, D.C.

Kodama, M., et al. 1996. *Using Demand-Based Parking Strategies to Meet Community Goals.* Monograph prepared for Mobile Source Air Pollution Reduction Committee under the AB 2766 Program, Los Angeles.

Levinson, H. 1982. *Parking in a Changing Time.* Urban Transportation Perspectives and Prospects. Westport, Conn.: The Eno Foundation.

Litman, T. 1999. *Parking Requirement Impacts on Housing Affordability*. Victoria Transport Policy Institute. (www.vtpi.org/park-hou.pdf).

Millard-Ball, A. 2002. "Putting on Their Parking Caps." *Planning,* April, 16-21.

Morrall, J. and Dan Bolger. 1996. "The Relationship Between Downtown Parking Supply and Transit Use." *ITE Journal*, February, 32-36.

Municipality of Metropolitan Seattle. 1992. *1991 Parking Utilization Study.* June.

NPA (National Parking Association), Parking Consultants Council. 1992. *Recommended Zoning Ordinance Provisions for Parking and Loading Spaces.* Washington, D.C.: National Parking Association. May.

1000 Friends of Oregon. 1997. *Making the Land Use, Transportation Air Quality Connection, Vol. 8—Making the Connections: Technical Report.* Portland, Ore.: 1000 Friends of Oregon. March.

Pinsoff, Suzan Anderson, and Terri Musser. 1995. *Bicycle Facility Planning.* Planning Advisory Service Report No. 459. Chicago: APA.

Pucher, J., C. Komanoff, C. and P. Schimek. "Bicycling Renaissance in North America? Recent Trends and Alternative Policies to Promote Bicycling." 1999. *Transportation Research Part A*, 33, no. 7/8: 625-54 (www.policy.rutgers.edu/papers/11.pdf).

Shoup, Donald C. 1999a. "In Lieu of Required Parking." *Journal of Planning Education and Research* 18, no. 4 (Summer): 307-20.

Shoup, D. 1999. "The Trouble With Minimum Parking Requirements." *Transportation Research Record,* Part A, 33, no. 7/8: 549-74.

Urban Land Institute. 1999. *Parking Requirements for Shopping Centers, Second Edition*. Washington, D.C.: Urban Land Institute

USDOT (U.S. Department of Transportation). 2002. "Talbe 1-9: Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances." (www.bts.gov/publications/nts/html/table_01_09.html).

U.S. Environmental Protection Agency. 1999. *Parking Alternatives: Making Way for Urban Infill and Brownfield Development.* Washington, D.C.: U. S. Environmental Protection Agency. December.

Victoria Transport Policy Institute. 2002. *TDM Encyclopedia* (www.vtpi.org/tdm20.htm).

Weant, R. and H. Levinson, H. 1990. *Parking.* Westport, Conn.: The Eno Foundation.

Willson, R. 1992. *Suburban Parking Econcomics and Policy: Case Studies of Office Worksites in Southern California.* Washington, D.C.: U.S. Department of Transportation. September.

_____. 1995. "Suburban Parking Requirements: A Tacit Policy for Automobile Use and Sprawl." *Journal of the American Planning Association* 61, no. 1: 129-42.

Washington State Department of Transportation. 1999. *Local Government Parking Policy and Commute Trip Reduction.* Olympai, Wash.: Washington State Department of Transportation (www.wsdot.ws.gov/tdm/triproduction (parking_policy.cfm).

ORDINANCES CONSULTED

n Bellevue, Washington
Source: Bellevue Land Use Code, Title 20; September 25, 1978
Shared parking standards, Section 20.20.590(I)

n Cambridge, Massachusetts
Source: Cambridge Zoning Ordinance; September 8, 1969
Maximum number of parking spaces in the North Point Residence District;
Article 16, Section 16.51.21.
Off-street parking requirements; Section 6.36

n Davis, California
Source: Davis Zoning Code, Chapter 40; no date
Off-street parking requirements, including bicycle parking; Section 40.14.090

n Grand Rapids, Michigan
Source: Grand Rapids Zoning Code, Title 5; August 24, 1999
C3 Central Business District Zone, automobile and bicycle parking; Section 5.167

n Greensboro, North Carolina
Source: Greensboro Unified Development Ordinance; July 1, 1992
Regulations of the East Market Street Pedestrian Scale Overlay District Established;
Section 30-4-4.7(C)

n Helena, Montana
Source: Helena Draft Unified Development Ordinance; November 2001
Maximum number of parking spaces; Section 11-15-08

n Holland, Michigan
Source: Holland Zoning Code, Chapter 39; March 1, 2000
Parking in the C-3 Central Business District; Section 39-52

n Iowa City, Iowa
Source: Iowa City Zoning Code; December 19, 1995
Off-street parking requirements, including bicycle parking; Section 14-6N-1

n Minneapolis, Minnesota
Source: Minneapolis Zoning Code, Title 20; November 12, 1999
Shared parking standards; Section 541.190
Parking regulations in the Pedestrian Oriented Overlay District; Section 551.140
Parking limitations in the Downtown Parking Overlay District; Section 551.740
and Section 551.760

n Pittsburgh, Pennsylvania
Source: Pittsburgh Zoning Code, Chapter 914; August 24, 2000
Purpose statement of off-street parking, loading, and access chapter; Section 914.01.A.
Off-street parking requirements; Section 914.02.A Schedule A
Special exceptions to off-street parking requirements; Section 914.07.G.2

n Portland, Oregon
Source: Portland Planning Code, Chapter 33; July 1, 2002
Purpose statement of off-street parking and loading chapter; Section 33.266.110
Parking in the Central City Plan District; Section 33.510.261
Off-street parking requirements; Section 33.266.110

n Redmond, Washington
Source: Redmond Community Development Guide; November 15, 2001
Off-street parking requirements; Section 20D.130

n Richmond, Virginia
Source: Richmond Zoning Code; June 25, 1990
Intent of the Parking Overlay Districts; Section 32-900.1

n San Antonio, Texas
Source: San Antonio Unified Development Code; May 3, 2001
Exceptions to maximum parking requirements; Section 35-526(b)(5)
and Section 35-526(I)

n Santa Cruz, California
Source: Santa Cruz Zoning Code; Title 24; January 29, 1985
Bicycle parking requirements; Section 24.12.250

ADDITIONAL RESOURCES

Bergman, D., ed. 1991. *Off-Street Parking Requirements.* Planning Advisory Service Report No. 432. Chicago: APA.

Ferguson, E. 1998. *Transportation Demand Management.* Planning Advisory Service Report No. 477. Chicago: APA.

Morris, M., ed. 1996. *Creating Transit-Supportive Land-Use Regulations.* Planning Advisory Service Report No. 468. Chicago: APA.

Shoup, D. 1995. "An Opportunity to Reduce Minimum Parking Requirements." *Journal of the American Planning Association* 61, No. 1: 14-28.

Smith, T. 1983. *Flexible Parking Requirements.* Planning Advisory Service Report No. 377. Chicago: APA.

Wittenberg. J. 1998. "Rethinking Parking Policies and Regulations." *Planning Advisory Service Memo*, August.

Parking Management Best Practices: Making Efficient Use of Parking Resources

By Todd Litman

Until recently, most planners assumed that—as much as possible—parking should be abundant and free.

Planning focused primarily on maximizing supply by applying generous minimum requirements and public subsidies of parking facilities. But there is growing realization that this approach can be harmful and that alternative management solutions are often better overall. Transportation professionals are now thinking about vehicle parking problems and evaluating solutions in new ways.

Parking management refers to policies and programs that result in more efficient use of parking resources. There are more than two dozen parking management strategies that, when appropriately applied, can significantly reduce the parking supply required in a particular situation and provide other economic, social, and environmental benefits, as summarized in the "Parking Management Benefits" sidebar. When all impacts are considered, improved management is often the best solution to parking problems. This article describes how to adjust parking planning practices to take advantage of management solutions. It is part of efforts by researchers and professional organizations to develop parking management guidance and evaluation tools.

HOW MUCH IS OPTIMAL?

Parking management changes the way we determine optimal parking supply. Most parking supply decisions are currently based on recommended minimum standards published by professional organizations such as the Institute of Transportation Engineers.

The current standards tend to be economically excessive. To appreciate why, it is helpful to know a little about how these standards are developed. They are based on parking demand surveys, most of which were performed in automobile-dependent locations. They reflect an 85th percentile curve, which means that only 15 out of 100 sites will be fully occupied even during peak periods. Peak period is based on the 10th to 20th design hour, which refers to the number of annual hours that demand is allowed to exceed supply at a particular location. A parking facility is considered *full* if it has 85 to 90 percent occupancy. These assumptions ensure that most parking facilities seldom or never fill. The standards tend to be excessive where parking is shared or priced; if overflow parking is available nearby; in areas with multimodal transport systems; where land costs are high; and where management programs are implemented.

This process is said to measure parking demand, but *demand* is actually a function: the quantity of a good that consumers would purchase at a given price. Most parking surveys are performed where parking is free, which is equivalent to asking how much food a store can give away. To truly measure demand, the analysis must determine how much parking would be used under various prices and conditions. For example, rather than saying, "This site requires 100 parking spaces," a planner could say, "This site requires 100 spaces if they are free, 80 spaces if priced at $2 per day, 60 spaces if priced at $5 per day, and 50 spaces if priced at $5 per day and a commute trip reduction program is implemented."

Most areas have economically excessive parking supply. For example, a parking demand study of Southern California suburban offices found that conventional standards are nearly twice as high as

PARKING MANAGEMENT BENEFITS

- **Facility cost savings.** Reduces costs to governments, businesses, developers, and consumers.
- **Improved quality of service.** Many strategies improve user quality of service by providing better information, increasing user options, reducing congestion, and creating more attractive facilities.
- **More flexible facility location and design.** Parking management gives architects, designers, and planners more ways to address parking requirements.
- **Revenue generation.** Some management strategies generate revenues that can fund parking facilities, transportation improvements, or other important projects.
- **Reduces land consumption.** Parking management can reduce land requirements and so helps to preserve green space and other valuable ecological, historic, and cultural resources.
- **Supports mobility management.** Parking management is an important component of efforts to encourage more efficient transportation patterns, which helps reduce problems such as traffic congestion, roadway costs, pollution emissions, energy consumption, and traffic accidents.
- **Supports smart growth.** Parking management helps create more accessible and efficient land-use patterns and supports other land-use planning objectives.
- **Improved walkability.** By allowing clustered development and buildings located closer to sidewalks and streets, parking management helps create more walkable communities.
- **Supports transit.** Parking management supports transit oriented development and transit use.
- **Reduced stormwater management costs; less water pollution and heat island effects.** Parking management can reduce stormwater flow, water pollution, and solar heat gain.
- **Supports equity objectives.** Management strategies can reduce the need for parking subsidies and improve travel options for nondrivers.
- **More livable communities.** Parking management can help create more attractive urban environments.

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About the Author

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needed. A University of Iowa study found that parking supply exceeded peak-period demand by 16 to 63 percent at various commercial centers. Parking surveys in 26 Seattle neighborhoods found that most had only 40 to 70 percent peak-period occupancy. In Minnesota, peak-period parking supply at several St. Paul-area shopping centers exceeded occupancy by an average of 31 percent; planners recommended reducing municipal parking requirements to about half of conventional standards. These survey results are particularly dramatic because many of these sites have less parking than current standards require; none have parking management programs, which can typically reduce parking requirements by 20 to 40 percent.

There are better ways to determine parking supply. Efficiency-based standards size facilities for optimal use—which means that the parking spaces are frequently full, provided that users have information on travel and parking options and that overflow parking is available nearby. Efficiency-based standards take into account geographic, demographic, and economic factors that affect parking demand. Where possible, parking is priced based on economic efficiency criteria.

Table 1 summarizes parking demand adjustment factors. Optimal parking supply is typically 20 to 50 percent lower than what conventional standards require, and even more over the long term if more efficient parking practices lead to additional diverse transport systems and more accessible land-use patterns.

Because it is impossible to predict future demand precisely, efficiency-based standards apply *contingency-based planning*, which means that planners identify solutions that can be deployed if needed in the future. For example, if a building is predicted to need 60 to 100 parking spaces, the conventional approach is to supply either a middle (80 spaces) or maximum value (100 spaces). With contingency-based planning, the lower-bound value (60 spaces) is initially supplied, with a plan that identifies solutions to be implemented if needed. This gives decision makers confidence that any future problems will be solved.

TABLE 1. PARKING DEMAND ADJUSTMENT FACTORS

(This table summarizes various factors that affect parking demand and parking requirements)

Factor	Description	Typical Adjustments
Geographic Location	Vehicle ownership and use rates in an area	Adjust parking requirements to reflect variations identified in census and travel survey data.
Residential Density	Number of residents or housing units per acre/hectare	Reduce requirements 1% for each resident per acre: Reduce requirements 15% where there are 15 residents per acre, and 30% if there are 30 residents per acre.
Employment Density	Number of employees per acre	Reduce requirements 10–15% in areas with 50 or more employees per gross acre.
Land-use Mix	Range of land uses located within convenient walking distance	Reduce requirements 5–10% in mixed use developments and more with shared parking.
Transit Accessibility	Nearby transit service frequency and quality	Reduce requirements 10% for housing and employment within 0.25 mile of frequent bus service and 20% for housing and employment within 0.25 mile of a rail transit station.
Car-sharing	Whether a car-sharing service is located nearby	Reduce residential requirements 5–10% if a car-sharing service is located nearby, or reduce 4–8 parking spaces for each car-share vehicle in a residential building.
Walkability	Walking environment quality	Reduce requirements 5–15% in walkable communities, and more if walkability allows more shared and off-site parking.
Housing Tenure	Whether housing is owned or rented	Reduce requirements 20–40% for rental versus owner occupied housing.
Pricing	Parking that is priced, unbundled, or cashed out	Reduce requirements 10–30% for cost-recovery pricing (i.e., parking priced to pay the full cost of parking facilities).
Unbundling Parking	Parking sold or rented separately from building space	Unbundling parking typically reduces vehicle ownership and parking demand 10–20%
Parking and Mobility Management	Parking and mobility management programs are implemented at a site	Reduce requirements 10–40% at worksites with effective parking and mobility management programs.
Contingency Plan	Use lower bound requirements if a contingency plan exists	Reduce requirements 10–30%, and more if a comprehensive parking management program is implemented.

Source: From Donald Shoup (1995), "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995.

PARKING MANAGEMENT STRATEGIES

Table 2 summarizes potential parking management strategies and their typical range of effectiveness at reducing the parking supply needed in a particular situation. Not every strategy is appropriate in every situation: Actual impacts vary depending on geographic and demographic factors, how a strategy is implemented, and other factors. Below are some general guidelines.

- Impacts are higher where there are more parking and travel options. For example, park-

TABLE 2. PARKING MANAGEMENT STRATEGIES
(*This table summarizes potential parking management strategies. It indicates the typical reduction in the amount of parking required at a destination, and whether a strategy helps reduce vehicle traffic, thereby also providing congestion, accident, and pollution-reduction benefits.)*

Strategy	Description	Typical Reduction	Traffic Reduction
Shared Parking	Parking spaces serve multiple users and destinations	10–30%	
Parking Regulations	Favor higher value uses such as service vehicles, deliveries, customers, quick errands, and people with special needs	10–30%	
More Accurate and Flexible Standards	Adjust parking standards to more accurately reflect demand in a particular situation	10–30%	
Parking Maximums	Establish maximum parking standards	10–30%	
Remote Parking	Provides off-site or urban fringe parking facilities	10–30%	
Smart Growth	Encourages more compact, mixed, multimodal land-use development	10–30%	√
Walking and Cycling Improvements	Improve walking and cycling conditions to expand the range of destinations serviced by a parking facility	5–15%	√
Increased Capacity of Existing Facilities	Increases parking supply by using otherwise wasted space, smaller stalls, car stackers, and valet parking	5–15%	
Mobility Management	Encourages more efficient travel patterns, including changes in mode, timing, destination, and vehicle trip frequency	10–30%	√
Parking Pricing	Charges motorists directly and efficiently for using parking facilities	10–30%	√
Improved Pricing Methods	Uses better charging techniques to make pricing more convenient and cost-effective	Varies	√
Financial Incentives	Provide financial incentives to shift modes	10–30%	√
Unbundled Parking	Rent or sell parking facilities separately from building space	10–30%	√
Parking Tax Reform	Change tax policies to support parking management objectives	5–15%	√
Bicycle Facilities	Provide bicycle storage and changing facilities	5–15%	√
Improved User Information	Provides convenient and accurate information on parking availability and price	5–15%	√
Improved Enforcement	Ensures that parking regulation enforcement is efficient, considerate, and fair	Varies	
Transportation Management Associations	Establish member-controlled organizations that provide transport and parking management services in a particular area	Varies	√
Overflow Plans	Establish plans to manage occasional peak parking demands	Varies	
Address Spillover Problems	Use management, enforcement, and pricing to address spillover problems	Varies	
Parking Facility Design and Operation	Improve parking facility design and operations to help solve problems and support parking management	Varies	

Source: From Donald Shoup (1995), "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995.

ing pricing will have greater demand-reduction impacts if implemented in conjunction with improvements in ride-share and public transit services.

- Financial incentives tend to have greater impacts on lower income consumers.
- Some strategies are complementary. For example, shared parking becomes more effective if implemented with suitable regulations, pricing, and walkability improvements.
- Impacts generally increase as programs mature.

Evaluating multiple strategies

Planners should take special care when predicting the impacts of a program that includes multiple parking management strategies. Some impacts overlap, while others have synergistic effects and become more effective if implemented together. For example, transportation management associations (TMAs) provide an institutional framework for implementing strategies that directly affect parking requirements. While it would be true to say that a TMA can reduce parking requirements by 10 to 30 percent, it would be incorrect to add the demand reductions of the TMA to the impacts of the individual strategies it helps implement.

Here is an illustration. Without a TMA, parking sharing, pricing, and mobility management strategies may each reduce parking requirements by 10 percent, but with a TMA they become more effective, providing reductions of 15 percent. Table 3 illustrates the incremental gain that can be attributed to the TMA due to the increase in the effectiveness of other strategies. In this example, the TMA causes an additional 12 percent reduction in parking requirements by enhancing the effects of other management strategies.

Total impacts are multiplicative, not additive. Shared parking reduces parking requirements by 10 percent, to 90 percent of the original level. The 10 percent reduction due to the parking pricing strategy reduces this further to 81 percent of the original level, and another 10 percent reduction from mobility management results in 73 percent of the original level. This results in a 27 percent reduction, somewhat less than the 30 percent reduction that might be expected if the total were calculated by adding three 10 percent reductions.

TABLE 3. TMA PARKING REQUIREMENT REDUCTIONS
(*This table shows how a transportation management association can reduce parking requirements by helping to implement specific management strategies)*

	Without TMA (percentage)	With TMA (percentage)	Reduction (percentage)
Shared Parking	10	15	5
Parking Pricing	10	15	5
Mobility Management	10	15	5
Total Impacts	*100%-(90% x 90%) = 27%*	*100%-(85% x 85%) = 39%*	*12*

Source: From Donald Shoup (1995), "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995.

Examples of Successful Parking Management Programs

Downtown Pasadena, California, redevelopment. During the 1970s, Old Pasadena's downtown had become run-down, with many derelict and abandoned buildings and few customers—partly because of limited parking for customers. Curb parking was restricted to two hours, but many

employees simply parked in the most convenient, on-street spaces and moved their vehicles several times each day.

The city proposed charging for on-street parking as a way to increase turnover and make parking available to customers. Many local merchants originally opposed the idea. As a compromise, city officials agreed to dedicate all revenues to public improvements that made the downtown more attractive. A parking meter zone (PMZ) was established, and revenues from parking were invested in the downtown.

This approach of linking parking revenues directly to added public services—and keeping the money under local control—helped guarantee the program's success. With this proviso, the merchants agreed to the proposal. They began to see parking meters as a way to fund the projects and services that directly benefit their customers and businesses. The city formed a PMZ advisory board consisting of business and property owners to recommend parking policies and set spending priorities for the meter revenues. Investments included new street furniture and trees, more police patrols, better street lighting, more street and sidewalk cleaning, pedestrian improvements, and marketing (including maps showing local attractions and parking facilities).

This created a "virtuous cycle" in which parking revenue funded community improvements that attracted more visitors; this in turn increased parking revenue and allowed further improvements. Extensive redevelopment, new businesses, and residential development followed. Parking is no longer a problem for customers, who can almost always find a convenient space. Local sales tax revenues have increased far faster than in other shopping districts with lower parking rates or in nearby malls that offer free customer parking. This indicates that charging market rate for parking (i.e., prices that result in 85 to 90 percent peak-period utilization rates) with revenues dedicated to local improvements can be an effective way to support urban redevelopment.

Tri-Met Parking Management. The Tri-County Metropolitan Transportation District, which manages transportation in the Portland, Oregon, area, has implemented various parking management strategies around transit stations to minimize costs and support transit-oriented development. These include:

- sharing parking with Park & Ride and other types of land uses, including apartments, churches, movie theaters, and government buildings near transit stations;
- using lower minimum parking requirements around transit stations; and
- allowing Park & Ride capacity near transit stations to be reduced if the land is used for transit-oriented development, thus allowing walk/bike trips to replace car trips.

More accurate parking requirements. Vancouver, British Columbia, is developing a more flexible approach to parking requirements for multifamily dwellings to support efficient transportation, smart growth, and affordable housing planning objectives. City staff proposed a Sustainable Transportation Credit Program that allows developers more flexibility based on their specific location and circumstances. The program is loosely based on the LEED green building rating system. Developers receive credits for reducing the number of parking stalls, providing parking spaces for car-share vehicles, and providing annual transit passes to building occupants.

Rich Sorro Commons, San Francisco. Rich Sorro Commons is a mixed use project with 100 affordable units and approximately 10,000 square feet

RESOURCES

Aspen, City of (www.aspenpitkin.com).

Austin, City of (2006). Parking Benefit District (www.ci.austin.tx.us/parkingdistrict/default.htm).

CORDIS (1999–2002). *Parking Policy Measures and the Effects on Mobility and the Economy*, Cost-Transport, CORDIS (www.cordis.lu).

Davidson, Michael, and Fay Dolnick (2002). *Parking Standards*, Planning Advisory Service Report 510/511, American Planning Association (www.planning.org).

Institute for Transportation Engineering (2004). *Parking Generation, 3rd Edition*, Institute of Transportation Engineers (www.ite.org).

Isler, Elizabeth E., Lester A. Hoel, and Michael D. Fontaine (2005). Innovative Parking Management Strategies for Universities: Accommodating Multiple Objectives in a Constrained Environment, Transportation Research Board Annual Meeting (www.trb.org).

Kolozsvari, Douglas, and Donald Shoup (2003). "Turning Small Change Into Big Changes," *Access 23*, University of California Transportation Center (www.uctc.net), Fall 2003, 2–7; www.sppsr.ucla.edu/up/webfiles/SmallChange.pdf.

Kuzmyak, J. Richard , Rachel Weinberger, Richard H. Pratt, and Herbert S. Levinson (2003). *Parking Management and Supply*, Chapter 18, Report 95, Transit Cooperative Research Program; Transportation Research Board (www.trb.org).

Litman, Todd (2006). "Parking Costs," *Transportation Cost and Benefit Analysis*, Victoria Transport Policy Institute (www.vtpi.org).

_____ (2006). *Parking Management Best Practices*, APA Planners Press (www.planning.org). A summary of this book is available as *Parking Management: Strategies, Evaluation and Planning*, Victoria Transport Policy Institute (www.vtpi.org/park_man.pdf), 2006.

_____ (2005). *Land Use Impacts on Transportation*, Victoria Transport Policy Institute (www.vtpi.org).

Marsden, Greg (2006). "The Evidence Base for Parking Policies—A Review," *Transport Policy*, Vol. 13, No. 6 (www.elsevier.com/locate/tranpol), November 2006, 447–457.

Oregon Downtown Development Association (2001). *Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast*, Transportation and Growth Management Program, Oregon Department of Transportation and Department of Environmental Quality (www.lcd.state.or.us/tgm/publications.htm).

Seattle, City of (2000). *Comprehensive Neighborhood Parking Study*, City of Seattle (www.cityofseattle.net/transportation/pdf/CNPS.pdf).

Shaw, John (1997). *Planning for Parking, Public Policy Center*, University of Iowa (www.uiowa.edu).

Shoup, Donald (2005). *The High Cost of Free Parking*, APA Planners Press (www.planning.org).

_____ (2005). *Parking Cash Out*, Report 532, Planning Advisory Service, American Planning Association (www.planning.org/pas).

_____ (1999). "The Trouble With Minimum Parking Requirements," *Transportation Research A*, Vol. 33, No. 7/8, Sept./Nov. 1999, 549–574; available at www.vtpi.org/shoup.pdf.

_____ (1995). "An Opportunity to Reduce Minimum Parking Requirements," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995, 14–28.

Transit for Livable Communities (2003). *The Myth of Free Parking*, Transit for Livable Communities (www.tlcminnesota.org).

TriMet (2005). *Community Building Sourcebook*, TriMet (www.trimet.org/pdfs/publications/community_sourcebook05.pdf).

U.S. Environmental Protection Agency (2006). *Parking Spaces/Community Places: Finding the Balance Through Smart Growth Solutions*, Development, Community, and Environment Division (DCED); U.S. Environmental Protection Agency (www.epa.gov/smartgrowth/parking.htm).

Willson, Richard (1995). "Suburban Parking Requirements; A Tacit Policy for Automobile Use and Sprawl," *Journal of the American Planning Association*, Vol. 61, No. 1, Winter 1995, 29–42.

of ground-floor retail. Conventional standards would normally require 130 to 190 parking spaces for such a building, but it was constructed with only 85 spaces because of its proximity to high-quality public transit services, two car-share parking spaces in the building, and the fact that the building provides affordable housing for tenants who are unlikely to own a car. The reduced parking supply freed up space for a child care center and more ground-level retail stores. Avoiding the need to provide just 17 fewer parking spaces allows the project to generate $132,000 in additional annual revenues (300 square feet per space at $25.80 per square foot in rent), making housing more affordable. The two car-share vehicles give residents access to a car without the costs of ownership—a particularly important benefit for low-income households.

Aspen, Colorado. Aspen experienced growing parking problems because of its success as an international resort. In 1991, the city built a 340-space underground parking structure in the city center. Despite its convenient location and low price, it remained half empty most days while motorists fought over on-street parking spaces nearby. Most spaces were occupied by locals and downtown commuters who performed the "90-Minute Shuffle"—moving their cars every 90 minutes to avoid a parking ticket.

In 1995, the city began charging for on-street parking using multispace meters. Parking fees are highest in the center and decline with distance from the core. Parking is priced on nearby residential streets, but residents are allowed a limited number of passes. The city's marketing campaign let motorists know about the meters and each resident received one free $20 prepaid parking meter card. Motorists were allowed one free parking violation, and parking control officers allow an hour of free parking to drivers who are confused by the meters.

Although some downtown workers initially protested (opponents organized a "Honk if you hate paid parking" campaign the day pricing began), pricing proved effective at reducing the city's parking problems, and six months later the program was supported 3–1 in the municipal election. Most downtown business owners now support parking pricing to ensure convenient parking for customers and to raise funds for city programs.

Austin Parking Benefit District. Parking spillover can make it difficult for residents and visitors to find parking. Some residents are concerned that public service vehicles cannot pass two lanes of parked vehicles on the street, and also feel that street parking reduces a neighborhood's attractiveness.

Austin, Texas, addresses these problems by allowing neighborhoods to establish a parking benefit district (PBD). A PBD is created by metering on-street parking (with pay stations on the periphery of the neighborhood or with the traditional parking meters) and dedicating the net revenue (less costs for maintenance and enforcement) toward neighborhood improvements such as sidewalks, curb ramps, and bicycle lanes. The PMD may be used in conjunction with a residential permit parking program to ensure that parking is available for residents and their visitors.

Campus parking management. A survey of university campus managers indicates that many universities are converting parking lots to buildings, fewer are adding parking capacity, and that many are implementing various parking and transportation management strategies in order to devote more campus land to academic facilities rather than parking lots. Typical parking management strategies include permits, meters, a cash-out program, a prohibitive policy for freshmen, and eligibility based on residential location. Annual permit fees vary depending on the location of the campus and the location of a parking space within the campus. Various strategies are used to deal with spillover parking problems.

COSTS AND BENEFITS

Parking management costs include additional planning, operation, and enforcement activities—in addition to motorists' inconvenience. However, many of these costs can be minimized with good planning and new technologies, such as electronic parking payment systems that accommodate various types of payment (coins, bills, debit and credit cards, telephone, and online) and variable price structures. They do not require motorists to predict how long they will park and only charge for the number of minutes a space is actually used. With careful planning, significant parking supply reductions can be achieved in conjunction with improved travel options, better user information, and more convenient pricing methods. Programs costs are fully recovered, and travelers are better off overall.

A major benefit of parking management is its ability to reduce various facility costs. Because parking facility costs are usually paid indirectly through rents, taxes, and as a cost component of retail goods, most people have little idea how much they actually pay for parking facilities or the potential savings from improved management. Figure 1 illustrates examples of annualized parking facility costs. They range from about $400 per space in suburban areas with low land values to nearly $3,000 a year for underground parking with attendants.

FIGURE 1. TYPICAL ANNUALIZED PARKING COSTS

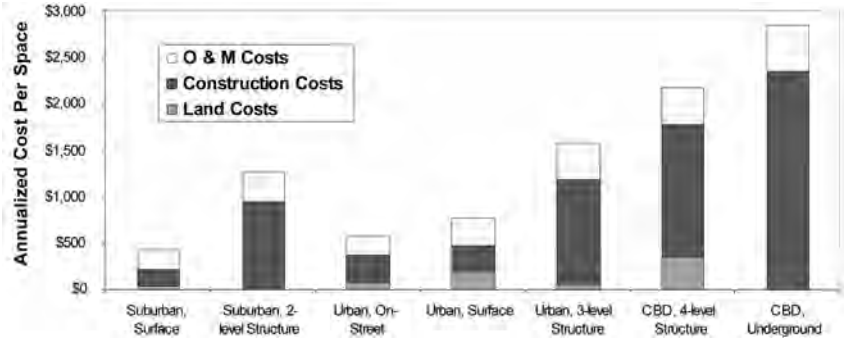
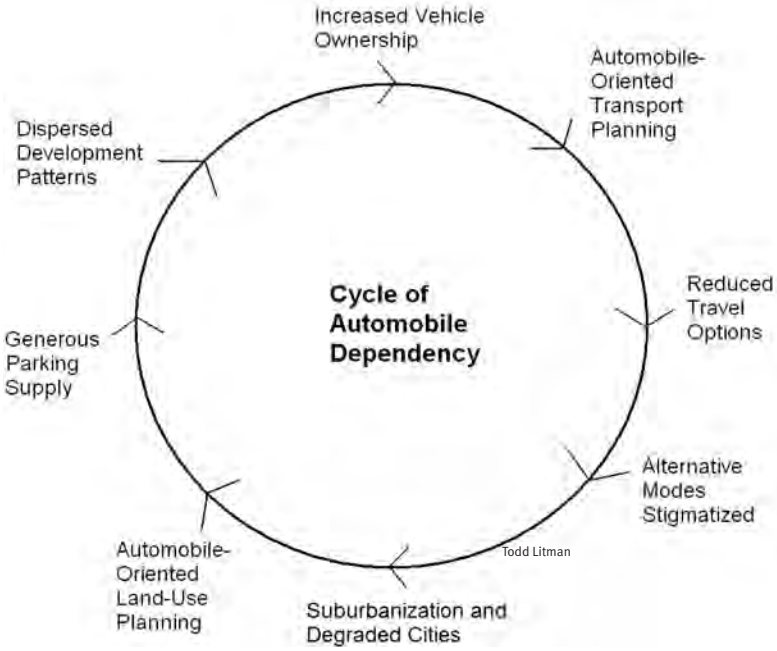


Figure 1 illustrates typical annualized parking facility costs, which range from less than $500 for suburban (low land value) surface parking to nearly $3,000 for structured or underground parking in a Central Business District.

Assuming two on-street and three off-street spaces (one residential and two commercial) per motor vehicle, with annualized costs averaging $400 per on-street, $600 per residential off-street, and $800 per nonresidential off-street space, parking costs total about $3,000 per vehicle or about $2,500 per capita. As described earlier, current parking planning practices result in a 20 to 50 percent greater supply than what is optimal, thereby increasing direct costs by $500 to $1,250 per capita.

Excessive parking standards contribute to the self-reinforcing cycle of increased automobile dependency and sprawled land use illustrated in Figure 2. This imposes indirect costs such as increased impervious surface and associated stormwater management costs, reduced green space, and reduced accessibility. This tends to be inequitable since it reduces accessibility for physically, economically, and socially disadvantaged people and forces people to pay for parking regardless of whether or not they own a vehicle. Although some lower income people benefit directly from subsidized parking, they would generally benefit more from flexible subsidies that can be used for other modes and nontransportation goods.

FIGURE 2. CYCLE OF AUTOMOBILE DEPENDENCY AND SPRAWL



This figure illustrates the self-reinforcing cycle of increased automobile dependency and sprawl.

Where parking is efficiently managed with flexible standards, efficient pricing, and parking subsidies shifted to cost-effective alternative management strategies, people tend to own five to 10 percent fewer vehicles and make 15 to 25 percent fewer vehicle trips, at least in urban and growing suburban conditions. This suggests that a significant portion of current transportation problems result from inefficient parking management.

Described more positively, improved parking management can help create more accessible land-use patterns and more multimodal transport systems, and help reduce various transport problems including congestion, facility costs, consumer transportation costs, traffic accidents, energy consumption, pollution emissions, and stormwater management costs, typically by 15 to 25 percent. To the degree that such programs are rational (total incremental benefits exceed total incremental costs), they tend to improve economic efficiency. They also tend to achieve social equity objectives by improving accessibility for disadvantaged people and by reducing cost burdens on lower income residents.

CONCLUSIONS

Current parking planning practices are inefficient and result in economically excessive parking supply, increased vehicle ownership and use, and more dispersed land-use development patterns that contribute to various economic, social, and environmental problems. As a result, planners increasingly emphasize management solutions to solve parking problems rather than continually increasing supply.

This article describes more than a dozen management strategies that result in more efficient use of parking resources. These strategies are technically feasible and cost-effective, and can provide many benefits to users and communities. A comprehensive parking management program that includes an appropriate combination of cost-effective strategies can usually reduce the amount of parking required at a destination by 20 to 50 percent and provide a variety of economic, social, and environmental benefits.

Although all these strategies have been implemented successfully in some situations, they are not being implemented as much as is economically justified. Implementing parking management requires overcoming substantial obstacles. Motorists have become accustomed to having abundant, free parking at most destinations and tend to oppose shifts to more rational management. Parking management implementation requires changing the way we think about parking problems and expanding the range of options and impacts considered during planning. It requires educating officials and the general public concerning the benefits of parking management, and reforming planning and funding institutions so resources currently devoted to parking facilities can be used for parking management.

Cover photo: Public parking in an underground garage. © iStockphoto.com/RyersonClark. Design concept by Lisa Barton.

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Zoning Practice — July 2009

Ask the Author

Here are reader questions answered by Todd Litman, author of the June 2009 *Zoning Practice* article "Parking Management Best Practices: Making Efficient Use of Parking Resources."

Question from Jacqui Lofaro, Southampton, N.Y.:

I am on the planning board in Southampton, New York. All parking is free. There is a huge parking problem, especially during the summer tourist season. How do you get the community and town board members to support charging? Thanks, and I look forward to your new book.

Answer from author Todd Litman:

Thanks for the question.

It is relatively easy to identify suitable parking management strategies (sharing, improved regulations, efficient pricing, commute trip reduction programs, reduced and more accurate parking requirements, etc.). The larger challenge is to convince decision makers and the general public to accept these changes; for example, that they must pay for parking that was previously free, that they will need to walk a few blocks between their parking space and destinations during peak periods, or that they will be encouraged to use alternative modes when possible.

The bad news is that current, inefficient parking management practices are well entrenched: Most motorists assume that parking should be abundant and free, and current zoning codes, development policies and municipal parking policies reflect these assumptions. Change can be difficult.

However, there is also good news. There are many reasons to change current policies and implement more efficient parking management. Current policies are wasteful and contradict most other planning objectives. They assume that land is cheap, that everybody drives everywhere, and that automobile dependency and sprawl are acceptable. As soon as we question any of those assumptions, for example, if land is costly and we want to deliver affordable housing, or a city is becoming more multimodal with a growing portion of trips by walking, cycling, and public transportation, then parking policy and planning reforms become justified. Every so often you will probably encounter an opportunity to introduce political change.

For example, your community may want to encourage more affordable housing and infill development, and you can point out that parking policy changes are needed to help achieve those objectives. Similarly, your community might consider traffic and parking congestion major problems, which also justify parking policy reforms and development of a parking management plan, or even better, a transportation management plan that includes parking management. Parking management and commute trip reduction can also be part of your community's plans to reduce climate change emissions and sprawl. In other words, parking management is an effective solution to many different problems (or, described differently, it helps achieve many different planning objectives).

Your challenge is to present these reforms in a positive way. Focus on the benefits and emphasize the need for comprehensive policies and programs to insure that these strategies can be implemented with minimal problems. For example, if you propose reduced parking requirements for new development, you should recognize that this could result in spillover parking problems, so your community should also implement suitable regulations, user information, and enforcement practices.

There are many reasons for communities to charge increasingly for parking, to manage parking demand, encourage use of alternative modes, and generate revenue. Many communities have successfully introduced pricing of previously free parking, including Aspen, Colorado, and Pasadena, California. It turns out that motorists are quite willing to pay for parking provided that they receive something in return: more convenience finding a space, a better local environment (for example, if revenues are used to finance streetscape improvements), or reductions in other fees and taxes. See Douglas Kolozsvari and Donald Shoup's article, "Turning Small Change Into

Big Changes,"**www.sppsr.ucla.edu/up/webfiles/SmallChange.pdf**.

Build partnerships. Developers, downtown associations, environmentalists, housing affordabilty advocates, and municipal engineers (who want to reduce stormwater management costs) all have good reasons to support more efficient parking management.

Learn more about parking management, and find good examples and case studies that demonstrate the success of parking management in comparable communities. Lots of good resources are now available:

CNT (2006), *Paved Over: Surface Parking Lots or Opportunities for Tax-Generating, Sustainable Development?*, Center for Neighborhood Technology; **www.drcog.org/documents/PavedOver-Final.pdf**.

CNU (2008), *Parking Requirements and Affordable Housing*, Congress for the New Urbanism, at **www.cnu.org/node/2241**.

Matthew R. Cuddy (2007), *A Practical Method for Developing Context-Sensitive Residential Parking Standards*, Dissertation, Rutgers University, **http://transportation.northwestern.edu/news/2007/Cuddy_dissertation_final_cv.pdf**.

FHWA (2007), *Advanced Parking Management Systems: A Cross-Cutting Study*, Report FHWA-JPO-07-011, Intelligent Transportation Systems, FHWA, USDOT, at **www.its.dot.gov/jpodocs/repts_te/14318.htm**.

HUD (2008), "Parking Regulations and Housing Affordability," *Regulatory Barriers Clearinghouse*, Volume 7, Issue 2, U.S. Department of Housing and Urban Development, at **www.huduser.org/rbc/newsletter/vol7iss2more.html**.

Litman, Todd (2004), *Parking Requirement Impacts on Housing Affordability*, VTPI, at **www.vtpi.org/park-hou.pdf**.

Litman, Todd (2006), *Parking Management Best Practices*, Planners Press, **www.planning.org/apastore/Search/Default.aspx?p=3502**.

Litman, Todd (2006), *Parking Management: Innovative Solutions to Vehicle Parking Problems*, Planetizen, **www.planetizen.com/node/19149**.

Todd Litman (2008), *Recommendations for Improving LEED Transportation and Parking Credits*, Victoria Transport Policy Institutem **www.vtpi.org/leed_rec.pdf**.

Manville, Michael, and Donald Shoup (2005), "People, Parking, and Cities," *Journal of Urban Planning and Development*, December, 2005, pp. 233-245, **http://shoup.bol.ucla.edu/People,Parking,CitiesJUPD.pdf**; summarized in *Access 25*, (**www.uctc.net**), Fall 2004, pp. 2-8.

Marshall, Wesley E., and Norman W. Garrick (2006), *Parking at Mixed-Use Centers in Small Cities*, *Transportation Research Record 1977*, Transportation Research Board, **www.darien.org/communitymatters/blog/archives/ParkingstudyfromUCONN.doc**; also see, *'Place First' Parking Plans*, **www.planetizen.com/node/34152**.

MTC (2007), *Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices*, Metropolitan Transportation Commission, **www.mtc.ca.gov/planning/smart_growth/parking_seminar/BestPractices.pdf**.

Mukhija, Vinit, and Donald Shoup (2006), "Quantity Versus Quality in Off-Street Parking Requirements," *Journal of the American Planning Association*, Vol. 72, No. 3, pp. 296-308, **http://shoup.bol.ucla.edu/QuantityVersusQualityInOff-StreetParkingRequirements.pdf**.

Redwood City (2007), *Downtown Parking*, Redwood City, **www.ci.redwood-city.ca.us/cds/redevelopment/downtown/parking.html**. The City's Parking Management Plan is at **www.ci.redwood-city.ca.us/cds/redevelopment/downtown/Parking/Downtown%20Redwood%20City%20Parking%20Plan.pdf**.

Russo, Ryan (2001), *Planning for Residential Parking: A Guide For Housing Developers and Planners*, Non-Profit Housing Association of Northern California, **www.nonprofithousing.org**, and the Berkeley Program on Housing and Urban Policy, **www.nonprofithousing.org/actioncenter/toolbox/parking**.

Schaller Consulting (2006), *Curbing Cars: Shopping, Parking and Pedestrian Space in SoHo*, Transportation Alternatives, **www.transalt.org/campaigns/reclaiming/soho_curbing_cars.pdf**.

Shoup, Donald (1999), "The Trouble With Minimum Parking Requirements," *Transportation*

Research A, Vol. 33, No. 7/8, Sept./Nov., pp. 549-574, **www.vtpi.org/shoup.pdf**.

Shoup, Donald (2005), *The High Cost of Free Parking*, Planners Press, **www.planning.org/apastore/Search/Default.aspx?p=1814**. This is a comprehensive and entertaining book of the causes, costs, and problems created by free parking, and how to correct these distortions.

Shoup, Donald (2005), *Parking Cash Out*, Report 532, Planning Advisory Service, American Planning Association, **www.planning.org/apastore/Search/Default.aspx?p=2439**.

Shoup, Donald (2006), *The Price of Parking On Great Streets*, Planetizen, **www.planetizen.com/node/19150**.

Shoup, Donald (2008), *The Politics and Economics of Parking On Campus*, University of California Los Angeles, **http://shoup.bol.ucla.edu/PoliticsAndEconomicsOfCampusParking.pdf**.

Simon Fraser University (2005), *Super Sustainable BC Market Mechanisms Briefing Paper: Transportation*, Simon Fraser University, **www.sfu.ca/~ssbc/Resources.htm**.

Topp, Christopher A. (2009), *Arapahoe County Parking Utilization Study Concerning Residential Transit Oriented Development*, School of Public Affairs, University of Colorado Denver, **www.vtpi.org/topp_parking.pdf**.

USEPA (2006), *Parking Spaces / Community Places: Finding the Balance Through Smart Growth Solutions*, Development, Community, and Environment Division (DCED); U.S. Environmental Protection Agency, **www.epa.gov/smartgrowth/parking.htm**.

Weinberger, Rachel , Mark Seaman, and Carolyn Johnson (2008), *Suburbanizing the City: How New York City Parking Requirements Lead to More Driving*, University of Pennsylvania for Transportation Alternatives, **www.transalt.org/files/newsroom/reports/suburbanizing_the_city.pdf**.

Supplemental answer from Todd Litman:

Moments after I sent my previous message I learned about the following document which was just released: **San Francisco On-Street Parking Management and Pricing Study**.

Question from Dan Fleishman, Director of Planning and Development, Stayton, Ore.:

I thoroughly enjoyed reading the June Zoning Practice. *In every city or town I have worked with, parking supply and demand in the downtown area has been an issue. I left northern New England and moved to Oregon three years ago. At 7,800 people, I am now working for the largest city that I have ever worked with or for in my 30-year career. Is there any research that indicates that the theories regarding parking management in large cities is applicable to smaller cities — those of 50,000, or 10,000 or less? Or do big-city folks not even consider us to be cities — just small towns?)*

Answer from author Todd Litman:

Yes, parking can be managed more efficiently in small towns and suburban areas. Many studies suggest that current zoning codes are excessive in small towns and strategies such as sharing and commute trip reduction programs can be effective. See:

Marshall, Wesley E., and Norman W. Garrick (2006), *Parking at Mixed-Use Centers in Small Cities*, *Transportation Research Record 1977*, **Transportation Research Board**; **www.darien.org/communitymatters/blog/archives/ParkingstudyfromUCONN.doc**; also see, *'Place First' Parking Plans*, **www.planetizen.com/node/34152**.

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Driving Urban Environments:
Smart Growth Parking Best Practices



A publication of the Governor's Office of Smart Growth
Robert L. Ehrlich, Jr., Governor ♦ Michael S. Steele, Lieutenant Governor
Prepared by: Robin Zimbler

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PARKING MANAGEMENT

As dependency on the automobile has grown, local policies have reinforced the car culture, accommodating increased parking demand through local zoning ordinances. The primary tool local governments have used to accommodate parking is parking ratio ordinances, which establish the minimum number of spaces a development project must provide for a given land use and project size. Table 1 outlines some of these general standards for minimum parking requirements based on land use. These ratios are typically drawn from generic parking generation rates, irrespective of site-specific and project-specific characteristics and other variables that would help to more accurately reflect market reality. The overstatement of parking ratios has in many cases led to an oversupply of parking.

There are many problems associated with current parking ratios and the subsequent oversupply of parking. These traditional approaches to regulating parking lead to vast expanses of parking which in turn separate land uses, reduce densities, impair walkability, and create obstacles to providing transit and pedestrian friendly communities. From a developer's perspective, inflated parking ratios reduce the development potential of a site, requiring more land to be used for parking as opposed to a higher and better use, and adding significant costs to development projects. In fact, some development projects may not be financially feasible under current local parking policies.

TABLE 1. General Standards for Minimum Parking Requirements

LAND USE	PEAK SPACE FACTOR	UNIT
Shopping Center > 600,000 square feet	4.5 spaces	per 1,000 square feet gross leasable area
Shopping Center < 600,000 square feet	4.0 – 4.5 spaces	per 1,000 square feet gross leasable area
Office	0.50 – 3.00 spaces	per 1,000 square feet gross leasable area, or
	0.10 – 0.75 space	per employee
Industrial	0.67 – 3.50 spaces	per 1,000 square feet gross leasable area, or
	0.36 – 1.60 spaces	per employee
Residential	0.20 – 2.00 spaces	per unit

Source: Urban Land Institute and National Parking Association, *The Dimensions of Parking*, Fourth Edition [Washington, D.C.: ULI, 2000]

Addressing these concerns requires local jurisdictions and developers to work together to revise parking policies to more appropriately manage parking. Revised parking policies should accommodate necessary parking, while at the same time encouraging attractive, pedestrian and transit friendly urban design, promoting alternative modes of transportation, preserving open space, and improving air and water quality.

This section of the paper details parking management best practices that aim to achieve the above mentioned objectives. Such "practices" or strategies include reduced minimum parking requirements, parking maximums, area-wide parking caps, shared parking, and parking districts. These strategies could be required through local zoning ordinances or be voluntary, on a project-by-project basis, implemented through developers' agreements. Given that efforts to control the supply of parking will only be feasible and effective when there are concurrent efforts to reduce the demand for parking, this section also proposes various best practices to reduce the demand for parking including transit investments, transit-oriented development and traditional neighborhood design policies, transportation demand management programs, unbundled parking, and parking pricing strategies.

Limiting Parking Supply

Local planners have traditionally regulated the supply of parking through zoning codes that prescribe minimum parking requirements for development projects based on land use and size. These minimum

requirements are typically drawn from parking generation rates and standards that are published by the Institute of Transportation Engineers. In one such commonly used publication, *Parking Generation*, the parking generation rates are derived from a small number of studies that measure peak parking demand at suburban locations, where parking is free and there is no public transit (Shoup, *Roughly Right or Precisely Wrong*). The maximum parking demand from these studies oftentimes becomes the minimum parking requirement established in zoning codes. Recognizing the limitations of these parking generation rates, planners will sometimes look to zoning codes in comparable cities to further inform their own minimum parking requirements. However, this comparison is also quite limited in that it cannot account for all of the geographic and demographic factors specific to a particular jurisdiction or development site. As a result of applying published generic parking standards or borrowing parking standards from seemingly comparable cities, minimum parking requirements tend to be excessive and inflexible, leading to more parking than is necessary.



Vast expanse of underutilized parking at shopping center in Towson, Maryland.

One of the primary ways local planners can more appropriately control the supply of parking is by revising local zoning ordinances to more accurately reflect local parking demand and circumstances. This portion of this section proposes potential revisions to local zoning ordinances including reduced parking requirements given a project's proximity to transit, surrounding land uses, demographics of prospective users, implementation of transportation demand management programs, or payment of fees in lieu of parking. Other strategies that might be considered for incorporation in local ordinances include parking maximums, area-wide parking caps, and shared parking. The roles parking management districts can play in controlling the supply of parking are also discussed in this section.

Reduced Minimum Parking Requirements

Local zoning ordinances have historically controlled the amount of parking at a site by imposing minimum parking requirements, calculated as a ratio of the number of parking spaces required per square foot, per dwelling unit, or other measure of intensity. This ratio varies by the type of land use. Rather than imposing inflexible requirements, local zoning ordinances could incorporate mechanisms to tailor parking requirements to specific development projects. The following list of factors are among those that should be considered.

- *Locational Factors*. The location of the proposed project will impact parking demand. For example, if a project is well served by mass transit, the project might generate a lower parking demand than what would otherwise be anticipated, relying on generic parking generation formulas. Moreover, if the proposed project is located amidst high-density development with a mix of land uses, there might be existing parking facilities nearby, thus reducing the demand for parking on-site. Users may also access the project and other nearby uses on foot, further reducing parking demand.

- *Demographic Factors*. The demographics of the anticipated users of a project, including employees, customers, and residents, will impact parking demand. For example, due to

Reduced Minimum Requirements for Locational and Demographic Factors - San Diego, California

The San Diego Municipal Code permits reduced minimum parking requirements for residential, office, retail, institutional, and industrial uses in designated transit areas and for residential uses in designated very low income areas. With respect to residential uses, the minimum parking requirements can be reduced in multiple dwelling unit developments, depending on the multiple dwelling unit type (number of bedrooms). For example, in a multiple dwelling unit development with 2 bedroom units, the basic minimum parking requirement is 2 spaces per dwelling unit; however, in both transit areas and very low income areas this requirement is reduced to 1.75 spaces per dwelling unit. With respect to nonresidential uses, the reduction in minimum parking requirements for developments in transit varies based on use. However, in general the minimum parking requirement for nonresidential uses in transit areas is about 85% percent of the minimum requirement for development outside transit areas.

the high cost of car ownership, low-income residents generally have lower levels of car ownership than that of the general public. If the anticipated users of a proposed project have low levels of car ownership, the project might generate a lower parking demand than what would otherwise be anticipated. The age distribution of anticipated users will also be indicative of parking demand. For example, if the anticipated users of a proposed project are seniors, the project will necessitate less parking than what would otherwise be anticipated.

In addition to tailoring parking requirements to project-specific conditions such as locational and demographic factors, local zoning ordinances might also prescribe reductions to minimum parking requirements on a project-by-project basis in exchange for a developer's commitment to a transportation demand management program or payment of fees in lieu of providing the required parking.

- *Transportation Demand Management Programs*. Transportation Demand Management (TDM) programs are typically employer-led programs intended to reduce the parking demand of employees by supporting carpooling, offering subsidies for transit, furnishing bicycle facilities, and providing shuttle service from off-site parking facilities. These features of TDM programs are discussed in greater detail in the following section on controlling parking demand. An example of a jurisdiction that reduces minimum parking requirements in exchange for an employer's creation and implementation of a TDM program is Hartford, Connecticut, where parking requirements can be reduced up to 30 percent in exchange for discounted carpool parking, rideshare promotions, subsidized transit passes and shuttle service from off-site parking.

- *Fees-in-lieu*. Fees-in-lieu are established by jurisdictions as an alternative to requiring on-site parking facilities. More specifically, some local jurisdictions allow reductions to minimum parking requirements in exchange for developer payment into a municipal parking or traffic mitigation fund. The accrued money from the municipal parking fund helps finance city-owned, centrally located, off-site parking facilities. The in-lieu fees may be mandatory or voluntary and are set either by calculating a flat rate for each parking space not provided or by carefully determining appropriate development-specific fees on a case-by-case basis. By paying fees-in-lieu, developers have the ability to circumvent constructing on-site parking facilities, and are subsequently able to improve site design and preserve unique and historic resources that might otherwise be demolished to accommodate on-site parking. Fees-in-lieu tend to be very effective when rapid development is occurring in a defined area. However, absent a critical mass of concurrent development projects in a defined area, the municipal parking fund may only increase in increments insufficient to develop municipal parking structures in a timely manner (Urban Land Institute 2000). As a result, developers might only opt to pay in-lieu fees when a parking facility will be available on a definite schedule and within an acceptable proximity to the development project. An example of a jurisdiction that allows developers to pay fees-in-lieu of the required parking is the Town of Westport, Connecticut. The Town's Zoning Regulations allow for developers to pay fees-in-lieu of providing all or a portion of the off-street parking spaces required for projects located in a designated Historic Design District. In this example, the fee-in-lieu of parking is set at $2,000 per

Reduced Minimum Requirements for Transportation Demand Management Programs – Seattle, Washington

The Seattle Municipal Code stipulates that for office or manufacturing uses that require 40 or more parking spaces, the minimum parking requirements may be reduced up to 40% by substituting transportation demand management programs. These provisions include:

- for every certified carpool space, the total parking requirement may be reduced by 1-9/10 spaces up to a maximum of 40% of the total parking requirement;
- for every certified vanpool purchased or leased by the applicant for employee use, the total parking requirement may be reduced by 6 spaces up to a maximum of 20% of the total parking requirement;
- if transit passes are provided to all employees and transit service is within 800 feet of the development, the total parking requirement may be reduced up to 10%; and
- for every 4 covered bicycle parking spaces provided, the total parking requirement may be reduced by 1 space up to a maximum of 5% of the total parking requirement.

deficit parking space and must be paid in full by the applicant prior to the issuance of a zoning permit.

Local zoning ordinances should be clear about the terms and conditions for reductions to minimum parking requirements "by-right", specifying the percent of required spaces that can be reduced for such conditions as proximity to transit, surrounding land use mix and density, demographics and behaviors of prospective users, implementation of TDM programs, and payment of fees-in-lieu. By setting clearly defined terms and conditions for reductions in minimum parking requirements, local jurisdictions can limit the number of projects that have to go through the lengthy and uncertain process of receiving a zoning variance.

Although reduced minimum parking requirements might benefit developers by reducing the costs associated with the construction, operation, and maintenance of parking facilities, developers may not opt for the reduced parking requirement because of impacts insufficient parking might have on the marketability of the project to lending institutions and prospective users. As a result, developers might still oversupply parking in order to meet inflated financing standards set by lending institutions. However, in many cases, lending institutions do refer to local zoning, and local jurisdictions have been revising local zoning ordinances to incorporate parking maximums or area-wide parking caps to ensure there is not an oversupply of parking; these strategies are discussed in the next part of this section.

Parking Maximums and Areawide Parking Caps

As discussed in the previous section on reduced minimum parking requirements, local zoning ordinances usually establish the amount of parking developers must provide. However, in contrast to minimum parking requirements, it is becoming more and more common for local jurisdictions to revise zoning ordinances to incorporate parking maximums or areawide parking caps, both intended to ensure that there is not an excess supply of parking.

- *Parking Maximums*. Parking maximums restrict the total number of parking spaces that can be constructed at a particular development site. For example, the City of Seattle allows a maximum of one parking space per 1,000 square feet of downtown office space, and is considering extending this maximum to areas outside of the downtown. The City of San Francisco limits parking to 7% of a downtown building's floor area (Millard-Ball 2002). Maximums can complement minimum parking requirements, thus ensuring a threshold level of parking supply, or can stand alone, leaving individual developers to determine the appropriate amount of parking necessary. While reduced minimum parking requirements allow developers the choice of providing more parking than the required amount, parking maximums are absolute limits on the amount of parking that can be provided. As such, parking maximums leave little room for making mistakes in projecting parking demand. If a jurisdiction underestimates parking demand and sets maximums too low, developers cannot "second guess" that decision and provide more parking, as they can with reduced minimum parking requirements.

- *Areawide Parking Caps*. Areawide parking caps limit the total number of parking spaces that can be constructed in a defined area. Similar to parking maximums, areawide parking caps set

Parking Maximums – Portland, Oregon

The Portland City Code has implemented parking maximums to complement parking minimums in areas outside the Central City district. The zoning ordinance specifies that the purpose of such provisions is to promote the efficient use of land, enhance urban form, encourage use of alternative modes of transportation, provide for better pedestrian movement, and protect air and water quality. The maximums vary with the use the parking is serving and the location of the use. That is, areas that are zoned for more intense development and are easily reached by alternative modes of transportation have lower maximums than areas of less intense development or less frequent or no transit service. For example, the minimum parking requirement for general office use is 1 space per 500 square feet of floor area, and the maximum parking requirement is 1 space per 294 square feet of floor area. However, if the development is located more than ¼ mile from a transit stop with 20-minute peak-hour bus service and more than ½ mile from a transit stop or station with 20-minute peak-hour light rail or streetcar service, the maximum number of parking spaces is actually increased to 125% of what otherwise would be the maximum requirement.

an absolute limit on the amount of parking that can be provided, in so doing, leaving little room for mistakes in projecting parking demand. Areawide parking caps require considerable administrative and planning effort to determine the appropriate number of parking spaces for a defined area, and to accurately apportion the allotted spaces to specific development projects.

Both parking maximums and areawide parking caps encourage better utilization of existing parking facilities and force businesses to encourage their employees and customers to use alternative modes of transportation. In fact, many jurisdictions that have instituted parking maximums or areawide parking caps have done so in response to non-attainment of environmental standards, particularly, air quality standards. For either parking maximums or areawide parking caps to be successful, it is imperative to have accessible and frequent public transportation, and the jurisdiction must have a strong real estate market, where the locational advantages considerably outweigh the perceived drawback of a lack of parking.

Shared Parking

Shared parking can be defined as parking utilized jointly among different buildings and facilities in an area to take advantage of different peak parking characteristics that vary by time of day, day of week, and/or season of year. For example, many businesses or government offices experience their peak business during normal daytime business hours on weekdays, while restaurants and bars peak in the evening hours and on weekends. This presents an opportunity for shared parking arrangements. Historically, local zoning ordinances have not permitted shared parking—stating that if two or more uses are located on the same lot or in the same structure, the total number of parking spaces required equals the sum of spaces required for each individual use. Since most parking spaces are only used part time, this policy leads to the underutilization of many parking facilities, with a significant portion of spaces unused. On the other hand, by allowing for and encouraging shared parking, local jurisdictions can decrease the total number of spaces required relative to the total number of spaces needed for each land use separately. As a result, allowing for shared parking arrangements significantly reduces the amount of land devoted to parking and, in so doing, creates more opportunities for creative site planning and landscaping.

Some local jurisdictions do incorporate language in local ordinances to permit and even encourage shared parking. These jurisdictions allow shared parking to meet minimum parking requirements for uses located within the same lot or building and also permit off-site shared parking arrangements to meet on-site parking requirements for complementary uses within a defined area. One way in which local ordinances help enable shared parking is to allow for off-street parking facilities to be located off-site of the lot on which the structure or use being served is located. Such ordinances usually specify a maximum distance from the structure or use within which the off-site parking facility must be located. These location requirements are typically based on acceptable walking distances. For example, the San Diego (CA) Municipal Code states that shared parking facilities must be located within 600 feet of the uses served. The Eugene (OR) Municipal Code allows for a longer distance stating that required off-street parking facilities must be within 1320 feet of the development site that the parking is required to serve. In addition to revisions to local zoning codes to enable shared parking, shared parking arrangements can be implemented through shared parking agreements between individual developers or the construction of public parking facilities.

There are several barriers to implementing shared parking arrangements. In particular, there is a considerable amount of planning needed to determine the appropriate number of parking spaces under shared parking arrangements. Some local jurisdictions calculate this number through the following method: 1) determine the minimum amount of parking required for each land use as though it were a separate use, by time period; 2) calculate the total parking required across uses for each time period; and 3) set the requirement at the maximum total across time periods. Other jurisdictions allow for the parties involved to determine the appropriate number of spaces. In these cases, the applicants must submit an analysis that shows that peak parking times occur at different times and that the parking area will be large enough to accommodate the anticipated demand. Since changes in ownership, operations, or use, might alter parking demand in the future, many ordinances that allow for shared parking require contingency plans to accommodate additional parking that may be necessary in the future.

Shared Parking – Montgomery County, Maryland

The Montgomery County Zoning Ordinance allows for shared parking 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 uses being served by the shared parking arrangement must be within a 500 feet walking distance of the shared parking facility. The number of parking spaces required under a shared parking arrangement in Montgomery County is calculated by the previous mentioned method.

The following is a generalized example of calculating the shared parking requirement for a mixed use development, given the regulations in the Montgomery County Zoning Ordinance. The calculations are based on a development project with general retail and office uses. The retail use has a gross floor area of 100,000 square feet and the office use has a gross floor area of 100,000 square feet. The development is located in the designated Southern Area of Montgomery County and is located 1,000 feet from a Metro station. Given this location, the minimum amount of parking normally required for a retail use is 5 spaces per 1,000 square feet gross floor area and the minimum requirement for an office use is 2.1 spaces per 1,000 square feet gross floor area. The following table summarizes the calculations. The "percentage of parking requirement column" is based on the parking credit schedule in the Montgomery County Zoning Ordinance.

	OFFICE USE			RETAIL USE			
	Minimum Parking Requirement	Percentage of Parking Requirement	**Adjusted Parking Requirement**	Minimum Parking Requirement	Percentage of Parking Requirement	**Adjusted Parking Requirement**	**Parking Requirement by Time Period**
Weekday Daytime	210	100%	**210**	500	60%	**300**	**510**
Weekday Evening	210	10%	**21**	500	90%	**450**	**471**
Weekend Daytime	210	10%	**21**	500	100%	**500**	**521**
Weekend Evening	210	5%	**10.5**	500	70%	**350**	**360.5**
Nighttime	210	5%	**10.5**	500	5%	**25**	**35.5**

For this example, the minimum parking requirement for the shared parking arrangement is **521 spaces** since that is the maximum number of spaces across the five time periods. This is significantly less than what would otherwise be required, 710 spaces, if shared parking were not permitted—a 26% reduction in the minimum parking requirement.

Parking Management Districts

Parking management districts are areas designated by local jurisdictions in which parking supply and rates are regulated to meet the parking needs of the area, at the same time as promoting transit use, ridesharing, and other alternative modes of transportation to the single occupancy vehicle. The two key components of parking management districts—supply management strategies and pricing policies—are designed to work together to enhance economic development and encourage a balanced transportation system in the parking management district. District-based supply management strategies are established to encourage mixed use development projects and areas and to ensure the maximum utilization of land, requiring less land area for parking and, in so doing, making more land available for tax-generating purposes. To complement these supply management strategies, district-based pricing policies are established to influence individual travel behavior and encourage alternative modes of transportation. These pricing policies are discussed in greater detail in the section of this paper on controlling parking demand.

With respect to district-based supply management strategies, the parking supply in parking management districts can be managed on a project-by-project basis or through the development of centralized, shared parking facilities. That is, some local jurisdictions manage parking supply in parking management districts by requiring parking ordinances for development projects located in the district. In applying for a parking

ordinance, developers must justify the parking levels that will be built as a part of the development project. For example, in Baltimore, Maryland, no land may be used as a parking lot nor may any building be razed so as to permit the use of the land as a parking lot unless authorized by an ordinance of the Mayor and City Council. This requirement is to permit the Mayor and City Council to consider and evaluate the need for the parking lot, the proposed appearance of the parking lot, and possible aesthetic damage to the area surrounding the parking lot, with particular respect to the proposed removal of historic or aesthetically valuable properties. By requiring a parking ordinance for development projects located in a parking district, jurisdictions can control the overall parking supply regulating on-site parking on a project-by-project basis.

Local jurisdictions can also manage parking supply in parking management districts by developing, operating, and maintaining publicly-owned, centralized parking facilities financed through fees in lieu and other methods described later in this paper in the section on parking financing. These facilities alleviate the need for individual development projects to provide parking on-site. For example, Montgomery County, Maryland, has established four parking management districts in Bethesda, Montgomery Hills, Silver Spring, and Wheaton. The purpose of each district is to support the comprehensive development of the central business district by providing, operating and maintaining economically self-sufficient parking facilities which keep pace with the needs generated by growth in each district. Moreover, the number of parking spaces provided in each district is carefully calculated given the desired modal split between private cars and transit. There are four major funding sources of the parking management districts including fees in lieu, parking receipts, enforcement revenues, and income from investments. By developing, operating, and maintaining centralized parking facilities, jurisdictions can control the overall parking supply, encouraging the shared use of off-site parking facilities by a variety of development projects.

Challenges to Limiting Parking Supply

There are several challenges to limiting parking supply through the above-mentioned strategies. Supply management strategies presuppose that the projected variations in parking demand are accurate, which is not always the case. Furthermore, changes in ownership or operations of existing uses, or future changes in land use, might alter parking demand. In case the projected parking demand proves inaccurate or changes over time and, as a result, projects generate a greater parking demand than originally anticipated, some local jurisdictions will only approve reduced minimum parking requirements or shared parking arrangements if the developer has an agreed upon plan to accommodate the additional spaces (Urban Land Institute 2000). Such plans might include land banks or landscaped reserves. For example, the Iowa City Zoning Ordinance allows for land banked areas to be used in place of up to 30% of the required parking. If at some point in the future, the additional parking spaces are needed, the property owner will be required to construct parking on the land banked area. Similar to Iowa City, Palo Alto, California, allows for land banked areas to be used in place of 50% of the required parking. However, in the case of Palo Alto, the land banked area is actually more appropriately called a landscaped reserve since the land must be landscaped or serve a recreational function such as a play area. Jurisdictions might also require developers' agreements and/or land covenants to ensure the continued implementation of agreed upon programs, irrespective of future ownership, operations, or change in use.

As discussed previously, parking maximums and areawide parking caps leave little room for mistakes in projecting parking demand. As a result, these policies must be somewhat flexible and regularly revised to ensure that an adequate level of parking is supplied. While some jurisdictions are revising local codes to incorporate maximums or areawide caps to complement minimum parking requirements, it is becoming more popular to replace minimums and maximums with more flexible parking medians. Under median parking requirements, a certain percentage of the median requirement is allowed above or below the median by right. Above or below this by right increase or decrease the developer must provide documentation to justify the levels of parking.

Overall, limiting parking supply might have unintended impacts should the actual parking demand exceed the anticipated level. If the parking supply is unable to accommodate demand, there might be spillover parking into adjacent uses and residential communities. In fact, many neighborhood residents will vehemently oppose any parking supply management strategy in fear that their neighborhood will become flooded by spillover parking with more cars bringing traffic and congestion. A potential solution to spillover parking is the creation and implementation of residential parking permit districts. Residential parking permit districts are designated areas in which the residents work with local jurisdictions to establish a program allowing them to park on the neighborhood streets, but restricts others from parking in these areas during certain hours. These districts are designed to reduce the impacts caused by students, customers, and

employees who do not park in the spaces provided in the nearby schools or businesses. In residential parking permit districts, permits could be made available to residents for a nominal fee—the revenues from these fees could in turn be used to fund neighborhood enhancements.

Finally, limiting parking supply will only be effective if there are concurrent efforts to control parking demand. Strategies to control parking demand, including transit investments, transit-oriented development and traditional neighborhood design policies, transportation demand management programs, unbundled parking, and pricing strategies, are discussed in this next portion of this section.

Controlling Parking Demand

One of the most effective ways of limiting parking supply is to reduce the needed supply through measures to control parking demand. In addition to the above mentioned supply management strategies, it is possible to reduce supply by influencing demand through investments in alternative modes of transportation, direct financial incentives for non-single occupancy vehicle use, pricing strategies, and policies supportive of transit-oriented development and traditional neighborhood design. This portion of this section outlines ways in which both the public and private sectors can influence parking demand, thus reducing the need for and subsequent provision of parking.

Transit Investments

One of the most effective ways of reducing the demand for parking is by providing people with a viable alternative to the personal automobile. Therefore, in seeking to control the demand for transportation facilities tailored to the automobile, the public sector must make a commitment to expand and otherwise improve transit systems and services. There are various ways in which transit systems could be improved to better meet the needs of existing users and potentially attract new users, including expanding already existing routes for existing modes, adding new routes for existing modes, and creating new modes such as express bus service. Capital investments could also be made to improve maintenance of facilities, such as buses and trains, and to revitalize transit stations, bus stops, and their surrounding neighborhoods. In addition to these capital investments in routes, modes, and facilities, operational improvements such as scheduling changes can be instituted to offer more frequent and convenient service. There are several challenges to these investments in transit. Capital projects may be extremely costly and demand a substantial upfront investment of government resources. Moreover, extensive planning and coordination is important to ensure appropriate location of routes and stations—this planning process adds additional time to what is already a time consuming process. As a result, it may take a long period of time before capital projects are fully operational. Finally, capital investments should be complemented by inducements such as marketing campaigns to help people realize the value of substituting mass transit for single occupancy vehicle use, improvements to fare structures, and enhanced passenger amenities.

MetroLink – St. Louis, Missouri

In July of 1993, MetroLink, a regional light rail system, began operating in St. Louis, Missouri. MetroLink's alignment stretches 34.3 miles from Lambert International Airport in St. Louis to Southwestern Illinois College in Belleville, Illinois. The system was built and is operated by Bi-State Development Agency as part of a fully integrated regional transportation system that also includes MetroBuses. The capital costs of the existing alignments was close to $800 million, of which the Federal Transit Administration paid about $600 million and the County governments paid the remaining portion. The federal contribution comes from its one-cent gasoline tax revenue base and covered all costs for design and engineering, construction, procurement, testing, start-up and project administration. The local match came from the asset value of the donated rights-of-way, structures, and facilities, and from a ½ cent sales tax. MetroLink operations are subsidized by sales taxes and passenger fares. The base fare is $1.25—service is free during lunch hours in the downtown district. In its first year of operation MetroLink carried nearly 9 million customers, almost double the projected ridership. In Fiscal Year 2001, 14.2 million customers rode MetroLink. It is estimated that 21% of MetroLink customers are former bus riders and the other 79% are new to transit. MetroLink has reduced vehicle miles traveled in the St. Louis region by as much as 139,100 miles per day, has saved 7,130 gallons of fuel each day, and in its first year of operation, reduced carbon emissions by between 4,500 and 9,600 metric tons (EPA TRAQ).

Transit-Oriented Development and Traditional Neighborhood Design Policies

To help foster pedestrian and transit friendly communities in which people do not need to rely exclusively on the personal automobile, local jurisdictions can develop policies that encourage transit-oriented development and traditional neighborhood design. Transit-oriented developments (TOD) are location-efficient, compact, walkable development projects with a balanced mix of residential, business, and institutional uses clustered around transit stations. Traditional neighborhood design (TND) developments are compact, mixed use, pedestrian-oriented communities that connect people to places and people to people. Both TODs and TND developments encourage the development of denser, mixed-use, pedestrian oriented areas where frequently visited services, jobs, housing, and, in the case of TOD, transit, are all easily accessible, reducing the reliance on the personal automobile and the subsequent need for parking facilities.

Although the benefits of TOD and TND have been well documented, there are still many challenges to both types of projects including community fears that increased densities will increase traffic congestion and lower property values, and developer and lender fears that TOD and TND projects have higher costs and risks than conventional development projects. Moreover, in many jurisdictions, existing codes and ordinances do not allow for the construction of mixed-use, pedestrian-oriented developments as alternatives to conventional use-segregated developments or require a prohibitive number of zoning variances.

Local jurisdictions can help enable TOD and TND by revising local zoning ordinances to include TOD and TND zones that allow for a mixing of uses and increased densities, can include affordable housing and reduced parking requirements, and prescribe design guidelines such as site development design criteria, street and streetscape design criteria, landscape design criteria, environmental standards, and scale requirements. Local jurisdictions can also help encourage TOD and TND projects by creating small area TOD and TND plans, making the necessary capital investments to support TOD and TND projects, and providing land assembly assistance and/or expedited permitting to developers wishing to undertake such projects.

Transit-Oriented Development Zoning – Concord, North Carolina

The Unified Development Ordinance of the City of Concord, North Carolina, designates transit-oriented development (TOD) districts to encourage a mixture of residential, commercial, and employment opportunities within a specified radius of identified light rail station or other public transit stations. The TOD zone allows for more intense and efficient use of land for the mutual reinforcement of public investments and private development in transit areas. The TOD zones are divided into two distinct subdistricts—TOD core and TOD periphery. All areas within ¼ mile of a transit station are classified as TOD core areas and all areas between ¼ and ½ mile of a transit station are classified as TOD periphery areas. The Unified Development Ordinance outlines different requirements for each of the subdistricts. The Ordinance allows for a mixing of residential and non-residential in both the TOD core and periphery areas, but does not prescribe the amount of land that needs to be allocated to each use. The Ordinance does regulate the density and floor area ratios in the TOD subdistricts. The following table illustrates this:

	Density (residential units per acre)		Floor Area Ratio (non-residential units)	
	Minimum	Maximum	Minimum	Maximum
TOD core				
Parcels, 2 acres or more	16	20	0.70	1.20
Parcels, less than 2 acres	12	16	0.50	1.00
TOD periphery				
Parcels, 2 acres or more	12	16	0.50	1.00
Parcels, less than 2 acres	8	12	0.30	0.60

The Concord Ordinance also details parking regulations specific to the TOD zones. More specifically, the Ordinance reduces minimum parking requirements in portions of TOD zones, stating that if a site is within 500 feet of a light rail alignment, the minimum required parking spaces is 50% of what otherwise would be required by the Ordinance. In addition, the Ordinance prohibits all surface parking facilities in the TOD core areas and allows for surface parking for only commercial uses in TOD periphery areas.

Traditional Neighborhood Design Zoning – Austin, Texas

The City of Austin's City Code allows for traditional neighborhood design by-right by designating traditional neighborhood zoning districts to encourage mixed use, compact, pedestrian-friendly development that diversifies and integrates land uses within close proximity to each other, and provides for the daily recreational and shopping needs of residents. As stipulated in the Austin Code, a traditional neighborhood district (TND) may consist of an area no less than 40 contiguous acres and not more than 250 contiguous acres. The City Code outlines five different types of areas in a TND—Neighborhood Center Area, Mixed Residential Area, Neighborhood Edge Area, Workshop Area, and Employment Center Area. The Code outlines different land use, site development, and design regulations for each type of area. A TND must have one Neighborhood Center Area and at least one Mixed Residential Area.

- A Neighborhood Center Area serves as the focal point of a TND, containing retail shops, offices, banks, a post office, places of worship, a community center, attached residential dwellings, and other uses that meet the daily needs of the residents. Townhouse, condominium, and multifamily uses shall be allocated not less than 20% of the land area, commercial uses shall be allocated not less than 20% of the land area, and civic uses shall be allocated not less than 5% of the land area in a Neighborhood Center Area. In addition, a Neighborhood Center Area is pedestrian-oriented, encouraging movement between the neighborhood center and Mixed Residential Area, and must include a public square.

- A Mixed Residential Area includes a variety of residential land uses including single-family homes, duplexes, townhouses, and apartments. Residential retail, commercial, and civic uses may also be located in a Mixed Residential Area. A Mixed Residential Area must include formal and informal open spaces and promote pedestrian activity. Single family residential use shall be allocated not less than 50% and not more than 80% of the land area, duplex use shall be allocated not more than 10% of the land area, townhouse, condominium, and multi-family uses shall be allocated not less than 10% of the land area, commercial uses shall be allocated not less than one percent and not more than two percent of the land area, and civic uses shall be allocated not less than two percent of the land area in a Mixed Residential Area.

In addition to a Neighborhood Center Area and at least one Mixed Residential Area, a TND may also have a Neighborhood Edge Area, a Workshop Area, or an Employment Center Area. A Neighborhood Edge Area is the least dense portion of a TND, with larger lots and greater setbacks than the rest of the area. A Workshop Area provides space for commercial and light industrial uses that are not appropriate for the Neighborhood Center Area, while an Employment Center Area provides space for large office and low-impact manufacturing uses.

Under the Austin City Code, formal and informal open spaces and an interconnected network of streets and alleys are all required components of a TND. More specifically, the Austin City Code requires that not less than 20% of the gross land area of the TND be open space and that overall impervious cover for a TND be limited to 65% of the net site area or the amount permitted in the watershed, whichever is less. The Code details impervious cover limits for each of the five types of areas as well.

Finally, the Austin City Code sets forth parking regulations specific to TND zones. Some of the more innovative TND parking regulations in the Code include the following: 1) A parking lot shall be located at the rear or side of a building (if at the side, appropriate screening must be provided; 2) A commercial use parking lot or garage must provide one bicycle parking space for every 10 motor vehicle parking spaces; 3) For parking in a Neighborhood Center Area, the required parking for a use may be located anywhere in the Neighborhood Center Area (community parking facilities are encouraged); 4) For parking in a Neighborhood Center Area, not more than 125% of the required parking for a use may be provided on-site; and 5) For parking in a Neighborhood Center Area, a commercial or a multi-family use may apply adjacent on-street parking toward the minimum parking requirements.

Transportation Demand Management Programs and Transportation Management Associations

According to Census 2000, it is estimated that 76% of workers sixteen years and over commute to work alone, 11% carpool, 5% take public transportation, and the remaining portion take another means or work from home. There are various reasons for this journey-to-work behavior—people may not live (or work) in an area that is within close proximity to transit service, people may want to have their personal automobile at work to perform errands or in case of emergency, or they may have off-site meeting during the day and need their personal automobile to get between the work place and the meeting site. In addition to these various and valid reasons, the provision of free parking at the workplace has clearly played a large role in influencing journey-to-work behavior. Most people want parking at work to be easily accessible and convenient so getting to and from the car does not add additional time to the workday. In response to these needs, free on-site parking has become a fringe benefit and a factor in the ability to recruit and retain employees.

Absent financial incentives for alternative travel modes to the single-occupancy vehicle and programs that alleviate the need for a personal automobile at work, solo driving will remain the overwhelmingly preferred mode of travel to work. Many employers and local jurisdictions have begun to implement transportation demand management (TDM) programs to influence travel behavior and induce people to take alternative modes to the personal automobile. TDM is a general term for programs that encourage a decrease in the demand for parking and other transportation tailored to the single-occupancy vehicle. TDM programs can either be employer-led programs designed to reduce the parking demand generated by employees, or publicly initiated programs to reduce the overall parking demand for all trips, not just journey to work trips. These programs might be direct financial incentives to use alternative travel modes or inducements such as preferential parking for carpools and vanpools, bicycle amenities, shuttles from peripheral parking locations and transit stations, and car sharing programs. Many of these programs are described in greater detail below.

- *Cash-Out Programs*. Many employers provide their employees with free on-site parking. Although employees do not see the costs of parking directly, these costs usually are passed on to all employees in the form of lower wages. Therefore, regardless of car ownership or journey to work mode, most employees end up paying for the costs of on-site parking facilities. In other words, employees who use alternative modes to the single occupancy vehicle in the end cross-subsidize those who drive to work alone. Many employers are now establishing and implementing cash-out programs to provide subsidized employees with a choice of receiving free parking or foregoing free parking for a cash payment equaling the cash equivalent of free parking, to use transit or other alternatives to the single-occupancy vehicle. As more and more employees opt for cash out, employers will likely require less and less parking. In fact, a Canadian study conducted by the Victoria Transport Policy Institute showed that cash out reduces parking demand by 15-25%. However, the effectiveness of cash out typically depends on the availability of transit and other alternative modes to solo driving and the availability, or lack thereof, of free and unregulated parking supplies, especially where employees could still park after taking the cash out rather than taking an alternative to the single occupancy vehicle. Moreover, cash out is not as effective in reducing solo driving as

Commuter Choice Maryland

Commuter Choice Maryland is a State-sponsored initiative to encourage employers to implement transportation demand management programs that reduce the use of single-occupancy vehicles. Commuter Choice Maryland programs can help employers save on taxes, reduce parking demand and costs, and recruit and retain valuable employees. Employers participating in Commuter Choice Maryland can develop a transportation demand management program tailored to their own individual needs—components of a Commuter Choice Maryland program might include employer-provided transit passes or vouchers, a vanpool program, a parking cash-out program, or a guaranteed ride home program. Employers implementing one of these programs through Commuter Choice Maryland can receive a Maryland state tax credit up to 50% for every dollar spent on commuter benefits programs. A maximum of $30 per participating employee per month applies to the state tax credit. In addition to the state tax credit, federal legislation passed as a part of the Transportation Equity Act of the 21st Century allows participating employers to offer federal tax-free commuter benefits to employees. As of January 1, 2002, tax-free benefits for transit and vanpool expenses can be offered in any amount up to $100 per month.

charging employees for parking with no other compensation. More specifically, according to a model developed by Donald Shoup at the University of California-Los Angeles, cash out is about two thirds as effective as charging for parking. Some local jurisdictions may enact ordinances to require employers who offer subsidized parking to offer eligible employees the option of taking the cash equivalent of free parking, while other jurisdictions leave it up to the employer as to whether or not they will implement a cash-out program. Finally, it is important to note that cash-out is different from transit subsidies, which are direct payments to employees for use of public transportation and usually equal the cost of a monthly pass or a portion thereof.

- *Peripheral Parking with Shuttles*. Local jurisdictions and employers may wish to provide peripheral parking locations outside the main activity center and offer shuttle service from those locations to the main core and employment sites. Local jurisdictions and employers might also wish to provide shuttle service from transit stations to employment sites that are located in areas that are not well-served by mass transit. Providing shuttle service from peripheral parking locations may not be effective in reducing single-occupancy vehicle use or overall parking demand, it might just shift where the necessary parking spaces are actually located from the main activity center to a more peripheral location. However, providing shuttle service from transit stations to employment sites can help reduce single-occupancy use and parking demand since people living in close proximity to a transit station will now have a viable alternative to driving to work. Shuttle service could also provide guaranteed ride home on an as needed basis.

- *Preferential Parking for Carpools and Vanpools*. In privately owned parking facilities developers or employers might provide incentives for alternative modes of travel to the single occupancy vehicle by reserving close-in, secure, covered, or otherwise preferable parking spaces for high-occupancy vehicles. Local jurisdictions can do the same in publicly owned facilities and might consider enacting legislation to require operators of privately owned facilities to do so. For example, the Portland Municipal Code requires for office, industrial, and institutional uses where more than 20 parking spaces are required that 5 spaces or 5% of the spaces, whichever is less, must be reserved for carpools. Moreover, the carpool spaces must be the closest spaces to the building entrance

Downtown Area Shuttle – Baltimore, Maryland

In March of 2002, Downtown Partnership of Baltimore began operating an employee shuttle program—the Downtown Area Shuttle (DASH). DASH service provides Downtown employees with access to over 1,200 parking spaces near Ravens Stadium and a convenient, reliable commuter bus connection to various employment sites and the core of Downtown Baltimore. The monthly fee for the use of the parking facilities at Ravens Stadium and the shuttle service is $50. Employees that carpool are charged a monthly rate of $20. Currently, this monthly program is only available to employees whose employers have contracted with Downtown Partnership. Other Downtown employees, residents, and visitors can ride the shuttle throughout Downtown for a 50-cent fare, but will not be able to park in the Ravens Stadium parking lots.

Triangle Transit Authority Rideshare Program – Greater Triangle Region, North Carolina

The Triangle Transit Authority (TTA), a regional public transportation authority serving Durham, Orange and Wake Counties in North Carolina, offers a rideshare program to provide vanpool and carpool services. In particular, as a part of the vanpool program, TTA provides a 15-passenger van to no fewer than seven commuters who live and work near each other and who share approximately the same work schedule. In addition to the vehicle, TTA pays for gas, and arranges and pays for maintenance. Vanpool riders pay a monthly fare based on monthly mileage. For example, a vanpool with a total monthly mileage of 520 miles pays in total $500.45 (or $35.75 per person based on a vanpool of 14). A vanpool with a total monthly mileage of 3145 miles pays in total $1,299.68. TTA offers a seat subsidy program to encourage the formation of vanpools. The rideshare program, among other TTA services and programs, is funded by a vehicle registration tax of up to $5 per registration, authorized by the North Carolina General Assembly in 1991, in addition to program revenues.

or elevator, but not closer than parking for the disabled. Local jurisdictions and employers could also promote carpooling or vanpooling by subsidizing vehicles or fuel costs.

- *Bicycle Facilities and Amenities*. Employers can encourage bicycling by providing bicycle parking or storage, showers, and lockers on-site. Local jurisdictions should consider requiring bicycle parking in zoning ordinances and reducing minimum parking requirements given the provision of bicycle parking over the required amount. For example, the Portland Municipal Code requires a minimum number of short term and long term bicycle spaces for residential and non residential uses. These requirements are intended to help meet the City's goal that 10% of all trips be made by bicycle. Moreover, bicycle parking may substitute for up to 25% of the required automobile parking—for every 5 non-required bicycle parking spaces, the automobile requirement is reduced by one space.

- *Car Sharing*. Both the public and private sector in the United States are beginning to follow Europe's lead in instituting car sharing programs to grant residents or employees access to a car when they need it without incurring the fixed costs associated with owning and operating a personal automobile. According to Zipcar, a privately owned car sharing company, each car sharing vehicle replaces four to eight privately owned cars, thus reducing parking demand. Moreover, car sharing reduces vehicle miles traveled, thereby, helping to alleviate traffic congestion and improve air quality. According to the Victoria Transport Policy Institute, car sharing is most effective in high-density, mixed-use areas where there are a variety of travel choices, flexible parking requirements, and transportation management associations that encourage employers and employees to use alternative travel modes to the single-occupancy vehicle. In car sharing arrangements, vehicle fleets are located in various areas throughout the jurisdiction, usually at transit nodes or in commercial districts. Residents can pay an annual membership fee and reserve a car by phone or on-line typically up to a year in advance. Members are then charged based on usage. This rate typically covers gas, maintenance, insurance, and parking. Some local jurisdictions are beginning to promote car sharing by reducing minimum parking requirements when developers or employers institute or participate in car sharing programs. For example, the Seattle Municipal Code allows for up to 5% of the total number of parking spaces provided in a project to be used to provide parking for vehicles operated by a City-recognized car sharing program. The number of required spaces may be reduced by one space for every parking space leased by a City-recognized car sharing program.

Car Sharing Programs in Washington D.C.

In December of 2001, the Washington Metropolitan Area Transit Authority (WMATA) launched a new car sharing program in the Washington D.C. area. WMATA is partnering with Flexcar, a privately owned, national car sharing company, to make cars available for hourly rental at or near selected Metro stations 24-hours-a-day, seven-days-a week. Flexcar charges a one-time $25 member initiation fee and offers different payments plans, including hourly and mileage rates, based on user needs and usage. One option charges members a monthly fee of $35 for 5 hours, while another option charges a $525 monthly fee for 100 hours of use. Flexcar currently has 36 cars at 21 locations in the Washington region and has over 500 approved members. The program has plans to expand to 200 cars by 2003 to keep pace with the increasing demand. Local jurisdictions in the Washington region are helping to ensure the success of car sharing programs. In Arlington County, Virginia, the County's Commuter Assistance Program is offering a $500 subsidy for businesses to join Flexcar or Zipcar, another for-profit car sharing company operating in the Washington region. The City of Alexandria, Virginia, will reimburse up to $105 of membership and application fees for residents and up to $50 for business membership fees and half of each employee's application fee up to $20 for membership to Flexcar or Zipcar.

As stated previously, TDM programs can be employer-led or publicly-initiated programs. However, it is becoming more common for TDM programs to be administered by transportation management associations. In fact, transportation management associations play an integral role in garnering support for and implementing demand management programs and district-based parking management strategies.

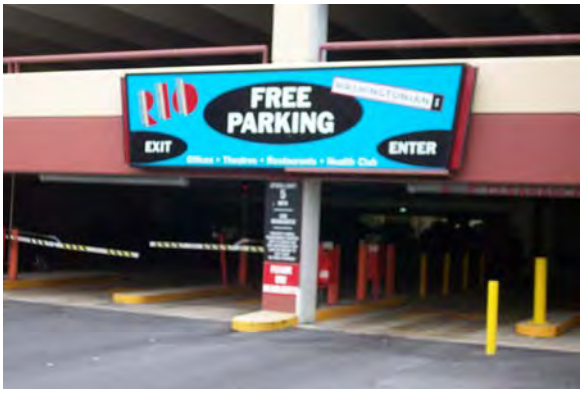
Transportation management associations are independent, non-profit, member-controlled organizations that bring together employees, retailers, business owners, public sector representatives and others to address transportation issues and provide transportation services in a particular area. The main objectives of transportation management associations are to improve air quality, circulation, and the attractiveness of the urban environment through the promotion of alternative modes to the single-occupancy vehicle. To achieve these objectives, transportation management associations might provide discounted transit passes, shuttle bus services from off-site parking facilities, guaranteed ride home programs, bicycle facilities, car sharing programs, and information kiosks.

Unbundled Parking

The costs of parking are often bundled into the rent or purchase price for residential and commercial units and buildings. This practice assumes that all tenants and owners have the same parking demand; therefore, regardless of car ownership all tenants and owners bear the costs of parking through increased rents or inflated purchase prices. Including costs of parking in rents and purchase prices encourages automobile ownership and is a disincentive for using alternative transportation modes. On the other hand, separating the payment of parking from the rent payment or purchase price, also known as "unbundling", can provide a more equitable allocation of costs by allowing tenants and owners to pay only for the parking they use and can reduce parking demand by making households pay the full cost of parking. Given that unbundling can reduce parking demand, development projects that unbundle parking or provide rebates to households who own fewer or no vehicles and will not use their allotted parking space or spaces could provide less parking than what otherwise might be required.

Pricing Strategies

One of the simplest ways to reduce parking demand is to charge users directly for the cost of parking. That is, parking prices for on-street meters and off-street parking facilities can be set to alter the cost of driving solo relative to travel alternatives, thereby influencing travel choice and reducing parking demand. In fact, according to the Victoria Transport Policy Institute, parking pricing typically reduces parking demand by 10-30% compared to unpriced parking. There are various ways in which operators of publicly owned and privately owned parking facilities can price parking to differentiate prices among different users to achieve economic, strategic, and policy objectives. Such pricing strategies include time-based pricing, vehicle occupancy pricing, and vehicle size pricing.



A sign on a parking garage in Gaithersburg, Maryland, advertises free parking, encouraging automobile use.

- *Time-Based Pricing*. Time-based pricing can be implemented in on-street parking and off-street parking facilities to discourage long-term commuter parking and encourage turnover, which is usually necessary for parking facilities to cover costs and earn a reasonable return. More specifically, meter rates and parking prices in lots and structures can be set to increase over time to variable rates that become more expensive for each additional hour.

- *Vehicle Occupancy Pricing*. Vehicle occupancy pricing can be established in off-street parking facilities to encourage the use of high occupancy vehicles. More specifically, rates can be set at or above market rates for solo drivers, while carpool or vanpool rates are discounted or free.

- *Vehicle Size Parking*. Vehicle size parking can be established in off-street parking facilities to encourage the use of compact cars, which demand a smaller land area for parking. More specifically, rates can be set at or above market rates for sport utility vehicles and other vehicles that might take up more than one space and can be set below market rate for compact vehicles.

To complement these parking pricing strategies, local jurisdictions could levy parking taxes on operators of off-street parking facilities. These taxes are typically passed on to users in the form of higher parking rates. For example, in Baltimore, Maryland, the Baltimore City Parking Authority collects a parking tax equal to

11% of a parking facility's gross transactions and $14 per month per monthly user. Moreover, local jurisdictions could implement and enforce time limits on meter parking to encourage turnover in commercial districts and discourage long-term commuter parking.

There are several challenges to implementing parking pricing, parking taxes, and time limits. First of all, it is generally difficult to impose parking pricing where parking is currently free. Moreover, if there are uncontrolled parking supplies nearby, users can circumvent paying for parking and park in those available spaces. Finally, as discussed previously in this paper, pricing strategies should only be implemented in areas where there is a viable alternative to the personal automobile and where the market is sufficiently strong so that pricing will not lead to economic dislocation.

Challenges to Controlling Parking Demand

The biggest challenge to controlling parking demand is that despite investments in transit infrastructure, parking pricing policies, and other demand management strategies, many people will still choose the single occupancy vehicle as their primary travel mode. Since the middle of the last century the American public indeed has had a love affair with the personal automobile—it is entrenched in the American way of life. Getting people to change their behavior has proven rather difficult. Demand management strategies must be complemented with aggressive marketing campaigns and education and outreach efforts to make people realize the value of substituting alternative modes to the personal automobile. Moreover, in developing and revising parking policies and programs, both the public and private sectors need to engage all of the stakeholders in the process so that the general public has a sense of collective responsibility over the success of such policies and programs. The following section is a summary of some of the supply and demand managements strategies proposed in this section that the public and private sectors might wish to include in parking policies and programs.

Possible Strategies

Local Jurisdictions

- Conduct a comprehensive review of parking requirements.
- Reduce parking requirements for specific locational and demographic factors.
- Reduce parking requirements when TDM programs are implemented.
- Reduce parking requirements in exchange for fees in lieu.
- Adopt maximums to complement minimum parking requirements or establish parking medians.
- Allow for shared parking at mixed-use development projects and in mixed-use areas.
- Designate parking management districts and develop area parking management plans for those districts. Parking management plans might include areawide parking caps, regulation of on-site parking facilities through parking ordinances, shared parking arrangements, construction of centralized publicly owned parking facilities, and pricing strategies.
- Allow landscaped reserves to meet parking requirements.
- Establish residential parking permit programs.
- Revise local zoning ordinances to create transit oriented development and traditional neighborhood design zones that allow a mixing of uses, increased densities, affordable housing, reduced parking requirements, and pedestrian oriented and environmentally friendly design.
- Enact ordinances to require employers who offer subsidized parking to offer eligible employees the option of taking the cash equivalent of free parking.

- Form public-private partnerships to provide shuttle service from peripheral parking locations and transit stations to employment site and the central business district.
- Require a certain percentage of spaces to be designated for carpools or vanpools.
- Form public-private partnerships to provide vanpool services or car sharing programs.
- Require development projects to include bicycle parking and reduce minimum parking requirements given the provision of bicycle parking over the required amount.
- Encourage unbundling of housing and parking costs.
- Set parking prices in municipal structures to benefit priority users such as high occupancy vehicles and compact cars.
- Implement time-based pricing to set prices higher during peak periods and increase over time.
- Provide signs, maps, and brochures to provide accurate information to users on parking facilities and availability.
- Elicit public involvement and include all stakeholders from the start in planning parking policies and programs.

Developers

- Provide an appropriate amount of parking given carefully estimated parking demand, as opposed to oversupplying parking.
- Seek opportunities to share parking between uses within a development project or with complementary uses in close proximity.
- Pursue transit-oriented development and traditional neighborhood design projects to create compact, mixed-use, pedestrian-friendly, walkable communities with viable alternatives to the personal automobile.
- Reserve close in, secure, covered, or otherwise preferable parking spaces for carpools and vanpools.
- Provide bicycle parking facilities including racks and lockers.
- Unbundle the cost of parking from the rent or purchase price of residential and commercial units or buildings.
- Charge users for the cost of parking and set parking rates to benefit priority users such as high occupancy vehicles and compact cars.

Employers

- Offer employees eligible for subsidized parking the option of taking the cash equivalent of free parking.
- Provide transit subsidies or discounted transit passes.
- Work with the public sector and/or other area employers to provide shuttle service from peripheral parking locations and/or transit stations.
- Work with the public sector and/or other area employers to develop and implement vanpool or car sharing programs.
- Reserve close in, secure, covered, or otherwise preferable parking spaces for carpools and vanpools.

- Provide bicycle parking facilities including racks and lockers and provide bicycle amenities such as showers and clothes lockers on-site.
- Implement a guaranteed ride home program.
- Provide information kiosks or bulletin boards to inform employees of ridesharing opportunities and programs.
- Charge users for the cost of parking and set parking rates to benefit priority users such as high occupancy vehicles and compact cars.

PARKING DESIGN

Since the advent of the personal automobile, the American landscape has become predominantly a habitat for cars, with streets, parking facilities, and other auto-oriented uses dominating the built environment. Parking facilities in particular have become an omnipresent feature of the American landscape, consuming land and resources, inhibiting the functioning of natural systems, creating dead gaps in what otherwise might be vibrant commercial areas, and creating conflicts between vehicles and pedestrians and bicyclists. This adverse impact on the walkability of communities is a particular challenge to creating lively, mixed use places with a unique sense of identity—attractive places where people want to linger, to gather, and to return over and over. It is precisely these kinds of walkable places that are essential to the success of smart growth development strategies.

This section of this paper proposes best practices to reverse the negative impacts parking facilities have traditionally had on the environment and the character of urban places. The best practices outlined in this section are organized by the objective each strategy or "practice" aims to achieve. The five main overarching objectives are:

- Design sites such that vehicles are not the dominant feature;
- Provide necessary parking without large expanses of pavement;
- Minimize runoff from parking lots utilizing techniques to return surface water to the ground;
- Encourage vibrant street level activity; and
- Create a safe and comfortable environment for pedestrians and bicyclists as well as vehicles.

The three types of parking facilities—on-street parking, surface parking lots, and parking structures—are each appropriate in different settings and under different circumstances, and all play integral roles in shaping the character of the built environment. For each proposed best practice, the type of parking the strategy applies to is listed. The final portion of this section briefly discusses some of the challenges to implementing smart parking design best practices.

OBJECTIVE: Design sites such that vehicles are not the dominant feature.

No one wants acres of pavement or blank walls dominating the streetscape, yet parking needs to be convenient, safe, and accessible. Given the adverse impacts of the visual prominence of parking facilities, local jurisdictions and developers alike should seek innovative design strategies to ensure that parking facilities do not become the dominant feature of the streetscape. The following are some best practices that might be considered.

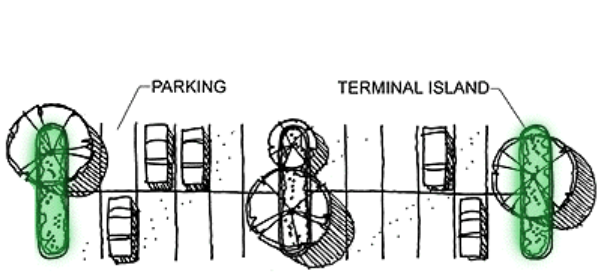
- *Location*. The location of parking facilities behind buildings is vital in creating more welcoming and pedestrian-friendly streetscapes that will attract users over and over again. The desire for safe, convenient, and accessible parking has typically led to the placement of parking areas in front of buildings. For example, in retail projects, shoppers typically want to enter and exit the parking facility with ease and want to avoid the frustration and stress associated with having to drive around and look for parking. In response to these needs, developers have typically provided parking areas in front of retail uses where it is highly visible and readily available. However, the placement of parking facilities in front of buildings has an effect on people as they walk or even drive by. Parking facilities in front of buildings create physical and psychological barriers to the building, as opposed to buildings placed close to the street, framing the public space and inviting people in. Indeed, from an urban design perspective, parking considerations should be secondary to the design and placement of buildings on the site. Parking facilities can be located in the interior of blocks and concealed by "liner" buildings with retail, offices, and housing. Parking is then



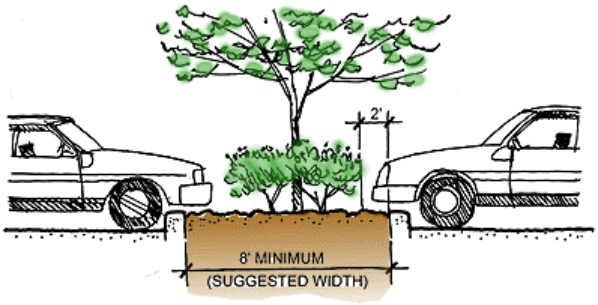
This parking structure in Bethesda, Maryland, is embedded in the block, obscured from street activity by more active uses.

found behind the building, accessible yet out of view. Signage could be used to direct users to the parking facility. And since for safety reasons developers typically want a single entrance, wayfinding will have to incorporated to get people from the parking area to the entrance, which may be in the front of the building. Moreover, on-street parking could be provided in the front of the building to provide visible and convenient auto access.
Applicability: Parking lots and structures

- *Screening and Landscaping*. As discussed previously, if at all possible, parking facilities should be placed behind buildings in the interior of blocks. For facilities placed to the front or side of buildings, there are various ways to screen parked cars from street level activity, thereby providing the necessary parking without overly compromising urban design. Parking facilities, including lots and structures, could be located where the site topography can help conceal them. Integrating parking facilities into site topography might also limit the impact a project may have on the functioning of natural systems. With respect to parking lots, when a parking lot abuts a public street the parked cars should be screened from public street frontage to obscure a majority of the parked cars. Screening can be continuous landscaping, attractive fencing or stone walls, among other materials. Overall, the buffer between the parking lot and the street should be no less than 15 feet wide—this liberal width should help to encourage the placement of parking lots behind buildings versus along the street. Finally, landscaping on the periphery of a parking facility and within parking areas can be used to soften the appearance of a parking facility from the street. More specifically, expanses of parking should be broken up with landscaped islands and planted strips, which include shade trees and shrubs. Such landscaping provides a canopy cover and reduces the urban heat island effect in the summer. Landscaping not only provides shade on hot days, absorbs carbon dioxide, and reduces pollutants emitted by vehicles as they sit in the sun, but also breaks up the visual impact, making the parking lot feel smaller and less overwhelming.
  Applicability: Parking lots and structures



Terminal Islands



Divider Medians

These two figures from the Henderson (Nevada) Development Code illustrate two parking lot landscaping techniques—terminal islands and divider medians. According to the interior parking lot landscaping standards in the Code, terminal islands must be provided at the end of each parking row, and divider medians between abutting rows of parking spaces are encouraged. Moreover, the Code stipulates the following: 1) for parking lots with 5-100 spaces, 1 tree must be planted for every 10 spaces; 2) each parking space must be located within 40 feet of a tree; and 3) at least 10 percent of the interior area of a parking lot must be devoted to landscape planting areas.

- *Architectural Treatments.* With respect to parking structures, there are various ways to help integrate parking structures with their surroundings, particularly through scale, materials, colors, and style. Architectural treatments can be used to screen cars and relate to the design of adjacent buildings. The architectural treatments should be divided into 30' increments to better integrate the parking structure with the scale and character of adjacent buildings and to provide the visual breaks to hold the interest of walkers passing by. Façade elements around the entry to the structure should be emphasized to reduce the visual prominence of the structure entry.
  Applicability: Parking structures

OBJECTIVE: Provide necessary parking without large expanses of pavement.

According to the Center for Watershed Protection, as much as 65% of the total impervious surface cover in the American landscape are surfaces designed for cars including, but not limited to, streets, parking lots, and

driveways. The paving over of the American landscape is clearly unsustainable, consuming land and resources and creating huge volumes of stormwater runoff that tax the capacity of sewer systems and degrade water quality in streams and other waterways. Local jurisdictions and developers alike should determine ways in which they can provide the necessary parking, while minimizing the amount of acreage that is converted to parking. The following are some best practices that might minimize the amount of pavement required for a parking facility while allowing the most cars to park on the site.

- *Provision of On-Street Parking*. On-street parking provides convenient access to adjacent uses and provides the best possible option to visitors since it offers the shortest possible time between stopping and shopping. Moreover, the provision of on-street parking can lessen the need for parking lots and structures, which convert a significant amount of acreage to parking. There are three different types of on-street parking—head-in, angle, and parallel. Each type of on-street parking has its pros and cons. Both head-in and angle parking can provide for more cars than a parallel parking configuration, but both require a considerable amount of right-of-way and, therefore, necessitate wider streets. Moreover, both head-in parking and angled parking create the potential for a greater number of traffic accidents, as drivers must back out of spots into the flow of traffic. Therefore, both of these types of parking are best designed on streets with slow moving traffic. On the other hand, parallel parking decreases the potential for accidents and requires a narrower right-of-way; however, parallel parking accommodates fewer cars than the other types of on-street parking. While on-street parking—head-in, angled, or parallel—may not fully accommodate the amount of parking necessary, it does provide visible and convenient auto access and can satisfy short-term parking needs. To complement on-street parking, development projects can incorporate other parking facilities, namely surface lots and structures, to accommodate longer-term parking needs.
  Applicability: On-street parking



King Farm, a New Town in Rockville, Maryland, utilizes on-street parking to accommodate required parking spaces and alleviate the need for parking lots and structures. This street uses both parallel parking and angled parking.

- *Construction of Structures Rather Than Lots*. Building vertically reduces the acreage of land converted to parking, thereby, reducing impervious surfaces. However, the type of parking facility—lot or structure—in a development site is usually determined by balancing the cost of land against the cost of constructing parking. In urban areas where land costs are at a premium, it is more cost-effective to build a parking structure than to build a surface parking lot. In suburban areas, the availability and low cost of land make surface parking lots more cost effective than parking structures. In these suburban areas, absent significant incentives to defray the costs of structured parking, it is unlikely that structured parking will become the norm. The following section of this paper on parking financing outlines some incentives and financing programs for structured parking.
  Applicability: Parking structures



Washingtonian Center, a retail and entertainment center in Gaithersburg, Maryland, includes a large structured parking facility to accommodate the necessary parking. This view is of the back of the structure; the front of the structure incorporates retail uses on the first floors.

- *Automated Parking Structures*. Automated parking structures have the potential to change the dynamics of land use, significantly reducing the demand for land devoted to parking and making more land available for revenue generating purposes. Automated parking can squeeze up to two times the number of cars in the same space as a conventional garage or, in other words, accommodate the same number of cars in half the space, and can be built on a site as small as 60 feet by 60 feet, in structures up to 20 stories high, above or below ground. These facilities are able to be so space-efficient because they operate using a computerized network of rails and pallets that lift and carry cars from the entrance bay to available slots with no human intervention. In addition to reducing the amount of land devoted to parking, there are many other benefits to automated parking. Automated parking makes parking safer and more convenient, eliminating the risk of car damage, theft, or personal injury, and reducing the water and air pollution attributed to exhaust fumes and impervious surfaces. Moreover, automated parking structures have complete flexibility in the design of the façade; therefore, they can be easily incorporated into existing urban design. In terms of costs, automated parking is now becoming a price-competitive and viable alternative to traditional ramp garages, as land costs in urban areas are at a premium. Automated structures have lower land acquisition costs since they require less land, construction costs are typically about the same as conventional above ground structures, and operating costs are somewhat lower since many automated structure are completely computerized and only require one person on-site. One potential drawback to automated parking is that it might make parking too efficient, leading to an increased driving demand.
  Applicability: Parking structures

- *Reduced Stall Dimensions and Compact Car Spaces*. Reducing the size of parking stall dimensions overall and dedicating a certain percentage of stalls to compact cars can reduce impervious surface cover. While the trend toward larger sport utility vehicles is often cited as a barrier to implementing stall minimization, stall width requirements in most local ordinances are much larger than the widest sport utility vehicles (Center for Watershed Protection). Reducing stall dimensions and dedicating compact car spaces will only be effective in reducing the footprint of parking structures if the number of parking spaces per floor is limited and additional spaces are accommodated by building additional floors.
  Applicability: On-street parking and parking lots and structures

- *Tandem/Stacked or Valet Parking*. Providing the required parking spaces in tandem or stacked parking arrangements or offering valet parking service reduces the amount of land devoted to parking. The City of Portland, Oregon, allows stacked parking or valet parking if an attendant is present to move vehicles. If stacked parking is used for required parking spaces, some form of guarantee must be filed with the City of Portland to ensure that an attendant will be present when the parking facility is in operation.
  Applicability: Parking lots and structures

- *Alternative Pavers*. Utilizing alternative pavers that permit water to penetrate reduces the overall impervious surface coverage and creates less stormwater runoff. Alternatives to concrete and asphaltic concrete include gravel, cobble, wood mulch, brick, grass pavers, turf blocks, natural stone, pervious concrete, and porous asphalt. Alternative pavers may not be ideal depending on site-specific characteristics such as climate, soil type, and traffic volume. However, they are recommended for overflow areas and can be used in cross walks and stalls to create a break in the paved area, thereby, facilitating groundwater recharge.
  Applicability: Parking lots



The use of alternative pavers in overflow areas reduces impervious surface coverage and helps facilitate groundwater recharge.
***Credit*: Center for Watershed Protection**

- *Multiple Lots*. Breaking up large parking lots into two or more areas can reduce the total amount of impervious surface and disconnect paved surfaces, thereby reducing stormwater runoff and facilitating

groundwater recharge. This practice also breaks up the perceived visual mass of parking facilities and can help to integrate "big box" uses, such as grocery stores, into neighborhood shopping districts.
Applicability: Parking Lots

OBJECTIVE: Minimize runoff from parking facilities utilizing techniques to return surface water to the ground.

Parking facilities have serious impacts on the functioning of natural systems, depleting the water supply and degrading water quality. Traditional stormwater management systems carry and discharge runoff from parking facilities directly into streams and rivers, thereby preventing ground water recharge and dumping pollutant loads into our waterways. Local jurisdictions and developers should seek innovative ways to manage stormwater runoff that support the functioning of natural systems. The following are some best practices that might be considered. Some of these practices may be more expensive upfront than traditional approaches; however, the costs may be offset by the reduced need for stormwater facilities and reduced maintenance costs.

- *Low Impact Development Techniques*. Local jurisdictions and developers are increasingly turning to Low Impact Development (LID) techniques to manage stormwater on-site. In particular, LID techniques can be critical in controlling the quality and quantity of stormwater runoff generated from the impervious surface of parking facilities. LID uses a wide array of methods to retain, detain, filter, recharge, and pass runoff through decentralized, distributed, small-scale controls to reestablish the predevelopment volume of runoff, recharge, storage, and evaporation on a development site. Ultimately, LID seeks to protect and restore important ecological and hydrological functions. Major components of LID include: 1) conservation of forests, natural vegetation, streams, wetlands, and open space, to the greatest extend practicable; 2) minimization measures including reduced clearing and grading, saving infiltratable soils, reducing or disconnecting impervious surfaces, reforesting, and reducing the use of pipes, curbs, and gutters; 3) concentration of runoff in open drainage systems and vegetative swales to slow down runoff, reduce discharges, and encourage more infiltration and evaporation; 4) integration of retention, detention, filtration, storage, and capture of runoff systems into the site; and 5) promotion of pollution prevention measures. With respect to parking facilities, common LID techniques used to control stormwater runoff include open sections, swales, and bioretention areas. Open sections encourage sheet flow to open channels where pollutants are removed through infiltration and vegetation/soil filtering prior to discharge, as opposed to the traditional curb and gutter methods that convey stormwater runoff and associated pollutant loads into streams. Vegetative swales direct stormwater into shallow bioretention areas that temporarily detain the water, facilitating infiltration into the subsurface and slowing and cleaning the remaining stormwater before it is discharged into waterways. Proper plant material selection is critical to the success of these measures. The effective use of LID techniques can significantly reduce the cost of providing stormwater management by eliminating the use of costly stormwater management infrastructure including ponds, pipes, curbs, gutters and roadway paving, among others. In fact, LID can reduce stormwater and site development design construction and maintenance costs by 25-30% compared to conventional approaches (Prince George's County Department of Environmental Resources).
  Applicability: Parking lots

- *Green Roofs*. Some developers of parking structures are beginning to incorporate green roofs on parking structures to retain and naturally filter stormwater runoff, thereby improving water quality. According to Roofscapes, Inc., green roofs can retain 50-60% of the total annual runoff volume of a roof, reducing the need for costly stromwater management systems. Underground parking structures often have lawns and parks planted on top. Above ground parking structures could also incorporate roof systems of vegetation, soil, drainage, and waterproof membranes to alleviate environmental problems including storm water runoff and the urban heat island effect. Additional benefits of greenroofs include improved livability of the urban environment by buffering noise, reducing glare, and offering an aesthetic alternative to asphalt roofing. Green roofs are more costly than traditional roof systems; however, the associated costs could be offset by the reduced need for stormwater facilities.
  Applicability: Parking structures

OBJECTIVE: Encourage vibrant street level activity.

Local jurisdictions and developers often view parking facilities as generators of economic development, as adequate parking can enhance the marketability of development projects to tenants and customers. However, the inappropriate location and unattractive design of parking facilities can actually constrain economic development, creating dead gaps of inactivity in what otherwise might be vibrant commercial environments. Local jurisdictions and developers should seek ways in which the necessary parking can be accommodated, at the same time as the street activity is enlivened. The following are some best practices that might be considered.

- *Provision of On-Street Parking*. On-street parking can play a vital part of a streetscape, fostering a more vibrant pedestrian commercial environment. More specifically, on-street parking provides a mental and physical buffer between pedestrians on a sidewalk and cars on a busy street. The public safety aspects of on-street parking are discussed in greater detail under the following objective on creating a safe and comfortable environment for pedestrians and bicyclists as well as vehicles.
  Applicability: On-street parking



Bethesda Row, a mixed-use retail and entertainment project in Bethesda, Maryland, incorporates on-street parking to foster a more vibrant pedestrian commercial environment.

- *Location*. Parking lots and structures should be located behind buildings rather than in front of them so they do not dominate street frontage, thereby creating a more welcoming pedestrian-friendly streetscape. The location of parking facilities was discussed in greater detail under the objective on designing sites such that vehicles are not the dominant feature.
  Applicability: Parking lots and structures

- *Retail and Commercial Uses*. Parking structures with frontage along streets should provide retail and commercial uses along the street in order to enhance the pedestrian experience and create street level activity. Newsstands and coffee shops typically are successful, in addition to government offices, particularly public safety and police sub-stations, which act as crime deterrents. Incorporating retail and commercial uses in parking structures has the added benefit of generating additional sources of revenue through the lease or sale of space. This is discussed in greater detail in the section on parking financing.
  Applicability: Parking structures



Washingtonian Center in Gaithersburg, Maryland, incorporates retail and commercial uses on the first floor of the parking structure.

OBJECTIVE: Create a safe and comfortable environment for pedestrians and bicyclists as well as vehicles.

Cars are typically at odds with pedestrians and bicyclists on the roadway—and this is no different in parking facilities. Local jurisdictions and developers should seek design strategies to ensure pedestrian and bicycle safety, without compromising the safe and expeditious movement of cars. The following are some best practices that might be considered.

- *Provision of On-Street Parking*. On-street parking is typically used in tandem with other street design elements to ensure the safe co-existence of vehicles, pedestrians, and bicyclists.

Such street design elements are commonly referred to as traffic calming measures. Traffic calming is a method of reducing traffic speeds and volumes and/or cut through traffic by instituting both physical measures such as traffic circles, speed humps, chicanes, and chokers, and operational measures such as increased police enforcement, speed displays, and community speed watch programs. Ultimately, these traffic calming measures are intended to reduce the negative effects of motor vehicle use and improve conditions for non-motorized street users such as pedestrians and bicyclists. On-street parking is one type of traffic calming measure and can be used in tandem with other measures to slow vehicle traffic and provide a buffer between moving cars and pedestrians and bicyclists.
Applicability: On-street parking

- *Limit Curb Cuts*. Curb cuts tend to increase pedestrian exposure to moving vehicles, limit opportunities for landscaping, eliminate on-street parking spaces, and aggravate traffic control. Limiting the number of curb cuts can help ensure pedestrian and bicycle safety, while allowing for safe and expeditious movement to and from the street system.
  Applicability: Parking lots and structures

- *Pedestrian Corridors*. Pedestrians should not have to walk through parking facilities where they must be on constant guard for moving vehicles. Parking facilities should incorporate a clearly defined pedestrian pathway from the public sidewalk, bus stops and on-street parking, through parking lots, to building entrances. The pedestrian pathway should be landscaped and or delineated by non-asphaltic material in a different color or texture from the parking area to enhance pedestrian safety and improve the appearance of the parking lot. Pedestrian pathways through parking areas to stairwells and elevators should also be incorporated in parking structures.
  Applicability: Parking lots and structures



Surface parking lots at King Farm in Rockville, Maryland, incorporate brick pavers to distinguish pedestrian walkways from the parking area.

- *Pedestrian and Bicycle Entrances*. Enhancing the pedestrian and bicycle entry to parking lots and structures helps buffer pedestrians and bicyclists from cars and reduce the relative importance of the vehicle entry.
  Applicability: Parking lots and structures

- *Bicycle Parking*. Providing for bicycle parking in prominent, convenient, and secure locations, might encourage people to bike between places as opposed to driving their personal automobiles.
  Applicability: On-street parking and parking lots and structures

- *Signage*. Parking guidance systems can help alleviate congestion and enhance pedestrian safety. A parking guidance system that shows drivers where they can find available parking spaces in a given area or parking structure can help drivers pay more attention to pedestrian and bicyclists instead of focusing on looking for an available parking space. Parking guidance systems also help people avoid the stress and frustration involved with driving around looking for parking.
  Applicability: Parking lots and structures



Absent adequate bicycle parking facilities, bicyclists may park their bicycles in improper locations.

- *Lighting*. The way parking lot lighting is designed can make the difference between an attractive and safe place or a neighborhood eyesore. Parking lots should utilize low-angle, cut-off fixtures to better direct light to those areas where it is needed. Parking lot lighting often involves balancing the need to provide adequate lighting to ensure personal safety with the concerns of neighboring property owners about glare and spillover lighting. Low-angle, cut-off fixtures minimize glare, spillover effects, and light pollution, at the same time as ensuring there is adequate lighting. Adequate lighting creates a safe environment for pedestrians and vehicles, particularly at night, and can add an aesthetic quality to a project.
  Applicability: On-street parking and parking lots

Challenges to Smart Parking Design

As a major urban land use, the design and layout of parking facilities should be of primary importance to local planners. However, local jurisdictions have actually inhibited innovative parking design through a bewildering mix of shortsighted and outdated regulations that govern the development process. These regulations, codified in various documents, including zoning ordinances, parking and street standards, and stormwater management guidelines, are difficult to decipher and sometimes contradictory. As a result, regulations can discourage developers from incorporating innovative parking design in development projects, as they are concerned about the time and money it might cost to navigate through the approval process. Developers recognize that the construction, operation, and maintenance of parking facilities are costly components of development projects, and that innovative design solutions can translate into reduced development and maintenance costs and allow projects to operate at a greater floor area ratio, thereby increasing the profitability of the project. Local planners need to take a closer look at the regulations that govern parking design to enable and encourage innovation. Developers can pressure local governments to do so and continue to seek innovative design solutions that may cost more money upfront but could translate into higher densities and more successful projects.

Possible Strategies

This section has provided recommendations to developers and local governments on the integration of parking facilities into the urban fabric to minimize environmental and aesthetic impacts. Although these recommendations have been structured under the specific objectives they aim to achieve, many of these recommended design strategies actually support multiple objectives. The chart on Page 28 summarizes the recommended strategies and illustrates the respective objectives and types of parking facilities to which each recommendation applies.

The following is a list of recommendations for local governments to consider that support the recommended innovative parking design strategies discussed in this section:

- Adopt minimum setbacks from street to parking lot to encourage placement behind buildings
- Reduce minimum parking requirements for structures and lots placed behind buildings
- Revise parking design guidelines to require screening for parking lots and architectural treatments for parking structures
- Revise design guidelines to require landscaping (ratio of trees to parking spaces or certain % canopy cover at maturity)
- Revise street standards to require on-street parking where applicable
- Reduce minimum parking requirements if on-street parking accessible
- Reduce minimum parking requirements for structures
- Revise stall dimensions
- Require a certain percent of spaces designated for compact cars

- Allow tandem/stacked parking and valet parking to meet minimum parking requirements
- Revise stormwater management guidelines to enable and encourage innovative stormwater management systems
- Reduce minimum parking requirements for implementation of innovative stormwater management systems (alternative pavers, swales, bioretention areas, open sections, green roofs)
- Reduce minimum parking requirements for incorporation of retail and commercial uses in parking structures
- Require bicycle parking
- Reduce minimum parking requirements for bicycle facilities
- Revise design guidelines to require pedestrian pathway landscaped or delineated by non-asphaltic material
- Revise design guidelines to require low-angle, cut-off lighting fixtures

	OBJECTIVES					**TYPE OF PARKING FACILITY**		
	Design sites such that vehicles are not the dominant feature	**Provide parking without large expanses of pavement**	**Minimize runoff from parking facilities**	**Encourage vibrant street level activity**	**Create a safe and comfortable environment**	**On-Street Parking**	**Parking Lot**	**Parking Structure**
Locate facility behind building	X			X	X		X	X
Integrate facility into site topography	X	X	X				X	X
Screen facility through landscaping or architectural treatments	X			X			X	X
Landscape interior parking areas	X	X	X				X	
Provide on-street parking		X		X	X	X		
Construct parking structures	X	X						X
Build automated parking structures	X	X						X
Reduce stall dimensions		X	X			X	X	X
Provide compact car spaces		X	X			X	X	X
Incorporate tandem/stacked or valet parking		X	X				X	X
Use alternative pavers		X	X				X	
Break up large parking lots	X	X	X				X	
Utilize open sections		X	X				X	
Incorporate vegetative swales and bioretention areas on-site		X	X				X	
Construct a green roof			X					X
Incorporate retail and commercial uses	X			X				X
Limit curb cuts				X	X		X	X
Provide clearly defined pedestrian corridors					X		X	X
Enhance bicycle and pedestrian entrances	X				X		X	X
Provide bicycle parking facilities					X	X	X	X
Implement a parking guidance system					X		X	X
Utilize low-angle, cut-off lighting					X	X	X	

Quantity versus Quality in Off-Street Parking Requirements

Vinit Mukhija and Donald Shoup

Most local governments' off-street parking requirements promote quantity over quality, focusing on ensuring an ample supply of parking. This has undesirable consequences for the built environment. Parking lots and parking structures routinely overwhelm the architecture and urban design of even the best buildings and neighborhoods. We argue that planners should worry less about the quantity of parking, and pay more attention to its quality. Through examples of zoning reforms adopted by some cities, we show how regulating the quality of parking has the potential to improve urban design.

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Most local off-street parking requirements emphasize quantity over quality. Local governments often have minimum parking requirements that overwhelm the physical landscape with an excessive supply of unattractive parking,[1] but relatively few impose design requirements on parking lots and parking structures. Off-street parking requirements focus on the ratio of parking spaces to floor area, usually neglecting the consequences for urban design. As a result, most parking lots are asphalt breaks in the urban fabric, and most parking structures present blank walls to the street. Parking lots and garages tend to interrupt the streetscape, expand the distances between destinations, and undermine walkability (see Figures 1 and 2). We argue that planners should worry less about the quantity of parking provided and should pay more attention to its quality.

Off-street parking requirements also reduce architectural quality. Architects often complain that they must shoehorn a building into the space remaining after the parking requirement has been satisfied, compromising the design. Thus reducing or removing parking requirements can make better design possible, and cities can use quality-based parking requirements within an urban design framework to reinforce the desired character of each neighborhood.

The market gives developers a strong incentive to provide adequate parking because lenders are unwilling to finance projects with inadequate parking and tenants are unwilling to rent space in them. But the market provides less incentive to improve parking design because many of the benefits of better parking design accrue to the community rather than to the property owner. Developers are more likely to spend money on a marble-veneered lobby (which will increase the value of the building) than on landscaping the parking lot (which will increase the value of the whole neighborhood).

In this article we show how planners can use the following five strategies to improve urban design.

1. Deregulate or limit the number of parking spaces.
2. Improve the location of parking.
3. Improve the design of surface parking.
4. Improve the design of parking structures.
5. Improve the design of residential garages.

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Figure 1. Off-street parking in Los Angeles.

Shifting the focus of parking requirements from quantity to quality will help planners to play a more constructive role in shaping the built environment.

Eliminating Minimum Off-Street Parking Requirements

Minimum parking requirements in zoning ordinances would not be needed if they did not increase the parking supply beyond what the market would provide (Shoup, 2005). Such requirements create a self-perpetuating cycle in which increasing the supply of parking leads to increased demand. Plentiful parking encourages people to buy more cars, and more cars lead cities to require even more parking spaces. Parking lots consume land that could be put to higher-value uses, such as housing, and they detract from the traditional pedestrian ambience of cities. As Alexander, Ishikawa, and Silverstein (1977) wrote 30 years ago:

> We suspect that when the density of cars passes a certain limit, and people experience the feeling that there are too many cars, what is really happening is that subconsciously they feel that the cars are overwhelming the environment, that the environment is no longer "theirs," that they have no right to be there, that it is not a place for people, and so on. After all, the effect of the cars reaches far beyond the mere presence of the cars themselves. They create a maze of driveways, garage doors, asphalt and concrete surfaces, and building elements which people cannot use. When the density goes beyond the limit, we suspect that people feel the social potential of the environment has disappeared. (p. 122)

To preserve and enhance walkability, Alexander and his coauthors suggested that only 9% of a city's land should be devoted to parking, though there is little empirical basis for this number. Some cities, such as Cleveland, Milwaukee, and Philadelphia, have eliminated parking requirements in



Figure 2. Off-street parking in San Francisco.
Source: San Francisco Planning Department

their downtowns to make them more accommodating to pedestrians. Other cities have reduced or eliminated parking requirements adjacent to public transit stops. An ordinance in Portland, Oregon states, "There is no minimum parking requirement for sites located less than 500 feet from a transit street with 20-minute peak hour service" (City of Portland, 2006).

Removing off-street parking requirements can also ease adaptive reuse and historic preservation. Older buildings rarely meet current minimum parking requirements, and as a consequence many stunning buildings are demolished and replaced by ordinary structures that do meet the requirements. Apart from the irreplaceable loss of heritage, such demolition limits the possibility of a rich and varied collage of buildings from different time periods.[2] To encourage the conversion of older, economically distressed office buildings to apartments and lofts, some cities exempt these buildings from parking requirements if they are converted to residential uses. Los Angeles, for example, does not require downtown buildings built before 1974 to add parking spaces if they are converted to dwelling units, guest rooms, or joint live-work quarters.[3]

Minimum parking requirements are intended to ensure an ample parking supply, and they imply that parking is a problem only when there is not enough of it. But too much parking also creates problems. Most major U.S. cities, including Boston, Chicago, New York, and San Francisco, regulate the maximum rather than the minimum number of parking spaces in their downtowns. Carmel, California, which is famous for its attractive downtown, is an extreme, but highly successful, example of limits on parking. Zoning helps to maintain Carmel's unique pedestrian ambience by prohibiting off-street parking spaces in the central commercial district:

> On-site parking is prohibited in the central commercial (CC) land use district. This policy reduces the need for curb cuts in sidewalks and the interference with free pedestrian traffic flow that would result from an excessive number of driveways. This policy is intended

> to enhance the opportunities for creating intra-block courts and walkways between properties and buildings.[4] (City of Carmel-by-the-Sea, 1998b)

The absence of off-street parking (and of cars driving across the sidewalks to reach it) helps make Carmel one of the best places in America to be a pedestrian, and people from all over the world come to walk around (see Figure 3). Few cities will want to prohibit off-street parking, and many may not want to limit it, but they may wish to restrict surface parking lots, as in downtown San Francisco: "No permanent parking lot shall be permitted in [downtown]; temporary parking lots may be approved as conditional uses . . . for a period not to exceed two years from the date of approval" (City of San Francisco, 2006).

Even without reducing their off-street parking requirements, cities like Palo Alto and Pasadena in California have improved urban design by offering developers the opportunity to pay a fee in lieu of providing all the parking spaces required by zoning. The cities then use the revenue to provide shared public parking spaces to replace those the developers would have provided. Public parking spaces built with the in-lieu revenue allow drivers to park once and visit multiple sites on foot, reducing vehicle traffic and increasing foot traffic. The in-lieu option makes it easier to restore historic buildings and rehabilitate historic areas for the reasons noted earlier. And because developers can meet their parking requirements without on-site parking, storefronts can be continuous, without the gaps that parking lots create. Developers can also undertake infill projects without assembling large parcels for on-site parking, and architects have greater design freedom. The public parking structures consume less land than if each development provided its own parking lot, and cities can place the structures where they interfere least with vehicle and pedestrian circulation. To improve the streetscape, some cities dedicate the first floor of public parking structures to retail uses. The in-lieu policy thus contributes to a better looking, safer, and more walkable city.

Some cities allow shared parking among sites where the peak parking demands occur at different times (e.g., banks and bars). Fewer spaces are needed to meet the combined peak demand, and each parking space is occupied more of the time.[5] For example, Circle Centre, a successful retail/entertainment development in downtown Indianapolis, would have needed 6,000 parking spaces if it were built with unshared parking for every individual use, but only 2,815 shared parking spaces were sufficient to meet the demand (Smith, 1996).

Removing or reducing off-street parking requirements does not restrict parking or reduce the market incentive for developers to provide an adequate supply. Letting markets determine the number of off-site parking spaces changes, but does not eliminate, planning for parking. Local governments should still regulate parking landscaping, layout, location, pedestrian access, provisions for the handicapped, security, setback, signage, storm water runoff, and urban design. The following section discusses ways to improve urban design by regulating the location and appearance of parking spaces.

Parking Location Requirements

The location and placement of parking greatly affects urban design. Parking lots located between the sidewalk and buildings make walking more onerous. To avoid this, planners can use conventional zoning regulations to require that parking be positioned below, behind, or beside buildings, rather than in front, and that buildings be oriented to the sidewalk.

Although Los Angeles did not begin to require off-street parking for retail and commercial buildings until 1946, cars and parking transformed the character of its commercial spaces in the first half of the 20th century. Richard Longstreth documented these changes. His work explains how merchants valued the sidewalk orientation of their businesses. Faced with an increase in the demand for parking, merchants initially provided parking spaces behind their buildings. Thus, major retail corridors like Wilshire Boulevard "maintained a sense of street-front drama by adhering to the pattern of showing facades and offering rear parking" (Longstreth, 1992, p. 152). Wilshire Boulevard set an example of pedestrian orientation for the region's smaller retail precincts during the 1930s and 1940s, but merchants finally abandoned pedestrians to make life more convenient for motorists and, as Liebs (1985) wrote, "the long-standing tenet of Main Street commercial site planning—line the shops along the sidewalk with room for parking only at the curb—was finally cast aside" (p. 14).

In a Planning Advisory Service report on how to prepare zoning ordinances, Lerable (1995) showed how the placement of parking lots can influence the pedestrian quality of the streetscape. The bottom panel of Figure 4 illustrates his recommended approach, placing parking lots behind buildings so that the only gap between shops is the access to parking. An even more desirable approach would close all gaps between the shops and provide access to the parking lot from a side street or rear alley. This would eliminate curb cuts on the main street, reduce driving across sidewalks to access the off-street parking, and allow the maximum amount of curb parking. Curb parking buffers the pedestrian



Figure 3. Walking in downtown Carmel.

from cars and other vehicles on the street, and improves the walking experience on the sidewalk.

Similar ideas are popular with new urbanist architects and planners (Calthorpe, 1993). New urbanists sometimes go so far as to recommend a specific building typology, such as a colonnaded arcade, in order to respect the streetscape and push parking behind the buildings. A less prescriptive method is the use of build-to lines, the opposite of setback lines. Whereas setbacks ensure that buildings are placed at least a specified distance back from the street, build-to lines require that buildings come up to a specified plane, usually the sidewalk. New York's Lower Manhattan Plan pioneered the use of build-to lines to define visual corridors and maintain street front continuity (Barnett, 1974).

Regulations on the location of parking should not be implemented uniformly across a city, but should match a larger urban design strategy that recognizes the differing characters of neighborhoods. The city of SeaTac, Washington, for example, focuses on developing pedestrian-friendly commercial districts. It prohibits parking lots from dominating the streets in the commercial districts: "No parking shall be located between the building and the front property line. On corner lots, no parking shall be located between the building and either of the two (2) front property lines" (City of SeaTac, 2006).[6] Such ideas are valuable outside commercial areas as well. In West Hollywood, California, zoning prohibits the use of a residential front yard for parking:

> Automobiles shall not be parked between the street property line and the front of a residential unit except on a driveway leading to a garage or carport, or a semicircular driveway on a lot that has a minimum frontage width of seventy feet.[7] (City of West Hollywood, 2006a)

Such requirements help put on-site parking spaces beside or behind buildings, rather than in front, and can be combined with some of the design improvement strategies we discuss in the next section.

Design Improvement Requirements

Rather than focus on individual land uses, planning for parking should actively shape public space. The following strategies show how cities can improve the design of surface parking, parking structures, and residential parking.

Improved Design of Surface Parking

Because of their ubiquity, parking lots create great problems for urban design. They will continue to be built,

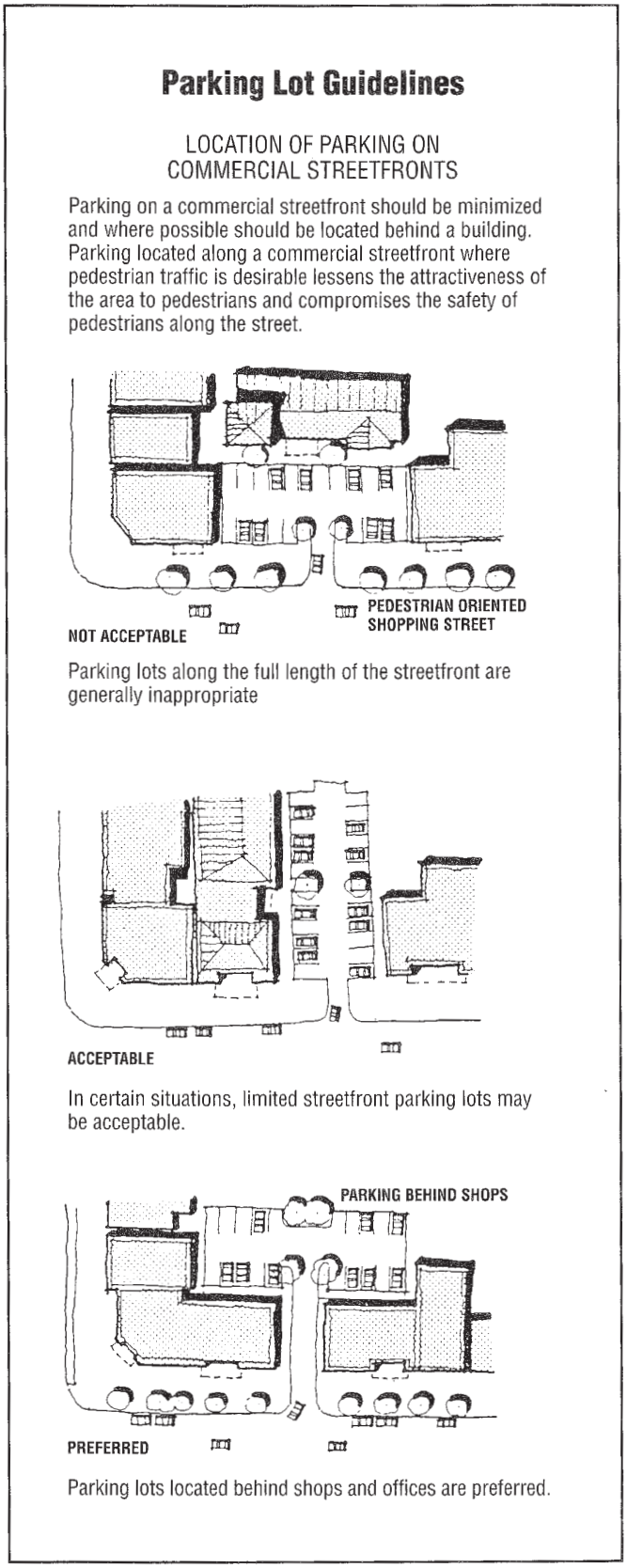


Figure 4. Parking lot guidelines.
Source: Lerable (1995, p. 30).

but better design strategies can help integrate them into the built environment and improve the public realm. We have already discussed the possibility of locating these lots behind or beside buildings. Another approach, offered by Lynch and Hack (1984), is to limit the size of the parking lots and to drop them "a few feet below pedestrian grade, so that the line of sight passes over the car . . . [which] also makes it easier to screen the lots with planting or low walls" (p. 265). Cities can also require that surface parking be screened, as in West Hollywood:

> Parking areas adjacent to a public right-of-way shall be provided with landscaping that is designed and maintained to screen cars from the view from the street to a height of forty-two inches, measured from the surface of the parking area. (City of West Hollywood, 2006d)

The reason for limiting the size of parking lots, dropping them partially below grade, and screening them is that conventional parking lots are visually unappealing. Other than concealing them, how can we make them more attractive? One strategy is to use landscaping. In the late 1980s, the Columbus Carscape Competition invited design ideas to improve parking design for a lot in downtown Columbus, Ohio. The winning entry transformed "the parking lot into a park, an urban plaza, through the use of ordinary elements of urban design—patterned pavers and lights under a canopy of trees" (Miller, 1988, p. 40). The winner proposed densely interspersing parking spaces with Bradford pear trees that "do not bear fruit but mark the seasons with white blossoms in the spring and leaves turning red-orange in the fall" (ibid.). The design was inspired by European urban plazas that accommodate cars, marketplaces, and other activities in a single location. Modest landscaping can improve even small parking lots tremendously, and at low cost (see Figure 5).

Many cities have landscaping requirements for parking lots. West Hollywood, for example, has developed a comprehensive strategy. First, the city requires one canopy tree for every eight parking spaces (City of West Hollywood, 2006c).[8] Second, it defines the number of points awarded for each of a number of landscape and design features, as shown in Table 1. Developers can choose how to achieve the required number of points. This strategy is not overly prescriptive, and allows designers to be creative, but even cities that did not wish to use a point approach could use ideas from Table 1.

In Southern California, solar collectors cover some parking lots (see Figure 6). Some look like high-tech trellises or public art, and feature changing patterns. This makes parking lots more attractive and shades the cars, but is still a costly approach, even taking into consideration the offsetting benefit from the electricity generated.

Parking Structure Design Requirements

Locating parking in structures occupies less land than surface parking. However parking structure design only occasionally enhances the built environment. In rare circumstances, collaboration between a skilled architect and an enlightened developer leads to a beautiful and functional parking structure, but developers often neglect the architecture and build parking structures as cheaply as possible. Most developers will voluntarily spend money to improve the appearance of a parking structure only to the extent that it increases the value of the residential or commercial development it serves. Because the private economic



Figure 5. Parking lot without and with landscaping, West Hollywood. (Photo courtesy of Paul Travis).

Table 1. Landscape and site development features qualifying as credits toward point totals for parking lots in West Hollywood, California.

Earned points	Qualifying landscape or site development features
10	8% of site area within parking lot perimeter occupied by landscaping.
4	Each canopy tree.
4	Each existing large or well-established tree or specimen plant retained.
6	Consistent use of vine pockets against walls.
5	Pedestrian amenities (e.g., thematic or comprehensive pedestrian lighting scheme, unique decorative materials, art, or ornamental sculpture or fountains), each.
4	Surfaces other than asphalt or concrete and permeable surfaces as part of hardscape (does not include planters). Light colored surfaces and grasscrete are encouraged.
4	Pavement surfaces of rubberized asphalt.
5	Decorative perimeter walls with integral architectural elements (e.g., gateways, coping, piers, and ornamental decorative materials).
The following are available only for parking lots with 51 or more spaces	
20	Integration of circulation, hardscape, walls, landscaping, and lighting into a central design concept approved by the Review Authority.
5	Clearly delineated axis to adjoining buildings or other site relationships.
5	Maximum separation of pedestrian and vehicular travel ways.
5	Transition zones to sidewalk and building-adjacent areas.
5	Ability to use parking lot space in other ways when not being used for parking, with uses and activities deemed compatible with the zoning of the site and surrounding properties (e.g., pedestrian space or basketball court).
6	Decorative perimeter walls with integral architectural elements (e.g., gateways, coping, piers, and ornamental and decorative materials).

Source: City of West Hollywood (2006b)

incentives for good parking design are weak, parking structures need architectural controls and review to ensure good urban design.

One strategy to improve urban design is to build parking structures that look like regular buildings.[9] This was a common practice in the early part of the last century. A more contemporary approach is to "wrap," or surround, a parking structure with retail or other uses. Dunphy, Myerson, and Pawlukiewicz (2003) suggested that "creative designers can wrap a parking structure with retail shops, eateries, residences, and services, such as dry cleaners" (p. 11). In addition to concealing the parking, this creates a mixed-use development, and patrons who park in the structure provide a built-in clientele for the retail businesses. However, this approach can increase a developer's cost if natural ventilation is not feasible and mechanical ventilation is required. In such cases, cities may offer the developer a higher floor area ratio as compensation. Alternatively, cities can require retail or residential uses only at the street level and some modest architectural details on the upper level facades (see Figure 7). San Diego's zoning ordinance mandates this approach for parking in the CBD: "All enclosed ground level parking areas shall be shielded from adjoining public *streets*, with such parking areas being separated from the public sidewalk by habitable residential or non-residential space, or utility rooms." (City of San Diego, 2006).



Figure 6. Solar collectors over a parking lot, Los Angeles.

Garage Door Restrictions

The importance of improved parking design is not limited to the commercial districts of cities. Parking infrastructure (garages and driveways) can easily overwhelm residential neighborhoods as well. To reduce the impact of parking on the residential streetscape, Carmel restricts the size of all residential garage doors that face a street to the width necessary for a single car: "On sites of less than 6,000 square feet, only a single-car-width garage door shall face the street" (City of Carmel-by-the-Sea, 1998a). As a result, garage doors do not dominate the fronts of houses. Figure 8 shows an example of a resulting facade. Portland, Oregon, limits the length of the garage wall facing the street to no more than 50% of the entire building façade (Wittenberg, 2002).[10] Other cities could follow similar strategies, limiting garage frontage but allowing more depth for parking.

Local governments can also restrict the location and design of garages. To prohibit "snout" houses with protruding garages that take up most of the street frontage, Olympia, Washington, requires that garages be located behind the house or stepped back from the facade of a building. To limit the view of garages from the street and to minimize curb cuts that disrupt the sidewalks, Olympia's garage design guidelines recommend that driveways be as narrow as possible and shared where feasible (see Figure 9). Recessed garages and balconies over garage doors also help the doors disappear in the shadows (see Figure 10). Garage sidewalls that face the street can be designed to appear as habitable spaces by incorporating windows and other design elements that are in character with the rest of the dwelling (City of Olympia, 2006).

Conclusion

Although we criticize the way planners now regulate parking, we do not call for deregulation. Instead, we recommend that planners use their ability to regulate parking more constructively, worrying less about the quantity of parking and more about its quality. Market



Figure 7. Parking structure with ground-floor retail, Beverly Hills.



Figure 8. Single-car-width garage, Carmel.



Figure 9. Shared driveway, Forest Hills.
(Photo courtesy of Joel Cochran).



Figure 10. Recessed garage door, Los Angeles.

forces can ensure an adequate number of parking spaces, but the economic incentives for good parking design are weak. Nonetheless, most local governments strictly regulate parking quantity but ignore its quality. As a result, parking now spoils much of the American landscape.

Even where local governments do regulate the design of parking lots and structures, minimum parking requirements require a massive parking supply that is difficult to camouflage. This article points out places that have put quality ahead of quantity in their regulation of parking, providing examples for other localities. We find at least five different approaches to improving urban design through creative off-street parking requirements: limiting the number of parking spaces; improving the location of parking; and requiring better design of parking lots, parking structures, and residential garages. Just as many cities have adapted zoning codes from other communities, they can use design regulations from other places to improve the quality of their own urban environments. Planners cannot significantly improve the design of cities without reforming local parking requirements to emphasize quality over quantity. While developers may object that better design will cost more, cities can mitigate these costs by reducing or removing minimum parking requirements. Reducing parking alone will improve urban design. As a famous architect once put it, less is more.

Acknowledgements

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Notes

1. In their illuminating history of how parking lots have affected American cities, Jakle and Sculle (2004) concluded, "Nothing over the past century has proven as disruptive of traditional urban landscape as parking. Perhaps nothing has made American cities less memorable" (p. 8). In his excellent guide to better design of parking lots and structures, Childs (1999) wrote, "The typical design of parking lots as simply a monofunctional expanse of cheap asphalt and a net of white lines is wasteful and destructive. . . . parking lots have eaten away cities in the United States like moths devouring a lace wedding gown" (p. xxi). Minimum parking requirements have made this bad situation even worse.

2. In their seminal work *Collage City*, Rowe and Koetter (1978) criticized the revitalization of cities based entirely on demolition and redevelopment, and made an argument for the preservation of older buildings and styles.

3. The Los Angeles Municipal Code states that for these conversions, "The required number of parking spaces shall be the same as the number of spaces that existed on the site on June 3, 1999, and shall be maintained and not reduced" (City of Los Angeles, 2001).

4. Carmel provides several parking lots on the periphery of its downtown.

5. The Urban Land Institute (1983) explains the economics of shared parking.

6. Similarly, the Rochester, New York, Municipal Code states, "parking shall not be permitted between a building and the sidewalk" (City of Rochester, 2005b).

7. Similarly, the Rochester, New York, Municipal Code states, "Parking for single-family, two-family and attached dwellings in all districts shall be limited to no more than three vehicles for each dwelling unit. No parking for such residential uses shall be located in the required side or front yard setback except in a legal driveway that provides access to the rear yard, a detached or attached garage." (City of Rochester, 2005a).

8. Similarly, the Rochester, New York, Municipal Code states, "A minimum of one landscaped area with a minimum size of 162 square feet (approximately nine feet by 18 feet) shall be provided for every 15 parking spaces and developed as islands within the parking surface area" (City of Rochester, 2005c).

9. West Hollywood requires that "Parking structures visible from street frontages shall be designed to be compatible with architectural character and quality of adjacent buildings and shall not adversely impact abutting pedestrian sidewalks" (City of West Hollywood, 2006e).

10. Similarly, New Jersey requires cities to calculate the number of off-street parking spaces in a way that reduces the garage frontage. A one-car garage and driveway combination counts as two parking spaces if the length of the driveway is at least 18 feet between the face of the garage door and the right-of-way (State of New Jersey, 2006).

References

Alexander, C., Ishikawa, S., & Silverstein, M. (1977). *A pattern language*. New York: Oxford University Press.

Barnett, J. (1974). *Urban design as public policy: Practical methods for improving cities*. New York: Architectural Record, McGraw-Hill.

Calthorpe, P. (1993). *The next American metropolis: Ecology, community, and the American dream*. New York: Princeton Architectural Press.

Childs, M. (1999). *Parking spaces: A design, implementation, and use manual for architects, planners, and engineers*. New York: McGraw-Hill.

City of Carmel-by-the-Sea, California. (1998a). City of Carmel-by-the-Sea Municipal Code, § 17.24.120 C.

City of Carmel-by-the-Sea, California. (1998b). City of Carmel-by-the-Sea Municipal Code, § 17.38.030 A.

City of Los Angeles, California. (2001). Los Angeles Municipal Code § 12.22 A 26(g)(3).

City of Olympia, Washington. (2006). Olympia Municipal Code § 18.05A.280 B 3.

City of Portland, Oregon. (2006). Portland Municipal Code § 33.266.119 B 3.

City of Rochester, New York. (2005a). Rochester Municipal Code § 120-173 F 1(c).

City of Rochester, New York. (2005b). Rochester Municipal Code § 120-173 F 1(d).

City of Rochester, New York. (2005c). Rochester Municipal Code § 120-173 F 2(f).

City of San Diego, California. (2006). San Diego Municipal Code § 151.0313 (h)(1).

City of San Francisco, California. (2006). San Francisco Municipal Code § 156(h).

City of SeaTac, Washington. (2006). SeaTac Municipal Code § 15.13.110 A 4(a).

City of West Hollywood, California. (2006a). West Hollywood Municipal Code § 19.28.090 D 1(a).

City of West Hollywood, California. (2006b). West Hollywood Municipal Code § 19.28.100 (Table 3-9).
City of West Hollywood, California. (2006c). West Hollywood Municipal Code § 19.28.100 B 1.
City of West Hollywood, California. (2006d). West Hollywood Municipal Code § 19.28.100 B 3(a).
City of West Hollywood, California. (2006e). West Hollywood Municipal Code § 19.28.110 B 1.
Dunphy, R., Myerson, D., & Pawlukiewicz, M. (2003). *Ten principles for successful development around transit*. Washington, DC: Urban Land Institute.
Jakle, J., & Sculle, K. (2004). *Lots of parking: Land use in a car culture*. Charlottesville, VA: University of Virginia Press.
Lerable, C. (1995). *Preparing a conventional zoning ordinance* (Planning Advisory Service Report No. 460). Chicago: American Planning Association.
Liebs, C. (1985). *Main street to miracle mile: American roadside architecture*. Boston: Little, Brown.
Longstreth, R. (1992). The perils of a parkless town. In M. Wachs & M. Crawford (Eds.), *The car and the city* (pp. 141–153). Ann Arbor, MI: University of Michigan Press.
Lynch, K., & Hack, G. (1984). *Site planning* (3rd ed.). Boston: MIT Press.
Miller, C. (1988). *Carscape, a parking handbook*. Columbus, OH: Washington Street Press.
Rowe, C., & Koetter, F. (1978). *Collage city*. Boston: MIT Press.
Shoup, D. (2005). *The high cost of free parking*. Chicago: Planners Press.
Smith, M. (1996, September). Circle Centre: How parking helped make urban retail/entertainment development work. *Parking*, 25–33.
State of New Jersey. (2006). New Jersey Administrative Code § 5:21-4.14(d)(2).
Urban Land Institute. (1983). *Shared parking*. Washington, DC: Author.
Wittenberg, J. (2002, August). Garages: Not just for cars anymore. *Zoning News*, 1–5.

The Practice of Parking Requirements

By Donald Shoup, FAICP

Cities have needed parking spaces ever since the two-wheeled chariot was invented in Sumeria about 5,000 years ago, but parking did not become a pandemic problem until the 20th century when cars appeared in great numbers.

Columbus, Ohio, became the first U.S. city to establish a parking requirement for any type of land use when it began to require off-street parking for apartment houses in 1923. Fresno, California, in turn, became the first U.S. city to establish parking requirements for any land uses other than housing when it began to require off-street parking for hotels and hospitals in 1939[1] (for author's notes, see web-based enhancements).

Although off-street parking requirements are now more than 80 years old, no textbooks in urban planning or transportation planning explain them. The only articles on parking requirements published in leading journals of the planning profession are severely critical of them, and no one has stepped up in their defense.[2]

THREE STEPS IN SETTING A PARKING REQUIREMENT

To set a parking requirement, an urban planner must (1) identify the land use, (2) choose the basis for the requirement, and (3) establish how many parking spaces to require per unit of the basis. Sometimes the steps are simple and straightforward. For example, a typical parking requirement for an office building is four parking spaces per 1,000 square feet of the building's floor area. The land use is an office building, the basis for the requirement is floor area, and a developer must provide four parking spaces per 1,000 square feet of floor area. For many land uses, however, the parking requirements are more complicated. Consider, for example, this parking requirement for automobile dealerships:

> 3.3 spaces for every 1,000 square feet of gross floor area of sales and showroom area; three spaces for every service bay in repair garage areas; one space for every vehicle customarily used in the operation of this use or stored on the premises.[3]



Michael Davidson



Eric Renard

(Above) Many parking requirements for automobile dealers have three bases—gross floor area, service bays, and vehicles—with a different number of parking spaces required per unit of each base. (Left) Should a city require any parking spaces at all for "uses" such as taxi stands, other than those required to park the taxis?

The parking requirement for automobile dealers has three bases—gross floor area, service bays, and vehicles—with a different number of parking spaces required per unit of each basis.

Planners must interpret some parking requirements on a case-by-case approach. Consider, for example, this requirement for a taxi stand:

> One space for each employee on the largest working shift, plus one space per taxi, plus sufficient spaces to accommodate the largest number of visitors that may be expected at any one time.[4]

This requirement also has three bases—employees, taxis, and visitors—but planners

Editor's note: This issue of Zoning Practice, *derived from Appendix A and portions of Chapter 21 of Donald Shoup's* The High Cost of Free Parking *(Planners Press, 2005), describes how city planners, most of whom are poorly trained and ill-informed about parking, determine and apply off-street parking requirements, and how, according to the author, "this process has gone so far wrong." It concludes with a discussion of the more market-based approach of parking benefit districts, which satisfy parking needs, allow for more developable urban land that would otherwise be used for disproportionately high amounts of parking, and produce revenues for public improvements. To purchase the book, visit Planners Book Service at www.planning.org/bookservice/.*

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ASK THE AUTHOR JOIN US ONLINE!

From February 20 to March 3, go online to participate in our "Ask the Author" forum, an interactive feature of Zoning Practice. *Donald Shoup, FAICP, will be available to answer questions about this article. Go to the APA website at www.planning.org and follow the links to the Ask the Author section. From there, just submit your questions about the article using an e-mail link. The author will reply, and* Zoning Practice *will post the answers cumulatively on the website for the benefit of all subscribers. This feature will be available for selected issues of* Zoning Practice *at announced times. After each online discussion is closed, the answers will be saved in an online archive available through the APA* Zoning Practice *web pages.*

About the Author
Donald Shoup, FAICP, is a professor of urban planning at the University of California, Los Angeles. He holds a doctorate in economics from Yale and is a Fellow of the American Institute of Certified Planners. From 1996 to 2001, Shoup directed the Institute of Transportation Studies at UCLA and, from 1999 to 2003, he chaired the university's Department of Urban Planning.

have considerable discretion in deciding how many spaces to require. They must estimate the largest working shift, the largest number of visitors expected at any one time, and how many cars they will park. If interpreted literally, this requirement appears to guarantee that the parking supply will accommodate the highest conceivable number of cars that could ever park at a taxi stand—and that most parking spaces will be vacant most of the time.

This parking requirement raises a raft of questions. First, requiring one parking space per employee and one space per taxi implies that all employees will drive to the taxi stand alone, park their own cars, and then take possession of a parked taxi. Is this a reasonable assumption? Might not, for example, some taxi drivers take their cabs home and return with them the next day? Second, requiring one space per employee on the largest working shift implies planners know how many employees will work on this shift. Working shifts may vary seasonally with sharp but infrequent peaks. The use of taxis may rise during heavy downpours, for example, but fall at other times when the weather is pleasant enough for walking. So how many employees are we really talking about? Third, requiring sufficient spaces to accommodate the largest number of visitors that may be expected at any one time implies planners can know this number, which they cannot. Who, after all, are the visitors to a taxi stand, and why would they want to park there? Most people who visit a taxi stand are probably without their cars, which is why they want a taxi. The largest number of visitors expected at any one time is impossible to know in advance and will, in any event, occur only rarely. Finally, why should a city require any parking spaces at all for a taxi stand, other than those required to park the taxis?

Sadly, the complicated and puzzling taxi-stand parking requirement is not an anomaly, or at least not much of one. Throughout the U.S., parking requirements are laden with similarly baffling rules, which combine to make the provision of parking long on regulation and short on common sense. But we should not be too quick to blame planners for this situation—planners are being asked, after all, to perform a hard job for which they have not been trained. Setting the parking requirement for any single land use is a challenge, and planners must set parking requirements for hundreds of land uses. In its most recent survey of parking requirements in 2002, the Planning Advisory Service (PAS) found 662 land uses with distinct parking requirements as well as 216 different factors used as the bases for them.[5]

662 LAND USES

The first step in setting a parking requirement is to define the land use. This is not an easy task, since even the definition of "land use" is open to interpretation. In *Urban Traffic: A Function of Land Use*, Robert Mitchell and Chester Rapkin describe various meanings of the term:

> The term "land use" (used so frequently in planning) has several specific meanings. It may refer to buildings or other improvements on the land, to the occupants or users of the land, to the major purposes of the occupancy of the land, or to the kind of activities on the land. Sometimes the term is employed without being defined specifically.[6]

Planners usually require parking spaces for land uses according to this last meaning: the major activities of the establishments based on the land. The variety of uses and standards cited in the PAS Report is astonishing: batting cages and body-piercing studios, construction trailers and convents, dance halls and detoxification centers, jewelry stores and junkyards, libraries and liquor stores, monasteries and mortuaries, night clubs and nunneries, sauna baths and sawmills, taverns and truck-wash facilities. Because parking demand varies greatly among these land uses, and the parking demand varies greatly among different cities for the same land use, setting the parking requirements for every land use in every city is a daunting task[7] (see web-based enhancements).

216 BASES

After identifying the land use the second step in setting a parking requirement is to decide how many parking spaces to require per . . . per what? To answer this question, planners seek to identify relevant factors that might help to predict parking demand. With no help to be found in textbooks on land-use and transportation planning (but perhaps with some inspiration from Rube Goldberg or Heath Robinson)[8],

WEB-BASED ENHANCEMENTS

Zoning Practice routinely posts information on the web for our readers. This issue comes with notes by the author and three tables: factors used as bases for minimum parking requirements; a survey of parking requirements for office buildings in 117 California cities between 1975 and 1993; and additional land uses with parking requirements in Southern California beyond the 662 identified in the Planning Advisory Service survey. We invite you to check out these enhancements at www.planning.org/ZoningPractice/currentissue.htm. We will do this whenever we determine that we can use our web pages to heighten the information value we are delivering to subscribers.

planners have identified these 216 factors that supposedly predict peak parking demand[9] (see web-based enhancements).

Floor area is the most common basis for parking requirements, but this measure raises many questions about the definition of floor area: should it be gross area, leasable area, sales area, or some other measure? For example, some cities require parking for restaurants in proportion to the dining area only, excluding the kitchen, while others require parking in proportion to the gross floor area, including the kitchen. (Gross floor area is the building's total floor area, including cellars, basements, corridors, lobbies, stairways, elevators, and storage; it is measured from the building's outside walls.) If a city requires parking in proportion to dining area, a larger kitchen area does not require more parking spaces, so restaurants will tend to have larger kitchens. But if the city requires parking in proportion to the gross floor area, a larger kitchen does require more parking spaces, so the requirement constrains the kitchen size. The definition of floor area for a parking requirement can thus directly alter the use of the space inside buildings.

The factor used as the basis for a parking requirement can have serious unintended consequences. For example, cities can require parking for manufacturing sites in proportion to employees or floor area. Consider the effects of these two requirements: (1) one space per employee on the shift of maximum employment or (2) two parking spaces per 1,000 square feet of floor area.[10] If the city requires one space per employee, a firm cannot hire more staff without adding more parking spaces. Requiring parking in proportion to employees thus increases the cost of employing labor and may reduce the number of workers hired.[11] But if the city requires two parking spaces per 1,000 square feet, a firm cannot expand its plant without adding more parking spaces, even if the expansion adds no new employees. Requiring parking in proportion to floor area thus increases the cost of plant space and may reduce investment in plant size. The factor chosen as the basis for a parking requirement therefore affects firms' hiring and investment decisions. Given these effects, how should planners require parking for manufacturing sites and for hundreds of other land uses?

CONVERGENCE TO THE GOLDEN RULE

The third step in setting a parking requirement is to specify the number of parking spaces required. The problem is that planners do not know how many parking spaces a drive-in restaurant (or any other land use) needs. Most planners know little more about parking than does the average citizen. Copying another city's requirement is therefore an obvious strategy for anyone who needs to recommend a parking requirement for any land use. If cities do copy from one another, their parking requirements should converge over time. Consider two surveys of parking requirements for office buildings in 117 cities in Southern California to see whether this convergence occurs. Rex Link, a parking consultant, conducted the first survey in 1975. I repeated the survey in 1993 to analyze trends in these cities' requirements during the previous 18 years.[12] The two surveys suggest cities do copy one another. In 1975, the most frequent requirement (the mode) was four spaces per 1,000 square feet. Of the cities requiring less than the mode in 1975, 65 percent had increased their requirement by 1993, and none had reduced it. Of the cities requiring more than the mode in 1975, 80 percent had reduced their requirement by 1993, and none had increased it. Only two of the 31 cities requiring four spaces per 1,000 square feet in 1975 had changed their requirement by 1993 (one up, one down). This convergence toward the mode doubled the percentage of cities requiring four spaces per 1,000 square feet from 27 percent in 1975 to 54 percent in 1993 (see web-based enhancements).

Practitioners sometimes refer to four spaces per 1,000 square feet as the "magic number" or "golden rule."[13] Because one off-street parking space (along with its share of ramps and aisles) occupies at least 300 square feet, four spaces occupy at least 1,200 square feet. Requiring four parking spaces per 1,000 square feet of floor area therefore commits at least 20 percent more space to parking than to buildings. After copying each others' parking requirements for many years, most cities now require more space for cars than for humans.



Photos by Michael Davidson

Communities get vast expanses of wasted space when parking space requirements are based on the relatively narrow period of peak demand. These photos of suburban shopping areas were taken during weekday business hours.

PARKING REQUIREMENTS AND REGIONAL CULTURE

When surveying the parking requirements for office buildings in Southern California, I noticed that many cities require parking spaces for more land uses than the PAS found in its national survey of parking requirements. I counted 110 additional land uses with parking requirements in Southern California—above and beyond the 662 reported by PAS (see web-based enhancements). These additional land uses tell us something about Southern California's culture and economy, and they confirm some cliches about the region.

Confirming our love of cars and everything about them, there are parking requirements for automobile display, drive-in dairies, drive-through establishments, lube-n-tune shops, tire recapping, truck storage, and used car sales. And true to the stereotype about our love of finery are the parking requirements for cosmetic processing, custom dressmakers, millinery shops, shoe shops, and shoeshine kiosks. Finally, the parking requirements for self-defense studios and homes for the aged suggest that we look to the future with concern for our safety and hope for long life.

PARKING REQUIREMENTS AND PARKING TECHNOLOGY

In setting parking requirements, planners often confuse the number of parking spaces with the capacity to park cars in them because the capacity of a parking lot or garage to accommodate parked cars is an ambiguous concept. During the hours of peak demand, valet and stack parking can increase capacity by storing cars in tandem or in the access aisles, thus substituting labor for land and capital in parking cars. Automated garages, in turn, substitute capital investment and technology for parking spaces. Requirements for a minimum number of parking spaces eliminate the option to substitute labor for land and capital in providing parked-car-hours, which is the fundamental measure of what is ultimately consumed when drivers leave their cars.

The capacity of a parking lot or structure is the number of parked-car-hours per hour it can provide. This capacity can be increased by devoting less space to each car, by reducing the time needed to park and unpark a car, and by decreasing the minimum vacancy rate necessary for efficient operation.

Parking consumption also has quality dimensions, including the safety of the parked cars and their owners, the speed of parking and unparking, protection from weather, and the like. In focusing on the sheer number of parking spaces, off-street parking requirements neglect many important considerations in how the parking supply can most efficiently meet parking demand. European and Asian cities have installed hundreds of automated garages that accommodate, in the same volume, twice as many cars as a conventional ramped garage. A driver pulls into the entry way of what looks like a single-car garage, steps from the car, and pulls a ticket. Sensors determine when all people have left the garage. The car is then lifted on a pallet and transferred from the entry bay to a storage slot. When the driver returns and reinserts the ticket, the car is delivered and pointed outward within one or two minutes. From the driver's point of view, the system works like valet parking, although the driver keeps the keys and no tip is expected. As an added advantage for urban design, the structure's facade can easily blend with the neighboring buildings.



(Left) Many zoning codes have not considered that changing lifestyles have serious parking implications. Home occupations, for example, have a significant impact on vehicular travel and parking. (Below) For generations, urbanites walked to the neighborhood church. Today, many parishioners drive to services because they live outside the neighborhood. The result: off-street parking requirements for churches and parking lots that replaced buildings once vital to the urban fabric.



Photos by Michael Davidson

Automated garages offer greater security for drivers, vehicles, and their contents, so insurance costs are lower. Because the cars are parked mechanically and the doors stay closed, horizontal and vertical spacing between them is minimal. No space is needed for ramps, aisles, elevators, and stairs. These space-saving features are a particular advantage for underground parking. Conventional underground structures require expensive excavation, shoring, waterproofing, fireproofing, lighting, and ventilation, so reducing the volume of a structure greatly reduces its cost. Furthermore, automated garages do not require ventilation because car engines are never running when inside the structure. Automated garages require only half the volume of conventional garages, and where land is scarce, they can reduce the capital and operating cost per parking space.[14]

Despite their advantages, automated garages are rare in the U.S., in part because most zoning codes require a certain number of physical parking spaces of a specific size and not a mechanical capacity to store the same number of cars. Furthermore, because the generous supply of required parking spaces has reduced the price of most parking to zero in the U.S., off-street parking requirements have reduced the potential profitability of automated garages and delayed their development. Parking requirements have also retarded the adoption of technologies that allow conventional garages to satisfy demand with fewer spaces. Electronic signs, for example, can display how many spaces are vacant on each floor so that drivers can go directly to a level with available spaces. In some garages, stalls have ceiling-mounted detectors that check whether a vehicle is present. The detectors send observations to

To change enough minds, urban planners must offer society something better than off-street parking requirements.

a central computer, which updates signs on every level of the garage pointing the route to the nearest vacant space. The individual detectors are equipped with lights and visible along the whole aisle, showing whether a space is available—occupied stalls are red and vacant ones are green—so drivers can easily see the nearest vacancies and avoid aisles with no vacancies.[15] The central computer can also display historical data on the occupancy and turnover rates of individual spaces and zones, and can provide the information necessary to analyze the operation of a garage and evaluate its performance. This technology is rare in the U.S., where the plentiful supply of parking makes efficient use less important.

WHAT WENT WRONG?

In attempting to assign a specific number of cars to almost every economic function in a city, parking requirements provide an interesting window onto the cities and showcase their quirks and priorities. But cities are too complex to be ordered and catalogued, and no amount of rational planning or dogged, well-intentioned work will ever measure everyone's "need" to park everywhere. Because this is what parking requirements are meant to do, it is little wonder they fail so spectacularly.

Current parking policies in America are aesthetically, economically, environmentally, and intellectually bankrupt. Admittedly, requiring "enough" parking spaces in a new development does seem sensible. If some people drive to work, should a new office building not have some parking spaces? So what went wrong?

The first problem is that planners require at least enough parking spaces to meet the peak demand for free parking, regardless of the cost. Second, and more fundamental, the parking requirements are unnecessary. After all, people also need food to live, but this does not mean planners should require every office building to provide a lunch room big enough to supply a free lunch at noon for everyone who works in the building.

Parking requirements are especially difficult to reform because they are entrenched in zoning codes and embedded in an elaborate structure of permits, variances, covenants, court decisions, and entitlements. Their results have literally been cemented into the city. Not only will planners have to reject parking requirements, but so too will businesses, property owners, voters, and elected officials. To change enough minds, urban planners must offer society something better than off-street parking requirements, and planners do have something better to offer: parking benefit districts with market-priced curb parking. Specifically, cities should de-require off-street parking, charge market prices for curb parking, and spend the resulting revenue to pay for neighborhood public improvements.

Removing off-street parking requirements does not mean off-street parking will disappear. Instead, where demand drives up the price of curb parking, developers will provide additional off-street parking of their own volition and charge for it accordingly.



Photos courtesy of the City of Pasadena

The Old Pasadena District in Pasadena, California. The city's Parking Development Fund, which is similar to a parking benefit district, helped transform the area into a vibrant and beautiful commercial district.



RETROFITTING AMERICA

Parking benefit districts can be retrofitted incrementally into existing neighborhoods. The new districts are not quite governments and not quite businesses, but they share some characteristics of each. They will manage their curb parking supply in a businesslike way, and the resulting revenue will support local public initiatives. Charging market prices for curb parking will improve transportation, and the public spending will improve neighborhoods. Removing off-street parking requirements will reduce the cost of development and will free up much urban land now legally dedicated to parking lots. In effect, cities have created an enormous land bank that can now be used for housing and other development if off-street parking requirements are removed.[16] The results of removing parking requirements will be gradual rather than dramatic.

After cities emancipate themselves from off-street parking requirements, many small but significant reforms can follow from the basic understanding that "free" parking has a high cost. In Los Angeles, for example, the Getty Museum charges for parking but admits people free, while the Huntington Museum offers free parking but charges people for admission. Charging more for parking and less for people will improve city life.

AN ILLUSTRATION: ADVISING THE MAYOR

Some people seem to think that charging market prices for curb parking would require a massively difficult social change, like Prohibition or the Reformation. Nevertheless, it has worked smoothly where cities have established parking benefit districts. Although these districts represent only a marginal change to existing practices, they can produce major improvements. To put parking benefit districts in the broader context of transportation, land use, and public finance suppose the mayor of a city in a developing nation asks for advice on how to deal with the parking problems caused by rapidly increasing car ownership. Consider two possible policies: (1) keep curb parking free and require all development to provide off-

Parking Requirements or Benefit Districts? Comparing Results

Criterion	Results: Parking requirements	Results: Benefit districts
1 Air quality	Worse	Better
2 Climate change	Faster	Slower
3 Energy consumption	Higher	Lower
4 Price of housing	Higher	Lower
5 Price of parking	Lower	Higher
6 Public revenue	Less	More
7 Public transportation	Worse	Better
8 Traffic congestion	Worse	Better
9 Urban design	Worse	Better
10 Urban sprawl	Faster	Slower
11 Walking environment	Worse	Better
12 Water quality	Worse	Better

street parking, or (2) charge market prices for curb parking and use the revenue to pay for local public services.

Free curb parking. Off-street parking requirements will hide the cost of parking in the prices for everything else. They will "collectivize" the cost of parking so everyone will pay for parking whether they use it or not. Free parking will encourage vehicle travel and discourage travel by foot, bicycle, and public transit. It will therefore increase energy consumption, traffic congestion, and air pollution. The city will be designed and built around free parking—at the expense of many other public goals. The nation will import more cars and fuel. The cost of required parking will be a hidden tax everyone must pay through higher prices for everything they buy, even if they do not own a car. The city will earn no curb parking revenue to pay for public investments.

Market prices for curb parking. Market prices for curb parking will "individualize" the cost of parking and give everyone an incentive to economize in using it. This policy will reveal the cost of parking and allow private choices to determine the off-street parking supply. Market prices will create a few curb vacancies so that drivers can always find a place to park near their destinations. The price of parking will restrain the demand for cars and will therefore reduce energy consumption, traffic congestion, and air pollution. More people will travel by foot, bicycle, carpool, and public transit. The nation will import fewer cars and less fuel. Because motorists will pay for parking directly, no one will be forced to pay for it indirectly. Curb parking revenue will pay for neighborhood public investments. To help the mayor choose, you might suggest criteria for comparing the two policies, and the table above shows 12 that would be relevant. Parking benefit districts excel on 11 of these: air quality, climate change, energy consumption, housing prices, public revenue, public transportation, traffic congestion, urban design, urban sprawl, walking environment, and water quality.[17]

With parking benefit districts, planners will more often work in partnership with neighborhoods.

A NEW STYLE OF PLANNING

Parking benefit districts will require a new style of urban planning. Planners now devote considerable effort to enforcing the parking requirements for new buildings or for changes in the use of existing buildings. As a result, they spend much of their time dealing with developers. With parking benefit districts, planners will more often work in partnership with neighborhoods, helping them decide how to manage curb parking and how to spend the public revenue it produces. In focusing on curb parking, city planners will also have to pay much more attention to streets, which they now largely neglect. As University of Washington professor of urban design Anne Vernez Moudon says, "Streets have become a void in the mind of city planners. Transportation planning has been made separate from city planning and, accordingly, streets separate rather than link the different pieces of the city."[18]

The revenue from curb parking will refocus planners' attention on streets and neighborhoods. Because neighborhoods will have real money to spend and real choices to make, the residents' preferences will acquire new weight and real community participation will be necessary. Concentrating planners' attention on the task of improving older neighborhoods may well be one of the new parking paradigm's most important benefits.

A collection of materials from communities with parking benefit districts is available to *Zoning Practice* subscribers by contacting Michael Davidson, editor, *Zoning Practice*, at the American Planning Association, 122 South Michigan Avenue, Suite 1600, Chicago, IL 60603, or by sending an e-mail to mdavidson@planning.org.

Cover photo: Modern cars with parking meter backdrop. Concept design by Lisa Barton; meter image by Getty Images.

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NOTES: THE PRACTICE OF PARKING REQUIREMENTS

1. Mogren and Smith (1952, 25). Hartmut Topp (1991, 12) says Germany began requiring building owners to provide off-street parking in 1939 when the Reichsgaragenordnung was enacted.

2. Shoup (1995, 1997, 1997a) and Willson (1995). Urban planners apparently feel no need to respond when articles in their profession's leading journals condemn a central practice of the profession. This silence suggests many planners don't read the journals, disagree with the criticism but don't have any response, or perhaps agree with the criticism but don't know what to do about it.

3. This is the parking requirement for an automobile sales establishment in St. Louis County, Missouri (Planning Advisory Service 1991, 8).

4. This is the parking requirement for a taxi stand in St. Clair Shores, Michigan (Planning Advisory Service 1991, 25).

5. Some of the 773 land uses in PAS Report 510/511 (2002) are duplicate names for what are essentially the same land uses. Abattoir, for example, is the same as slaughterhouse.

When the 111 duplicate names are removed, there are 662 different land uses. The 15 surveyed cities are: Bellevue, Washington; Cambridge, Massachusetts; Davis, California; Grand Rapids, Michigan; Greensboro, North Carolina; Helena, Montana; Holland, Michigan; Iowa City, Iowa; Minneapolis, Minnesota; Pittsburgh, Pennsylvania; Portland, Oregon; Redmond, Washington; Richmond, Virginia; San Antonio, Texas; and Santa Cruz, California.

6. Mitchell and Rapkin (1954, 13).

7. The parking requirements for even the most frivolous-sounding land uses sometimes create serious debates. For example, Newport Beach, California, tripled its parking requirement for nail salons from one parking space for every 240 square feet of salon area to one space per 80 square feet in 1995. The planning commission had previously rejected the increase because the economic development committee had argued it would penalize new business. One member of the city council opposed the increase on the grounds that "I think this is targeting a successful industry. . . . I think it's antibusiness" (*Los Angeles Times*, April 1, 1995).

8. Rube Goldberg (American) and Heath Robinson (British) sketched complex contraptions, often dilapidated from overuse, designed to perform simple tasks and usually run by overly serious attendants executing simple duties like cutting a string.

9. These 216 factors used as bases for parking requirements were reported in the surveys conducted by the Planning Advisory Service in 1964, 1971, 1991, and 2002. Additional factors are used by cities not included in the surveys.

10. The Planning Advisory Service found these two requirements in its 1991 survey (PAS 1991,18).

11. Requiring one parking space per employee increases the cost of employing labor but does not increase the cost of employing capital (computers, machines, etc.), and can thus encourage firms to substitute capital for labor in their production decisions.

12. Link (1975). The requirement was calculated for a 10,000-square-foot, three-story office building. A few cities included in Link's 1975 survey were not included in the comparison because the city's 1993 requirement was difficult to interpret. For example, in 1993 the City of Banning required "one parking space for each employee on the largest shift plus one space per 350 square feet of floor area." Therefore, building size alone is insufficient to calculate the required parking.

13. Willson (1995, 30).

14. Beebe (2000) describes the history and technology of automated parking garages.

The garage operations have backup computer systems for each feature, and the high degree of redundancy greatly reduces the probability of mechanical error. Articles on automated parking garages are in *Parking Today* (January 1998 and March and May 2003), *Urban Land* (May 1998), The Wall *Street Journal* (February 13, 1999), *New York Times* (September 21, 2003), and *Slate* (April 1, 2004). The title of the Slate article by Josh Levin ("The Valet You Don't Have to Tip") suggests another advantage of robotic parking. See also the manufacturers' websites at www.roboticparking.com and www.spacesaverparking.com.

15. This guidance system is used in the Smart Park garage at the Baltimore-Washington International Airport. Information on the system is available at www.signalpark.com.

16. Some parking lots already serve as land banks for later development, and the interim use for parking is referred to as a "taxpayer" (Shoup 1969 and 1970).

17. Water quality is included in this list for two reasons. First, paved parking lots increase the impervious surface area in a city, reduce the area for water to percolate into the soil, and increase stormwater runoff. Parking lots also accumulate oil drippings that contain toxic metals such as chromium, and the runoff then pollutes water supplies. Second, the revenue from curb parking can pay for piped water and sewers in parking benefit districts.

18. Moudon (1987, 16).

American Planning Association Making Great Communities Happen

Zoning Practice — February 2006

Ask the Author

Here are reader questions answered by Donald Shoup, FAICP, author of the January 2006 *Zoning Practice* article "The Practice of Parking Requirements."

Question from Henry Jackson, AICP, Planning Manager, LFUCG Planning Division, Lexington, Kentucky:

At the risk of vastly over-simplifying the issue, is there any sort of table of recommended "urban" off-street parking rates versus traditional suburban rates?

Answer from author Donald Shoup:

No, there is no table of recommended off-street parking requirements for urban sites. Most cities base their parking requirements on surveys of the peak parking demand observed at a few suburban sites that offer free parking and lack public transit. This policy is inappropriate even in suburban areas, and it is absurd in urban areas.

Transportation engineers define parking demand as the peak parking occupancy observed at a site, without taking into account the price of parking. Cities then require new land uses to supply at least enough parking spaces to satisfy this peak demand, without considering how much these spaces cost. The maximum observed parking demand thus becomes the minimum required parking supply. Planning for parking is planning without prices.

Planning for parking is a circular process, and it starts from the premise that curb parking is free. If developers do not supply enough spaces to satisfy the demand for free parking at a site, some cars drawn to the site will park at the curb, and neighbors will complain about spillover. To prevent this spillover, cities require developers to supply at least enough off-street spaces to satisfy the peak demand for free parking at every site. Ubiquitous free parking then inflates the demand for vehicle travel, and cities must limit urban density so that new development won't generate more vehicle trips than nearby roads can carry. This lower density spreads activities farther apart, and further increases vehicle travel and parking demand. Planners then use surveys of the parking demand at existing sites to estimate how many parking spaces to require for new sites. This circular logic explains why planning for transportation and land use has gone subtly, incrementally wrong. Planning for parking in the U.S. is really planning for *free* parking.

Chapters 2 and 3 in *The High Cost of Free Parking* discuss how common errors in setting parking requirements inflate the parking supply. And here is a link to a short article, "Roughly Right vs. Precisely Wrong," that criticizes the data used to set parking requirements: **www.uctc.net/access/access20.pdf**.

Question from Jeff Campbell:

Initially, I just wanted to comment that I truly enjoyed your article. It was extremely informative. I have a question regarding parking for neighborhood churches. You briefly address the issue in a caption one of the pictures in the article. You noted that since more parishioners are driving to work, more communities are requiring off-street parking for churches and parking lots that replaced buildings once vital to the urban fabric.

My question relates to similar issues. Is it typical for municipalities to require a church to have parking requirements for every use that the building may serve. For example, if a church building serves as a sanctuary, a banquet center, offices, Sunday school, are parking spaces required for each of these uses. Please keep in mind that none of these uses would be concurrent. Obviously, the congregation would not have church service and Sunday school at the same time. The pastor would not be in his office during service. If the municipality were to require parking spaces for each use, then a small church may be required to have 95 parking spaces for 150 parishioners. This does not make a lot of sense.

As you stated in your article, this sort of planning to meet the peak demand is unnecessary. A parking provision for all these non-concurrent uses seems ludicrous. In your experience, is this

sort of ordinance or requirement typical, or does this type or requirement represent a rogue ordinance? The alternative, more sensible, parking interpretation for a church with these non-concurrent uses is to require one parking space for three church seats, would it not?

Answer from author Donald Shoup:

The common planning practice of requiring enough spaces to meet the peak demand for free parking is particularly inappropriate at land uses with short, sharp peaks in demand. The peak parking occupancy at a church may last for only a few hours each week. Using this peak demand to set a minimum parking requirement leaves many parking spaces empty almost all the time. The full cost of the parking lot is incurred to serve a few hours each week, so the cost per hour the parking spaces are occupied can be enormous. Religious leaders advise, "Do not build the church for Easter Sunday," but planners ignore this advice for the church parking requirements.

Because the required parking is so expensive and is used so infrequently, churches often try to provide fewer spaces than the zoning demands. Where the parking requirement for a church is based on the number of fixed seats or the linear feet of permanent seating, for example, churches can evade the limit by using folding chairs instead of seats attached to the floor. And because some churches don't want to pay for parking spaces they use only on Sundays, they take advantage of the folding-chair loophole, as the *New York Times* explains:

> There is a stretch of Flushing, Queens, where Christians, Buddhists, Jews, Muslims and Hindus worship within blocks of one another without a hint of sectarian strife. When it comes to parking spaces, though, it is all-out war. Every Sunday, a flood of cars descends on the neighborhood, thanks in large part to its dozens of newly built Korean churches. City law requires houses of worship to provide parking spaces for their parishioners if they have seating fixed to the floor, but many of the churches use folding chairs and are thus not covered by that rule. For years, residents have complained bitterly about that situation — and the ungodly noise, the crowds and the cars that often block their driveways.

Parking requirements can also prevent a church from occupying a site. The *San Diego Union-Tribune* reported on a typical dispute about church parking. The Community of Praise Baptist Church rented an aging storefront for their services in a part of National City, California, that is zoned for churches. Six months after occupying the vacated furniture store with no off-street parking, the church found that it had neglected to check the city's parking requirements. In defense of the church, a member of the City Council who drove past the church on Sundays and saw available parking argued that the church offered more customers to local businesses and placed more people in the high-crime area during times when the area was a ghost town. "The Lord placed us here," Pastor E. M. Williams said. Nevertheless, the City Planning Commission voted 4-3 to deny an occupancy permit because there weren't enough parking spaces.

Parking requirements can freeze older buildings in their existing uses, or even prevent any feasible use at all. If a building doesn't have the parking spaces required for a new use, zoning won't allow the new use even if all other planning requirements are met. Parking requirements have become a moral imperative, and in planning disputes they are invoked in nonnegotiable terms, like sacred cows. All it takes to prohibit a new use for an older building is to say "It doesn't have all the required parking." People who oppose a project for any reason can cite the lack of required parking as the reason for objecting to it, as though parking were the real issue. When a proposed new restaurant, for example, requests a variance to open without the required number of off-street parking spaces, protests often come from existing restaurants that want to stifle competition, even if the site is in a derelict part of town where everyone else would like to see a new restaurant. The frequent references to parking requirements in planning disputes make it appear that everyone always insists on more parking, including even environmentalists who are no friends of the car.

Consider the dispute in 2002 over a 22-acre, $42-million megachurch proposed on the south side of Chicago. Naturally, anything that big raises land-use planning questions, and the opponents usually invoke parking requirements as a reason to reject a development or scale it back. Referring to the issue of whether 2,000 parking spaces would be enough for the new Salem Baptist church, the Reverend James Meeks said, "I don't care if Jesus is a member of your church, the City Council zoning board will not pass a project that doesn't have the proper amount of parking."

Chapter 17 in *The High Cost of Free Parking* recommends a solution to the dilemma of church parking: cities should allow nonresidents to pay for curb parking in a neighborhood, and they should set with the prices for nonresident parking to ensure that demand does not exceed the supply of spaces. This arrangement is called a "parking benefit district." Parking *benefit* districts are similar to parking *permit* districts because residents can park free on the streets in front of their homes. The benefit districts differ from conventional permit districts in two ways:

1. Nonresidents can to park on the streets in a benefit district if they pay the fair market price.
2. The city earmarks the resulting revenue to finance added public services in the district.

The price for nonresident parking in a benefit district can be set high enough to ensure vacancies for both residents (who park free) and nonresidents (who pay to park). The new revenue can finance additional public services in the neighborhood, beyond those provided everywhere in the city. The city can clean the streets more often, fill potholes, repair the sidewalks, plant trees, remove graffiti, preserve historic buildings, or put utility wires underground in the neighborhoods where the benefit districts generate revenue. Seen from the residents' side of the bargain, charging nonresidents for curb parking resembles Monty Python's plan to solve Britain's economic problems by taxing all foreigners living abroad.

To answer your question, then, I do not think cities should require any off-street parking for churches. Each congregation can make its own decisions about parking, with or without divine guidance. If the neighborhoods surrounding churches become parking benefit districts, higher prices for nonresident parking on Sundays can manage demand and settle the strife. We need a new Golden Rule for the price of parking: C*harge others what they would charge you.*

Question from Benjamin S. Lyman, Community Development Department, City and Borough of Juneau, Alaska:

In our downtown core, which is also our historic district, we have adopted a parking overlay district where no off-street parking is required when existing structures are re-used. This has a great effect on allowing developers to re-use historic buildings without resulting in more off-street parking. In this overlay district, however, we do require 40 percent of the standard off-street parking requirement for new construction.

Since off-street parking is not desirable in terms of retaining the historic character of the district or in terms of promoting walkability, we are interested in simply abolishing all parking requirements in this area. Our consultant for re-writing our historic district design standards brought up a concern regarding this proposal — if we abolish all parking requirements in the historic district, developers could tear down existing one- and two-story historic buildings and construct new three- or four-story buildings (we have a fairly low height restriction that prevents taller buildings), as they would not have to provide any parking for the new structure. Do you have any suggestions as to how we can protect the existing historic structures and still promote development of existing empty lots while not requiring off-street parking that we don't want in the area anyway?

Our Planning Commission is interested in using a Local Improvement District to fund construction of centralized parking for the district in an equitable way, but the business community strongly opposes this. We have also discussed establishing a Business Improvement District, as this would likely be an easier sell to the business community, but it seems that a BID works better for maintenance of structures than it does for construction.

Last but not least, a fee-in-lieu of parking program has been in the works for well over 10 years, but has never been adopted. I'm working on reviving the effort to adopt it, but the same question regarding protection of historic buildings applies to this effort (our existing parking overlay districts are larger than the historic district, and include many historic buildings outside the historic district). So although we've got a lot of support for changing our parking requirements & management in the downtown area, the crux of many of the discussions comes back to historic preservation, and as far as I can tell, your discussion of historic preservation does not apply, due to our existing parking overlay districts.

Any ideas?

Thanks for a great book, and all your work on rectifying the horrible situations that have resulted from parking requirements.

Answer from author Donald Shoup:

Thanks for your questions. I will first discuss how parking requirements affect redevelopment in historic districts, and then the issue of in-lieu fees in historic districts.

Do Off-Street Parking Requirements Deter Redevelopment?

Your consultant makes an interesting argument about using off-street parking requirements to deter the redevelopment of historic sites. Off-street parking requirements *do* deter redevelopment-even in blighted areas the city wants to redevelop. Cities sometimes deliberately use high parking requirements as an indirect way to discourage specific land uses. If residents oppose fast food restaurants, for example, a higher parking requirement can make it more difficult to build them. But this strategy creates even more problems because the fast food restaurants

that *do* get built have supersize parking lots that are asphalt eyesores, and residents dislike them even more. The right way to discourage an undesired land use is to regulate the offending aspects of the land use, not simply to require more parking spaces that make that land use even more undesirable.

Consider the broader implications of your consultant's recommendation to use off-street parking requirements to deter redevelopment in your historic district. Off-street parking requirements retard the redevelopment of *all* property, not just historic property. In this way, off-street parking requirements reduce the supply and increase the price of housing. If even a reduced parking requirement of 40 percent of the standard off-street parking requirement can prevent redevelopment, consider how your city's standard parking requirement must prevent redevelopment everywhere, even in neighborhoods where you want to encourage higher density.

Planners long ago noticed that parking requirements restrict housing construction. In 1935 Los Angeles began to require one off-street parking space per dwelling unit for multifamily housing, and a 1948 article in the *Journal of the American Institute of Planners* noted a surprising result: "In many cases, the number of garage spaces actually controlled the number of dwelling units which could be accommodated on a lot."

Planners have also long known that restricting the supply of housing, parking requirements inevitably increase rents. In 1961, Oakland began to require one space per dwelling unit for apartment buildings. Data collected in a study of 45 apartment projects developed in the four years before Oakland required parking, and 19 projects developed in the two years afterward found that the construction cost per apartment increased by 18 percent, and the number of apartments on a typical lot fell by 30 percent. The study attributed these effects to the parking requirements.

The zoning change made prior densities impossible without underground garages. This increased the cost of development if the same density were to be achieved before and after the zoning change ... The developers interviewed stated that the increased pre-development land costs encouraged development of an apartment with a higher rent structure.

Developers said that *adding* an apartment required another parking space, but *enlarging* an apartment did not; they therefore built fewer but larger apartments. Reluctant to build expensive underground garages, developers reduced the number of apartments and devoted more land to surface parking.

Chapter 5 in *The High Cost of Free Parking* assembles much more evidence showing that off-street parking requirements reduce the supply and increase the cost of housing. In particular, requiring a fixed number of parking spaces per dwelling unit disproportionately increases the cost of small apartments, and makes them uneconomical. This policy clearly discourages small apartments, but many cities require the same number of parking spaces regardless of dwelling-unit size. A survey in California's Silicon Valley found that half the cities have the same parking requirement for any size unit, whether a small studio or a five-bedroom penthouse.

I do not recommend using off-street parking requirements as the best way to deter redevelopment in historic areas. If you do not want more parking in your historic district, you should not require it. Some cities offer tax abatements to owners who donate easements on historic properties (the Mills Act in California is an example of legislation for this purpose).

In-Lieu Fees in Historic Districts

If you do keep the parking requirements for new development in your historic district, but do not want on-site parking at each new development, you can require developers to pay in-lieu fees for all the required parking, rather than provide the parking itself. Chapter 9 in *The High Cost of Free Parking* explains how the policy has worked well in Carmel, California. You can use the in-lieu fees to build public parking structures in appropriate locations, or to improve sidewalks and public transit.

Question from Paul Isaks, Transport Specialist, ACT Planning and Land Authority, Canberra, Australia:

I have a question relating to Donald Shoup's February 2006 Q&A response. The 85 percent utilization rate intrigues me. What is the basis for this figure? Why not 90 percent or some other figure? Is it possible to achieve 85 percent utilization for all parking areas in a district, or is this a target figure better applied to the total of all parking spaces in all carparks in a commercial area or center? (I haven't read The High Cost of Free Parking *yet, but I have it on order and hope that my copy will be here in the next week or two.) I'd be interested to hear.*

Answer from author Donald Shoup:

The 85 percent occupancy rate is only an approximate goal for curb parking, but any sensible goal

would not be far different from 85 percent. What about 90 percent, for example, which would still leave a few vacant spaces? This would increase the number of cars parked at the curb by only 6 percent, but would reduce the number of vacant spaces by a third. So you don't get many more cars parked, but you significantly reduce the ease of finding a vacant space. Drivers would have spend more time cruising to find a vacant space, and they would also have to spend more time walking from their cars to their destinations and back. Perhaps one empty space on each side of every block is the most sensible goal. If there are an average of eight curb spaces on each block, seven should be occupied and one empty. Given the stochastic nature of arrivals and departures, you will need to trade off some time with two or more vacancies so that you have less time with no vacancies. Basically, I would say that it is hard to make a case for any curb parking occupancy goal other than about 85 or 90 percent.

I would argue that cities should try to achieve this occupancy goal on every block. For example, if all curb spaces are occupied in one part of downtown but half of the curb spaces are empty in another part of downtown, the meter rates should be raised where all spaces are full and reduced where half of the spaces are empty.

Cities can rely on prices to maintain a few curb vacancies and to create turnover. Prices cannot constantly fluctuate to maintain an occupancy rate of exactly 85 percent, of course, but they can vary sufficiently to avoid chronic overcrowding or underuse. If about 15 percent of spaces are vacant, the price is right.

A variable price for curb parking may seem impractical at first, but the price of metered curb parking already varies between daytime (when the meters operate) and nighttime (when parking is free). Meters are usually free at night even though the curb spaces may be crowded. Free parking at night probably stems from the idea that parking meters are intended to create turnover. It does not make sense to have one-hour parking meters enforced at 3 a.m., but it does make sense to charge for parking if it is scarce. When spaces are allocated by prices rather than time limits, the price may be lower at night, but need not be zero.

Other transportation prices also vary according to supply and demand. The price of gasoline, for example, fluctuates in response to the balance between supply and demand, and it is hard to imagine gasoline being sold any other way. Indeed, when gasoline prices were controlled for a brief period in the 1970s, the results were disastrous. The long lines of cars at filling stations dramatically showed the disadvantages of not letting prices fluctuate to balance supply and demand. Cars searching for underpriced curb parking are mixed in with those actually going somewhere, but they are comparable to cars waiting in line for underpriced gasoline.

The price of most commercial parking varies by time of day and day of the week. Parking lot operators instinctively raise prices when their occupancy rates regularly approach 100 percent, and some operators claim they do not own a "full" sign because they never need one. To set the prices for on-street parking, cities can use the traditional four-step process that commercial operators use to set prices for off-street parking:

1. Look to see if your lot is full or empty.
2. Check your competition.
3. If you are full and they are empty, raise your price.
4. If you are empty and they are full, lower your price.

Question from Brian Gibson, Transportation Planner, Fargo-Moorhead Council of Governments, Fargo, North Dakota:

I understand your basic premise — market driven parking will help capture the true cost of parking (and automobiles in a general sense) and more efficiently regulate the need for parking.

But, in Fargo-Moorhead our planners are considering not just minimum parking requirements, but maximum parking requirements also. They are tired of retailers demanding acres and acres of free parking when the planners have no tools to limit their request to a "reasonable" size. By adopting market driven parking requirements, I can foresee that Big Box Inc. will gladly pay for the convenience of oversized parking lots because they have the revenue to do so, but Mom & Pop across town won't or can't and suddenly there is a question of equality. Mom & Pop will cry that they can't compete with Big Box Inc. unless they have free parking too.

I can also see how a parking benefit district would work in a CBD with lots of density and shared parking already. But out in suburbia it seems like it would work to keep the large, wealthy retailers entrenched at the top of the pyramid, and would even contribute to pulling more jobs out of the CBD as successful downtown businesses move to the urban fringe in search of the free "convenient" parking that their customers "deserve". It would even become a marketing tool for them.

How do you reconcile the questions of market justice?

What part if any do you see maximum parking restrictions playing in the current "free parking" environment?

What part if any do you see maximum parking restrictions playing in the "market driven" environment?

Answer from author Donald Shoup:

Most cities have minimum parking requirements, not maximum parking limits. Despite their ambivalence on whether to require or restrict parking, planners always seem to regulate it. This behavior recalls a Soviet maxim: "What is not required must be prohibited." American cities put a floor under the parking supply to satisfy the peak demand for free parking, and then cap development density to limit vehicle trips. European cities, in contrast, often cap the number of parking spaces to avoid congesting the roads, and combine this strategy with a floor on allowed development density to encourage walking, cycling, and public transport. That is, Americans require parking and limit density, while Europeans require density and limit parking. The American policy looks exceptionally foolish when combined with complaints about traffic congestion and calls for smart growth.

Maximums versus Minimums

There is probably as little analysis to justify specific parking caps as there is to justify the specific parking minimums, and the parking caps may, by default, become the parking minimums for many developments. Nevertheless, parking caps make far more sense than minimum parking requirements as a planning policy. A few American cities-Boston, New York, and San Francisco-do limit parking in their downtowns, but even these cities require parking everywhere else. If parking caps *reduce* vehicle trips, parking requirements surely *increase* them. If we want to reduce traffic congestion, energy consumption, and air pollution, the simplest and most productive single reform of American zoning would be to declare that all the existing off-street parking requirements are maximums rather than minimums, without changing any of the numbers, as the London Borough of Kensington and Chelsea did in 1995. From that point on we could let the market take care of parking, and let city planners take care of the many vital issues that really demand their attention.

Minimum parking requirements, with no maximum, imply that cities care only about having enough parking spaces, and that there can never be *too many*. But as Jane Jacobs (1962) says,

> The main purpose of downtown streets is transaction, and this function can be swamped by the torrent of machine circulation. The more downtown is broken up and interspersed with parking lots and garages, the duller and deader it becomes in appearance, and there is nothing more repellant than a dead downtown. ... In a panicky effort to combat the suburbs on their own terms, something downtown cannot do, we are sacrificing the fundamental strengths of downtown — its variety and choice, its bustle, its interest, its compactness, its compelling message that this is not a way-station, but the very intricate center of things. The only reason people come downtown or set up business downtown at all is because downtown packs so much into such a compact area.

Because downtown packs so much into a small area, people are willing to visit it even if they have to pay for parking and then walk to get there. A successful downtown must be accessible, which means traffic and parking, but too much parking enfeebles a downtown. Fred Kent, president of Partners for Public Spaces, describes the difference in parking "requirements" for a great place and a dull place:

> Parking is important where the place isn't important. In a place like Faneuil Hall in Boston it's amazing how far people are willing to walk. In a dull place, you want a parking space right in front of where you're going.

Kent also says minimum parking requirements "assure that a place will be uninteresting." Or as Jane Holtz Kay put it, "The more parking, the less place. The more place, the less parking." Where there are plenty of off-street parking spaces, "the pedestrian is now as likely to be ambushed by a car sliding from some underground garage as visually assaulted by gap-toothed parking lots and eerie garage facades." Similarly, urban designer Dom Nozzi (2003) says,

> When we hear the claim that there is "not enough parking downtown," what we are really hearing is that there is "not enough *free* parking *a few feet* from where I want to go." To demand such an impossible supply of parking is to ask a downtown to compete with outlying suburbs *on suburban terms,* that is, asking for the impossible.

Off-street parking requirements have different meanings for new buildings and for existing buildings. *For a new building,* parking requirements determine the number of spaces that a developer must *supply. For an existing building,* parking requirements limit the uses that a city will *allow.* Given the haphazard methods planners use to set parking requirements, they make

many important land-use decisions with no rational basis.

Equity for Mom & Pop

In regard to the question of whether maximum parking limits will harm Mom & Pop stores, I think minimum parking requirements do far more harm. Do Mom & Pop stores really have so much money that they want to build new quarters on greenfield sites and provide lots of free parking? In reality, minimum parking requirements often make it hard for Mom & Pop stores to reuse older buildings. For example, if a building has 2 parking spaces per 1,000 square feet of floor area, most zoning codes will not allow it to be converted to a new use with a requirement of more than 2 spaces per 1,000 square feet unless more parking spaces are added or a variance is obtained. Adding new spaces to an older building is usually out of the question because there is simply no room. Older buildings are thus limited to uses for which the existing parking supply meets the parking requirements. As one consultant wrote to me, "There are heartbreaking stories of people who are trying to make use of vacant buildings but are forbidden to do so by onerous parking requirements."

I recommend that cities should charge market prices for curb parking and eliminate off-street parking requirements. To judge whether charging for curb parking is fair, we can compare it with the current alternative-off-street parking requirements that increase the prices of everything else. With off-street parking requirements, even households without cars pay for parking indirectly in the form of higher prices for everything they buy. In contrast, when curb spaces are priced at market rates, only parkers must absorb the cost. Charging for curb parking thus seem fairer than imposing off-street parking requirements, especially when for those who are too poor to own a car. The 2001 National Household Travel Survey found that households with incomes less than $25,000 a year are nine times more likely not to own a car than households with incomes greater than $25,000 a year. Similarly, households living in a rented residence are six times more likely than homeowners not to own a car. Because cars are unequally distributed in the population, charging drivers for the curb parking they use is fairer than forcing everyone to pay for off-street parking whether they use it or not. Parking requirements take money from the poor to subsidize the better off: drivers park without paying, while nondrivers pay without parking.

I am *not* saying we should pay more for parking. Off-street parking requirements force everyone, including the carless, to pay too much for parking indirectly. I *am* saying we should pay for parking directly. Cities can *individualize* — decollectivize — the cost of parking, so that we pay less for parking if we use less. While we all want to park free, we should not elevate this wish into a social judgment that charging for curb parking is unfair, especially when we compare it with the alternative-off-street parking requirements that impose a heavy burden even on those with the least ability to pay. Almost everyone will be better off by paying only for the parking they use, and *not* paying the high costs that off-street parking requirements impose on everyone.

I have put a short summary of my recommendations for curb parking prices at this link:
http://shoup.bol.ucla.edu/Parking_on_a_Great_Street.pdf

Question from Kaizer Rangwala, City of Farmers Branch Planning Department, Farmers Branch, Texas:

Our first ring suburban city will get light rail services in 2010. Our vision for the transit area is a compact, mixed-use, pedestrian-friendly town center.

The light rail transit agency owns a functional park and ride tract near the future station platform site. While the progressive transit agency would be interested in a public-private partnership for a mixed-use project with structured parking on their tract they would still like to retain a minimum number of parking spaces for their riders.

Is there a strong link between free parking at transit stops and increased transit ridership.

Answer from author Donald Shoup:

Providing free parking at rail stations greatly increases the cost of transit oriented developments because parking spaces are more expensive in denser areas. A study by the California Department of Transportation points out the higher burden of parking requirements in TODs:

> Increased densities in TODs, coupled with the goal of improving accessibility for pedestrians to transit stations, often means building structured parking garages. Parking spaces in structures can cost from $10,000 to $30,000 each, compared to about $5,000 per space for surface parking ... These increased costs can negatively affect the financial feasibility of projects, even if they are otherwise profitable. Hence, if the design and location of TODs enable a reduction in the number of parking spaces needed, the cost savings can be significant.

If cities do not reduce the number of spaces required in a TOD by more than the increased cost

per space in structures, the cost of the required parking is higher in a TOD than in a conventional development. Suppose, for example, a city requires 4 spaces per 1,000 square feet of floor area in a conventional development, and the developer's cost of surface parking is $5,000 per space; the cost of the required parking is thus $20 per square foot of floor area. Suppose the city requires only 2 spaces per 1,000 square feet in a TOD, and the developer's cost of structured parking is $20,000 per space; the cost of the parking required for a TOD is thus $40 per square foot of floor area, or twice the cost in a conventional development.

Rather than giving free parking to transit riders, I think transit agencies should consider developing their parking lots and requiring all developments to offer "Eco Passes" to their tenants. Several transit agencies-in Dallas, Denver, Salt Lake, and San Jose, for example-offer employers the option to buy Eco Passes that give all their employees the right to ride free on all local transit lines. This arrangement reduces to zero the employees' marginal cost of riding public transit, and therefore makes transit (in terms of perceived money cost) similar to driving and parking free. Because many commuters won't ride transit even when it is free, the transit agencies' cost per Eco Pass holder is low, and the agencies can therefore sell the Eco Passes at a surprisingly low price. In California's Silicon Valley, the Santa Clara Valley Transportation Authority (SCVTA) charges between $5 and $80 a year per employee for Eco Passes, depending on the employer's location and number of employees. The price of an Eco Pass is much lower than that of a conventional pass. Because frequent riders often buy the conventional passes, transit agencies must price them on the assumption that buyers will use them frequently. The price of an Eco Pass is much lower because employers buy the Eco Passes for all commuters regardless of whether or not they ride transit. The SCVTA's price for its Eco Pass is only 1 to 19 percent of the price for its conventional pass ($420 a year). Allowing a TOD developer to offer low-cost Eco Passes in lieu of high-cost parking spaces can thus improve the TOD's financial feasibility.

A study of travel patterns in California found that, in practice, TOD employers are far more likely to offer commuters free parking than a transit subsidy. In Los Angeles, for example, 89 percent of all commuters who worked in a TOD in Hollywood were offered free parking, while only 19 percent were offered a transit subsidy. In Orange County, 87 percent of commuters in a TOD in Anaheim were offered free parking, while only 8 percent were offered a transit subsidy. In San Diego, 83 percent of commuters in a TOD in Mission Valley were offered free parking, while only 17 percent were offered a transit subsidy. The TODs were also embedded in regions where free parking was the norm, and this free parking elsewhere had a major influence on the TOD residents' travel behavior. Among TOD residents, only 5 percent of those whose employers offered free parking rode transit to work, while 45 percent of those whose employers did *not* offer free parking rode transit. TODs will have little effect on travel behavior if parking remains free everywhere, even in the TODs themselves, and transit remains expensive.

Providing Eco Passes instead of parking spaces will increase transit ridership, reduce the cost of transit-oriented development, improve urban design, and reduce traffic congestion, air pollution, and energy consumption. These benefits will come at low cost if the transit system has excess capacity, as most do.

So to answer your specific question, I do not think that *free* parking at transit stops is necessary to increase ridership. Even where free parking does increase transit ridership, it is an extraordinarily expensive way to gain riders. TOD may be a far more productive use for valuable land at transit stops. Portland, Oregon, for example, is turning a park-and-ride lot at one rail station into a TOD. Converting free parking lots at rail stations into TODs with Eco Passes can increase rather than reduce transit ridership.

Chapter 10 in *The High Cost of Free Parking* discusses the question of parking at transit oriented developments.

Question from Kirk Westphal, Ann Arbor, Michigan:

Is there a general rule of thumb that would help a large town or small city "sell" the case that they've reached the point where it would be advisable to begin conversion from surface to structured parking? A certain density of existing retail or office within a minimum area? Projected growth in commercial square footage? Land values?

Answer from author Donald Shoup:

In *Parking Structures*, Mary Smith of Walker Parking Consultants/Engineers shows that both surface parking and above-ground structured parking costs about $12,000 per space if the price of land is $30 per square foot. (See "Planning for Structured Parking," in Anthony Chrest, Mary Smith, Sam Bhuyan, Donald Monahan, and Mohammad Iqbal, *Parking Structures*, Third Edition, Boston: Kluwer Academic Publishers.) Structured parking is cheaper than surface parking at land prices above $30 per square foot ($330 per square meter or $1.3 million per acre).

The vast deserts of surface parking lots in many cities present a great opportunity as land banks

for future redevelopment. Urban designer Jonathan Barnett explains how land can be reclaimed from surface parking by building parking structures:

> A garage can absorb five or six acres of [surface] parking while occupying less than an acre itself ... the cost of decanting the [surface] parking [into a garage] becomes the cost for the land that is made available. (*Redesigning Cities: Principles, Practice, Implementation,* Chicago: Planners Press, 2003, p. 54-55).

We can calculate the cost of recovering land from surface parking by building garages. An acre of surface parking contains about 130 parking spaces (at 330 square feet per parking space), so a six-acre lot will hold 780 spaces. If all 780 parking spaces are stacked on six levels in a garage that covers only one acre, the remaining five acres of land become available for development, without any reduction in the parking supply. If the construction cost is $10,000 per space, the total cost will be $7.8 million. The cost of the five vacated acres of land formerly used for surface parking is thus $1.6 million an acre ($7,800,000 ÷ 5 acres = $1,560,000), or $36 a square foot.

Appendix E in *The High Cost of Free Parking* compares the cost of surface and structured parking.

Question from Terry Spence, AICP, Member of the Environmental Quality Advisory Council, Fairfax County, Virginia:

How can the availability of parking impact the number of single-car drivers?

Answer from author Donald Shoup:

Thanks for your succinct question.

The price of parking strongly affects travel choices, and the availability of free parking is invitation to drive to work alone. Free parking is the most common fringe benefit offered to workers in the US, and 95 percent of American automobile commuters park free at work. Almost every commuter who can choose between a private car and public transit will drive to work if there is free parking at work. Free parking at work helps explain why 91 percent of all commuters drive to work, and why 93 percent of their cars have only one occupant.

Many solo drivers who park free would drive to work alone even if they had to pay for parking. But some solo drivers who park free would carpool, ride public transit, walk, or bike to work if they had to pay for parking; these commuters drive to work alone because they can park free. Case studies and statistical models suggest that, when compared with driver-paid parking, employer-paid parking increases the number of cars commuters drive to work by about 33 percent.

Some employers offer commuters the option to take the cash equivalent of any parking subsidy offered. The choice between a parking subsidy or its cash equivalent shows that "free parking" has an opportunity cost-the forgone cash. The option to cash out a parking subsidy thus raises the effective price of commuter parking without charging for it. Commuters can continue to park free at work, but the cash option also rewards commuters who carpool, ride public transit, walk, or bike to work.

California requires many employers to offer parking cash-out. This requirement applies only to employers who rent their parking spaces from a third party, so the employer breaks even when a commuter forgoes a rented parking space and takes the cash. Case studies of employers who offer parking cash out in Southern California show that it reduced vehicle travel to work by 12 percent-equivalent to removing one of every eight cars from the road during peak commute hours. By reducing vehicle travel, it also reduced vehicle emissions by 12 percent. Parking cash out cost the employers only $2 a month per employee because they saved almost as much on parking as they paid in cash to commuters. Federal and state income tax revenues increased by $65 a year per employee because many commuters voluntarily traded their tax-exempt parking subsidies for taxable cash. Employers said that parking cash out is simple and fair, and that it helps recruit and retain workers. Parking cash out thus produces benefits for commuters, employers, taxpayers, cities, and the environment. It accomplishes all these goals simply by letting commuters choose how to spend their own money.

Planning Advisory Service Report 532, *Parking Cash Out*, summarizes the research on how the price of parking affects commuting choices.

Question from Roy Lopata, Planning Director, Newark, Delaware:

Do you think that "cash in lieu of off-street spaces" systems, used by some communities to encourage quality downtown redevelopment is a hybrid form of pricing for parking? By the way, the Newark Planning Department, in addition to its traditional land-use regulatory role, administers downtown off-street parking in our community.

Answer from author Donald Shoup:

In-lieu fees allow cities to price parking, but they are mainly a new way to subsidize parking. Some cities give developers the option to pay a fee in lieu of providing the required parking spaces. The cities then use the revenue to provide public parking spaces to replace the private parking spaces that the developers would have provided. These in-lieu fees give developers an alternative to providing the required parking spaces on-site.

Chapter 9 in *The High Cost of Free Parking* explains and analyzes in-lieu fees. To learn about in-lieu programs, I surveyed planning officials in 47 cities that offer them: 24 in the United States, seven in Canada, six in the United Kingdom, six in Germany, two in South Africa, and one in Iceland. I consulted the officials who administer the in-lieu fees, and examined the fee ordinances and supporting documents.

Planning officials reported that in-lieu fees provide several benefits for both cities and developers. These benefits fall into seven categories:

1. *Flexibility.* Developers gain a new option. If providing all the required parking spaces on-site would be difficult or too expensive, developers can instead pay the in-lieu fee.

2. *Shared Parking.* Public parking spaces built with the in-lieu revenue allow shared use among different sites whose peak parking demands occur at different times (a bank and a bar, for example), and fewer spaces are needed to meet the combined peak parking demands.

3. *Park Once.* When all businesses have individual parking lots, they want only their customers to park there. Once customers have left the store, the owners want them out of the lot as soon as possible, requiring the customers to drive to another private lot in order to make a second stop in a nearby business. Shared public parking allows drivers to park once and visit multiple sites on foot, thereby reducing vehicle traffic and increasing foot traffic.

4. *Historic Preservation.* Parking requirements can discourage adaptive reuse of historic buildings if the additional parking spaces required for a new use are difficult to provide on-site. By removing the requirement for on-site parking spaces, in-lieu fees make it easier to restore historic buildings and rehabilitate historic areas. The owner of an old brownstone, for instance, may want to rehabilitate it and turn it into a restaurant, but cannot because it lacks the required parking. Without the in-lieu option, the building may stay unused, or — worse yet — be torn down and replaced by a parking lot. With the in-lieu option, the building is restored and the neighborhood gets a new place to eat.

5. *Consolidation.* Some cities also allow developers and property owners to pay in-lieu fees to remove the existing required parking spaces. This option consolidates scattered parking spaces, assists infill development, improves urban design, and encourages conversion of parking lots to higher-and-better uses that provide more services, yield more revenue, and employ more people. All property owners, not just developers, can use more of their land for buildings and less for parking.

6. *Fewer Variances.* Where providing the required parking is difficult, developers often request variances to reduce the parking requirements for their sites. These variances weaken the general plan, require administration, and create unearned economic windfalls for some developers but not others. By making fewer variances necessary, in-lieu fees allow cities to create a level playing field for all developers.

7. *Better Urban Design.* Parking requirements typically result in surface parking lots for smaller buildings that cannot support their own parking garages. Because in-lieu fees allow stores to meet their parking requirements without on-site parking, they allow continuous storefronts without "dead" gaps created by parking lots. Developers can undertake infill projects without assembling large parcels for on-site parking, and architects have greater design freedom. The public parking structures consume less land than would be required if each site provided an on-site parking lot, and cities can place the structures where they interfere least with vehicle and pedestrian circulation. To improve the streetscape, some cities dedicate the first floor of public parking structures to retail uses. The in-lieu policy thus contributes to a better looking, safer, and more walkable city.

Planners in most of the surveyed cities said that the in-lieu fees have become a form of administrative relief for developers who find it difficult to provide the required parking on site. In practice, the in-lieu fees give developers an alternative to providing expensive on-site parking spaces, and the shared public parking gives downtown the park-once advantages of shopping malls.

In response to your question about in-lieu fees and pricing, the city can charge for parking in the public spaces financed by the in-lieu fees. One common practice in public parking garages financed by in-lieu fees is to offer one or two hours of free parking, and to charge for any additional time parked. So I would add the ability to price parking to the previous seven advantages that I listed.

By putting an official dollar value on the cost of parking spaces, the in-lieu fees produce an unintended side effect: they reveal the cost of satisfying the off-street parking requirements. The cost of providing the required parking is usually bundled into the total cost of development with no separate accounting, but the in-lieu fees put the cost of required parking spaces out in the open. We can therefore use the in-lieu fees to estimate the cost of satisfying a city's parking requirement. This estimate can be called the "parking impact fee" implicit in the off-street parking requirement. The simplest way to explain a parking impact fee is to calculate it for one land use — office buildings.

The parking impact fee imposed by a parking requirement depends on (1) the number of parking spaces required, and (2) the in-lieu fee per space.

To see how a parking requirement and an in-lieu fee are equivalent to an impact fee, consider the in-lieu program in Palo Alto, California. Palo Alto requires four spaces per 1,000 square feet of floor area, and in 2002 its in-lieu fee was $50,994 per space. A developer who provides no parking must pay the city an in-lieu fee of $203,976 per 1,000 square feet of office space ($50,994 x 4), or $204 per square foot ($203,976) 1,000).

The parking requirement and the in-lieu fee together are therefore equivalent to an impact fee of $204 per square foot of office space. In-lieu fees do not impose any burden on urban development; they merely give developers a new option that can reduce the burden of meeting a parking requirement. Parking requirements impose the burden on development, and the in-lieu fees quantify it. Normally, the cost parking is hidden in the overall cost of development, but the in-lieu fees expose the extraordinarily high cost of providing all the required parking spaces.

As with most impact fees, it is not clear exactly who pays for the required parking, but someone has to — landowners, investors, workers, developers, and users of real estate. It is clear that drivers don't pay, and it would be a mistake to assume that, because drivers don't pay, nobody pays. The cost of parking doesn't cease to exist just because drivers park free. Given the high cost of required parking spaces, and their harmful consequences, planners should not uncritically assume that the demand for parking automatically justifies off-street parking requirements. Demand depends on price, but planners rarely think about the price drivers pay for parking, or what the required spaces cost.

Drivers park free for 99 percent of their trips, and parking requirements that satisfy the existing demand for parking will satisfy the demand for free parking, no matter how much it costs. In-lieu fees unveil the high cost of free parking.

Question from Randy Nicholson, Comprehensive Planning Manager, Town of Hilton Head Island, South Carolina

Because of our seasonal market, we always struggle with parking standards. We have "maximum" parking standards to reduce pervious areas and provide additional greenspace. Developers tell us tenants go where parking is convenient for customers. Developers try to provide more spaces than our standards allow. Why would developers give up parking, knowing the tenant may just move down the street where the parking is plentiful and his customer parks out front?

P.S.: Developers of Bethesda Row in Maryland, a poster child for CNU, notes they were successful because most of the parking was provided by Montgomery County. The developer's website notes:

> ***Public Parking***
> *There are 17 public garages or lots with over 6,600 spaces and 766 on-street meters within walking distance of the movies, shops and restaurants. Garage and lot public parking is FREE on Saturdays, Sunday and holidays. On the street, parking is FREE on Sundays and holidays only. Remember, be sure to read all signs and check the meter color code system. Copper meters have a one-hour time limit, blue meters have two hours and silver meters have nine or more hours.*
>
> ***Private Parking***
> *Paid parking lots operated by Federal Realty are located on Bethesda Avenue behind the Rio Grande Cafe and in the old Giant parking lot, as well as on Elm Street by Jaleo.*
>
> ***Valet Parking***
> *Many restaurants offer valet parking for a reasonable fee.*

Answer from author Donald Shoup:

I can suggest several possible strategies to deal with requests to provide more parking than the city allows for a development. The city can require developers who want to provide more than the required number of spaces to:

1. *Pay the city a fee for each additional space.* This will test the strength of the developers' desire to provide more parking.

2. *Put all their parking underground.*

3. *Reduce parking demand before they are allowed to increase their parking supply.* For example, a development's owners could be required to offer free transit passes to every employee as a condition for increasing the parking supply. The free transit passes may reduce parking demand by enough so the developer would not want to increase the parking supply. Hotels could be required to offer free transit passes to all guests.

4. *Unbundle all parking in the development.* That is, the developer's owners would have to charge tenants separately for parking. Employers would have to charge employees for parking. Hotels would have to charge guests separately for parking. For example, Bellevue, Washington, requires downtown office buildings with more than 50,000 square feet to identify the cost of parking as a separate line item in all leases, with the minimum monthly rate per space not less than twice the price of a bus pass. Because the price of a bus pass was $72 a month in 2003, the minimum price of a leased parking space was $144 a month. This lease rate for parking does not increase the overall cost of occupying office space in a building because the payment for the office space itself declines as a result. In other words, unbundling separates the rent for offices and parking, but does not increase their sum. Bellevue's unbundling policy makes parking cash out easy for employers and profitable for commuters. If more cities require unbundled parking in leases, many more employers will be able to offer parking cash out, and many more commuters will carpool, ride the bus, walk, or bike to work.

Question from Mike Brusseau:

Our firm was hired to evaluate the impacts at build-out of a small, somewhat isolated coastal community in New York. The community contains roughly 6,000 residents and has a traditional "Main Street" business district.

Our client has asked us to investigate such things as impacts to: water, sewage disposal, emergency services, the local school district and street system, the environment, housing stock, and others. One issue that has arisen is the potential impact of projected residential growth on the availability of and demand for parking in the downtown. That is, there is a shortage of parking. Since the business district and community are somewhat isolated, it is anticipated that the introduction of new residents, by itself, will increase activity in the downtown, thereby exacerbating the parking shortage. (We understand we can easily estimate new parking demand needed to serve future stores and industries based on the community's off-street parking requirements outlined in its Town Code, but we have been asked to address the parking issue from a different perspective.)

We have conducted some research, and have not identified an acceptable way by which to project the number of new parking spaces needed in the downtown to serve the estimated increase in population in the community.

Do you have any suggestions in terms of a suitable methodology or could you point us toward resources that may be helpful? One avenue we considered involves trying to find information about the average number of trips per week per household for groceries, dining, recreation, parks and entertainment, library, town hall, etc.

Answer from author Donald Shoup:

I cannot recommend an acceptable way to project the number of new parking spaces needed in the downtown to serve the estimated increase in population in the community. And I strongly advise against trying to load the cost of downtown parking onto the cost of new housing.

Trying to impose the cost of commercial parking in the downtown onto the cost of new housing outside the downtown exemplifies one of the worst tendencies in American urban planning. Cities try to make everyone except drivers pay for parking. Cities require off-street parking spaces because the market supposedly fails to provide enough of them. But the market fails to provide many things at a price everyone can afford. It fails to provide affordable housing for many families, for instance, and those who argue for affordable housing usually find themselves in an uphill battle. But cities have without a second thought imposed planning requirements to ensure affordable parking. Rather than charge fair market prices for on-street parking, cities require ample off-street parking for every land use. As a result, most of us drive almost everywhere we go.

Parking profoundly affects the markets for both transportation and land, but is treated as an afterthought, and the idea of adding downtown parking to the existing off-street parking requirements for suburban housing is dangerous nonsense. Off-street parking requirements increase the cost of housing, subsidize cars, distort transportation choices, encourage sprawl, burden low-income households, damage the economy, and degrade the environment. Off-street parking requirements are a disease masquerading as a cure. In city planning, free parking has become more important than affordable housing.

Parking requirements bundle the cost of parking spaces into the cost of dwelling units, and therefore shift the cost of parking a car into the cost of renting or owning a home — making cars more affordable but housing more expensive. The higher the parking requirement, the higher the cost of housing. When the U.S. Census Bureau surveyed owners and managers of multifamily rental housing to learn which governmental regulations made their operations most difficult, parking requirements were cited more frequently than any other regulation except property taxes.

Parking requirements are now firmly ensconced in planning practice, but experience suggests that future planners may regret them. Urban planners had a habit in the 1950s and 1960s of hurling themselves with gusto into implementing some truly bad ideas. High-rise public housing projects were once state-of-the-art, but many cities have demolished them. Urban renewal (which Jane Jacobs compared to bloodletting) was once the best hope of downtowns, but most cities have abandoned it in favor of historic preservation. Similarly, some cities have shifted from minimum parking requirements to parking caps, and other cities may follow. Consider also these 180-degree turns in transportation planning.

In the 1950s, many cities created one-way street systems to speed traffic through downtowns, and in the 1990s converted them back to two-way streets to calm traffic. Similarly, in the 1950s, many cities eliminated on-street parking in downtowns to reduce congestion, and built off-street parking to replace it. In the 1990s, a common strategy was to restore on-street parking to calm traffic, and to redevelop off-street parking lots to increase downtown density. We do eventually recognize our mistakes, and we may some day condemn off-street parking requirements just as we now condemn the public housing and urban renewal disasters of the 20th century.

I don't know if your client is the city or the developer, but I would urge the city to abandon the unwise notion of trying to load the cost of downtown parking onto the cost of new housing elsewhere in the city. Chapter 5 in *The High Cost of Free Parking* discusses how parking requirements drive up the cost of housing, and it presents ample evidence to use in the case you ask about.

Question from Stephen J. Kerlin, AICP, Director of Planning and Economic Development, Town of Ashland, Massachusetts:

Our community of 15,000 has a hamlet-style downtown. There are municipal parking lots for 125 plus spaces in this area. Nevertheless, there is no required parking requirements downtown. We are in the process of rezoning downtown into a mixed use environment with greater density with upper story usage. We need to establish some minimum requirements for parking without infringing on current businesses and their lack of off-street parking. Any thoughts?

Answer from author Donald Shoup:

A hamlet-style downtown sounds delightful, and I hope you can preserve it. But I don't think off-street parking requirements will help. Quite the opposite. Off-street parking requirements will reduce the land available for both shops and housing, and will increase the cost of adding housing.

Developers, landowners, and merchants all have ample incentives to provide enough parking for their customers and tenants. To preserve your downtown while increasing density, I suggest requiring better parking *design* rather than more parking *spaces*.

The market gives developers a strong incentive to provide adequate parking because lenders may be unwilling to finance projects with inadequate parking and tenants may be unwilling to rent space in them. But the market provides little incentive to improve parking design. Developers are more likely to spend money on a marble-veneered lobby (which will increase the value of the building) rather than on landscaping the parking lot (which will increase the value of the whole neighborhood). If you have an urban design framework guiding the character of the built environment, quality-based parking requirements can reinforce the desired character of each neighborhood.

Quality-based requirements can be quite simple. Here is an ordinance that prohibits parking lots from dominating the streets in commercial districts:

> No parking shall be located between the building and the front property line. On corner lots, no parking shall be located between the building and either of the two (2) front

property lines. (City of SeaTac, Washington)

More ideas about improving the design of parking are included in Chapter 3 of *The High Cost of Free Parking* and in an article, "Quantity versus Quality in Off-Street Parking Requirements," forthcoming in the *Journal of the American Planning Association.*

But I understand that citizens will worry about how higher density will increase the demand for parking. What can you do to ensure that this increased demand will not create a parking shortage? I suggest that you consider these two policies: (1) charge performance-based prices for curb parking, and (2) return the revenue to pay for added public services. These two policies can improve parking and increase the economic vitality of your downtown.

Performance-based parking prices

Performance-based prices will balance the varying demand for parking with the fixed supply of spaces. We can call this balance between demand and supply the Goldilocks principle of performance-based parking prices: The price is too high if many spaces are vacant, and too low if no spaces are vacant. When a few vacant spaces are available everywhere, the prices are just right. If prices are adjusted to yield one or two vacant spaces in every block (about 85 percent occupancy), everyone will see that curb parking is readily available. No one can say that performance-based parking prices will drive customers away if most curb spaces are occupied all the time.

Prices that produce an occupancy rate of about 85 percent can be called performance-based for three reasons. First, curb parking will perform efficiently. Most spaces will be occupied, but drivers will always be able to find a vacant space. Second, the transportation system will perform efficiently. Cruising for curb parking will not congest traffic, waste fuel, and pollute the air. Third, the economy will perform efficiently. The price of parking will be higher when demand is higher, and this higher price will encourage rapid parking turnover. Drivers will park, buy something, and leave quickly so that other drivers can use the spaces. For parking, transportation, and economic efficiency, cities should set prices to yield about an 85 percent occupancy rate.

Local revenue return

Performance-based prices for curb parking can yield ample public revenue. If the city returns this revenue to pay for added public spending on the metered streets, residents and local merchants will support the performance-based prices. The added funds can pay to clean and maintain the sidewalks, plant trees, improve lighting, bury overhead utility wires, remove graffiti, and provide other public improvements.

Put yourself in the shoes of a merchant in an older business district where curb parking is free and customers complain about a parking shortage. Suppose the city installs meters and charges prices that produce a few vacancies. Everyone who wants to shop in the district can park quickly, and the meter money is spent to clean the sidewalks and provide security. These added public services make the business district a place where people want to be, rather than merely a place where anyone can park free if they can find a space. Returning the meter revenue generated *by* the district *to* the district *for* the district can convince merchants and property owners to support the idea of performance-based prices for curb parking.

Performance-based prices will improve curb parking by creating a few vacancies, the added meter revenue will pay to improve public services, and these added public services will create political support for performance-based prices. And curb parking will always be free if there is no shortage at a zero price.

Redwood City, California, sets performance-based prices to achieve an 85 percent occupancy rate in its downtown, and it returns the parking revenue to pay for added public services in the downtown. Once the merchants and property owners understood that the downtown would receive its meter revenue, they strongly supported the policy, and the city council adopted the program unanimously. Here is a link to the ordinance: **http://shoup.bol.ucla.edu/Redwood%20City.pdf**.

Here is a link to a short article on how parking meters with local revenue return have sparked a commercial revival in Old Pasadena: **http://shoup.bol.ucla.edu/SmallChange.pdf.**

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Parking Spaces / Community Places

Finding the Balance through Smart Growth Solutions

Development, Community, and Environment Division (1807T)
U.S. Environmental Protection Agency
Washington, DC 20460

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January 2006

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Beyond Generic Parking Requirements

In calculating parking requirements, planners typically use generic standards that apply to individual land-use categories, such as residences, offices, and shopping. The most commonly used guidelines, issued by the Institute of Transportation Engineers in the Parking Generation Handbook (ITE, 2004), are based on observations of peak demand for parking at single-use developments in relatively low-density settings with little transit (Shoup, 2005). In such places, the destinations are widely separated, parking is typically free, and walking, biking, and transit are not available. As a result, planners assume in effect that every adult has a car, every employee drives to work, and every party visiting a restaurant arrives by car. Under these conditions, parking can take up more than 50 percent of the land used in a development (see figure). For more compact, mixed-use, walkable places, these standards end up calling for far more parking than is needed.

A surplus of parking really can be too much of a good thing. It creates a 'dead zone' of empty parking lots in the middle of what ought to be a bustling commercial district or neighborhood. This dead zone means there is less room for the offices and homes that would supply a steady stream of office workers and residents who might patronize businesses in the area -- and less room to cluster other businesses that will attract more foot traffic. Requiring more parking than the market actually demands adds substantial costs to development and redevelopment, and in some cases the added costs will prevent development altogether. For example, the future site of the D'Orsay Hotel in a prime location in Long Beach, California sat for years as a low-revenue parking lot -- every developer who considered building on it was stopped in part by the high cost of building a garage to fulfill the city's minimum parking requirement. It is under development today as a hotel and retail complex in large part because innovative strategies reduced the parking burden on the developer. See page 52 for the full case study.

Most planners surveyed relied on neighboring cities and national handbooks to determine parking requirements. This practice may result in inappropriate requirements if local conditions or policy approaches differ.

— Michael Kodama, Michael R. Kodama Planning Associates

Parking requirements are often copied from one jurisdiction to another, and so are remarkably consistent across different cities. Generic standards do not take into account the many highly local variables that influence parking, such as density, demographics, availability of public transit, potential for biking and walking, or the availability of other parking nearby. The obvious results of such rigid requirements are big empty parking lots -- and they can also result in empty buildings. Perfectly useable space in older buildings with limited or no on-site parking may prove unrentable, because the businesses that would like to locate there are unable to meet high minimum parking requirements. The buildings remain vacant, thwarting redevelopment plans (Shoup, 2005).

Generic parking standards have simply not kept up the complexity of mod-

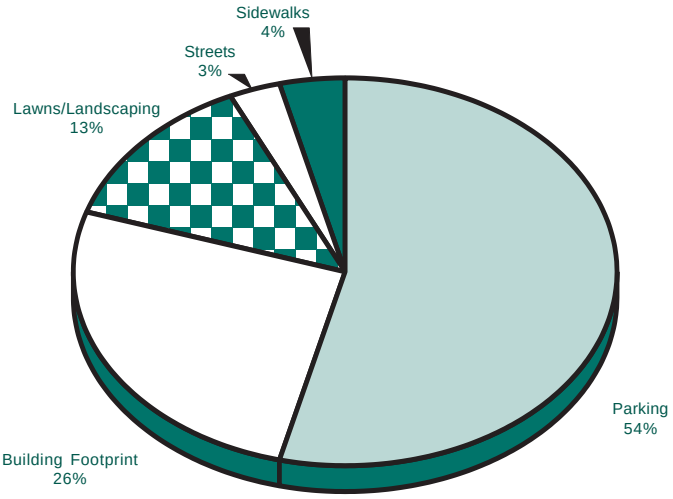
ern mixed-use development and redevelopment. But parking requirements can be altered to allow planners to better measure the true demand for parking and to balance parking with wider community goals. This approach entails careful consideration of land-use and transportation characteristics that relate to parking demand. Successful examples consider the following factors.

■ **Development type and size.** Take into account the specific characteristics of the project: is there a large theatre that requires evening parking, or will small shops attract short-term, daytime patronage? Can the two share parking spaces? Parking demand is of course also influenced by the size of the development, which is typically measured by total building square footage.

■ **Development density and design.** Consider the density of the development. Research shows that each time residential density doubles, auto ownership falls by 32 to 40 percent (Holtzclaw et al. 2002). Higher densities mean that destinations are closer together, and more places can be reached on foot and by bicycle—reducing the need to own a car. Density is also closely associated with other factors that influence car ownership, such as the presence of good transit service, the community's ability to support stores located in neighborhoods, and even the walkability of neighborhood streets.

■ **Demographics.** Consider the characteristics of the people using

Site Coverage
for Typical Commercial Development
(averages for Olympia, Washington)



Source: City of Olympia Public Works Department, and the Washington State Department of Ecology, 1995.

In the process of establishing parking requirements, local communities are sometimes engaged in a balancing act. They must consider access, mobility, and traffic safety, but they also must encourage appropriate land use and traffic management, environmental protection, and energy and resource conservation.

— Thomas P. Smith
"Flexible Parking Requirements"
Planners Advisory Service Report 377

the development, including employees, customers, residents, and visitors. People of different incomes and ages tend to have different car ownership rates.

- **Availability of transportation choices.** Take into account the modes of transportation available to employees, visitors, and residents. Access to public transportation in a particular development, for example, can reduce parking demand. Walkable neighborhoods and bicycle amenities can also reduce parking demand.

- **Surrounding land-use mix.** Consider the neighboring land uses and density to better understand parking needs. For example, an office building parking lot will be empty when the restaurant next door is packed, so requiring both to provide for 100 percent of their parking needs simply wastes space.

- **Off-site parking.** Consider the parking that is already available nearby: on the street, on nearby properties, or in public garages that may be available for users of a new development. On-street parking can be considered to reduce the amount of on-site parking required for new development, or as a reserve should new uses require more parking than expected. On street parking has the added benefit of acting as a buffer between pedestrians and traffic, increasing the attractiveness of walking.

Land use and demographic information are important tools for establishing context-specific parking requirements that better balance supply and demand for parking.



The Costs of Parking

This section describes the costs of providing parking, both in terms of financial and environmental health. While parking is necessary, providing too much of it can exert a high cost, so understandings its impact is important. That impact can vary considerably with the amount and type of parking provided, and the types of development being served.

Financial Costs

The financial cost of providing parking is driven by three key factors: the number of parking spaces required, the 'opportunity cost' of the land used for parking, and the cost per parking space[1]. Parking requirements that assume suburban levels of demand in urban locations may necessitate large surface lots or parking garages, unnecessarily increasing the cost of infill and other compact development. The opportunity cost is the cost of using a space for parking instead of for a use with higher value. This varies considerably depending on the development context. In infill locations, the opportunity cost can be quite high, as each on-site parking space can reduce the number of new housing units or other users by 25 percent or more (Transportation and Land Use Coalition, 2002).

The cost per space depends on engineering and design considerations. Cost per parking space includes land, construction, maintenance, utilities, insurance, administrative, and operation costs (Tumlin and Siegman, 1993). The per-space costs tend to be higher in infill locations, providing a strong incentive for avoiding a parking surplus. Towns that are trying to encourage infill development or compact new suburbs can help spur those activities by accurately gauging parking demand. In general, the following factors affect the cost per space of parking:

- **Structured versus surface parking.** Parking garages are more costly to construct, operate, and maintain than surface parking lots, but can be desirable in urban locations seeking to create a more walkable environment. For example, Shoup (1998) reports construction costs of over $29,000 per space for a structured garage in Walnut Creek, California, against perhaps $2,000 per space to construct surface parking. Underground parking structures are more costly to construct than above-ground structures because of the added expense of excavation and required engineering.

Ignoring both the cost of providing parking spaces and the price charged for parking in them, urban planners thus set minimum parking requirements to satisfy maximum parking demand.

— Donald Shoup
Department of Urban Planning, UCLA

[1] All costs are updated to 2004 dollars. Costs include various components as noted. Where amortized, they assume a 7.5% interest rate over a 30-year period, and annual operating costs.

- **Land cost.** Land costs vary widely across settings (urban/suburban), geographic areas, and location within a particular city. Land costs in urban centers are generally much higher than in suburban areas. For example, in 1997 the cost per square foot of land in downtown Charlotte, North Carolina, was $121, while suburban land cost $21 (ULI, 1997). Higher land costs make the efficient supply and use of parking critical to development and redevelopment in urban areas.

- **Configuration and size of parking facility.** Parking structures and lots are more expensive to build and operate on smaller lots and complex land configurations, due in part to economies of scale. For example, smaller garages have higher costs per parking space because of the fixed capital costs (e.g., stairwells, ramps, and elevators) and fixed operating costs. These characteristics—smaller lots and more complex land configurations—are typical of urban areas, making parking more expensive at these locations.



- **Geologic conditions.** Parking structures on land with more sensitive seismic conditions or land with difficult terrain also cost more per parking space because they require more complex engineering and construction design. While geologic conditions vary across the country, developers have a greater choice of sites when considering development in suburban and rural areas. Sites in urban areas are more limited, and terrain with geologic constraints may be more difficult to avoid.

Land and construction costs, which account for most of the costs of parking, vary considerably across cities and parking designs. Construction costs alone also range widely due to building codes, materials, and labor costs, but per space construction costs for structures (above- or below-grade) are typically much higher than for surface lots. Willson (1995) expresses parking costs in terms of a monthly amount that would pay for the land, construction, and operating costs of providing a parking space. The reported monthly cost calculated for six surface parking sites in Southern California ranged from $50 to $110 per space, with an average of $86. The average cost for two sites in Southern California with above ground structured parking was $175 per space per month. Litman (2004) analyzes cost-recovery thresholds for parking under various scenarios, finding a range from $20 to nearly $200 per month to finance, build, operate, and maintain a parking space. With such wide variability, national averages, especially those including land costs, clearly do not have much meaning. This underlines the

importance of looking at costs for a specific area when assessing potential savings from reducing oversupply.

Environmental Costs

In addition to tangible financial costs, parking has 'external' costs that affect the natural environment and the surrounding community, and these are typically not factored into development decisions. Parking lots and garages themselves have a direct impact on the environment, and they can affect the environment indirectly by cutting off transportation choices, encouraging driving that pollutes the environment.

Direct environmental impacts include: degraded water quality, stormwater management problems, exacerbated heat island effects, and excessive land consumption. Construction of surface parking often paves ground that once absorbed and filtered rainwater. This increases stormwater runoff, which can result in more flooding. The oil and other pollutants washed off the parking lot exacerbate water pollution. Dark pavement can artificially raise air temperature, resulting in 'heat islands' that raise air-conditioning bills. In undeveloped areas, forests, wetlands and other natural features should be considered part of a region's "green infrastructure" that process stormwater, clean the air, and provide wildlife habitat. Ensuring that parking areas are sized to a development's actual needs instead of to a generic requirement can preserve this infrastructure.

Parking also indirectly affects the environment, primarily because parking influences how and where people choose to travel. In conventional low-density, single-use development, the required large surface parking lots create places that are not friendly to pedestrians or transit. These places also require more and longer trips between homes, workplaces, schools, shops, and parks. As a result, people make the rational choice to drive almost everywhere -- and these areas register more vehicle miles of travel per capita. Increases in travel rates are associated with increased emissions of pollutants, including carbon monoxide and the pollutants that contribute to dangerous ground-level ozone. Air pollution is associated with asthma and many other health problems, driving up health-care costs.

Compact development that mix uses can reduce the need for surface parking, preserving green infrastructure while also reducing the amount of driving necessary for community residents. By creating an environment that supports the efficient use of parking, such development can also lead to better balance between parking needs and other community goals.

For further discussion of the environmental impact of development patterns, see *Our Built and Natural Environments: A Technical Review of the Interactions between Land Use, Transportation and Environmental Quality* (EPA, 2001a).

Innovative Parking Alternatives

As local governments respond to public demand for better development patterns, many have created alternatives to inflexible minimum parking requirements. The alternatives are aimed at avoiding an oversupply of parking, minimizing parking demand, or using the power of the marketplace to regulate parking. In areas of existing development, avoiding oversupply encourages better use of existing parking facilities and better evaluation of parking needs. Other policies give people an alternative to driving, and so reduce the demand for parking. And market-based pricing systems can help better match demand and supply, ensuring expensive parking spaces are used efficiently. Some of these strategies have lowered total development costs, further encouraging compact, mixed-use development patterns that moderate parking demand.

This section presents a selection of policies that make parking requirements more flexible. It includes a discussion of how and why these alternatives were developed, their advantages and limitations, and real-world examples. Each application has its own unique characteristics, and this diversity makes it impossible to isolate the costs and benefits of specific policies. The discussion presented here is not intended to portray any specific policy as universally applicable. Rather, community context should always be considered when balancing parking with other goals.

Strategies That Work

Parking Alternative	Example Location
Context-Specific Requirements	Montgomery County, Maryland Milwaukee, Wisconsin Los Angeles, California Eugene, Oregon Seattle, Washington Boston, Massachusetts
Centralized Parking, In-Lieu Fees	Miami, Florida Chattanooga, Tennessee West Palm Beach, Florida
Shared Parking	Long Beach, California Indianapolis, Indiana
Other Supply Strategies	Portland, Oregon Redmond, Washington Iowa City, Iowa
Land Banking and Landscape Reserves	Portland, Oregon Palo Alto, California Carmel, California Cleveland, Ohio Iowa City, Iowa
Car-Sharing	Boston, Massachusetts Washington, DC San Francisco, California Seattle, Washington Boulder, Colorado
Subsidies for Transit	Boulder, Colorado Santa Clara County, California San Bernardino County, California Montgomery County, Maryland
Transit Improvements	Portland, Oregon Chattanooga, Tennessee
Pedestrian and Bicycle Facilities	Schaumburg, Illinois Kendall, Florida
Transportation Demand Management Programs	Cambridge, Massachusetts Seattle, Washington Montgomery County, Maryland
Pricing Strategies	Los Angeles, California Santa Monica, California San Diego, California Pasadena, California

Reduce Oversupply

As discussed earlier, in communities working to create mixed-use, compact, walkable places, inflexible application of conventional minimum parking requirements tends to create an oversupply of parking. This creates unnecessary environmental impacts and fi-

nancial costs. The strategies discussed below can reduce the supply of parking while still effectively meeting demand.

Context-Specific Standards

Setting parking standards to fit the particular context of a neighborhood or development is a challenge planners are just beginning to tackle. As discussed earlier, parking requirements are often applied for each land use city wide, and so lack the flexibility needed to address different parking needs.

A major challenge for city planners is how to make codes more flexible and sensitive to specific local conditions, but still provide the predictability desired by developers. Codifying reductions in parking requirements provides the greatest certainty for governments, citizens and neighbors, and developers, and enables all to plan for balancing parking with other development goals. When the reductions in parking requirements are clearly stated in the codes, developments are less likely to be held up in the permitting process or challenged by local residents. Planners need to develop an understanding of local parking markets, combine this with experience from other settings, and then create local parking requirements. Some of the mechanisms being used are:

- **Transit zoning overlays.** In areas with frequent transit service, especially those served by rail stations, fewer residents, workers, and shoppers require parking. In addition, the density and mix of uses possible around rail stations can sometimes support market-rate parking, which leads to more efficient use. Many cities find they can reduce minimum parking requirements for certain uses that are within a specified distance of a rail station or frequent bus route. For example, Montgomery County, Maryland reduces parking requirements by as much as 20 percent, depending on distance from a Metrorail station. Parking are only one aspect of transit zoning overlays, which often address issues such as density, design, and allowable uses. Codes may encourage shared parking in transit zones, which accommodates more cars than parking reserved solely for residents and commuters.

- **New zoning districts or**

Location- and Use-Specific Requirements

Milwaukee, Wisconsin

Milwaukee has some of the lowest city wide parking ratios anywhere in the country. Parking ratios for retail are two spaces per 1,000 square feet, compared to the Institute of Transportation Engineers' standard of one to 300 square feet. For business uses, Milwaukee requires eight spaces for the first 2,000 square feet, and one for each subsequent 1,000 square feet. In the downtown zone, there are no minimum parking requirements for any land use except high-density housing, where the ratio is a very low two spaces per three units. The city generally discourages surface lots within the downtown and dictates that at least 50 percent of the ground floor of parking structures be used for retail.

These policies were enacted in 1986 and strengthened in October 2002 with new credits for transit-oriented development, on-street parking, and shared parking. Developments within a defined geographical area near transit (which encompasses over half of the city area) are granted reductions of up to 15 percent in the minimum requirements. Further reductions are allowed for on-street spaces adjacent to the property (up to a 1:1 space credit), and for shared parking (up to 0.75 space credit for each shared space). One to one credits are also allowed for leased parking spaces in existing lots within 750 feet of the site.

Source: Milwaukee Department of City Development, 2002.

specific plans. In compact, mixed-use, walkable neighborhoods and town centers parking requirements can frequently be lower than typical minimum requirements. Some communities have adopted designated zoning districts or neighborhood specific plans to accomplish this. Most commonly, this applies to the downtown; Milwaukee finds that parking and other goals can be met with lower parking requirements than in outlying locations. Some areas waive the minimums altogether, letting the development market decide where and how to build parking. The same techniques can be applied to neighborhoods outside of downtowns that offer frequent transit, such as Seattle's Pike/Pine district. Specific plans, which detail development requirements at the parcel level, are particularly useful to encourage infill development in older neighborhoods or on brownfield sites.

Location- and Use-Specific Requirements

Seattle, Washington

Seattle's zoning code grants reductions in minimum parking requirements based on several factors, including:

- Affordable housing. Minimum parking requirements are reduced to between 0.5 and 1.0 space per unit, depending on income, location, and size of unit.
- Senior housing and housing for people with disabilities.
- Car-sharing. Only for multi-family developments that allow dedicated on-site parking for the city's recognized car-sharing operator.
- Location. No parking minimums are set for downtown and they are reduced in mixed-use, dense neighborhoods.\

Source: Seattle Department of Transportation, 2001.

- **Parking freezes.** The amount of parking required can be directly reduced through parking freezes that cap the total number of parking spaces in a particular metropolitan district. . Cities with successful parking freezes generally have strong economies and well developed transit systems, and are attractive to tenants, customers, and visitors. Such cities can attract businesses because the benefits of the urban location outweigh the potential drawback of limited parking, and because public transit offers a viable alternative to automobile use. Downtown Boston has had a parking freeze in effect for many years in an effort to control driving and the associated emissions. Downtown San Francisco has applied a cap on commuter parking, as their downtown street network functions at capacity during rush hours, and transit and other travel options are numerous. Jurisdictions using the restrictions generally view each new parking space (commuter spaces in particular) as the generator of one more rush-hour vehicle trip, and want to limit those trips to reduce air pollution and congestion.

- **Reductions for affordable and senior housing.** Successful regions frequently struggle to provide affordable housing, as desirability and supply drive up housing prices. In many of these places, providing housing to lower-income workers and senior citizens can become an important goal. Since people with lower incomes and older people tend to own fewer vehicles parking requirements can

be reduced for below-market-rate units and senior housing. This reduces the overall cost of providing such housing, and may increase the number of units that can be provided. Los Angeles grants a reduction of 0.5 spaces per unit for deed-restricted affordable housing units, with further reductions if they are within 1,500 feet of mass transit or a major bus line.

- **Case-by-case evaluation.** Where area-wide or systematic code changes are not possible, reductions in parking requirements can be granted on a case-by-case basis, often on the condition that mitigation measures such as car-sharing (see page 23) are provided. Cities such as Eugene, Oregon specify in their zoning codes that such reductions will be granted subject to a parking study showing that the proposed provision will be adequate to meet demand.
- **Abolish requirements.** Another approach is for cities to simply abolish all parking requirements in neighborhoods that are served by a range of travel options and where surrounding residential areas are protected from spillover parking from other users (Millard-Ball, 2002). This leaves it up to developers—who have a financial interest in meeting tenants' needs while not oversupplying parking—to determine how many spaces are needed.

Maximum Limits and Transferable Parking Entitlements

Maximum limits turn conventional parking requirements upside down by restricting the total number of spaces that can be constructed. Planners set maximum limits much as they set minimum requirements. Typically, a maximum number of spaces is based on the square footage of a specific land use. For example, Portland, Oregon, allows buildings in the central business district a maximum of 0.7 parking spaces per 1,000 square feet of office space, and 1.0 space per 1,000 square feet of net building area for retail.

The generous parking capacity required by planners often goes unused. Studying office buildings in ten California cities, Richard Willson (1995) found that the peak parking demand averaged only 56 percent of capacity.
— Donald Shoup, UCLA

Communities can make maximum parking requirements more flexible by introducing transferable parking entitlements, as in Portland Oregon. The allowed number of parking spaces for a particular development are an "entitlement" that can be transferred or sold to another development if they are unused. This policy enables cities to control the parking supply, without restricting developments that would not be feasible without additional parking. Projects that require more parking can proceed, while those that need less parking can benefit by selling their rights, or negotiating shared parking agreements for their employees or customers.

Portland's planners are using parking maximums in an attempt to "improve mobility, promote the use of alternative modes, support existing and new economic development, maintain air quality, and enhance the urban form of the Central City" (City of Portland, 1999). By combining maximums with transferable parking entitlements, Portland's downtown provides ample

parking for retail and other priority uses, along with market-rate commuter parking, in a compact, walkable area with a mix of uses and transportation choices.

Both planners and developers benefit from restricting the number of parking spaces allowed. From the city's perspective, maximum limits:

- Improve the urban environment by preserving open space and limiting impervious surfaces;
- Reduce congestion;
- Encourage attractive, pedestrian-friendly urban design; and
- Promote transportation choices.

From the developer's perspective, maximum limits:

- Minimize costs for parking construction, operations, and maintenance;
- Reduce traffic and traffic-related costs; and
- Allow development at a greater floor-to-area ratio, increasing leasable space.

There are challenges to setting and maintaining maximum limits. Planners must consider possible spillover parking in surrounding residential neighborhoods if parking in those areas is free.. To avoid such spillover, developers must understand the factors that affect parking demand and ensure that viable transportation choices exist. A common policy for preventing parking spillover into residential areas is to implement residential parking permit programs, but these have drawbacks (see discussion of parking benefit districts on page 33). Changes in frequency or routing of transit, increases or decreases in development densities, or changes in land use can all influence the demand for parking in the neighborhood.

Linking Maximum Limits and Transit Improvements
Portland, Oregon

In Portland, Oregon, maximum parking 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 in Goose Hollow, located several blocks from the transit mall, is allowed 2.0 spaces per 1,000 square feet.

These maximum limits have not been problematic to developers. In fact, property values and customer volume in the parking-restricted areas near transit stations are higher than in other areas. In a 1987 survey of 54 businesses located near light rail transit, 66 percent of business owners said that their businesses had been helped because they were located near public transit; 54 percent reported increased sales volumes as a result of being located near transit, in spite of reduced parking supply.

Source: Tri-County Metropolitan Transportation District of Oregon, 1999.

With restrictive maximum limits on the number of parking spaces, developers may worry about the long-term marketability of a property. Marketability should not be a concern for competing developments in the same locale if all developments must adhere to the maximum limits. Parking restrictions that may seem to place urban areas at a disadvantage can be offset by amenities other than parking, such as convenient access to services and places of employment, attractive streetscapes, or pedestrian-friendly neighborhoods. City governments and developers should

incorporate these elements to attract businesses and residents. Maximum requirements are not ideal for all locations. Municipalities that employ maximum requirements must have accompanying accessible and frequent public transportation. It is also important for the area to be sufficiently stable economically to attract tenants without needing to provide a surplus of parking. A number of cities have implemented maximum parking requirements, including San Francisco and Seattle.

Shared Parking

The concept of shared parking is based on the simple idea that different destinations attract customers, workers, and visitors during different times of day. An office that has peak parking demand during the daytime, for example, can share the same pool of parking spaces with a restaurant whose demand peaks in the evening. The first shared parking programs arose when developers, interested in reducing development costs, successfully argued that they could accommodate all demand on site with a reduced number of spaces. The Urban Land Institute (ULI) report *Shared Parking* (2005) presented analytic methods for local governments and developers to use on specific projects, and as mixed-use projects continue to grow in number and sophistication, ULI continues to update this methodology.

Shared Parking

Circle Centre — Indianapolis, Indiana

Opened in September 1995, Circle Centre in Indianapolis' central business district offers retail and entertainment destinations. This development contains 630,600 square feet of retail space and100,000 square feet of restaurant, speciality, and entertainment space, as well as a 2,700-seat cinema. One of the factors that led to the financial success of this $300 million project was a shared parking arrangement that saved money and allowed a pedestrian-friendly design.

Under generic minimum parking requirements, Circle Centre would have needed about 6,000 parking spaces. By using shared parking, the project was built with just 2,815 spaces. Shared parking for Circle Centre is used for both customers and employees. The mixed-use nature of the development project allows customers to use a single parking space for multiple destinations within the complex. Employees can use nearby off-site parking, particularly in evenings and on weekends when more than 12,000 nearby off-site spaces that normally serve downtown office workers become available. Taking these two shared parking components into account decreases the estimated need for on-site parking by more than 50 percent.

This reduction in parking demand translates into considerable cost savings. At parking costs of about $10,000 per space for aboveground structured parking, development costs were reduced by about $30 million.. In addition, operating costs were reduced by approximately $1 million per year.

Source: Smith, 1996.

By allowing for and encouraging shared parking, planners can decrease the total number of spaces required for mixed-use developments or single-use developments in mixed-use areas. Developers benefit, not only from the decreased cost of development, but also from the "captive markets" stemming from mixed-use development. For example, office employees are a captive market for business lunches at restaurants in mixed-use developments.

Shared parking also allows for more efficient use of land and better urban design, including walkability and traffic flow. Shared parking encourages use of centralized parking lots or garages and discourages the development of many scattered small facilities. A sidewalk with fewer driveway interruptions and more shop fronts is more comfortable and interesting for pedestrians and will encourage walking. Reducing driveways also results in more efficient traffic flow because there are fewer turning opportunities on main thoroughfares. This has the added benefits of reducing accidents and reducing emissions from idling vehicles stuck in traffic.

Establishing shared parking requirements involves

site-specific assessment or use of time-of-day parking utilization curves, which were developed by the ULI in *Shared Parking.* Planners need to consider several factors when developing shared parking requirements, including the physical layout of the development; the number of spaces for each of the individual land uses; the types of parking users (e.g., employees, residents, or hotel guests who park all day, or customers and visitors who park for short periods of time); and hourly accumulation of parking for each land use.

Montgomery County, Maryland, allows for shared parking to meet minimum parking requirements when any land or building under the same ownership or under a joint-use agreement is used for two or more purposes. The county's ordinance also allows parking reductions based on proximity to transit, participation in TDM programs, or location in the central business district. The county uses the following method to determine shared requirements for mixed-use developments:

Calculating Parking for Mixed-Use Developments (Montgomery County, Maryland)

	Weekday		Weekend		Nighttime
	Daytime (9 a.m. - 4 p.m.)	Evening (6 p.m. - 12 a.m.)	Daytime (9 a.m. - 4 p.m.)	Evening (6 p.m. - 12 a.m.)	(12 a.m. - 6 a.m.)
Office	300*	30	30	15	15
Retail	168	252	280*	196	14
Entertainment	40	100*	80	100*	10
TOTAL	**508**	382	390	311	39

* Peak demand by use.
Source: Smith 1983, page 7.

- Determine the minimum amount of parking required for each land use as though it were a separate use, by time period;
- Calculate the total parking required across uses for each time period; then
- Set the requirement at the maximum total across time periods.

The table above illustrates how peak demand occurs at different times of the day and week for different land uses. While maximum parking demand for the office component of the project occurs during the daytime on weekdays, maximum demand for retail occurs during the daytime on weekends, and peak entertainment demand is in the evening. For this example, setting parking requirements using maximum demand would have resulted in requiring 680 spaces (300 spaces for office, 280 spaces for retail, and 100 spaces for entertainment). By recognizing the shared parking potential, the developer cut almost 200 unnecessary parking spaces (about 25 percent), represent-

ing a considerable cost savings.

An American Planning Association report, *Flexible Parking Requirements*, highlights factors that facilitate shared parking (Smith, 1983). The report suggests that for shared parking to function effectively, parking requirements for individual land uses must reflect peak-demand land use and common parking facilities must be near one another. Parking spaces should not be reserved for individuals or groups.

Centralized Parking
Chattanooga, Tennessee

To encourage urban development in downtown Chattanooga while limiting congestion and air pollution, the Chattanooga Area Regional Transit Authority (CARTA) developed a strategy to provide peripheral parking and a free shuttle service. The system is designed for the city's linear central business district and allows workers and visitors to drive to the city, park in one of the two peripheral garages, and use the shuttles to travel up and down the 15-block business corridor. By constructing parking at either end of the business district, CARTA intercepts commuters and visitors before they drive into and through the city center, reducing traffic congestion.

The two parking garages Shuttle Park South (550 spaces) and Shuttle Park North (650 spaces), are owned by CARTA and operated privately. The free shuttle buses are financed through the garages' parking revenues. They depart from each garage every five minutes all day, every day, and pass within walking distance of most downtown destinations.

The electric-powered shuttles transport approximately one million riders each year, making shuttle-served property attractive to businesses. Since 1992, when the shuttle service began, over $400 million has been spent on development in Chattanooga, including the successful aquarium, over 100 retail shops and over 60 restaurants. CARTA's initiatives won commendation from EPA, receiving a "Way to Go" award in 1996 for innovative transportation solutions that support urban development.

Sources: EPA, 1998; Chattanooga News Bureau, 1999.

Centralized Parking Facilities and Management

A subset of shared parking is the construction of centralized parking lots and garages. Some cities mandate centralized parking facilities and finance them through development impact fees, in lieu parking fees, or negotiated contributions established during the environmental review process. Centralized parking can be built and operated by a public entity or public/private partnership and reduce the costs of parking because large facilities are less expensive on a per space basis to build and maintain than small facilities. The example in the next chapter of Wilton Manors, Florida, is such a case.

Centralized parking facilities can meet urban design goals if they allow the elimination of small surface parking lots and driveways that interrupt the walkable fabric of mixed-use areas. Centralized parking enables travelers to park once to visit several destinations, potentially reducing on-street congestion from short trips within an area. Developers are sometimes concerned that centralized parking will be inconvenient for building occupants, but these concerns can be addressed in part by building several "centralized" facilities throughout a business district or mixed-use area. Centralized management can still ensure coordinated policies for their use, maintaining many of the advantages of centralized parking. In other cases, the operator can provide shuttle services to and from centralized garages. Many downtown areas have successfully instituted centralized parking. Some cities, such as Pittsburgh and Chattanooga (see box) operate such facilities at the periphery of the downtown, reducing traffic and mobile source emissions in the core and freeing up land in the center city for other development.

In-Lieu Parking Fees

In-lieu parking fees are one way to finance such centralized public garages and give developers flexibility in providing parking on-site. Developers

are able to avoid constructing parking on site by paying the city a fee, and the city in return provides off-site parking that is available for use by the development's tenants and visitors. The city determines the fees, generally based on the cost of providing parking.

Cities set fees 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. Shoup (2005) reports that in-lieu fees in the United States range from $2,000 to $20,000 per parking space and may or may not reflect the true costs of providing parking. These fees can be imposed as a property tax surcharge or at the time of development permitting.

In-lieu parking fees provide a mechanism for providing parking in balance with other community goals, satisfying the public as well as planners and developers. Using in-lieu fees and centralized garages can:

- Reduce overall construction costs;
- Avoid construction of awkward, unattractive on-site parking that could compromise historic buildings;
- Increase public access to convenient parking;
- Ensure that parking facilities will be used more efficiently; and
- Encourage better urban design with streetscapes uninterrupted by parking lots and driveways.

In establishing in-lieu parking fees, planners must be aware of potential developers' concerns that the lack of on-site parking will make developments less attractive to tenants and visitors. This can be an issue if available public parking is insufficient, inconveniently located, or inefficiently operated. Planners must carefully consider the parking demand for each participating property and provide enough parking to meet this demand in order to avoid creating a perceived or real parking shortage. Planners must also work to ensure that public parking facilities are located and operated in ways that support development.

In-Lieu Parking Fees

Coconut Grove — Miami, Florida

Coconut Grove is a pedestrian-oriented, entertainment, dining, and shopping village in southern Miami. To maintain Coconut Grove's continuous street frontage and keep it attractive to pedestrians, city planners established flexible parking requirements. Developers or property owners have three choices for satisfying minimum parking requirements: they can provide off-street parking, contract spaces elsewhere, or pay in-lieu fees. With little space left to develop and high land costs, most property owners choose to pay the $50 per space per month fee to the city and use the land for more productive, revenue-generating purposes. The city uses the in-lieu fees to provide shared, structured parking, improve transit service, and maintain the sidewalks and pedestrian amenities. By investing the in-lieu fees in a combination of parking and other improvements, the city helps to keep Coconut Grove walkable and maintain the attractive aesthetic character of the area.

Source: Coconut Grove Chamber of Commerce.

Accounting for Uncertainty

Estimating parking demand is not an exact science, and a few communities are setting aside land through land banking and landscape reserves that can be converted into parking if shortages arise. Landscaping can often be used to turn this set-aside land into an attractive amenity for the development

or wider community, but requiring new development to purchase additional land as insurance against uncertain parking demand imposes additional costs, which may work against community redevelopment goals.

Land banking and landscape reserves are particularly useful policies when the expected need for off-street parking for a particular use is uncertain, due to unknown or unusual operating characteristics, or if no data is available to establish need. Cities could respond by requiring the construction of parking spaces that may well sit empty. But these techniques allow supply to be determined by the best estimates, with the security that more parking can be constructed if needed. In some cases, landscape reserves can be required in conjunction with parking reductions granted in return for company plans to reduce private vehicle trips, known as Transportation Demand Management (TDM) plans. If the employer falls out of compliance with the TDM plan, they can be required to go to the expense of constructing additional parking.

Land Banking

Iowa City, Iowa, and Palo Alto, California

Both Iowa City and Palo Alto have enacted land-banking policies in their parking codes. In some neighborhood commercial zones in Iowa City, minimum parking requirements may be waived or relaxed, and land banking used in place of up to 30 percent of the otherwise required parking. If an enforcement official determines in the future that the additional parking spaces are needed, the property owner can be required to construct parking on the land banked area.

Palo Alto's code authorizes the city to defer up to 50 percent of the required spaces as a landscape reserve where the expected need for off-street parking for a particular development is uncertain. The California Park Apartments development, for example, was allowed to defer 22 of the 95 parking spaces required by city code, using the land instead for a family play lot, a barbeque area, and picnic benches. Nearly 15 years after construction, the landscape reserve has not been needed for parking, and the community enjoys the environmental and social benefits of the recreation area.

Source: Iowa City and Palo Alto Zoning and Parking Codes.

Land banking and landscape reserve policies have been implemented in cities throughout Oregon (including Portland), as well as Palo Alto, California; Carmel, California; Cleveland; and Iowa City, Iowa. Palo Alto allows reductions of up to 50 percent in minimum parking requirements, provided that the difference is made up through a landscape reserve. None of the city's landscaped reserves have subsequently been required for parking.

To avoid confusion with terminology, it should be noted that land banking can also refer to the purchase of land by a local government or developer for use or resale at a later date. Banked land is sometimes used as interim parking to generate revenue generation—parking fees from temporary lots are put towards construction of later phases of the development, and at some point built over into buildings or structured parking.

Manage Demand

While reducing excess parking supply is important in eliminating the waste of unused parking spaces, some communities are looking to directly reduce the demand for parking, by providing people with readily available alternatives to driving. Demand reduction programs include car sharing, subsidies for transit, transit improvements, pedestrian and bicycle facilities, and comprehensive vehicle trip reduction programs that may include telecommuting and/or flexible work schedules to reduce commuting. While these programs are typically developed by local governments, their success often depends

on the commitment of businesses to implement them effectively.

Car-Sharing

Car-sharing is a neighborhood-based, short-term vehicle rental service that makes cars easily available to residents on a pay-per-use basis. Members have access to a common fleet of vehicles, parked throughout neighborhoods so they are within easy walking distance, or at transit stations. In programs with the most advanced technology, members simply reserve the nearest car via telephone or the Internet, walk to its reserved space, open the door using an electronic card, and drive off. They are billed at the end of the month, gaining most of the benefits of a private car without the costs and responsibilities of ownership, and without having to search for parking when their trip is over.

In urban neighborhoods with good transit access, car-sharing can eliminate the need to own a vehicle, particularly a second or third car that is driven less than 10,000 miles per year. In San Francisco, nearly 60 percent of households that owned vehicles before joining the car-sharing program have given up at least one of them within a year, and another 13 percent were considering it (Nelson\Nygaard, 2002). Zipcar, which operates in Boston, New York, and Washington, DC, reports that 15 percent of members sell their private car. In Europe, which has a far longer experience with car-sharing, each shared vehicle takes between four and ten private cars off the road -- and out of city parking spaces (City of Bremen, 2002).

Car-Sharing, Pricing Strategies

Van Ness and Turk Development -- San Francisco, California

This development includes 141 residential units in a dense area of San Francisco, with only 51 parking spaces. The development was granted a substantial reduction in parking requirements—nearly two-thirds—from the city's minimum of 1 space per unit, to 1 space per 2.8 units. The reduction was granted in large part because of the developers' agreement to provide two parking spaces for car-sharing operator City CarShare, accessible to residents and all CarShare members. Strong community and organizational support, as well as proximity to major transit corridors, were also factors.

If the developers had been required to build the additional 90 spaces required by code, they would have been forced to add either subterranean levels or parking lifts, which save space by stacking vehicles on top of each other. These expensive options would have cost between $1.35 million for lift technology (estimated at $15,000 per space) or $8.1 million for additional below-grade parking levels (estimated at $60,000 to $90,000 per space).

The developer also "unbundled," parking costs, so that residents are charged for parking separately from rent. The current market rate for parking is $280 to $300 per space per month. By charging separately for parking and incurring lower construction costs, the developer is able to keep apartment rents lower.

Source: Thieophilos Developers, 2002.

In some cities, developers have been allowed to reduce the number of parking spaces if they incorporate car-sharing. Developers may need to contribute towards set-up costs and/or provide parking spaces reserved for car-sharing vehicles as part of a project. Car-sharing can be provided as part of a mitigation agreement with the local jurisdiction in return for a reduction in minimum parking requirements. Alternatively, the parking reduction can be codified through zoning ordinances, as is being considered in Portland, Oregon, San Francisco, and Seattle.

Car-sharing can also be a useful tool to reduce parking demand in commercial developments. Employees can use a shared vehicle for meetings and errands during the workday, allowing them to take transit, carpool, walk, or bicycle to work. Car-sharing works best in compact, mixed-use neighborhoods, where firms with corporate memberships tend to use the vehicles during the day and residents can use them in the evenings and on weekends.

Formal car-sharing programs have been established in many cities, including Boston; Washington, DC; San Francisco; Oakland, California; Portland, Oregon; Seattle; and Boulder, Colorado, and are being established in many others. Some programs are run by non-profits with significant government support. Private for-profit companies, notably Flexcar and Zipcar, are operating in a number of cities, but they often work with the city or the local transit agency to secure reserved parking spaces on city streets or in transit park-and-ride lots. Alternatively, developers can provide shared vehicles themselves, or facilitate informal car-sharing among residents. Car-sharing reduces parking demand, but it also brings a broad range of other benefits, including fewer vehicle trips with less associated pollution, and improved mobility for low-income households who may not be able to afford to own a car, if rental rates are low enough..

Incentives for Transit

Financial incentives to ride transit can help reduce parking demand. They can be provided by employers, by cities, or by residential property managers.

Car-Sharing, Parking Maximums

Rich Sorro Commons -- San Francisco, California

Plans for Mission Bay, a 303-acre brownfield redevelopment area in San Francisco, include 6,000 units of housing, office space, university facilities, a hotel, community services, and retail. The city introduced parking maximums in this area to maximize the amount of new housing, make the most of the new Third Street Light Rail line through the neighborhood, and minimize traffic impacts on congested streets and the nearby freeway. Residential parking maximums were set at one space per unit.
One of the first projects completed was Rich Sorro Commons, a mixed-use project with 100 affordable units and approximately 10,000 square feet of ground floor retail. It was constructed with only 85 parking spaces, due to:

- Excellent proximity to light rail, commuter rail, and frequent bus service;
- Provision of two parking spaces for City CarShare; and
- Units below market rate, with tenants who are less likely to own a car.

With fewer parking spaces, Rich Sorro Commons was able to make space available for a childcare center and retail stores at ground level. The 17 would-be parking spaces were converted to retail space that is expected to generate revenues of $132,000 annually for the project (300 square feet per space at $25.80 per square foot in rent), making housing more affordable. The two City CarShare vehicles are available to residents, giving them access to a car without the costs of ownership – a particularly important benefit for low-income households.

Source: Kenneth Jones, Developer, 2002.

In the case of employer-paid transit pass plans, the employer pays the cost of employees' transit, often instead of providing a free parking space. This fringe benefit for employees reduces the demand for parking at the workplace, which in turn reduces traffic, air pollution, and energy consumption. It can equalize the transportation benefit that traditionally only went to employees who drove to work and received a free parking space. It also reduces costs, as transit benefits are generally less expensive to employers than providing parking. A transit pass in Los Angeles, for example, costs $42 per month, whereas the average cost for a parking space is $91 per month (Shoup, 1997b). To promote transit subsidies, the 1998 Transportation Equity Act for the 21st Century changed federal law so that transit benefits are not counted as payroll or as income (see also the description of cash-out programs on page 31). In some cases, city planners respond to employer-paid transit benefits by lowering minimum parking requirements. For example Montgomery County, Maryland's office zoning requirements allows a 15 percent reduction in minimum parking requirements if businesses offer reimbursed transit passes (Smith, 1983). The reduction in required parking can make urban development opportunities more inviting.

Transit incentives can also be useful for residential developments, or even for neighborhoods.. Property managers in Boulder, Colorado, and Santa Clara County, California, for example, can bulk-purchase transit passes for all their



Courtesy of City Car Share

residents at deeply discounted rates. The principle is similar to that of insurance—transit agencies can offer lower rates on passes because not all residents will actually use them regularly. Residents can take transit for free, meaning they are less likely to own a vehicle. Another benefit of prepaid transit programs is that they encourage residents to take transit spontaneously, since costs are paid up-front. A person does not have to commit to transit full-time in order to be able to reduce their demand for vehicle travel and parking. Developers who agree to fund transit passes can thus be rewarded with lower parking requirements.

Using Parking Revenue to Support Transit

Boulder, Colorado

Faced with a shortage of parking for customers, Boulder developed a program to encourage downtown employees to commute by other means. In 1993, Boulder's City Council mandated restricted downtown parking and appealed for parking demand management for the city's commuters.

The Central Area General Improvement District (CAGID), made up of many of downtown's 700 businesses, responded to the Boulder City Council's demands by creating a system using revenue from downtown parking meters to pay for free bus passes. The passes are provided for all of the district's 7,500 employees, and cost $500,000 each year The program has changed travel behavior, freeing up valuable customer parking spaces:

- Employee carpooling increased from 35 percent in 1993 to 47 percent in 1997.
- The district's employees require 850 fewer parking spaces.
- The increase in available parking has encouraged more retail customers to shop in downtown Boulder.

Boulder has created a special website with information about parking issues in the region: http://boulderparking.com.

The City of Boulder offers deeply discounted Eco-Passes to businesses outside the CAGID and to residents, and encourages walking and bicyccling. These programs mean Boulder employees avoid 212,500 single-occupancy vehicle trips per year, saving an estimated two million miles of pollution- and congestion-causing automobile trips. use is prevented each year.

Source : Boulder Community Network, 1999.

Transit Improvements

One of the best ways to reduce the demand for parking is to improve transit service so that it is frequent, convenient, and easy to use. Local government officials can improve public transit through major projects, such as adding light rail lines or streetcars, or creating systems that give buses priority at lights and intersections. They can also lengthen transit service hours, increase the frequency of bus and train service, and revitalize transit stations. Small improvements can also help, such as convenient SmartCard payment systems, improved bus stops and shelters, and real-time directional and schedule information systems. Portland, Oregon's MAX light rail system exemplifies the widespread benefits of transit improvements. The light rail system encourages transit-oriented development, decreases automobile commuting, and eases demand for parking. In fact, the light rail improvements eliminated the need for six downtown parking towers (EPA, 1998). These improvements are also partially responsible for $1.3 billion in new development in Portland over the last 10 years.

Pedestrian and Bicycle Facilities

Demand for parking can be reduced by providing pedestrian and bicycle facilities and amenities that make it easier and more pleasant for people to walk or bicycle to work, on errands, or to lunch. These changes can alleviate traffic congestion; for example, the automobile-dependent design of Tyson's Corner, Virginia, has resulted in high volumes of traffic at lunch time because

people cannot walk to restaurants or to run errands.

Promoting bicycling and walking can be accomplished through both comprehensive policies and simple changes to the street.. Some jurisdictions have adopted 'complete streets' policies that require every road construction or improvement project to provide safe access for everyone using the road, including transit users, bicyclists, and pedestrians (see www.completestreets.org). Other communities have focused on closing gaps in the sidewalk or bikeway network, by adding sections of sidewalks, bike lanes, or multi-use paths where needed to ensure safe travel by those modes.

In addition to paying attention to the street, bicycling and walking can be encouraged through design changes that make walking and bicycling more secure and pleasant. The Downtown Master Plan for Kendall, Florida (Miami-Dade County), discusses several design concepts to improve pedestrian and bicycle access. Some of the key elements promoted, but not required, by this program are listed in the text box to the right.

Developers can also encourage bicycling and walking by providing on-site facilities such as bicycle racks and even lockers and showers. For example, officials in Schaumburg, Illinois, a suburb of Chicago, have incorporated provisions into their zoning ordinance to encourage bicycle use. The ordinance requires all retail centers to have a minimum of 10 bicycle spaces located at each main building entrance. To increase awareness, the ordinance requires that bike racks be highly visible; to protect bicyclists, the ordinance requires bicycle parking areas to be separated from automobile parking. Other jurisdictions require covered, secure bicycle parking for employees who will be leaving their bicycles all day.

Designing for Pedestrians

Kendall, Florida

Close attention to design can dramatically improve the environment for pedestrians. The city of Kendall, Florida, has started to redevelop a conventional mall near a rail station into a new town center. The Downtown Master Plan specifies a number of improvements to create a compact, walkable place with good connections to existing neighborhoods:

- Bicycle/pedestrian access via new sidewalks and pathways.
- Trees and shrubs along edges facing streets and sidewalks.
- Parking hidden in the rear or in parking garages.
- Shade and rain protection for pedestrians, such as colonnades, arcades, marquees, second-floor balconies, wide awnings, or tree canopies.
- Buildings positioned along the sidewalks at a deliberate alignment, giving a designed shape to the public space.
- Doors and windows spaced at close intervals to generate activity, direct views to merchandise, and make walking interesting.
- Minimal number of driveways and parking lot entries that can making walking unsafe and erode urban space.

Source: Downtown Master Plan, Kendall, Florida, 1998.

Travel Demand Management (TDM) Programs

Travel demand management (TDM) programs combine several trip-reduction strategies to meet explicit travel goals. Some TDM programs are put into place by a single employer; others are managed by governments or business improvement districts and focus on a developed area that may include both businesses and homes. These programs typically attempt to decrease the number of trips by single-occupant vehicles, sometimes setting goals such as reduced vehicle trips or reduced miles traveled, while increasing the use of a variety of commuting and travel alternatives, including transit, carpooling, walking, and bicycling. TDM plans can be used by city planners to allow developers to build fewer parking spaces.

TDM programs may encourage transit incentives, parking cash-out, and other strategies mentioned here. In addition, these programs typically incorporate an assortment of complementary program elements that make it easier for people to give up solo driving. Examples include:

- "Guaranteed ride home" services that allow employees who use public transit to get a free ride home (usually via taxi) if they miss their bus or if they need to stay at work late.
- Company fleet cars that can be used for business meetings or running errands during the workday
- Preferential and/or reserved parking for vanpools/carpools.
- Carpooling and/or vanpooling with ride-matching service. Ride matching through informal "ride boards" or an employee transportation coordinator, helps people find and form carpools with neighbors.
- Cell phones for carpoolers to facilitate timing of pick-ups.

Shared Parking, Transit Improvements, TDM Program
Lindbergh City Center -- Atlanta, Georgia

The Lindbergh City Center is a mixed-use, high-density development in Atlanta on property owned by the transit agency, MARTA. The project was envisioned with a goal of having transit carry 30 percent of all trips to and from the center. The development, which includes a hotel and restaurant as well as office, retail, and residential space, centers on a MARTA light rail station that connects it to downtown Atlanta, the airport, and other areas. Parking reductions were allowed because of shared parking between office and retail uses, because of the ample transit access, and as a result of the Transportation Demand Management programs. Parking requirements for the first phase of the development were reduced by 20 percent overall; for office space the reduction is as high as 70 percent. Condominiums are allowed an 8 percent reduction, from 2 to 1.85 spaces per unit.

Source: Paul Vespermann, Lindbergh City Center, 2002.

Employers have little incentive to implement vehicle trip reduction programs if they are not granted reductions in minimum parking requirements. They would not be able to realize the potential cost savings from providing less parking, but would simply be faced with a large number of empty spaces. Some cities, such as South San Francisco (see box), have acknowledged this through ordinances that reduce parking requirements for projects that include vehicle trip reduction programs.

Pricing Strategies

Although parking is often provided at no charge to the user, it is never free. Each space in a parking structure can cost upwards of $2,500 per year in maintenance, operations, and the amortization of land and construction costs. Even on-street spaces incur maintenance costs and an opportunity cost in forgone land value. These costs end up hidden in rental fees and even in the costs of goods and services. Donald Shoup, Professor of Urban Planning at UCLA, has published extensively on parking policy in the United States. He believes that accurately pricing parking would solve many park-

ing problems (Shoup, 2005).

The cost of parking is generally subsumed into lease fees or sale prices. However, providing anything for free or at highly subsidized rates encourages overuse and means that more parking spaces have to be provided. Charging users for parking is a market-based approach that passes the true cost of parking to users, and encourages use of other transportation modes. If the fee charged to users of parking facilities is sufficient to cover construction, operation, and maintenance costs, it may encourage some users to seek alternative transport modes. Even where there are few alternatives to driving, parking pricing can encourage employees to seek out carpooling partners. In addition to reducing the cost of parking provision, pricing strategies bring substantial environmental and congestion benefits, particularly since they tend to reduce peak-period vehicle trips the most.

Travel Demand Management Ordinance

South San Francisco, California

South San Francisco is one of the few cities in the U.S. to enact a citywide Transportation Demand Management (TDM) ordinance, which allows reduced parking requirements for projects meeting TDM requirements. The ordinance applies to all nonresidential developments that expect to generate 100 or more average daily trips, or to projects seeking a floor area ratio (FAR) bonus. Parking reductions are not fixed, but are subject to case-by-case review and depend on the number and extent of TDM elements.

For example, the brownfield, mixed-use Bay West Cove development, which is located close to transit and bus service, was able to reduce required parking by 10 percent by implementing the following TDM strategies:

- Free parking for carpools and vanpools.
- Late-night taxi service and feeder shuttle service.
- Transit subsidy of $25 per month for all tenant employees.
- Late-night taxi service and feeder shuttle service.
- Guaranteed ride home program.
- Provision of a transportation coordinator.
- On-site project amenities such as child care, showers and lockers, electric vehicle charging, bicycle storage facilities, and a transit information kiosk.
- Parking charges of at least $20 per month for employee parking spaces.

Developers can use the savings from reduced parking construction and the income from paid parking to offset or cover the costs of implementing such programs.

Source: City of South San Francisco, 2003.

However, free parking is an ingrained American tradition. An estimated 99 percent (Shoup, 2005) of parking in the United States is free. How can paying for parking ever be a good thing for drivers? Drivers are willing to pay for parking that is more convenient and readily available. For example, on-street spaces near shopping destinations are much more likely to be available to customers if priced and regulated to prioritize short stays -- if they are free, they will be used for all-day parking by employees or residents. For residents, separating the cost of parking from the cost of rent or a mortgage provides an economic benefit to those who choose to own fewer cars. In addition, the revenue generating from putting an accurate value on parking can be used to benefit an entire neighborhood.

For commuters, making the cost of parking part of the decision on how to get to work encourages transit use and other alternatives, reducing traffic congestion. Parking charges have been found to reduce employee vehicle trips, and thus daily parking demand, by between 7 percent and 30 percent

or more, depending on factors such as the level of charges and the availability of alternatives to driving alone. One researcher has calculated that each 1 percent rise in parking fees is accompanied by a 0.3 percent decrease in demand (Pratt, 2000).

Cities and developers are using a variety of pricing strategies to better balance parking demand and supply. They include parking cash-out programs, pricing that prioritizes certain types of trips, residential parking plans, and parking benefit districts.

Cash-Out Programs

Cash-out programs allow employees to choose a transportation benefit, rather than simply accepting the traditional free parking space. Under such programs, employers offer employees the choice of:

- Free or subsidized parking,
- A transit or vanpool subsidy equal to the value of the parking (of which up to $100 per month is tax-free under current federal law), or
- A taxable payment approximately equal to the value of the parking, essentially cash to commuters who bicycle or walk to work.

Employees who opt for the non-parking subsidies are not eligible to receive free parking from the employer and are responsible for their parking charges on days when they drive to work. The cost savings for employers



associated with cash-out payments depend on the amount of the payments. If the full cash equivalent is provided, this demand reduction program does not reduce the total costs of providing parking. However, employees may accept cash payments lower than the full equivalent of the parking subsidy. If partial cash payments are used, employers face lower overall transportation subsidy costs, and employees still benefit. The programs help end the inequity of providing a free parking space benefit to drivers, while offering nothing to those who choose to arrive via transit, foot, or bicycle.

Cash-out programs are often easier to implement than direct charges, as they are generally more acceptable to employees, particularly when free parking had been the norm. However, their impact on travel behavior is usually lower, due to the administrative burden on employees, inertia in changing travel habits, and the fact that cash-out payments can be a taxable benefit whereas free parking is not.

Cash-out programs provide significant environmental, social, and economic benefits. For example, in response to California's mandatory cash-out requirement, eight firms reported an average 17 percent reduction in the total number of solo drivers (Shoup, 1997a). Thus, another benefit of cash-out programs is a reduction in traffic congestion and associated pollution.

Cash-Out Program

Santa Monica, California

In 1992, California instituted a mandatory cash-out program. The California Health and Safety Code Section 43834 reads, "'Parking cash-out program' means an employer-funded program under which an employer offers to provide a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space."

The effects of the cash-out program on transportation use in Santa Monica have been significant. A study conducted by Donald Shoup of the UCLA found that for two Santa Monica employers, the share of solo commuters decreased by between 7 and 8 percent once the cash-out program was in place. This reduction in solo commuters is responsible for a decrease in annual commuting of 858 vehicle miles (Shoup, 1997a).

Prioritizing Trips

Parking pricing can be a tool to prioritize some types of trips over others, according to their purpose and duration. It allows managers to cater to certain users, such as short-term shoppers, while discouraging other users, such as commuters, who add to peak-hour congestion and occupy a parking space for an entire day. These pricing strategies allow the overall supply of parking to be minimized, while ensuring spaces are available for critical users. They can also alleviate pressure to provide more parking from retailers and businesses, who may be concerned that lack of parking discourages shoppers. For example:

- Low prices for short-term parking encourages shopping trips, and limiting the duration of parking can also support these high-turnover trips. For example, charging $0.25 per hour with a two-hour maximum will allow many people to use a single space over the course of a day. The same space priced at $2.50 for up to ten hours will likely serve a single commuter. The parking revenue might be the same, but the sales for businesses and sales tax for the city will likely be much higher with short-term parking.

- Parking charges that are levied by the hour or day, with no discounts for monthly parking, remove the incentive to drive every day to "get your money's worth" from the monthly parking pass.
- Parking charges at transit stations that only apply before a certain time (such as 9:00 am) encourage users to ride transit when it is less crowded, rather than contributing to crowding in the peak.
- Sophisticated new parking meters can charge visitors a different rate than residents or employees with parking permits, preserving parking for regular users while maximizing revenue from occasional users.

Residential Parking Pricing

Parking charges can also be introduced at residential developments, through separating or "unbundling" the cost of parking from rents or sale prices. Rather than being provided with a set number of spaces whether they need them or not, residents can choose how many spaces they wish to purchase or rent. An alternative to direct charges is to provide "rent rebates" or discounts to residents who own fewer vehicles and do not use their allocated parking spaces.



In many urban areas with limited off-street parking, curb parking is reserved for residents through residential parking permit programs. In most cases these programs give residents free or very inexpensive curb parking permits and prohibit anyone else from parking there. However, this can leave many spaces unused during the day when nearby businesses could use extra parking. A few communities, including Aspen Colorado and Tucson Arizona, are experimenting with allowing businesses to buy permits in these areas at very high rates, or are charging hourly parking fees (Shoup, 2005). The revenue generated can be used to benefit the neighborhood, in one version of a parking benefit district, as described below.

Parking Benefit Districts

The revenue from parking can be used to directly benefit the street or the

neighborhood where the money is collected. Parking benefit districts receive the revenue from meters and residential permits within the district. Once administrative costs are covered, all money goes to transportation and neighborhood improvements such as undergrounding of utility wires (Shoup, 1995), regular street and sidewalk cleaning, installation of benches, nice lighting, or other amenities. Parking benefit districts can allow new development to use available on-street and other spaces, while addressing potential capacity problems through market pricing of curb and off-street parking. Earmarking revenue to directly benefit the neighborhood or commercial district helps to generate support for charges from local residents and businesses, who might otherwise resist paying for parking that used to be free. Often, local residents or businesses have a say in how the newly available revenue will be spent.

The most common use of Parking Benefit Districts has been in downtown business districts, usually using parking meter revenue. Cities such as San Diego and Pasadena, California, have implemented such districts. The concept also applies to residential areas. Most residential parking permit programs give residents free or very inexpensive curb parking permits and prohibit anyone else from parking there. However, this can leave many spaces unused during the day when nearby businesses could use extra parking, and neighborhoods could certainly use the revenue that could be generated by charging for street parking.. A few communities, including Aspen Colorado and Tucson Arizona, are experimenting with allowing businesses to buy permits in these areas at very high rates, or are charging hourly parking fees (Shoup, 2005). Furthermore, this concept can be refined based on the neighborhood. For example, a neighborhood adjacent to an institution such as a hospital or university might implement a two-tiered residential permit program. Residents could buy permits at one rate, while excess on-street capacity would be sold at market value to non-residents.

Shared Parking

8. Shared Parking

Fact Sheet







This smart growth tool can be used in rural, suburban, or urban communities.

What is Shared Parking?

Shared parking is a tool through which adjacent property owners share their parking lots and reduce the number of parking spaces that each would provide on their individual properties. Shared parking is not a new concept. It has been used extensively in traditional neighborhood commercial nodes and downtown settings for decades. In these locations, there are higher-density office or apartment buildings, with shops and restaurants lining the sidewalks. People often park in one spot and then walk from one destination to another. The effect is that those various uses share the same parking spaces. Shared parking is being used more and more in conjunction with new development. If adjacent land uses have different peak hours of parking demand, then they can share the some of the same parking spaces.

Why use Shared Parking?

Parking is one of the largest uses of land in urban and especially suburban areas. In a typical suburban shopping center, for example, parking occupies more land area than the building itself. Often, sites with large parking lots are located next door to other sites with equally large lots. If adjacent sites serve different purposes, each parking lot may lie empty for long periods of time. This suggests that an excessive amount of space is given over to parking, and that less parking would be needed if the lots were somehow connected, shared, and used more efficiently. Shared parking can reduce the amount of land needed for parking, creating opportunities for more compact development, more space for pedestrian circulation, or more open space and landscaping.

Two Approaches to Shared Parking

There are two main approaches to shared parking: (1) contractual agreements between adjacent uses; and (2) parking management districts. Whereas the first approach involves only two adjacent users, the second approach encompasses an entire district with multiple property owners. Under a contractual agreement, the circumstances under which parking spaces would be shared would be explicitly defined in the contract. In a parking district, all uses within the district would have access to all the parking spaces at any given time.

Used with permission.

Approach 1: CONTRACTUAL AGREEMENT BETWEEN TWO ADJACENT USES

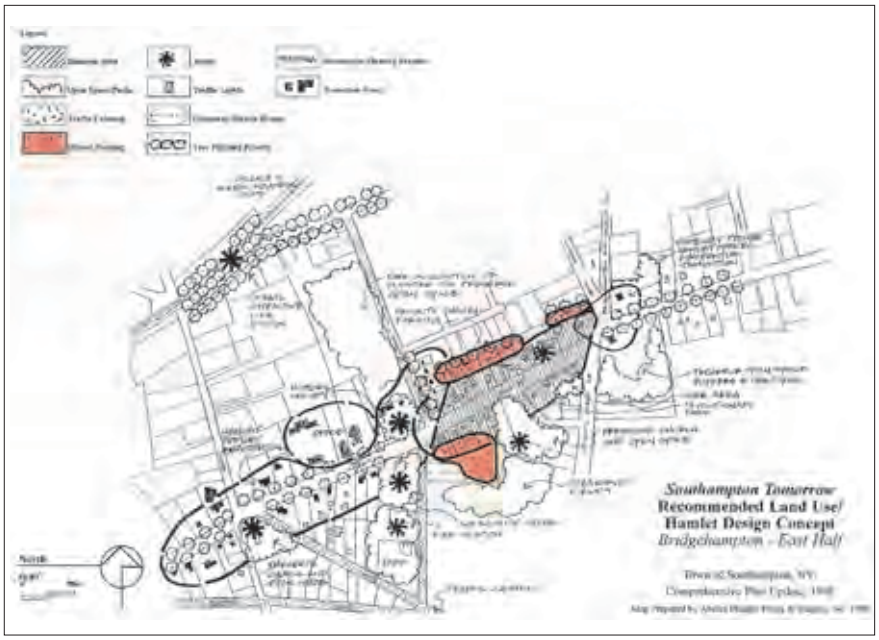
Toolbox

Special Permit Approval. For two uses in a commercial area, shared parking should be encouraged as part of the review process. The provisions should state that shared parking between two adjacent land uses (whether on the same site or on adjacent sites) would be preferred, especially if they have different peak times (e.g., a movie theater and a supermarket) or, conversely, if they share the same patrons (e.g., a dry cleaner and a deli)

Demonstrated Difference in Peak Parking Demand. As part of the approval process, the developer would have to demonstrate that the two land uses have differing peak-hours (or days, or seasons) of parking demand, or that the total parking demand at any one time would be adequately served by the total number of parking spaces.

Contractual Agreement Required. A development agreement between sharing property owners is necessary in order to ensure the proper functioning of the shared parking arrangement. The adopting ordinance needs to require such an agreement between developers as a condition of engaging in shared parking, and model language for an agreement should be adopted.

This plan for the Bridgehampton hamlet center in Southampton, Long Island calls for a shared parking area that would serve the hamlet businesses. (Source: APPS, Inc.)



Keys to Success

Target auto-oriented mixed-use commercial uses. Shared parking works best in situations where there are somewhat dissimilar land uses, with different peak hours of use — i.e., a hotel and an office, or a home supply store and a movie theater. A traditional mix of uses (in the form of a "Main Street" environment) is not necessary, but the use mix must be varied enough to generate different peak times of demand. But

bear in mind that shared parking can also work for complementary uses where the patrons go from store to store (e.g., an antique center). The essential ingredient in both cases is that patrons park once.



Keep the "sum" clause. Most zoning ordinances have minimum parking requirements for each individual use, and on multi-use sites, most zoning ordinances require that the total parking requirement be equal to the sum of the requirement for each individual use. This requirement should not be removed, because it ensures an adequate amount of parking where there are two similar uses on the same site, especially where they do not share the same customers. For example, a site with a grocery store and a home supply store would tend to have the same peak-hours of customer attraction. The "sum" clause would ensure that adequate parking is available during weekends and evenings.



Provide zoning incentives in auto-oriented business centers. In many commercial centers and office parks, businesses depend on large parking lots for business and have a natural business incentive to provide as much parking as possible. Zoning incentives for shared parking can encourage a reduction in the size of the parking lots. Incentives that could be provided for shared parking include an increase in floor area ratio (FAR) and increased flexibility in certain bulk regulations, such as building coverage or height. Incentives for shared parking are generally not necessary in traditional neighborhood centers or downtown areas, because the scarcity of land in those locations provides an inherent economic incentive for pursuing shared parking.



Make shared lots walkable. Parking spaces that are shared should be located within a reasonable walking distance of all the destinations they are intended to serve. Generally, the preferred parking-space-to-front-door distance that a person is willing to walk for shopping or work is 400 to 800 feet, and the maximum is generally 1,200 feet. In addition, walkways, crosswalks, decorative paving, stop signs for cars, and landscaping are needed to allow ease of walking through the parking areas, such that the shared parking area is well-integrated with each of the sites that it serves.

Conduct a demonstration project. Demonstration projects can help develop interest in shared parking. A local government can spearhead the task of developing a shared parking arrangement between two adjacent uses, taking on the time and cost of analyzing the parking demand, developing a potential sharing scheme, and preparing and negotiating the shared parking agreement. This initiative would create a model that could be used by other developers on independent shared parking arrangements.

Approach 2: PARKING MANAGEMENT DISTRICTS

Toolbox

Collection of Fees. 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. The district is responsible for parking-related maintenance, security, taxes, enforcement, utilities, signage, and so on. Fee collection can be facilitated by the local government, by being included as a separate line item on property tax bills.

Governance by Oversight Committee. A parking district is typically governed by an oversight committee elected by the members of the district. The oversight committee would be responsible for overseeing the district and responding to the concerns of members.

Keys to Success

Target compact, mixed-use, pedestrian-oriented commercial nodes where parking is in short supply. Parking districts are particularly well-suited to locations with multiple small property owners in a compact, pedestrian-oriented setting. Such an environment is conducive to walking, and therefore, most customers will prefer to park once and then circulate on foot. The parking district allows many businesses to share the same pool of parking, a desirable outcome in locations where parking is in short support.

Redesign the parking lots. As compared to shared parking agreements between two adjacent sites, the creation of a parking management district opens up the opportunity of comprehensively redesigning the parking lots. Rather than having a

series of smaller-sized parking lots divided by arbitrary lots lines with landscaped buffers, lots can be consolidated and circulation systematized, with more creative and effective landscaping, pedestrian circulation, and lighting.

Charge for parking. Users are generally accustomed to paying for parking in a neighborhood or downtown environment. Because parking is limited, paid parking will encourage some people to walk, carpool, or use transit, rather than driving. Also, paid parking encourages greater turnover of parking spaces, which is critical for business in an environment where parking is in short supply.

Establish rules for new development. Even though all spaces in a parking district are shared, property owners often maintain title over the portions of their properties that lie within the common parking field. If the membership in the district exempts the owner from making available a minimum number of spaces on his or her property, the owner could potentially remove the parking spaces on the property to make way for an addition. Such an action would remove spaces from the district while creating additional parking demand through the increase in building space. When the parking district is established, rules should be set up to determine whether such an action would be permissible and what the property owner's obligation would be to the district. For example, the district bylaws could stipulate that a property owner could undertake an expansion only if he or she provided additional spaces elsewhere. Similarly, rules would have to be established in the case of a district expansion or contraction.

Take on-street parking into account. In a compact environment, where parking spaces are in short supply, on-street parking is a critical resource. Those on-street spaces should be managed by the parking district as well. They should be metered, as the turnover of on-street spaces is particularly important for business, and they should be redesigned in conjunction with the redesign of the off-street lots.



Parking is often provided to excess. These shopping centers along Route 58 in Riverhead, Long Island have provided acres of parking that are often underutilized. This image is ubiquitous in America. (Source: APPS, Inc.)

For More Information

1. Portland Metro. Shared Parking Handbook, 1997. <www.metro-region.org/metro/growth/ main/sharedpark.pdf>.
2. Victoria Transport Policy Institute, Online Transportation

Demand Management Encyclopedia, 2001. <www.vtpi.org/tdm>.

3. Urban Land Institute, Washington, DC. Phone: (202) 624-7000, <www.uli.org>.

See also, Detailed Technical Analysis on Shared Parking, available through CRCOG.

Prepared by Abeles Phillips Preiss & Shapiro, Inc., 2002.

Appendix A: 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.

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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.

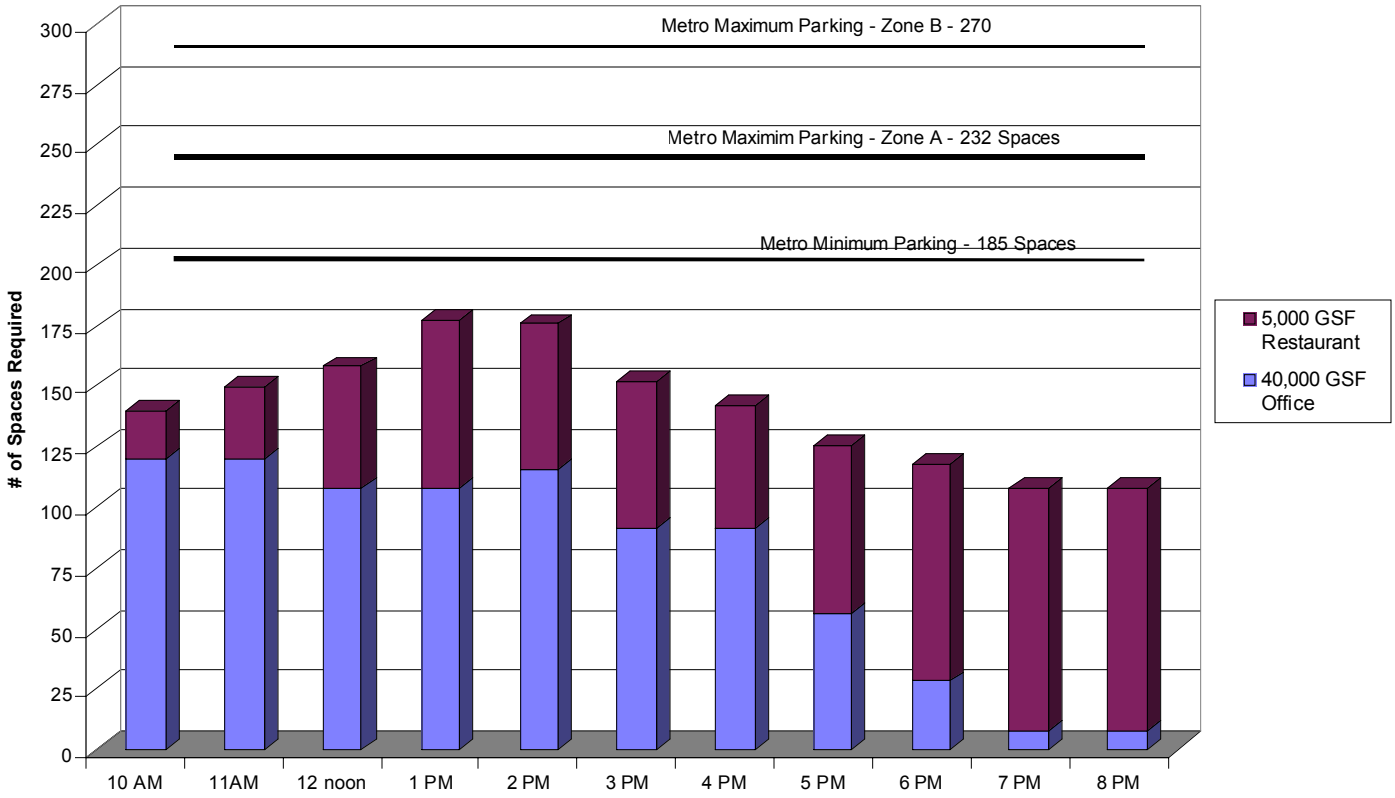
Example:
Minimum Parking Required by Metro Title 2 rates from Independent calculations for two uses *185 spaces*
Peak Hour Parking Needs with Shared Parking *178 spaces*
Net Savings 7 spaces

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: Model - Shared Use Agreement for Parking Facilities
Effective:_____

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

   -SAMPLE CLAUSE-
   [Lessee shall have exclusive use of the facilities. The use shall only be between the hours of 5:30 PM Friday through 5:30 AM Monday and between the hours of 5:30 PM and 5:30 AM 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 CLAUSE-
   [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 responsibility for utilities and taxes. This could include electrical, water, sewage, and more.

-SAMPLE CLAUSE-
[Lessor shall pay all taxes and utilities associated with the facilities, including maintenance of existing facility lighting as directed by standard safety practices.]

4. SIGNAGE

This section should describe signage allowances and restrictions.

-SAMPLE CLAUSE-
[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 CLAUSE-
[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 communication relationship.

-SAMPLE CLAUSE-
[Lessor and lessee agree to cooperate to the best of their abilities to mutually use the facilities without disrupting 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 CLAUSE-
[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 CLAUSE PROVIDED-

9. TERMINATION

This section should describe how to or if this agreement can be terminated and post termination responsibilities.

-SAMPLE CLAUSE-
[If lessor transfers ownership, or if part of all of the facilities are condemned, or access to the facilities is changed 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 CLAUSE PROVIDED-

IN WITNESS WHEREOF, the parties have executed this Agreement as of the Effective Date Set forth at the outset hereof.

[Signature and notarization as appropriate to a legal document and as appropriate to recording process negotiated between parties.]

Shared Parking

Sharing Parking Facilities Among Multiple Users

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TDM Encyclopedia
Victoria Transport Policy Institute
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Updated 22 July 2008

This chapter provides information on techniques for sharing parking facilities among various users to increase efficiency.

Description

Shared Parking means that parking spaces are shared by more than one user, which allows parking facilities to be used more efficiently. It is a type of Parking Management. Shared Parking takes advantage of the fact that most parking spaces are only used part time by a particular motorist or group, and many parking facilities have a significant portion of unused spaces, with utilization patterns that follow predictable daily, weekly and annual cycles.

There are various degrees of shared parking. A parking space assigned to a specific user is not shared at all. On-street parking spaces located in a busy, mixed use urban area tends to be the most shared. In between are parking spaces that are shared among various employees at a particular worksite, parking that is shared by customers at a variety of businesses located in a mall, or arrangements by one facility to use another facilities parking at certain times, such as a tavern that allows its parking spaces to be used on Sunday mornings by attendees at a nearby church. An assigned employee parking space is typically used about 2,000 hours per year, while an on-street parking space in a busy area often gets three times as much use. Efficient sharing of spaces can allow parking requirements to be reduced significantly.

Specific ways of sharing parking are described below.

Zoned Rather Than Assigned Spaces

Parking can be shared among a group of employees or residents, rather than assigning to individuals. For example, 100 employees or residents can usually share 60-80 parking spaces without problem, since not all employees will drive to work at one time.

This strategy complements other TDM strategies that encourage people to reduce their vehicle ownership and use, such as Commute Trip Reduction and Location Efficient Development. This type of sharing can be a consumer option. For example, motorists could be offered an assigned space for $100 per month, or a shared space for $60 per month. This allows individuals to decide whether they are willing to pay extra for an assigned space, or capture the savings that result from shared parking.

Share Parking Between Sites

Parking can be shared among different buildings and facilities in an area to take advantage of different peak periods (see Table 1). For example, an office complex can efficiently share parking facilities with a restaurant or theaters, since offices require maximum parking during weekdays,

Used with permission.

while restaurants and theaters require maximum parking during evenings and weekends. As a result, the total amount of parking can be reduced 40-60% compared with standard off-street parking requirements for each destination (Smith, 1983). Barton-Aschman Associates (1982) and ITE (1995) provide specific recommendations for shared parking implementation.

Table 1 **Peak Parking Demand**

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		

This table indicates peak parking demand for different land use types. Parking can be shared efficiently by land uses with different peaks.

Public Parking/In Lieu Fees

Parking can be shared by relying on public parking facilities rather than having each building provide private off-street parking, since each public space can serve many users and destinations. As a result, 100 public parking spaces can be equivalent to 150 to 250 private parking spaces. Developers or building owners can be allowed or required to pay in-lieu fees that fund public parking facilities as an alternative to minimum requirements for private off-street parking (Shoup, 1999b). On-street parking tends to be the best type of public parking facility for sharing, since it is visible and convenient. It is therefore helpful to manage on-street parking for maximum use, particularly in busy Commercial Centers.

Geographic Considerations

Shared Parking is limited by the proximity of destinations that share a parking facility. Exactly how close they must be depends on the type of land use and the type of user. Table 2 summarizes acceptable walking distances for various types of activities. Acceptable walking distance is also affected by the quality of the pedestrian environment, climate, line of site (longer distances are acceptable if people can see their destination), and "friction" (barriers along the way, such as crossing busy traffic).

Table 2 **Acceptable Walking Distances** (Parking Evaluation)

Adjacent (Less than 100 ft)	Short (less than 800 ft)	Medium (less than 1,200 ft)	Long (less than 1,600 ft)
People with disabilities	Grocery stores	General retail	Airport parking
Deliveries and loading	Professional services	Restaurant	Major sport or cultural
Emergency services	Medical clinics	Employees	event
Convenience store	Residents	Entertainment center	Overflow parking
		Religious institution	

This table indicates maximum acceptable walking distance from parking to destinations for various activities and users. It assumes good pedestrian conditions (sidewalks, crosswalks, level terrain) that are outdoors and uncovered, with a mild climate.

In general, the potential for sharing parking is greatest in areas where land use activities are Clustered, and the benefits from sharing parking are greatest due to high parking costs. Priorities for sharing parking are listed below.

1. *On-street parking on commercial streets.* These are the most convenient parking spaces and so should be managed for maximum turnover to serve short stops (shopping and other errands), by limiting time or applying short-term pricing. This usually means limits of less than 2 hours.

2. *Off-street public parking facilities and on-street parking outside the commercial streets.* These are less convenient parking spaces and so should be managed for longer stops, including parking by employees, long-term visitors and residents.

3. *Off-street private parking facilities.* These are often the most convenient parking spaces for a particular site, but may also be convenient for other nearby users. They tend to be used to serve other nearby facilities with different peaks. For example, since a bar has peak demand during Saturday night and a church has peak demand during Sunday morning, they can efficiently share parking if located near to each other (usually within a block or so).

The concept of Shared Parking is well known, but it is often discouraged by current planning practices. Conventional planning often reflects an assumption that communities want the greatest possible supply of parking provided at the lowest possible price. Standards used in most communities require each building or facility include a minimum amount of off-street parking supply, based on studies of peak-period demand. Transportation professionals and public officials often prefer generous, simple and consistent minimum parking standards because they are easy to administrate and minimize spillover problems. All of these factors contribute to inefficient use of parking resources: many parking lots are seldom or never full, even during peak periods, and most parking spaces are unused most of the time.

These practices are well established, but are beginning to change, particularly in growing urban communities. Increasingly, communities have objectives to encourage infill development, use of alternative modes and reduce the portion of land that is paved.

How it is Implemented

Shared Parking is usually implemented by municipal government policy to allow and encourage it, with sharing arrangements actually made between individual facility developers and managers. It may require changes to zoning codes (see below), and development of appropriate standards and practices that local transportation planners can use to evaluate, manage and enforce shared parking arrangements. It can be encouraged by establishing parking sharing brokerage services to match potential sharing partners, which can be provided by a Transportation Management Association or local government agency.

Shared parking can also be implemented by providing public parking as a substitute for private parking. This can be done by:

- Providing a maximum amount of on-street parking in an area.
- Providing public off-street parking.
- Managing public parking faculties so the most convenient spaces are available to priority uses (such as customers).
- Addressing barriers, such as inadequate walkways that limit use of public parking.

- Encouraging more Clustered development.
- Allowing or requiring in lieu fees instead of private off-street parking.

Model Shared Parking Code

Below is an example of wording to allow shared parking in municipal parking ordinances.

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 3 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. (M-F = Monday to Friday)

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 nonrequired 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.

Travel Impacts

Shared Parking does not directly reduce vehicle travel if it substitutes for increased parking supply. To the degree that it increases the available supply of parking and reduces parking prices it can encourage automobile travel. To the degree that Shared Parking allows more Clustered Development it can encourage use of alternative modes.

Table 4 Travel Impact Summary

Travel Impact	Rating	Comments
Reduces total traffic.	0	Depends on parking cost and land use impacts.
Reduces peak period traffic.	0	"
Shifts peak to off-peak periods.	0	"
Shifts automobile travel to alternative modes.	0	"
Improves access, reduces the need for travel.	0	"
Increased ridesharing.	0	"
Increased public transit.	0	"
Increased cycling.	0	"
Increased walking.	0	"
Increased Telework.	0	"
Reduced freight traffic.	0	"

Rating from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Benefits And Costs

Shared Parking can reduce parking facility costs (including aesthetic and environmental impacts), allows greater flexibility in facility location and site design, and encourage more efficient land use. Marshall, Garrick and Hansen (2008) found that low-speed urban streets with on-street parking tend to have lower

traffic speeds, and so conclude that on-street parking is, "a tool to help create places that are safer, more walkable, require less parking, and have more vitality." Costs include reduced motorist convenience and prestige, and increased automobile travel if it increases total parking supply. For more information see Parking Policy Evaluation.

Table 5 **Benefit Summary**

Objective	Rating	Comments
Congestion Reduction	0	Depends on parking cost and land use impacts.
Road & Parking Savings	3	Can provide significant parking facility savings.
Consumer Savings	2	Can provide savings to consumers.
Transport Choice	0	Depends on parking cost and land use impacts.
Road Safety	0	Depends on parking cost and land use impacts.
Environmental Protection	2	Reduces paved area.
Efficient Land Use	2	Allows more clustered land use.
Community Livability	2	Allows more clustered land use.

Rating from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Equity Impacts

The Equity impacts of Shared Parking depend on how it is implemented and what is assumed to be the alternative. If Shared Parking reduces total parking costs it can increase horizontal equity by reducing cross subsidies from non-drivers to drivers. If it provides savings that are passed on to lower-income people it can be progressive. If it helps create more Accessible land use it can benefit people who are transportation disadvantaged and improve basic mobility.

On the other hand, zoning codes may be considered most equitable if they are applied consistently. Flexible standards, which are required for Shared Parking, may be considered unfair to competitors, and may create spillover problems if they fail (for example, if employees parking on residential streets rather than using a parking lot several blocks away as arranged by their employer).

Table 6 **Equity Summary**

Criteria	Rating	Comments
Treats everybody equally.	0	Varies depending on circumstances.
Individuals bear the costs they impose.	0	"
Progressive with respect to income.	0	"
Benefits transportation disadvantaged.	0	"
Improves basic mobility.	0	"

Rating from 3 (very beneficial) to –3 (very harmful). A 0 indicates no impact or mixed impacts.

Applications

Shared Parking can be applied in many situations (Evaluating Parking). It is particularly appropriate where:

- A specific parking problem exists.
- Land values and parking facility costs are high.
- Clustered development is desired.
- Traffic congestion or vehicle pollution are significant problems.
- Excessive pavement is undesirable.

Table 7 **Application Summary**

Geographic	Rating	Organization	Rating
Large urban region.	3	Federal government.	0
High-density, urban.	3	State/provincial government.	1
Medium-density, urban/suburban.	3	Regional government.	2
Town.	3	Municipal/local government.	3
Low-density, rural.	2	Business Associations/TMA.	3
Commercial center.	3	Individual business.	3
Residential neighborhood.	3	Developer.	3
Resort/recreation area.	3	Neighborhood association.	3
		Campus	3

Ratings range from 0 (not appropriate) to 3 (very appropriate).

Category

Land Use Management

Relationships With Other TDM Strategies

Shared Parking is a type of Parking Management and a Parking Solution. It is often implemented as part of TDM, Commute Trip Reduction, Transportation Management Associations and Campus Trip Reduction programs. It supports and is supported by Pedestrian and Cycling Improvements, Transit Improvements, Smart Growth, New Urbanism, Clustering and Transportation Pricing Reforms. It is important for Location Efficient Development.

Stakeholders

Shared Parking is primarily implemented by local government policies and agencies, and by individual developers and businesses. Implementation often involves changing current planning, enforcement and design practices, sometimes with the support of professional organizations. Transportation Management Associations can provide parking facility brokerage services (for example, maintaining a system to match businesses that can share parking facilities).

Barriers to Implementation

Shared Parking require overcoming the traditional assumption that society benefits from a maximum supply of free or low-priced parking, and the resistance from land use and transportation planning institutions that are accustomed to inflexible minimum parking standards. Some public officials consider Shared Parking difficult to administrate (since it requires flexible parking standards, verification and enforcement), unfair (since some developers benefit more than others), and risky (since they could create spillover problems. Users accustomed to assigned spaces may object to this practice. There may be inadequate capacity during unusual peak demand periods.

Best Practices

Best practices for Shared Parking are described in various reports listed below. They include:

- Establish standard 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, verification and enforcement.

- Educate planning officials and developers as 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. Encourage use of in lieu fees to substitute for private off-street parking.
- Use Transportation Management Associations or local planning agencies to provide Shared Parking matching and brokerage services.
- Insure that there is good pedestrian access and appropriate signage for users concerning Shared Parking.
- Perform regular parking studies and feedback from users to identify problems with Shared Parking.
- Anticipate potential spillover problems, and respond with appropriate regulations and enforcement programs.

What Street Parking Can Do For Downtowns
By Norman W. Garrick and Wesley Marshall (www.courant.com/news/opinion/commentary/hc-plcgarrick0511.artmay18,0,2436671.story).

As in other parts of the country, Connecticut towns and cities are struggling to revitalize their downtowns. Some of the planning and design decisions made in the 1950s and 1960s make this goal more difficult. One such decision is the elimination of street parking from many of our town centers.

Although this practice of not accommodating street parking is now routine, there has been little research done to assess its impact on urban centers. However, a growing number of urban planners have pointed out that centers that have retained street parking, along with other compatible features of pre-1950s town centers, are some of the most successful downtowns in the country.

In order to address this dichotomy between conventional practice and emerging urban theory, we at the University of Connecticut designed two studies of on-street parking and its impact on downtowns. One was based upon case studies of six New England town centers (West Hartford; Northampton, Mass.; Brattleboro, Vt.; Avon Center; Glastonbury Center and Somerset Square in Glastonbury). In the second study, we investigated how street design affected vehicle speeds and safety, based on a study of more than 250 Connecticut roads.

What we found through these studies was that on-street parking plays a crucial role in benefiting activity centers on numerous levels. Here are some of the main benefits.

• *Higher efficiency:* Users of the downtowns consistently selected on-street parking spaces over off-street surface lots and garage parking. The on-street spaces experienced the most use and the highest turnover.

• *Better land use:* Using the curbside for parking saves considerable amounts of land from life as an off-street surface parking lot. Medium-sized town centers can save an average of more than two acres of land by providing street parking. This efficiency can allow for much higher-density commercial development than is possible if the center relies solely on off-street surface lots.

• *Increased safety:* We showed conclusively that drivers tended to travel at significantly slower speeds in the presence of features such as on-street parking and small building setbacks. Slower vehicle speeds provide pedestrians, cyclists and drivers more time to react, and when a crash does occur, the chance of it being life-threatening is greatly reduced. In short, on-street parking can help to create a safer environment.

• *Better pedestrian environment:* Our study results showed that centers with on-street parking and other compatible characteristics such as generous sidewalks, mixed land uses, and higher densities recorded more than five times the number of pedestrians walking in these areas compared with the control sites, which lack these traits.

Nearly every town in the state has the street space available that could be used for on-street parking. Town leaders should consider it. Our results suggest that on-street parking is a tool that can help create a vibrant and safe town center environment.

Norman W. Garrick is an associate professor of civil and environmental engineering and director of the Center for Transportation and Urban Planning at the University of Connecticut. Wesley Marshall is a doctoral candidate in transportation engineering and urban planning at UConn.

Examples and Case Studies

Shared Parking at Portland Transit Stations

The Tri-Met (Portland area) Park & Ride Policy encourages Shared Parking near transit stations as an efficient and cost effective way to provide parking while minimizing the amount of land devoted to parking facilities. Park & Ride lots are shared with apartment complexes, a regional justice center, churches and movie theaters at more than three dozen sites. With some Transit Oriented Development projects, Tri-Met allows the total supply of off-street parking to decline. For example, if a Park & Ride facility is replaced by a new Transit Oriented Development of at least 30 residential units per acre, at least 75 employees per acre, or other comparable high-density development (Tri-Met, 2001).

City of Monrovia Downtown Parking Management

By Dick Singer, City of Monrovia Public Information Officer

It seemed a risk worth taking - locating a 12-screen, 2,400-seat movie theater in the middle of Monrovia's Old Town without providing the usual adjacent parking structure.

It made sense. Monrovia's Old Town business district is compact (six blocks long and two wide) and abutted by residential neighborhoods on three sides. Medium and high-density housing (mainly senior citizen) had been developed immediately adjacent to the commercial properties. Both MTA and Foothill Transit buses provide service to the edges of Old Town and Monrovia has an active dial-a-ride service providing door-to-door public transportation.

Old Town was redeveloped in the 1970s as a pedestrian-friendly "main street" shopping and service district. Free public parking lots and street parking combined to provide more than 1,200 spaces scattered throughout the district that were never more than 80% filled. For several years, a Friday night Family Festival street fair - running weekly from March through to Christmas - drew as many as 8,000 people on a typical summer night with very little overflow parking into residential neighborhoods. Additionally, most of the businesses using public parking for their employees closed at 5 p.m. and few stores stayed open past 7 p.m., meaning that a shared parking plan seemed feasible - daytime use for office workers and nighttime use for theater goers.

The theater was to go up on one of the public parking lots, so those spaces had to be replaced, and were by the

expansion of another City-owned lot and the re-configuration of a sidestreet adjacent to both that lot and the theater site. When the theater opened, there were more spaces than before the project began. In its first six months of operation, the theater has attracted good crowds and the parking has yet to be a problem. Lot and street parking is sufficient to handle the demand and convenient enough so movie-goers will happily walk two-to-three blocks between their cars and the theater to stroll past shops and restaurants.

The shared-parking plan has worked well in the project's early stages. The second phase of our plan is now about to begin. Theater crowds are drawing a new business mix to the district (as planned) and we are aware that more nighttime business use will develop over the next year. An assessment district is now in the works to finance more Old Town parking - either a structure or an additional street-level lot - to handle the expected increase.

Wit and Humor
Bars and churches are an ideal combination to share parking. Bars have their peak demand Saturday nights and churches have peak demand Sunday mornings. Bar patrons who stay late can simply leave their cars in the parking lot and walk to church early the next morning to pray for forgiveness.

References And Resources For More Information

Mary **Barr** (1997), *Downtown Parking Made Easy; 6 Strategies for Improving the Quality and Quantity of Downtown Parking*, Downtown Research and Development Center (New York; www.downtowndevelopment.com), available from Alexander Communications Group (www.alexcommgrp.com).

Barton-Aschman Associates (1982), *Shared Parking*, Urban Land Institute (www.uli.org).

Booz Allen Hamilton (2006), *International Approaches to Tackling Transport Congestion: Paper 2: Parking Restraint Measures*, Victorian Competition and Efficiency Commission (www.vcec.vic.gov.au).

CBF (2001), *Building Healthier Neighborhoods with Metrorail: Rethinking Parking Policies*, Chesapeake Bay Foundation (www.cbf.org/resources/pubs/rethinking_parking.pdf).

CNU (2008), *Parking Requirements and Affordable Housing*, Congress for the New Urbanism (www.cnu.org); at www.cnu.org/node/2241.

Reed **Everett-Lee** (1999), *Parking Management*, Transportation Tech Sheet, Congress for New Urbanism (www.cnu.org).

Reid **Ewing** (1996), *Best Development Practices; Doing the Right Thing and Making Money at the Same Time*, Planners Press (www.planning.org).

Norman W. **Garrick** and Wesley Marshall (2008) "What Street Parking Can Do For Downtowns," *The Hartford Courant*, (www.courant.com/news/opinion/commentary/hc-plcgarrick0511.artmay18,0,2436671.story).

ITE (2004), *Parking Generation*, Institute of Transportation Engineers (www.ite.org).

ITE (1995), *Shared Parking Planning Guidelines*, Institute of Transportation Engineers (www.ite.org).

ITE (1999), *Transportation Planning Handbook*, Institute of Transportation Engineers (www.ite.org).

Michael **Kodama** (1999), *Parking Management Handbook; How to Use Parking Management to Better Utilize Parking Resources*, Dept. of Environmental Quality, State of Oregon (www.deq.state.or.us).

K.T. Analytics (1995), *Parking Management Strategies: A Handbook For Implementation*, Regional Transportation Authority (Chicago), 1995; available as FTA, *TDM Status Report: Parking Supply Management and TDM Status Report: Parking Pricing*, Federal Transit Administration (www.fta.dot.gov/library/planning/tdmstatus/tdm.htm).

Todd **Litman** (1998), *Pavement Busters Guide*, VTPI (www.vtpi.org).

Todd **Litman** (1999), *Parking Requirement Impacts on Housing Affordability*, VTPI (www.vtpi.org).

Todd **Litman** (2000), "*Transportation Land Valuation; Evaluating Policies and Practices that Affect the Amount of Land Devoted to Transportation Facilities*," VTPI (www.vtpi.org).

Todd **Litman** (2002), "Parking Costs," *Transportation Cost and Benefit Analysis: Techniques, Estimates and Implications*, Victoria Transport Policy Institute (www.vtpi.org); available at www.vtpi.org/tca/tca0504.pdf.

Todd **Litman** (2006), *Parking Taxes: Evaluating Options and Impacts*, VTPI (www.vtpi.org); available at www.vtpi.org/parking_tax.pdf.

Todd **Litman** (2006), *Parking Management Best Practices*, Planners Press (www.planning.org).

Todd **Litman** (2006), *Parking Management: Strategies, Evaluation and Planning*, Victoria Transport Policy Institute (www.vtpi.org); available at www.vtpi.org/park_man.pdf.

Todd **Litman** (2006), *Parking Management: Innovative Solutions To Vehicle Parking Problems*, Planetzen (www.planetizen.com/node/19149).

Kyle **Maetani**, Michael Kodama, Richard Willson, William Francis & Associates (1996), *Using Demand-Based Parking Strategies to Meet Community Goals; Local Government Parking Management Handbook*, Mobile Source Air Pollution Reduction Committee (MSRC), South Coast Air Quality Management District (www.aqmd.gov).

Wesley E. **Marshall** and Norman W. Garrick (2006), *Parking at Mixed-Use Centers in Small Cities*, Transportation Research Board Annual Meeting (www.trb.org); at www.mdt.mt.gov/research/docs/trb_cd/Files/06-2864.pdf.

Wesley E. **Marshall**, Norman W. Garrick and Gilbert Hansen (2008), *Reassessing On-Street Parking*, Transportation Research Board 87th Annual Meeting (www.trb.org).

Karel **Martens** (2005), *Effects of Restrictive Parking Policy on the Development of City Centers*, Environmental Simulation Laboratory, Tel Aviv University, for Israeli Ministry of Transport; available at www.mot.gov.il/wps/pdf/HE_TRAFFIC_PLANNING/RestrictiveParkingPolicy.pdf.

Adam **Millard-Ball**, Patrick Siegman, and Jeffrey Tumlin (2004), "Solving Campus Parking Shortages: New Solutions for an Old Problem," *Planning for Higher Education*, Society of College and University Planning (www.scup.org), Vol. 33, No. 1, pp. 30-43.

MRSC (2005), *Downtown Parking Solutions*, Municipal Research and Service Center of Washington (www.mrsc.org/Subjects/Transpo/Tpark/transsolut.aspx).

NPH (2003), *Residential Parking Tool Box*, Non-Profit Housing Association of Northern California; at

www.nonprofithousing.org/actioncenter/toolbox/parking/content.html. This website provides information on residential parking regulations, costs and management strategies to improve efficiency and increase housing affordability.

ODDA (2001), *Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast*, Oregon Downtown Development Association, Transportation and Growth Management Program, Oregon DOT and Dept. of Environmental Quality (www.lcd.state.or.us/tgm/publications.htm).

Oregon Downtown Development Association (2001), *Parking Management Made Easy: A Guide to Taming the Downtown Parking Beast*, Transportation and Growth Management Program, Oregon DOT and Dept. of Environmental Quality (www.lcd.state.or.us/tgm/publications.htm).

John **Shaw** (1997), *Planning for Parking*, Public Policy Center, University of Iowa, Iowa City (www.uiowa.edu).

Donald C. **Shoup** (1999), "In Lieu of Required Parking," *Journal of Planning Education and Research*, Vol. 18, pp. 307-320.

Donald **Shoup** (2005), *The High Cost of Free Parking*, Planners Press (www.planning.org).

Thomas P. **Smith** (1983), *Flexible Parking Requirements*, PAS Report 377, American Planning Association (www.planning.org).

Mott **Smith** (2006), *Onsite Parking: The Scourge of America's Commercial Districts*, Planetizen (www.planetizen.com/node/19246).

Stein Engineering (1997), *Shared Parking Handbook*, Portland Metro (www.metro-region.org); available at www.metro-region.org/library_docs/land_use/sharedpark.pdf.

Tri-Met (2001), *Park & Ride Policy*, Tri-County Metropolitan Transportation District of Oregon (www.tri-met.org).

TSTC (2001), *Parking Management*, Tri-State Transportation Campaign (www.tstc.org).

ULI (2000), *The Dimensions of Parking*, Urban Land Institute (www.uli.org) and the National Parking Association.

USEPA (1999), *Parking Alternatives: Making Way for Urban Infill and Brownfield Development*, Urban and Economic Development Division, US Environmental Protection Agency, EPA 231-K-99-001 (www.smartgrowth.org); available at www.smartgrowth.org/pdf/PRKGDE04.pdf.

Wilbur Smith Associates, Michael R. Kodama Planning, Richard Willson, KT Analytics and Rick Williams Consulting (2006), *Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices*, Draft Report, Metropolitan Transportation Commission (www.mtc.ca.gov); available at www.mtc.ca.gov/planning/smart_growth/parking_study/Nov06/MTC_Parking_BestPracticesDraft.pdf.

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CHAPTER 4.10

Model Shared Parking Ordinance

PRIMARY SMART GROWTH PRINCIPLES ADDRESSED:

- Variety of transportation choices
- Compact building design

Communities have used several tools to minimize the overall amount of surface parking in neighborhoods, downtowns, and commercial areas. One tool has been to allow certain land uses to meet the minimum requirements for parking spaces by sharing spaces with other uses. Shared parking arrangements are applied when land uses are adjacent or in close proximity to one another, have different parking demand patterns, and are able to use the same parking spaces or lots throughout a day. Shared parking is also commonly used in mixed use developments where commercial and office tenants have varying hours of operation. In general, shared parking is most effective when the land uses have significant different peak parking characteristics that vary by time of day and day of the week. They often work well for businesses, restaurants, churches, schools, and other uses.

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Jurisdictions with shared parking standards tend to limit the types of land uses to which such provisions can be applied. For example, in Bastrop, Texas, shared parking may be allowed in the case of mixed uses (different buildings) for up to 50 percent of the parking spaces required for a theater or other place of evening entertainment (after 6:00 p.m.), or shared parking may be provided for a church when there is available parking for banks, offices, and similar uses not normally open, used, or operated during the same hours as church events or services. Shared parking must be in the same parking lot (Bastrop 2003).

In Fort Collins, Colorado, residential uses are prohibited from reducing the amount of parking required per unit by using shared parking. The rationale for this is that circumstances may arise where a resident is unable to access the shared lot and thus would have no parking available at all. Planners recognize that such a scenario would be very unpopular and could undermine the overall effort to promote shared parking (Barkeen 2003).

The commentary for Portland Metro's Model Shared Parking Ordinance notes that the closer shared spaces are to the land uses they serve, the more likely the arrangement will be a success. The model ordinance provides maximum distances between land uses and parking spaces that would make them eligible to be classified as shared parking spaces or areas (Portland Metro 1997).



Marya Morris

Figure 4.10.1. *Shared parking arrangements are common in mixed use developments where commercial and office tenants with different hours of operation are in close proximity to each other.*

Of the dozen or so ordinances that were reviewed for this model, Seattle offers the largest overall reductions in required parking in its shared parking provisions. For example, where an office use and a retail sales or service use share parking, the parking requirement for the retail sales and service use may be reduced by 20 percent, provided the reduction does not result in fewer spaces than the minimum required for the office use. For arrangements involving a residential and retail sales and service use, the residential use may reduce its parking by 30 percent, provided the reduction does not result in less than the minimum required for the retail and service use. And for residential and office use shared arrangements, the residential portion may be reduced by as much as 50 percent, provided there is still the minimum required amount for the office use. However, no restaurant or entertainment uses may share parking with residential uses. Jurisdictions using this model ordinance may consider applying no minimum number of required spaces for office uses if such an approach is appropriate and practical in the local districts.

The ordinance has additional provisions for shared parking arrangements between land uses that are either solely daytime uses or solely nighttime and Sunday uses. Daytime uses include administrative offices, retail sales and service (excluding restaurants), and wholesale storage. Nighttime and Sunday uses include restaurants and drinking establishments, religious uses, theaters, and school auditoriums. The planning director can authorize that up to 90 percent of the parking required for a daytime use may be supplied by the off-street parking provided by a nighttime or Sunday use and vice versa, and up to 100 percent when the nighttime or Sunday use is a religious facility. Applicants must show there is no major conflict between the operating hours of the uses that share parking.

According to Mark Troxel, a land-use planning analyst with the City of Seattle, shared parking is applied primarily by single-owner, mixed use buildings. This is the case for two primary reasons: Seattle's land-use code has many mixed use zones, and the city strongly encourages mixed use developments that incorporate residential and retail uses, residential and office uses, or a combination thereof. Troxel says that because "parking is such a big cost driver" most developers are eager to use shared parking as a means of reducing the total number of spaces they must provide (Troxel 2004).

Less than 5 percent of the shared parking arrangements in Seattle are between adjacent properties with different owners. Troxel says this is largely because each property owner is required to sign a parking covenant, which essentially places an easement on the portion of the parking that one owner is providing to the other as part of the arrangement. In the past, landowners had signed covenants without a sunset date, essentially locking them into the arrangement indefinitely. Troxel says some of those arrangements became a problem for property owners who sell their property (when the new owners balk at the existing parking covenant) and for the other owner who still needs the parking but must deal with the new owner. Finally, in some cases property owners have granted rights to share the exact same spaces with as many as six other properties. Such problems with the covenants and the oversharing of parking are difficult to remedy.

The model shared parking ordinance here adapts Seattle's regulations. Under this model, applicants for zoning permits in certain areas within the community would either be required to evaluate the use of shared parking or may elect to do so. The zoning administrator or other code enforcement official would promulgate guidelines for the preparation of shared parking feasibility studies, which applicants would use. Where the shared parking proposal entails two or more separately owned properties, the owners of those properties must enter into an agreement regarding access to, and maintenance and management of, the shared parking spaces. The zoning administrator may require applicants to submit a shared parking plan as part of the site plan requirements for a zoning permit.

101. Purpose

(1) The purposes of the ordinance are to:

(a) allow a reduction in the total number of parking spaces required for certain properties in cases where a mix of adjacent land uses have varying peak periods of parking demand;

(b) reduce the overall amount of impervious surfaces, specifically the amount of land devoted to surface parking; and

(c) support [plan name] policies that call for:

[List relevant plan policies here such as: 1. Encouraging compact development and efficient use of land; 2. Promoting nonmotorized vehicle trips including walking and bicycling; and 3. Improving accessibility and mobility to common destinations for users of all transportation modes.]

102. Applicability

(1) Applicants for a zoning permit for any change of use [must or may] evaluate the feasibility of shared parking arrangements as part of their application where:

(a) The proposed use is in an area identified in [plan name] as characterized by concentrated or mixed use development, including land located in the following zoning districts:

[1. Central business district]

[2. Town center district]

[3. Transit station or transit-oriented development district]

[4. Regional center district]

[5. Neighborhood commercial district]

[6. Main street district]

Comment: *These are sample names for zoning districts. Users of this model can substitute their own districts.*

(b) The number of parking spaces proposed by the applicant is more than [10] percent of, or more than [10] spaces greater than, the minimum number of parking spaces required by the [parking standard ordinance], whichever is greater.

103. General Provisions

(1) Shared parking is allowed between two or more uses to satisfy all or a portion of the minimum off-street parking requirement.

(2) Shared parking is permitted between different categories of uses or uses with different hours of operation.

(3) A use for which an application is being made for shared parking shall be located within [800] feet of the parking facility.

(4) The reductions to parking permitted through shared use of parking shall be determined as a percentage of the minimum-parking requirement as modified by the reductions permitted in other sections of the parking ordinance.

Comment: *A jurisdiction may allow initial reductions in parking requirements for certain uses or in certain districts that would be calculated prior to the consideration of a shared parking arrangement. Seattle, for example, allows for reductions in parking standards for landmark buildings, for uses in areas where transit is available, and in pedestrian commercial zones.*

(5) An agreement providing for the shared use of parking, executed by the parties involved, shall be filed with the [zoning administrator]. Shared parking privileges shall continue in effect only as long as the agreement, binding on all parties, remains in force. If the agreement is no longer in force, parking shall be provided as otherwise required by this chapter.

104. Calculation of Parking Requirements for Shared Parking; Shared Parking Feasibility Study

[Alternative 1]

(1) Where shared parking arrangements are proposed, the [zoning administrator] shall determine the number of parking spaces that may be shared based on a shared parking feasibility study prepared by the applicant for a zoning permit. The [zoning administrator] shall promulgate written guidelines for the preparation of such studies by [date].

(2) A shared parking feasibility study shall:

(a) identify the properties and uses for the study (the study may include properties and uses not the subject of the zoning permit, provided that the applicant obtains a letter of authorization from the property owner or his or her agent);

(b) determine the number of parking spaces that would be required by applying the standard for the uses for all of the properties in subparagraph (2)(a), above;

(c) determine the peak parking demand for the combined demand of all of the uses for all of the properties in subparagraph (2)(a), above, using standard parking generation rates in sources approved by the [zoning administrator]; and

(d) compare the results of subparagraphs(2)(b) and (c), above. [See sidebar, page 145.]

If the [zoning administrator] finds that the shared parking feasibility study is consistent with guidelines promulgated pursuant to paragraph (1), above, the [zoning administrator] shall use the lesser of the two parking demands calculated in subparagraph (2)(d), above, as the minimum number of parking spaces to be provided for all the properties and uses in the study.

(3) If standard parking generation rates for any of the uses in the study are not available, the applicant may collect data at similar sites to establish local parking demand rates. If the shared parking feasibility study assumes use of an existing parking facility, the applicant shall conduct field surveys to determine actual parking accumulation.

Comment: *The Urban Land Institute (2005) has developed procedures for conducting shared parking studies. For parking generation rates see, for example, Davidson and Dolnick (2001), which contains examples of parking standards from hundreds of ordinances around the United States. In addition, see ITE (2004)* and *ITE (1995), which contain guidelines for planning and regulating shared parking facilities.*

Shoup (2005) assails planners' use of parking standards altogether. He argues that, because of numerous significant flaws in how jurisdictions calculate parking standards, the amount of parking that gets built bears little or no relationship to what is actually needed. This has resulted in an oversupply of parking in many jurisdictions, which has had far reaching negative implications on everything from the natural environment to downtown revitalization efforts to making transit infeasible through low-density auto-dependent land-use patterns.

[Alternative 2]

(1) Business establishments constituting different categories of use may share parking as follows:

(a) If an office use and a retail sales and service use share parking, the parking requirement for the retail sales and service use may be reduced

by 20 percent, provided that the reduction does not exceed the minimum parking requirement for the office use.

(b) If a residential use shares parking with a retail sales and service use other than lodging uses, eating and drinking establishments, or entertainment uses, the parking requirement for the residential use may be reduced by 30 percent, provided that the reduction does not exceed the minimum parking requirement for the retail sales and service use.

(c) If an office and a residential use share off-street parking, the parking requirement for the residential use may be reduced by 50 percent, provided that the reduction shall not exceed the minimum parking requirement for the office use.

(2) Shared Parking for Uses with Different Hours of Operation.

(a) For the purposes of this section, the following uses shall be considered daytime uses, operating anytime between the hours 8:01 a.m. and 5:59 p.m. [Monday through Friday only]:

1. Customer service and administrative offices
2. Retail sales and services, except [eating and drinking establishments and] entertainment uses
3. Wholesale, storage, and distribution uses
4. Manufacturing uses
5. Other similar primarily daytime uses, as determined by the [zoning administrator]

(b) For the purposes of this section, the following uses shall be considered nighttime uses, operating anytime between the hours of 6:00 p.m. and 8:00 a.m., or [Saturday and] Sunday uses:

1. Auditoriums accessory to public or private schools
2. Religious facilities
3. Entertainment uses, such as theaters, bowling alleys, and dance halls

[4. Eating and drinking establishments]

5. Other similar primarily nighttime or Sunday uses, as determined by the [zoning administrator]

Comment: *A good deal of judgment must be applied to determine which uses are "daytime" and which are "nighttime" activities because these are not cut-and-dried determinations. Of these, eating and drinking establishments may be the most problematic. A restaurant that is a "supper club" would be a "nighttime" use, but one that serves breakfast and lunch would not. For that reason, they have been placed in brackets.*

(c) The [zoning administrator] may authorize upon application the use of up to 90 percent of the required off-street parking for a daytime use to serve as the required off-street parking provided for a nighttime or Sunday use and vice versa, except that this may be increased to 100 percent when the nighttime or Sunday use is a religious facility. The applicant shall demonstrate that there is no substantial conflict in the principal operating hours of the uses for which the sharing of parking is proposed.

(3) Shared Parking for the Uses of the Same Type

(a) The [zoning administrator] may authorize in writing shared parking arrangements between two or more commercial uses having the same or overlapping operating hours, allowing reductions in the total minimum number of required parking spaces as follows:

1. Up to a 20 percent reduction in the total minimum number of required parking spaces for four or more separate establishments;
2. A 15 percent reduction in the total minimum number of required spaces for three establishments; and
3. A 10 percent reduction in the total minimum number of required spaces for two establishments.

(b) No reductions to the parking requirement shall be made if the proposed business establishments have previously received a reduction through the provisions for shared parking under paragraphs (1) or (2) above.

(c) The establishments for which the application is being made for shared parking shall be located within 800 feet of the parking facility. The parking facility shall be located in a commercial or residential-commercial zone.

(d) The reductions to parking quantities allowed through shared parking shall be determined as a percentage of the minimum parking requirement

as stated in section [cite to section establishing minimum parking requirements by use].

(e) New business establishments seeking to meet parking requirements by becoming part of an existing shared parking arrangement shall provide the [zoning administrator] with an amendment to the agreement stating their inclusion in the shared parking facility or area.

105. Written Agreement between Property Owners to Share Parking

(1) Where an application for a zoning permit for which shared parking is proposed includes two or more separately owned properties and the [zoning administrator] has made a determination of the minimum number of required parking spaces for the each of the applicable properties and uses, the [zoning administrator] shall require that the owners of the properties enter into a legal agreement guaranteeing access to, use of, and management of designated shared parking spaces. The agreement shall be in a form approved by the [local government law director], included as a condition of the zoning permit, and enforceable by the [local government].

(2) Where an application for a zoning permit for which shared parking is proposed includes two or more properties owned by the same property owner and the [zoning administrator] has made a determination of the minimum number of required parking spaces for the applicable properties and uses, the [zoning administrator] shall require that the owner of the properties shall enter into a legal agreement with the [local government] guaranteeing access to, use of, and management of designated shared parking spaces. The agreement shall be in a form approved by the [local government law director], included as a condition of the zoning permit, and enforceable by the [city or county].

106. Shared Parking Plan

(1) The [zoning administrator] may require an applicant for a zoning permit that incorporates shared parking to submit a shared parking plan. Such a plan shall be included as an addendum to a site plan and shall be drawn to the same scale. A shared parking plan includes one or more of the following:

(a) A site plan showing parking spaces intended for shared parking and their proximity to the uses 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.

(2) The shared parking plan shall satisfy the following standards, as applicable:

(a) Shared spaces for residential units must be located within [300] feet of dwelling unit entrances they serve.

(b) Shared spaces at nonresidential 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.

(c) Clearly delineated and direct pedestrian connections must be provided from the shared parking area(s) to the building entrances.

(d) Pedestrians shall not be required to cross an arterial street to access shared parking facilities except at a signalized intersection along a clearly delineated pedestrian pathway.

AN EXAMPLE OF A SHARED PARKING CALCULATION

Calculate the shared parking required for a mixed use development with a 40,000-gross-square-foot (GSF) office building and a 5,000 GSF restaurant.

Step 1. Determine the base parking required (as per the local parking ordinance) for each land use.

Assume the parking standards ordinance requires, at a minimum, 2.7 spaces per 1,000 GSF for office uses and 15.3 spaces per 1,000 GSF for restaurants.

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 base requirement: 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 (e.g., those contained in ULI (1983)) or other studies 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 4.10.1 shows the various hourly parking demand rates for offices and restaurants (columns 2 and 4) from ULI data. These rates were multiplied by the 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 Table 4.10.1 above. Below is the combined peak parking demands for several critical hours during the day (Table 4.10.2):

TABLE 4.10.1. WEEKDAY HOURLY PARKING DEMAND RATIOS FOR OFFICE BUILDINGS AND RESTAURANTS

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

Adapted from ULI 1983 [2005]

TABLE 4.10.2. COMBINED PARKING REQUIREMENTS

Metro Codes	Office Code Requirements	40,000 GSF Office	Restaurant Code Requirements	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**

Adapted from Portland Metro 1997

Combined Demand for Office, peak hour at 11 a.m.:
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 7 p.m.:
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 1 p.m.:
Office = 2.7 spaces/1,000 GSF, Restaurant = 14.0/1,000 GSF

Combined Demand = (2.7 x 40) + (14.0 x 5) = 108 + 70 = **178 spaces**

Peak-Hour Parking Demand for Combination of Uses = 178 spaces

Step 3. Compare the calculations of the two steps above. The lesser of the two parking demands shall be used as the minimum number of parking spaces required.

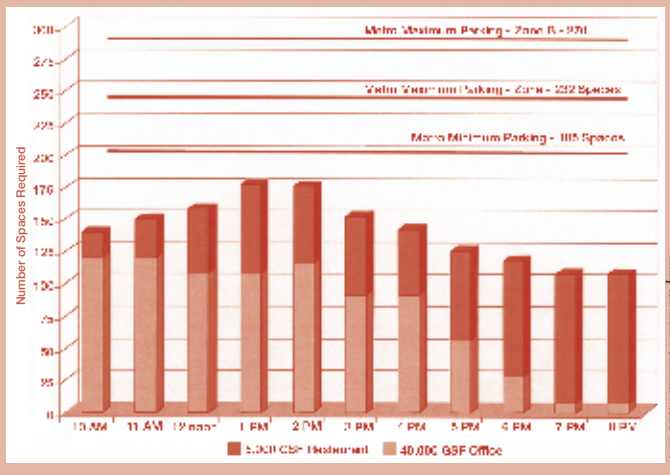
Minimum parking required for both uses according to local parking standards = 185 spaces

Peak-hour parking needs with shared parking = 178 spaces

185 – 178 = Net savings of 7 spaces

Table 4.10.2 shows the potential savings in the construction of parking spaces based on the calculations in the example. Using the maximum parking ratio requirements from the Portland, Oregon, Metro Functional Plan for its Zones A and B, a shared parking arrangementcould save as many as 101 parking spaces. The effect of shared parking for this example is also show in Figure 4.10.2.

FIGURE 4.10.2. PARKING COMPARISONS: SHARED PARKING DEMAND VERSUS CODE REQUIREMENTS



Adapted from Portland Metro 1997

REFERENCES

Barkeen, Bob (Planner, City of Fort Collins, Colo., Department of Planning). 2003. Telephone conversation. November 18.

Bastrop (Tex.), City of. 2003. *Zoning Ordinance.* Chapter 5, Section 38.7, "Rules for Computing Number of Parking Spaces." Available at http://codes.franklinlegal.net/bastrop%2Dflp.

Davidson, Michael, and Fay Dolnick. 2001. *Parking Standards.* Planning Advisory Service Report No. 510/511. Chicago: American Planning Association.

Fort Collins (Colo.), City of. 2007. *Land Use Code.* Section 3.2.2. "Access, Circulation, and Parking." Available at www.colocode.com/ftcollins/landuse/article3.htm#div3d2.

Institute of Transportation Engineers (ITE). 1995. *Shared Parking Planning Guidelines.* Washington, D.C.: ITE.

———. 2004. *Parking Generation.* Washington, D.C.: ITE.

Portland (Ore.), City of. *Zoning Ordinance.* Chapter 33.266, "Parking and Loading," Section 33.266.115, "Maximum Allowed Parking Spaces." Available at www.portlandonline.com/shared/cfm/image.cfm?id=53320.

Portland Metro. 1997. *Shared Parking in the Portland Metro Area*. Appendix A, "Model Shared Parking Ordinance Provisions." Available at www.crcog.org/publications/CommDevDocs/TCSP/Ch08_Technical_Part2_Parking.pdf.

Redmond (Wash.), City of. 2007. *Community Development Guide.* Section 20D.130.10-020, "Required Off-Street Parking," and Section 20D.130.10-030, "Design Requirements for Parking Facilities." Available at www.codepublishing.com/WA/redmond.html.

Rouphail, N., J. Hummer, J. Milazzo II, and P. Allen. 1998. "Capacity Analysis of Pedestrian and Bicycle Facilities: Recommended Procedures for the '*Pedestrian*' Chapter of the *Highway Capacity Manual*." Federal Highway Administration report FHwA-RD-98-107. Available at www.fhwa.dot.gov/tfhrc/safety/pubs/98-107/title.htm.

Seattle, City of. 2008. *Land Use Code*. Subtitle 3, Division 2, Chapter 23.54, "Quantity and Design Standards for Off-Street Parking and Access," and Section 23.54.020, "Parking Quantity Exceptions." Available at http://clerk.ci.seattle.wa.us/~public/toc/23-54.htm.

Smith, Mary S. 2005. *Shared Parking*. 2d ed. Washington, D.C.: ULI.

Troxel, Mark (Senior Planner, City of Seattle Department of Planning and Development). 2004. Telephone conversation with Marya Morris. January 7.

THE CITY OF SAN DIEGO

RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO
AND WHEN RECORDED MAIL TO:

City of San Diego
Development Services Department
1222 First Ave., MS-301
San Diego, CA 92101

(THIS SPACE IS FOR RECORDER'S USE ONLY)

SHARED PARKING AGREEMENT

This SHARED PARKING AGREEMENT ("Agreement") is entered into and effective _____, 20_____, by and between _____, _____and the City of San Diego.

RECITALS

WHEREAS, pursuant to sections 142.0535 and 142.0545 of the Land Development Code, the City of San Diego specifies criteria which must be met in order to utilize off-site shared parking agreements to satisfy on-site parking requirements.

NOW, THEREFORE, in consideration of the recitals and mutual obligations of the parties as herein expressed, _____, _____ and the City of San Diego agree as follows:

1. _____ the owner of the property located at _____ , agrees to provide _____ the owner of the property located at _____ with the right to the use of (____) parking spaces _____ from _____ as shown on Exhibit A to this Agreement on property located at _____.

   1.1 Applicant: _____ Co-Applicant: _____
   Assessor Parcel No: _____ Assessor Parcel No: _____
   Legal Description: _____ Legal Description: _____
   _____ _____

2. The parking spaces referred to in this Agreement have been determined to conform to current City of San Diego standards for parking spaces, and the parties agree to maintain the parking spaces to meet those standards.

3. The Parties understand and agree that if for any reason the off-site parking spaces are no longer available for use by _____, _____ will be in violation of the City of San Diego Land Development Code requirements. If the off-site parking spaces are no longer available, Applicant will be required to reduce or cease operation and use of the property at Applicant's address to an intensity approved by the City in order to bring the property into conformance with the Land Development Code requirements for required change for required parking. Applicant agrees to waive any right to contest enforcement of the City's Land Development Code in this manner should this circumstance arise.

   Although the Applicant may have recourse against the Party supplying off-site parking spaces for breach of this Agreement, in no circumstance shall the City be obligated by this agreement to remedy such breach. The Parties acknowledge that the sole recourse for the City if this Agreement is breached is against the Applicant in a manner as specified in this paragraph, and the City may invoke any remedy provided for in the Land Development Code to enforce such violation against the Applicant.

(Continued on Page 2)

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4. The provisions and conditions of this Agreement shall run with the land for those properties referenced in paragraph 1 of this document and be enforceable against successors in interest and assigns of the signing parties.

5. Title to and the right to use the lots upon which the parking is to be provided will be subservient to the title to the property where the primary use it serves is situated.

6. The property or portion thereof on which the parking spaces are located will not be made subject to any other covenant or contract for use which interferes with the parking use, without prior written consent of the City.

7. This Agreement is in perpetuity and can only be terminated if replacement parking has been approved by the City's Director of the Development Services Department and written notice of termination of this agreement has been provided to the other party at least sixty (60) days prior to the termination date.

8. This Agreement shall be kept on file in the Development Services Department of the City of San Diego in Project Tracking System (PTS) Project Number: _____ and shall be recorded on the titles of those properties referenced in paragraph 1 of this document.

In Witness whereof, the undersigned have executed this Agreement.

_____
Applicant

Date: _____

_____
Party/Parties Supplying Spaces

Date: _____

_____
Deputy Director

Business and Process Management, Development Services

Date: _____

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDGMENTS PER CIVIL CODE SEC. 1180 ET.SEQ.

Marshall Township, PA

Chapter 208. Zoning Code
Article 1900. Off-street Parking and Loading
Section 208-1902. Parking Facilities Required

208-1902.B. Shared Parking

1. In order to accommodate the usage of the same parking spaces for two (2) or more different land uses, requiring different principal hours of use, a lower number of the required parking spaces may be permitted. Subsequent changes in land uses within the mixed use development shall require a new occupancy permit and proof that sufficient parking will be available. The following provisions apply to shared parking:

(a) The required parking for mixed uses shall be computed as follows:

(i) Determine the minimum amount of parking required for each land use as though it were a separate use.

(ii) Using the Table below, determine the number of spaces needed by each use for each of the four (4) time periods by multiplying the parking required for each use by the corresponding percentage of use for that time period.

(iii) Calculate the total number of spaces needed for all uses for each time period.

(iv) The time period with the highest number of parking spaces required for the sum of all uses shall be the number of parking spaces required.

CALCULATING PARKING FOR MIXED-USE DEVELOPMENTS				
USE	**WEEKDAY**		**WEEKEND**	
	Daytime (8 AM-6PM)	Evening (6PM – 11 PM)	Daytime(8 AM- 6PM)	Evening(6PM – 11 PM)
Office/Industrial	100%	10%	10%	5%
Retail/Personal Services	60%	90%	100%	70%
Hotel	75%	100%	75%	100%
Residential	50%	75%	100%	80%
Restaurant	75%	100%	100%	100%
Entertainment/ Recreational	40%	100%	80%	100%
All other uses	100%	100%	100%	100%

2. To apply for usage of the shared parking requirement, a table shall be submitted showing the breakdown of the gross floor area devoted to each of the above five (5) land use categories. The total amount of required parking shall be tabulated by use and time period. The time period requiring the highest number of parking spaces shall be selected as the basis for the shared parking requirement.

3. Agreement For Shared Parking Plan

A shared parking plan shall be enforced through written agreement. An attested copy of the agreement between the owners of record shall be submitted to the Planning Director who shall forward a copy to the Township Solicitor for review and approval. Proof of recordation of the agreement shall be presented to the Planning Director prior to issuance of a certificate of occupancy. The agreement shall:

(a) List the names and ownership interest of all parties to the agreement and contain the signatures of those parties;

(b) Provide a legal description of the land;

(c) Include a site plan showing the area of the parking parcel

(d) Describe the area of the parking parcel and designate and reserve it for shared parking unencumbered by any conditions which would interfere with its use;

(e) Agree and expressly declare the intent for the covenant to run with the land and bind all parties and all successors in interest to the covenant;

(f) Assure the continued availability of the spaces for joint use and provide assurance that all spaces will be usable without charge to all participating uses;

(g) Describe the method by which the covenant shall, if necessary, be revised.

Sussex (DE), County of. 2008. *County Code*.
Chapter 115 Zoning.
Article XXII. Off-Street Parking.

Section 115-165. Joint Use and Off-Site Facilities.
All parking spaces required herein shall be located on the same lot with the building or use served.

B. Shared parking. The Planning and Zoning Commission may authorize a reduction in the number of required parking spaces for multiple use developments or for uses that are located near one another with a maximum distance from the farthest parking space (or in the case of a parking garage, the pedestrian entrance to the garage) of 600 feet to the public entrances or a lighted, semi-weather-proofed covered walkway leading to the public entrances for commercial uses and with a maximum distance of 600 feet (or in the case of a parking garage, the pedestrian entrance to the garage) to the residential entrances that are being considered in the shared uses and, which have different peak parking demands and operating hours. Shared parking shall be subject to the following standards:

(1) Location. All uses that participate in a single shared parking plan shall be located on the same lot or on lots that share a common boundary. The shared parking lot shall be developed and used as though the uses on the lots were a single unit.

(2) Shared parking study. A shared parking study signed and sealed by a Delaware licensed professional engineer in a form acceptable to the Planning Director shall be submitted which clearly establishes those uses that will utilize the shared spaces at different times of the day, week, month and year, including seasonal or mode adjustment factors. The study shall:

(a) Be based on the most current Urban Land Institute's shared parking study methodology or other generally accepted methodology;

(b) Address the size and type of activities, the composition of occupants, the rate of turnover for proposed shared spaces and the anticipated peak parking and traffic loads;

(c) Provide for a reduction by not more than 50% of the combined parking required for each use;

(d) Provide for no reduction in the number of spaces reserved for persons with disabilities;

(e) Provide a plan to convert the reserved area to parking area if it is ever required; and

(f) Be reviewed and approved by the Planning Director and the Planning and Zoning Commission.

(3) Agreement for shared parking plan. A shared parking plan shall be enforced through written agreement. An attested copy of the agreement between the owners of record shall be submitted to the Planning Director who shall forward a copy to the County Attorney for review and approval. Proof of recordation of the agreement shall

be presented to the Planning Director prior to issuance of a certificate of occupancy. The agreement shall:

(a) List the names and ownership interest of all parties to the agreement and contain the signatures of those parties;

(b) Provide a legal description of the land;

(c) Include a site plan showing the area of the parking parcel and the open space reserved area which would provide for future parking and any required stormwater management facilities;

(d) Describe the area of the parking parcel and designate and reserve it for shared parking unencumbered by any conditions which would interfere with its use;

(e) Agree and expressly declare the intent for the covenant to run with the land and bind all parties and all successors in interest to the covenant;

(f) Assure the continued availability of the spaces for joint use and provide assurance that all spaces will be usable without charge to all participating uses;

(g) Describe the obligations of each party, including the maintenance responsibility to retain and develop reserved open space for additional parking spaces if the need arises;

(h) Incorporate the shared parking study by reference; and

(i) Describe the method by which the covenant shall, if necessary, be revised.

(4) Change in use. Should any of the shared parking uses be changed, or should the Planning Director find that any of the conditions described in the approved shared parking study or agreement no longer exist or if the Planning Director and Planning and Zoning Commission determine that insufficient parking is an issue, the owner shall have the option of submitting a revised shared parking study and an amended shared parking agreement in accordance with the standards of this subsection or of providing the number of spaces required for each use as if computed separately. If the Planning Director determines that the revised shared parking study or agreement does not satisfy the off-street parking needs of the proposed uses, the shared parking request shall be denied, and no certificates of occupancy shall be issued until the full number of off-street parking spaces are provided.

(5) Revocation of permits. Failure to comply with the shared parking provisions of this subsection shall constitute a violation of this Code and shall specifically be cause for revocation of a certificate of occupancy.

Tumwater (WA), City of. 2009. *Municipal Code*.
Title 18. Zoning
Chapter 18.50. Off-Street Parking

18.50.090 Shared and Combined Parking Facilities

A. Definitions

1. Combined parking: Two or more land uses or a multi-tenant building which merge parking needs to gain a higher efficiency in vehicular and pedestrian circulation, economize space, reduce impervious surface and result in a superior grouping of building(s).

2. Shared Parking: Two or more land uses or a multi-tenant building which merge parking needs based on "different" operating hours to gain a higher efficiency in vehicular and pedestrian circulation, economize space, reduce impervious surface and result in a superior grouping of building(s).

B. General provisions. The Development Services Director may require an applicant to demonstrate that shared or combined parking is feasible when adjacent land uses have different hours of operation. Mixed use and shopping center developments with similar operating hours may also be required to submit a parking demand study to determine if parking can be combined.

1. Authority. In order to eliminate multiple entrances and exits, reduce traffic hazards, to conserve space and to promote orderly development, the Development Services Director and Hearings Examiner are each hereby authorized to group cooperative parking facilities for a number of uses in such a manner as to obtain the maximum efficiency in parking and vehicular circulation.

2. Agreement. If authorized by the Development Services Director, an agreement establishing shared or combined use of a parking area, approved by the City Attorney, shall be recorded with the County Auditor's Office. Such agreements shall run with the land for all properties with shared or combined parking and require City approval for any change or termination.

3. Termination of combined or shared use.
   a. In the event that a combined or shared parking agreement is terminated, those businesses or other uses with less than the required parking shall notify the Development Services Director within ten (10) days and take one of the following actions:

      1) Provide at least fifty (50) percent of the required parking within one-hundred eighty (180) days, and provide the remaining required parking within three hundred and sixty five (365) days following the termination of the shared or combined use; or

      2) Demonstrate, based upon a study deemed reliable by the Director of Development Services, that the available parking is sufficient to accommodate the use's peak parking demand; or

      3) Apply for and receive an administrative parking modification. (see 18.50.080)

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b. If sufficient parking is not provided, the use, or that portion of the use out of compliance with this chapter, shall be terminated upon the expiration of the time period specified in 4.a(i) above. This requirement shall be established as a condition of the occupancy permit for uses relying on combined or shared parking.

4. Allocation.

a. Shared Parking. For land uses in close proximity of each other that operate or are used at entirely different times of the day or week, the Development Services Director may allow shared parking facilities to satisfy the parking requirements of such uses if the parking facilities are within ¼ mile (1,320 feet) of all primary entry areas to buildings being served by such facilities.

1) When two (2) or more land uses, or uses within a building, have distinctly different hours of operation (e.g., office and church), such uses may qualify for a shared parking credit. Required parking shall be based on the use that demands the greatest amount of parking.

2) If two (2) or more land uses, or uses within a building, have different daytime hours of operation (e.g. bowling alley & auto parts store), such uses may qualify for a total parking reduction of no more than fifty (50) percent.

b. Combined Parking. Two or more uses which have similar hours of operation and combine parking facilities may qualify to decrease the number of parking spaces (see Figure 18.50.090(A)). The combined parking facility must be cooperatively established and operated in accordance with Section 18.50.090.B.2. The Development Services Director may require a parking demand study to ensure sufficient parking is provided.

Parking In-Lieu Fees

Item No:
Meeting Date: **February 17, 2004**

Staff Report

January 28, 2004

TO: City Council

FROM: Bill Emlen, Community Development Director
Katherine Hess, Community Development Administrator
Ken Hiatt, Principal Planner

SUBJECT: **Resolution Amending the Parking In-lieu fees for the Central Commercial (C-C) and Mixed Use (M-U) Zoning Districts**

Recommendation

That the City Council:

1. Hold a public hearing;
2. Approve the attached resolution amending the in-lieu-of parking fees for the Central Commercial and Mixed Use zoning Districts.

Background and Analysis

Parking In-lieu Fees

The in-lieu of parking fee option for parking has been a policy in Davis since the late 70's and was previously set at $8,000 per required space. Designed to encourage infill development and generate funds to provide consolidated off-site parking, the program had generated roughly $190,000 up until 1998.

Seeing little potential of the program to generate adequate revenue to fund a new parking structure and finding the fee to be a disincentive to expansion of business and development in the Core, the City Council adopted an in-lieu fee reduction program in 1998 (see Attachment 2). Under this program, projects that meet specific objectives for the downtown such as ground floor retail and upper level housing can be granted parking in-lieu fee reductions or waivers.

While effective in encouraging reinvestment in the downtown, this approach has proven to be a cumbersome and often inconsistent way to assessing parking obligations for new projects.

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To address these issues, staff and the DDBA have been working to develop parking requirements that accurately reflect the demand for parking generated by mixed use developments in conjunction with amendments to the parking in-lieu fee that do not creating a barrier to further redevelopment downtown. The following shared objectives were used to evaluate potential outcomes:

- Encourage / foster continued redevelopment of smaller underutilized properties within the Downtown with particular emphasis on the "Core of the Core", while planning and providing for parking on a district wide basis.
- Parking standards should accurately represent the shared use of parking inherent in the downtown and reflect the higher proportion of non-automobile trips to downtown destination.
- Parking standards should be simplified, user friendly, and consistently applied throughout the Central Commercial District.
- In-lieu fees for downtown mixed use projects should be set at a rate that does not recover the full cost for structured parking downtown but requires a "fair share" contribution the development of such parking facilities. The balance of the cost of providing structured parking should be paid through a combination of Redevelopment, Assessment Districts, and/or user fees.

Amendments to the Parking Requirements and Provision of In-lieu Fee Payments
An ordinance establishing parking standards specific to the Central Commercial district and procedural provisions to the payments of in-lieu-of parking fees was adopted at the City Council Meeting of February 3, 2004 (see Attachment 3).

Resolution Amending the In-lieu fee
In conjunction with the new parking requirements for the CC district, staff in consultation with the DDBA, analyzed options for in-lieu-of parking fees with the goal of establishing a fee that captured a reasonable cost of developing future consolidated parking downtown, but at the same time did not create a barrier to further private reinvestment. The attached resolution proposes to do away with existing tiered fee reduction approach and establish the in-lieu-of parking fee at a flat $4,000 per require parking space. It would also not continue the provision for City Council to approve further reductions on a case by case basis.

As is the case now, the fee would apply to all parking spaces required as part of new construction but not accommodated on-site within the project or in an approved off-site location. In recognition of the complimentary nature of the peak parking demands between upper story office uses and ground floor retail uses, the new resolution proposes that no fee be required for ground floor retail uses that occupy space in a new multi-story building.

In-lieu-of parking fees are assessed at initial occupancy of the new or expanded building. To address concerns of subsequent conversion of ground floor merchandising retail uses, the resolution requires:

that for any ground floor merchandising retail space for which in-lieu of parking fees were not initially required, and is subsequently converted to a non-merchandising retail use within five years of initial occupancy of the space, in-lieu-of parking fees shall be paid prior to certificate of occupancy for the new use based on the parking standards and fees in effect at such time.

Summary

The proposed in-lieu-of parking fee, combined with the revisions to the parking requirements in the Central Commercial District, are necessary to establish a provision for parking that is consistent with City goals, policies and guidelines for further enhancement of the downtown. The revisions will provide for parking in-lieu-fees to be generated that will be used by the city to construct smaller public parking resources downtown as opportunities arise and provide partial funding of the next parking structure currently under study.

Attachments:

1. Resolution Amending In-lieu of Parking Fee
2. Existing Resolution reducing In-lieu-of Parking Fees
3. Ordinance Amending CC parking requirements and In-lieu of Parking Payments

RESOLUTION NO. _____, SERIES 2004

RESOLUTION OF THE CITY COUNCIL OF THE CITY OF DAVIS ESTABLISHING IN-LIEU-OF PARKING FEE FOR CORE COMMERCIAL AND MIXED USE ZONING DISTRICTS

WHEREAS, the Zoning Ordinance currently allows for the payment of fees in-lieu of developing parking on-site for each individual project;

WHEREAS, in-lieu of parking fees allow for more efficient use of land for commercial purposes and preservation of the pedestrian ambiance and architectural character of the district;

WHEREAS, the City of Davis also has a variety of goals and policies to enhance the economic strength and physical appearance of the downtown Davis;

WHEREAS, in furtherance of these goals, the City Council established a reduced parking in-lieu fee for the Central Commercial (C-C) and Mixed Use (M-U) districts in 1998;

WHEREAS, the fees are to be reviewed and updated from time to time as the Council determines appropriate;

WHEREAS, the City Council, in conjunction with the revisions to the parking standards for the C-C district; desires to rescind the current parking in-lieu fee reduction and amend the base in-lieu fee to a rate that reflects approximately 25% of the cost of a structured parking space with an expectation that the balance of the cost of the required parking will be provided through assessment district and redevelopment funds;

NOW, THEREFORE BE IT RESOLVED, that the City Council of the City of Davis hereby establishes the in-lieu-of parking fee for the C-C and M-U Zoning District at $4,000 per parking space except as otherwise provided herein;

NOW, THEREFORE BE IT FURTHER RESOLVED, that for multi-story projects that include ground floor merchandising retail use(s), as defined in Exhibit A to this Resolution, the in-lieu-of parking fees for the project shall be based on the non-merchandising retail uses occupying space within the project at initial occupancy, and no additional in-lieu-parking fees are required for merchandising retail use(s) occupying the ground floor;

NOW, THEREFORE BE IT FURTHER RESOLVED, that for any ground floor merchandising retail space for which in-lieu of parking fees were not initially required, and is subsequently converted to a non-merchandising retail use within five years of initial occupancy of the space, in-lieu-of parking fees shall be paid prior to certificate of occupancy for the new use based on the parking standards and fees in effect at such time; and

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the prior Resolution reducing parking-in-lieu fees for Central Commercial and Mixed Use Zoning districts, Resolution No. 8343, Series 1998, is hereby rescinded.

PASSED AND ADOPTED by the City Council of the City of Davis on this _th day of _____, 2004, by the following vote:

AYES:

NOES:

ABSENT:

_____
SUSIE BOYD
Mayor

ATTEST:

BETTE RACKI
City Clerk

Exhibit A

Merchandising Retail:

Establishments engaged in selling goods or merchandise to the general public for personal or household consumption and rendering services incidental to the sale of such goods.

Uses consistent with this definition would include those selling on site:

- General Merchandise
- Clothing
- Shoes
- Sporting Goods
- Home Furnishings / Appliances
- Home / Garden Improvement Products
- Other similar uses

Uses not consistent with this definition would include:

- Food Service / Restaurants
- Personal Services
- Offices
- Financial Institutions
- Entertainment Uses
- Other similar uses

ATTACHMENT 2

RESOLUTION NO. 8343, SERIES 1998

RESOLUTION REDUCING PARKING-IN-LIEU FEE
FOR CORE COMMERCIAL AND MIXED USE ZONING DISTRICTS

WHEREAS, the City of Davis has a variety of policies to enhance the economic strength of downtown Davis; and,

WHEREAS, the City of Davis currently has a parking-in-lieu fee of $8,000 per space in the Core Commercial and Mixed Use zoning areas of downtown Davis; and,

WHEREAS, it has been demonstrated to the City that the imposition of the current parking-in-lieu fee is a disincentive to the expansion and growth of businesses located in the downtown, and this fee has not substantially generated revenues to assist with major parking facility expansions; and,

WHEREAS, after discussions with the Chamber of Commerce and the Davis Downtown Business Association, the City has found support for major reductions in the parking-in-lieu fee.

NOW, THEREFORE, BE IT RESOLVED, that the City Council approves reducing the parking-in-lieu fee for projects in the Core Commercial zoning district as established herein:

I. If a project has predominantly retail uses on ground floor (any use on upper stories):
   A. No fee is required for up to 10 required parking spaces;
   B. A fee of $2,000 per space is established for the next fifteen spaces (spaces 11 through 25);
   C. A project may be approved for reduction of fees for more than 25 parking spaces, subject to City Council review on a case-by-case basis.

II. If a project is predominantly commercial on the ground floor, but is not predominantly retail (any use on upper stories):
   A. A fee of $2,000 per space is established for up to 25 required parking spaces;
   B. A project may be approved for reduction of fees for more than 25 parking spaces, subject to City Council review on a case-by-case basis.

III. If a project is predominantly residential on the ground floor:
   A. There is no reduction in parking-in-lieu fees for parking required to meet the needs of the first-floor units;
   B. A fee of $2,000 per space is established for second or third floor residential units.

NOW, THEREFORE, BE IT FURTHER RESOLVED, that the City Council approves reducing the parking-in-lieu fee in the Mixed Use zoning district as established herein:

I. If new square footage or a new building is constructed, and there is no demolition of any structure existing as of the date of this resolution, a fee of $2,000 is established for up to 5 required spaces;

II. If a change of use in an existing structure requires additional parking, a fee of $2,000 per space is established for up to 5 required spaces;

III. If a project is predominantly residential on the ground floor, there is no reduction in parking-in-lieu fees for parking required to meet the needs of the first-floor units

IV. A fee of $2,000 per space is established for second or third floor residential units in mixed-use projects, if there is no demolition of any structure existing as of the date of this resolution.

V. A project may be approved for reduction of fees for more than 5 parking spaces or if an existing building is to be demolished, subject to City Council review on a case-by-case basis.

NOW, THEREFORE BE IT RESOLVED, this reduction shall be effective for projects which apply for building permits after May 1, 1998.

PASSED AND ADOPTED by the City Council of the City of Davis on this 22nd day of April, 1998, by the following vote.

AYES: Boyd, Forbes, Kaneko, Partansky, Wolk.

NOES: None.

ABSENT: None.

LOIS WOLK
Mayor

ATTEST:

BETTE RACKI
City Clerk

Attachment 3

Davis, CA
DATE: 02-03-04
ITEM NO: 4H

ORDINANCE NO. 2148

AN ORDINANCE AMENDING CHAPTER 40 OF THE MUNICIPAL CODE PERTAINING TO PARKING REQUIREMENTS FOR THE CENTRAL COMMERCIAL DISTRICT AND IN-LIEU-OF PARKING PAYMENTS

THE CITY COUNCIL OF THE CITY OF DAVIS DOES HEREBY ORDAIN AS FOLLOWS:

SECTION 1.
Amend Section 40.14.090 Central Commercial District Parking Requirements) of Chapter 40 of the Davis Municipal Code so that as amended the section will read as follows:

Off-street parking and loading facilities shall be required for all uses, subject to the requirements set forth in sections 40.25.01 to 40.25.120 and the requirements of this section. The requirements of this section shall prevail in case of conflict.

(a) Construction of on-site parking shall not be allowed for office or commercial uses unless below grade or above the ground floor or an integral part of the building structure. Participation in a parking district as per section 40.25.050, or in-lieu-of payments as per section 40.25.060, shall be required.
(b) Parking for residential uses shall be provided on-site in accordance with Section 40.25,070, or in an off-site location as provided for in Section 40.25.050 (e).
(c) For projects within the Downtown Core District as defined within the Downtown and Traditional Residential Neighborhood Design Guidelines, access to on-site parking should come from an existing alley or non-prime retail storefront street.
(d) The number of parking spaces required shall be as set forth in Section 40.25.090 except as specified below:

Use	Parking Spaces Required
Athletic club; exercise studio; music, photography, art, and dance studios	1 space per 500 square feet of gross floor area
Retail stores and shops	1 space per 500 square feet of gross floor area
Office, service, financial institutions	1 space per 500 square feet of gross floor area
Restaurant/café	1 space for every 250 square feet of gross floor area (no parking required for outdoor seating)
Hotel	3 spaces for every 4 units
Multi-Family live-work/studio and one bedroom two bedroom three or more bedrooms	 1 space 1.5 spaces 1 space per bedroom

(e) **Bicycle parking.**
(1) The number and location of all bicycle parking spaces shall be determined by the community development director or his/her designee.
(2) Multiple dwellings are required to provide two bicycle spaces per dwelling unit.

SECTION 2.
Amend Section 40.25.060 (In-Lieu-of Parking Payments) of Chapter 40 of the Davis Municipal Code so that as amended the section will read as follows:

Section 40.25.060 In-lieu-of parking payments
Off-street parking for properties where on-site parking is not permitted at grade level, or where in-lieu-of payments are a permitted alternative to on-site parking, may be provided as follows:

(a) By payment to the city in an amount equal to the value of the required parking on a per parking place basis. From time to time the city council shall establish by resolution the value of off-street parking facilities on a per parking place basis. Funds collected by the city from such payment shall be deposited in a special fund and used only by the city to acquire and/or develop on-street or off-street parking and related facilities which are determined by the city council to alleviate the need for parking spaces in the core area.
(b) Such parking shall be available to the public and shall be in or near commercial districts of the city.
(c) Funds paid to the city for in-lieu-of parking shall not be refundable except as otherwise provided for by State law.
(d) All in-lieu-of parking fees shall be paid prior to the issuance of certificate of occupancy. In the case of a multi-tenant building, the fees shall be calculated based on and paid prior to the issuance of certificate of occupancy for each individual tenant spaces.

SECTION 3.
Amend Section 40.25.090 (Parking and Loading Areas – Number of Parking spaces required) of Chapter 40 of the Davis Municipal Code so that as amended the first sentence of the section will read as follows:

Section 40.25.090 Number of Parking spaces required
Except as otherwise specified in Sections 40.12 (CN), 40.14 (CC), and 40.15(MU) the number of off-street parking spaces required shall be set forth in the following subsections:

SECTION 4. Findings
The City Council of the City of Davis hereby finds that the public necessity and convenience and general welfare require the adoption of the amendment as set forth and that said amendment is consistent with the Davis General Plan and Core Area Specific Plan.

SECTION 5.
This ordinance shall become effective on and after the thirtieth (30th) day following its adoption.

INTRODUCED ON January 20, 2004 and PASSED AND ADOPTED on February 3, 2004 by the following vote:

AYES: GREENWALD, PUNTILLO, BOYD.
NOES: NONE.
ABSTAIN: ASMUNDSON, HARRINGTON.

Susie Boyd
SUSIE BOYD
Mayor

ATTEST:
Bette E Racki
BETTE RACKI
City Clerk

Parking In Lieu of Fee (change effective 12/2/2004)

On December 1, 2004 the City of Bend, City Council adopted the revised in lieu of fee rate structure and policy detailed below:

1. The fee is calculated on a tiered rate structure:

For each of the first 1 to 5 spaces	$2,500.00/space*
For each of the next 6 to 20 spaces	$4,500.00/space*
For each space from 21 and more	$7,000.00/space*

*These fees are subject to the discounts and financing options contained in the City Council policies adopted with the resolution.

2. Discounts and financing options available:
   - An applicant may receive a discount in the in-lieu of fee amount due by 10% by entering into a lease to purchase parking permits in the garage structure for five (5) consecutive years.
     - The applicant may enter into a lease for parking permits anytime up to 5 years after the date of the original application.
     - The discount will only become available once the parking structure is complete.
     - The monthly cost for the permit shall be equal to the market rate for permits in the structure.
     - The discount will become effective upon the signing of a lease for parking permits.
     - The discount will only be applicable for the number of parking spaces leased.
     - The required spaces do not need to be leased all at one time, allowing for developer flexibility as buildings become leased over time.
     - If an applicant pays the entire amount due at time of permit and enters into a lease anytime within the 5 year period after application, they will be reimbursed for the amount of the discount only.
     - To qualify for a lease, the City of Bend will require a lien on the real property during the term of the lease.

   - If a developer/owner selects to provide on site parking either underground or above surface newly constructed as part of the development, then they shall receive a discount in the in-lieu fee amount equivalent to the fees assessed for the number of parking spaces provided in the underground or above surface structured parking lot.

   - An applicant may select to have the in-lieu fee financed over a 10 year period at a fixed interest rate of (TBD) per annum the first year. The interest rate shall be reviewed on an annual basis. This obligation shall be contained in a loan agreement which shall be secured in a manner satisfactory to the City.
   - An applicant may now pay in lieu of fees at time of occupancy rather than at time of permit. To delay the payment of fees, the City of Bend will require a lien on the real property equal to the amount of in lieu of fees due.

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CITY OF CORVALLIS

COUNCIL POLICY MANUAL

POLICY AREA 7 - COMMUNITY IMPROVEMENTS

CP 02-7.15 Fee-in-Lieu Parking Program for Parking-Related Improvements in the Central Business (CB) District and the Riverfront (RF) District

Adopted December 16, 2002
Revised November 21, 2005
Affirmed May 7, 2007

7.15.010 Purpose

The Land Development Code requires all new development in the CB and RF Districts (the downtown) to construct, at a minimum, one parking space per 1,000 square feet of commercial space and one space per each residential unit. The Corvallis Comprehensive Plan directs that the downtown area is to remain in a compact urban form, and it is sometimes difficult in the downtown to provide both the required parking and the required urban density to maintain such a form on the same piece of property. The Fee-in-Lieu Program allows developers to pay a fee for each parking space rather than construct said space. The fund into which the fee is paid is reserved for future provision of publicly accessible parking spaces in the CB and RF Districts.

7.15.020 Policy

7.15.021 Applicability

This policy applies to all development in the CB and RF Districts required to construct parking spaces according to provisions of the Land Development Code. In general, it is recognized that constructing public parking improvements is preferred to payments in lieu of construction. However, in certain instances, it may be in the best interest of the community to accept payments in lieu of construction to provide for improvements that will help maintain the CB and RF Districts in a compact urban form. The decision to allow payment in lieu of construction will be made by the Planning Commission and/or City Council for development proposals requiring a public hearing, or by the Community Development Director for development

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projects which are permitted uses.

7.15.022 Determination of Fee-in-Lieu Parking Program Fee

The fee associated with this Fee-in-Lieu Program is established as of November 21, 2005, to be $4,000 for each parking space the construction of which a developer chooses not to construct or provide through long-term agreement for the use of available nearby spaces. This fee shall be tied to the Engineering News Record Construction Cost Index 20-City average (ENR CCI) for November 2002, which is 6578.03. The fee shall be updated yearly based on each year's updated ENR CCI for November. The actual in-lieu of fee amount shall be established at the time of payment.

7.15.023 Fee Collection

The Fee-in-Lieu Parking Program fee will be collected by the City, prior to the issuance of any final occupancy permits for the building or portion thereof associated with the fees.

Notwithstanding any other provision herein to the contrary, whenever a Fee-in-Lieu Parking Program charge for five or more spaces would otherwise be due and collectable, the developer may apply upon forms provided by the City Manager for payment of the charge in not more than 20 semi-annual installments plus interest. Upon receipt of such an application, the City Manager shall compute the amount of the Fee-in-Lieu Parking Program charge, the dates upon which each installment on that charge is due, the name or names of the developer(s) of the development for which the Fee-in-Lieu Parking Program charge is imposed, and the description of the property upon which the development is occurring or has occurred. The total amount of the charge shall be subject to interest at the rate of 10 percent per annum, which interest shall be the full and only compensation to the City for its administrative costs and shall be secured by property, bond(s), deposits, letter of credit or other security acceptable to the City Manager. Each installment shall be paid within fifteen days of the dates established above, beyond which fifteen day period a late fee shall be charged. The late fee shall equal five percent of the amount due and an additional late charge shall be assessed for each month the installment remains unpaid. If the developer elects to secure the charge(s) with real property, the developer shall obtain the consent of the owner or owners of record or of the contract purchaser or purchasers of record of the real property. The burden of showing the identity of the owner or owners of record or of the contract purchaser or purchasers of record of the parcel shall be upon the developer. Any deferred payment secured with real property shall become a lien upon the property and the City Manager shall docket the lien in the docket of liens; and from the time that

docketing is completed, the City shall have a lien upon that described property for the total amount of the charge. That lien may be enforced in the manner provided in ORS Chapter 223. That lien herein shall have priority over all other liens and encumbrances of any character.

7.15.024 Accounting

Fee-in-Lieu Parking Program fees and all the interest earnings on those fees will be placed in an account specific to the provision of publicly accessible parking in the CB and RF Districts. These accounts will be co-managed between the Community Development Department and the Finance Department. The City will maintain a record of all properties that have met their required parking space obligation by paying the appropriate fee for the spaces. Payment of this fee does not absolve the developer from any future obligation to participate in future construction of publicly accessible parking spaces through additional funding mechanisms (e.g., a local improvement district, tax increment financing, etc.). Payment of this fee also does not guarantee the developer that parking spaces will be constructed for the sole use of or in the immediate proximity of that development.

7.15.025 Project Implementation

Projects funded from the Fee-in-Lieu Parking Program may be implemented either by the construction of publicly accessible parking spaces through the City's Capital Improvement Program or by disbursing funds to a developer constructing the improvements. Funds may also be used to convert exisitng private parking spaces to publicly accessible parking spaces through the purchase or lease of underutilized private parking spaces. Planning for parking capital improvement projects funded by Fee-in-Lieu Parking Program fees will be initiated at the discretion of the Community Development Director, contingent upon budget approval by the City Council. It should be recognized that to provide for a logical and cost effective construction of parking improvements, projects funded by Fee-in-Lieu Parking Program fees may be phased and may be constructed such that the parking spaces do not directly serve the parcels from which the fee was collected.

7.15.030 Review and Update

This Community Improvements Policy shall be reviewed biennially by the Community Development Director beginning in January of 2007.

subsection (E)(1) of this section or to the nearest entrance to the structure which the facility is required to serve, for uses in subsection (E)(2) of this section.

1. For all uses in the downtown core area the parking facility must be within 200 feet.

2. For marinas the parking facility must be within 400 feet.

3. Ancillary residential uses, as defined in FHMC 17.08.060, in the downtown core area as defined in FHMC 17.08.180, are subject to the provisions of this chapter and shall have one space per dwelling unit.

4. For all uses outside the downtown core area the parking area must be within 100 feet.

5. For all residential dwelling units the parking facility must be on the same lot which the parking spaces are to serve.

F. On-Street Parking Spaces.

1. If the proposed parking area plan submitted pursuant to FHMC 17.68.060 would require elimination of one or more existing on-street parking spaces within the downtown core area, the parking requirements prescribed in subsection B of this section are increased by two off-street parking spaces for each on-street space to be eliminated;

2. If, however, such parking area plan would restore one or more existing on-street parking spaces within the downtown core area, by reducing existing curb cuts or other conflicts, the off-street parking requirements prescribed in subsection B of this section are reduced by two off-street parking spaces for each on-street parking space restored by said plan. (Ord. 1172 § 91, 2001)

17.68.040 Joint use.

A. The land use administrator may authorize the joint use of parking facilities, in order to meet the requirements of this chapter, through a joint use agreement between the owners of a use which required parking primarily during one time period and a use which required parking primarily during a substantially different time period.

B. No more than one joint use parking agreement may be applied to any portion of any parking facility, and no more than two uses may share any portion of any parking facility.

C. The applicant shall clearly demonstrate that there is no substantial conflict between the operating hours of the uses for which joint use of off-street parking facilities is proposed.

D. The applicant shall present a binding legal agreement, executed by the parties holding an ownership interest in the properties subject to the proposed joint use parking agreement. The agreement shall provide that it may be enforced by the town and shall be irrevocable for the term of the proposed joint use parking. Further, it shall provide that in the event the joint use parking becomes unavailable, adequate replacement off-street parking shall be provided or that one or both uses shall be discontinued. Such instrument, after being approved as to form and manner of execution by the town attorney, shall be approved by the land use administrator, recorded with the county auditor, and filed with the town building official prior to the issuance of a building permit. (Ord. 1172 § 92, 2001)

17.68.050 Waiver of requirements.

A. Fee in Lieu of Parking Spaces.

1. Within the downtown core area only, the land use administrator may waive all or part of the on-site parking requirements prescribed in FHMC 17.68.030 upon written request by the applicant to pay a fee into the parking improvement fund created pursuant to subsection B of this section, said payment to be in lieu of furnishing the required parking spaces. In making a determination on the request, the land use administrator shall consider:

a. The extent to which the parking requirements which apply to the proposed development impose a particular hardship upon the applicant;

b. Whether granting the request would be unreasonably burdensome to other property owners in the downtown core area; and

c. Whether granting the request would lead to a better overall result than would strict adherence to the parking requirements of

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this chapter for the purposes of encouraging appropriate land uses, improving pedestrian circulation and achieving better parking design.

2. The fee to be paid in lieu of providing the required parking spaces shall be $13,500 per space required, or such other amount as the town council shall hereafter set by ordinance, based on current values for the purchase of land and construction of off-street parking spaces, or on a rental fee for each required space.

3. The fee in lieu of parking spaces shall be paid in full to the town prior to the issuance of a building permit.

B. Parking Improvement Fund.

1. There is hereby created in the town treasury a special fund designated the "parking improvement fund," into which all in-lieu parking fees shall be deposited, to be expended only for public improvements listed in a parking improvement plan to be adopted by the town council. The town council may from time to time direct that other moneys be transferred into the fund to be used for the purposes of the fund;

2. The fund shall be used exclusively for planning, acquisition, design, development, construction and financing of parking facilities for use by the downtown core area, all consistent with the specific project priorities set forth in the parking improvement plan, as adopted or thereafter amended by the town council. (Ord. 1372 § 15, 2008; Ord. 1172 § 93, 2001)

17.68.060 Plan required.

A. General Plan. The applicant shall submit a plan of the proposed parking facilities at the time of the application for the building or occupancy permit which the parking facilities will serve. The plan shall include the following:

1. North point and scale;

2. All adjacent streets, alleys, sidewalks and curbs;

3. Storm drainage facilities, designed and approved in accordance with Chapter 12.02 FHMC as amended;

4. Ownership of entire lot or parcel to be developed;

5. Existing and proposed land contours;

6. Existing trees which have a trunk diameter of six inches or greater measured four feet above grade;

7. Outline of all existing and proposed structures;

8. Completely dimensioned parking layouts, clearly showing all parking stalls, driveways and aisles, with parking stalls sequentially numbered;

9. All traffic-control devices such as parking stripes designating car stalls, directional arrows or signs, bull rails, curbs, and other developments;

10. Parking stalls, aisles and driveways shall be clearly marked as follows:

Hard-surfaced parking areas shall use white paint or equivalent material to delineate stalls, zones for persons of disability, and directional arrows; and each stall developed to compact car dimensions shall be clearly labeled "COMPACT" on the parking surface;

11. Landscaping shall be shown pursuant to FHMC 17.68.070; and

12. Lighting of areas provided for off-street parking shall be designed and arranged to prevent a nuisance or hazard to passing traffic, and where a parking facility shares a common boundary with any residentially zoned property, the lighting devices shall be shaped and directed to shield the light from such neighboring property.

B. Minimum Dimensions.

1. Preliminary Parking Plans. Preliminary parking plans which do not show each parking space, access aisle and driveway pursuant to subsection A of this section, or acres reserved for future parking on a gross area basis, shall allow 300 square feet per vehicle.

2. Standard Sized Parking Spaces.

a. Standard sized parking spaces placed parallel to the access driveway or aisle shall be a minimum of nine feet wide and 23 feet long. Driveways or aisles serving standard sized parallel spaces shall be a minimum of 22 feet wide for two-way traffic or 12 feet wide for one-way traffic.

b. Standard sized parking spaces placed at an angle to the access driveway or aisle shall conform to the minimum dimen-

MEMORANDUM

CITY/BOROUGH OF JUNEAU
155 South Seward Street, Juneau, Alaska 99801

TO: Assembly Lands Committee **DATE:** February 1, 2006

FROM: Ben Lyman, Planner
Community Development Department

Rorie Watt, Chief CIP Engineer
Engineering Department

RE: Fee In Lieu of Parking

In the many discussions that have taken place regarding the adoption of a Fee In Lieu of Parking ordinance, three issues have been raised again and again. We believe that the issues are resolvable, they are:

1) Use of the collected fees;
2) Fee per parking space; and
3) Area eligible for proposed program.

This memorandum is a brief introduction to these issues.

1. Use of Fees:
The voter approved downtown parking garage and transit facility is an appropriate use of collected fees. We recommend that FILs collected be utilized for this project, or for constructing or improving other parking, or for managing or reducing parking demand. In the past, some have suggested that FILs be tied directly to a specific project. We feel this linking is unnecessary.

Draft Recommendation:
We recommend that the fees be collected and disbursed in a similar fashion as the existing Water Extension Fund.

2. FIL per Space:
The previous draft FIL ordinance called for the FIL for a single parking space to be $26,000. In our opinion, this amount is excessive for the following reasons:

A. The FIL only allows the builder to avoid providing parking, no other benefit is provided. Therefore it is not appropriate to charge the full value of a parking space.
B. The builder (or tenant) who needs parking will have to lease space. This changes parking from a code requirement and development obstacle into a fungible commodity.
C. CBJ currently over subscribes the Marine Park Parking Garage (300 permits for 204 spaces). Parking spaces that are not dedicated to a single user are of greater benefit.

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CITY/BOROUGH OF JUNEAU
ALASKA'S CAPITAL CITY

Draft Recommendation:
We recommend that the fee be calculated based on a thirty-year lease of a parking space in the municipal garage. Generally, this value would be in the $10-$15,000 range. If the FIL is too high, developers will not use the mechanism, a FIL that is too low will be insufficient to fund parking improvements. If housing development incentives are desired, a percentage fee reduction could also be considered.

3, Area Eligible:
We suggest that participation in the Fee In Lieu program be discretionary, contingent on a Planning Commission approval that includes a finding of potential impacts to existing on-street or other public parking. We recommend that geographical and temporal restrictions be placed in the initial ordinance.

Draft Recommendation:
We recommend that the initial FIL ordinance allow eligibility within the historic district, MU and MU2 zoning districts and the PD-1 and PD-2 parking districts (see map), and have a sunset clause after one calendar year. We recommend that the ordinance be adjusted and expanded over time.

Conclusion:
Fee in Lieu is reasonable and within reach. The issue has been discussed and desired by City staff, developers, the Assembly, and the Planning Commission for more than a decade. Implementation may not be perfect, but it is a needed and desired improvement to the existing code. Potential effects of a FIL ordinance include development of housing included with commercial construction and freeing up valuable industrial land on the rock dump that is currently encumbered by parking for recent Franklin Street development. FIL is a tool that should be allowed at the discretion of the Commission, and proposed at the option of the developer.

The Planning Commission has been holding work sessions on this topic. A FIL ordinance contains policy and fiscal impacts of concern to both the Assembly and the PC. We recommend that the Assembly COW hold a joint work session with the commission.

Attachments

Menu of in-lieu options

• **Fee-in-lieu of off-street parking**--one-time payment per space at time of permitting. Set fee per parking space.

• **Fee-in-lieu financed similarly to LID** with single property owner. Payment is made over time, plus interest. Set fee (plus interest) per parking space.

• **Transit passes-in-lieu of off-street parking**--contract to purchase transit passes for all employees/tenants/occupants annually. Percentage of parking requirement reduction.

Example: A new office development requires 30 parking spaces, but the site is within ¼ mile of a Capital Transit stop served twice every 30 minutes (one bus in each direction every 30 minutes). The developer opts to commit to purchasing an annual bus pass for every employee for the life of the building, or until other parking provisions are made, in return for a 20% reduction in the number of required parking spaces, so 24 spaces now required. This provides:

- Capital Transit with guaranteed income, regardless of actual ridership.
- Employees with the tax-free benefit of free transit passes.
- Developers with reduced up-front development and land costs.
- Property owners with reduced site maintenance costs.

• **Parking tokens (paid parking validation) –in-lieu of off-street parking**—either a one-time purchase of tokens at time of permitting or a contract to purchase a number of tokens annually. Set number of tokens to parking space reduction or percentage of requirement reduction depending on agreement.

Example: A new business downtown cannot accommodate off-street parking on the project site, but the developer does not want to pay a one time fee-in-lieu for required parking spaces. Instead, they want to provide their customers with tokens as a form of validated parking—the customers can use the tokens to pay for parking in any CBJ-managed pay parking lot or structure (Marine Park Parking Garage or Main and Egan Lot, plus any future pay lots) on a future visit to downtown. These tokens would also be accepted at any meters installed in downtown at a future date. The developer (or building owner) would be required to purchase a set value of tokens annually to distribute at their discretion (a shop owner could give the tokens to outstanding employees as a reward, to customers who spend more than a minimum amount, or under a system of their own). This is essentially fee-in-lieu, but the use of the parking space is allocated according to the developer's or owner's desires.

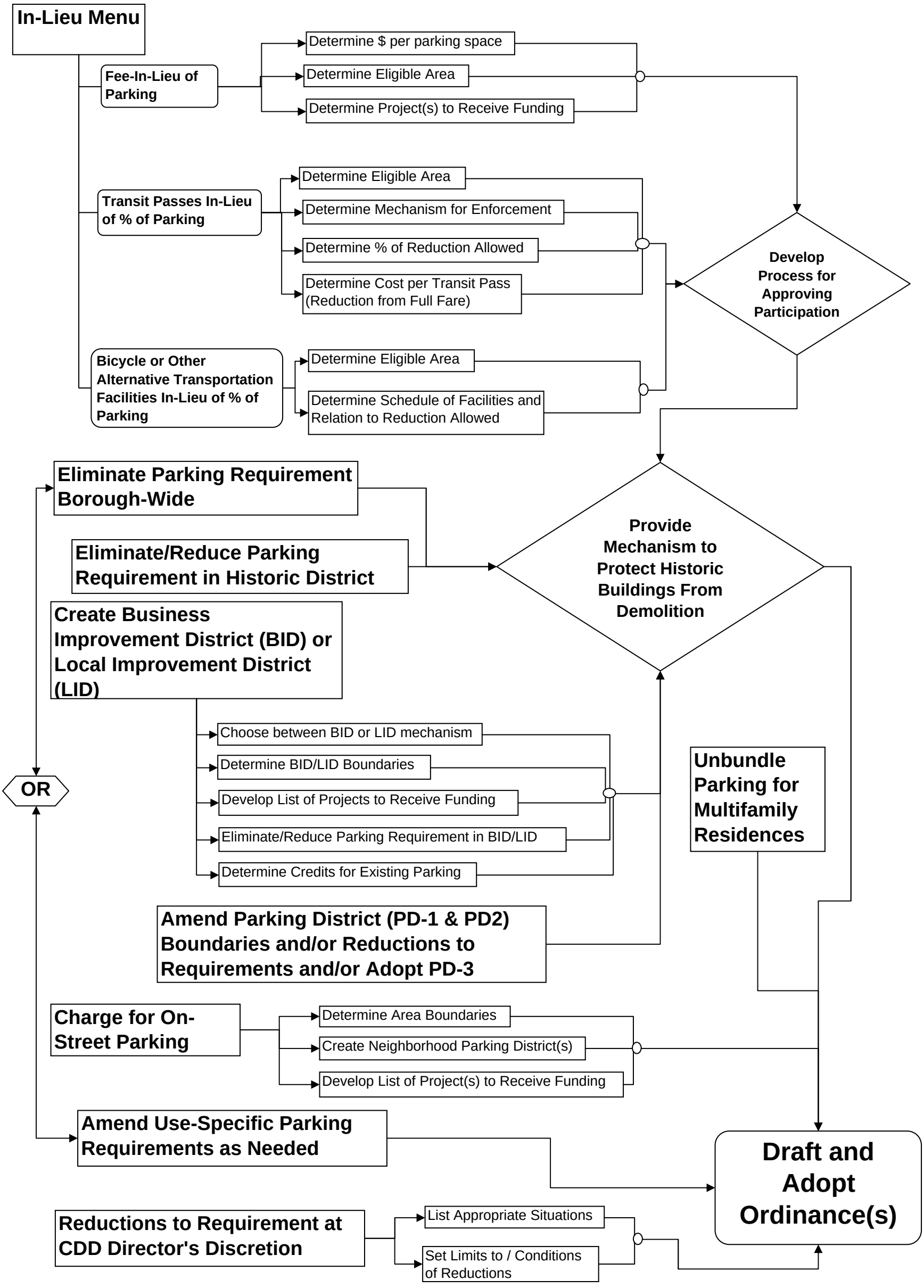
Items on the In-Lieu Menu Require:

- Support of parking management agencies for using/selling tokens.
- Support of Capital Transit for transit passes-in-lieu.
- Changes to CBJ Code beyond the Land Use Code (Title 49).

Flowchart showing parking-related projects and amendments to the Code of the City and Borough of Juneau.

This flowchart is intended as a guide to understand the various projects and amendments that may be pursued to address parking-related issues in downtown and throughout the borough in order to aid discussion. Each project or amendment will require public hearings and stakeholder participation. The various amendments and projects are each at various stages of completion, from simple text amendments to Title 49 that will be presented to the Planning Commission in the near future, to the Fee-In-Lieu of parking amendment that has been discussed for many years but has not yet been adopted, to adoption of a Business Improvement District, to the elimination of all off-street parking requirements borough-wide.

The list of options presented in this flowchart is not exhaustive, and many communities across the United States have adopted other parking-related programs that are not listed here, such as parking cash-out and maximum parking limits.



Juneau, AK. 2009. *Compiled Laws Of The City And Borough.*
Title 49. Land Use
Chapter 49.40. Access, Parking and Traffic
Article II. Parking and Loading

49.40.210. Minimum space and dimensional standards for parking and off-street loading.
(d) Exceptions.
(5) Fee in lieu of parking spaces.
(A) There is adopted the Downtown Fee in Lieu of Parking District Map, dated October 30, 2006, as the same may be amended from time to time by the assembly by ordinance.

(B) Off-street parking for new and existing developments, for any use, may be waived if the requirements of this section are met. The determination of whether these requirements are met shall be made by the Director if the requested waiver is for five or fewer parking spaces, or by the Commission if the requested waiver is for six or more parking spaces.

(C) The property seeking a waiver of the parking requirement must be located within the area shown on the Downtown Fee In Lieu of Parking District Map, and be supported by a finding by the Director or Commission as set forth in CBJ 49.40.210(d)(5)(B), above, that it will not have significant adverse impacts on nearby on-street parking and:

(i) Vacant on the effective date of this ordinance;

(ii) Occupied by a building built within the 50 years prior to the date of adoption of this ordinance; or

(iii) Occupied by a building built more than 50 years prior to the date of adoption of this ordinance, and the Director or Commission, after considering the recommendation of the Historic Resources Advisory Committee, finds that the proposed development does not affect the historical significance, historical attributes, or otherwise compromise the historic integrity of the structure based on the United States Secretary of the Interior's Standards for Rehabilitation.

(D) The applicant shall pay a one-time fee to the City and Borough of $8,500.00 per parking space waived under this section. For residential uses, this fee shall be reduced by 50 percent to $4,250.00. This fee shall be adjusted annually by the Finance Department to reflect the changes in the Consumer Price Index for Anchorage as calculated by the State of Alaska, Department of Labor; or the United States Department of Labor, Bureau of Labor Statistics.

(E) Any fee due and not paid within 45 days after the development obtains temporary or permanent occupancy, or, in the case of existing developments, 45 days after the waiver is granted, shall be a lien upon all real property involved and shall be paid in ten equal annual principal payments plus interest. The lien shall be recorded and shall have the same priority as a City and Borough special assessment lien. Except as provided herein, the annual payments shall be paid in the same manner and on the same schedule as provided for special assessments, including penalties and interest on delinquent payments, as provided in CBJ 15.10.220. The annual interest rate on unpaid fees shall be one percent above the Wall Street

Journal Prime Rate, or similar published rate, on January 2nd of the calendar year the agreement is entered into, rounded to the nearest full percentage point, as determined by the finance director.

RESOLUTION NO. 7847

A RESOLUTION OF THE CITY OF SCOTTSDALE, MARICOPA COUNTY, ARIZONA, REPEALING RESOLUTIONS NUMBERED 2594, 2607, 3255, 3334 AND 3506, AND ESTABLISHING THE PAYMENT, FEE AND FEE ADJUSTMENT PROCEDURES FOR IN-LIEU PARKING CREDIT(S) AS PROVIDED BY THE PARKING SECTION OF THE CITY OF SCOTTSDALE APPENDIX B BASIC ZONING ORDINANCE.

WHEREAS, Ordinance No. 455 of the City of Scottsdale adopted zoning regulations for the City; and

WHEREAS, Section 9.109.C. and subsections therein of Ordinance No. 455 as amended by Ordinance No. 3662 provide for the payment in-lieu of provided on-site parking in the Downtown Overlay (DO) and Downtown (D) districts, but do not specify payment or dollar fee amount; and

WHEREAS, the fee for parking in-lieu payment was set by the adoption of Resolution 2594, amended by Resolution No. 2607, Resolution No. 3255, Resolution No. 3334, and Resolution No. 3506, which required the payment of money to the City; and;

WHEREAS, the City Council desires to repeal Resolutions numbered 2594, 2607, 3255, 3334 and 3506; and

WHEREAS, the City Council desires to establish the payment criteria and fees that also permit construction of public parking spaces in order to receive in-lieu parking credits as provided for in the Parking Section of the City of Scottsdale Appendix B Basic Zoning Ordinance; and

WHEREAS, the City Council desires to establish a Downtown Parking Program Enhancement account to deposit such fees and disburse the fees for the operation of a downtown parking program, the provision and maintenance of public parking, the operation of tram shuttle services, and services related to the management and regulations of public parking.

NOW, THEREFORE, LET IT BE RESOLVED, by the City Council of the City of Scottsdale, Maricopa County, Arizona, as follows:

Section 1: Resolutions numbered 2594, 2607, 3255, 3334 and 3506 are hereby repealed.

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Section 2. As of the effective date of this Resolution, the payment for permanent in-lieu parking credit(s) is hereby established as any of the following:

a. A lump sum fee for permanent in-lieu parking space credit is hereby established as $11,862.54 per permanent in-lieu parking space credit. Where a fractional number of parking spaces are calculated, the fee shall be calculated to the nearest tenth, and the fee assessed on a pro-rated basis.

b. The complete construction of one (1) public parking space for every one (1) permanent in-lieu parking space credit, whereby the property owner pays the total cost of construction. The total cost of construction includes, but is not limited to, the cost: to receive all necessary City approvals and permits; to obtain materials; to design the public parking space(s); for labor; and the construction of a new, publicly owned parking space. The parking space(s) shall be constructed in accordance with the City of Scottsdale's approved standards, without a monetary contribution from the City of Scottsdale. The parking space(s) shall be located within the City's right-of-way and/or on City property, and shall be within three-hundred (300) feet of the owner's property that requires the in-lieu parking space credit(s). To receive the permanent in-lieu parking space credit(s), the owner shall enter into an agreement approved by the City Council to construct the new public parking space(s) in accordance with this resolution.

c. A combination of subsections a. and b. whereby the property owner pays $11,862.54 per permanent in-lieu parking space credit, and completes construction of one (1) public parking space for every one (1) permanent in-lieu parking space credit in accordance with subsection b.

Section 3: The payment installment fee for each permanent in-lieu parking space credit purchased is hereby established to require a minimum $790.84 nonrefundable deposit, and a subsequent payment of at least $112.30 per month for a period not to exceed 15 years. Where a fractional number of parking spaces are calculated, the fee shall be calculated to the nearest tenth, and the fee assessed on a pro-rated basis.

Section 4: The monthly payment fee for each term in-lieu parking credit leased from the City is hereby established as $112.30 per parking space credit. Where a fractional number of parking spaces are calculated, the fee shall be calculated to the nearest tenth, and the fee assessed on a pro-rated basis. The lessee of a term in-lieu parking credit(s) shall enter into an agreement approved by the Planning and Development Services General Manager or designee for the payment of fees prior to the occupancy of the use necessitating the need for the term in-lieu parking credit(s) and the lessee shall continue to make the monthly payments to the City in accordance with the agreement until which time the lessee abandons the use necessitating the need for the term in-lieu parking credit(s).

Section 5: The monthly payment fee for each term evening-use in-lieu parking credit leased from the City is hereby established as $31.63 per month per parking credit. Where a fractional number of parking spaces are calculated, the fee shall be calculated to the nearest tenth, and the fee assessed on a pro-rated basis. The lessee of a term evening-use in-lieu parking credit(s) shall enter into an agreement approved by the Planning and Development Services General Manager or designee, for the payment of fees prior to the occupancy of the use necessitating the need for the term evening-use in-lieu parking credit(s) and the lessee shall continue to make the monthly payments to the City in accordance with the agreement until which time the lessee abandons the use necessitating the need for the term evening-use in-lieu parking credit(s).

Section 6: The payment fees shall be recalculated every first day of January to reflect yearly cost adjustments based upon the Consumer Price Index (CPI).

Section 7: A Downtown Parking Program Enhancement account is hereby established to provide for the collection of in-lieu parking credit payment fees and the disbursement of funds for the operation of a downtown parking program, the provision and maintenance of public parking, the operation of tram shuttle services, and services related to the management and regulations of public parking.

Section 8: The City Council has full power and discretion to determine which method will satisfy the payment for in-lieu parking space credits.

Section 9. The effective date of this Resolution is 12:01 a.m. on March 27, 2009.

PASSED AND ADOPTED by the Council of the City of Scottsdale, Maricopa County, Arizona this 24th day of February, 2009.

ATTEST:

By: _____
Carolyn Jagger
City Clerk

CITY OF SCOTTSDALE, an Arizona municipal corporation

By: _____
W.J. "Jim" Lane
Mayor

APPROVED AS TO FORM:

By: _____
Deborah Robberson
City Attorney

City of Woodland

REPORT TO MAYOR AND CITY COUNCIL

AGENDA ITEM

TO: THE HONORABLE MAYOR
AND CITY COUNCIL

DATE: February 5, 2008

SUBJECT: Ordinance Adding Downtown Parking Standards, Establishing Parking District Boundaries and In-Lieu of Parking Fee

Report in Brief

The proposed Ordinance will add Section 25.23.15 to the Municipal Code regarding Downtown Parking Standards and will establish the boundaries of the Downtown Parking District for the purposes of allowing an in-lieu of parking fee.

Staff recommends that the City Council:

1. Adopt the Initial Study and Negative Declaration for the proposed parking ordinance.
2. Introduce Ordinance _____ to add Section 25.23.15 to the Woodland Municipal Code for the purpose of downtown parking.
3. Approve Resolution _____ establishing Parking District boundaries and an in-lieu of parking fee.

Background

The purpose for the proposed Ordinance is to continue the actions necessary to facilitate implementation of the City's Downtown Parking Management Plan and General Plan goals and policies with regard to Downtown Parking. A first step in implementing an overall comprehensive parking strategy is the adoption of necessary Zoning Code revisions.

As discussed in the Planning Commission report dated November 1, 2007, **Attachment A,** typical suburban parking standards do not adequately address downtown conditions. Parking standards should be one component in the mix that helps to encourage smart growth principals and economic development by ***providing reasonable and effective standards that are clearly defined and easily understood*** and which meet the needs of the businesses, customers and development community. The intent is to proactively prepare for future parking needs. This will require revising standards, collecting fees toward future parking supply, and the implementation of innovative parking management policies.

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Staff has worked with the City Attorney to develop the Ordinance to address the concerns on this issue. Staff has translated the concepts discussed in the November report into recommended code language.

Discussion

New Parking Standards

The City of Woodland's parking standards are recommended to be modified to reflect the existing and anticipated pedestrian orientation of the downtown, to retain the historical feel of the downtown core, and to avoid imposing suburban standards that would result in large paved areas on Main Street and within the City center. The following are the intended purposes for a revised parking program in the Downtown:

- Maintain and enhance a pedestrian oriented environment in the Downtown.
- Promote and encourage economic investment in the Downtown area.
- Promote re-use and renovation of historic buildings in the Downtown while encouraging new investment and construction.
- Enhance the vitality of the Downtown by encouraging an appropriate mix of future development and land uses.
- Encourage mixed-use development supporting residential and office uses on the upper floors, and ground floor offices, retail and restaurants.

The modifications include changes to residential and commercial related standards and incorporate special provisions to allow shared parking in limited cases, off-site parking also in limited situations, and in lieu-of-parking fees. See **Attachments B and C** for a flow chart on use of the standards and ordinance text language.

A significant feature of the ordinance is that existing buildings in the downtown will not be required to provide new parking, unless there is an addition or expansion or the addition of residential uses where there were none previously. New development will be required to provide parking. Provisions are included to allow shared parking, off-site parking, or in-lieu-of parking fees.

In-Lieu Fee

In-lieu fees provide an alternative for developers who wish to construct new projects or do major renovations to existing buildings where it is either not feasible or undesirable to construct on-site parking. In fact, the Downtown Specific plan prohibits the development of surface parking on Main Street. The purpose of the fee is to recover ***some*** of the capital cost of constructing new parking facilities.

In-lieu fees would be deposited in a special fund and used by the City to develop or assist in developing parking structures. Fees generally go to construct parking facilities at locations that support the parking needs of the area while not compromising safety and ambiance of the downtown area. The Downtown Specific Plan includes possible locations for future parking structures.

It is recommended that the In-lieu fee for downtown projects should be set at a rate that does not recover the full cost for structured parking downtown, but provides a "fair share" contribution toward the future development of such parking facilities. In a typical suburban situation new development would be required to pay the full cost for the construction of new parking. In this case, paying a partial fee is ultimately more cost effective and functions as an ***incentive*** toward encouraging development in the downtown. The balance of the cost for providing structured parking will likely be paid through a combination of Redevelopment funds, Major Projects Financing Plan fee, City/County/State Superior Court partnership contributions, and possibly through future assessment district and long term user fees.

The City conducted a land evaluation study of the downtown last year and more recently obtained cost estimates from area cities and determined that the estimated cost per structured parking space is $20,000 to $25,000 per space. At this time it is ***suggested that the City set an in-lieu of parking fee at $5,000.*** However, should development and economic factors change, the City Council will have the ability to reevaluate and raise or lower fees. It is proposed that the City's Code be amended to provide for in-lieu fees and state that from time to time the City Council shall establish by Resolution the value of off-street parking facilities and fee amount on a per parking stall basis. **Attachment D** includes the Resolution establishing the in-lieu-of parking fee.

Fiscal Impact

Funds from the General Fund have been utilized for Community Development salaries and the completion of the Initial Study. Limited Redevelopment funds were utilized on a land cost summary analysis. It is hoped that this ordinance will facilitate downtown redevelopment, increased investment, and enhanced City revenues through a rejuvenated commercial core.

Public Contact

Noticing has taken the following forms:

- Posting of the City Council agenda.
- Quarter page ad in the Daily Democrat published on January 16, 2008 with a second publishing on January 23, 2008.
- A quarter page ad was published prior to the Planning Commission meeting, held on January 3, 2008.
- The Woodland Chamber of Commerce was notified of the City Council meeting and a copy of this report provided to them.

In addition to the above notification efforts, the concept of proposed parking standard changes and an in-lieu fee was brought forward to the City Council in March of 2007. At that time the Council expressed general support of the proposed changes. Staff brought the proposed parking amendments before the Planning Commission for a first review on November 7, 2007. At that time, the Commission expressed general support and directed staff to work with the Chamber and stakeholders in the Downtown. Staff met with the Chamber Government Affairs group, on November 20, 2007 and the Chamber Board on December 13, 2007.

The Chamber Government Affairs representatives expressed support, but indicated that they would feel more comfortable if a broader group of board members and downtown business representatives had a chance to discuss the matter. They indicated that the proposed changes were consistent with ideas and proposals previously discussed as part of the Downtown Parking Management Plan. On December 13, 2007, staff gave a presentation on the proposed parking ordinance at the full Woodland Chamber Board.

The Board has 18 members and all received copies of the November 7, 2007 Planning Commission staff report. The Chamber placed a notice of meeting in the newspaper and sent a notice to 600 members that the parking ordinance discussion was on the agenda for that meeting.

Staff has received no comments expressing concern from the Chamber and the Woodland Chamber of Commerce has in the past supported policies and implementation of the Downtown Specific Plan.

Commission Recommendation

The proposed Ordinance and Resolution were heard as a public hearing on January 3, 2008 by the Planning Commission. The Planning Commission recommended 6-0 that the City Council approve the proposed changes.

During review the Planning Commission discussed the in-lieu fees. A question was asked regarding the in-lieu fees and why they should be considered. Discussion ensued wherein it was stated that the intent is to have a density of activity in the downtown with parking located to the periphery, off Main Street. The use of in-lieu fees provides that needed alternative when a project is not able to meet the full extent of its on-site parking. The downtown standards are intended to facilitate a pedestrian environment in which a “park once” strategy is encouraged, that multiple visits may be accomplished with one parking stop.

Environmental Review

An Initial Study and Negative Declaration were prepared to address the proposed code changes. These are included in Attachment F. No significant environmental effects were identified. A Notice of Intent to Adopt a Negative Declaration was published 21 days prior to the meeting date and a copy posted in the County Clerk’s office, January 16, 2008. The Initial Study and Negative Declaration are included as Attachment E.

SUBJECT: Ordinance Adding Downtown Parking Standards, Establishing Parking District Boundaries and In-Lieu of Parking Fee	**PAGE:** 5 **ITEM:**

Recommendation for Action

Staff recommends that the City Council:

1. Adopt the Initial Study and Negative Declaration for the proposed parking ordinance.
2. Introduce Ordinance _____ to add Section 25.23.15 to the Woodland Municipal Code for the purpose of downtown parking.
3. Approve Resolution _____ establishing Parking District boundaries and an in-lieu of parking fee.

Prepared by:
Cindy A. Norris, Senior Planner

Reviewed by:
Barry Munowitch, AICP
Assistant City Manager

_____
Mark G. Deven
City Manager

Attachments:

Attachment A:	Planning Commission Report from November 1, 2007
Attachment B:	Downtown Parking Standards Flow Chart
Attachment C:	Downtown Parking Ordinance
Attachment D:	Downtown Parking In-Lieu fee and District Boundary Resolution
Attachment E:	Initial Study and Negative Declaration

Parking Requirement Reductions and Exemptions

Austin (TX), City of. 2009. *City Code.*
Title 25. Land Development
Chapter 25-2. Zoning
Subchapter E. Design Standards And Mixed Use
Article 2. Site Development Standards
2.4. Parking Reductions

2.4.2. Reduction of Minimum Off-Street Parking Requirements. This section provides for reductions in the minimum off-street parking requirements in Chapter 25-6, Article 7, Off-Street Parking and Loading. The minimum off-street parking requirement shall be reduced as follows:

A. By one space for each on-street parking space located adjacent to the site on a public street, including spaces on Internal Circulation Routes that meet public street standards.

B. By up to 10 percent to preserve significant stands of trees or protected trees in addition to those required to be preserved by the Code, pursuant to protection measures specified in the Environmental Criteria Manual. If the applicant provides more parking spaces than the minimum required, the additional parking spaces may not result in the removal of significant stands of trees or protected trees.

C. By 20 spaces for every car-sharing vehicle provided in a program that complies with the requirements prescribed by the Director by administrative rule.

D. By one space for each shower facility with three or more lockers provided for employees in a nonresidential building.

Unless otherwise specified, the above reductions may be applied cumulatively, and may be applied in addition to the urban core parking reduction authorized in Section 25-6-478, but in no case may the minimum off-street parking requirements for a project set forth in Chapter 25-6, Appendix A, be reduced by more than 40 percent.

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6. Availability of facilities. Owners of off-street parking facilities may post a sign indicating that all parking on the site is available only for residents, customers and/or employees. Signs shall conform to the standards in the Bend Code.

D. Exceptions and Special Standards for Parking

1. Exceptions for required parking.

   a. Seasonal outdoor seating where the seating area is less than 500 square feet is exempt from the required parking standards.

   b. The total number of required motor vehicle parking spaces for an industrial, commercial, or office use may be reduced by 5 percent for each of the listed activities which are provided by the owners or operators, up to a maximum 10 percent reduction in the total number of motor vehicle spaces per development.

      - Designating at least 10% of the employee motor vehicle parking spaces as carpool/vanpool parking and placing such spaces closer to the building than other employee parking;
      - Providing showers and lockers for employees who commute by bicycle;
      - Providing twice as many covered, secured bicycle parking racks or facilities as required by this ordinance;
      - Providing a transit facility (e.g., bus stop) that is approved by the local transit authority, with related amenities. Related amenities include, but are not limited to, a public plaza, pedestrian sitting areas, shelter, and additional landscaping.
      - Other incentives provided in an approved Employee TDM Plan.

2. Special Standards for Commercial Customer Parking. The motor vehicle parking areas shall be located and designed to facilitate safe and convenient pedestrian and bicycle movement to and from public sidewalks, streets, or transit stops. Ways to achieve this standard may include, but are not limited to:

   - Front facades and primary entrances of all buildings are oriented to a public street or a private internal drive or street, to minimize pedestrian and bicycle travel through a parking area and to provide safe, convenient, and direct travel routes for pedestrians;
   - One or more raised walkways are provided through the parking areas, meeting federal Americans with Disabilities Act requirements, in order to provide safe, convenient, and direct travel routes for pedestrians through the parking areas;
   - Walkways abutting parking spaces or maneuvering areas are protected from vehicles through either landscaping buffers, minimum 3 feet wide on each side, or curbs on both sides.
   - Walkways across vehicle aisles are delineated by non-asphaltic material in a different color or texture than the parking areas;
   - On-site pedestrian walkways and bikeways connect to existing pedestrian and bicycle circulation systems that serve adjacent commercial uses or residential areas;
   - Internal drives or streets are designed to City standards for local streets in regard to pavement width, sidewalks, and street trees. Sidewalks comply with ADA standards. Sidewalks 10-15 feet wide abutting front building facades are strongly encouraged. Internal vehicular circulation design for the site complies with City street connectivity standards, including maximum block length and perimeter.
   - Internal drives or streets connect to public streets abutting the site, unless physically precluded by pre-existing buildings.

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Grand Rapids (MI), City of. 2009. *City Code*.
Title V. Zoning and Planning
Chapter 61. Zoning Ordinance
Article 10. Parking, Loading and Circulation
Sec. 5.10.05. Reductions in Parking Requirements

A. Reductions. Off-street parking requirements may be reduced based on the requirements of Subsections B, C, D, and E below.

1. The Planning Director may reduce off-street parking requirements by fifty (50) percent. The Planning Director may refer the decision of allowable off-street parking reductions to the Planning Commission, based on neighborhood character, absence of public parking or the results of a parking demand study.

2. The Planning Commission, using Special Land Use procedures, may eliminate or reduce up to all one hundred (100) percent of required off-street parking.

3. Administrative Departure. An Administrative Departure for part or all of the off-street parking requirements, not to exceed eight (8) spaces, may be granted by the Planning Director, where the building comprises ninety (90) percent or more of the lot, or the lot cannot otherwise accommodate the required parking.

B. Alternate Modes of Transportation. One or more of the following methods may be utilized to reduce off-street parking requirements.

1. *Transit.* Parking requirements may be reduced for buildings, structures or uses within three hundred (300) feet of a Bus Rapid Transit (BRT) station or one hundred (100) feet of a transit stop. A Transportation Demand Management (TDM) study may be required to demonstrate that a sufficient number of vehicle drivers would immediately opt for transit, and therefore would not result in adverse parking impacts on surrounding properties. The Rapid shall verify in writing that the transit station or transit stop is in a permanent location.

2. *Alternative Vehicles.* Parking spaces reserved, signed, and enforced for Low-Emitting and Fuel-Efficient Vehicles (vehicles that are either classified as Zero Emission Vehicles (ZEV) by the California Air Resources Board or have achieved a minimum green score of 40 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide) or for car-sharing services, may count as four (4) regular parking spaces. Electric car spaces shall include a power outlet for use by the parked car. Such spaces should be closest to the main entrance (exclusive of spaces designated for handicapped). Parking spaces reserved, signed, and enforced for carpooling or vanpooling services may count as two (2) regular parking spaces.

3. *Bicycle.* Parking requirements may be reduced by one (1) space for every four (4) covered, secure bicycle parking spaces, where lockers, one or more floor pumps, and a work stand are provided on site. Parking requirements may be further reduced by four (4) spaces where free showers are available for employee use within the building.

C. On-Street and Business District Parking.
1. The use of on-street parking or publicly-owned business district parking lots or parking structures to meet a portion of the minimum off-street parking requirements shall be permitted, provided the following conditions are met:

a. Adequate on-street, district lots or parking structures exist within five hundred (500) linear feet of the primary entrance of the main building;

b. No more than fifty (50) percent of the off-street parking space requirement is met through the use of on-street, district lot or structure parking;

c. The intensity of the use and its parking requirements shall not substantially adversely impact surrounding uses; and

d. There is no negative impact to existing or planned traffic circulation patterns.

2. A parking demand study may be required to demonstrate that adequate available spaces exist on street or in a district lot or parking structure.

D. Payment in Lieu of Parking. A parking program may be instituted to develop publicly-owned district parking lots or structures as opposed to individually owned and operated parking areas.

1. *Payment.* In lieu of providing the required off-street parking space for any development located in a mixed-use commercial Zone District, a payment may be made to the City's Parking Facilities Account or to a special assessment fund.

2. *Parking Facilities Account.* The Planning Commission may approve in-lieu payment for up to eighty (80) percent of required parking in the TN-CC Zone District, subject to review and approval under Site Plan Review procedures in Section 5.12.11. The Planning Commission, shall take into consideration the comments and suggestions of the City's Automobile Parking Commission. The purpose of the Parking Facilities Account as set forth in Chapter 31 of the City Code, is to fund the planning, designing, acquiring, building, financing, and developing, but not maintaining, of public off-street parking facilities which shall be designated by the City Commission as serving the TN-CC Zone District. The Parking Facilities Account may also be used for other alternatives to the provision of parking facilities in the Zone District, including Transportation Demand Management measures. Chapter 31 shall establish an amount which, if paid to the Parking Facilities Account, shall constitute provision of one (1) off-street parking space. Chapter 31, also sets forth conditions for partial in-lieu payments and recording of in-lieu payments.

3. *Special Assessment.* The City may, as part of any special assessment levied to defray a portion of the cost of a parking facility, determine that the payment or, alternatively the levy of a special assessment, shall constitute provision of a designated number of parking spaces for the building or structure, and any future building or structure, located on the property specially assessed. The determination of the number of parking spaces deemed to be provided, if any, shall be made at the time that the special assessment is levied.

E. Shared Parking Agreements.

1. *Mixed-Land Use.* Where a mix of land uses creates staggered peak periods of parking demand, shared parking agreements that have the effect of reducing the total amount of required parking spaces are encouraged. Shared parking agreements for off-street parking for two (2) or more buildings or uses is permitted subject to the following:

a. The total number of required parking spaces for each use on each lot shall not be reduced by more than fifty (50) percent.

b. Shared parking areas shall be located within three hundred (300) feet of the use.

c. Adjacent lots shall be interconnected for vehicular passage.

d. Shared parking leases or agreements shall have a term of not less than five (5) years, including any renewals at the option of the lessee.

2. *Easements.* Written easements that provide for continued use and maintenance of shared parking shall be submitted to the Planning Director for review and approval. Any agreement shall include provisions to address changes in use.

F. Mixed-Use Parking Coefficient. Where the Planning Director determines that a mix of land uses could reduce the number of required parking spaces, Table 5.10.05.F. below shall be used. To calculate mixed-use parking requirements, the required parking for each use shall be totaled, and then divided by the appropriate mixed use coefficient:

Table 5.10.05.F. Mixed Use Parking Coefficients	Residential	Lodging	Office	Retail	Other Commercial
Residential	X	1.1	1.4	1.2	1.1
Lodging	1.1	X	1.7	1.3	1.2
Office	1.4	1.7	X	1.2	1.1
Retail	1.2	1.3	1.2	X	1.0
Other Commercial	1.1	1.2	1.1	1.0	X

For example, for a mixed-use development containing office and retail uses:

Total required parking =;frac;;(ParkingOFFICE + ParkingRETAIL);1.2; = /14 + 21 1.2; + 29.17 = 30

If there are more than two (2) uses in the development, the required parking for all uses shall be totaled and divided by the lowest applicable coefficient.

For example, for a mixed-use development containing office, residential, and retail uses:

1/2Total required Parking = (P/subOFFICE + PRESIDENTIAL + P/subRETAIL);1.2; = 14 +12 + 21/1.2 + 39.17 = 40

G. Deferral of Parking Spaces. The Planning Commission may approve a smaller number of parking spaces than required in Table 5.10.04.C. as part of a Special Land Use approval, subject to the following:

1. The owner can demonstrate that the required number of parking spaces is excessive;

2. An area of sufficient size to meet the deferred number of parking spaces, along with access drives, aisles and other required parking lot features, shall be retained as open space;

3. A deferred parking site plan shall identify the area where parking is being deferred, including dimensions and dotted parking lot layout;

4. Stormwater management requirements shall be based on the required parking to ensure adequate capacity if an expansion is necessary; and

5. The owner agrees in writing to construct the deferred parking within six (6) months of a written request from the Planning Director.

a. The proposed development is highly supportive of the intent of the Gresham Downtown Plan, as contained in Volume 2 - Policies of the Community Development Plan; and

b. The need for additional parking cannot reasonably be met through provision of on-street parking or shared parking with adjacent or nearby uses; and

c. The proposed development demonstrates that its design and intended uses will support high levels of both transit and pedestrian activity; and

d. The site plan shall indicate where additional parking can be redeveloped to more intensive transit supportive use in the future; and

e. The parking in excess of the maximum is constructed as part of a parking structure.

4. New surface parking lots in the Downtown Plan District are limited to 40,000 square feet in size per site.

5. Commercial Parking Facilities on surface parking lots are prohibited in the Downtown Plan District. Public parking facilities owned by a local, county, or regional governments, an urban renewal agency or a transportation management association are allowed on surface lots or in structures.

6. New surface parking lots can only be constructed in the Downtown Plan District as approved with a development permit for an allowed use that requires off-street parking, except for public parking facilities.

7. Parking facilities are not allowed as the first phase of a development but must be constructed in conjunction with buildings that are part of the development.

8. Bicycle parking shall be provided in conformance with **Section 9.0830** and **Table 9.0851**.

C. Downtown and Civic Neighborhood Plan Districts. Surface parking lots exceeding minimum parking requirements in both Downtown and Civic Neighborhood Plan Districts shall be designed to allow for more intensive future site development.

9.0853 Exceptions to Minimum Parking Space Standards (refer to Table 9.0851)

A. Parking District Waiver. Minimum off-street parking spaces required by may be waived for properties within the boundaries of a public parking district that provides district-wide parking facilities.

B. Allowed Motor Vehicle Parking Reductions. A reduction of up to 10% of minimum off-street vehicle parking requirements is allowed as a right of development for all non-residential uses.

C. Reduction for Bike Parking. Off-street motor vehicle parking requirements for non-residential uses may be reduced by an additional 10% to the reductions allowed in **Subsection (B)** and/or **(D)** if replaced by bicycle parking above that required, at a rate of two bicycle spaces for one vehicle space.

D. Motor Vehicle Parking Reductions near LRT Stations. Minimum off-street vehicle parking requirements may be reduced by an additional 10% to the reduction permitted in **Subsection (B)** above in the Transit Development District; High Density Residential District-60; Transit Development District - Medium Density - Civic; Transit Development District -High Density - Civic; High - Density Residential - Civic; Moderate - Density Residential - Civic. The reduction in this section also applies to residential uses.

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E. Additional Motor Vehicle and Bicycle Parking Reductions. The Manager may reduce the total required off-street vehicle and bicycle parking spaces by up to a total of 50% when an applicant for a development permit can demonstrate in a parking study prepared by a traffic consultant or in parking data from comparable sites (1) that use of transit, demand management programs, and/or special characteristics of the customer, client, employee or resident population will reduce expected vehicle use and parking space demand for this development, as compared to standard Institute of Transportation Engineers (ITE) vehicle trip generation rates and minimum City parking requirements, and (2) a reduction in parking will not impact adjacent uses.

F. Motor Vehicle Parking Reductions for Existing Uses. Property owners of existing non-residential development may take advantage of incentives to reduce vehicle parking below the minimum off-street vehicular parking standards as provided below:

1. When expansion of floor area and/or redevelopment of the site necessitates or creates the opportunity to reconfigure existing parking, the owner may take advantage of applicable vehicle parking reductions provided in **Subsections (B), (D)** and **(E)** above.

2. Even when no expansion or redevelopment of the site is proposed, the property owner may replace up to 10% of existing parking spaces with the following:

a. Additional landscaping;

b. On-site pedestrian plazas, seating areas, shelters and/or walkways;

c. Bicycle parking in addition to the number of parking spaces required. New bicycle parking shall conform to all design standards contained in **Section 9.0830**.

G. In addition to other reductions of this section, parking requirements may be reduced under the modification of regulation provisions of **Section 10.1521**.

9.0854 Exceptions to Maximum Parking Space Standards

A. Except in the Downtown Plan District, if application of the maximum parking standard would result in less than 6 parking spaces for a development with less than 1,000 square feet of floor area, the development shall be allowed up to 6 parking spaces. If application of the maximum standards would result in less than 10 parking spaces for a development of 1,000 to 2,000 square feet of floor area, the development shall be allowed up to 10 parking spaces.

B. In the following land use districts, the Manager, under Type II procedures, may approve exceptions to the maximum parking space standards based on the criteria provided below:

1. Station Center and Rockwood Town Center Districts.

a. The proposed development is highly supportive of the intent of the Station Center District, Rockwood Town Center District, or Transit Street Designations stated in **Sections 4.0500** and **A5.501(G)**, if applicable, and

b. The need for additional parking cannot reasonably be met through provision of on-street parking or shared parking with adjacent or nearby uses; and

c. The proposed development demonstrates that its design and intended uses will support high levels of existing or planned transit and pedestrian activity; and

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Milwaukee (WI), City of. 2008. *Zoning Ordinance*.
Subchapter 4. General Provisions
295-403. Parking
2. Number of Spaces.

b. Adjustment to Number Required. For any use except one- or 2-family residential, the number of parking spaces required for a particular use may be reduced in accordance with the following credits:

b-1. One space for each off-site parking space which is owned or rented by the property or business owner for the purpose of providing parking to the use in question. Such off-site spaces shall be located within 700 feet of the use, as measured by using the shortest pedestrian route from the nearest corner of the parking facility to the main public entrance of the use served. For a non-residential use, the off-site spaces shall not be located on a site containing a wholly residential use. Off-site parking spaces shall also conform with the regulations of the zoning district in which they are located.

b-2. One space for each on-street parking space that is located immediately adjacent to the site of the use, provided that such on-street space is available for public use during the hours of operation of the use. To qualify for this credit, an on-street parking space shall be in compliance with all city parking regulations and shall measure at least 20 feet long if a parallel space.

b-3. 0.75 spaces for each space in a shared parking facility that serves different uses on a shared site or adjacent sites. An applicant requesting approval of a shared parking facility shall submit survey data substantiating a request for shared parking facility credits. The application shall describe the limits of the area in which the shared parking credits are to apply and the parking space reduction applicable to each use. The number of required parking spaces shall only be reduced if the following criteria are met:

> b-3-a. The shared parking spaces shall be maintained as long as the uses they serve are in operation.
>
> b-3-b. The peak hours of parking demand for the uses served by the shared parking facility do not coincide.
>
> b-3-d. The required number of bicycle parking spaces will be provided.
>
> b-3-e. The property owner or owners shall sign and record, with the Milwaukee county register of deeds, a written agreement which is in a form satisfactory to the city attorney and which states that there will be no substantial change in the use or occupancy of the property or properties that will increase the demand for parking in the shared parking facility. This agreement shall also include a statement that the property owner or owners and their tenants shall be provided access to, and use of, the shared parking facility. A copy of the agreement shall be filed with the commissioner.

b-4. A reduction of 25% in the number of parking spaces required if the use is located in the area bounded by Capitol Drive on the north, Lincoln Avenue on the south, Lake Michigan on the east and 43rd Street/Sherman Boulevard on the west or is within 1,000 feet of any regularly scheduled bus stop. This reduction is permitted

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because of the relatively high availability of public transit service and resultant potential for reduced parking demand in the designated area and in locations in close proximity to bus stops. A reduction of 25% shall also be permitted if the property owner or developer submits written documentation of an ongoing, formally-established bike-and-shower or car pool program at the principal use of the premises and the commissioner determines that the bike-and-shower program or car pool program is of sufficient magnitude and duration to warrant the reduction.

b-5. One space for each space that the use is required to have but does not because the use was previously legally established without the currently required number of parking spaces and without a variance or special use permit from the board.

b-6. A reduction in the number of spaces required may be granted by the board upon a determination that a reduced number of spaces would be appropriate. Such reduction may occur only upon request of the owner, who shall submit survey data to support the argument for reducing the required number of spaces. In order to approve such a reduction, the board shall find either of the following:

b-6-a. The number of spaces needed to serve the use is fewer than the number normally required for this land use.

b-6-b. In the long term, occupancy of the property of the structure or property will not result in an increase in parking demand.

b-7. One space for each space in a public parking lot or public parking structure located within 700 feet of the use, as measured by using the shortest pedestrian route from the nearest corner of the parking lot or structure to the main public entrance of the use served.

c. For a newly-constructed commercial building or commercial building addition with over 2,000 square feet of floor area, a minimum of one bicycle parking space shall be provided for each 2,000 square feet of floor area.

d. Shared Parking Required When Feasible.

d-1. If the development is adjacent to a land use with off-street parking facilities and different hours of operation, and the applicant believes that provision of shared parking is infeasible, the applicant shall submit to the commissioner a signed affidavit indicating that the applicant has made a good-faith effort to locate shared parking facilities, documenting the nature and extent of that effort, and explaining the rationale for concluding that the provision of share parking facilities is infeasible.

d-2. An applicant for a mixed residential and commercial development or a shopping center development adjacent to one or more existing mixed residential and commercial developments or shopping center developments shall submit to the commissioner a parking demand study that indicates whether off-street parking for the proposed development can be combined with off-street parking at the existing developments.

Minneapolis (MN), City of. 2009. *Code of Ordinances*.
Title 20. Zoning Code
Chapter 541. Off-Street Parking and Loading
Article IV. Reducing Off-Street Parking Requirements

541.190. Shared parking. The zoning administrator may authorize a reduction in the total number of required parking spaces for two (2) or more uses jointly providing off-street parking when their respective hours of peak operation do not overlap. Shared parking shall be subject to the location requirements of section 541.250 and the following conditions:

(1) *Computation.* The number of shared spaces for two (2) or more distinguishable land uses shall be determined by the following procedure:

a. Multiply the minimum parking required for each individual use, as set forth in Table 541-1, Specific Off-Street Parking Provisions, by the appropriate percentage indicated in Table 541-4, Shared Parking Calculations, for each of the six (6) designated time periods.

b. Add the resulting sums for each of the six (6) columns.

c. The minimum parking requirement shall be the highest sum among the six (6) columns resulting from the above calculations.

d. Select the time period with the highest total parking requirement and use that total as the shared parking requirement.

(2) *Other uses.* If one (1) or all of the land uses proposing to make use of shared parking facilities do not conform to the general land use classifications in Table 541-4, Shared Parking Calculations, as determined by the zoning administrator, then the applicant shall submit sufficient data to indicate the principal operating hours of the uses. Based upon this information, the zoning administrator shall determine the appropriate shared parking requirement, if any, for such uses.

(3) Alternative procedure. An application may be submitted requesting that the zoning administrator authorize a greater reduction in the total number of required parking spaces for two (2) or more uses where an applicant believes that Table 541-4, Shared Parking Calculations, does not adequately account for circumstances unique to the particular property or properties in question. The application shall include, at a minimum, a parking study with a detailed description of the proposed uses, their hours of operation, their anticipated peak parking demand, and anticipated hours that such peak parking demand would occur. Based upon information demonstrating that the peak parking demand for the uses in question would not coincide, the zoning administrator may authorize a greater parking reduction than is authorized by Table 541-4, Shared Parking Calculations. The zoning administrator may impose reasonable conditions to mitigate potential negative effects.

(4) *Process.* An application for shared parking shall be submitted on a form approved by the zoning administrator, as specified in Chapter 525, Administration and Enforcement.

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Table 541-4 Shared Parking Calculations

General Land Use Classification	Weekdays			Weekends		
	2:00am-7:00am	7:00am-6:00pm	6:00pm-2:00am	2:00am-7:00am	7:00am-6:00pm	6:00pm-2:00am
Office	5%	100%	5%	0%	10%	0%
Retail sales and services	0%	90%	80%	0%	100%	60%
Restaurant (not 24 hr)	10%	70%	100%	20%	70%	100%
Residential	100%	60%	100%	100%	75%	90%
Theater	0%	40%	90%	0%	80%	100%
Hotel						
Guest rooms	100%	55%	100%	100%	55%	100%
Restaurant/lounge	40%	60%	100%	50%	45%	100%
Conference rooms	0%	100%	100%	0%	100%	100%
Religious institution	0%	25%	50%	0%	100%	50%
Reception or meeting hall	0%	70%	90%	0%	70%	100%
Museum	0%	100%	80%	0%	100%	80%
School, grades K--12	0%	100%	25%	0%	30%	10%

541.195. Shared vehicles. Where one or more passenger automobiles are provided on-site for common use by residents, the minimum parking requirement for a multiple-family residential use may be reduced by ten (10) percent provided there are no more than one hundred (100) dwelling units per shared automobile. (2009-Or-002, § 17, 1-9-2009)

541.200. Transit incentives. Upon determination by the zoning administrator, the minimum parking requirement may be reduced under the following conditions:

(1) *Multiple-family dwellings.* The minimum parking requirement may be reduced ten (10) percent if the proposed use is located within three hundred (300) feet of a transit stop with midday service headways of thirty (30) minutes or less in each direction.

(2) *Non-residential uses.* The minimum parking requirement may be reduced ten (10) percent if the use provides an adequate sheltered transit stop within the development, as determined by the city engineer. The reduction shall not be awarded for sheltered transit stops that are both in the public right-of-way and detached from the principal structure.

(3) *Process.* The applicant for such transit incentives shall submit an application on a form approved by the zoning administrator, as specified in Chapter 525, Administration and Enforcement.

541.210. Valet parking. The off-street parking requirement for restaurants, hotels, and theaters located in buildings existing on the effective date of this ordinance may be fulfilled by maintaining a valet parking service for customers. The valet service shall provide service to and from the main entrance. A passenger loading area, as approved by the city engineer, shall be provided near the main entrance. Availability of this service shall be conspicuously posted inside and outside the establishment near the main entrance. The valet shall be properly licensed to operate a motor vehicle. The parking area in which the automobiles are parked shall be no farther than eight hundred (800) feet from the main entrance. Parking areas used exclusively for valet parking need not be striped.

541.220. Bicycle incentive. (a) *Non-residential uses.* The minimum automobile parking requirement for each non-residential use may be reduced ten (10) percent or one (1) space, whichever is greater, where bicycle parking spaces are provided equal to twenty[-five] (25) percent of the number of required automobile spaces specified in Table 541-1, Specific Off-Street Parking Requirements, but not less than four (4) bicycle parking spaces. This incentive shall allow for a reduction in the automobile parking requirement of no more than twenty-five (25) spaces on a zoning lot. To qualify for this incentive, bicycle parking shall comply with the standards for required bicycle parking as specified in this ordinance. Where the bicycle incentive calculation results in a number less than or equal to the minimum bicycle parking requirement for a use specified in Table 541-3, Bicycle Parking Requirements, the bicycle incentive shall be increased to one (1) space greater than the minimum requirement.

Salt Lake (UT), City of. 2009. *City Code*.
Title 21A. Zoning
Chapter 21A.44. Off Street Parking and Loading

Section 21A.44.040. Transportation Demand Management
Because the purposes and intent of this title include the lessening of congestion on the streets and roads, as well as generally protecting the public health, safety and welfare, specific standards and regulations are outlined which are intended to reduce traffic congestion and environmental pollution associated with vehicular transportation. The standards and regulations established are intended to be components of an overall transportation demand management plan.

A. Bicycle Parking Requirements: Encouraging the use of bicycles is an important nonmotorized transportation alternative and a component of a transportation demand management program.

1. Required Bicycle Parking Spaces: The minimum number of bicycle parking spaces provided for any use shall be five percent (5%) of the vehicular parking spaces required for such use.

2. Design Standards For Bicycle Parking Spaces: Bicycle parking spaces shall be:

a. Located on the same lot as the principal use;

b. Located to prevent damage to bicycles by cars;

c. In a convenient, highly visible, active, well lighted area;

d. Located so as not to interfere with pedestrian movements;

e. As near the principal entrance of the building as practical;

f. Located to provide safe access from the spaces to the right of way or bicycle lane;

g. Consistent with the surroundings in color and design and incorporated, whenever possible, into buildings or street furniture design;

h. Designed to allow each bicycle to be supported by its frame;

i. Designed to allow the frame and wheels of each bicycle to be secured against theft;

j. Designed to avoid damage to the bicycles;

k. Anchored to resist rust or corrosion, or removal by vandalism;

l. Designed to accommodate a range of bicycle shapes and sizes and facilitate easy locking without interfering with adjacent bicycles.

3. Waiver Of Requirement: If after at least one year from the time that the bicycle parking has been provided to satisfy the requirements of this title, the property owner documents to the zoning administrator that cycling has been promoted within

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the company and that the bicycle parking provided is not being used in good weather, the zoning administrator shall waive all or part of the bicycle parking requirement.

B. Car Pool Parking Incentives: The following regulations are intended to encourage the use of car pooling to increase vehicle occupancy and reduce traffic volumes and congestion:

1. Applicability: The regulations of this subsection shall apply to all nonresidential buildings or uses constructed after April 12, 1995, that employ one hundred (100) or more people. This shall include multiuse buildings and lots which collectively employ one hundred (100) or more people with buildings constructed after the adoption date of this title, April 12, 1995.

2. Reserved Parking Spaces: Each use subject to the requirements of this subsection shall devote ten percent (10%) of the total number of employee parking spaces for vehicles participating in a car pool program. Car pool parking spaces shall be located to provide superior convenience. The number of employee parking spaces shall be based on one parking stall for each two (2) employees on the highest shift.

3. Submission Of Car Pool Parking Plan: Each use subject to the requirements of this subsection shall submit a plan of the employee parking spaces reserved for car pooling to the development review team for review and approval. The plan shall:

a. Specify the total number of employee parking spaces provided;

b. Indicate the number and location of parking spaces reserved for car pooling; and

c. Include a copy of the car pool program which identifies the individuals participating in the car pool program.

4. Delineation Of Car Pool Parking Spaces: Car pool parking spaces shall be marked by sign or marking on the pavement to identify that the use of the spaces is reserved for the car pool program.

5. Waiver Of Requirement: If after at least one year from the time that the parking stalls reserved for car pooling vehicles have been provided to satisfy the requirements of this title, the property owner documents to the zoning administrator that car pooling has been promoted within the company and that the parking stalls reserved for car pooling vehicles are not being used, the zoning administrator may waive all or part of the car pooling parking requirement.

C. Special Minimum And Maximum Parking For Certain Districts: The regulations of this subsection are intended to reduce traffic volumes in certain zoning districts by reducing the minimum number of parking spaces required, and in some cases, limiting the maximum number of parking spaces permitted. The districts subject to these special controls are districts where alternative forms of transportation exist. The districts subject to these special controls shall be subject to the requirements of section 21A.44.060 of this chapter, only to the extent specifically established in this subsection.

1. D-1 District:

a. Minimum Parking Required; Nonresidential Uses: The minimum number of parking spaces required for nonresidential uses shall be as follows:

(1) No parking is required for the first twenty five thousand (25,000) square feet of floor area.

(2) One space shall be required per one thousand (1,000) square feet of gross floor area in excess of twenty five thousand (25,000) square feet.

b. Minimum Parking Required; Residential Uses: One-half (1/2) parking space shall be required for each dwelling unit.

c. Parking Allowed; Nonresidential Uses: The number of parking stalls provided for any nonresidential use, other than retail sales and service uses, shall not exceed the amount permitted in the following four (4) phase schedule:

(1) Phase One: No parking maximum is specified. Phase one commences at the adoption date hereof, April 12, 1995, and remains in effect for two (2) years.

(2) Phase Two: Parking maximum ratio of four (4) parking stalls for each one thousand (1,000) square feet of gross floor area. Phase two shall commence at the end of phase one and shall remain in effect for two (2) years.

(3) Phase Three: Parking maximum ratio of three (3) parking stalls for each one thousand (1,000) square feet of gross floor area. Phase three shall commence at the end of phase two and shall remain in effect for two (2) years.

(4) Phase Four: Parking maximum ratio of two and one-half (21/2) parking stalls for each one thousand (1,000) square feet of gross floor area. Phase four shall commence at the end of phase three and shall remain in effect permanently from that time.

(5) Phasing Process: The process of enacting phases two, three and four shall include a review and decision process that will involve receiving a recommendation from the city's contract manager of the downtown improvement district, a recommendation from the planning commission and a public hearing before the city council, prior to a final city council decision to enact the next phase. The decision to enact a subsequent phase shall include an analysis of alternative modes of transportation, air quality regulations, land use development, traffic congestion and specifically, the status of the proposed light rail transit system. A subsequent phase shall only be enacted with an affirmative vote by the city council.

d. Maximum Parking Allowed; Retail Sale And Service Uses: The maximum parking for retail sales and service uses shall not exceed four (4) parking stalls for each one thousand (1,000) square feet of gross floor area. Implementation of this maximum parking requirement shall commence two (2) years from the adoption date hereof, April 12, 1995, and shall remain in effect permanently from that time.

e. Maximum Parking Allowed; Residential Uses: The maximum parking for residential uses shall not exceed two (2) parking stalls for each residential unit.

f. Exemption From Maximum Parking: Exemptions from the maximum parking requirements in this subsection C1 may be authorized as a conditional use pursuant to the procedures and standards of chapter 21A.54 of this title. Additionally, the applicant must demonstrate that additional parking is necessary to support a specific land use and that additional on site parking is the most feasible means of supplying the parking demand.

2. R-MU District:

a. For single-family and two-family residential uses in the R-MU district, one parking stall shall be required for each unit. For multiple-family residential uses in the R-MU district, one-half (1/2) parking space shall be provided for each dwelling unit.

b. Credit for on street parking may be granted, as provided in subsection D of this section.

3. CN And CB Districts:

a. For residential uses in the CN and CB districts, not less than one parking space shall be provided for each dwelling unit.

b. Credit for on street parking may be granted, as provided in subsection D of this section.

4. G-MU, D-3, And D-4 Districts:

a. For residential uses in the G-MU, D-3 and D-4 districts, not less than one parking space shall be provided for each dwelling unit.

b. For buildings that have ten (10) or more residential units with at least twenty percent (20%) of the units as either affordable, senior housing, or assisted living units shall be allowed to have a minimum of one-half (1/2) of a parking space provided for each dwelling unit.

5. G-MU And D-3 Districts:

a. For nonresidential uses in the G-MU and D-3 districts, no off street parking shall be required for the first five thousand (5,000) square feet of floor area. For all uses with more than five thousand (5,000) square feet, the parking requirement shall be one space per one thousand (1,000) square feet of gross floor area, including the initial five thousand (5,000) square feet.

6. D-4 District:

a. For nonresidential uses in the D-4 district, no off street parking shall be required for the first twenty five thousand (25,000) square feet of floor area. For all uses with more than twenty five thousand (25,000) square feet, the parking requirement shall be one space per one thousand (1,000) square feet of gross

floor area, which shall not include the initial twenty five thousand (25,000) square feet.

7. TC-75 District:

a. For nonresidential uses in the TC-75 district, no off street parking shall be required for the first five thousand (5,000) square feet of floor area. For all nonresidential uses with more than five thousand (5,000) square feet, the parking requirement shall be one space per one thousand (1,000) square feet of gross floor area, including the initial five thousand (5,000) square feet.

b. All residential parking requirements listed in table 21A.44.060F of this chapter are reduced by fifty percent (50%) within the TC-75 zoning district.

D. Credit For On Street Parking: This subsection is intended to reduce the amount of unnecessary parking spaces and to encourage pedestrian activity as an alternative means of transportation. Credit for on street parking shall be allowed only within the RB, R-MU, CN, CB, CSHBD, D-1, D-2 and D-3 districts. Some or all of the off street parking spaces required in section 21A.44.060 of this chapter may be met by the provision of on street spaces. Such credit shall require the site plan review approval. Requests for on street parking shall meet the following requirements:

1. All on street parking facilities shall be designed in conformance with the standards established by the city transportation engineer;

2. Prior to approving any requests for on street parking, the development review team shall determine that the proposed on street parking will not materially adversely impact traffic movements and related public street functions; and

3. Credit for on street parking shall be limited to the number of spaces provided along the street frontage adjacent to the use.

Scottsdale (AZ), City of. 2009. *Revised Code*.
Appendix B. Basic Zoning Ordinance.
Article IX. Parking and Loading Requirements.

Sec. 9.104. Programs and incentives to reduce parking requirements.
The following programs and incentives are provided to permit reduced parking requirements in the locations and situations outlined herein where the basic parking requirements of this ordinance would be excessive or detrimental to goals and policies of the city relating to mass transit and other alternative modes of transportation.

A. Administration of parking reductions. Programs and incentives which reduce parking requirements may be applied individually or jointly to properties and developments. Where reductions are allowed, the number of required parking spaces which are eliminated shall be accounted for both in total and by the individual program, incentive or credit which is applied. The record of such reductions shall be kept on the site plan within the project review file. Additionally, the reductions and manner in which they were applied shall be transmitted in writing to the property owner.

B. Credit for on-street parking. Wherever on-street angle parking is provided in the improvement of a street, credit toward on-site parking requirements shall be granted at the rate of one (1) on-site space per every twenty-five (25) feet of frontage, excluding the following:

1. Frontage on an arterial, major arterial or expressway as designated by the street classification plan.
2. Frontage on a street that is planned to be less than fifty-five (55) feet wide curb-to-curb.
3. Frontage within twenty (20) feet of a corner.
4. Frontage within ten (10) feet of each side of a driveway or alley.
5. Frontage within a fire hydrant zone or other emergency access zone.
6. Locations within the (D) Downtown zoning district.
7. Locations within the (DO) Downtown Overlay.

C. Credit for bicycle parking facilities.
1. Purpose. The City of Scottsdale, in keeping with the federal and Maricopa County Clean Air Acts, wishes to encourage the use of alternative transportation modes such as the bicycle instead of the private automobile. Reducing the number of vehicular parking spaces in favor of bicycle parking spaces helps to attain the standards of the Clean Air Act, to reduce impervious surfaces, and to save on land and development costs.

2. Performance standards. The City Manager or designee may authorize credit towards on-site parking requirements for all uses except residential uses, for the provision of bicycle facilities beyond those required by this ordinance, subject to the following guidelines:

a. Wherever bicycle parking is provided beyond the amount required per Section 9.103.B, required bicycle parking, credit toward required on-site vehicular parking may be granted pursuant to the following:

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i. Downtown (D) zoning districts: one (1) vehicular space per eight (8) bicycle spaces.
ii. All other zoning districts: one (1) vehicular space per ten (10) bicycle spaces.

b. Wherever bicycle parking facilities exceed the minimum security level required per Section 9.103.B, required bicycle parking, credit towards required onsite vehicular parking may be granted at a rate of one (1) vehicular space per every four (4) high-security bicycle spaces. High-security bicycle spaces shall include those which protect against the theft of the entire bicycle and of its components and accessories by enclosure through the use of bicycle lockers, check-in facilities, monitored parking areas, or other means which provide the above level of security as approved by the City Manager or designee.

c. Wherever shower and changing facilities for bicyclists are provided, credit towards required on-site vehicular parking may be granted at the rate of two (2) vehicular spaces per one (1) shower.

d. The number of vehicular spaces required per table 9.2 shall not be reduced by more than five (5) percent or ten (10) spaces, whichever is less.

D. Credit for participation in a joint parking improvement project. After the effective date of this ordinance, no new joint parking improvement projects shall be designated in the City of Scottsdale. Existing joint parking improvement projects may continue to exist, subject to the standards under which they were established. The joint parking improvement project was a program through which a group of owners with mixed land uses including an area of more than three (3) blocks and at least six (6) separate ownerships could join together on a voluntary basis to form a parking improvement district, providing parking spaces equal to a minimum of thirty (30) percent of their combined requirements according to the ordinance under which they were established. Each participant property could have received credit for one and one-half (1 1/2) times his proportioned share of the parking spaces provided. The project required that a statement be filed with the superintendent of buildings stating the number of spaces assigned to each participating property. No adjustments were to be permitted subsequent to the filing of this statement.

E. Mixed-use shared parking programs.

1. Purpose. A mixed-use shared parking program is presented as an option to reduce the total required parking in large mixed-use facilities in which the uses operate at different times from one another throughout the day (mixed-use facilities are defined in article III, definitions). The city recognizes that strict application of the required parking ratios may result in the provision of excessive numbers of parking spaces. This results in excessive pavement and impermeable surfaces and discourages the use of alternate transportation modes. A mixed-use shared parking program allows the property developer to use parking spaces more efficiently by allowing the same spaces to be "shared" by various land uses.

2. Applicability. The mixed-use shared parking program may be applied for where mixed-uses are proposed. The applicant may choose this option or may opt to prepare a parking master plan pursuant to 9.104.F, parking master plan.

3. Procedure.

a. When a parking plan is required as part of any site plan review or permitting procedure, a mixed-use shared parking program may be requested by the applicant at the same time.

b. The mixed-use shared parking program may also be requested exclusive of any other site plan review or permitting procedure.

c. Mixed use shared parking plans shall be reviewed by, and are subject to the approval of, the City Manager or designee.

d. Alternatively, the applicant may elect to have the shared parking plan reviewed by, and subject to the approval of, the City Council in a public hearing.

e. For changes of use in mixed-use projects (as defined in article III, definitions) the applicant must demonstrate that parking necessary for the new mix of uses does not exceed the amount which was required by the previous mix of uses.

4. Limitations on mixed-use shared parking. The total number of parking spaces required by table 9.2 shall not be reduced by more than twenty (20) percent.

5. Performance standards. The City Manager or designee may authorize a reduction in the total number of required parking spaces for two (2) or more uses jointly providing on-site parking subject to the following criteria:

a. The respective hours of operation of the uses do not overlap, as demonstrated by the application on table 9.3, schedule of shared parking calculations. If one or all of the land uses proposing to use joint parking facilities do not conform to one of the general land use classifications in table 9.3, schedule of shared parking calculations, the applicant shall submit sufficient data to indicate that there is not substantial conflict in the principal operating hours of the uses. Such data may include information from a professional publication such as those published by the institute of transportation engineers (ITE) or the urban land institute (ULI), or by a professionally prepared parking study.

b. A parking plan shall be submitted for approval which shall show the layout of proposed parking.

c. The property owners involved in the joint use of on-site parking facilities shall submit a written agreement approved by the city attorney requiring that the parking spaces shall be maintained as long as the uses requiring parking exist or unless the required parking is provided elsewhere in accordance with the provisions of this article. Such written agreement shall be recorded by the property owner with the Maricopa County Recorder's Office prior to the issuance of a building permit, and a copy filed in the project review file.

Table 9.3. Schedule of Shared Parking Calculations

General Land Use Classification	Weekdays			Weekends		
	Mid.--7:00 a.m.	7:00 a.m.--6:00 p.m.	6:00 p.m.--Mid.	Mid.--7:00 a.m.	7:00 a.m.--6:00 p.m.	6:00 p.m.--Mid.
Office and industrial	5%	100%	5%	0%	60%	10%
Retail	0%	100%	80%	0%	100%	60%
Residential	100%	55%	85%	100%	65%	75%
Restaurant	50%	70%	100%	45%	70%	100%
Hotel	100%	65%	90%	100%	65%	80%
Cinema/theater	0%	70%	100%	5%	70%	100%

How to use the schedule of shared parking. Calculate the number of spaces required for each use if it were free-standing (refer to the schedule of minimum on-site parking requirements). Applying the applicable general land use category to each proposed use, use the percentages to calculate the number of spaces required for each time period, (six (6) time periods per use). Add the number of spaces required for all applicable land uses to obtain a total parking requirement for each time period. Select the time period with the highest total parking requirement and use that total as your shared parking requirement.

F. Parking master plan.

1. Purpose. A parking master plan is presented as an option to promote the safe and efficient design of parking facilities for sites larger than two (2) acres or those downtown district/retail specialty uses larger than sixty thousand (60,000) square feet. The city recognizes that strict application of the required parking standards or ratios may result in the provision of parking facilities of excessive size or numbers of parking spaces. This results in excessive pavement and impermeable surfaces and may discourage the use of alternate transportation modes. A parking master plan allows the property developer to establish a more efficient parking scheme through the following requirements.

2. Applicability. The parking master plan is appropriate to alleviate problems of reuse and is also applicable as an alternative to the above mixed-use shared parking programs.

3. Procedure.

a. When a parking plan is required as part of any site plan review or permitting procedure, the parking master plan may be requested by the applicant at the same time.

b. The parking master plan may also be requested exclusive of any other site plan review or permitting procedure.

c. Parking master plans shall be reviewed by, and are subject to the approval of, the City Manager or designee.

d. For changes of use in mixed-use projects (as defined in article III, definitions) the applicant must demonstrate that parking necessary for the new mix of uses does not exceed the amount which was required by the previous mix of uses.

4. Limitations on parking master plans. The City Manager or designee shall only permit reductions of up to twenty (20) percent of the total parking required per table 9.2. Reductions of more than twenty (20) percent of required parking shall be subject to approval by the City Council.

5. Elements of a parking master plan. The parking master plan shall contain the following:

a. A plan, which graphically depicts where the spaces and parking structures are to be located.

b. A report, which demonstrates how everything shown on the plan complies with or varies from applicable standards and procedures of the city.

c. The plan shall show all entrances and exits for any structured parking and the relationship between parking lots or structures and the circulation master plan.

d. The plan, supported by the report, shall show the use, number, location, and typical dimensions of parking for various vehicle types including passenger vehicles, trucks, vehicles for mobility impaired persons, buses, other transit vehicles and bicycles.

e. The plan, supported by the report, shall include phasing plans for the construction of parking facilities and any interim facilities planned.

f. Whenever the applicant requests any reductions in the number of required parking spaces as provided for in this ordinance, the required report shall be prepared by a registered civil engineer licensed to practice in the State of Arizona and shall document how any reductions were calculated and upon what assumptions such calculations were based.

g. Parking ratios used within the report shall be based upon uses or categories of uses already listed within table 9.2, schedule of parking requirements. If the use is not listed in table 9.2, then the applicant may request an ordinance amendment to table 9.2 rather than a variance from its standards.

h. Such other information as is determined by the reviewing authority to be necessary to process the parking master plan.

6. Performance standards. Parking shall comply with the requirements of the zoning ordinance as amended except where application of the following criteria can show that a modification of the standards is warranted. This shall be determined by

the City Manager or designee pending his or her review of the materials described in subsection 5. above.

a. The parking master plan shall provide sufficient number and types of spaces to serve the uses identified on the site.

b. Adequate provisions shall be made for the safety of all parking facility users, including motorists, bicyclists and pedestrians.

c. Parking master plans shall be designed to minimize or alleviate traffic problems.

d. Parking spaces shall be located near the uses they are intended to serve.

e. Adequate on-site parking shall be provided during each phase of development of the district.

f. The plan shall provide opportunities for shared parking or for other reductions in trip generation through the adoption of transportation demand management (TDM) techniques to reduce trip generation, such as car pools, van pools, bicycles, employer transit subsidies, compressed work hours, and high occupancy vehicle (HOV) parking preference.

g. Surfacing of the lot shall be dust-proof, as provided by Section 9.106.C.1.

h. The parking master plan shall attempt to reduce environmental problems and to further the city's compliance with the federal Clean Air Act amendments of 1990 through appropriate site planning techniques, such as but not limited to reduced impervious surfaces and pedestrian connections.

i. Compliance with the federal Clean Air Act amendments of 1990 shall be considered.

j. Reductions in the number of parking spaces should be related to significant factors such as, but not limited to:

(1) Shared parking opportunities;
(2) Hours of operation;
(3) The availability and incorporation of transit services and facilities;
(4) Opportunities for reduced trip generation. Through pedestrian circulation between mixed-uses (as defined in article III, definitions);
(5) Off-site traffic mitigation measures;
(6) Recognized variations in standards due to the scale of the facilities;
(7) Parking demand for a specified use; and
(8) The provisions of accessible parking spaces beyond those required per Section 9.105.

k. Reductions in the number of parking spaces for neighborhood-oriented uses may be granted at a rate of one (1) space for every existing or planned residential unit located within two (2) blocks of the proposed use, and one-half

(0.5) space for every existing or planned residential unit located within four (4) blocks of the proposed use.

7. Approval. The property owner involved in the parking master plan shall submit a written agreement approved by the city attorney requiring that the parking facility and any associated transportation demand management (TDM) techniques shall be maintained without alteration unless such alteration is authorized by the City Manager or designee. Such written agreement shall be recorded by the property owner with the Maricopa County Recorder's Office prior to the issuance of a building permit, and a copy filed in the project review file.

G. Valet parking. Reserved.

H. (DO) Downtown Overlay District Program.

1. Purpose. This parking program will ease the process of calculating parking supply for new buildings, remodels, or for buildings with new tenants or new building area.

This parking program consists of two (2) elements: Parking required and parking waiver.

2. The amount of parking required shall be:

a. If there is no change of intensity of use on any lot that has a legal use existing at the date of this ordinance adoption, no additional parking shall be required.

b. Parking credits.

i. Parking credits under this program shall be only for permanent on-site parking, parking improvement districts, or permanent parking in-lieu credits. Only these parking credits shall carry forward with any lot that has parking credits at the time of this ordinance adoption.

ii. This (DO) downtown ordinance does not void public agreements for parking payments of any type of parking program that was established prior to the effective date of this ordinance.

iii. Any parking improvement district or permanent parking in-lieu credits that the lot has that are in excess of the current parking demand shall remain with the lot.

iv. Property owners are still required to pay for any public or private program that allowed them to meet the parking requirements.

v. Properties with P-3 Parking district zoning shall have the option of using this method of calculating parking credits, or to use the credits provided by the P-3 Parking district.

c. Parking for increase in intensity in use not otherwise allowed or for additional floor area shall provide parking in conformance with this (DO) downtown overlay

district program parking credits and waiver, and the parking provisions in section 6.1208 and Article IX.

3. Parking waiver within the (DO) downtown overlay district.

a. Purpose. This parking waiver is designed to act as an incentive for the new buildings, remodels, or for buildings with new tenants, and for building area expansion of smaller downtown businesses, whose expansion will have a minimal impact on parking demand.

b. Applicability. Upon application, property owners may have parking requirements waived if they meet the following criteria:

i. Are within the (DO) Downtown Overlay district.

ii. Are used for retail, office or personal services uses allowed in the underlying district.

c. Limitations on this parking waiver.

i. Can be used only once per individual lot existing at the effective date of this ordinance.

ii. Can only be used on first and second floors.

iii. Can be used for retail, office or personal services uses allowed in the underlying district.

iv. Is limited to a maximum of two thousand (2,000) square feet of new building, or building area expansion size.

v. Cannot be used on land that was used for parking in the past two years unless the same number of physical parking spaces are replaced elsewhere.

d. Residential addition parking waiver. This parking waiver is designed to act as an incentive for the integration of one or more residential units as part of a business expansion of a maximum of two thousand (2,000) total square feet. One parking space will be required per residential unit, this parking can be reallocated from on site existing parking corresponding to other uses.

Seattle (WA), City of. 2009. *Land Use Code*.
Subtitle III. Land Use Regulations
Division 2. Authorized Uses and Development Standards
Chapter 23.54. Quantity and Design Standards for Access and Off-Street Parking

23.54.020 Parking quantity exceptions.

The parking quantity exceptions set forth in this section apply in all zones except downtown zones, which are regulated by Section 23.49.019, and Major Institution zones, which are regulated by Section 23.54.016.

A. Adding Units to Existing Structures in Multifamily and Commercial Zones.

1. For the purposes of this section, "existing structures" means those structures that were established under permit, or for which a permit has been granted and has not expired as of the applicable date, as follows:

a. In multifamily zones, August 10, 1982;

b. In commercial zones, June 9, 1986.

2. If an existing residential structure in a multifamily or commercial zone has parking that meets the development standards, and the lot area is not increased, one (1) unit may be added without additional parking. If two (2) units are added, one (1) space will be required; three (3) units will require two (2) spaces, etc. Additional parking must meet all development standards for the particular zone.

3. In a Lowrise Duplex/Triplex zone:

a. When an existing residential structure provides less than one (1) parking space per unit, one (1) parking space is required for each additional dwelling unit when dwelling units are added to the structure or the structure is altered to create additional dwelling units;

b. When an existing nonresidential structure is partially or completely converted to residential use, then no parking space shall be required for the first new dwelling unit, provided that the lot area is not increased and existing parking is screened and landscaped to the greatest extent practical.

Additional parking provided shall meet all development standards for the Lowrise Duplex/Triplex zone.

4. If an existing structure does not conform to the development standards for parking, or is occupied by a nonconforming use, no parking space is required for the first new or added dwelling unit, provided:

a. The lot area is not increased and existing parking is screened and landscaped to the greatest extent practical.

b. Additional parking provided shall meet all development standards for the particular zone.

c. This exception shall not apply in Lowrise Duplex/Triplex zones.

B. Tandem Parking in Multifamily Structures.

1. Off-street parking required for multifamily structures may be provided as tandem parking, as defined in Section 23.54.030. A tandem parking space counts as one and one-half (1 1/2) parking spaces, except as provided in subsection B2 below, and must meet the minimum size requirements of subsection A of Section 23.54.030.

2. When a minimum of at least one (1) parking space per dwelling unit in a multifamily structure is required, the total number of parking spaces provided, counting each tandem parking space as one space, may not be less than the total number of dwelling units.

C. Parking Exception for Landmark Structures. The Director may reduce or waive the minimum accessory off-street parking requirements for a use permitted in a Landmark structure, or when a Landmark structure is completely converted to residential use according to Sections 23.42.108 or 23.45.006, or for a use in a Landmark district that is located in a commercial zone, as a special exception pursuant to Chapter 23.76, Procedures for Master Use Permits and Council Land Use Decisions.

1. In making any such reduction or waiver, the Director will assess area parking needs. The Director may require a survey of on- and off-street parking availability. The Director may take into account the level of transit service in the immediate area; the probable relative importance of walk-in traffic; proposals by the applicant to encourage carpooling or transit use by employees; hours of operation; and any other factor or factors considered relevant in determining parking impact.

2. The Director may also consider the types and scale of uses proposed or practical in the Landmark structure, and the controls imposed by the Landmark designation.

3. Such a reduction or waiver may be allowed, for conversion of structures to residential use, only if the Director also determine that there is no feasible way to meet parking requirements on the lot.

D. Expansion of Existing Nonresidential Uses in Commercial Zones. In commercial zones additional parking spaces for nonresidential uses are not required for the expansion of existing structures if the minimum parking requirement would not be increased by more than ten (10) percent. If the minimum parking requirement would be increased by more than ten (10) percent, the parking spaces required for the entire expansion shall be provided. This exception may be used only once for any individual structure.

E. Reductions to required parking in pedestrian-designated zones are permitted according to the provisions of Section 23.54.015 Chart D.

F. Reductions to Minimum Parking Requirements for Nonresidential Uses.

1. Reductions to minimum parking requirements permitted by this subsection will be calculated from the minimum parking requirements in Section 23.54.015. Total reductions to required parking as provided in this subsection may not exceed forty (40) percent.

2. Transit Reduction.

a. In NC zones and C zones, except pedestrian-designated zones, and in the Seattle Mixed (SM) zone, except on Class 1 Pedestrian Streets, the minimum parking requirement for a nonresidential use, except institutions, may be reduced by twenty (20) percent when the use is located within eight hundred (800) feet of a street with midday transit service headways of fifteen (15) minutes or less in each direction. This distance will be the walking distance measured from the nearest bus stop to the property line of the lot containing the use.

b. In industrial zones, the minimum parking requirement for a nonresidential use may be reduced by fifteen (15) percent when the use is located within eight hundred (800) feet of a street with peak transit service headways of fifteen (15) minutes or less in each direction. This distance will be the walking distance measured from the nearest bus stop to the property line of the lot containing the use.

3. Substitution of Alternative Transportation. For new or expanding offices or manufacturing uses that require forty (40) or more parking spaces, the minimum parking requirement may be reduced up to a maximum of forty (40) percent by the substitution of alternative transportation programs, according to the following provisions:

a. For every certified carpool space accompanied by a cash fee, performance bond or alternative guarantee acceptable to the Director, the total parking requirement will be reduced by one and nine-tenths (1 9/10) spaces, up to a maximum of forty (40) percent of the parking requirement. The Director will consult with the Seattle Rideshare Office in certifying carpool spaces and the location of carpool parking.

b. For every certified vanpool purchased or leased by the applicant for employee use, or equivalent cash fee for purchase of a van by the public ridesharing agency, the total parking requirement will be reduced by six (6) spaces, up to a maximum of twenty (20) percent of the parking requirement. Before a certificate of occupancy may be issued, details of the vanpool program shall be specified in a Memorandum of Agreement executed between the proponent, the Director, and the Seattle Rideshare Office.

c. If transit or transportation passes are provided with a fifty (50) percent or greater cost reduction to all employees in a proposed structure for the duration of the business establishment(s) within it, or five (5) years, whichever is less, and if transit service is located within eight hundred (800) feet, the parking requirement shall be reduced by ten (10) percent. With a twenty-five (25) percent to forty-nine (49) percent cost reduction, and if transit service is located within eight hundred (800) feet, the parking requirement shall be reduced by five (5) percent.

d. For every four (4) covered bicycle parking spaces provided, the total parking requirement shall be reduced by one (1) space, up to a maximum of five (5) percent of the parking requirement, provided that there is access to an arterial over improved streets.

G. Shared Parking.

1. Shared Parking, General Provisions.

a. Shared parking is allowed between two (2) or more uses to satisfy all or a portion of the minimum off-street parking requirement of those uses as provided in subsections G2 and G3.

b. Shared parking is allowed between different categories of uses or between uses with different hours of operation, but not both.

c. A use for which an application is being made for shared parking must be located within eight hundred (800) feet of the parking.

d. No reduction to the parking requirement may be made if the proposed uses have already received a reduction through the provisions for cooperative parking, subsection H.

e. Reductions to parking permitted through shared use of parking will be determined as a percentage of the minimum parking requirement as modified by the reductions permitted in subsections A though F.

f. An agreement providing for the shared use of parking, executed by the parties involved, must be filed with the Director. Shared parking privileges will continue in effect only as long as the agreement, binding on all parties, remains in force. If the agreement is no longer in force, then parking must be provided as otherwise required by this chapter.

2. Shared Parking for Different Categories of Uses.

a. A business establishment may share parking according to only one of the subsections G2b, G2c or G2d.

b. If an office use shares parking with one of the following uses:

(1) general sales and services.
(2) heavy sales and services uses.
(3) eating and drinking establishments.
(4) lodging uses.
(5) entertainment.
(6) medical services.
(7) animal shelters and kennels.
(8) automotive sales and services, or
(9) maritime sales and services;

the parking requirement for the non-office use may be reduced by twenty (20) percent, provided that the reduction will not exceed the minimum parking requirement for the office use.

c. If a residential use shares parking with one of the following uses:

(1) general sales and services,
(2) heavy sales and services uses,
(3) medical services,
(4) animal shelters and kennels,

(5) automotive sales and services, or
(6) maritime sales and services;

the parking requirement for the residential use may be reduced by thirty (30) percent, provided that the reduction does not exceed the minimum parking requirement for the nonresidential use.

d. If an office and a residential use share off-street parking, the parking requirement for the residential use may be reduced by fifty (50) percent, provided that the reduction does not exceed the minimum parking requirement for the office use.

3. Shared Parking for Uses With Different Hours of Operation.

a. For the purposes of this section, the following uses will be considered daytime uses:

(1) Commercial uses, except eating and drinking establishments, lodging uses, and entertainment uses;
(2) Storage uses;
(3) Manufacturing uses; and
(4) Other similar primarily daytime uses, when authorized by the Director.

b. For the purposes of this section, the following uses will be considered nighttime or Sunday uses:

(1) Auditoriums accessory to public or private schools;
(2) Religious facilities;
(3) Entertainment uses, such as theaters, bowling alleys, and dance halls;
(4) Eating and drinking establishments; and
(5) Other similar primarily nighttime or Sunday uses, when authorized by the Director.

c. Up to ninety (90) percent of the parking required for a daytime use may be supplied by the off-street parking provided by a nighttime or Sunday use and vice-versa, when authorized by the Director, except that this may be increased to one hundred (100) percent when the nighttime or Sunday use is a religious facility.

d. The applicant must show that there is no substantial conflict in the principal operating hours of the uses for which the sharing of parking is proposed.

e. The establishment of park-and-pool lots is permitted, provided that the park-and-pool lot will not use spaces required by another use if there is a substantial conflict in the principal operating hours of the park-and-pool lot and the use.

H. Cooperative Parking.

1. Cooperative parking is permitted between two (2) or more business establishments that are commercial uses according to the provisions of this subsection.

2. Up to a twenty (20) percent reduction in the total number of required parking spaces for four (4) or more separate business establishments, fifteen (15) percent

reduction for three (3) business establishments, and ten (10) percent reduction for two (2) commercial uses may be authorized by the Director under the following conditions:

a. No reductions to the parking requirement may be made if the proposed business establishments have already received a reduction through the provisions for shared parking, subsection G of this section.

b. Each business establishment for which the application is being made for cooperative parking is located within eight hundred (800) feet of the parking, and the parking is located in a commercial or residential-commercial zone or the Seattle Mixed (SM) zone.

c. The reductions to parking permitted through cooperative parking will be determined as a percentage of the minimum parking requirement as modified by the reductions permitted in subsections A through F of this section.

d. An agreement providing for the cooperative use of parking must be filed with the Director when the facility or area is established as cooperative parking. Cooperative parking privileges will continue in effect only as long as the agreement to use the cooperative parking remains in force. If the agreement is no longer in force, then parking must be provided as otherwise required by this chapter. New business establishments seeking to meet parking requirements by becoming part of an existing cooperative arrangement must provide the Director with an amendment to the agreement stating their inclusion in the cooperative parking facility or area.

I. Reductions to Minimum Parking Requirements for Department of Parks and Recreation (DOPAR) Community Centers.

1. When family support centers are located within DOPAR community centers, the Director may, upon request by DOPAR, lower the combined parking requirement for the community center and the family support center up to a maximum of fifteen (15) percent.

2. The parking requirement may be reduced only if the reduction is supported by a recommendation of the Project Advisory Committee formed to review the DOPAR community center, and the Director determines and makes written findings that:

a. The lower parking requirement is necessary to preserve existing natural features or recreational facilities deemed significant by DOPAR and the Project Advisory Committee formed to review the DOPAR community center, and the reduction is the minimum necessary to preserve such features and/or facilities; and

b. The surrounding streets can accommodate overflow parking from the combined community center and family support center or, alternatively, any adverse parking impacts on the neighborhood from the combined community center and family support center will be mitigated.

J. Parking for City-recognized Car-sharing Programs.

1. For any development, one (1) space or up to five (5) percent of the total number of required spaces, whichever is greater, may be used to provide parking for vehicles

operated by a car-sharing program. The number of required parking spaces will be reduced by one (1) space for every parking space leased by a car-sharing program.

2. For any development requiring twenty (20) or more parking spaces under Section 23.54.015 that provides a space for vehicles operated by a car-sharing program, the number of required parking spaces may be reduced by the lesser of three (3) required parking spaces for each car-sharing space or fifteen (15) percent of the total number of required spaces. In order to gain this exception, an agreement between the property owner and a car-sharing program must be approved by the Director and the agreement, along with a notice that the agreement is the basis for this exception to the parking requirement, must be recorded with the title to the property before a Master Use Permit is issued.

K. Peat Settlement-prone Environmentally Critical Areas. Except in Single-family, Residential Small Lot, and Lowrise zones, the Director may reduce or waive the minimum accessory off-street parking requirements to the minimum extent necessary to offset underground parking potential lost to limitations set forth in Section 25.09.110 on development below the annual high static groundwater level in peat settlement-prone areas. In making any such reduction or waiver, the Director will assess area parking needs. The Director may require a survey of on- and off-street parking availability. The Director may take into account the level of transit service in the immediate area; the probable relative importance of walk-in traffic; proposals by the applicant to encourage carpooling or transit use by employees; hours of operation; and any other factor or factors considered relevant in determining parking impact.

L. SM/D/40-85 zone. As a Type I decision pursuant to Chapter 23.76, Procedures for Master Use Permits and Council Land Use Decisions, the Director may reduce required parking for any proposed uses in the SM/D/40-85 zone to a level not less than the amount needed to serve parking demand to be generated by those uses as demonstrated to the satisfaction of the Director by a parking demand study performed by a licensed professional engineer and submitted by the applicant.

Downtown District
Special Parking Requirements

Auburn (WA), City of. 2009. *City Code*.
Title 18. Zoning
Chapter 18.29. DUC Downtown Urban Center District

H. Parking Ratios. The following parking standards shall apply within the DUC zone in lieu of any standard noted in ACC 18.52.020 or provision of ACC 18.52.030.

Use Type	Minimum Required	Maximum Allowed for Surface Parking Lots
Retail	2 stalls/1,000 nsf	4 stalls/1,000 nsf
Office	2 stalls/1,000 nsf	4 stalls/1,000 nsf
Residential	1 stall per dwelling unit	2 per dwelling unit
Restaurant	0.5 stall per 4 seats	1 stall per 4 seats
nsf = net square feet		

1. Parking requirements for uses not listed shall be determined by a study of parking demand for that use, as prepared by a qualified professional and as accepted by the director.

2. Retail and restaurant uses less than 3,000 nsf in area shall be exempt from parking requirements.

3. Uses sharing a common parking facility may reduce the required number of stalls by 25 percent.

4. Required parking may be located off-site, so long as it is:

a. Located within the DUC zone;

b. Within 1,000 feet of the property;

c. Connected to the property by streets improved with sidewalks or walkways; and

d. Tied to the site by a contractual agreement reviewed and approved by the city attorney that is filed with the city and deed of record at the county.

5. On-street parking that is located directly adjacent to a development site may be used to satisfy minimum parking requirements and shall not be included in determining maximum surface parking allowances.

6. Dedicated off-site parking provided within a parking structure may be used to provide FAR bonuses for a project on a separate site, provided the parking structure is located consistent with this chapter.

7. The maximum standards noted in the table above may be exceeded if all stalls above the maximum limit are provided within a parking structure.

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8. Compliance with these standards is not required for a change of use within an existing building or whenever there is an expansion of an existing building or a new building replaces an existing building that does not increase the floor area by more than 25 percent.

9. In lieu of providing the minimum parking required by this section, an applicant may request to pay for each required parking stall into a special fund that will be used to provide and upgrade municipal parking to serve the DUC zone. The per-stall fee shall be as specified in the city's fee schedule.

Austin (TX), City of. 2009. *City Code*.
Title 25. Land Development
Chapter 25-6. Transportation

Article 7. Off-Street Parking and Loading

Division 5. Special Provisions for Property in the Central Business District (CBD), a Downtown Mixed Use (DMU) Zoning District, and the Central Urban Redevelopment (CURE) Combining District Area

25-6-591. Parking Provisions For Development In The Central Business District (CBD) And A Downtown Mixed Use (DMU) Zoning District

(A) In a central business district (CBD) or downtown mixed use (DMU) zoning district:

(1) off-street parking is not required for a use occupying a designated historic landmark or located in an existing building in a designated historic district;

(2) off-street parking is not required for a use occupying less than 6,000 square feet of floor space in a structure that existed on April 7, 1997;

(3) except as provided in Subsections (A)(4) and (B), the minimum parking facility requirement is 20 percent of the number of parking spaces required by Appendix A (Tables Of Off-Street Parking And Loading Requirements) and the maximum parking facility requirement is 60 percent of the number of parking spaces required by Appendix A (Tables Of Off-Street Parking And Loading Requirements); and

(4) a parking facility for a residential use must provide at least 60 percent of the number of parking spaces required by Appendix A (Tables Of Off-Street Parking And Loading Requirements);

(5) except as provided in Subsections (C) and (D), a parking garage must be separated from an adjacent street by a pedestrian-oriented use described in Section 25-2-691 (Waterfront Overlay (WO) District Uses) that fronts on the street at the ground level;

(6) a curb cut for a garage access must have a width of 30 feet or less; and

(7) at the intersection of sidewalk and parking access lane, ten degree cones of vision are required.

(B) The number of parking spaces allowed under Subsection (A)(3) may be increased:

(1) by the director if all parking spaces are contained in a parking structure; or

(2) by the Land Use Commission if the criteria in Section 25-6-501(D) (Off-Site Parking Allowed) are satisfied.

(C) The Land Use Commission may waive the requirement of Subsection (A)(5) during the site plan review process after determining that:

(1) present and anticipated development in the area is not amenable to access by pedestrians;

(2) the requirement does not allow a reasonable use of the property; or

(3) other circumstances attributable to the property make compliance impractical.

(D) If a waiver is granted under Subsection (C), an area for which the requirement is waived must be screened.

Crystal Lake (IL), City of. 2009. *Unified Development Ordinance*.
Article 4. Development and Design Standards
Section 4-200. Off-Street Parking and Loading

5. Parking in the Downtown District

Special conditions exist in the Downtown District of the City, due to the availability of on-street parking spaces and public off-street parking lots. These public facilities contribute to a reduced need for off-street parking spaces. Therefore, buildings, structures and all uses located in the Downtown District are allowed a reduction in the required number of parking spaces to provide 70% of the required number of spaces for a similar new building or use. When unusual circumstances exist and meeting these provisions would constitute a hardship or make the redevelopment of properties in the Downtown Business District economically impractical, the City will receive a cash contribution in lieu of on-site parking facilities. Value per parking space for this contribution will be calculated taking into consideration comparable land value, the cost of design, engineering, construction, lighting and landscaping. Funds received by the City in lieu of on-site parking facilities will be utilized to provide additional downtown parking facilities.

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Table 20-150				
Location	**Height Limit***	**Setback***	**Special Conditions***	**Supplemental Standards***
			from Balbach, if Design Guidelines are met	common property lines for each two feet in excess of 70 feet
Market Street (west side, Balbach to Pierce)	60 feet	Front and side setbacks not permitted		Setbacks allowed for recessed entries
Market Street (west side, Pierce to Hwy 280)	120 feet	Minimum 10 feet to residential property line		Height may not exceed a slope of 3:2, as measured from ground level at the adjacent residentially zoned property line

*Where no standard is specified, the development standards of the DC District shall prevail

Part 4
Downtown Off-Street Parking Requirements

20.70.300 Downtown Parking Management Zone – Creation

A Downtown Parking Management Zone is hereby established, being those properties in the Downtown Zoning Districts.

20.70.310 Definitions

All references to "Off-street parking space" in this Chapter shall have the definition set forth in 20.90.050 of this Title.

20.70.320 Downtown Parking Management Zone – Minimum Off-Street Parking Requirements

The minimum number of off-street parking spaces required for uses conducted in the Downtown Parking Management Zone is shown on Table 20-140 under the column titled "Parking". Whenever the minimum number of off-street parking spaces required for use is not specified in Table 20-140, the Director shall determine which of the specified uses is most similar to the unspecified use, and the minimum requirement for that specified use shall apply. All references to building square footage shall be based on "floor area" in Section 20.90.050.

20.70.330 Reduction of Requirement

In addition to exceptions provided for under Section 20.90.200, the following reductions in parking requirements may be made by the Director:

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A. The Director may grant up to a fifteen percent (15%) reduction in the number of spaces required as part of the issuance of a development permit where the reduced number of spaces will be adequate to meet the parking demand generated by the project when the following findings are made:

1. The project has developed a Travel Demand Management (TDM) program that provides evidence that a TDM program will reduce parking demand and identifies the percentage of parking demand that will be reduced through the TDM program. The TDM program will incorporate one (1) or more elements of TDM including, but not limited to measures such as Ecopass, parking cash-out, alternate work schedules, ride sharing, Transit Support, Carpool/Vanpools, shared parking, or any other reasonable measures; and

2. The project demonstrates that it can maintain the TDM program for the life of the project and it is reasonably certain that the parking shall continue to be provided and maintained at the same location for the services of the building or use for which such parking is required, during the life of the building or use.

B. For mixed use projects, the Director may reduce the required parking spaces by up to fifty percent (50%), including any other exceptions or reductions as allowed under Title 20, upon making the following findings:

1. That the reduction in parking will not adversely affect surrounding projects;

2. That the reduction in parking will not be dependent upon public parking supply; or reduce the surrounding public parking supply; and

3. The project demonstrates that it can maintain the TDM program for the life of the project and it is reasonably certain that the parking shall continue to be provided and maintained at the same location for the services of the building or use for which such parking is required, during the life of the building or use.

C. The total parking required for a project may be reduced by up to one hundred percent (100%) as part of a development permit where public parking is provided on-site as part of a public or private development project. Public parking spaces may be applied toward the parking requirements for the use applying no more than a one-for-one standard. The finding shall be made in the development permit by the Director and be based on an alternate peak use, shared parking or parking demand analysis.

D. The project will provide replacement parking either on site, off-site within reasonable walking distance or pay the current in-lieu fee for the parking required if the project fails to maintain a TDM program.

20.70.340 Increase in Allowed Parking

The Director may increase the number of parking spaces allowed for a particular use as part of issuing a development permit where the allowed number of spaces will be inadequate to meet the parking demand when the following findings are made:

A. The number of parking spaces allowed is inadequate to meet the parking requirements of the individual buildings and uses;

B. The available off-site facilities are not accessible to the building or adequate for uses to be served.

20.70.350 Tandem Parking

A. The Director may issue a development permit to allow tandem parking spaces to satisfy up to fifty (50%) percent of the required off-street parking.

B. This permit shall be issued only upon a finding, based on an adequate parking management plan, that the reconfiguration of spaces will be adequate to meet the parking demand generated by the project.

C. This finding shall be based upon a parking demand analysis which may include, without limitation, alternate peak use of parking spaces, shared parking, proximity to public transit.

20.70.360 Nonconforming Prior Uses

Any structure in the Downtown Parking Management Zone legally instituted prior to April 30, 2004 shall be a legal nonconforming use for purposes of this Part.

20.70.370 Enlargement, Intensification or Change in Use

A. Any structure which is a legal nonconforming use pursuant to Chapter 20.150 is exempted from the application of this Part, except to the extent of the construction of any additional structure or enlargement of the existing structure.

B. New structures on parcels that are ten thousand (10,000) square feet or less with up to thirty thousand (30,000) square feet of building area do not need to provide parking.

C. Additions to structures totaling less than twenty percent (20%) of the existing structure are exempt from providing parking.

D. Additions to a historic landmark, structures in a historic district, or contributing structures to a historic district, do not need to provide parking if the addition conforms to the Secretary of Interior Historic Design ("Guidelines").

20.70.380 Amount of In-Lieu Fees

The amount of the in-lieu off-street parking fee shall be set forth in the schedule of fees established by resolution of the City Council.

20.70.385 In-Lieu Fee Fund

A special fund exists entitled, "The Downtown Parking Management Zone Off-Street Parking In-Lieu Fee Fund". Any in-lieu off-street parking fee collected shall be deposited in said special fund. Moneys deposited in the Downtown Parking Management Zone Off-Street Parking In-Lieu Fee Fund shall be expended only to acquire sites for, and/or pay costs of the construction of, public off-street parking facilities in or near the Downtown Parking Management Zone.

20.70.390 Preferred Parking

A. When payment of the in-lieu off-street parking fee has been made, the owners of the subject property may be given preference in the leasing of monthly parking spaces in City off-street parking facilities which are located within reasonable walking distance of the subject property, if such spaces are available. Such spaces may be made available on a monthly basis.

B. The number of preferential parking spaces shall not exceed the number of required off-street parking spaces for which the in-lieu fee was paid. The preferences under this Section shall remain in effect for a period not to exceed twenty (20) years from date of the issuance of the building permit or the acceptance of the conditional use permit. The granting of these preferences, in any case, shall be at the sole discretion of the City and may be withdrawn at any time once granted.

20.70.395 Inconsistent Provisions

A. This Part shall control over any inconsistent provisions of this Title. All other requirements set forth in this Chapter, not inconsistent with this Part, shall control over any other inconsistent provisions of this Title.

B. No variance or exception pursuant to Part 11 of Chapter 20.100 shall apply to any requirement specified in this part.

Scottsdale (AZ), City of. 2009. *Revised Code*.
Appendix B. Basic Zoning Ordinance
Article IX. Parking And Loading Requirements
Sec. 9.100. On-Site Parking

9.108. Special parking requirements in districts.

C. Downtown Overlay (DO) district (parking in-lieu only) and Downtown (D) districts.

1. Parking requirements. Parking capacity shall satisfy the requirements of the land uses served, and can be provided by any of the following options: On-site parking, remote parking, parking in-lieu payments, or evening-use parking credits, as limited by these regulations. These regulations shall not be subject to variances.

2. Parking in-lieu payments. A parking requirement for nonresidential uses may be met by a parking in-lieu payment to the downtown parking fund that shall be used for the operation of a downtown parking program which may include, but is not limited to, the provision and maintenance of public parking spaces, the operation of tram shuttle services linking public parking facilities and downtown activity centers, and services related to the management and regulations of public parking. The city shall not be obligated to provide in-lieu parking spaces. The City Council shall determine whether or not to allow in-lieu parking based on the following criteria: (A) Property size and configuration, (B) the amount of parking available to the area, or (C) the future opportunity to provide parking in the area. Fractional parking requirements may be paid for on a pro rata basis. The amount of the in-lieu fee shall be established by the City Council, and may include penalties for late payment. Parking in-lieu credits may be purchased either as permanent parking credits, or as impermanent parking credits in accordance with the following:

a. Permanent parking in-lieu credits: parking space credits purchased under this permanent in-lieu option shall be permanently credited to the property. These parking credits may be purchased either by installment payments to the city over a fixed period of time, or by payment of a lump sum fee. Under the lump sum purchase option, purchase shall be made by payment of the total fee in the manner described herein. The installment purchase option shall require an initial cash deposit and a written agreement binding the applicant to make subsequent monthly installment payments. The installment purchase agreement shall not create a payment term longer than fifteen (15) years, and shall include payment procedures adopted by the planning and community development department. Payment of the lump sum in-lieu fee or payment of the installment purchase deposit and execution by both parties of the installment purchase agreement, shall be completed prior to the issuance of a building permit if one is required, or to the issuance of a certificate of occupancy.

b. Monthly parking in-lieu credits: Parking credits obtained by payment of a monthly in-lieu fee under this option are only for the term of the activity requiring the parking and are not permanently credited to the property. Properties must first possess a minimum of four and one-half (4 1/2) parking spaces per one thousand (1,000) square feet of net floor area of building, and may thereafter subscribe for additional required parking spaces by paying the monthly in-lieu fee. Payments shall be made in accordance with a written agreement and procedures adopted by the planning and community development department. The first monthly payment

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shall be made prior to issuance of a certificate of occupancy for the business for whose benefit the monthly payments are made.

3. FAR bonus for underground and on-site structure parking. A maximum FAR bonus of three-tenths (0.3) is available subject to the following:

a. In a type 1 area, eighty (80) percent of the required parking is in a shared structure parking.

b. In a type 2 area, ninety (90) percent of the required parking is underground. Where shared structure parking is underground parking provided by a project is less than stipulated above, the FAR bonus shall be adjusted downward on a pro rata basis.

Parking in-lieu payments may be utilized to satisfy shared structure parking or underground parking incentives on a space per space basis.

4. Evening-use parking. Establishments conducting business between the hours of 5:00 p.m. and 3:00 a.m. qualify for evening-use parking credits for parking spaces identified to be vacant during those hours, subject to the following requirements:

a. Application for evening use parking credits shall be through the use permit process and shall be made by the property owner on behalf of the establishment requiring the parking credits.

b. Before qualifying for evening use parking credits, a property must possess a minimum of four and one-half (4 1/2) parking spaces per one thousand (1,000) square feet of net building area, on-site or by one (1) of the means provided for in paragraph c.(3) below.

c. Evening-use parking credits may be granted for spaces provided from one (1) or more of the following sources:

(i) Same-site: Parking spaces on the same property which are unutilized during the designated evening hours.

(ii) Adjacent or nearby site: Unutilized parking spaces on adjacent or near-by properties which meet the requirements of this Section and 9.107.C. and D.

(iii) Public on-street and on-site spaces: After exhausting available "same-site" evening-use parking credits, additional credits may be sought using unutilized public on-street and on-site parking spaces, subject to the following requirements:

(1) The use permit application shall be accompanied by an analysis, acceptable to the City Manager or his designee, establishing the availability and location of the unutilized public parking spaces for which evening-use parking credits are being sought.

(2) The maximum number of evening-use parking credits is limited to twenty (20) parking spaces or to fifty (50) percent of the "base minimum" parking requirement ascribed to the property, whichever is less, for which a monthly

fee established by City Council will be charged and deposited in a downtown parking fund.

d. The application shall provide a plan acceptable to the City Manager or his designee for the security and maintenance of the parking areas and their environs in a neat and orderly condition, and shall demonstrate that the areas meet the lighting requirements of Section 7.600.

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Tucson (AZ), City of. 2009. *Land Use Code*.
Article 3. Development Regulations
Division 3. Motor Vehicle And Bicycle Parking Requirements
3.3.6 Exceptions.

3.3.6.1 Downtown Redevelopment District. Within the Downtown Redevelopment District, the following off-street motor vehicle and bicycle parking regulations apply.

A. Office Use. Required off-street motor vehicle parking for office use is as follows.

1. For buildings with less than five hundred thousand (500,000) square feet, one (1) space for every four hundred (400) square feet of gross floor area.

2. For buildings with five hundred thousand (500,000) square feet or more, one (1) space for every five hundred (500) square feet of gross floor area.

B. Uses Other Than Offices. Required off-street motor vehicle parking for all uses other than office uses in the Downtown Redevelopment District is one (1) space per three hundred (300) square feet of gross floor area.

C. Residential. Required off-street motor vehicle parking for residential uses in the Downtown Redevelopment District is one (1) space for each dwelling, one (1) space for each apartment where rent/lease of space is not by the bedroom, or one (1) space for each bedroom in projects where rent/lease of space is by the bedroom.

D. Bicycle Parking. Required bicycle parking shall be provided as set forth in Sec. 3.3.6.2.

E. New Land Use in an Existing Building. No additional motor vehicle or bicycle parking spaces are required for a new land use which does not expand the existing structure.

F. Expansions of Existing Development.

1. No additional motor vehicle or bicycle parking spaces are required for the following.

   a. Expansions that do not involve construction of new structures or the elimination of existing required parking spaces.

   b. Expansions that involve construction of new structures of less than one thousand (1,000) square feet of gross floor area or less than twenty-five (25) percent of the existing gross floor area, whichever is less.

2. Expansions that involve construction of a new structure(s) of one thousand (1,000) square feet or more of gross floor area or twenty-five (25) percent or more of the gross floor area of the existing structure must provide motor vehicle and bicycle parking spaces only for the area of expansion.

3. Expansions that involve the removal of existing required motor vehicle or bicycle parking spaces must relocate the removed spaces either on site or in conformance with the provisions of this Division.

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G. Public Area Amenity Incentive. Required off-street motor vehicle parking spaces for a use may be reduced by a percentage equal to twice the ratio of open space to GFA up to a maximum of eight (8) percent, if an interior public open space is provided. The interior public open space may be a roofed atrium, courtyard, plaza, galleria, or similar area. To qualify for a public area amenity reduction in required parking, all of the following criteria must be met.

1. The space is designed to encourage pedestrian activity and public use.

2. The space is not, in whole or in part, designated as tenant area.

3. Not more than fifteen (15) percent of the total area of the space is allocated toward corridor space.

4. The space is a minimum of thirty (30) feet wide in any horizontal direction, with a floor-to-ceiling height of at least twenty (20) feet.

5. The space is visible and physically accessible directly from a public right-of-way or public open space and is located no more than one (1) floor level above or below grade.

6. A minimum of one (1) linear foot of seating is provided for every thirty (30) square feet of interior public open space.

7. A natural lighting source, either direct or indirect, such as skylights or clerestory windows, is provided for the space.

H. In/Lieu Fee. The off-street parking requirements established by this Section (Sec. 3.3.6.1) may be satisfied in whole or in part by paying the City parking in-lieu fee in an amount established by separate ordinance to be used by the City for the construction of one (1) or more Downtown public parking facilities.

I. New Parking Facilities. All new parking facilities shall be designed so that vehicles are not visible from the adjoining street level, through incorporation of design elements such as pedestrian arcades, occupied space, or display space.

Woodland (CA), City of. 2008. *City Code*.
Chapter 25 Zoning Ordinance
Article 23. Off-Street Parking and Loading

Sec. 25-23-15. Downtown Parking District

In lieu of Section 25-23-10 of the city code, the provisions of this section shall apply to the area identified as the downtown parking district. The downtown parking district boundaries shall be determined as set forth in this section.

(1) Purpose. The purpose for the downtown parking district is to:

(A) Maintain and enhance a pedestrian oriented environment in the downtown parking district;

(B) Promote and encourage economic investment in the downtown parking district;

(C) Promote re-use and renovation of historic buildings in the downtown parking district, while encouraging new investment and construction;

(D) Enhance the vitality of the downtown parking district by encouraging an appropriate mix of future development and land uses;

(E) Encourage mixed-use development supporting residential and office on the upper floors and ground floor office, retail and restaurants.

(2) Parking Requirements. Off-street parking shall be provided in connection with the erection, addition, alteration, expansion or change of use of any building or structure in the following amounts:

(A) Hotel: one space per room plus one space for the manager;

(B) Live/work: one space per unit;

(C) Multifamily:
Studio: one space per unit
1 bedroom: one space per unit
2 bedroom: one and three-quarter spaces per unit
3+ bedroom: two spaces per unit.

(D) Offices (except medical offices and clinics): one space for each four hundred square feet of gross floor area;

(E) Retail stores, banks: one space for each three hundred square feet of gross floor area;

(F) Restaurants, cafes, coffee shops, bars and establishments with on-site alcohol sales: one space for each three hundred square feet of gross floor area;

(G) Studio, photography, dance, music, or art gallery: one space for every three hundred square feet of gross floor area;

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(H) Uses not listed: the community development director may allocate off-street parking for uses of a similar nature to those listed in subsections (2)(D) through (2)(G) of this section, at one space per three hundred square feet of gross floor area. If specific standards are not addressed in this section, the provisions of Section 25-23-10 shall apply.

(3) Special Provisions.

(A) Existing buildings which currently operate in accordance with the downtown specific plan are exempt from this section, except as otherwise provided in subsection (3)(C) of this section.

(B) New buildings shall be required to meet the parking requirements set forth in this section.

(C) Off-street parking in accordance with subsection (2) of this section shall be required upon the expansion, addition or change in use of existing buildings as follows:

(i) Addition, enlargement or change of use of building: any building or structure which is enlarged, expanded or converted to residential use, shall provide off-street parking in the amount required for the enlarged, remodeled or converted building or use. Off-street parking shall be required only if the square footage of a building is increased by ten percent or more.

(ii) Residential use: on-site parking shall be required for any building, or portion thereof, that is converted to residential use.

(D) Parking requirements may be waived as follows:

(i) A minimum of one on-site parking space per residential unit shall be required, except as allowed in subsection (2)(C) of this section.

(ii) Shared parking pursuant to subsection (4) of this section.

(iii) Payment of in-lieu parking fees pursuant to subsection (5) of this section.

(iv) Off-site parking within three hundred feet for residential uses pursuant to subsection (6) of this section.

(E) On-Street Parking. New on-street parking spaces created as the result of a development may be counted toward the commercial parking requirement. However, on-street spaces lost due to development (i.e., curb cut), shall be considered a loss of a space and must either be replaced on-site or be subject to in-lieu parking fees.

(F) Bike Parking. All new developments shall provide and maintain bicycle parking facilities. Bike parking shall be provided with all new development projects. The racks shall be visible and located in safe, well lit and secure locations. Bike parking in dispersed locations is preferable to a single high capacity location. The number and placement of bike parking shall be determined at the time of design review.

(4) Shared Parking for Nonresidential Uses. In exceptional circumstances, nonresidential parking facilities may request that the planning commission consider and approve a shared parking agreement. Shared parking may be considered if multiple uses on the same parcel cooperatively operate the facilities and if some uses generate parking demands when other uses are not in operation. The applicant shall provide documentation, including a shared parking use analysis to the satisfaction of the planning commission, justifying the requested shared parking reduction. A request for shared parking to reduce parking demand by a maximum of twenty-five percent from the underlying base standards shall be subject to the following findings and restrictions:

(A) Sufficient evidence has been provided to establish that there are unique aspects of the use or location that justify a possible reduction in on-site parking. The evidence shall describe the nature of the uses and the times when the uses operate so as to demonstrate the lack of potential conflict between them. Analysis shall include possible future impacts should uses change and evaluation of alternative future uses; and

(B) The number of spaces provided will meet the greatest parking demand of any participating use; and

(C) Shared parking may be considered in the case of public or quasi-public uses and where it is adequately demonstrated that there will be no conflict in type and the time of the uses, such as may be the case for a use that only operates during weekends or evening. If it can be demonstrated that the uses are such that there will be no conflict over the life of the project and restrictions are provided to ensure that case, then the applicant may request consideration by the planning commission to increase the percentage of parking reduced above twenty-five percent; and

(D) Additional documents, covenants, deed restrictions, or other agreements as may be deemed necessary by the planning commission and approved by the city attorney, are executed to ensure that the parking spaces provided are maintained and used as approved for the life of the nonresidential development; and

(E) The planning commission finds that parking may be reduced beyond that allowed in the downtown parking district as a result of special circumstances regarding the nature of the development proposed in that additional reduction is warranted; and

(F) There will not be a significant negative impact to surrounding properties; and

(G) If applied in conjunction with other waivers, there will be sufficient parking within the downtown parking district, this will not create a hardship or negative impact, and this will promote the general health, safety and welfare of the community; and

(H) The owner or operator of a business that uses approved shared parking spaces to satisfy the parking requirements of this section shall immediately notify the community development director of any change of ownership or planned use of the property for which the spaces are required, and of any termination or default of the shared parking agreement; and

(I) Upon notification of possible termination of the shared parking agreement, the community development director shall determine a reasonable time in which one of the following shall occur:

(i) Substitute parking shall be provided that is acceptable and secured; or

(ii) An in-lieu parking fee shall be paid for each space eliminated.

(5) In-Lieu Parking Fee. In lieu of subsections (2), (3) and (4) of this section, the off-street parking requirements may be satisfied through the payment of an in-lieu parking fee. The in-lieu parking fee shall be administered as follows:

(A) Establishment of Amount of Fee. The amount of the in-lieu parking fee shall be set by separate resolution following a public hearing of the city council. The city council may adjust the fee at their discretion as frequently as is deemed necessary based on factors including, but not limited to, inflation, the cost of providing new parking spaces, and the market value of the parking spaces.

(B) Applicable to Geographic Area. Only properties located within the downtown parking district shall be eligible to apply for the in-lieu parking fee. The city council may, by resolution and following a public hearing, change or modify the boundaries for the in-lieu parking fee, or determine new boundaries.

(c) Determination of Eligibility. The community development director may allow a payment of in-lieu parking fees as an alternative to providing all or a portion of the required parking spaces on-site if it can be adequately demonstrated to the community development director that one or more of the following conditions apply:

(i) It is infeasible to provide the required parking spaces on-site due to the size, shape or topography of the site, or other special circumstances pertaining to the property.

(ii) Providing the required parking spaces on-site is detrimental to the pedestrian nature of the downtown parking district.

(iii) The uses proposed for the project do not require parking to be on the project site.

(iv) Encouraging users of the project site to walk from off-site parking to the project site would be beneficial to the downtown parking district.

(v) The existing and planned parking supply in the vicinity of the project site is adequate.

(vi) Public assembly uses may not exempt more than fifty percent of the required parking for that use utilizing an in-lieu of parking fee.

(D) Payment of Fee. Should the community development director approve an in-lieu parking fee request, payment shall be made to the city in one lump sum prior to the issuance of a building permit or, if a building permit is not required, within forty-five days of written request by city for payment. The in-lieu parking fee shall

be a one time only, nonrefundable payment and shall be considered full satisfaction of the off-street parking requirement for the number of parking spaces for which the in-lieu parking fee was paid.

(E) Effect of Payment. In-lieu parking fees shall be used exclusively to make available additional parking spaces for public use within the downtown parking district and do not guarantee the construction of spaces in any particular area of the downtown parking district or within any particular period of time. In-lieu parking fees are solely an alternative means of satisfying the applicant's obligation to provide off-street parking as required by this section. Payment of the in-lieu parking fee does not carry any other guarantees, rights, or privileges to the applicant.

(6) Off-Site Parking for Residential Use. Construction of off-site parking within three hundred feet of a residential project site may be considered by the planning commission for exceptional circumstances in which there are unusual or unique site constraints that prohibit the ability to provide parking and where secured off-site parking is potentially available, subject to the following findings and restrictions:

(A) Evidence has been provided to establish that there are unusual physical restrictions or circumstances on the subject property to justify the use of off-site parking, and that an adequate site is available within three hundred feet of the subject property under the same ownership. Consideration may be given to off-site properties held under a long-term lease through a recordable covenant, or other security.

(B) Any required parking spaces that are off-site shall be committed by a recordable covenant, lease, or other agreement, executed by and between the owner and, if applicable, the lessees of the off-site parking spaces, which adequately reflects the conditions of approval and the approved off-site parking plan, and is approved by the city attorney.

(C) The owner or operator of a business that uses approved off-site parking spaces to satisfy the parking requirements of this section shall immediately notify the community development director of any change of ownership or planned use of the property for which the spaces are required, and of any termination or default of the off-site parking agreement.

(D) Upon notification of possible termination of an off-site parking agreement, the community development director shall determine a reasonable time in which one of the following shall occur:

(i) Substitute parking shall be provided that is acceptable and secured; or

(ii) An in-lieu parking fee shall be paid for each space eliminated.

Green Parking Lot Design

NEMO

NONPOINT EDUCATION
FOR MUNICIPAL OFFICIALS

TECHNICAL PAPER **NUMBER 5**

Parking Lots

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

Introduction

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

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

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

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

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

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

Parking Lot Location

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

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

Used with permission.

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

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

NEMO Recommendations Regarding Parking Lot Location

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

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

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

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

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

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

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

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

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

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

Parking Lot Size

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

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

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

Parking Spaces Required by Zoning

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

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

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

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

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

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

Parking Space Size Required by Zoning

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

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

Parking Lot Drives, Curb Cuts and Stall Arrangements

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

There are four common angles used to design parking space arrangement, 90°, 60°, 45° and 30°. The angle used depends on the situation and the available space. 30° and 45° parking

are used when the parking area is narrow and reduced traffic aisle widths (13') are needed. However, both require a large amount of paved area per vehicle, approximately 252- sq. ft. per car. The 60º stall is commonly used due to the ease of entering and backing out of stalls and the relatively narrow (18') traffic aisle required. However the angle requires 217-sq. ft. gross area per car. The 90° parking uses only 171 -sq. ft. of pavement per vehicle, thus achieving the highest car capacity of the four different angles. Some planners feel the 90º stall is best used for all day parking as it presents some difficulty for entering stalls. However, most people are quite used to this arrangement as it is often used in retail areas.

NEMO Recommendations Regarding Parking Lot Size

- All parking areas, other than those associated with single family detached residential units, should require special permits and be subject to site plan review.

- To reduce the size of parking spaces, review existing zoning regulations pertaining to parking space size and compare them to national standards. For example, do your regulations reflect the trend to smaller sized cars and do they provide variations in space requirements for compact versus full size cars?

- Where necessary revise land use regulations to define "Maximum lot coverage," by all impervious surfaces, not just building size and bulk.

- To reduce parking lot size, conduct random utilization studies of existing parking lots to determine if required spaces are being utilized. Revise your regulations based on survey results.

- To provide fewer parking spaces, allow median or maximum, rather than "minimum" number of spaces required by zoning.

- To provide fewer spaces, ask for fees in lieu of required spaces in areas where the required spaces are not needed or because of site limitations, they cannot be built. Fees should be deposited in a fund dedicated to improving transit and parking facilities.

- To provide fewer spaces, allow reductions of parking requirements if developers provide transportation alternatives, such as ridesharing, transit pass subsidies and employee busing.

- To provide fewer and smaller lots, encourage the use of shared parking, especially in mixed-use areas.

- To reduce or avoid large impervious areas, require that parking in areas generating large individual or collective parking lots, such as central business districts, malls, universities, hospitals, theaters and sports arenas provide underground, 1st floor or muti-story garage parking.

- To reduce the adverse impacts of large impervious parking surfaces, revise local zoning regulations to encourage or require that parking lots have porous rather than impervious surfaces. Porous surfaces may be required for the entire lot or in certain areas such as the parking stalls, pedestrian walkways, landscaped areas and overflow parking. Porous surfaces such as crush stone, paver stone, grass and porous asphalt mixtures should be considered.
- Set limits on the number of permitted parking spaces in certain areas, such as downtowns. Encourage several smaller parking lots accommodating no more than 20 to 25 cars, rather than fewer, larger facilities.

- In areas served by mass transit, provide incentives for its use, while making surface parking difficult.

- Require grass or other porous parking surfaces at seasonal sites such as beaches, parks, stadiums and fairs.

- Where possible encourage the used of 90º angle parking as it is the arrangement that uses the least amount of pavement per vehicle.

- Minimize the number and size of parking lot curb cuts and driveways.

Parking Lot Design

After a community reviews its' plans and regulations regarding the location and size of parking lots, it should look at parking lot design. Planners have long suggested that sections of parking lots be landscaped to keep vehicles cool in summer, improve the lot's appearance and function and to break up the flow of storm water. Perimeter landscaping can screen the lot from public view, while interior landscaping can break up large expanses of asphalt, promote driver and pedestrian safety and help define different lot areas, such as long-term versus visitor parking.

In addition to their positive contributions to parking lot appearance and safety, landscaped areas can help moderate dust, wind, heat, noise, glare and air pollution. They can also abate water pollution by reducing the volume and velocity of runoff flowing over large paved areas. Landscaped areas can be sunk below grade and designed to serve as drainage or bio-retention filters to receive runoff from adjacent paved areas.

Some communities require landscaping in all parking lots while others require it in minimum sized lots, expressed either in total area or number of parking spaces. For example, a five or six car lot is a common minimum size for required landscaping.

Suggested minimum areas of parking lots to be landscaped range from 5 to 25% of the total paved area. A 1964 planning advisory service report entitled, "parking lot aesthetics" recommends a minimum of 10% of a parking lot's total area be landscaped. This percentage is the minimum standard used by most planners, engineers and landscape architects. Anything

less than 10% is felt to not provide enough area for effective landscaping.

Regulations should encourage the use of existing vegetation in both perimeter and interior landscaped areas. Preserving existing vegetation is an excellent way to minimize site disturbance and maintain existing drainage patterns. Austin, Texas requires that for development along county roads, at least forty percent of the site remain in an undisturbed, natural state and 100' vegetative buffers be maintained or provided. In some instances it may be necessary to supplement existing vegetation with additional plantings to effectively shade or screen the parking lot.

Definitions of landscaping found in zoning regulations vary tremendously. Some regulations include hard, man-made or artificial materials such as: fences, wood or masonry walls, fountains, pools, screens and sculpture. Other regulations limit the definition of landscaping to natural vegetation, including turf, shrubs, trees, flowers, hedges and earthen mounds or berms. However, most regulations permit combinations of materials. For example, sand, stone and decorative mulches are commonly permitted as groundcovers, while plants, hedges and vines are often planted next to wood or masonry walls.

Parking lot landscaped areas have often been used as snow dumps. Ideally, trucks should remove snow from the lot. Where this is not feasible, snow-piling sites should be provided in locations other than parking stalls, sidewalks and landscaped areas.

There are two parking lot areas where landscaping may be required, perimeter and interior spaces.

1. Perimeter Landscaped Areas

Parking lot perimeter landscaped areas include screens and buffers located: between the lot and street, between the lot and adjacent uses and, the entrance to the parking lot.

Perimeter landscaped areas rely on the height, width, type, and density of landscape materials to screen or separate parking from adjacent land uses. Screens such as berms, fences, walls, evergreen plantings and hedges, are commonly placed along the street front and side yards. Screens separating parking lots from residential uses might be 8 to 10 feet high to provide privacy to dwellings on the first and second floors. Vehicle heights vary, but common ranges are from 4 to 8 feet tall. Walls or plant materials meant to screen parked cars from the sidewalk or adjacent uses, should use vehicle height as a design standard. Screens separating parking lots from streets might be limited to heights of 2 Whatever landscape design is chosen, regulations should contain provisions requiring continuous maintenance.

Porous Parking Surfaces

Another feature to consider when designing parking lots, is the use of porous surface materials such as grass, crushed stone, porous asphalt and concrete mixtures and blocks or brick laid in sand. The porous surfaces can cover the entire lot, or certain areas, such as parking stalls. Porous surfaces should be designed to encourage the direct infiltration and cleansing of storm water, thus reducing the adverse environmental impacts of large impervious parking areas. The Town of West Hartford, Connecticut required the developer of a major regional shopping mall to install a large “overflow parking area,” surfaced entirely of grass. The parking area surrounding Miami's Orange Bowl is also grassed. Both sites underlay the grass surface with sub-bases designed for infiltration and plastic grid systems to hold topsoil and grass and distribute vehicle weight.

As a minimum, communities should require that landscaped buffers and islands be designed as porous infiltration areas. Some communities require that pedestrian walkways be porous, while others require that everything other than the traffic lanes have pervious surfaces.

NEMO Recommendations Regarding Parking Lot Design

- The zoning regulation's “statement of intent” should describe why landscaping is required in parking areas. In addition to landscaping’s role of improving lot appearance and safety, mention its’ value regarding water quality protection and storm water management.

- Regulations lacking parking lot landscape standards should be revised to include them.
- Where feasible, porous parking surfaces should be used in place of impervious materials.

- Where feasible existing grades and vegetation should be retained and used for naturalistic landscaping of parking lots.

- Any paved parking areas should drain to on-site vegetative filter strips and any landscaped areas built above grade should have curb, berm or wall breaks to allow runoff inflow.

- Perimeter and interior landscaped areas should be designed as bio-retention filters or vegetated filter strips capable of cleansing and infiltrating storm water runoff. To be effective filters, the landscaped areas should be built below grade and planted with vegetation that is heat and salt tolerant and has filtration capabilities.

- Allow flexibility in landscape design. Buffer and screen width and height will vary based on adjacent uses and the landscape materials proposed to screen or buffer those uses from the parking lot.

- Require that a minimum percentage of the parking lot's landscaped area be devoted to interior landscaping.
- Adjacent parking lots should be separated with landscaped filter strips to break up large impervious areas and to filter runoff from these areas.
- Regularly sweep and vacuum impervious parking areas to remove pollutants.
- Where feasible, retrofit existing impervious parking lots with porous surfaces.

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San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook

First Edition ~ January 2009



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SAN MATEO COUNTYWIDE
Water Pollution Prevention Program
Clean Water. Healthy Community.

Prepared by:

Nevue Ngan Associates
Sherwood Design Engineers

<< *El Camino Real*
Green Street Concept Sketch
San Mateo County, California

CHAPTER 2

DESIGN STRATEGIES FOR GREEN STREETS AND PARKING LOTS

Within the last decade, a new interest has developed in using stormwater design strategies that mimic the hydrology of healthy watersheds. These stormwater strategies have been referred to by a variety of names, such as Low Impact Development (LID) facilities, rain gardens, swales, etc. These various forms of "green infrastructure" all manage stormwater runoff within the landscape.

Before choosing and designing a stormwater facility, there are certain site design strategies that should be first explored in order to maximize a site's full potential as a green street or parking lot.

This chapter looks at the full "toolbox" of stormwater design strategies that are most applicable to conditions in San Mateo County. Figure 2-1 illustrates how this toolbox is comprised of "Site Layout Strategies" and "Stormwater Facility Strategies."

Site layout strategies describe ways that a site can be designed more efficiently in order to create additional landscape space and ways to help mimic natural hydrologic processes. In some respects, site layout strategies are considered "passive" stormwater management.

Stormwater facility strategies showcase ways that stormwater can be "actively" managed. Examples include using pervious paving, vegetated swales, planters, rain gardens, and other landscape-based strategies.

In terms of design process, Figure 2-2 illustrates a simple three-step design process when working on green street and parking lot projects. Using this process will help designers think of ways to comprehensively "green" a project site without jumping ahead and merely selecting a stormwater facility.

Figure 2-1:
THE STORMWATER MANAGEMENT STRATEGY "TOOLBOX"

Site Layout Strategies	Stormwater Facility Strategies
Provide Efficient Site Design	Pervious Paving
Balance Parking Spaces with Landscape Space	Vegetated Swales
Utilize Surface Conveyance of Stormwater	Infiltration and Flow-Through Planters
Add Significant Tree Canopy	Rain Gardens
Provide Alternative Transportation Options	Stormwater Curb Extensions
	Green Gutters

Figure 2-2:

Step 1:

Address Site Layout

Emphasize efficient site design in order to maximize potential landscape area and minimize impervious surface. Design the site to drain stormwater runoff on the landscape's surface and minimize underground piped infrastructure. Green the street or parking lot by adding new trees and preserving any existing mature trees.

Step 2:

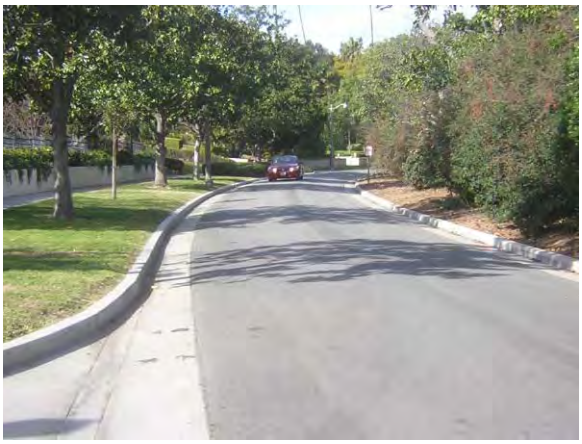
Incorporate Alternative Transportation Options

Green streets and parking lots are not just about managing water, they should also provide and promote options for alternative transportation. Whenever possible, incorporate pedestrian walkways, bike lanes, and mass transit infrastructure.

Step 3:

Choose Stormwater Facilities

Implement stormwater facilities that actively capture and treat runoff from impervious surfaces. Design vegetated swales, planters, rain gardens, and other stormwater facilities based on a site's contextual land use and the various constraints each site presents.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-3: *This narrow residential street maximizes the amount of landscape space and minimizes the amount of impervious area that generates stormwater runoff.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-4: *This arterial street emphasizes multiple transit options. The center median has a street car line, bike lanes flank both sides of the street, buses share travel lanes with autos, and pedestrians can safely cross street intersections.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-5: *Selecting stormwater facilities, such as this rain garden, is the final step in the 3-step design process.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-6: *This narrow residential street allows for adequate traffic flow and generates less stormwater runoff than conventionally wider streets.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-7: *This typical urban street is almost 100% impervious and designed primarily for auto flow. This combination creates a bleak streetscape environment that also generates large quantities of stormwater runoff.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-8: *By utilizing a more efficient site design, the wasted space in the street example above can easily be converted into conventional landscaping or be used for stormwater facilities. This retrofit opportunity also includes space for a bike lane.*

One of the first questions a designer or builder should ask themselves about their project is: Has the impervious area from streets, parking lots, and/or buildings been minimized? From a design perspective, there are several effective strategies to minimize these areas. However, what makes sense from a design perspective may conflict with prevailing policy. Design and policy must work together in order to achieve site-specific stormwater goals. A carefully thought out site plan will often yield the space for a stormwater facility(s) that fits seamlessly with the other site uses. This holds true for new streets, parking lots, and buildings, but is especially evident when designing street and parking lot retrofit projects. The following describes possibilities for gaining additional landscape space for streets, parking lots, and building envelopes.

Streets

•Narrow travel lanes from 12 feet to 10 feet (or less depending on street type). This helps to reduce impervious area, reduces new development infrastructure costs, calms traffic in pedestrian-oriented areas, and helps create room for stormwater facilities.

•Consolidate travel lanes/on-street parking. Can a travel lane on multi-lane streets be eliminated altogether? Can the size or number of parking spaces be reduced in order to increase landscape area along a street? Exploring a "yes" answer to these questions can often yield landscape space for stormwater facilities, as well as create space for bike lanes, wider sidewalks, and a more balanced and vibrant streetscape.

•Convert unused asphalt space next to travel lanes into landscape areas that can be used for stormwater management.

Parking Lots

•Shorten parking stall lengths to 15 feet and/or shorten the drive/back-up aisles to 22 feet (this will most likely require revisions in municipal code). The shorter stalls can still accommodate SUVs, and the drive aisles can still allow cars to comfortably back up and travel within the parking lot. Portland, Oregon and other cities have allowed even smaller parking lot dimensions within their city codes. These strategies are especially effective for creating landscape space in parking lot retrofits.

•When looking at parking lots, it is important to ask the question of how much parking is needed on an "average day." Parking lots often have many empty parking stalls for most of the year. This is especially true with shopping mall and "big box" store parking lots. As municipal requirements allow, parking lots can provide for the average day (as opposed to peak) condition, or at least can provide peak overflow parking zones with pervious paving.

Building Envelopes

•Buildings and their adjacent surroundings can also be designed to use space efficiently, which can affect how surrounding streets and parking lots will be designed. For example, in new construction, buildings can be designed to allow for parking stalls to be tucked under the second floor podium. Using this design strategy can greatly reduce or possibly eliminate the need for additional site parking.

•Many buildings already have conventional landscaping around the building envelope that functions only as screening or aesthetics. Depending on site conditions, these landscape areas can be converted into stormwater facilities and thus maximize the use of the space.



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-9: *An existing, inefficiently designed parking lot with little landscaping.*



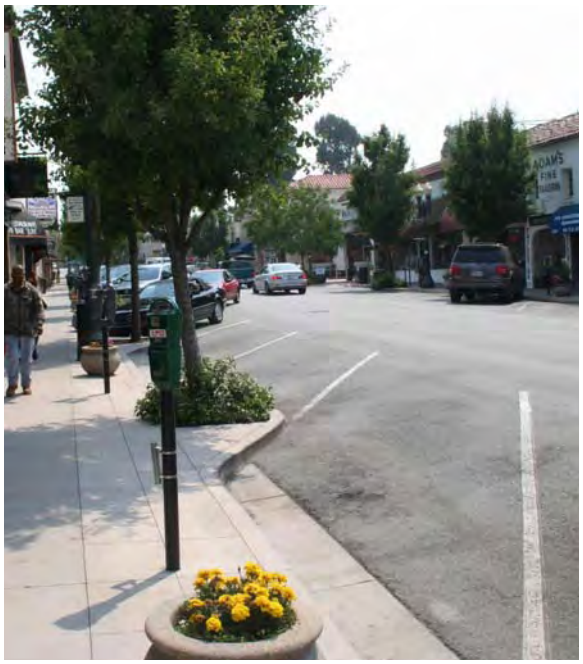
SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-10: *The same parking lot redesigned to efficiently use space yielded a vegetated swale, sidewalk, and landscape zone for street trees.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-11: *This apartment complex allows for cars to park underneath the building's second floor. This allows for a more efficient site plan.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-12: *A typical commercial main street in San Mateo County that uses angled on-street parking.*

Street Example: Angled Parking

Many commercial main streets in San Mateo County use angled on-street parking rather than parallel parking stalls. The angled parking configuration yields more parking spaces along the street frontage compared to parallel parking. However, angled parking requires much of the street's right-of-way to be dominated by parking at the expense of sidewalk, landscape, and stormwater management space. This is especially true along streets with active outdoor storefronts, such as restaurants and boutique shops. Figures 2-14 and 2-15 compare the existing condition of using 30 degree angled on-street parking with that of a redesigned condition using parallel parking. By switching from an angled to parallel parking configuration, considerable space can be made available for wider sidewalks, more landscaping, and stormwater management.



SOURCE: GOOGLE EARTH

Figure 2-13: *An aerial view of a commercial main street using 30 degree angled on-street parking. Notice how much space is wasted at the back end of each oversized parking stall. Also notice the narrow the sidewalk zone.*

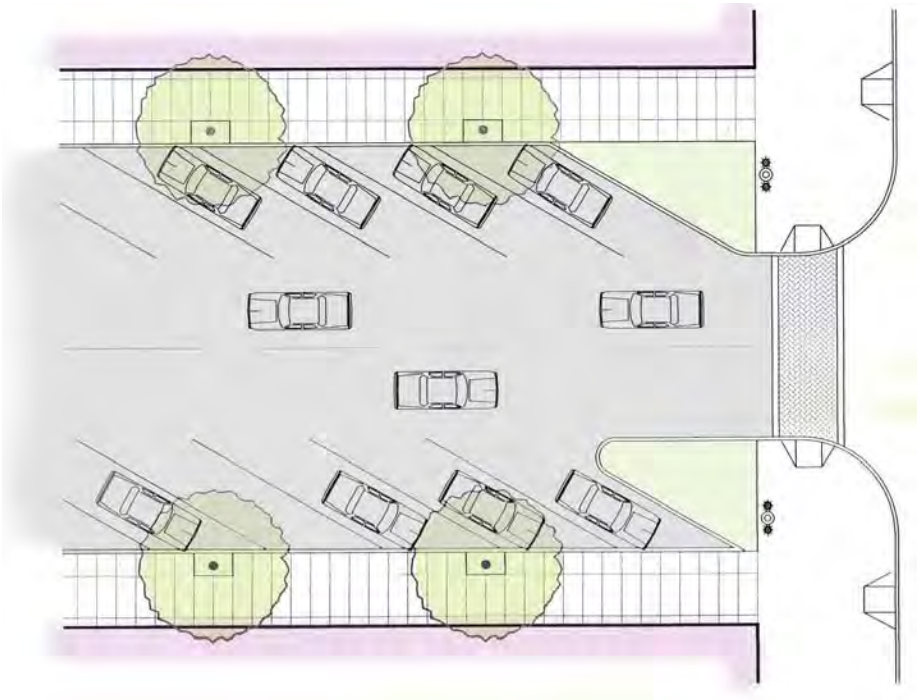


Figure 2-14: *A typical commercial main street in San Mateo County that uses angled on-street parking.*

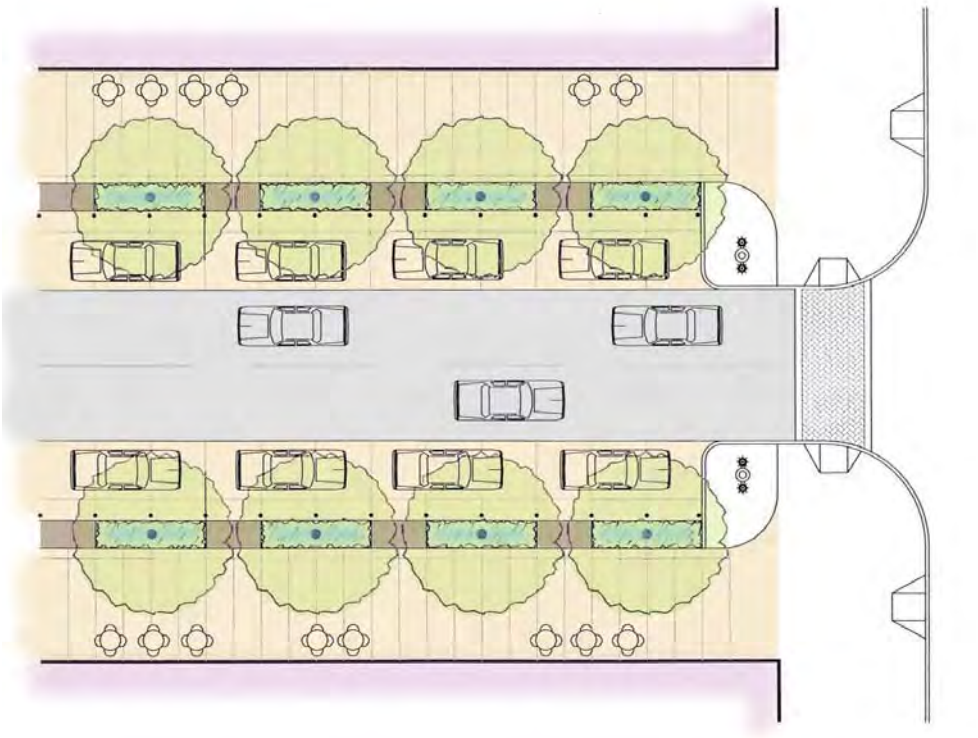


Figure 2-15: *When redesigned with parallel parking, this street gains significantly wider sidewalks, more green space, and better opportunities for stormwater management.*

Parking Lot Example: Reducing Parking Stall and Travel Aisle Dimensions

Sometimes local planning and design codes require more surface parking than is actually necessary for a particular business or use to thrive. Furthermore, parking lots are also often designed with oversized parking stalls and travel/back-up aisles. By fully utilizing the amount of space for parking and reducing the oversized dimensions, a considerable amount of space can be created for landscape-based stormwater management The hypothetical parking lot conditions illustrated in Figures 2-16 through 2-19 show how a conventional parking lot with oversized parking stalls and travel aisle dimensions compares with a more efficient parking lot design. Both scenarios have the same amount of parked cars. However, the more efficient parking lot design yields far more potential green space.

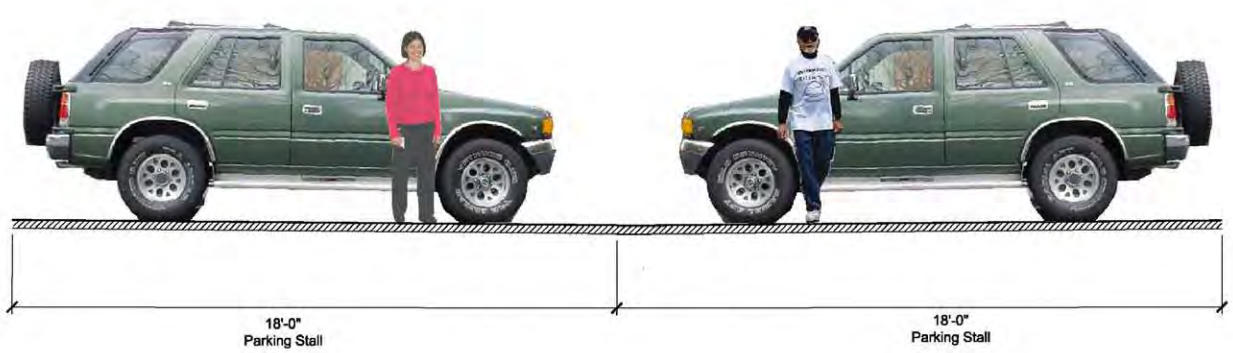


Figure 2-16: *This typical cross section illustrates a conventional parking lot condition with 18 feet long parking stalls.*

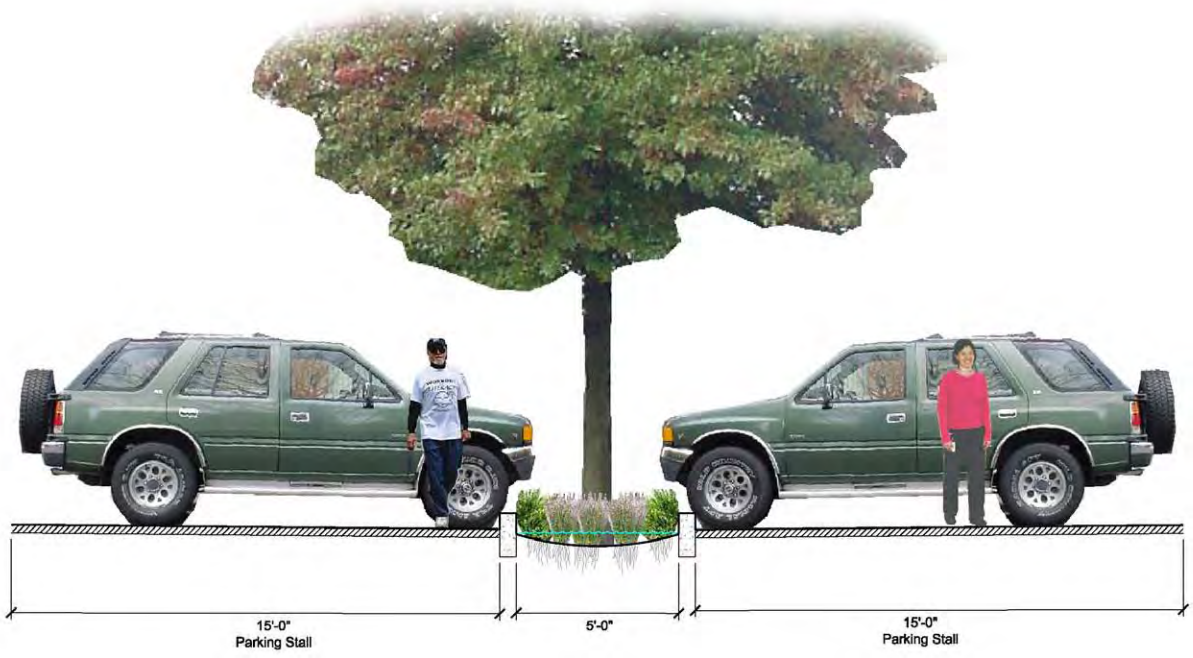


Figure 2-17: *This cross section shows how a 15 feet parking stall can help create room for landscaping used for stormwater management. Note that the parked cars in both scenarios are placed in the same place and fit within reduced length the parking stalls.*

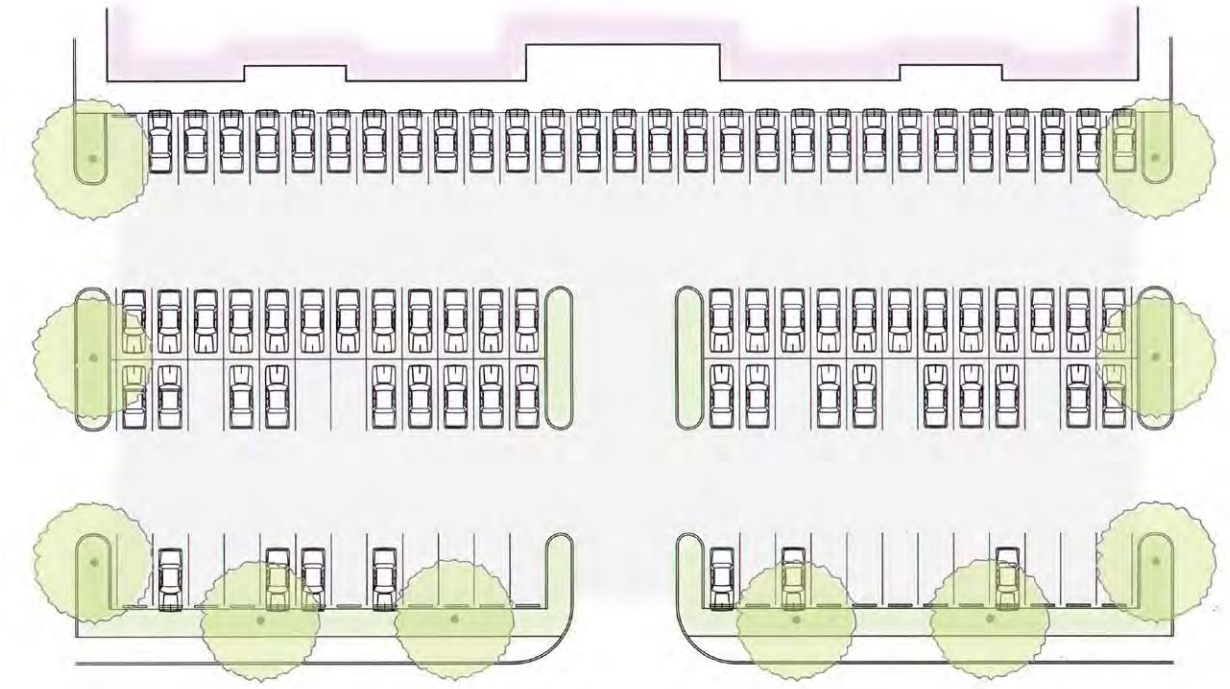


Figure 2-18: *This is a hypothetical parking lot example with both oversized parking stalls and vehicle travel aisles.*



Figure 2-19: *A redesigned parking lot using 15 foot long parking stalls and 22 foot wide vehicle travel aisles yields significant amounts of landscape space that can be used for stormwater management. This example also has improved pedestrian circulation within the parking lot.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-20: *This parking lot has significant amounts of landscape area balanced with parking spaces.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-21: *Along this commercial street, well-maintained landscape areas replace parking spaces in order to create a pleasing streetscape.*

The very notion of green streets and green parking lots is to incorporate as much green space as possible in order to better manage stormwater runoff. However, adding green space can often be in conflict with the need for on-street or storefront parking. The best green street and parking lot designs should provide balance between parking and landscape space. Given that many urban streets are designed primarily for vehicular travel and on-street parking, with little or no green space, and parking lots are often oversized, some level of compromise will be necessary to truly design a balanced condition.

Some parking loss might be acceptable or even desirable if the overall street or parking lot condition has a stronger aesthetic appeal due to increased landscape area and enhanced pedestrian spaces. Studies have shown that greening of business districts increases community pride and positive perception of an area, drawing customers to the businesses (Project Evergreen, 2008).



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-22: *This innovative example in Mountain View, CA boldly greens the street with street trees and moveable planters. The planters can be placed in the parking zone to create additional space for tables and seating or can be removed to maintain on-street parking. This is an excellent example of balancing parking spaces with landscape and people space.*

In order to promote and mimic a more natural hydrologic condition, it is important to remember that the natural landscape does not convey stormwater runoff quickly off of a site. Rather, stormwater infiltrates into the ground, or is conveyed slowly on the surface to low spots in the landscape. The latter condition is the kind of design scenario that this guidebook hopes to recreate.

Designing a network of small stormwater surface conveyance features can be done for new development and retrofit projects. Traditional landscape areas can be transformed into naturalized stormwater conveyance systems simply by depressing greenspace into the existing landscape. Larger stormwater facilities can be interconnected with swales, runnels, trench drains, and other surface conveyance systems. Having this conveyance network reduces peak flows and volumes, recharges groundwater aquifers, and provides water quality treatment.

Allowing stormwater to flow on the surface has other benefits besides improving water quality, such as:

• Increasing awareness and connecting people to natural systems. Stormwater is no longer perceived as "out of sight, out of mind."

•Reducing stormwater facility sizes. Stormwater facilities that accept runoff from surface conveyance are generally less deep than stormwater facilities receiving underground piped runoff.

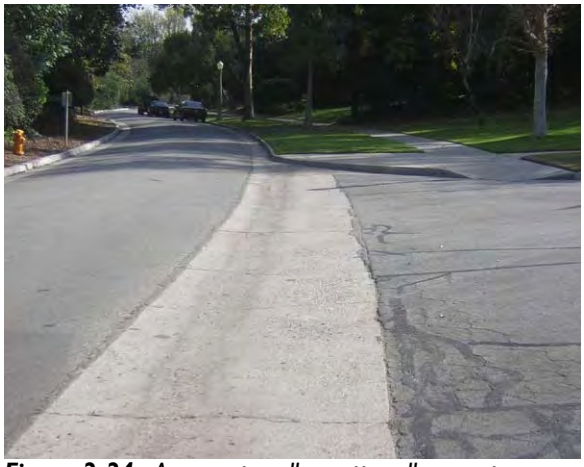
•Simplifying maintenance. It is easier to detect and repair any problems when stormwater conveyance is on the surface.

•Reducing up-front installation costs. Surface conveyance systems can be less expensive to install than underground systems.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-23: *A trench drain connects runoff between two landscape areas.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-24: *A concrete valley gutter allows water to flow through an intersection on the surface. The landscape system in the background is a good candidate for a vegetated swale retrofit.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-25: *Vegetated channels like this can be designed even in urban conditions for the purpose of conveying stormwater runoff.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-26: *Trees are a vital resource for managing stormwater. Leaves, branches, and the roughness of bark intercept rainfall and decrease the rate of stormwater runoff.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-27: *These mature trees along a residential street in San Mateo County help shade the pavement.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-28: *These mature oak trees in a San Mateo County neighborhood have been preserved and are an aesthetic resource to the community.*

Trees contribute significantly to the slowing, absorbing, and filtering of rainwater. They intercept water on leaf surfaces, as well as "drink" water that does infiltrate into the soil. An averaged size tree can intercept and absorb hundreds of gallons of water a day depending on the tree species.

Adding significant amounts of tree canopy has other important environmental benefits not directly related to stormwater management.

Energy Benefits: Trees provide natural cooling benefits by evaporating water and providing direct shading of surfaces. Planting more trees can help reduce the urban heat island effect.

Air Quality Benefits: Trees act as natural filters or "lungs" to remove air pollutants, such as ozone, nitrogen oxides, sulfur dioxide, and ammonia.

Economic Benefits: Studies have shown that having mature trees and well-maintained landscaping can increase property values and provide a more enjoyable shopping experience in business districts.

It is important to preserve existing, healthy trees whenever possible. Mature existing trees should influence how and where stormwater facilities are designed. If the location of an existing mature tree is in direct conflict with the location of a proposed stormwater facility, it might be more advantageous to alter the design of the stormwater facility in order to preserve and protect the existing tree. Mature trees are often able to soak up water at a rate comparable to what can be infiltrated in a stormwater facility. In terms of overall stormwater benefit, it is usually worth reducing stormwater facility size in order to save a mature tree.

Stormwater facilities are often used to capture and cleanse various pollutants that originate from motor vehicles. An alternative to this treatment approach is to prevent pollutants from being released by motor vehicles in the first place. There are essentially two ways to accomplish this goal. One option is to build cleaner automobiles, but this technology is still evolving and "clean" cars may still be decades away. The second option is to give people more transportation choices, such as walking, biking, and mass transit. The equation is simple: a reduction in cars equals a reduction in the pollution associated with cars. The solution, however, is not so easy. Our street infrastructure is designed predominately for the movement of automobiles, providing little incentive for people to walk, ride their bikes, or take a bus or train to reach a nearby destination. Designing streetscapes that are pleasant, safe, and have a strong sense of livability is the best way to inspire people to use alternative forms of transportation.

In order to balance the need for walking, biking, and mass transit, some difficult decisions will undoubtedly need to be made. However, there are many opportunities to provide a more balanced transportation system. Cost-effective strategies include providing:

- Access to bus and light rail by creating incentives for new development and redevelopment to occur near stops/stations or by providing shuttle service
- Bicycle lanes on streets
- Bicycle racks in parking lots
- Bicycle storage and changing rooms
- Preferred parking or drop-off areas for car/vanpooling



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-29: *This well-designed street emphasizes a strong pedestrian realm.*



SOURCE: WWW.FLICKR.COM/PHOTOS/KGRADINGERS

Figure 2-30: *A bike-friendly street design.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-31: *This street in South San Francisco accommodate both pedestrians and bus transit.*



Pervious paving allows rainwater to either pass through the paving system itself or through joint openings between the pavers.

SOURCE: NEVUE NGAN ASSOCIATES

Pervious paving systems allow rain water to pass through their surface and soak into the underlying ground. While these systems help reduce the amount of stormwater runoff by creating a pervious surface, they are not considered a treatment measure. Pervious paving must be designed to not only manage stormwater runoff adequately, but also maintain the same load bearing capacity as conventional paving in order to support the weight and forces applied by vehicular traffic.

Functionally, the distinguishing feature among the different pervious pavement systems is the means by which the surface is made permeable. Pervious concrete and asphalt are formulated with pore spaces within the material itself. Permeable joint pavers allow rainwater to pass through evenly spaced gaps between the pavers' edges. Reinforced grass and gravel grid systems also allow rainwater to soak into open pore spaces in the soil medium.

The most desirable approach to using pervious paving is to combine this strategy with landscape-based stormwater management whenever possible. Pervious paving is primarily used on roadways with low-traffic speeds and volumes, but there are successful examples of pervious asphalt and concrete employed on high-traffic streets. Pervious paving should not be used in situations with known soil contamination or high groundwater tables. Generally, soil infiltration rates that exceed or meet the accepted standard of 0.5"/hr are suitable for pervious paving systems.

Good Places For Using Pervious Paving:

- Low-volume streets
- Parking stalls (streets and parking lots)
- Alleys
- Residential driveways
- Sidewalks (depending on material and ADA-compliance)

Why Choose Pervious Paving:

- Reduces the size of stormwater treatment measures
- Can be the only viable option in ultra-urban conditions or in parking lots that are interiorly drained

Potential Constraints of Pervious Paving:

- Requires well-drained native soil
- Has a relatively high installation cost
- Can be difficult to maintain and difficult to repair in small batches if using porous concrete and asphalt.
- Has a limited infiltration effectiveness on street slopes over 5%

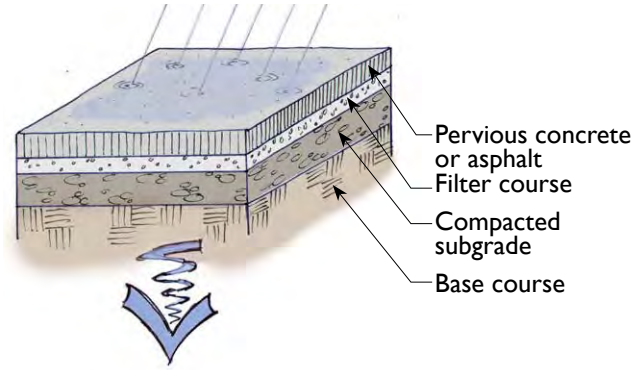


Figure 2-32: **Pervious Concrete/Asphalt Diagram**

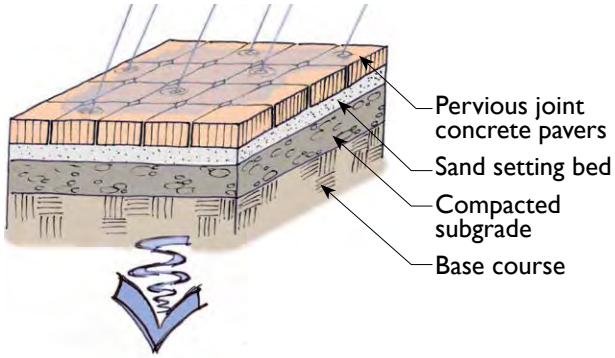


Figure 2-33: **Typical Pervious Joint Paver Diagram**

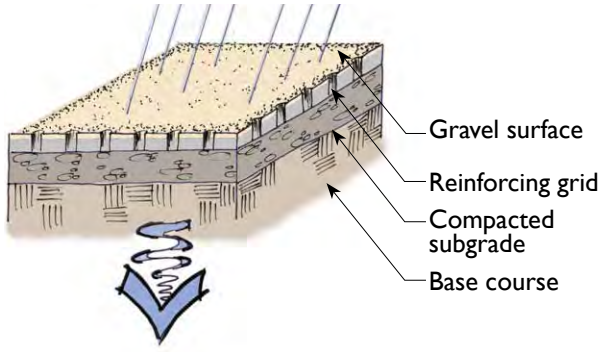


Figure 2-34: **Reinforced Gravel Paving Diagram**

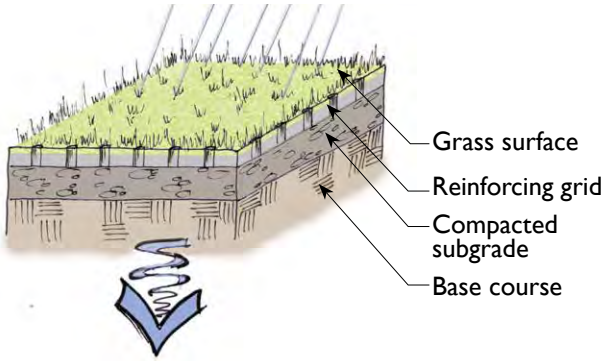


Figure 2-35: **Reinforced Grass Paving Diagram**



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-36: *The difference between drainage on pervious asphalt and impervious asphalt is evident in this photo.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-37: *This residential driveway utilizes pervious joint pavers in San Mateo County.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-38: *A plastic grid system filled with gravel provides the structural strength for a vehicle to slowly drive on.*



SOURCE: WWW.RITTER-TECHNIK.CO.UK

Figure 2-39: *Reinforced grass paving allows water to pass through the root zone of the grass and into the underlying soil while still maintaining a hard surface for vehicular travel.*



SOURCE: WWW.HANNEMANANDFINEIS.COM

Figure 2-40: *Pervious concrete allows water to pass through pore spaces within the aggregate.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-41: *Pervious concrete allows for stormwater management and its light color helps reflect heat rather than absorb it.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-42: *As shown in this photo, the forces applied by tires at turning, stopping, and starting locations can sometimes leave depressions on the surface of pervious paving.*

Pervious Asphalt and Concrete:

Pervious asphalt and concrete production is similar to that of standard asphalt and concrete. The main difference is that the fines are left out of the aggregate added to the mixture. This results in small holes within the paving that allows water to drain through the surface. When installing pervious asphalt and concrete, it is critical that the subgrade is properly prepared and that the surface is poured correctly. As with conventional paving, if pervious asphalt and concrete are not properly installed, they are prone to failure. Also, once installed, both pervious asphalt and concrete tend to be difficult to patch repair because the paving mixture is typically made in large batches.

One problem cited in past parking lot projects using pervious paving is that sometimes the forces applied by wheels turning, stopping, and starting tore up the surface of pervious asphalt and create depressions within parking lot stalls (see Figure 2-42). However, the technology of pervious paving systems is constantly improving, and this may not be as much of an issue with current technology.

Pervious asphalt has been used successfully on interstates and other limited access roads where there are no turning vehicles. Compared to conventional asphalt, the use of pervious asphalt on high-speed roads reduces the accumulation of puddles and the danger of hydroplaning. It is also generally less expensive to install than pervious concrete.

Pervious concrete is more expensive than conventional concrete; hence, it is economically more viable to use in large batches. Pervious concrete works well for parking lot applications and low volume streets.

Regular maintenance of pervious asphalt and concrete is required for the long-term viability of the paving system. Vacuum cleaning the pervious paving system on a regular basis is imperative to limit the amount of sediment clogging the pore spaces.

Pervious Joint Pavers:

Any type of paver can create a pervious surface if there are spaces between them and those spaces are filled with sand or other porous aggregate. Many interlocking concrete unit pavers are designed specifically for stormwater management applications. They allow water to pass through joint gaps that are filled with sand or gravel and infiltrate into a thick gravel subgrade. This system is widely applicable to both small and large paving applications and it offers the flexibility to be repaired because small sections can be removed and replaced. Interlocking concrete unit pavers offer flexibility in color, style, joint configuration, and paving pattern It is important to note that selected pervious joint pavers along pedestrian walkways must be ADA-compliant and not cause tripping hazards. When installing pervious joint pavers, care should be taken to assure that the base and subgrade is properly constructed in order to minimize the potential for differential settlement. Regular vacuum cleaning of the paver joints will help prevent clogging and extend the longevity of the system. Pervious joint paving tends to be more costly to install than other pervious paving systems.

Reinforced Gravel Paving:

A gravel paving system uses small, angular gravel without the fines and a structure that helps provide support to create a rigid surface. Gravel can be a viable alternative to a traditional paved surface in areas of low use that still require a rigid surface.

Reinforced Grass Paving:

In the right situations, grass paving, or other hybrids between paving and planting, can be used to provide structural support while also allowing for some plant growth and stormwater infiltration. These systems may be appropriate in areas of low use and where soil, drainage, sunlight, and other conditions are conducive to plant growth.



SOURCE: ABBY HALL-EPA

Figure 2-43: *Pervious joint pavers within a parking lot application. Any overflow from the pervious pavers drains into a swale.*



SOURCE: MUTUAL MATERIALS

Figure 2-44: *Sand-set interlocking concrete unit pavers create gaps between adjoining pavers and allow water to soak into the ground.*



SOURCE: NEVUE NGAN ASSOCIATES

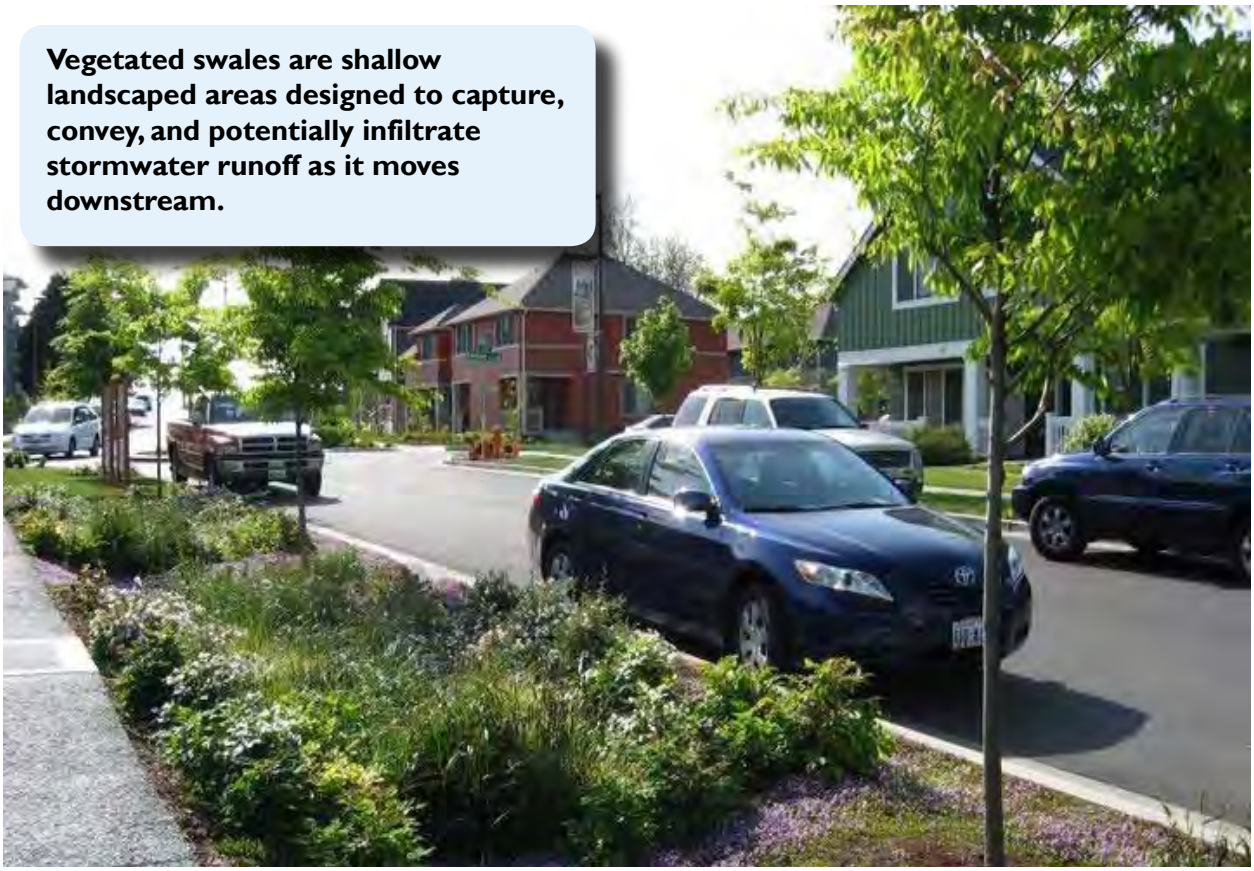
Figure 2-45: *A close up view of gravel paving within a reinforced plastic grid system.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-46: *Grass paving installed in a residential driveway.*

Vegetated swales are shallow landscaped areas designed to capture, convey, and potentially infiltrate stormwater runoff as it moves downstream.



SOURCE: ABBY HALL-EPA

Vegetated swales are long, narrow landscaped depressions, with a slight longitudinal slope. They are primarily used to convey stormwater runoff on the land's surface while also providing water quality treatment. As water flows through a vegetated swale, it is slowed by the interaction with plants and soil, allowing sediments and associated pollutants to settle out. Some water soaks into the soil and is taken up by plants, and some may infiltrate further if native soils are well drained. The remaining water that continues to flow downstream travels more slowly than it would through pipes in a traditional stormwater conveyance system. Vegetated swales are typically built very shallow and contain runoff that is only a few of inches deep.

Parking lots and certain street conditions that have a long, continuous space to support a functioning landscape system are excellent candidate sites for vegetated swales. The longer a vegetated swale is, the greater the residence time for slowing and filtering of stormwater runoff.

Vegetated swales are relatively low-cost, simple to construct, and widely accepted as a stormwater management strategy.

Vegetated swales can be planted in a variety of ways ranging from mown grass to a diverse palate of grasses, sedges, rushes, shrubs, groundcovers and trees.

For green street and parking lot applications, vegetated swales can be used in both relatively flat conditions or steeper conditions up to a 5% longitudinal slope. For swales above a 2% slope, check dams or terraces should be used to help slow the flow of water. Additional guidance on check dams for green street and parking lot applications is provided in Chapter 5 of this guidebook.



SOURCE: ABBY HALL-EPA

Figure 2-47: *A residential street with a vegetated swale.*



SOURCE: SHERWOOD DESIGN ENGINEERS

Figure 2-48: *A local San Francisco Bay Area parking lot with a vegetated swale.*

Good Places for Vegetated Swales:

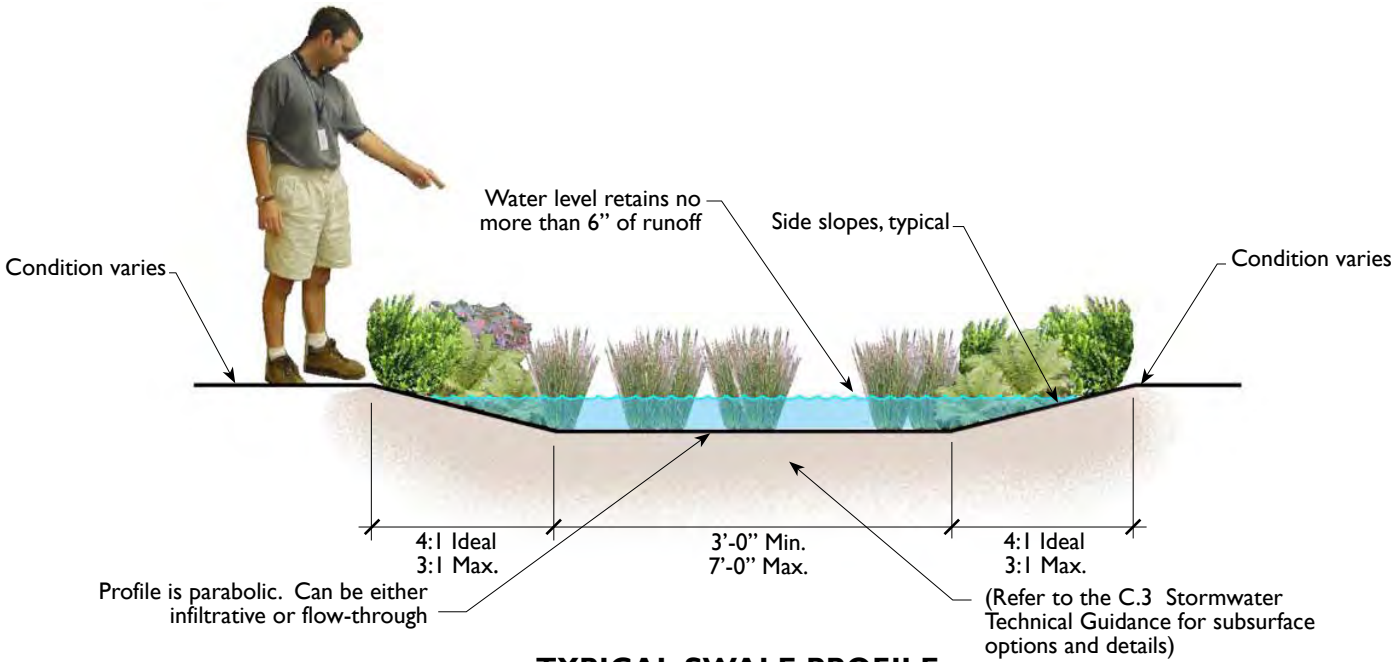
- New residential and commercial streets
- Arterial streets and boulevards
- Within street medians on new streets
- Within the interior and along the edges of parking lots

Why Choose Vegetated Swales:

- Widely-accepted stormwater strategy
- Simple to construct
- Relatively low-cost to implement

Potential Constraints:

- Need long, continuous spaces which can be difficult to find in retrofit conditions
- Difficult to incorporate other streetscape elements within swales (lighting, signage, etc.)
- More difficult to provide good pedestrian circulation through swales
- Often designed to be "too deep" and, as a result, are not aesthetically pleasing



TYPICAL SWALE PROFILE



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-49: *These oversized parking spaces could be made just a few feet shorter in order to create space for swales between rows of parked cars.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-50: *A potential residential street swale opportunity in an existing planting strip. Dashed lines show where a vegetated swale could be added.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-51: *A potential urban street swale opportunity in an overly wide sidewalk zone. Dashed lines show where a vegetated swale could be added.*

How can swales be used in streets and parking lots?

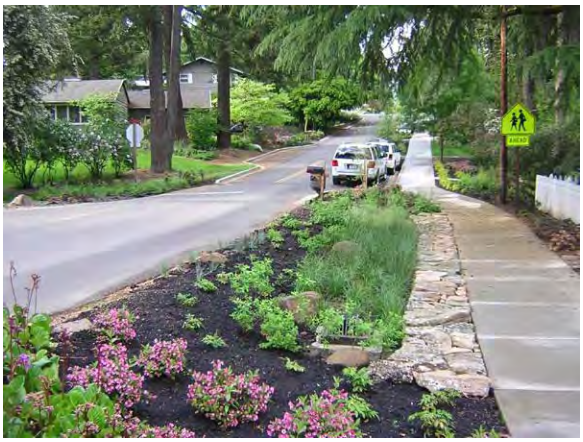
Streets

Streets can be ideal places to incorporate swales, provided that there is a long uninterrupted stretch of landscape or paved area that can be converted to capture and manage runoff. Often existing streets have a wide right-of-way space that is under-utilized. Look for long, unplanted median strips or unused planting strips between the sidewalk and the street. These areas can often be retrofitted to serve as vegetated swales. Is the center turn lane necessary? Can turn lanes be removed, travel lanes moved to the center, and vegetated swales added on the sides? Can the travel lane widths on a particular street be reduced? Sometimes reducing a lane from 12 feet to 10 feet can allow the placement of a vegetated swale alongside a street. Does a street really need or effectively use on-street parking? Can some of that extra impervious area be consolidated into swales?

Parking Lots

There are many creative ways to include swales in parking lots. For example, shorter parking stalls can yield a few extra feet of area that can be used for swales. The leftover space in front of angled parking configurations can also be consolidated into landscaped swales. Narrowing driveway/back-up aisles can free up space for extra landscape area. One of the best applications is to incorporate vegetated swales into the perimeter of existing parking lot landscaping. If there is an abundance of surface parking available, it might be possible to redesign this extra space into vegetated swales.

Street Applications



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-52: *Residential street with a vegetated swale.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-53: *A vegetated swale alongside a steep residential street.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-54: *An arterial street with a vegetated swale.*

Parking Lot Applications



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-55: *An elementary school parking lot with a vegetated swale.*



SOURCE: WWW.IA.NRCS.USDA.GOV/FEATURES/URBAN PHOTOS

Figure 2-56: *A vegetated swale within a large parking lot.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-57: *A commercial center with a parking lot vegetated swale.*



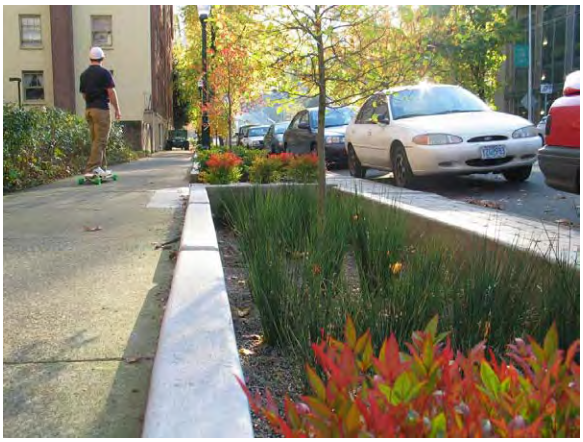
Infiltration and flow-through planters are contained landscape areas designed to capture and retain stormwater runoff.

SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Planters are narrow, flat-bottomed, often rectangular, landscape areas used to treat stormwater runoff. Their most distinguishing feature is that the side slopes typically used in swales are replaced with vertical side walls. This allows for more storage volume in less space.

There are two types of planters used for stormwater management: infiltration and flow-through planters. Infiltration planters depend on native soil conditions that allow runoff to soak into the underlying soil. Flow-through planters are completely contained systems that only allow runoff to soak through the planter's imported soil bed and then into an underdrain system. Infiltration planters are more desirable because they allow for greater volume reduction and further ease the burden on local storm drain facilities. Flow-through planters should be used where native soil conditions are unfavorable to infiltration, where there is underlying soil contamination, and/or where the seasonal high water table is within 10 feet of the landscape surface. When using infiltration planters and similar infiltration practices, follow the Infiltration Guidelines contained in the C.3 Stormwater Technical Guidance.

Stormwater planters are easily incorporated into retrofit conditions and in places where space is limited. They can be built to fit between driveways, utilities, trees and other existing site elements. They can be planted with a simple palate of sedges and/or rushes or a mixture of trees and shrubs. Because planters have no side slopes and are contained by vertical curbs, it is best to use plants that will grow at least as tall as the planter's walls in order to help "soften" the edges. Planters can be used in both relatively flat conditions and in steep conditions if they are appropriately terraced.



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-58: *An urban street infiltration planter.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-59: *A parking lot infiltration planter.*

Good Places for Stormwater Planters:

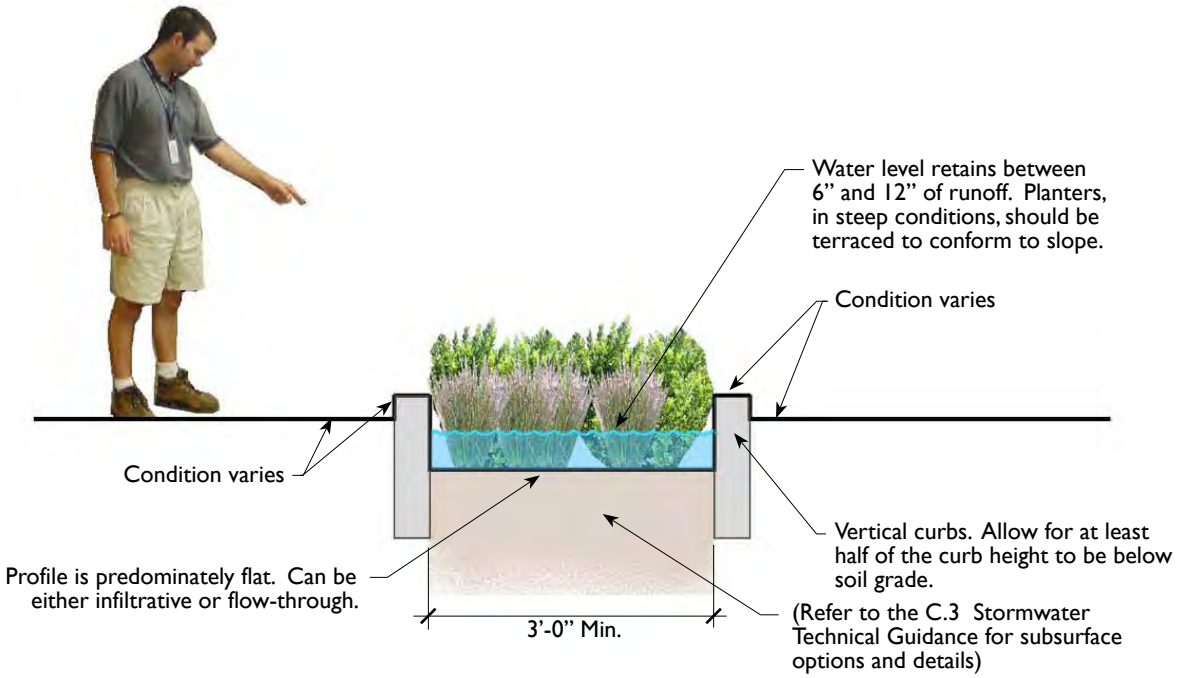
- Commercial streets and parking lots where space is often constricted

Why Choose Stormwater Planters:

- Are best landscape solution for ultra-urban conditions
- Can be used with or without on-street parking depending on available space
- Can fit between other streetscape elements (trees, utilities, signage, etc.) and are highly versatile in shape and size
- Can provide both volume and flow stormwater benefits

Potential Constraints:

- Are generally more expensive than swales due to increased hardscape infrastructure
- Are only contextually appropriate in high density urban settings

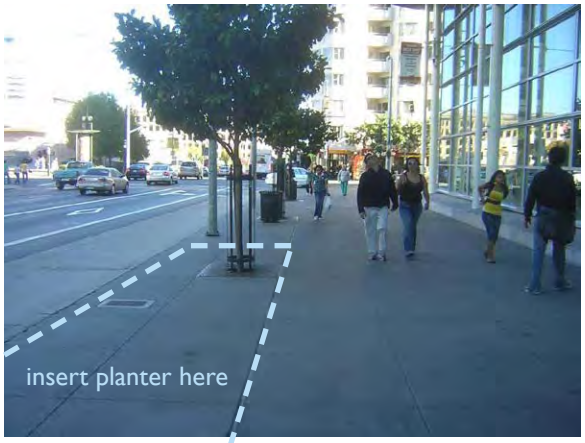


TYPICAL PLANTER PROFILE



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-60: *Planters can be retrofitted within the existing stalls in parking lots. Dashed lines show where a planter could be added.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-61: *Planters can be retrofitted on urban streets with overly wide sidewalk zones. Dashed lines show where a planter could be added.*

How can planters be used in streets and parking lots?

Streets

Planters are a good candidate for dense urban streets because they can often fit between driveway curb cuts, utilities, trees, and street furnishings. As long as there is an adequate path for people to access their vehicles and the sidewalk, planters can be a very good choice for streets that require on-street parking. For streets not requiring parking, planters can be used in very narrow conditions adjacent to the street curb.

Parking Lots

Planters can also be an effective design tool for parking lot applications. Parking lot planters can be designed to take the place of a few parking spots, or they can fit in the long, narrow space between the front-ends of parking stalls.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-62: *This urban street in San Mateo County has no on-street parking and a very wide sidewalk space. This is a perfect opportunity for inserting a stormwater planter. Dashed lines show where a planter could be added.*

Street Applications



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-63: *Stormwater planters located on a street without on-street parking.*



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-64: *Stormwater planters located on a street with on-street parking.*



SOURCE: NEVUE NGAN ASSOCIATES

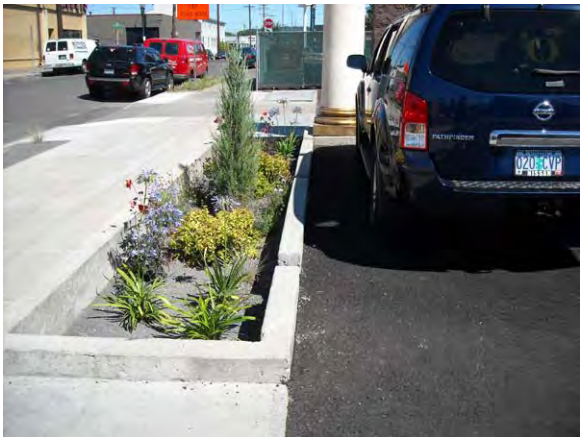
Figure 2-65: *A bold example of an urban residential stormwater planter.*

Parking Lot Applications



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-66: *A stormwater planter within a parking lot's landscape island.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-67: *A narrow stormwater planter on the edge of a parking lot.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-68: *A stormwater planter within the interior median of a parking lot.*



Rain gardens are shallow landscape areas that can collect, slow, filter and absorb large volumes of water, delaying discharge into the watershed system.

SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Rain gardens are large, shallow, vegetated depressions in the landscape. They can be any size or shape, and are often molded to fit in "leftover" spaces in parking lots, along street frontages, and in situations where streets intersect at odd angles. They are also typically designed to be flat-bottomed without any longitudinal slope in order to maximize storage potential for stormwater.

Rain gardens retain stormwater, thereby attenuating peak flows and overall volume. They can also allow for infiltration, depending on the capacity of the native soil. Although rain gardens can share certain characteristics with swales and planters (they can be designed with vertical curbs or side slopes), they differ from swales in that their primary function is the maximum storage of runoff, not conveyance.

The primary advantage of rain gardens is their versatility in size and shape. Because rain gardens are larger in size, they can potentially cost more than other stormwater facility options, but they also manage correspondingly larger volumes of stormwater. Hence, they can offer a good value. Simple rain garden applications that do not use extensive hardscape or pipe infrastructure can be very cost effective to install.

It is best if rain gardens allow for natural infiltration. However, if infiltration is not possible, rain gardens can also be designed as a flow-through system with an underdrain.

Rain gardens are also known as bioretention areas in the California Stormwater Quality Association's *"Best Management Practices Handbook"* and in the C.3 Stormwater Technical Guidance.

Rain gardens can be planted with a variety of trees, shrubs, grasses, and groundcovers, depending on the site context and conditions.

Generally, locations with soil infiltration rates that exceed or meet the accepted standard of 0.5"/hr are suitable for using infiltrative rain gardens.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-69: *A triangle-shaped rain garden retrofitted along a busy arterial street.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-70: *A large rain garden retrofitted in a school parking lot.*

Good Places for Rain Gardens

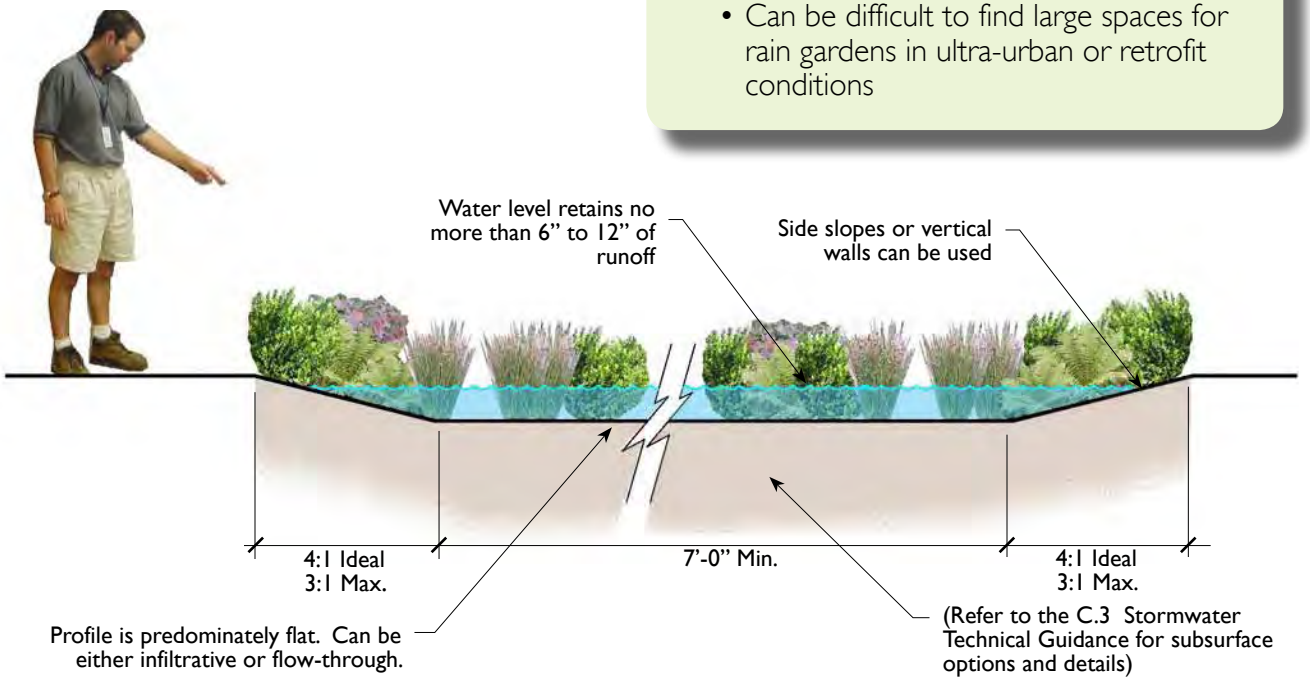
- Underutilized space adjacent to parking lots and streets
- Large parking lot islands
- Residential areas
- Left over spaces created by angled street intersections

Why Choose Rain Gardens:

- Can often significantly "green" a space that would otherwise be leftover asphalt area
- Can be inexpensive to build depending on the amount of hardscape and pipe system used
- Can provide the greatest stormwater flow and volume benefit because of their large size
- Offer versatility in shape

Potential Constraints:

- Often more maintenance required because of their large size
- Can be difficult to find large spaces for rain gardens in ultra-urban or retrofit conditions

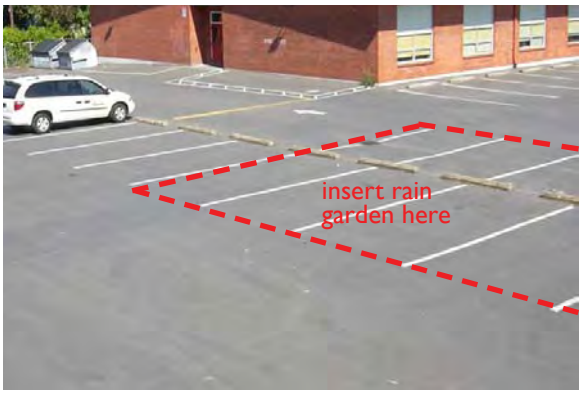


TYPICAL RAIN GARDEN PROFILE



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-71: *Large unused landscape space on the periphery of parking lots offers good retrofit opportunities. Dashed lines show where a rain garden could be added.*



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-72: *Oversized and under-used parking areas in the interior of parking lots can easily be transformed into rain gardens. Dashed lines show where a rain garden could be added.*

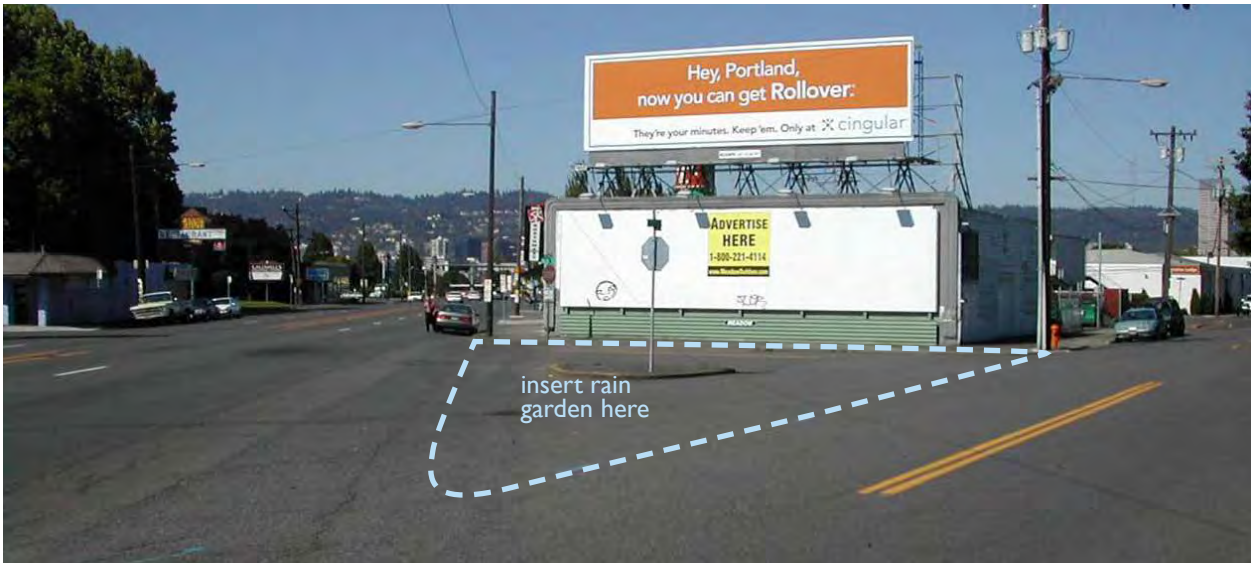
How can rain gardens be used in streets and parking lots?

Streets

Rain gardens can be retrofitted in a variety of street applications. Large areas of unused or inefficiently used spaces are prevalent throughout downtown centers, industrial areas, and residential neighborhoods. These leftover landscape and asphalt spaces are prime candidates for building rain gardens.

Parking Lots

Rain gardens areas are quite useful in larger parking lot conditions (i.e., shopping malls, big box stores) because they can be designed to manage large amounts of stormwater runoff. For retrofit conditions, it is often a popular choice to convert several parking stalls into one larger rain garden rather than use smaller swale and planter applications.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-73: *Large under-used areas where streets intersect at odd angles are excellent opportunities for rain gardens. Dashed lines show where a rain garden could be added.*

Street Applications



SOURCE: WWW.IA.NRCS.USDA.GOV/FEATURES/URBAN PHOTOS

Figure 2-74: *A simple residential street rain garden.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-75: *An artful urban rain garden application.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-76: *Rain gardens can conform to any shape, but should be appropriately sized for the amount of catchment area.*

Parking Lot Applications



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-77: *This rain garden next to an elementary school collects runoff from adjacent neighborhood streets and the school's parking lot.*



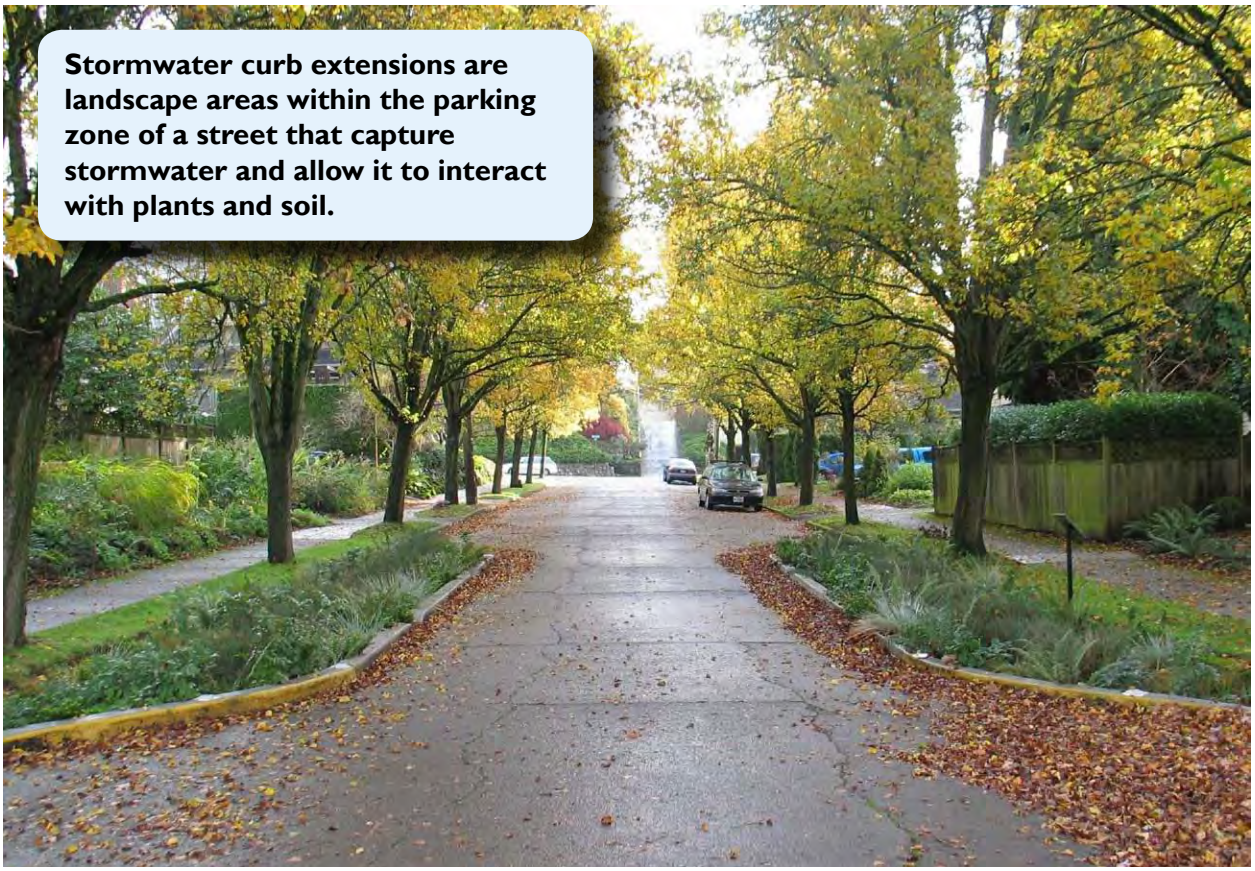
SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-78: *This rectangular rain garden area receives runoff from both a parking lot and the building's rooftop.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-79: *A simple grassy rain garden with trees collects runoff from adjacent parking lot stalls.*



Stormwater curb extensions are landscape areas within the parking zone of a street that capture stormwater and allow it to interact with plants and soil.

SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Stormwater curb extensions are landscape areas that extend into the street and capture stormwater runoff. Conventional curb extensions (a.k.a. bulb outs, chokers, chicanes) are commonly used to increase pedestrian safety and help calm traffic. A stormwater curb extension shares these same attributes plus adds a stormwater benefit by allowing water to flow into the landscape space. This landscape space can be designed with the physical characteristics of vegetated swales, planters, or rain gardens depending on the available space and specific site conditions.

Stormwater curb extensions are particularly advantageous in retrofit situations because they can often be added to existing streets with minimal disturbance. The small footprint of stormwater curb extensions allows for an efficient stormwater management system that often performs very well for a relatively low implementation cost.

Stormwater curb extensions can be used in a variety of land uses from low-density residential streets to highly urbanized commercial streetscapes. Curb extensions are excellent to use in steep slope conditions because they can act as a "backstop" for capturing runoff from upstream flow. For use in green street applications, curb extensions should have check dams installed for street slopes over 2%. For streets slopes over 5%, the interior of the curb extensions should be terraced with check dams and act more as a series of planters. Stormwater curb extensions can be planted with a variety of trees, shrubs, grasses and groundcovers, depending on site context and conditions.



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-80: *In this residential street example, runoff is completely managed within a stormwater curb extension.*



SOURCE: CONTEXTSENSITIVESOLUTIONS.ORG

Figure 2-81: *Curb extensions can fit nearly anywhere and help calm traffic for a safer pedestrian experience.*

Good Places for Curb Extensions:

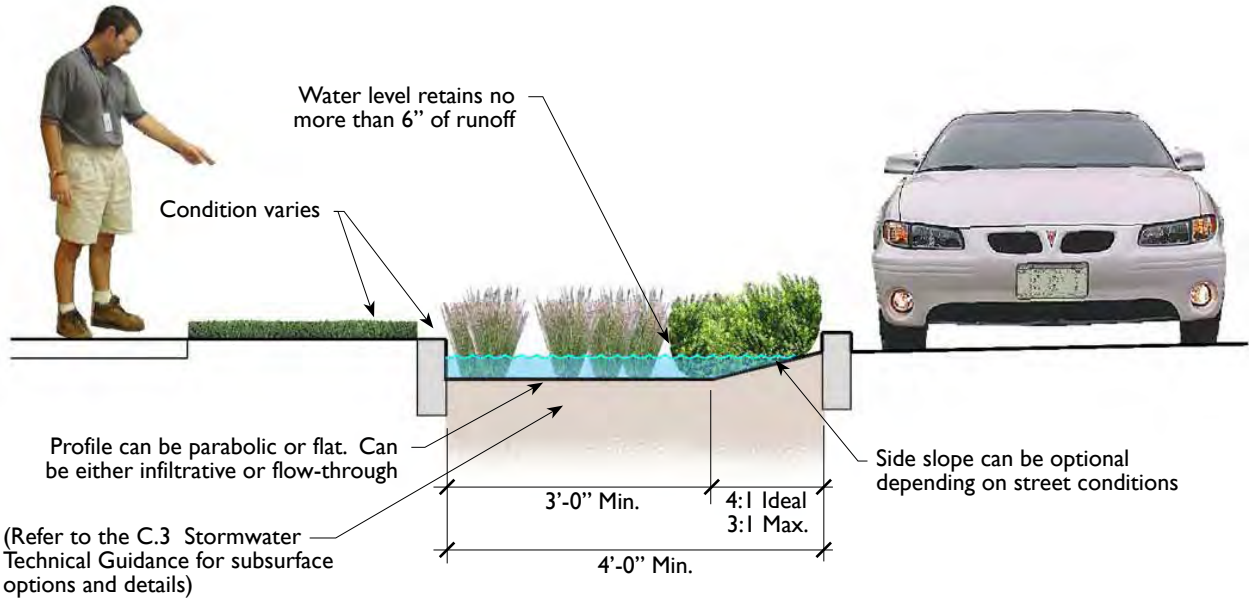
- Parking zones along commercial streets
- Low-density residential settings where on-street parking is under-used

Why Choose Curb Extensions:

- Can significantly "green" a street with minimal investment
- Can be inexpensive to build depending on the local land use context
- Can be flexible in both shape and size to conform to site conditions
- Can act as a "backstop" to capture stormwater flow on steep streets
- Can narrow portions of a street and provide traffic calming benefits

Potential Constraints:

- Generally requires the removal of on-street parking
- Can sometimes conflict with bike travel if adequate space is not allowed between edge of curb extension and a street's travel lane

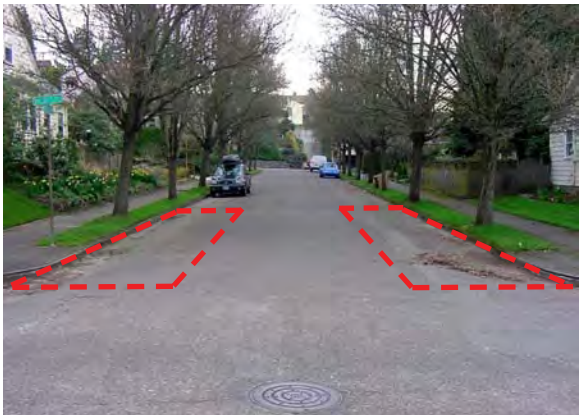


TYPICAL CURB EXTENSION PROFILE



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-82: *Angled parking stalls in downtown streets can be converted into stormwater curb extensions and would provide more of a balance between landscaping and parking. Dashed lines show where a stormwater curb extension could be added.*



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-83: *Parking zones on residential streets are prime candidates for stormwater curb extension retrofits. Dashed lines show where a stormwater curb extension could be added.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-84: *Parking zones along many urban streets have areas that are striped as "no parking" and could be converted into stormwater curb extensions. Dashed lines show where a stormwater curb extension could be added.*

How can stormwater curb extensions be used in residential or urban conditions?

Low-Density Residential Conditions

Existing residential streets offer some of the best opportunities to convert a portion of the street's parking zone into stormwater curb extensions. Many low-density residential streets in San Mateo County do not have many parked cars during average conditions, so utilizing the parking zone to capture stormwater often may have little or no parking impact to residents. Stormwater curb extensions in low-density residential areas can often be installed with minimal impact to existing infrastructure. In some cases, the curb extensions can be designed so that the existing street curb and stormwater inlets can be left in place.

High-Density Residential/Urban Conditions

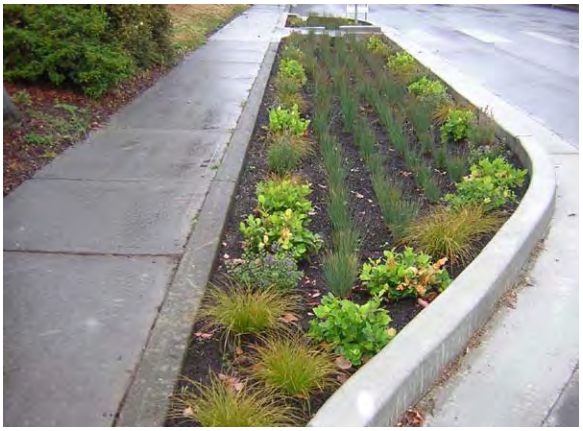
In areas where on-street parking is fully utilized, smaller stormwater curb extensions, spaced more frequently, can be used to minimize parking loss to any individual property. It is important, though, that they are appropriately sized to handle the amount of stormwater runoff from the catchment area (see "Sizing" in Chapter 5). In many urban examples, there are streets striped with "no parking" zones that could be converted into stormwater curb extensions without any loss of parking. There are also instances where existing curb extensions that are paved with concrete or have landscaping can be redesigned to manage stormwater. Stormwater curb extensions can also be designed on streets with an angled parking configuration.

Residential Applications



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-85: *A pair of stormwater curb extensions installed along a low-density neighborhood street.*



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-86: *A stormwater curb extension along a neighborhood collector street. For this project, the existing street curb was retained.*



SOURCE: KEVIN ROBERT PERRY - CITY OF PORTLAND

Figure 2-87: *Curb extensions can provide for stormwater management and safer crossings for pedestrians.*

Urban Applications



SOURCE: DAVE ELKIN - CITY OF PORTLAND

Figure 2-88: *Accessible pedestrian ramps can also be integrated into the design of stormwater curb extensions.*



SOURCE: DAVE ELKIN - CITY OF PORTLAND

Figure 2-89: *An urban intersection retrofitted with stormwater curb extensions.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-90: *This large stormwater curb extension provides a safer intersection and enhanced bus stop.*



Green gutters help capture and slow stormwater runoff within very narrow and shallow landscaped areas along a street's edge.

SOURCE: NEVUE NGAN ASSOCIATES

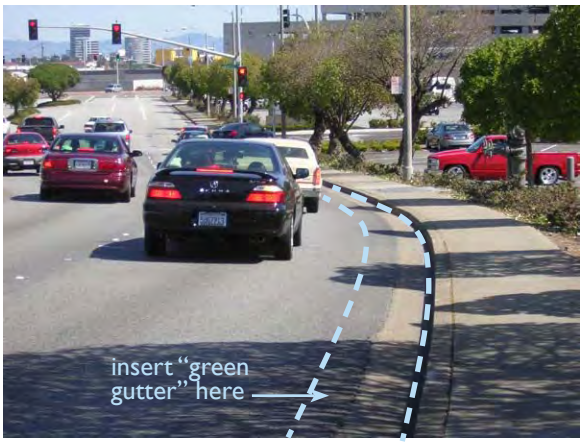
Green gutters are very narrow, landscape systems along street frontages that capture and slow stormwater flow. Typically less than three feet wide, green gutters most resemble planters in that they are confined by vertical curbs and have a flat-bottom profile. Unlike typical planters, however, green gutters are designed to be very shallow with little or no water retention. While infiltration of stormwater is a possibility, the primary purpose of using green gutters is to provide a site design measure using strip of landscaping to help filter out pollutants and slow the flow of water.

The most promising use of green gutters is along excessively wide streets that do not require, or need, on-street parking. In many cases, simply narrowing a residential or commercial street's travel lanes can yield room for a green gutter application.

Green gutters have other benefits besides filtering stormwater pollutants from roadways. They also introduce more green space along streets that lack landscaping. Furthermore, these narrow strips of green help provide a landscape buffer between auto traffic and pedestrians, resulting in a more desirable and potentially safer condition for people.

Green gutters are a new design strategy, and there are not yet any projects built to date. However, there are multiple conditions in San Mateo County where green gutters would be suitable.

The main disadvantage of using green gutters is that they require a fairly long footprint in order to adequately filter and slow stormwater. In addition, they most likely will not meet sizing requirements needed for compliance with C.3 Stormwater Technical Guidance, so they are most applicable for the types of retrofit projects that do not trigger compliance with C.3 regulations. Even with these limitations, there are abundant opportunities in San Mateo County to implement green gutter projects.



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-91: *Green gutters can often be installed parallel to an excessively wide travel lane. Dashed lines show where a green gutter could be added.*



SOURCE: NEVUE NGAN ASSOCIATES

Figure 2-92: *This wide shoulder space can be converted to have both a green gutter and a bike lane.*

Good Places for Green Gutters:

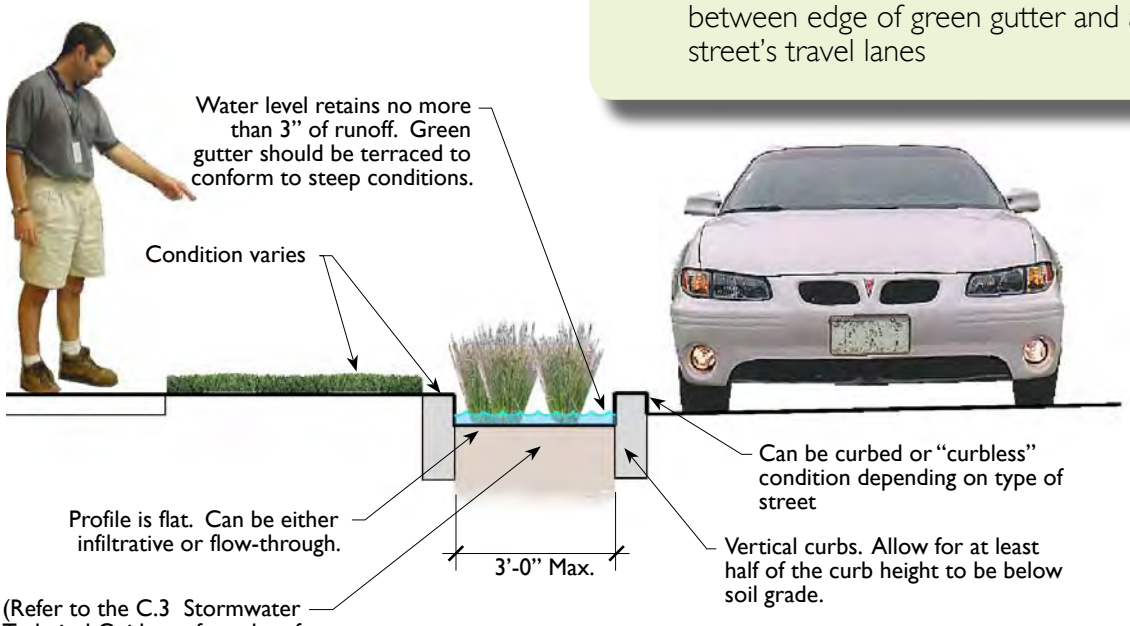
- Residential, commercial, and arterial street frontages that have oversized wide travel lanes or "dead space" between travel lanes and the sidewalk zone

Why Choose Green Gutters:

- Can often significantly "green" a street with minimal investment
- Can be inexpensive to build depending on the local land use context
- Can help create a more walkable street environment by providing a green buffer between auto traffic and the sidewalk

Potential Constraints:

- Require a long, continuous space to effectively slow and filter stormwater pollutants
- Are very shallow and do not retain large amounts of runoff
- Most likely cannot be designed to meet C.3 stormwater treatment requirements
- Can sometimes conflict with bike travel if adequate space is not allowed between edge of green gutter and a street's travel lanes



TYPICAL GREEN GUTTER PROFILE

Design Guidelines





for 'Greening' Surface Parking Lots







TORONTO City Planning

November 2007
DRAFT

Used with permission.

DESIGN GUIDELINES FOR 'GREENING' SURFACE PARKING LOTS

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1.0 INTRODUCTION

Typically, the emphasis in parking lot design is on accommodating vehicle movements, maximizing the number of parking spaces, and ensuring ease of maintenance and servicing. Once these functional criteria are satisfied, "left-over" spaces may or may not be landscaped or dedicated for pedestrian use.

As a result, there are often few landscaped areas within a parking lot and those that are provided tend to be insufficient in size and design to support healthy trees and vegetation. Pedestrians are also given low priority and may be left to navigate between parked cars and across wide driveways, which presents safety concerns.

When functional requirements are the only objectives considered in parking lot design, the design outcome is generally undesirable, with poor quality landscaping, unattractive streetscapes and a lack of pedestrian safety, comfort and amenity.

Conventional surface parking lots also represent an environmental challenge. Large expanses of asphalt contribute to the urban heat island effect, which raises local air temperature, elevates smog, and, in turn, increases energy demand for summer cooling. Vehicles left to "bake in the sun" can be significant polluters as well, emitting smog-forming contaminants when parked and requiring additional energy for cooling when travel resumes.

Traditional parking lot surfaces prevent rainwater and snowmelt from being absorbed into the soil to replenish groundwater. During storms and winter thaws, impermeable pavement can produce rapid run-off which poses flooding hazards and the risk of carrying pollutants directly into our lake, rivers and streams. Dark surfaces can also increase the temperature of stormwater run-off, disrupting water quality in receiving areas.

The Design Guidelines for 'Greening' Surface Parking Lots respond to both the urban design and environmental challenges associated with a surface parking lot. The Guidelines are intended to create surface parking lots that are not only efficient, but also safe, attractive and environmentally responsible.

'Greening' the surface parking lot involves planting trees, providing good quality soil and generous landscaped areas, enhancing pedestrian and cycling infrastructure, managing stormwater on-site, reducing the urban heat island effect, and using sustainable materials and technologies.

Urban Design and Environmental Challenges



"Left-over" space with poor quality landscaping



Unsightly parking lot dominating the street edge



Large expanse of unshaded asphalt contributing to urban heat and polluted stormwater run-off

2.0 PURPOSE AND OBJECTIVES

The Design Guidelines for 'Greening' Surface Parking Lots implement Built Environment and Natural Environment policies of the Official Plan (Chapters 3.1 and 3.4). This includes policies related to improving the public realm, enhancing pedestrian safety and comfort, increasing shade, enhancing the quality of landscaping, encouraging on-site stormwater management, and promoting the use of sustainable materials and technologies. Specific Official Plan policies relevant to the design of surface parking lots are summarized in Appendix A.

The Guidelines also provide design options and strategies to implement many environmental performance targets of the Toronto Green Development Standard (GDS). GDS performance targets relevant to the design of surface parking lots include measures for reducing the urban heat island effect, improving pedestrian and cycling infrastructure, using energy efficient fixtures and recycled materials, managing stormwater run-off on-site, and preserving and enhancing the urban forest.

Sections in the Design Guidelines for 'Greening' Surface Parking Lots which correspond to the environmental categories and performance targets of the GDS are identified by the following symbols:


Air quality (including urban heat island effect)


Energy efficiency and greenhouse gas emissions


Water quality and efficiency


Solid waste reduction


Urban ecology

TORONTO OFFICIAL PLAN

"New development will provide amenity for adjacent streets and open spaces to make these areas attractive, interesting, comfortable and functional for pedestrians"

3.1.2 Built Form Policy 5

"To support strong communities, a competitive economy and a high quality of life, public and private city-building activities and changes to the built environment, including public works, will be environmentally friendly"

3.4 The Natural Environment Policy 1

Before planning and building surface parking lots, the feasibility of alternatives, such as underground or structured parking, should be considered. When these preferred alternatives are not feasible, surface parking lots should be carefully designed to enhance the urban design and environmental conditions.

Surface parking lot design should reflect the following objectives:

- Respect the existing or planned context
- Enhance the safety and attractiveness of the public realm (adjacent streets, parks and open spaces)
- Create direct, comfortable and safe pedestrian routes
- Provide shade and high-quality landscaping
- Mitigate the urban heat island effect
- Manage stormwater quality and quantity on-site
- Incorporate sustainable materials and technologies



Landscaped street edge



Dedicated pedestrian route



Shade within the lot



Bio-retention area



Permeable surface

3.0 HOW AND WHERE THE GUIDELINES APPLY

The Design Guidelines for 'Greening' Surface Parking Lots apply to the design, review and approval of all developments containing surface parking.

The Guidelines have city-wide applicability and will normally apply to the evaluation of design alternatives in rezoning, official plan amendment and site plan applications. Owners of existing parking lots are not required, but are encouraged, to make alterations and improvements consistent with the Guidelines at the time of resurfacing or other appropriate phase in the development life-cycle.

The Guidelines will also apply to the development of surface parking lots owned and/or operated by the City of Toronto or any Agency, Board or Commission of the City of Toronto. The Guidelines should be considered when opportunities arise to retrofit or enhance existing City parking lots.

The Guidelines are intended to be read together with the Official Plan, applicable Zoning By-laws and Secondary Plans, the Toronto Green Development Standard (GDS) and other applicable City standards, policies and guidelines.

When using the Guidelines in conjunction with the Toronto Green Development Standard, developers, designers and reviewers of sites with surface parking lots should give particular consideration to guidelines marked with the GDS symbols (see 2.0 Purpose and Objectives). The GDS is currently voluntary for the private sector and is to be applied, where feasible, to the City of Toronto or any Agency, Board or Commission of the City of Toronto.

In many areas of Toronto, parking is required to be underground, allowing for intensification, mixed use, open space, etc. at-grade. Adhering to the Design Guidelines for 'Greening' Surface Parking Lots does not constitute approval for surface parking where it is otherwise prohibited by the Zoning By-law.

4.0 DESIGN GUIDELINES

The previous three sections of the Design Guidelines for 'Greening' Surface Parking Lots provide background, policy rationale and design objectives for improving the quality of surface parking lots in the City of Toronto. This section 4.0 Design Guidelines, provides the necessary direction and strategies to implement and achieve a higher standard in surface parking lot design.

The Design Guidelines section is organized into five sub-sections:

4.1 Location and Layout
4.2 Vehicle Access and Circulation
4.3 Pedestrian Access and Circulation
4.4 Landscaping
4.5 Stormwater Management

Each sub-section provides a range of strategies and specific measures intended to improve the urban design and environmental conditions of the surface parking lot.

Designers of surface parking lots are encouraged to generate site-specific solutions that meet the intent of the Guidelines.



Commercial parking lot with internal tree planting

4.1 LOCATION AND LAYOUT

4.1.1 General Requirements

a. Locate surface parking behind or beside buildings, away from primary street frontages and street corners.

b. Parking spaces should not be located between the front facade line of buildings and a street edge.

c. Divide larger parking areas both visually and functionally into smaller parking courts.

d. Organize parking spaces and rows to provide consolidated soft landscaped areas and opportunity for on-site stormwater management. (see also 4.4 Landscaping and 4.5 Stormwater Management)

e. Position parking rows perpendicular to the main building entrance(s) to assist safe pedestrian movement toward the building.

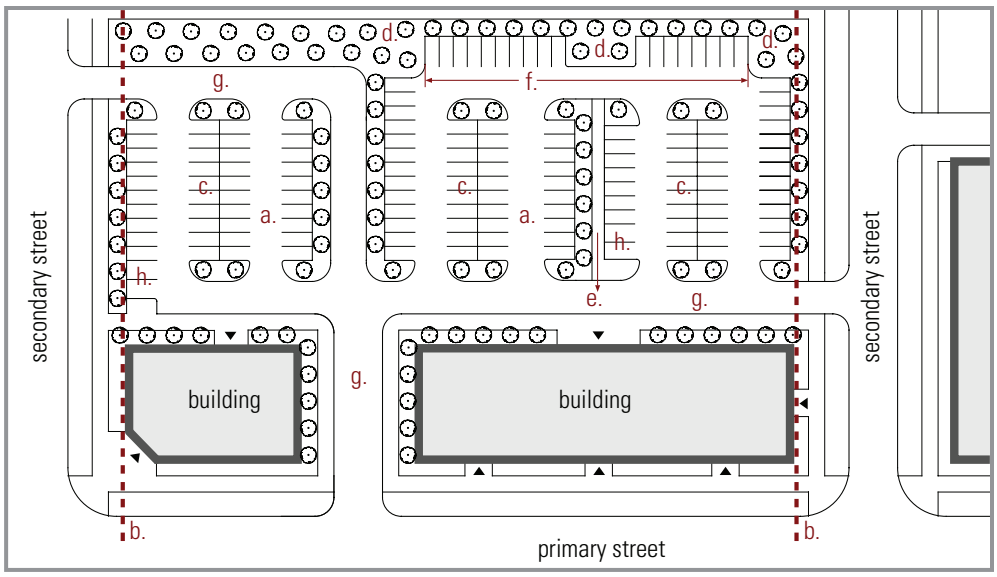
f. Limit the length of parking rows to a maximum of 60m (20-23 contiguous spaces typical). Longer rows should include landscaped breaks, such as islands, with shade trees. (see 4.4.3 Internal Landscaping)

g. To reduce potential vehicle and pedestrian conflicts related to vehicles moving in and out of parking spaces, where possible, avoid locating parking along major drive aisles, street access driveways or in front of building entrances and service areas. Use landscaped islands and medians for separation. (see 4.4.3 Internal Landscape)

Note: Exceptions might include parking lots on small/narrow sites or disabled parking and short-term loading spaces where proximity to building entrances is important; however, no parking spaces shall be located within the clear-throat area of street access driveways as per applicable Access Management Guidelines.

h. Locate and provide accessible parking spaces in accordance with applicable disabled parking by-laws, using the City of Toronto Accessibility Design Guidelines where appropriate.

i. For developments with multiple phases, submit a phasing plan to identify all current and future parking lot requirements. Parking areas should be constructed incrementally to match land use build-out schedules. Areas not required for parking and interim parking lots should be landscaped.



Conceptual parking lot layout – Note: Letters correspond to guidelines in sub-section 4.1.1

4.1.2 Site Grading

a. Ensure that any grade changes at the edge of surface parking lots provide a subtle transition to surrounding areas.

b. Avoid significant changes in grade (greater than 4% slope) between the public sidewalk and pedestrian access and circulation routes. Ensure universally accessible routes are provided across any grade changes.

c. Limit the maximum grades on landscaped areas to 33% (3:1) or less to ensure that grassed slopes can be maintained.

d. Limit the use of retaining walls, particularly along street frontages, parks, ravines and other areas of the public realm.

   Note: Where retaining walls cannot be avoided, minimize the overall height or provide low terraces, use durable, attractive materials, and incorporate intensive soft landscaping.

e. When appropriate, use the existing site grading to enhance the screening of parking lots.

f. Provide a site grading plan compatible with the stormwater management approach selected for the site:

   - apply a cross-grade for paved surfaces as low as 1.5% to encourage slower stormwater flow
   - use manufacturer recommended grading parameters for permeable pavement installations to enable water infiltration
   - slope surfaces to direct stormwater toward landscaping, bio-retention areas or other water collection/treatment areas as identified on the site (see also 4.5 Stormwater Management)



A subtle change in grade at the edge of the parking lot screens parked cars

4.1.3 Lighting

a. Provide a comprehensive Lighting Plan for the parking lot site. Lighting should create an identity for the parking lot, enhance adjacent streets and pedestrian environments and be appropriate to the location, context and scale of the areas being lit.

b. Select different luminaries with a coordinated appearance to light pedestrian pathways, parking spaces, drive aisles, building and site entrances and other relevant parking lot features.

c. Balance the need for safety and security with the reduction of energy consumption and light pollution:

- ensure all parking spaces and circulation routes are well-lit
- install lighting that is appropriately scaled to its purpose, i.e. avoid "over lighting"
- direct light downward and avoid light overspill on adjacent properties, streets and open spaces
- use energy-efficient fixtures and bulbs
- incorporate opportunities for off-grid power generation, e.g. solar, wind, etc.

d. Provide pedestrian-scaled lighting, such as bollards or lower-scale pole fixtures along pedestrian routes.

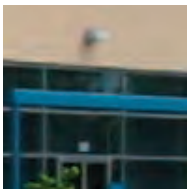
e. Consider lighting elements for their aesthetic and design value, not simply their lighting function or ease of maintenance.

f. Coordinate the location of lighting with pedestrian clearways, tree planting and other landscaping.


A coordinated lighting scheme


Pedestrian light


Parking lot light


Building entrance light


A pedestrian pathway defined and lit with appropriately-scaled fixtures

4.1.4 Other Site Elements

a. Integrate bicycle parking, shopping cart corrals, ticket or payment kiosks, signage, public art, and other applicable site elements into the design and layout of the parking lot. Indicate the location of these elements on the Site Plan.

b. Structures related to site elements, such as bicycle parking or shopping carts, should incorporate sustainable materials and technologies whenever possible.

c. Locate short- and long-term bicycle parking in highly visible, well-lit, accessible and weather protected areas. Incorporate way-finding signage as appropriate.

d. Provide at least 0.6m clearance between parked bicycles and adjacent walls, poles, landscaping, street furniture, drive aisles and pedestrian clearways and at least 1.5m clearance from vehicle parking spaces. (refer to Chapter 9 - Bicycle Parking, in the Toronto Bike Plan for more information)

e. Where shopping carts are associated with parking lot use, position cart corrals so that each row of parking has access to a cart return area.

Note: Shopping cart corrals are encouraged to extend the width of two parking rows and incorporate landscaping to buffer adjacent parking spaces. (see 5.2 Additional Diagrams)

f. Explore opportunities for public art early in the planning process. Examples of public art opportunities in parking lots might include enhancement to the street edge, screening, a marker of the entrance or exit, or a focal point sculpture.



Bicycle parking with a protective canopy creates a unique parking lot edge and integrates well with the streetscape design



This parking lot entry provides an opportunity for bold public art
Artwork credit: "Between Heaven and Earth" by John McEwen

4.2 VEHICLE ACCESS AND CIRCULATION

a. Limit the number and width of curb cuts for street access driveways to minimize interruption to the public sidewalk, streetscape and perimeter landscaping. (refer to the applicable Access Management Guidelines for driveway requirements)

b. Provide access to surface parking lots from secondary streets or laneways whenever possible.

c. Share driveway access between adjacent sites where feasible.

d. Define street access driveways and internal vehicle routes with curbed landscaped areas, tree planting and lighting. Explore opportunities to include public art.

e. Size vehicle circulation routes according to use. Avoid using over-sized driveways, drive aisles and turning radii.

   Note: Limiting the width of driveways and drive aisles reduces the expanse of parking areas and provides more opportunity for soft landscaping. Minimizing turning radii reduces the length of pedestrian crossings and encroachment into landscaped areas.



Driveway well defined with landscaping and decorative lighting

f. Where circulation routes require wider driveways and turning radii (i.e. fire lanes, service areas), coordinate the location of these routes with major drive aisles.

g. Provide continuous circulation throughout the site. Avoid dead end driveways and turn around spaces.

h. Ensure unobstructed motorist and pedestrian sight distance and provide clearly marked crossings at all intersections between vehicle routes and pedestrian pathways.



Shared street access driveway to mid-block and rear parking lots

4.3 PEDESTRIAN ACCESS AND CIRCULATION

a. Establish a direct and continuous pedestrian network within and adjacent to parking lots to connect building entrances, parking spaces, public sidewalks, transit stops and other pedestrian destinations.

b. Provide at least one pedestrian route between the main building entrance and the public sidewalk that is uninterrupted by surface parking and driveways.

c. In larger parking lots or where parking lots serve more than one building or destination, provide designated pedestrian pathways for safe travel through the parking lot.

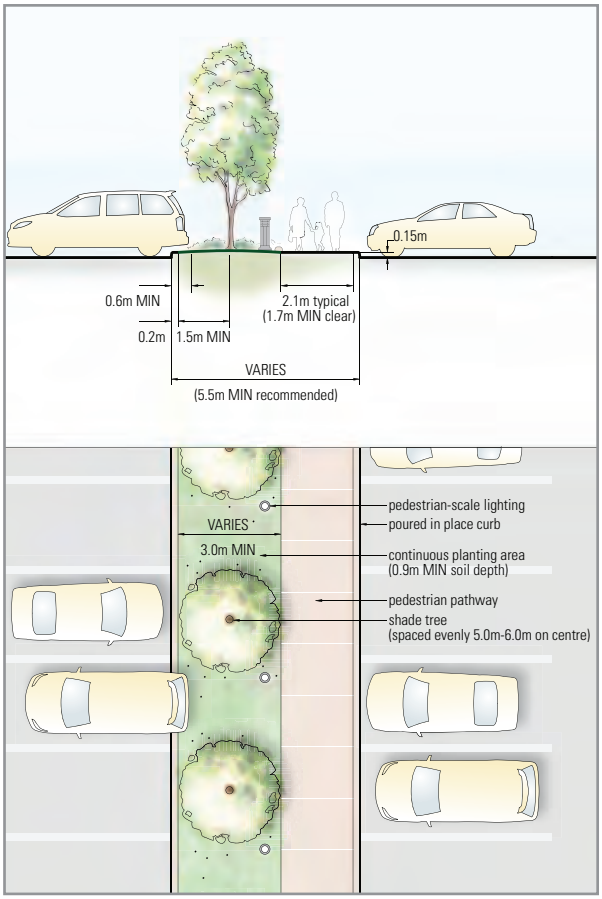
d. The width, number and orientation of pedestrian routes should match the anticipated flow of pedestrian traffic through the site. Consider the space requirements for equipment related to parking lot use, such as shopping carts, strollers and mobility aids, when planning the width and location of pedestrian routes.

e. All pedestrian routes within a parking lot should include:

- a barrier-free pathway, with a minimum clear width of 1.7m (wider pathways are encouraged and may be required depending on parking lot use);
- shade trees (or a shade structure) along one or both sides of the pathway;
- pedestrian-scale lighting to illuminate and define the route; and
- a clear division from vehicular areas, with a change in grade, soft landscaping and a change in surface material



Landscaped pedestrian route provides a safe, direct and pleasant connection between the building entrance, surrounding parking spaces and other buildings

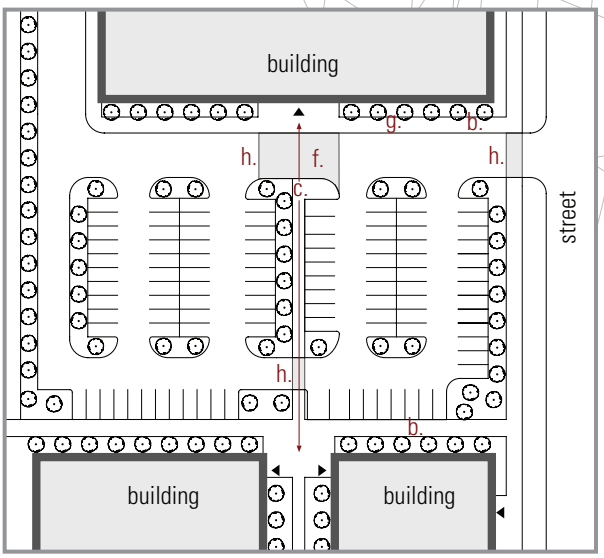


Design concept for pedestrian pathway with single row of shade trees. Note: See 5.2 Additional Diagrams for further design options

f. Consider installing "tables" (rolled curbs bordering slightly elevated crossings) at major internal intersections to serve as a traffic calming feature and provide pedestrian priority.

g. Provide enhanced pedestrian pathways along street access driveways.

h. Where pedestrian routes cross street access driveways and other major drive aisles, clearly mark crossings and provide unobstructed sight distance for both pedestrians and vehicles.



Conceptual pedestrian access and circulation scheme
Note: Letters correspond to guidelines in sub-section 4.3

4.4 LANDSCAPING

4.4.1 General Requirements

a. Retain and protect existing trees, vegetation, natural slopes and native soils and integrate these features into the overall landscape plan.

b. Distribute landscaping throughout the site to soften and screen parking lot edges, reinforce circulation routes, create pleasant pedestrian conditions and maximize shade and stormwater benefits. (see sections 4.3, 4.4.2, 4.4.3, 4.5 for details)

c. Consolidate soft landscaped areas, particularly in larger parking lots, to enhance tree and plant material growing conditions.

d. Landscaped areas should be designed to accommodate the following:

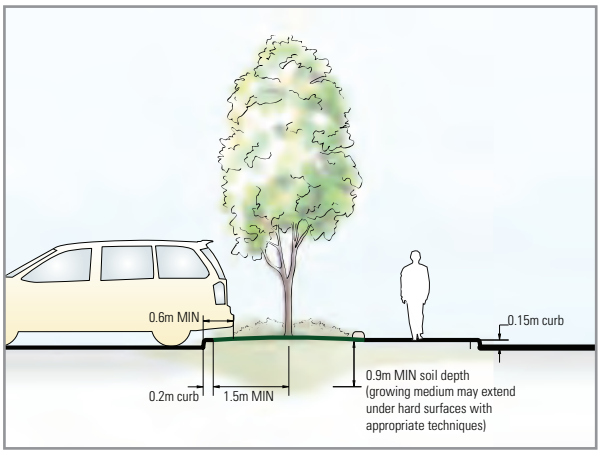
- trees planted with access to at least $30m^3$ (at 0.9m depth) of good quality soil (see Appendix B)
- trees planted at least 1.5m from curbs, sidewalks, driveways and other hard surfaces to buffer from stress caused by salt, snow piling, vehicle overhang and compacted soils
- all other plant material, except sod or groundcover, set back a minimum 0.6m from any curb edge to protect from vehicle overhang and mechanical damage
- high-branching, deciduous shade trees planted evenly at 5m to 6m intervals (or as appropriate to the selected species) to quickly establish continuous canopy coverage

e. Expand rooting zones of landscaped areas under adjacent hard surfaces.

Note: Techniques may include the use of structural soils or cells, continuous planting trenches and/or permeable paving.



Existing mature trees protected and incorporated into the parking lot landscape



Design concept for pedestrian pathway with single row of shade trees. Note: See 5.2 Additional Diagrams for further design options.

f. Select plant material that is suitable to the growing environment of the parking lot:

- use species (native and non-native) that are hardy, drought- and salt-tolerant, and resistant to the stresses of compacted soils and weather exposure
- include suitable native species where possible and appropriate (see Appendix B).
- avoid planting invasive species near ravines and other natural areas
- avoid monocultures which can be susceptible to disease
- consider sun, shade and irrigation requirements
- incorporate a variety of deciduous and coniferous trees and shrubs for year-round interest, texture, shape and seasonal colour

g. Install a permanent irrigation system in all landscaped areas. Where possible, collect rainwater from rooftops and other surfaces for plant irrigation.

h. Identify hose bibs, sprinkler outlets, storage reservoirs, and other applicable irrigation elements on the Landscape Plan. Locate valves and other maintenance controls in discrete, yet accessible areas.

i. Where landscaping might impact motorist/ pedestrian sight distance, keep shrubs below 0.85m in height and prune trees so that the lowest branches will be at least 2m above ground level. Limit any other landscape features that might cause obstructions to a maximum height of 1m.

j. Ensure overhanging branches of trees or shrubs adjacent to pedestrian pathways maintain a clear headspace of at least 2m.

k. Coordinate tree planting with the location of light standards and other utilities.



Seasonal variety with shade trees and understory planting

4.4.2 Streetscape and Perimeter Landscaping

a. Provide a landscaped area at least 3m in width between surface parking and all property lines. Consult the applicable Zoning By-law for additional setback requirements.

b. Edge treatments along streets and other public spaces should visually screen parked vehicles, but not completely obstruct views into and out of the parking lot for the purpose of supporting pedestrian safety and security.

c. For parking lot edges adjacent to streets, parks or other public open space, provide the following:

- at least one row of shade trees, spaced evenly at 5m to 6m intervals (or as appropriate to the selected species) for the length of the parking lot edge
- screening, consisting of continuous planting, alone or in combination with a low decorative fence/wall or a landscaped berm. Typically, keep shrubs, fences or walls to a maximum height of 1m

  Note: The location, design and character of the screening should fit in with and enhance the existing landscape and built form character of the street or public open space.
- a coordinated appearance with the existing or planned streetscape treatment (refer to the Toronto Urban Design Streetscape Manual)

d. Set back screening at least 1m from the edge of public sidewalks and 0.6m from parking lot curbs. Screening should not encroach into the public street right-of-way.



A low hedge and shade trees enhance the public sidewalk and parking lot edge



A decorative wall, fencing and shade trees screen views into the parking lot

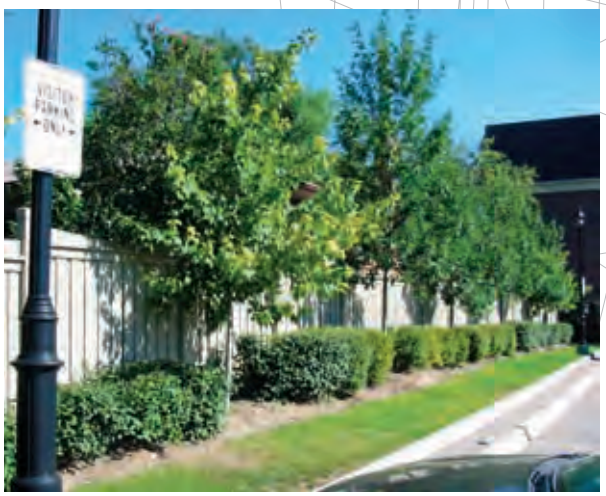


A soft landscaped berm lessens the appearance of parked vehicles from the street

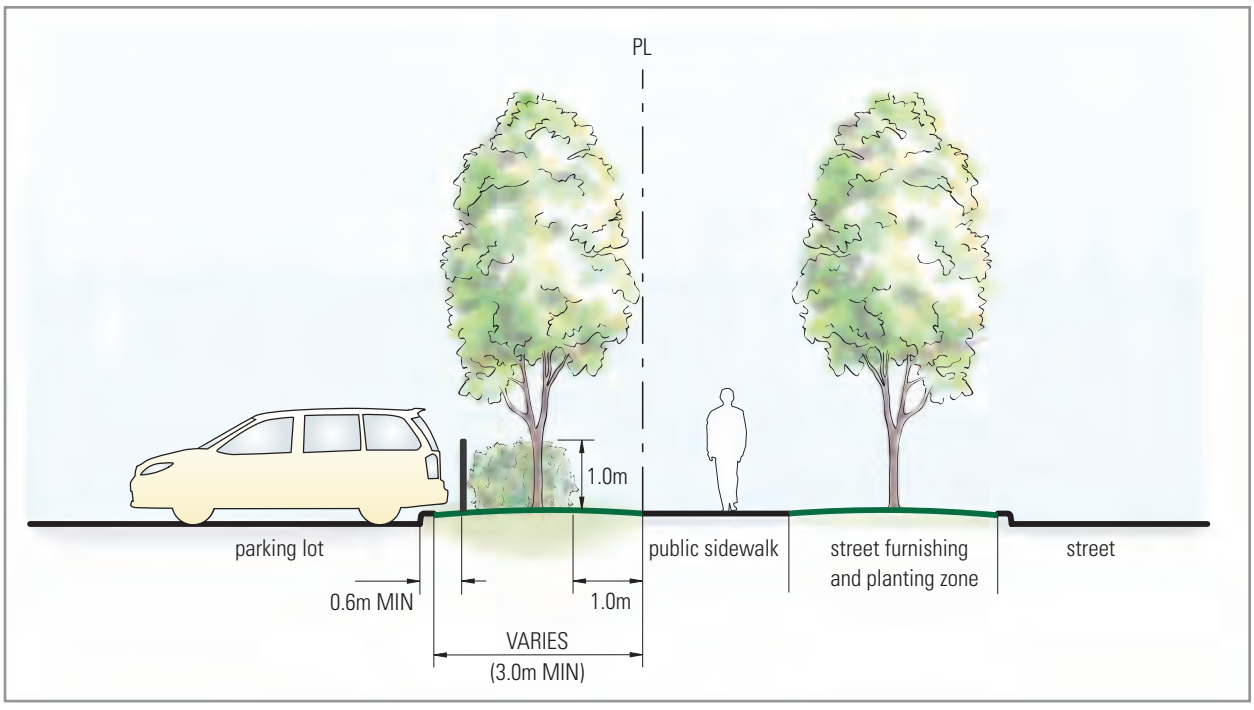
e. For parking lot edges not adjacent to the public realm, provide soft landscaping with a variety of deciduous and coniferous trees and plantings. Include bio-retention or other stormwater management systems as appropriate. (see 4.5 Stormwater Management)

f. Install high-quality privacy fencing with landscaped screening between parking lots and neighbouring, less compatible uses.

g. Where possible, include landscaping and a pedestrian walkway between parking lots and building edges.



High quality privacy fencing, softened with shrubs and shade trees, screens parking lot from neighbouring property



Design concept for street facing parking lot edge

4.4.3 Internal Landscaping

a. Incorporate soft landscaped areas and trees within the parking lot to define major vehicle and pedestrian routes, provide shade and break-up the expanse of paved areas.

Note: Soft landscaped areas include islands, medians, bio-retention areas and other consolidated planting areas.

b. All soft landscaped areas should contain suitable growing medium and be sized and designed to support healthy trees and plants (refer to section 4.4.1 and Appendix B). Consolidate smaller landscaped areas to provide better quality growing conditions and support for a broader range of tree and plant species.

c. Define internal landscaped areas with a continuous 15cm curb to prevent damage from vehicles and snow clearance, to separate planting areas from pedestrian pathways, and to prevent soil and other landscape material from spreading over adjacent surfaces.

Note: Taller or shorter curbs are permitted where vehicle overhang and door clearances are not an issue. Curb cuts are permitted to support accessibility and stormwater initiatives.

d. Plant high-branching deciduous trees throughout the parking lot interior to provide shade for pedestrians, vehicles and surfaces:

- provide internal shade trees at a minimum ratio of one tree planted for every five parking spaces supplied
- distribute internal shade tree planting such that no parking space is more than 30m from a tree

Note: On small or narrow sites, shade trees provided in non-street facing perimeter planting areas can be counted toward the internal tree requirement, provided that the maximum distance from a parking space (30m) is met.



Generously sized islands provide space for shade trees, lighting and understory planting



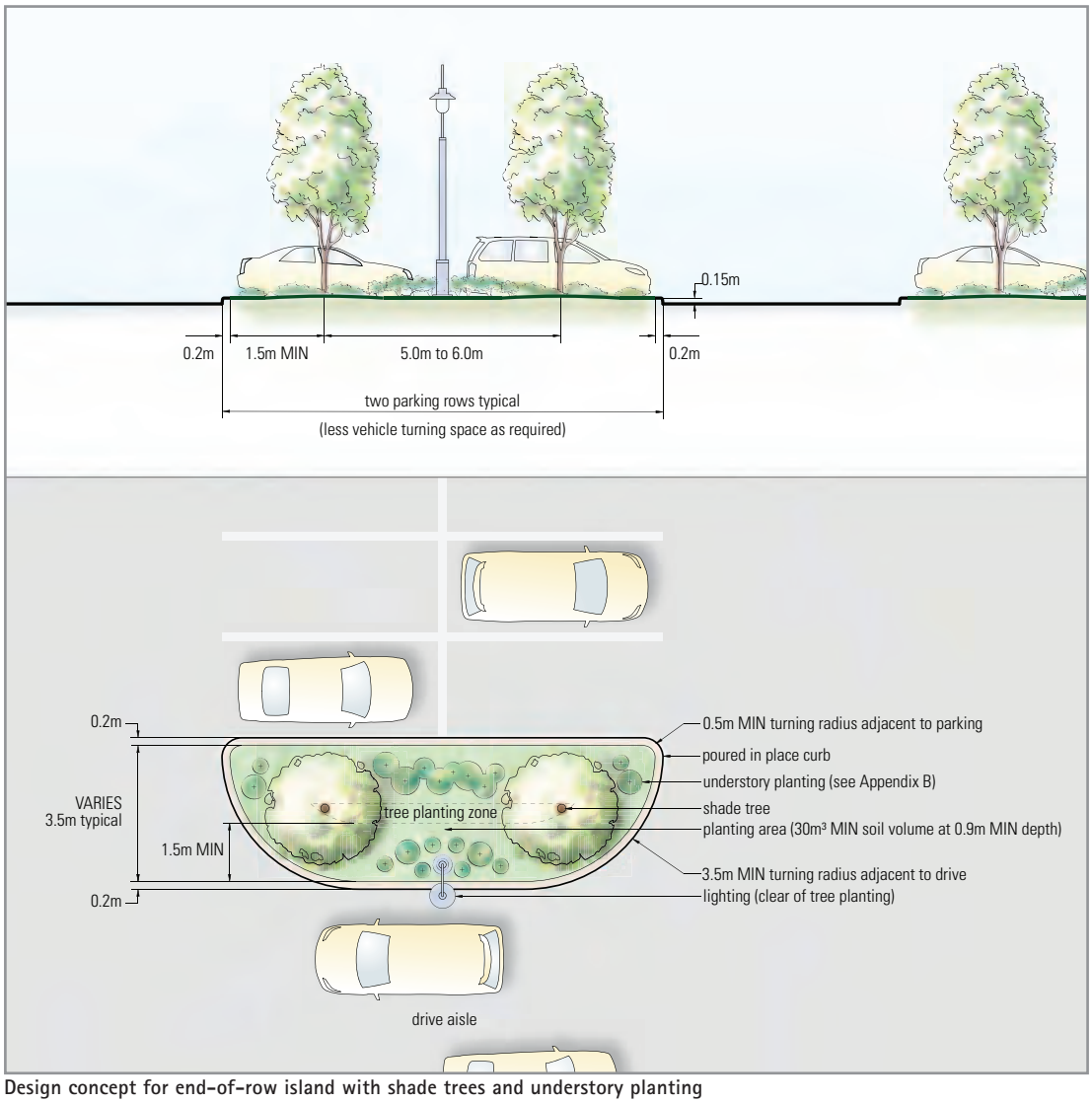
Street access driveway by a curbed median with tree planting, shrubs, colourful flowers and lighting

e. Include landscaped islands at the beginning and end of each parking row and to break up longer rows or highlight special features:

- provide a minimum growing environment of 30m^3 (at 0.9m depth) of good quality soil (see Appendix B)

  Note: This typically results in a landscaped area at least 3.5m wide for end-of-row islands and 3m wide for mid-row islands

- plant at least 1 high-branching deciduous shade tree (2 preferred) in each island
- include understory planting, such as shrubs, perennials, ornamental grasses and groundcover



Design concept for end-of-row island with shade trees and understory planting

f. Provide continuous landscaped medians every 3 (or fewer) banks of parking.

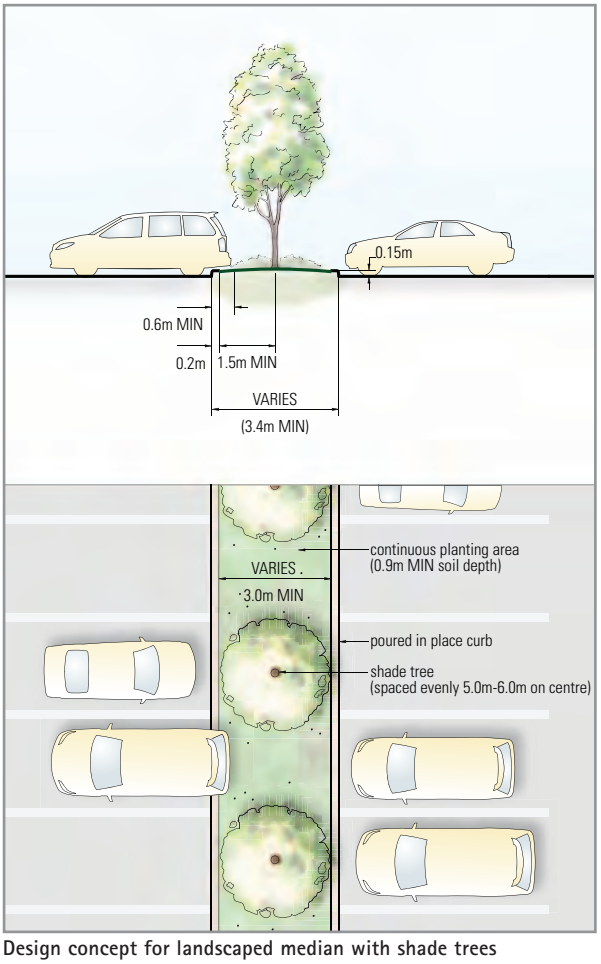
Note: A "bank" of parking consists of 2 parking rows and a drive aisle.

g. Medians should have a landscaped area at least 3m in width and combine with shade tree planting requirements, pedestrian pathways and/or stormwater management as appropriate. (see also 4.3 Pedestrian Access and Circulation and 4.5 Stormwater Management)

Note: Shade structures may replace shade tree planting, only after the minimum interior tree requirement is satisfied or when sufficient soil volume and planting conditions cannot be achieved for proper tree growth. (see 5.2 Additional Diagrams)



A landscaped median shades and cools parked vehicles and surfaces and provides stormwater benefit



Design concept for landscaped median with shade trees

4.4.4 Surfaces

a. Install decorative paving or a change in paving material/colour to emphasize edges, pedestrian routes and crossings, entrances, loading areas and other special features within the parking lot.

b. Where possible, install surfaces containing recycled or sustainable material.

c. Limit the use of dark, impervious surfaces within the parking lot:

- use light-coloured materials, such as concrete, white asphalt or light-coloured pavers, in the hardscape to reduce surface temperatures and contribution to the urban heat island effect
- install permeable/porous pavement, such as open-jointed pavers, porous concrete/ asphalt, or turf/gravel grids, as appropriate to parking lot use and conditions

  Note: Permeable paving should be installed in all overflow parking areas and is encouraged for use in snow storage areas and hardscapes surrounding trees. Consider turf grids/grassy pavers for areas of low traffic or infrequent use.

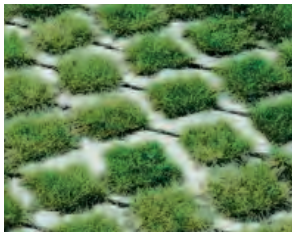
d. When installing porous/permeable paving material, follow manufacturer specifications for minimum and maximum slopes.

Examples of permeable paving:


Open joint pavers


Porous asphalt


Pervious concrete


Turf grid


Special pavers define the pedestrian crossing leading to the main building entrance

e. Construct the subgrade of any porous pavement to allow adequate drainage and prevent frost heave.

  Note: This is particularly important where clay or silty soil conditions are prevalent.

f. Install perforated subdrains below permeable paving, as required, to store, filter or convey water to additional stormwater facilities.

g. If permeable pavement or pavers are planned for use along driveways leading to public streets or other heavily traveled routes, the surface material and base course must be selected, designed and certified to withstand the anticipated traffic loading stresses and maintenance impacts.

h. Permeable pavements shall be subject to an ongoing maintenance program by the owner (e.g. sweeping, annual vacuuming). Sand should not be used for winter maintenance, unless otherwise specified by the product manufacturer.



Open joint pavers provide opportunity to retain rainwater and snowmelt on-site

4.5 STORMWATER MANAGEMENT

4.5.1 General Requirements

a. Refer to the Toronto Green Development Standard and the Wet Weather Flow Management Guidelines for water balance targets and recommended stormwater management strategies.

b. Minimize the extent of impermeable surfaces within the parking lot.

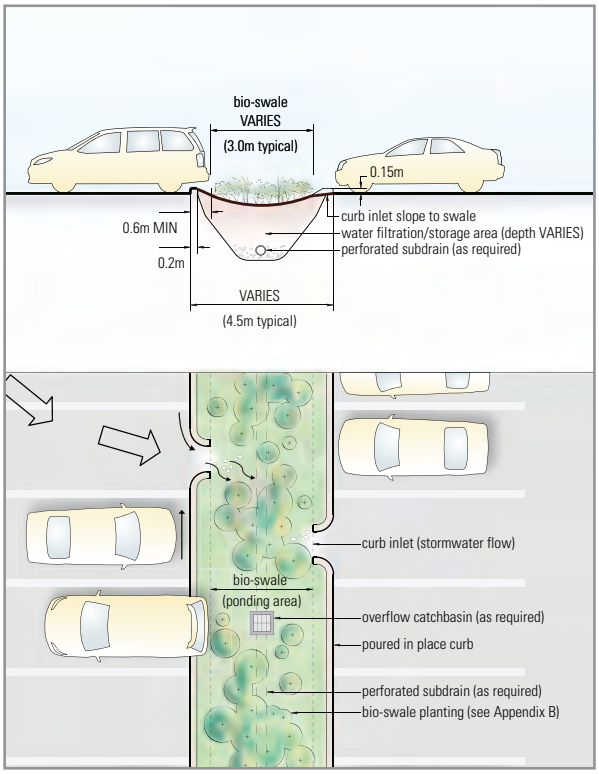
Note: This may be achieved in many ways, including; limiting the size and number of parking spaces to the required minimums stated in the applicable By-laws; limiting the width of drive aisles and looking for opportunity to share access routes as per applicable By-laws and City standards; and/or using permeable paving where hard surfaces are required.

c. Manage rainwater and snowmelt on-site with designs that encourage infiltration, evapotranspiration and water re-use:

- apply a "treatment train" approach
- use permeable paving for parking spaces, drive aisles, overflow parking, snow storage areas and other hard surfaces in the parking lot (refer to 4.4.4 Surfaces)
- plant trees, shrubs and other absorbent landscaping throughout the parking lot to provide shade and places for water uptake (refer to 4.4 Landscaping)
- create bio-retention areas, such as swales, vegetated islands and overflow ponds
- include catchbasin restrictors and oil/grit separators as appropriate
- incorporate opportunities to harvest rainwater (active or passive) from rooftops and other hard surfaces for landscape irrigation



A bio-retention area adjacent to a parking lot drive aisle



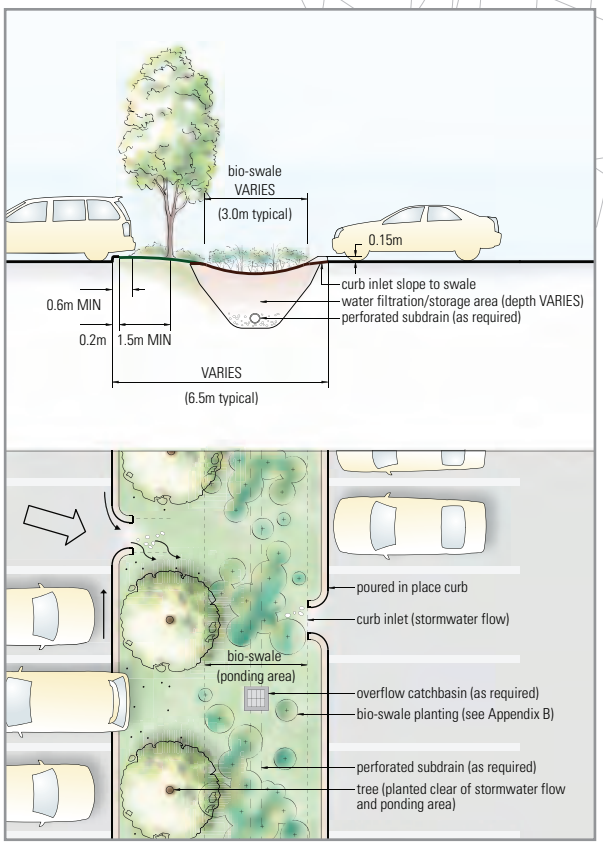
Design concept for bio-retention swale without tree planting

d. Where installed, bio-retention areas should be appropriately designed and located to filter, store and/or convey the expected stormwater flows from surrounding paved areas.

e. Although the design of each bio-retention area should be site specific, consider the following:

- select plant species that are tolerant of extreme conditions, such as flooding, drought, salt and other contaminants (refer to Appendix B)
- provide a planting medium, composed of good quality soil, with a minimum depth of 0.6m and at least 0.9m depth if trees are planted (refer to Appendix B)
- plant trees (if applicable) above grade from ponding areas and clear of stormwater flow
- ensure that any surface water is fully drained within 48 hours or less
- use poured in place curbs with cuts for water inlets
- include a perforated subdrain, check dams and overflow catchbasins as required to manage excess water

f. Ensure overland flow routes and stormwater inlets and outlets are clear of debris and snow piling.



Design concept for bio-retention swale with tree planting

4.5.2 Snow Storage

a. Snow storage areas should be identified on the Landscape Plan and have a minimum dimension of 2.6m by 1.5m to accommodate snow piling from a typical plough blade.

b. Provide snow storage areas away from public streets and other areas where motorist/pedestrian sight distance and continuous landscape screening are essential.

c. Sodded areas or portions of landscaped areas may be identified for snow storage with plant material selected accordingly.

d. Where overflow parking or bio-retention areas are provided, these areas may be used for snow storage.

e. Hard surfaced areas used for snow storage are encouraged to have permeable paving to retain snowmelt on-site. (see 4.4.4 Surfaces)



A bio-retention area used for snow storage

Permeable Pavement

Low Impact Development strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth. This approach improves water quality, minimizes the need for expensive pipe-and-pond stormwater systems, and creates more attractive developments.

MASSACHUSETTS **LOW IMPACT DEVELOPMENT** TOOLKIT

FACT SHEET #6

PERMEABLE PAVING





Overview

Since impervious pavement is the primary source of stormwater runoff, Low Impact Development strategies recommend permeable paving for parking areas and other hard surfaces. Permeable paving allows rainwater to percolate through the paving and into the ground before it runs off. This approach reduces stormwater runoff volumes and minimizes the pollutants introduced into stormwater runoff from parking areas.

All permeable paving systems consist of a durable, load bearing, pervious surface overlying a crushed stone base that stores rainwater before it infiltrates into the underlying soil. Permeable paving techniques include porous asphalt, pervious concrete, paving stones, and manufactured "grass pavers" made of concrete or plastic. Permeable paving may be used for walkways, patios, plazas, driveways, parking stalls, and overflow parking areas.

Applications and Design Principles

Permeable paving is appropriate for pedestrian-only areas and for very low-volume, low-speed areas such as overflow parking areas, residential driveways, alleys, and parking stalls. It can be constructed where the underlying soils have a permeability of at least 0.3" per hour. Permeable paving is an excellent technique for dense urban areas because it does not require any additional land. With proper design, cold climates are not a major limitation; porous pavement has been used successfully in Norway, incorporating design features to reduce frost heave.

Permeable paving is not ideal for high traffic/high speed areas because it has lower load-bearing capacity than conventional pavement. Nor should it be used on stormwater "hotspots" with high pollutant loads because stormwater cannot be pretreated prior to infiltration. Heavy winter sanding may clog joints and void spaces.

Management Objectives

- Reduce stormwater runoff volume from paved surfaces
- Reduce peak discharge rates.
- Increase recharge through infiltration.
- Reduce pollutant transport through direct infiltration.
- Improve site landscaping benefits (grass pavers only.)

Metropolitan Area Planning Council
MAPC
arc of innovation
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Cover: A driveway in Connecticut built with manufactured paving stones. Lower photo shows paving stone detail. P*hoto: University of Connecticut, Jordan Cove Urban Monitoring Project*

Above: A parking lot with concrete grass paver parking stalls. Lower photo shows grass paver detail. *Photos: Lower Columbia River Estuary Partnership*

Right: A schematic cross section of permeable paving. In some applications, the crushed stone reservoir below the paving is designed to store and infiltrate rooftop runoff as well. *Image: Cahill Associates, Inc. 2004*

Three Major Types of Permeable Paving

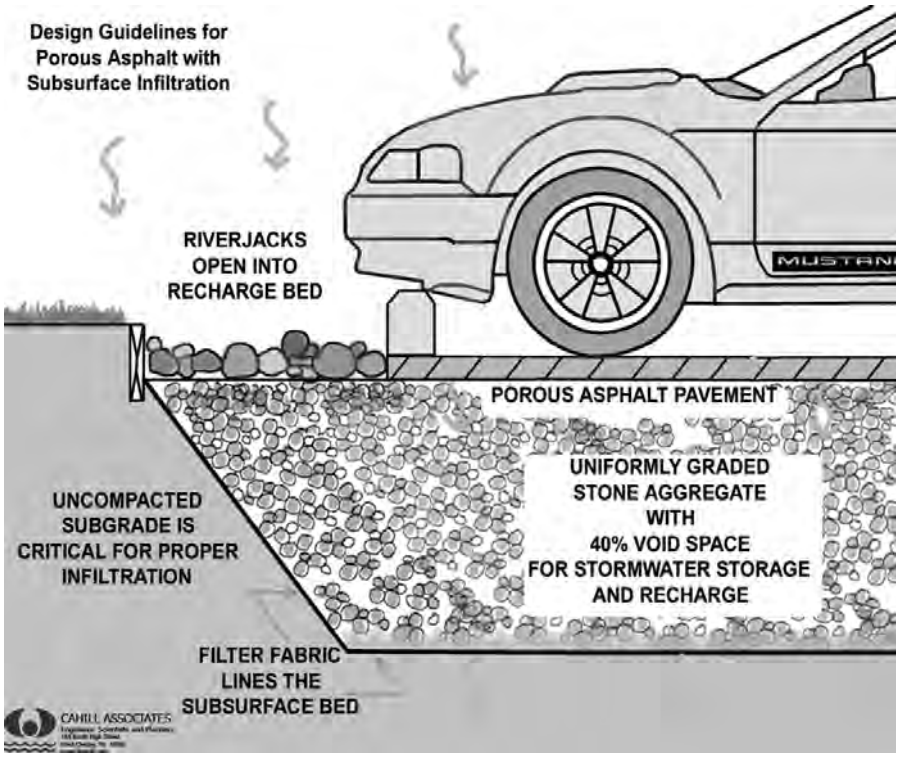
- Porous asphalt and pervious concrete appear to be the same as traditional asphalt or concrete pavement. However, they are mixed with a very low content of fine sand, so that they have 10%-25% void space and a runoff coefficient that is almost zero.
- Paving stones (aka unit pavers) are impermeable blocks made of brick, stone, or concrete, set on a prepared sand base. The joints between the blocks are filled with sand or stone dust to allow water to percolate downward. Runoff coefficients range from 0.1 – 0.7, depending on rainfall intensity, joint width, and materials. Some concrete paving stones have an open cell design to increase permeability.
- Grass pavers (aka turf blocks) are a type of open-cell unit paver in which the cells are filled with soil and planted with turf. The pavers, made of concrete or synthetic, distribute the weight of traffic and prevent compression of the underlying soil. Runoff coefficients are similar to grass, 0.15 to 0.6.

Each of these techniques is constructed over a base course that doubles as a reservoir for the stormwater before it infiltrates into the subsoil. The reservoir should consist of uniformly-sized crushed stone, with a depth sufficient to store all of the rainfall from the design storm. The bottom of the stone reservoir should be completely flat so that infiltrated runoff will be able to infiltrate through the entire surface. Some designs incorporate an "overflow edge," which is a trench surrounding the edge of the pavement. The trench connects to the stone reservoir below the surface of the pavement and acts as a backup in case the surface clogs.

Benefits and Effectiveness

Porous pavement provides groundwater recharge and reduces stormwater runoff volume. Depending on design, paving material, soil type, and rainfall, permeable paving can infiltrate as much as 70% to 80% of annual rainfall.

Porous pavement can reduce peak discharge rates significantly by diverting stormwater into the ground and away from the pipe-and-pond stormwater management system.





Above: A parking lot with conventional asphalt aisles and paving stone parking stalls. Paving stones are most appropriate for low-speed, low-traffic areas. *Photo: Lower Columbia River Estuary Partnership*

- Grass pavers can improve site appearance by providing vegetation where there would otherwise be only pavement.
- Porous paving increases effective developable area on a site because portions of the stormwater management system are located underneath the paved areas, and the infiltration provided by permeable paving can significantly reduce the need for large stormwater management structures on a site.

Limitations

- Permeable paving can be prone to clogging from sand and fine sediments that fill void spaces and the joints between pavers. As a result, it should be used carefully where frequent winter sanding is necessary because the sand may clog the surface of the material. Periodic maintenance is critical, and surfaces should be cleaned with a vacuum sweeper at least three times per year.
- In cold climates, the potential for frost heave may be a concern for the use of permeable paving. Some design manuals recommend excavating the base course to below the frost line, but this may not be necessary in rapidly permeable soils. In addition, the dead air and void spaces in the base course provide insulation so that the frost line is closer to the surface.
- Permeable paving should not receive stormwater from other drainage areas, especially any areas that are not fully stabilized.
- Permeable paving can only be used on gentle slopes (<5%); it cannot be used in high-traffic areas or where it will be subject to heavy axle loads.
- Snow plows can catch the edge of grass pavers and some paving stones. Rollers should be attached to the bottom edge of a snowplow to prevent this problem.



Above: A handicap-accessible park pathway made of permeable paving stones.
Photo: GeoSyntec Consultants, Inc.

Maintenance

- Post signs identifying porous pavement areas.
- Minimize use of salt or sand during winter months
- Keep landscaped areas well-maintained and prevent soil from being transported onto the pavement.
- Clean the surface using vacuum sweeping machines. For paving stones, periodically add joint material (sand) to replace material that has been transported.
- Monitor regularly to ensure that the paving surface drains properly after storms.
- Do not reseal or repave with impermeable materials.
- Inspect the surface annually for deterioration.
- Grass pavers may require periodic reseeding to fill in bare spots.

Design Details

- For all permeable paving, base course is a reservoir layer of 1"-2" crushed stone; depth to be determined by storage required and frost penetration.
- Permeable paving require a single-size grading of base material in order to provide voids for rainwater storage; choice of materials is a compromise between stiffness, permeability, and storage capacity. Use angular crushed rock material with a high surface friction to prevent traffic compaction and rutting.
- The design may also include a 2" thick filter course of 0.5" crushed stone, applied over the base course. A geotextile fabric may be laid at the top of the filter layer to trap sediment and pollutants.
- For grass pavers, use deep-rooted grass species whose roots can penetrate the reservoir base course. Irrigation may be required but should be infrequent soakings so that the turf develops deep root systems. Grass pavers are not suitable for every day, all day parking because the grass will get insufficient sunlight. Better for use as occasional overflow parking.
- The introduction of dirt or sand onto the paving surface, whether transported by runoff from elsewhere or carried by vehicles, will contribute to premature clogging and failure of the paving. Consequently, permeable paving should be constructed as one of the last items to be built on a development site, after most heavy construction vehicles are finished and after the majority of the landscaping work is completed.

Cost

On most sites, permeable paving costs more than conventional asphalt or cement paving techniques. In the case of porous asphalt and pervious concrete, construction costs may be 50% more than conventional asphalt and concrete. Construction costs of paving stones and grass pavers varies considerably and will depend on the application. As with any site improvement or stormwater management structure, property owners should provide a budget for maintenance of permeable paving, at an annual rate of 1%-2% of construction costs.

Permeable paving reduces the need for stormwater conveyances and treatment structures, resulting in cost savings elsewhere. Permeable paving also reduces the amount of land needed for stormwater management and may satisfy requirements for greenspace, allowing more development on a site.

Local Case Study

West Farms Mall – West Hartford, CT

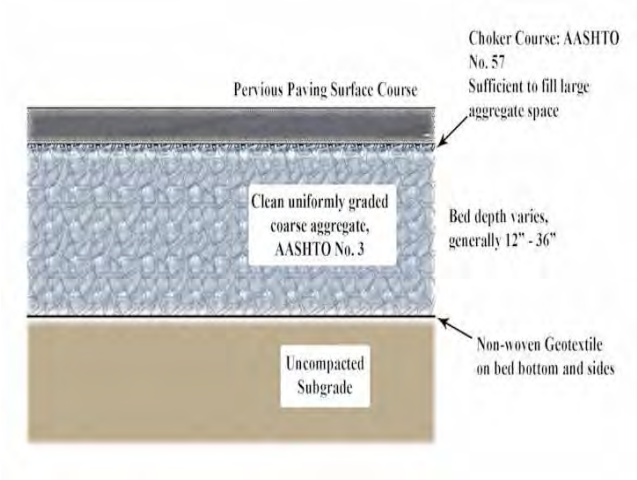
Grass pavers were installed at the West Farms Mall off of I-84 at exit 40, to handle peak-season overflow parking associated with a mall expansion. Over four acres of reinforced turf was designed to accommodate 700 spaces of overflow parking for the peak shopping seasons. There are a few drains installed in the reinforced turf but are only used during very heavy storms. Because the reinforced turf works so well the existing storm drainage system did not have to be enlarged for the additional parking. The overflow parking area needs to be mowed on a regular basis and treated like a regular lawn. The area also needs to be plowed as any parking would be. Rollers were fit to the bottom of the snow plow so the reinforced turf would not be damaged. The manager of the Westfarms facility is satisfied with the turf.

Websites

www.unh.edu/erg/cstev/index.htm
www.invisiblestructures.com/GP2/whole_lotof_turf.htm
www.uni-groupusa.org/case.htm
www.nemo.uconn.edu/
www.lowimpactdevelopment.org/epa03/pavespec.htm
www.epa.gov/ednnrmrl/repository/abstrac2/abstra2.htm
www.forester.net/sw_0503_advances.html

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BMP 6.4.1: Pervious Pavement with Infiltration Bed



Pervious pavement consists of a permeable surface course underlain by a uniformly-graded stone bed which provides temporary storage for peak rate control and promotes infiltration. The surface course may consist of porous asphalt, porous concrete, or various porous structural pavers laid on uncompacted soil.

Key Design Elements

- Almost entirely for peak rate control
- Water quality and quantity are not addressed
- Short duration storage; rapid restoration of primary uses
- Minimize safety risks, potential property damage, and user inconvenience
- Emergency overflows
- Maximum ponding depths
- Flow control structures
- Adequate surface slope to outlet

Potential Applications

Residential: Limited
Commercial: Yes
Ultra Urban: Yes
Industrial: Yes
Retrofit: Yes
Highway/Road: Limited

Stormwater Functions

Volume Reduction: Medium
Recharge: Medium
Peak Rate Control: Medium
Water Quality: Medium

Water Quality Functions

TSS: 85%
TP: 85%
NO3: 30%

Other Considerations

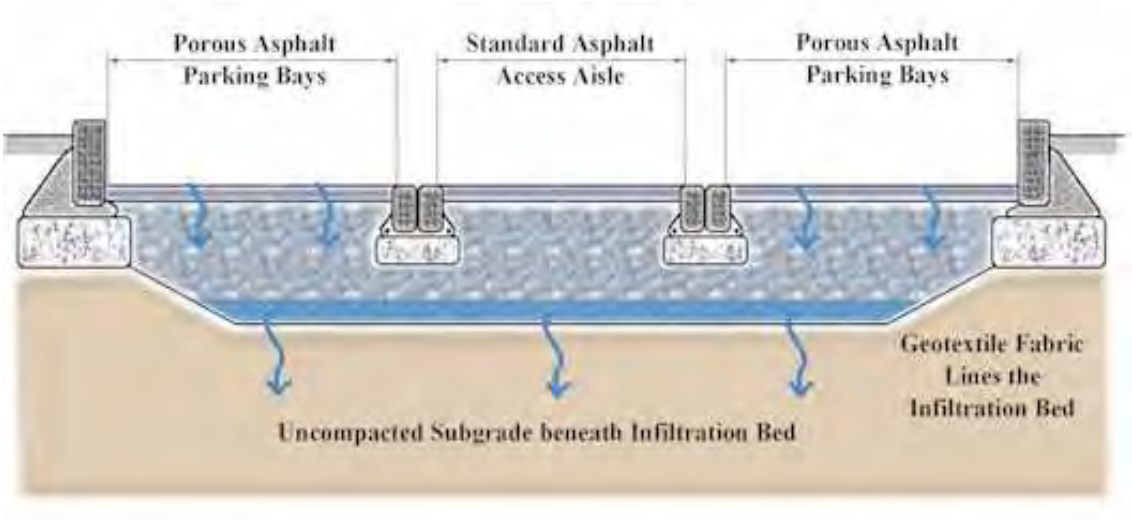
- **Protocol 1. Site Evaluation and Soil Infiltration Testing** and **Protocol 2. Infiltration Systems Guidelines** should be followed, see Appendix C

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Description

A pervious pavement bed consists of a pervious surface course underlain by a stone bed of uniformly graded and clean-washed coarse aggregate, 1-1/2 to 2-1/2 inches in size, with a void space of at least 40%. The pervious pavement may consist of pervious asphalt, pervious concrete, or pervious pavement units. Stormwater drains through the surface, is temporarily held in the voids of the stone bed, and then slowly drains into the underlying, uncompacted soil mantle. The stone bed can be designed with an overflow control structure so that during large storm events peak rates are controlled, and at no time does the water level rise to the pavement level. A layer of geotextile filter fabric separates the aggregate from the underlying soil, preventing the migration of fines into the bed. The bed bottoms should be level and uncompacted. If new fill is required, it should consist of additional stone and not compacted soil.





Pervious pavement is well suited for parking lots, walking paths, sidewalks, playgrounds, plazas, tennis courts, and other similar uses. Pervious pavement can be used in driveways if the homeowner is aware of the stormwater functions of the pavement. Pervious pavement roadways have seen wider application in Europe and Japan than in the U.S., although at least one U.S. system has been constructed . In Japan and the U.S., the application of an open-graded asphalt pavement of 1” or less on roadways has been used to provide lateral surface drainage and prevent hydroplaning, but these are applied over impervious pavement on compacted sub-grade. This application is not pervious pavement.

Properly installed and maintained pervious pavement has a significant life-span, and existing systems that are more than twenty years in age continue to function. Because water drains through the surface

course and into the subsurface bed, freeze-thaw cycles do not tend to adversely affect pervious pavement.

Pervious pavement is most susceptible to failure difficulties during construction, and therefore it is important that the construction be undertaken in such as way as to **prevent**:

- Compaction of underlying soil
- Contamination of stone subbase with sediment and fines
- Tracking of sediment onto pavement
- Drainage of sediment laden waters onto pervious surface or into constructed bed

Staging, construction practices, and erosion and sediment control must all be taken into consideration when using pervious pavements.

Studies have shown that pervious systems have been very effective in reducing contaminants such as total suspended solids, metals, and oil and grease. When designed, constructed, and maintained according to the following guidelines, pervious pavement with underlying infiltration systems can dramatically reduce both the rate and volume of runoff, recharge the groundwater, and improve water quality.



In northern climates, pervious pavements have less of a tendency to form black ice and often require less plowing. Winter maintenance is described on page 17. Pervious asphalt and concrete surfaces provide better traction for walking paths in rain or snow conditions.

Variations

Pervious Bituminous Asphalt

Early work on pervious asphalt pavement was conducted in the early 1970's by the Franklin Institute in Philadelphia and consists of standard bituminous asphalt in which the fines have been screened and reduced, allowing water to pass through small voids. Pervious asphalt is placed directly on the stone subbase in a single 3 ½ inch lift that is lightly rolled to a finish depth of 2 ½ inches.

Because pervious asphalt is standard asphalt with reduced fines, it is similar in appearance to standard asphalt. Recent research in open-graded mixes for highway application has led to additional improvements in pervious asphalt through the use of additives and higher-grade binders. Pervious asphalt is suitable for use in any climate where standard asphalt is appropriate.



Pervious Concrete

Pervious Portland Cement Concrete, or pervious concrete, was developed by the Florida Concrete Association and has seen the most widespread application in Florida and southern areas. Like pervious asphalt, pervious concrete is produced by substantially reducing the number of fines in the mix in order to establish voids for drainage. In northern and mid-Atlantic climates such as Pennsylvania, pervious concrete should always be underlain by a stone subbase designed for stormwater management and should never be placed directly onto a soil subbase.

While pervious asphalt is very similar in appearance to standard asphalt, pervious concrete has a coarser appearance than its conventional counterpart. Care must be taken during placement to avoid working the surface and creating an impervious layer. Pervious concrete has been proven to be an effective stormwater management BMP. Additional information pertaining to pervious concrete, including specifications, is available from the Florida Concrete Association and the National Ready Mix Association.







Pervious Paver Blocks



Pervious Paver Blocks consist of interlocking units (often concrete) that provide some portion of surface area that may be filled with a pervious material such as gravel. These units are often very attractive and are especially well suited to plazas, patios, small parking areas, etc. A number of manufactured products are available, including (but not limited to):

- Turfstone; UNI Eco-stone; Checkerblock; EcoPaver

As products are always being developed, the designer is encouraged to evaluate the benefits of various products with respect to the specific application. Many paver products recommend compaction of the soil and do not include a drainage/storage area, and therefore, they do not provide optimal stormwater management benefits. A system with a compacted subgrade will not provide significant infiltration.

Reinforced Turf and Gravel Filled Grids

Reinforced Turf consists of interlocking structural units that contain voids or areas for turf grass growth and are suitable for traffic loads and parking. Reinforced turf units may consist of concrete or plastic and are underlain by a stone and/or sand drainage system for stormwater management There are also products available that provide a fully permeable surface through the use of plastic rings/grids filled with gravel..

Reinforced Turf applications are excellent for Fire Access Roads, overflow parking, occasional use parking (such as at religious facilities and athletic facilities). Reinforced turf is also an excellent application to reduce the required standard pavement width of paths and driveways that must occasionally provide for emergency vehicle access.

While both plastic and concrete units perform well for stormwater management and traffic needs, plastic units tend to provide better turf establishment and longevity, largely because the plastic will not absorb water and diminish soil moisture conditions. A number of products (e.g. Grasspave, Geoblock, GravelPave, Grassy Pave, Geoweb) are available and the designer is encouraged to evaluate and select a product suitable to the design in question.





Applications

Parking

Walkways

Pervious Pavement Walkways

Pervious pavement has also been used in walkways and sidewalks. These installations typically consist of a shallow (8 in. minimum) aggregate trench that is sloped to follow the surface slope of the path. In the case of relatively mild surface slopes, the aggregate infiltration trench may be "terraced" into level reaches in order to maximize the infiltration capacity, at the expense of additional aggregate.





Playgrounds



Alleys

Roof drainage; Direct connection of roof leaders and/or inlets





Limited use for roads and highways





Design Considerations

1. Protocol 1, Site Evaluation and Soil Infiltration Testing required (see Appendix C).

2. Protocol 2, Infiltration Systems Guidelines must be met (see Appendix C).

3. The overall site should be evaluated for potential pervious pavement / infiltration areas early in the design process, as effective pervious pavement design requires consideration of grading.

4. Orientation of the parking bays along the existing contours will significantly reduce the need for cut and fill.

5. Pervious pavement and infiltration beds **should not be placed on areas of recent fill** or compacted fill. Any grade adjust requiring fill should be done using the stone subbase material. Areas of historical fill (>5 years) may be considered for pervious pavement.

6. The bed bottom should not be compacted, however the stone subbase should be placed in lifts and lightly rolled according to the specifications.

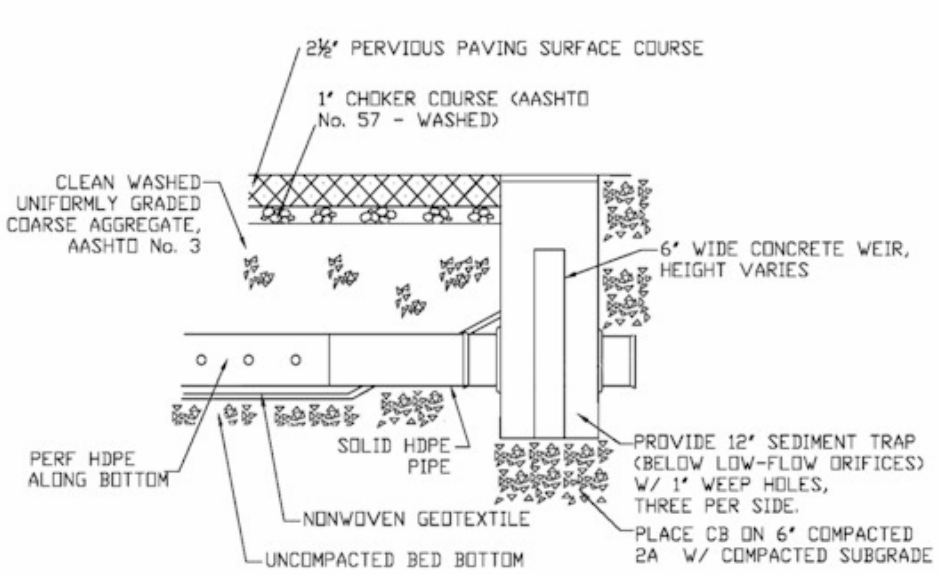
7. During construction, the excavated bed may serve as a temporary sediment basin or trap. This will reduce overall site disturbance. The bed should be excavated to within twelve (12) inches of the final bed bottom elevation for use as a sediment trap or basin. Following construction and site stabilization, sediment should be removed and final grades established.

8. **Bed bottoms should be level or nearly level**. Sloping bed bottoms will lead to areas of ponding and reduced distribution.

9. **All systems should be designed with an overflow system**. Water within the subsurface stone bed should never rise to the level of the pavement surface. Inlet boxes can be used for cost-effective overflow structures. All beds should empty to meet the criteria in Chapter 3.

10. While infiltration beds are typically sized to handle the increased volume from a storm, they should also be able to convey and mitigate the peak of the less-frequent, more intense storms (such as the 100-yr). Control in the beds is usually provided in the form of an outlet control structure. A modified inlet box with an internal weir and low-flow orifice is a common type of control structure. The specific design of these structures may vary, depending on factors such as rate and storage requirements, but it always should include positive overflow from the system.

11. The subsurface bed and overflow may be designed and evaluated in the same manner as a detention basin to demonstrate the mitigation of peak flow rates. In this manner, the need for a detention basin may be eliminated or reduced in size.



12. A weir plate or weir within an inlet or overflow control structure may be used to maximize the water level in the stone bed while providing sufficient cover for overflow pipes.

13. Perforated pipes along the bottom of the bed may be used to evenly distribute runoff over the entire bed bottom. Continuously perforated pipes should connect structures (such as cleanouts and inlet boxes). Pipes should lay flat along the bed bottom and provide for uniform distribution of water. Depending on size, these pipes may provide additional storage volume.

14. Roof leaders and area inlets may be connected to convey runoff water to the bed. Water Quality Inserts or Sump Inlets should be used to prevent the conveyance of sediment and debris into the bed.

15. Infiltration areas should be located within the immediate project area in order to control runoff at its source. Expected use and traffic demands should also be considered in pervious pavement placement.

16. Control of sediment is critical. Rigorous installation and maintenance of erosion and sediment control measures should be provided to prevent sediment deposition on the pavement surface or within the stone bed. Nonwoven geotextile may be folded over the edge of the pavement until the site is stabilized. The Designer should consider the placement of pervious pavement to reduce the likelihood of sediment deposition. Surface sediment should be removed by a vacuum sweeper and should not be power-washed into the bed.

17. Infiltration beds may be placed on a slope by benching or terracing parking bays**.** Orienting parking bays along existing contours will reduce site disturbance and cut/fill requirements.



18. The underlying infiltration bed is typically 12-36 inches deep and comprised of clean, uniformly graded aggregate with approximately 40% void space. AASHTO No.3, which ranges 1.5-2.5 inches in gradation, is often used. Depending on local aggregate availability, both larger and smaller size aggregate has been used. The critical requirements are that the aggregate be uniformly graded, clean washed, and contain a significant void content. The depth of the bed is a function of stormwater storage requirements, frost depth considerations, site grading, and anticipated loading. Infiltration beds are typically sized to mitigate the increased runoff volume from a 2-yr design storm.

19. Most pervious pavement installations are underlain by an aggregate bed; alternative subsurface storage products may also be employed. These include a variety of proprietary, interlocking plastic units that contain much greater storage capacity than aggregate, at an increased cost.

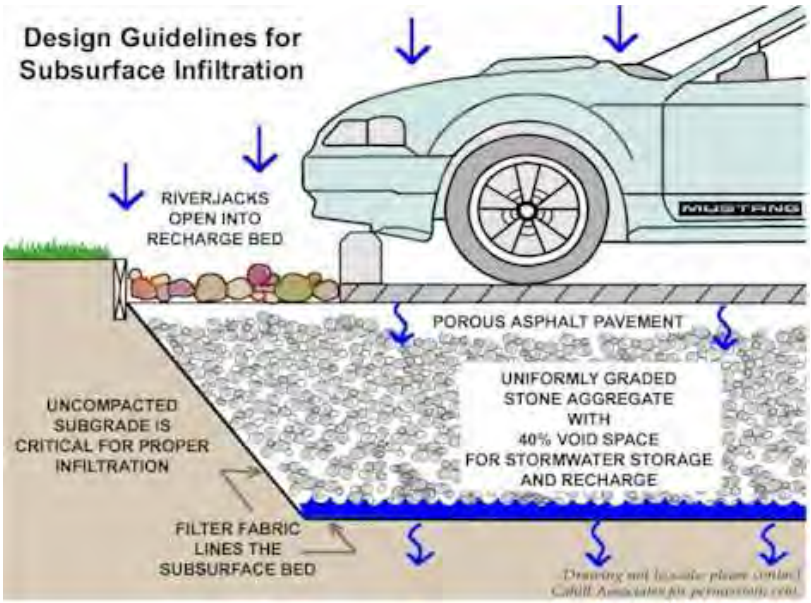
20. All pervious pavement installations should have a backup method for water to enter the stone storage bed in the event that the pavement fails or is altered. In uncurbed lots, this backup drainage may consist of an unpaved 2 ft wide stone edge drain connected directly to the bed. In curbed lots, inlets with water quality devices may be required at low spots. Backup drainage elements will ensure the functionality of the infiltration system, if the pervious pavement is compromised.



21. In areas with poorly draining soils, infiltration beds below pervious pavement may be designed to slowly discharge to adjacent wetlands or bioretention areas. Only in extreme cases (i.e. industrial sites with contaminated soils) will the aggregate bed need to be lined to prevent infiltration.

22. In those areas where the threat of spills and groundwater contamination is likely, pretreatment systems, such as filters and wetlands, may be required before any infiltration occurs. In hot spot areas, such as truck stops, and fueling stations, the appropriateness of pervious pavement must be carefully considered. A stone infiltration bed located beneath standard pavement, preceded by spill control and water quality treatment, may be more appropriate.

23. The use of pervious pavement must be carefully considered in areas where the pavement may be seal coated or paved over due to lack of awareness, such as individual home driveways. In those situations, a system that is not easily altered by the property owner may be more appropriate. An example would include an infiltration system constructed under a conventional driveway. Educational signage at pervious pavement installations may guarantee its prolonged use in some areas.



Detailed Stormwater Functions

Volume Reduction Calculations

Volume = Depth* (ft) x Area (sf) x Void Space

*Depth is the depth of the water stored during a storm event, depending on the drainage area and conveyance to the bed.

Infiltration Volume = Bed Bottom Area (sf) x Infiltration design rate (in/hr) x Infiltration period* (hr) x (1/12)

*Infiltration Period is the time when bed is receiving runoff and capable of infiltrating at the design rate. Not to exceed 72 hours.

Peak Rate Mitigation
See in Chapter 8 for Peak Rate Mitigation methodology that addresses link between volume reduction and peak rate control.

Water Quality Improvement
See in Chapter 8 for Water Quality methodology that addresses pollutant removal effectiveness of this BMP.

Construction Sequence

1. Due to the nature of construction sites, pervious pavement and other infiltration measures should by installed toward the end of the construction period, if possible. Infiltration beds under pervious pavement may be used as temporary sediment basins or traps provided that they are not excavated to within 12 inches of the designated bed bottom elevation. Once the site is stabilized and sediment storage is no longer required, the bed is excavated to the its final grade and the pervious pavement system is installed.

2. The existing subgrade under the bed areas should NOT be compacted or subject to excessive construction equipment traffic prior to geotextile and stone bed placement.

3. Where erosion of subgrade has caused accumulation of fine materials and/or surface ponding, this material shall be removed with light equipment and the underlying soils scarified to a minimum depth of 6 inches with a York rake (or equivalent) and light tractor. All fine grading shall be done by hand. All bed bottoms should be at a level grade.



4. Earthen berms (if used) between infiltration beds should be left in place during excavation. These berms do not require compaction if proven stable during construction.

5. Geotextile and bed aggregate should be placed immediately after approval of subgrade preparation. Geotextile should be placed in accordance with manufacturer's standards and recommendations. Adjacent strips of geotextile should overlap a minimum of 16 in. It should also be secured at least 4 ft. outside of bed in order to prevent any runoff or sediment from entering the storage bed. This edge strip should remain in place until all bare soils contiguous to beds are stabilized and vegetated. As the site is fully stabilized, excess geotextile along bed edges can be cut back to bed edge.

6. Clean (washed) uniformly graded aggregate is placed in the bed in 8-inch lifts. Each layer should be lightly compacted, with the construction equipment kept off the bed bottom as much as possible. Once bed aggregate is installed to the desired grade, a +/- 1 in. layer of choker base course (AASHTO #57) aggregate should be installed uniformly over the surface in order to provide an even surface for paving.





7. The pervious pavement should be installed in accordance with current standards. Further information can be obtained from the appropriate Association.

The full permeability of the pavement surface should be tested by application of clean water at the rate of at least 5 gpm over the surface, using a hose or other distribution devise. All applied water should infiltrate directly without puddle formation or surface runoff.

Maintenance Issues

The primary goal of pervious pavement maintenance is to prevent the pavement surface and/or underlying infiltration bed from being clogged with fine sediments. To keep the system clean throughout the year and prolong its life span, the pavement surface should be vacuumed biannually with a commercial cleaning unit**. Pavement washing systems or compressed air units are not recommended.** All inlet structures within or draining to the infiltration beds should also be cleaned out biannually.

Planted areas adjacent to pervious pavement should be well maintained to prevent soil washout onto the pavement. If any washout does occur it should be cleaned off the pavement immediately to prevent further clogging of the pores. Furthermore, if any bare spots or eroded areas are observed within the planted areas, they should be replanted and/or stabilized at once. Planted areas should be inspected on a semiannual basis. All trash and other litter that is observed during these inspections should be removed.

Superficial dirt does not necessarily clog the pavement voids. However, dirt that is ground in repeatedly by tires can lead to clogging. Therefore, trucks or other heavy vehicles should be prevented from tracking or spilling dirt onto the pavement. Furthermore, all construction or hazardous materials carriers should be prohibited from entering a pervious pavement lot.

Special Maintenance Considerations:

- Prevent Clogging of Pavement Surface with Sediment
  - Vacuum pavement 2 or 3 times per year
  - Maintain planted areas adjacent to pavement
  - Immediately clean any soil deposited on pavement
  - Do not allow construction staging, soil/mulch storage, etc. on unprotected pavement surface
  - Clean inlets draining to the subsurface bed twice per year

Winter Maintenance

Winter maintenance for a pervious parking lot may be necessary but is usually less intensive than that required for a standard impervious surface. By its very nature, a pervious pavement system with subsurface aggregate bed has superior snow melting characteristics than standard pavement. The underlying stone bed tends to absorb and retain heat so that freezing rain and snow melt faster on pervious pavement. Therefore, ice and light snow accumulation are generally not as problematic. However, snow will accumulate during heavier storms. Abrasives such as sand or cinders should not be applied on or adjacent to the pervious pavement. Snow plowing is fine, provided it is done carefully (i.e. by setting the blade slightly higher than usual, about an inch). Salt is acceptable for use as a deicer on the pervious pavement, though nontoxic, organic deicers, applied either as blended, magnesium chloride-based liquid products or as pretreated salt, are preferable.

Repairs

Potholes in the pervious pavement are unlikely; though settling might occur if a soft spot in the subgrade is not removed during construction. For damaged areas of less than 50 square feet, a declivity could be patched by any means suitable with standard pavement, with the loss of porosity of that area being insignificant. The declivity can also be filled with pervious mix. If an

area greater than 50 sq. ft. is in need of repair, approval of patch type should be sought from either the engineer or owner. Under no circumstance should the pavement surface ever be seal coated. Any required repair of drainage structures should be done promptly to ensure continued proper functioning of the system.

Cost Issues

- Pervious asphalt, with additives, is generally 10% to 20% higher (2005) in cost than standard asphalt on a unit area basis.
- Pervious concrete as a material is generally more expensive than asphalt and requires more labor and experience for installation due to specific material constraints.
- Permeable interlocking concrete pavement blocks vary in cost depending on type and manufacturer.

The added cost of a pervious pavement/infiltration system lies in the underlying stone bed, which is generally deeper than a conventional subbase and wrapped in geotextile. However, this additional cost is often offset by the significant reduction in the required number of inlets and pipes. Also, since pervious pavement areas are often incorporated into the natural topography of a site, there generally is less earthwork and/or deep excavations involved. Furthermore, pervious pavement areas with subsurface infiltration beds often eliminate the need (and associated costs, space, etc.) for detention basins. When all of these factors are considered, pervious pavement with infiltration has proven itself less expensive than the impervious pavement with associated stormwater management. Recent (2005) installations have averaged between $2000 and $2500 per parking space, for the pavement and stormwater management.

Specifications

The following specifications are provided for informational purposes only. These specifications include information on acceptable materials for typical applications, but are by no means exclusive or limiting. The designer is responsible for developing detailed specifications for individual design projects in accordance with the project conditions.

1. **Stone** for infiltration beds shall be 2-inch to 1-inch uniformly graded coarse aggregate, with a wash loss of no more than 0.5%, AASHTO size number 3 per AASHTO Specifications, Part I, 19th Ed., 1998, or later and shall have voids 40% as measured by ASTM-C29. Choker base course aggregate for beds shall be 3/8 inch to 3/4 inch uniformly graded coarse aggregate AASHTO size number 57 per Table 4, AASHTO Specifications, Part I, 13th Ed., 1998 (p. 47).

2. **Non-Woven Geotextile** shall consist of needled nonwoven polypropylene fibers and meet the following properties:
   a. Grab Tensile Strength (ASTM-D4632) ≥ 120 lbs
   b. Mullen Burst Strength (ASTM-D3786) ≥ 225 psi
   c. Flow Rate (ASTM-D4491) ≥ 95 gal/min/ft^2
   d. UV Resistance after 500 hrs (ASTM-D4355) ≥ 70%
   e. Heat-set or heat-calendared fabrics are not permitted.

   Acceptable types include Mirafi 140N, Amoco 4547, Geotex 451, or approved others.

3. **Pipe** shall be continuously perforated, smooth interior, with a minimum inside diameter of 6-inches. High-density polyethylene (HDPE) pipe shall meet AASHTO M252, Type S or AASHTO M294, Type S.

4. **Storm Drain Inlets and Structures**
   a. Concrete Construction: Concrete construction shall be in accordance with PennDOT Pub. 4082003 including current supplements or latest edition.

   b. Precast concrete iInlets and manholes: Precast concrete inlets may be substituted for cast-in-place structures and shall be constructed as specified for cast-in-place. Standard inlet boxes will be modified to provide minimum 12" sump storage and bottom leaching basins, open to gravel sumps in sub-grade, when situated in the recharge bed.

   c. All PVC Catch Basins/Cleanouts/Inline Drains shall have H-10 or H-20 rated grates, depending on their placement (H-20 if vehicular loading).

   d. Steel reinforcing bars over the top of the outlet structure shall conform to ASTM A615, grades 60 and 40.

   e. Permanent turf reinforcement matting shall be installed according to manufacturers' specifications.

5. **Pervious Bituminous Asphalt**
   Bituminous surface course for **pervious paving** should be two and one-half (2.5) inches thick with a bituminous mix of 5.75% to 6% by weight dry aggregate. **In accordance with ASTM D6390, drain down of the binder shall be no greater than 0.3%**. If more absorptive aggregates, such as limestone, are used in the mix, then the amount of bitumen is to be based on the testing procedures outlined in the National Asphalt Pavement Association's Information Series 131 – "Pervious Asphalt Pavements" (2003) or PennDOT equivalent.

   Use neat asphalt binder modified with an elastomeric polymer to produce a binder meeting the requirements of PG 76-22 as specified in AASHTO MP-1. The elastomer polymer shall be styrene-butadiene-styrene (SBS), or approved equal, applied at a rate of 3% by weight of the total binder. The composite materials shall be thoroughly blended at the asphalt refinery or terminal prior to being loaded into the transport vehicle. The polymer modified asphalt binder shall be heat and storage stable.

   Aggregate shall be minimum 90% crushed material and have a gradation of:

U.S. Standard Sieve Size	Percent Passing
½ (12.5 mm)	100
3/8 (9.5 mm)	92-98
4 (4.75 mm)	34-40
8 (2.36 mm)	14-20
16 (1.18 mm)	7-13
30 (0.60 mm)	0-4
200 (0.075mm)	0-2

   Add hydrated lime at a dosage rate of 1.0% by weight of the total dry aggregate to mixes containing granite. Hydrated lime shall meet the requirements of ASTM C 977. The additive must be able to prevent the separation of the asphalt binder from the aggregate and achieve a

required tensile strength ratio (TSR) of at least 80% on the asphalt mix when tested in accordance with AASHTO T 283. The asphaltic mix shall be tested for its resistance to stripping by water in accordance with ASTM D-1664. If the estimated coating area is not above 95 percent, anti-stripping agents shall be added to the asphalt.

Pervious pavement shall not be installed on wet surfaces or when the ambient air temperature is 50 degrees Fahrenheit or lower. The temperature of the bituminous mix shall be between 300 degrees Fahrenheit and 350 degrees Fahrenheit (based on the recommendations of the asphalt supplier).

6. Pervious Concrete

GENERAL

Weather Limitations: Do not place Portland cement pervious pavement mixtures when the ambient temperature is 40 degrees Fahrenheit or lower or 90 degrees Fahrenheit or higher, unless otherwise permitted in writing by the Engineer.

Test Panels: Regardless of qualification, Contractor is to place, joint and cure at least two test panels, each to be a minimum of 225 sq. ft. at the required project thickness to demonstrate to the Engineer's satisfaction that in-place unit weights can be achieved and a satisfactory pavement can be installed at the site location.

Test panels may be placed at any of the specified Portland Cement pervious locations. Test panels shall be tested for thickness in accordance with ASTM C 42; void structure in accordance with ASTM C 138; and for core unit weight in accordance with ASTM C 140, paragraph 6.3.

Satisfactory performance of the test panels will be determined by:
Compacted thickness no less than ¼" of specified thickness.

Void Structure: 15% minimum; 21% maximum. Unit weight plus or minus 5 pcf of the design unit weight.

If measured void structure falls below 15% or if measured thickness is greater than ¼" less than the specified thickness of if measured weight falls less than 5 pcf below unit weight, the test panel shall be removed at the contractor's expense and disposed of in an approved landfill.

If the test panel meets the above-mentioned requirements, it can be left in-place and included in the completed work.

CONCRETE MIX DESIGN
Contractor shall furnish a proposed mix design with proportions of materials to the Engineer prior to commencement of work. The data shall include unit weights determined in accordance with ASTM C29 paragraph 11, jigging procedure.

MATERIALS
Cement: Portland Cement Type I or II conforming to ASTM C 150 or Portland Cement Type IP or IS conforming to ASTM C 595.

Aggregate: Use No 8 coarse aggregate (3/8 to No. 16) per ASTM C 33 or No. 89 coarse aggregate (3/8 to No. 50) per ASTM D 448. If other gradation of aggregate is to be used, submit data on proposed material to owner for approval.

Air Entraining Agent: Shall comply with ASTM C 260 and shall be used to improve resistance to freeze/thaw cycles.

Admixtures: The following admixtures shall be used:
Type D Water Reducing/Retarding – ASTM C 494.
A hydration stabilizer that also meets the requirements of ASTM C 494 Type B Retarding or Type D Water Reducing/Retarding admixtures. This stabilizer suspends cement hydration by forming a protective barrier around the cementitious particles, which delays the particles from achieving initial set.

Water: Potable shall be used.

Proportions:
Cement Content: For pavements subjected to vehicular traffic loading, the total cementitious material shall not be less than 600 lbs. Per cy.
Aggregate Content: the volume of aggregate per cu. yd. shall be equal to 27 cu.ft. when calculated as a function of the unit weight determined in accordance with ASTM C 29 jigging procedure. Fine aggregate, if used, should not exceed 3 cu. ft. and shall be included in the total aggregate volume.

Admixtures: Shall be used in accordance with the manufacturer's instructions and recommendations.

Mix Water: Mix water shall be such that the cement paste displays a wet metallic sheen without causing the paste to flow from the aggregate. (Mix water yielding a cement paste with a dull-dry appearance has insufficient water for hydration).

- Insufficient water results in inconsistency in the mix and poor bond strength.
- High water content results in the paste sealing the void system primarily at the bottom and poor surface bond.

An aggregate/cement (A/C) ratio range of 4:1 to 4.5:1 and a water/cement (W/C) ratio range of 0.34 to 0.40 should produce pervious pavement of satisfactory properties in regard to permeability, load carrying capacity, and durability characteristics.

INSTALLATION
Portland Cement Pervious Pavement Concrete Mixing, Hauling and Placing:
Mix Time: Truck mixers shall be operated at the speed designated as mixing speed by the manufacturer for 75 to 100 revolutions of the drum.

Transportation: The Portland Cement aggregate mixture may be transported or mixed on site and should be used within one (1) hour of the introduction of mix water, unless otherwise approved by an engineer. This time can be increased to 90 minutes when utilizing the specified hydration stabilizer. Each truck should not haul more than two (2) loads before being cycled to another type concrete. Prior to placing concrete, the subbase shall be moistened and in a wet condition. Failure to provide a moist subbase will result in a reduction in strength of the pavement.

Discharge: Each mixer truck will be inspected for appearance of concrete uniformity according to this specification. Water may be added to obtain the required mix consistency. A minimum of 20 revolutions at the manufacturer's designated mixing speed shall be required following any addition of water to the mix. Discharge shall be a continuous operation and shall be completed as quickly as possible. Concrete shall be deposited as close to its final position as practicable and such that fresh concrete enters the mass of previously placed concrete. The practice of discharging onto subgrade and pulling or shoveling to final placement is not allowed.

Placing and Finishing Equipment: Unless otherwise approved by the Owner or Engineer in writing, the Contractor shall provide mechanical equipment of either slipform or form riding with a following compactive unit that will provide a minimum of 10 psi vertical force. The pervious concrete pavement will be placed to the required cross section and shall not deviate more than +/- 3/8 inch in 10 feet from profile grade. If placing equipment does not provide the minimum specified vertical force, a full width roller or other full width compaction device that provides sufficient compactive effort shall be used immediately following the strike-off operation. After mechanical or other approved strike-off and compaction operation, no other finishing operation will be allowed. If vibration, internal or surface applied, is used, it shall be shut off immediately when forward progress is halted for any reason. The Contractor will be restricted to pavement placement widths of a maximum of fifteen (15') feet unless the Contractor can demonstrate competence to provide pavement placement widths greater than that to the satisfaction of the Engineer.

Curing: Curing procedures shall begin within 20 minutes after the final placement operations. The pavement surface shall be covered with a minimum six-(6) mil thick polyethylene sheet or other approved covering material. Prior to covering, a fog or light mist shall be sprayed above the surface when required due to ambient conditions (high temperature, high wind, and low humidity). The cover shall overlap all exposed edges and shall be secured (without using dirt) to prevent dislocation due to winds or adjacent traffic conditions.

Cure Time:

1. Portland Cement Type I, II, or IS – 7 days minimum.
2. No truck traffic shall be allowed for 10 days (no passenger car/light trucks for 7 days).

Jointing: Control (contraction) joints shall be installed at 20-foot intervals. They shall be installed at a depth of the 1/ 4 the thickness of the pavement. These joints can be installed in the plastic concrete or saw cut. If saw cut, the procedure should begin as soon as the pavement has hardened sufficiently to prevent raveling and uncontrolled cracking (normally after curing). Transverse constructions joints shall be installed whenever placing is suspended a sufficient length of time that concrete may begin to harden. In order to assure aggregate bond at construction joints, a bonding agent suitable for bonding fresh concrete shall be brushed, tolled, or sprayed on the existing pavement surface edge. Isolation (expansion) joints will not be used except when pavement is abutting slabs or other adjoining structures.

TESTING, INSPECTION, AND ACCEPTANCE

Laboratory Testing:
The owner will retain an independent testing laboratory. The testing laboratory shall conform to the applicable requirements of ASTM E 329 "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction" and ASTM C 1077 "Standard Practice for Testing Concrete and Concrete Aggregates for use in Construction, and Criteria for Laboratory Evaluation" and shall be inspected and accredited by the Construction Materials Engineering Council, Inc. or by an equivalent recognized national authority.

The Agent of the testing laboratory performing field sampling and testing of concrete shall be certified by the American Concrete Institute as a Concrete Field Testing Technician Grade I, or by a recognized state or national authority for an equivalent level of competence.

Testing and Acceptance:
A minimum of 1 gradation test of the subgrade is required every 5000 square feet to determine percent passing the No. 200 sieve per ASTM C 117.
A minimum of one test for each day's placement of pervious concrete in accordance with ASTM C 172 and ASTM C 29 to verify unit weight shall be conducted. Delivered unit weights are to be determined in accordance with ASTM C 29 using a 0.25 cubic foot cylindrical metal measure. The measure is to be filled and compacted in accordance with ASTM C 29 paragraph 11, jigging procedure. The unit weight of the delivered concrete shall be +/- 5 pcf of the design unit weight.

Test panels shall have two cores taken from each panel in accordance with ASTM 42 at a minimum of seven (7) days after placement of the pervious concrete. The cores shall be measured for thickness, void structure, and unit weight. Untrimmed, hardened core samples shall be used to determine placement thickness. The average of all production cores shall not be less than the specified thickness with no individual core being more than ½ inch less than the specified thickness. After thickness determination, the cores shall be trimmed and measured for unit weight in the saturated condition as described in paragraph 6.3.1 of 'Saturation' of ASTM C 140 "Standard Methods of Sampling and Testing Concrete Masonry Units." The trimmed cores shall be immersed in water for 24 hours, allowed to drain for one (1) minute, surface water removed with a damp cloth, then weighed immediately. Range of satisfactory unit weight values are +/- 5 pcf of the design unit weight.

After a minimum of 7 days following each placement, three cores shall be taken in accordance with ASTM C 42. The cores shall be measured for thickness and unit weight determined as described above for test panels. Core holes shall be filled with concrete meeting the pervious mix design.

References and Additional Sources

Adams, Michele (2003). Porous Asphalt Pavement with Recharge Beds: 20 Years & Still Working, *Stormwater* 4, 24-32.

Backstrom, Magnus (1999). *Porous Pavement in a Cold Climate*, Licentiate Thesis, Lulea, Sweden: Lulea University of Technology (http://epubl.luth.se).

Cahill, Thomas (1993). *Porous Pavement with Underground Recharge Beds, Engineering Design Manual*, West Chester Pennsylvania: Cahill Associates.

Cahill, Thomas (1994). A Second Look at Porous Pavement/Underground Recharge, *Watershed Protection Techniques*, 1, 76-78.

Cahill, Thomas, Michele Adams, and Courtney Marm (2003). Porous Asphalt: The Right Choice for Porous Pavements, *Hot Mix Asphalt Technology* September-October.

Ferguson, Bruce (2005). *Porous Pavements*, Boca Raton, Florida: CRC Press.

Florida Concrete and Products Association (no date). *Construction of a Portland Cement Pervious Pavement*, Orlando: Florida Concrete and Products Association.

Hossain, Mustaque, Larry A. Scofield, and W.R. Meier, Jr. (1992). Porous Pavement for Control of Highway Runoff in Arizona: Performance to Date, *Transportation Research Record* 1354, 45-54.

Jackson, Newt (2003). *Porous Asphalt Pavements*, Information Series 131, Lanham, Maryland: National Asphalt Pavement Association.

Kandhal, Prithvi S. (2002). *Design, Construction, and Maintenance of Open-Graded Asphalt Friction Courses,* Information Series 115, Lanham, Maryland: National Asphalt Pavement Association.

Kandhal, Prithvi S., and Rajib B. Mallick (1998). *Open-Graded Asphalt Friction Course: State of the Practice*, Report No. 98-7, Auburn, Alabama: Auburn University National Center for Asphalt Technology.

Kandhal, Prithvi S., and Rajib B. Mallick (1999). *Design of New-Generation Open-Graded Friction Courses*, Report No. 99-2, Auburn, Alabama: Auburn University National Center for Asphalt Technology.

Mallick, Rajib B., Prithvi S. Kandhal, L. Allen Cooley Jr., and Donald E. Watson (2000). *Design, Construction and Performance of New-Generation Open-Graded Friction Courses*, Report No. 2000-01, Auburn, Alabama: Auburn University National Center for Asphalt Technology.

Paine, John E. (1990). *Stormwater Design Guide, Portland Cement Pervious Pavement*, Orlando: Florida Concrete and Products Association.

Smith, David R. (2001). Permeable Interlocking Concrete Pavements: Selection, Design, Construction, Maintenance, 2nd ed., Washington: Interlocking Concrete Pavement Institute.

Tappeiner, Walter J. (1993). *Open-Graded Asphalt Friction Course*, Information Series 115, Lanham, Maryland: National Asphalt Pavement Association.

Thelen, E. and Howe, L.F. (1978). *Porous Pavement*, Philadelphia: Franklin Institute Press.

OFF-STREET PARKING

§157.140 PURPOSE.

The purpose of this subchapter is to establish standards for the provision of adequate off-street parking facilities for permitted residential, commercial, industrial and other nonresidential uses. (Ord. G-16-97, passed 12-9-97)

§157.141 GENERAL REQUIREMENTS.

(A) **Applicability.**

(1) Any new freestanding building or use except in the CM5A District.

(2) An addition to an existing building where the addition increases the size of the existing building by over 25%, provided the addition does not displace required parking spaces, with the following exceptions:

i. For elementary, middle, junior high, and senior high school uses, the standard shall apply only in cases where additional classrooms are being added; and

ii. For church uses, the standard shall apply only in cases where additional sanctuary space is being added;

(3) A new use of an existing building which requires a greater number of parking spaces than the previous use (based on the table in §157.144), with the following exceptions:

i. In the CM5A and CM5B Districts, the standards shall not apply to new uses of existing buildings (no additional off-street parking shall be required for the new uses); and

ii. In the CM5C Districts, the standards shall apply only to the following uses or activities: a new bar/tavern; a dance or similar school; a restaurant; a night club or similar entertainment use; the addition of units to an existing residential structure; or the conversion of a residential structure to nonresidential use.

(B) **Location of spaces.** All parking spaces required by this subchapter shall be provided on the same lot, tract or development parcel as the building, structure, or use for which the spaces are required**,** except in the case of off-site parking areas for church, synagogue, or other religious building use, or school uses, where the lot is either under the same ownership or operates under an executed agreement allowing for its use and is located within 500 feet of the primary use (as measured between closest property lines).

(C) **Multiple uses and/or buildings.** Where multiple uses exist in the same building or more than one building exists on the same lot, tract or development parcel, off-street parking requirements shall equal the sum of the requirements for the individual uses. Parking areas for multiple buildings may be provided collectively in one or more parking areas as long as the individual use requirements are met and the parking is provided on the same lot, tract or development parcel.

(D) **Maintenance.** Off-street parking spaces and any required landscaping shall be provided and maintained by the property owner or other occupant of the property.

(E) **Compliance with Americans with Disabilities Act.** The design and construction of all new off-street parking areas shall comply with the applicable requirements of the Americans with Disabilities Act (ADA).

(F) **Off-Street Parking Space Credits.** To allow for flexibility concerning parking standards in the City's nonresidential zoning districts (CM1-5; SC1-4; and IN1-3) in order to accomplish the Comprehensive Plan's objectives of urban revitalization, enhancing the pedestrian environment, and encouraging the use of transit, parking space credits shall be allowed for nonresidential uses in these districts as set forth below:

(1) On-street parking spaces directly in front of and to the side of the lot, tract, or development parcel where the proposed or existing use is located may be counted towards satisfying the minimum off-street parking requirements;

(2) One (1) required off-street parking space for each on-site bicycle rack (a rack must store a minimum of four (4) bicycles), up to 2% of the total parking requirement;

(3) If access to public transit is located within 400 feet of the lot, tract, or development parcel where the proposed or existing use is located, this may serve in lieu of one (1) required off-street parking space;

(4) If construction techniques such as pervious pavement, block and concrete modular pavers, and grid pavers are used for off-street parking surfaces, each space provided as a result may serve in lieu of two (2) required off-street parking spaces, up to a maximum of 10% of the number of required spaces;

(5) However, in the CM5B and CM5C Districts, where existing off-street parking exists, or additional spaces are required, the resulting off-street parking provided after the application of these credits shall not be less than two spaces (it is intended that a minimum of 2-4 off-street parking spaces be provided behind existing or proposed structures on the same lot, tract, or development parcel in these districts where practical, primarily to accommodate employee parking).

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(G) **Off-Street Parking Space Waivers.** To allow for flexibility concerning parking standards in order to accomplish the Comprehensive Plan's objectives of allowing for mixed uses, encouraging new construction that is compatible with existing structures and development patterns, encouraging the provision of parking situations more suitable for higher density urban areas, and enhancing the pedestrian environment, the Zoning Administrator may grant waivers of required off-street parking spaces, as part of its review of a Site Plan Routing project or Improvement Location Permit application. To request a waiver, the applicant/owner shall submit a written request setting forth the reasons why a waiver should be granted. Upon receiving a request for a waiver of a required development plan, the Zoning Administrator shall review and either approve or deny the request. The Zoning Administrator shall notify the applicant in writing of the action and reasons for the approval or denial. In reviewing the request, the Zoning Administrator shall consider the following:

(1) The size of the property;

(2) The location of existing structures on the property;

(3) The existing zoning and development patterns in the vicinity of the site;

(4) The size, site layout, and potential impact of the request on surrounding land uses;

(5) The benefit of public notice and input on the request;

(6) The previous use of the property;

(7) The need for additional on-site parking, based on the intensity of the land use and the availability of parking in the immediate vicinity of the site; and

(8) Whether the provision of additional on-site parking would create a practical difficulty in the use of the property.

(Ord. G-16-97, passed 12-9-97)

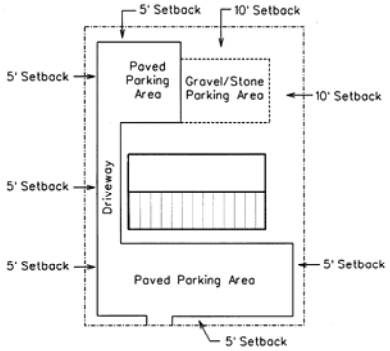
§157.142 PARKING AREA IMPROVEMENT STANDARDS.

(A) **Establishment of standards.** The Board of Public Works shall establish minimum standards and specifications for paving, surfacing, and drainage of all land used for off-street parking and all driveways serving parking areas, whether required by this subchapter or otherwise provided.

(B) **Paving and drainage.** All land which is placed in use for off-street parking and all driveways serving parking, delivery, and loading areas, shall be paved with asphalt, concrete, or other approved all-weather hard surface, including construction techniques such as pervious pavement; block, concrete, and similar modular pavers, and grid pavers; and shall be drained with materials and in a manner which meets the current minimum standards and specifications for parking areas adopted by the Board of Public Works. However, in industrial zoning districts, parking areas which are provided in addition to the minimum number of spaces required as set forth in §157.144 shall not be required to be paved, but may have a gravel surface which meets the current minimum standards and specifications for parking areas adopted by the Board of Works. Also, single and two family residential uses which do not include public parking areas as defined in this chapter shall not be required to pave driveways and parking areas. However, the parking, storage, or display of motor vehicles on grass or other similar areas which do not have a paved or gravel surface shall not be permitted.

(C) **Curbing.** All public parking areas shall have curbing or other acceptable elements around the perimeter of the parking area at a sufficient location to keep vehicles from overhanging or encroaching upon abutting properties, streets, alleys or sidewalks or landscape areas. Curbing shall also be used if necessary to facilitate drainage and to prevent the discharge of water onto adjacent properties.

(D) **Location standards.** Except as further noted below, any paved area used for off-street public or employee parking, including driveways or driving lanes, shall be located a minimum of five (5) feet from any property line except for driveways or driving lanes which provide direct access. Any gravel area, including driveways, used for off-street public or employee parking shall be located a minimum of ten (10) feet from any property line except for driveways or driving lanes which provide direct access. In CM5C Districts, parking areas shall be located a minimum of 20 feet from any front property line; and new parking areas in these districts are intended to only be permitted where there is an adequate existing alley access, so that a new driveway onto the primary commercial street is not required. These location standards shall not apply to any single or two family residential driveway or parking area which does not meet the definition of "public parking area" as set forth in this chapter.



Parking Area Location Standards

(E) **Accessibility**. All parking facilities provided pursuant to this subchapter shall be directly accessible from an improved public right-of-way or other approved access provisions.

Herndon (VA), Town of. 2009. *Code of Ordinances*.
Chapter 78 Zoning
Article V. Development Standards

Sec. 78-500.3. Off-Street Parking Standards

(k) Parking alternatives.

(4) Standards for alternative materials. The zoning administrator may approve alternative materials based on the following standards:

a. Porous parking area surfacing may be considered for purposes of facilitating on-site stormwater control or environmental conservation. It is not intended for porous parking area surfacing to facilitate temporary parking arrangements or economy of site development.

b. Porous parking area surfacing materials may be provided In accordance with the Herndon Public Facilities Manual, as a special asphaltic paving material that allows stormwater to infiltrate at a high rate. Infiltrated water is temporarily retained below the pavement within a high-void aggregate base. Porous pavement is applicable as a substitute for conventional asphalt pavement on parking areas.

c. Porous parking area surfacing materials are not located on easements for underground utilities, in accordance with the Herndon Public Facilities Manual.

d. In accordance with section 78-502.7, reduction in the minimum number of required parking spaces, alternative paving materials may be required by the zoning administrator in cases where required parking areas encroach upon critical root zones.

e. Porous parking areas are properly maintained.

g. Where possible porous parking area surfacing materials are used in areas proximate to and in combination with on-site stormwater control devices.

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Nags Head (NC), Town Of. 2009. *Code of Ordinances*.
Chapter 48. Zoning
Article V. Off-Street Parking And Loading Requirements

Sec. 48-162. Parking lot requirements for single-family and two-family (duplex) dwelling units.

(3) Improvement standards for single-family and two-family dwelling units:

a. Required parking spaces shall be graded and paved with asphalt, concrete, gravel, porous paving as approved by the town engineer or an open-face paving block over sand and filter-cloth base, provided that the open-face paving block is equivalent to TurfstoneTM with regards to compressive strength, density, absorption and durability.

b. As an alternative to the open face paving block, as stated above, an applicant may improve up to 20 percent of the required spaces with plastic turf reinforced products utilizing curb stops to clearly delineate the parking space. The use of such product shall be reviewed and approved by the town engineer and shall count as lot coverage.

Sec. 48-163. Parking lot requirements for all uses other than single-family and two-family (duplex) dwelling units.

(4) Improvement standards for all uses other than single-family and two-family dwelling units:

a. Required parking spaces shall be graded and paved with asphalt, concrete, gravel, porous paving as approved by the town engineer or an open-face paving block over sand and filter-cloth base, provided that the open-face paving block is equivalent to TurfstoneTM with regards to compressive strength, density, absorption and durability.

b. As an alternative to the open face paving block, as stated above, an applicant may improve up to 20 percent of the required spaces with plastic turf reinforced products utilizing curb stops to clearly delineate the parking space. The use of such product shall be reviewed and approved by the town engineer and by the public safety department and shall count as lot coverage.

Sec. 48-168. Off-street loading.

(b) Loading spaces shall be located at least 50 feet from any street right-of-way and shall be paved with asphalt, concrete, porous paving as approved by the town engineer or an open-face paving block over sand and filter-cloth base, provided that the open-face paving block is equivalent to TurfstoneTM with regards to compressive strength, density, absorption and durability.

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Bicycle Parking

Durango (CO), City of. 2009. *Code of Ordinances*.
Title 27. Land Use and Development Code
Article 10. General Regulations
Sec. 10-2. Parking and Loading Standards.

10-2-4. Bicycle parking spaces.

(a) At least three (3) bicycle parking spaces or one (1) bicycle parking space for each ten (10) of the required off-street automobile parking spaces, whichever is greater, must be provided in all districts, except R, RS-R, RS-4, RS-5 and RST-8 districts.

(b) No more than thirty (30) bicycle parking spaces shall be required on any one (1) property.

(c) Type of bicycle parking facility required:

(1) Provide for storage and locking of bicycles, either in medium-security racks where the frame and at least one (1) wheel can be secured, or in lockers (or similar safe storage areas).

a. The provision of lockers is optional, but encouraged for assigned use by employees and regular bicycle commuters. Each locker, which shall be installed in a building or covered parking areas/ garages, shall count as three (3) bicycle parking spaces.

(2) The surface of bicycle parking spaces need not be paved, but shall be finished to avoid mud and dust.

(3) Racks shall be bordered by physical barriers or located at a sufficient distance from motor vehicles to prevent damage to parked bicycles.

(d) Location of bicycle parking facilities:

(1) Wherever possible bike racks should be located within one hundred (100) feet of a building entrance and be clearly visible from the building entrance and its approaches. If necessary, signs should be posted that indicate the location of bicycle parking.

(e) Off-street automobile parking spaces may be substituted with bicycle parking spaces:

(1) Any new and pre-existing nonresidential development in any zoning district may convert up to five (5) percent of the required off-street automobile parking spaces into additional bicycle parking spaces (not already required by the Code) at the following ratios:

a. One (1) automobile parking space for every six (6) bicycle spaces;

b. One (1) automobile parking space for every two (2) bicycle lockers.

(2) Bicycle parking spaces shall comply with all subsections in section 10-2-4.

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Bicycle Parking Standards

9.0830 Bicycle Parking Design Standards

All developments shall meet the following minimum requirements for bicycle parking and design:

A. Purpose. Bicycle parking is required in most land-use districts and categories to encourage the use of bicycles by providing safe and convenient places to park bicycles. The required number of spaces is lower for uses that do not tend to attract bicycle riders and higher for those that do. Additionally, some bicycle parking is required on the basis of specifically encouraging employee, student or customer related bicycle use.

The main purpose of these design standards is to ensure that bicycle parking is visible from the street, is convenient to cyclists in its location, and provides sufficient security from theft and damage.

B. Minimum Required Bicycle Parking Spaces and Methods: The required minimum number of bicycle parking spaces for each principal use is given in **Table 9.0851**. Additional bicycle parking spaces may be required at common use areas.

C. Bicycle Parking Location and Access

1. Use. Areas set aside for required bicycle parking must be clearly reserved for bicycle parking only.

2. Lighting. Required bicycle parking must have a minimum lighting level of 3 foot candles.

3. Location. Outdoor bicycle parking must be located closer to primary building entrances than auto parking, within 50 feet or less from the primary building entrances. Outdoor bicycle parking shall be visible from on-site buildings and/or the street. When the bicycle parking area is not visible from the street, directional signs shall be used to locate bicycle parking areas (see Sign Code **Section A6.050(C)**). Bicycle parking may be located inside a building on a floor which has an outdoor entrance open for use and floor location which does not require stairs to access the space; exceptions may be made for parking on upper stories within multi-story residential buildings.

4. Amenities. Bicycle parking areas are encouraged to include a bench and bicycle rack screened with 30-36 inches shrubs from any parked cars or arterial streets.

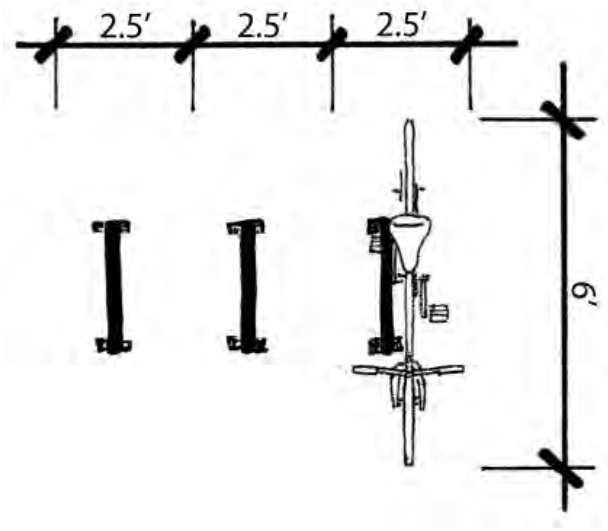
5. Pedestrian Conflicts. Bicycle parking and bicycle racks shall be located to avoid conflict with pedestrian movement and access walk required by the Building Code. With approval of the Manager, bicycle parking may be located in the public sidewalk or right-of-way, where this does not conflict with pedestrian accessibility.

D. Covered Bicycle Parking Spaces. All required bicycle parking spaces must be sheltered from precipitation by means such as roof extensions, overhangs, awnings, arcades, carports or enclosures. Bicycle parking permitted in the public right of way is not required to be covered. Bicycle parking for public trails is not required to be covered except when located at picnic shelters where bicycle parking must be sheltered.

Fifty percent of the required bicycle parking at transit stations, centers, and park and ride lots, must be lockable enclosures or lockers.

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FIGURE 9.0830 BICYCLE PARKING



E. Bicycle Rack Types and Space Dimensions

1. Bicycle rack type. The racks provided in the required bicycle parking facilities shall ensure that bicycles may be securely locked to them without undue inconvenience.

a. Bicycle parking facilities shall offer security in the form of either a lockable enclosure in which the bicycle can be stored or a stationary object (i.e., a "rack") upon which the bicycle can be locked. Bicycle parking racks, shelters or lockers must be securely anchored to the ground or to a structure.

b. Bicycle racks must hold bicycles securely by means of the frame. The frame must be supported so that the bicycle cannot be pushed or fall to one side in a manner that will damage the wheels. A list of standard, acceptable bicycle racks, shelters and lockers will be provided by the City. This will not preclude other designs with approval of the Manager.

2. Bicycle Parking Space Dimensions. Bicycle parking spaces shall be at least 2.5 feet wide by 6 feet long and, when covered, provide a vertical clearance of 7 feet. An access aisle of at least 5 feet wide shall be provided and maintained beside or between each row of bicycle parking.

a. Each required bicycle parking space must be accessible without moving another bicycle.

b. Bicycle parking spaces required by this Chapter may not be rented or leased except where required motor vehicle parking is rented or leased. At cost or deposit fees for bicycle parking are exempt from this requirement.

F. Paving and Surfacing of Bicycle Parking Area. Outdoor bicycle parking facilities shall be surfaced with hard surfacing material at least 2 inches minimum (i.e. pavers, asphalt, concrete or similar material). This surface must be designed to maintain a well-drained condition.

G. Exemptions. The following uses are exempted from Bicycle Parking requirements:

- Temporary Uses
- Agricultural

- Mini-storage facilities for household and consumer goods.
- Home Occupations

Off-Street Loading

9.0840 Off-Street Loading Requirements

A. Purpose of Loading Area Regulations. The purpose of these regulations is to provide the number, size, location, and screening requirements for loading areas in mixed-use, commercial, and industrial uses. The intent of these regulations is to minimize disruption of traffic flow by freight-carrying vehicles blocking the public right-of-way and to minimize impacts to vehicular and pedestrian circulation.

B. When Loading Area Regulations Apply. This regulation applies to all non-residential development in mixed-use, commercial, and industrial districts, whether or not a permit or other approval is required for the development.

C. General Loading Area Regulations

1. Loading area requirements are provided in **Table 9.0840(C)**. The number of required loading spaces is based on the use of the building and the building size minus any residential component square footage. Where two or more uses are located on the same premises, the number of loading area spaces required is the sum of the spaces required for each use (based on square footage of each use) computed separately. The Manager may reduce but not eliminate loading area requirements, where approval criteria are satisfied.

2. The provision and maintenance of off-street loading facilities is a continuing obligation of the property owner.

3. Loading and maneuvering areas shall be hard-surfaced unless a permeable surface is required to reduce surface runoff, as determined by the Manager.

4. Parking of passenger vehicles may be allowed in off-street loading areas subject to specific time limits to prevent conflicts with off-street loading activities. If parking is allowed, the parking time limits shall be clearly posted. These parking spaces shall not count towards meeting general parking requirements.

5. Required Off-Street Loading

a. Each required off-street loading space in an industrial area shall have a minimum length of 60 feet, a minimum width of 12 feet, and a minimum vertical clearance of 15 feet high, inside dimensions with a 60-foot maneuvering apron.

b. Each required off-street loading space, other than industrial zones, shall have a minimum length of 30 feet, a minimum width of 12 feet, and a minimum vertical clearance of 14 feet 6 inches high, inside dimensions with 30-foot maneuvering apron.

6. Loading areas must comply with the setback and perimeter landscaping and screening standards. When parking areas are prohibited or not allowed between a building and a street, loading areas are also not allowed unless approved by the Manager under special circumstances.

7. Uses not specifically mentioned: In the case of a use not specifically mentioned, the requirements for off-street loading facilities shall be the same as the above-mentioned uses,

Folsom (CA), City of. 2009. *Municipal Code.*
Title 17. Zoning
Chapter 17.57. Parking Requirements

17.57.090. Bicycle Parking Facilities.

A. Bicycle Parking Requirement.

1. For multifamily residential, 1 bicycle parking space per every 5 dwelling units. Where this parking requirement results in a fraction of a space, another space need not be provided unless the fraction exceed 50 percent.

2. Office and retail commercial, minimum 5 bicycle parking spaces for up to 25 required vehicle parking spaces. An additional bicycle parking space is required for every 10 additional vehicle parking spaces required or portion thereof. The maximum number of bicycle parking spaces required is 20, unless more are deemed necessary for major employment and commercial facilities by the community development director.

3. For public facilities and civic centers (municipal offices, parks, swimming pools, museums and auditoriums), the number of bicycle spaces shall be 30 percent of the vehicle parking normally required or immediately available to the facility. The maximum number of bicycle parking spaces required is 25, unless more are deemed necessary for major public facilities and civic centers by the community development director.

4. For elementary, middle and high schools, bicycle parking spaces number 25 percent of peak enrollment shall be provided.

B. Design Standards.

Bicycle parking facilities shall be installed in a manner which allows adequate spacing for access to the bicycle and the locking device when the facilities are occupied. General space allowances shall include a 2-foot width and a 6-foot length per bicycle and a 5-foot maneuvering space behind the bicycle. The facilities shall be located on a hard, dust-free surface, preferably asphalt or concrete slab.

Bicycle parking facilities shall consist of at least a stationary bicycle rack, typically a concrete slab or vertical metal bar, where the bicyclist supplies a padlock and chain or cable to secure the bicycle to a stationary object.

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Minneapolis (MN), City of. 2009. *Code of Ordinances*.
Title 20. Zoning Code
Chapter 541. Off-Street Parking and Loading
Article III. Specific Off-Street Parking Requirements

541.180. Bicycle Parking.

(b) Bicycle parking standards. Each required bicycle parking space must be accessible without moving another bicycle and its placement shall not result in a bicycle obstructing a required walkway. Bicycle racks shall be installed to the manufacturer's specifications, including the minimum recommended distance from other structures. In addition:

(1) Required short-term bicycle parking spaces shall be located in a convenient and visible area within fifty (50) feet of a principal entrance and shall permit the locking of the bicycle frame and one (1) wheel to the rack and shall support a bicycle in a stable position without damage to the wheels, frame or components. With the permission of the city engineer, required bicycle parking may be located in the public right-of-way. Public bicycle parking spaces may contribute to compliance with required bicycle parking when located adjacent to the property in question.

(2) Required long-term bicycle parking spaces shall be located in enclosed and secured or supervised areas providing protection from theft, vandalism and weather and shall be accessible to intended users. Required long-term bicycle parking for residential uses shall not be located within dwelling units or within deck or patio areas accessory to dwelling units. With permission of the zoning administrator, long-term bicycle parking spaces for non-residential uses may be located off-site within three hundred (300) feet of the site.

(c) Downtown districts. Developments with five hundred thousand (500,000) square feet of new or additional gross floor area in downtown districts shall provide bicycle parking and bicycle facilities as required by Chapter 549, Downtown Districts. All other developments in the downtown districts shall provide one (1) secure bicycle parking space for every twenty (20) automobile spaces provided, but in no case shall fewer than four (4) or more than thirty (30) bicycle parking spaces be required. For the purposes of this section, a secure bicycle parking space shall include a bicycle rack which permits the locking of the bicycle frame and one (1) wheel to the rack, and which supports the bicycle in a stable position without damage to wheels, frame or components. Residential uses in the downtown districts are subject to the requirements of Table 541-3, Bicycle Parking Requirements.

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Mountain View (CA), City of. 2009. *Code of Ordinances*.
Chapter 36. Zoning
Article XII-A. Landscaping
Division A36.37. Parking and Loading

Section A36.37.100. Bicycle parking standards.

Bicycle parking facilities shall be provided in compliance with this section and the Bicycle Parking Guidelines provided by the department.

A. Classification of bicycle parking facilities.

1. Class I facilities. Intended for long-term parking (e.g., for employees); protects against theft of entire bicycle and of its components and accessories. The facility shall also protect the bicycles from inclement weather, including wind-driven rain. Three (3) design alternatives for Class I facilities are as follows:

    a. Bicycle locker. A fully enclosed, weather-resistant space accessible only by the owner or operator of the bicycle. Bicycle lockers may be premanufactured or designed for individual sites. All bicycle lockers shall be fitted with key locking mechanisms. This is the preferred Class I facility;

    b. Restricted access. Class III bicycle parking facilities located within an interior locked room or locked enclosure accessible by key only to the owners or operators of the bicycles parked within. The maximum capacity of each restricted room or enclosure shall be ten (10) bicycles; and

    c. Enclosed cages. An exterior enclosure for individual bicycles, where contents are visible from the sides but the top is covered, and which can be securely locked by a user-provided lock. This type of facility is only to be used for retail and service uses and multiple-family development.

Class I facilities other than lockers, restricted access rooms or enclosed cages, but providing the same level of security, may be approved by the zoning administrator. A written building management policy of permitting bicycles to be stored in private offices or multifamily dwellings (including apartments, townhomes and condominiums), or in designated areas within the structure where adequate security is provided, may be approved by the zoning administrator as an alternative to Class I facilities.

2. Class II and Class III facilities. Intended for short term parking (e.g., for shoppers, visitors). A stationary object to which the user can lock the frame and both wheels. Should be protected from weather whenever possible. The zoning administrator may require either a Class II or Class III facility depending on where the facilities are to be located.

    a. Class II facilities are designed so that the lock is protected from physical assault and therefore the facility need not be within constant visual range. A Class II rack shall accept padlocks and high security U-shaped locks.

    b. Class III facilities are less secure and therefore shall be within constant visual range of persons within the adjacent structure or located in well-traveled pedestrian areas.

B. Bicycle parking design standards:

1. Class I(b), Class II and Class III facilities shall provide at least a twenty-four (24) inch clearance from the centerline of each adjacent bicycle, and at least eighteen (18) inches from walls or other obstructions;

2. An aisle or other space shall be provided for bicycles to enter and leave the facility. This aisle shall have a width of at least five (5) feet to the front or the rear of a standard six (6) foot bicycle parked in the facility;

3. Class I facilities at employment sites shall be located near the structure entrances used by employees;

4. Class II or Class III facilities intended for customers or visitors shall be located near the main structure used by the public;

5. Paving of bicycle parking areas is required;

6. Convenient access to bicycle parking facilities shall be provided. Where access is via a sidewalk or pathway, curb ramps shall be installed where appropriate;

7. Lighting shall be provided in all bicycle parking areas. In both exterior and interior locations, lighting of not less than one (1) footcandle of illumination at ground level shall be provided; and

8. The zoning administrator shall have the authority to review the design of all bicycle parking facilities required by this section with respect to safety, security and convenience. The zoning administrator shall consider the Bicycle Parking Guidelines in determining the type, location and design of bicycle parking facilities.

C. Number and type of bicycle spaces required. The following standards shall apply:

1. Number of bicycle parking spaces. The number of bicycle parking spaces required is determined by Section A36.37.040 (Number of Parking Spaces Required); and

2. Class of bicycle parking spaces. The zoning administrator may require that a certain percentage of the spaces be Class I, Class II, or Class III depending on the potential users. The zoning administrator shall use the Bicycle Parking Guidelines in determining the appropriate proportions of each class.

D. Showers and changing room standards. Two (2) employee shower and changing room facilities, one each for male and female employees, shall be provided for any new structure constructed or for any addition to or enlargement of, any existing structure requiring over two hundred (200) employee parking spaces. This requirement is applicable to industrial, research and development, corporate office and similar high employment businesses. The floor area used for shower and changing rooms shall be not be included in the calculations for floor area ratio limits.