THE AUTOMOBILE AT REST

Toward Better Parking Policies in the Delaware Valley

September 2008

Delaware Valley Regional Planning Commission

The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals and the public with a common vision of making a great region even greater. Shaping the way we live, work and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region – leading the way to a better future.

Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

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EXECUTIVE SUMMARY

This report presents an overview of parking policies and requirements in the Delaware Valley region, along with strategies for better managing and designing parking better.

At first glance, parking seems like a straightforward issue. However, as this report demonstrates, parking is a complex issue that affects the natural and built environment as well as the social fabric of our communities. Viewed at the regional level, parking can be designed and managed in conjunction with other land uses to support transit systems, enhance the vitality of core urban areas, and prevent sprawl from overtaking valuable open space. At the local level, parking strategies help communities minimize congestion, foster economic development, preserve neighborhood quality of life, and protect natural resources.

Each of the region's 353 municipalities sets its own parking requirements within its municipal zoning ordinance. The requirements are typically based on national standards, usually derived from sources such as the Institute of Transportation Engineers and the Urban Land Institute. The standards usually dictate that a set number of parking spots be provided for a certain number of dwellings or square footage of office, retail, or industrial space. The standards, however, often assume that all trips will be made by car and that destinations will be isolated and single-use in character. The standards fail to recognize the different types of parking provisions that may be desirable or cost-appropriate for different contexts such as downtowns, suburban shopping districts, or rural areas. They provide little guidance about shared parking, public parking garages, and other strategies that recognize that parking should be sensitive to the broader context rather than being viewed as just a single use. Likewise, municipal parking ordinances-which are typically based on the standards and which apply to communities with a variety of contexts ranging from downtown to rural-often result in too much parking or requirements that are not flexible for mixed-use settings. Thus, parking requirements can exert a strong influence on the built and natural environment, and how a community grows or redevelops.

This report provides planners, local leadership, and citizens with information about best practices for designing, managing, and regulating parking. In conjunction with this data, the report reviews parking policies currently in place throughout the region. Together, these elements can be used to help solve local parking challenges, to inform plans for future parking and land use strategies, and to determine where updates to ordinances are appropriate.

Chapter 1 examines the types of issues that parking standards should consider, focusing in particular on parking supply and demand and on innovative ways to calculate parking requirements. Chapter 2 looks at issues related to parking management. While parking standards reflect a straightforward goal of matching parking supply to anticipated parking demand, parking management seeks to reduce demand and improve supply where appropriate or necessary through such strategies as

Image Source: DVRPC

pricing, car-sharing, and shared-parking facilities. Chapter 3 describes costs and financing strategies related to the development of parking. Chapter 4 reviews the different types of parking (such as off-street, structured, or bicycle) and describes the contexts and design treatments that best match each type. This chapter also demonstrates the complex ways that parking interacts with and influences land uses. Chapter 5 identifies the environmental impacts of parking with a focus on the critical issue of stormwater. Chapter 6 evaluates the relationship between parking and transit. This chapter also considers two major models of transit parking: transit-oriented development (TOD) and park-and-ride. Chapter 7 examines parking practices from counties and local governments in the Delaware Valley region, describing trends and highlighting best practices. Chapter 8 summarizes the report's recommendations on reducing parking requirements, sharing parking, and better designing and managing parking. Appendix A includes data on parking requirements in the region's 353 municipalities and is published separately due to its size. Appendix B includes model language for parking requirements in zoning ordinances from the American Planning Association. Appendix C is a sample lease agreement between a municipality and an owner/business tenant for commuter use of a parking lot (shared parking).

As a whole, the report reveals the complexity of design, financial, environmental, and social considerations that must be balanced when local governments create parking policies, and equips the reader with information and tools to create solutions tailored to local needs and opportunities.

Source: DVRPC

INTRODUCTION

As a study of parking in the region, this report raises a host of questions. What types of parking are regulated in the region and why? Are municipalities oversupplying parking in ordinances? Is free parking a right-for visitors, workers, or residents? Should parking supply and management cater to the needs of residents, businesses, tourists, or institutions? How do parking facilities in core urban areas and suburban communities affect patterns of congestion on roads across the region? Should more parking be made available near transit hubs? Or is a better goal the development of transit-oriented villages with limited parking? This report tackles questions like these to begin to unravel the complex and interconnected ways that parking impacts the Delaware Valley region.

Issues of parking supply and demand feature prominently in this report because conventional parking standards usually (and often exclusively) focus on setting a required minimum number of parking spaces for various land uses. This is a critical standard, and one that local governments cannot afford to overlook as they prepare and revise ordinances. Too much parking can destroy the walkability and aesthetic qualities of downtowns, promote congestion and increased vehicle miles of travel, and slow economic development by imposing expensive and unnecessary requirements on developers and businesses. Too little parking stymies commercial activity, drives away tourists, makes businesses less attractive places to work for, and creates conflicts between residents and visitors who must compete for spaces.

Other than the rote application of parking standards, there is no "right" number that indicates when "enough" parking is available. The supply and design of parking is a value judgment that must be made based on community goals. Likewise, there is no such thing as a set "demand" for parking. Parking demand is a reflection of pricing, availability, accessibility, and travel choices. Contemporary best practices in parking standards look beyond recommended numbers of parking spaces for individual uses to consider ways that the local context, mix of uses, and availability of alternative modes of transportation create a more nuanced relationship between parking supply and demand.

Optimizing supply is fundamental to planning for parking. However, parking impacts quality of life in a myriad of ways-and parking policies can do far more than ensure that an appropriate number of spaces is available. With proper design and management, parking can enhance community character and walkability; prevent harmful impacts to natural resources; facilitate use of transit to reduce congestion and ensure the viability of the transit system; and support equitable access to opportunity and social resources.

Parking management techniques are designed to alter existing supply and demand dynamics when appropriate. For example, a business with limited capacity to expand parking facilities may elect to provide workers with a shuttle service and transit benefits to promote reduced vehicle use. To ensure the vitality of businesses located along a commercial corridor, a local government may institute a

Image: A residential development with an attached parking garage in Center City Philadelphia.
Source: DVRPC

meter system that promotes turn-over of spaces directly in front of shops, complemented by more affordable, long-term parking facilities for workers located at a greater distance. Local governments grappling with high levels of congestion may create flexible parking standards that allow commuters to park (for transit or park-and-ride) in church and movie theater lots which are underutilized during work-day hours. These strategies tailor the use of parking facilities to the particular needs and opportunities available in a specific context.

Likewise, design strategies match the physical orientation and construction of parking to the particular attributes of a place. A township may take action to protect the historical character and walkability of a village by requiring parking to be located behind buildings and mandating landscaping treatments or first floor retail for parking areas located along pedestrian pathways. In response to concerns about quality of life, sense of place, and congestion, a planner may recommend shared and rear-building parking strategies to retrofit a suburban, automobile-dependent corridor. Local leadership in a community with a major park-and-ride transit station may choose to spur investment and reduce congestion by converting surface lots to structured parking and promoting mixed-use development to create a transit-oriented district. Municipalities concerned with flooding may institute pervious parking requirements and parking maximums.

Recommending these parking solutions is one thing. Implementing them is another. Fortunately, a number of financing tools make development of innovative parking solutions a viable option for municipalities of all sizes. Tax increment financing, fee-in-lieu, and density bonuses offer opportunities for the public and private sector to work together to achieve parking solutions with benefits to a range of stakeholders.

As these examples show, parking policies can help achieve an array of goals. The bottom line is that creative parking solutions are complex from a design perspective and from a financing perspective. However, from a land-use and economic development standpoint, incentives and regulations to build hidden, structured, and mixed-use parking are becoming an increasingly critical economic factor, with market impacts for growth in a variety of contexts. It will be important in the coming years to look at expanding the incentives and opportunities for financing such projects, rather than simply increasing the regulatory burden on developers.

Chapter 7 takes a close look at parking standards in all 353 of the region's municipalities. The task for the planner, citizen, or local government leader is to compare the solutions presented in this report with the standards currently in place in their community and to ask whether their regulations are up-to-date and enable achievement of local goals. While an important objective of this report is to educate decision-makers and citizens about the role of parking in creating better places, the fundamental goal is to facilitate local planning and action to improve parking throughout the region.

Image: Smart parking policies can help municipalities ensure the highest and best use of their land, rather than requiring prime real estate to be taken up by seas of parking. Source: DVRPC

CHAPTER 1:
PARKING STANDARDS, SUPPLY & DEMAND

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PARKING STANDARDS

Traditionally, municipal parking codes require a minimum number of parking spaces per site, typically calculated by the size and use of the development. Conventional planning practices reflect an assumption that it is desirable to maximize parking supply and minimize user cost. The minimum standards were adopted with the ambition of minimizing walking, enhancing property competitiveness, and preventing spillover of parking to adjacent facilities or local streets and neighborhoods (Kuzmyak 2003). Minimum parking requirements do produce a local benefit: they ensure that every land use can accommodate all the vehicles attracted to the site. Unfortunately, this local benefit comes at a high cost to the community as a whole.

The 3rd Edition of Parking Generation by the Institute of Transportation Engineers (ITE) in 2004 is an update to the 2nd Edition published in 1987 and is the most common reference used to determine minimum parking requirements. It is intended to provide empirical data to designers, planners, and engineers on the subject of parking demand for various land uses. The data in the manual represents parking demand studies where one or more hours of observations were conducted on a given day. Parking demand data is included for 91 types of land use. The statistics in the report provide averages, ranges, and statistical quality values that can help the analyst determine the nature of parking demand for a given land use, and where more detailed local studies are needed. Given this information, analysts can assess the amount of parking anticipated to be generated by a proposed land use development or the estimated parking demand generated by existing uses (ITE 2004).

Virtually all of today's parking standards currently in existence are excessive, resulting in a host of problems. The conventional parking standards published in technical reports such as the Institute of Transportation Engineers' (ITE) Parking Generation are based on parking demand surveys. In most cases, fewer than a dozen demand surveys are used to set standards for many land use categories. The analysis does not usually take into account geographic, demographic, and economic factors that can affect parking demand (Shoup 1999). **Often times, these parking requirements are based on peak parking demands for a specific use, ignoring off-peak occupancy and thus resulting in an oversupply of parking throughout most of the day or year.** This surplus, created by parking minimums, is costly for developers to provide, and subsidizes personal automobile use. Any parking cost considerations have been eliminated as virtually all of the data for parking standards are derived at locations where parking is free, typically resulting in inflated rates. There is no consideration given to special circumstances where maximum parking spaces may not be needed. **The standards simply do not account for the complexity of a downtown** in terms of land use, transit

Image: Parallel parking on a textured parking lane in Philadelphia.
Source: DVRPC

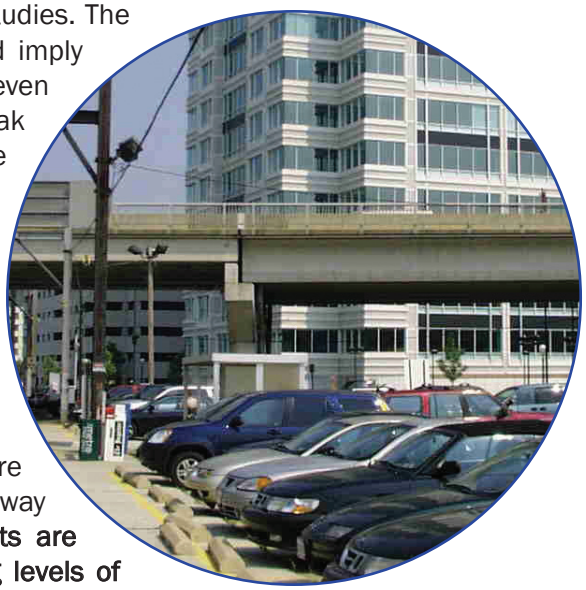
availability, density, urban form, hours of commerce, land constraints, or community goals. Current parking standards have not kept up with the newer kinds of mixed-use developments and various types of urban redevelopment. **The amount of parking at any given establishment can be altered to better balance the true demand for parking.**

TABLE 1: COMPARISON OF TYPICAL NATIONAL PARKING STANDARDS

	Typical Minimum Parking Standards	*ITE Parking Generation 3rd Ed.*
Land Use Category	**85th Percentile Index**	**Parking Supply Ratio**
Single-Family Housing	2.0 / dwelling	2.0 / dwelling
Multifamily Housing	1.5 / dwelling	variable
Senior Housing	0.5 / dwelling	1.2 - 1.4 / dwelling
Lodging	1.0 / bedroom	1.3 / bedroom
Retail	5.0 per 1,000 square feet of GLA	variable
Office	3.3 per 1,000 square feet of GFA	4.0 / 1,000 sq ft

Source: Davidson and Dolnick, 2002; Stover and Koepke, 2002 and ITE Parking Generation, 3rd Edition, 2004; Note: GLA= Gross Leasable Area; GFA=Gross Floor Area.

Table 1 compares two data sets from different sources that represent how a municipality typically sets minimum parking standards in their zoning ordinance or separate parking ordinances. The first column illustrates typical minimum parking standards developed by planning organizations that are based on numerous parking demand studies. The regulations that reflect an 85th percentile demand standard imply that 85 out of 100 sites will have unused parking supply even during peak periods. The second column shows the average peak period parking demand. This computed value is the mean of the peak parking demand ratio for each study site within the peak parking period, divided by the hours of observation. Both the Typical Minimum Parking Standards and Parking Generation use an index or ratio to express the number of spaces that should be supplied at a particular location. They generally reflect the highest level of parking supply that may be required.



To exacerbate the problem of oversupply, parking standards are often copied from one jurisdiction to another. Because of the way in which they are typically established, **parking requirements are remarkably consistent across different cities, despite varying levels of economic vitality, population size, and development density**. In some instances, cities are often completely unaware of alternative parking demand assessment tools. Setting parking requirements by relying on what other cities have done not only risks repeating someone else's mistake, but it also fails to reveal where the requirements came from in the first place

Image: Parking at the Conshohocken SEPTA station.
Source: DVRPC

(Shoup 1999). Furthermore, municipal planners have been known to set parking requirements that can be defined as conservative, implying that this approach is cautious and responsible (Shoup 1999). The data provided in the ITE manual appeal to urban planners because minimum requirements are intended to meet the peak parking demand. Without any training, research, or understanding, planners can use these standards to calculate exactly how many parking spaces are required for a variety of land uses (Shoup 1999). There is no other source that provides systematic data that relates peak parking demand to land use.

A number of studies show that parking supply typically exceeds the demand for parking, even when parking is free. For example, suburban business and office parking ratios typically range between three to four spaces per 1,000 square feet of occupied space. This rate often equates to one parking space for every employee (Shoup and Willson 1992). Peak occupancy rates collected from five studies showed a range of only 1.2 to 2.8 parked vehicles per 1,000 square feet of building space, with an overall average of 2.2 and a median of 2.4. Even when the results are adjusted for building space that is not occupied, the lower end of the range becomes 1.4 per 1,000 square feet. Demand for parking demonstrated in these studies represents 50 to 80 percent of parking supply (Kuzmyak 2003). This suggests that, barring special circumstances, a parking ratio of 2.0 spaces per 1,000 square feet would be sufficient to satisfy the needs of most office parks.

The trend toward higher parking ratios has also had a negative impact on the competitiveness of older properties. Class A office properties in suburban locations built in the 1970s and 1980s are perhaps at greatest risk, as they were usually constructed with surface parking at ratios around three spaces per 1,000 square feet. Parking is probably the main reason why numerous suburban office properties have become uncompetitive. Real estate professionals report that tenants are leaving older buildings and moving to newer buildings in areas with higher parking ratios (Cowley and Spillette 2001).

As developable land becomes scarce and traffic mobility continues to decline, the idea of transit-oriented, walkable, higher-density urban cores has re-emerged. However, many cities find their efforts to encourage infill development are being hampered by conventional parking policies. **These policies, which were intended to ensure that ample parking would be provided, are now a significant barrier to economic growth and development.** Other policies designed to provide free or very low-cost parking are now preventing cities from effectively managing the parking that they do have.

The Dimensions of Parking (ULI, 2000) outlines a more comprehensive way of estimating parking demand. The process begins by collecting background data defined in four parameters: trip generator, trip-maker characteristics, trade-area transportation and constraints, and time frame parameters. The trip generator is the type of land use or building use the parking serves. The trip-maker characteristics are the socioeconomic attributes of the persons expected to visit the development. The trade-area transportation and constraints include the portion of multipurpose trips, the accessibility of the site, parking efficiency and attractiveness, the cost of parking, alternative modes,

Image: This is a walk-up station along PATCO's RiverLINE. Other stations provide park-and-ride facilities.
Source: DVRPC

and local parking policy and codes. The time frame parameters refer to peak-to-daily relationships, periodic daily, monthly, and seasonal factors, and non-periodic factors such as upward or downward trends in economic activity.

Once the background data is collected, the information can be used to estimate total person-trips, broken down into two categories: automobile or other modes (non-auto). Parking demand can now be estimated for both peak and off-peak periods. Although there is considerably more work involved with this methodology versus traditional off-the-shelf parking generation manuals, parking demand can be estimated to a greater degree of accuracy. Parking can be supplied to meet demand that is more precisely determined by local conditions.

Calculating and providing the appropriate amount of parking can be challenging for municipalities. A surplus of parking, particularly in the form of surface lots, uses valuable land resources and often results in disconnected development patterns. This can create vast dead zones of empty parking lots in what could be a bustling business district. Requiring more parking than the market demands also adds substantial cost to development and redevelopment. In some cases, the added cost of parking can prevent development altogether. Conversely, parking deficiencies in urban areas can result in spillover to adjacent neighborhoods. **Alternatives to traditional parking requirements allow for more appropriate determinations of the number of parking spaces needed based on the type and size of the development, the development density, availability of transportation choices, and surrounding land use.**

The Pennsylvania Housing Research/Resource Center (PHRC) last year published Pennsylvania Standards for Residential Site Development (April 2007), which presents advisory residential site development standards to assist municipalities in updating their residential land development standards for sustainability, based on current science and engineering. While these new guidelines are only advisory, not mandatory, they are written like an ordinance, making them easily adoptable. The recommendations are based on a 1999 PHRC study that determined two critical issues, which are:

- A general lack of creativity in the design and development of residential land in Pennsylvania, due to a **lack of flexibility within municipal zoning and subdivision ordinances**. While this inflexibility results in consistency within a municipality, it does not permit the design creativity necessary to enable sustainable development.
- **A lack of regulatory consistency** among site improvement design standards from one municipality to another, resulting in confusion and unnecessary costs to builders and developers.

These shortcomings have created local parking standards that are often excessive and inflexible, resulting in the creation of unnecessarily large surface parking lots with impervious cover. Likewise, stormwater design standards, including those for parking lots, are too rigid and do not encourage or

Image: Parking in Eagleview (Exton, PA) is positioned behind the homes, with shared access areas.
Source: DVRPC

allow for low-impact development, which is further discussed in Chapter 5. Many local municipalities have not updated their stormwater management plans to permit permeable surfaces in parking lots, for instance, though the state has encouraged it.

The Pennsylvania recommended parking requirements for residential land uses contain requirements for residents of each dwelling unit (Table 2).

TABLE 2: PENNSYLVANIA RECOMMENDED REQUIREMENTS FOR PARKING FOR RESIDENTIAL DWELLINGS

Housing Unit Type/Size	Parking Spaces (per dwelling unit)
Single-Family Detached	2.0
Townhouse, Duplex, Quad	1.7
Apartments/Condos	
3 or more bedrooms	1.4
1 or 2 bedrooms	1.2
Efficiency	1.0

Source: Pennsylvania Housing Research/Resource Center. Pennsylvania Standards for Residential Site Development. April 2007.

New Jersey has required residential land development standards, contained within the New Jersey Administrative Code Title 5 Chapter 21, entitled *Residential Site Improvement Standards*. These were adopted in 1997 and revised in 2007. The code allows alternative parking standards for areas served by mass transit, and for urban areas with different parking needs than suburban areas. It also allows the counting of on-street parking spaces in overall requirements. Requirements for attached units already include provisions for guest parking (0.5 spaces per unit), which must be provided either on-street or in common parking areas. The New Jersey parking requirements for residential land uses are contained in Table 3.

TABLE 3: NEW JERSEY PARKING REQUIREMENTS FOR RESIDENTIAL LAND USES

Housing Unit Type/Size	Parking Spaces (per dwelling unit)
Single-Family Detached	
2 Bedroom	1.5
3 Bedroom	2.0
4 Bedroom	2.5
5 Bedroom	3.0
Two Family (Duplex)	Single Family Detached applies to each unit
Garden Apartment or Midrise	
1 Bedroom	1.8
2 Bedroom	2.0
3 Bedroom	2.1
Townhouse	
1 Bedroom	1.8
2 Bedroom	2.3
3 Bedroom	2.4
High Rise	
1 Bedroom	0.8
2 Bedroom	1.3
3 Bedroom	1.9
Mobile Home	
1 Bedroom	1.8
2 Bedroom	2.0
Retirement Community	Based on most appropriate housing unit type and size above.
Recreational Homes (owner-occupied)	Based on most appropriate housing unit type and size above.
Assisted Living	0.5

Source: New Jersey Administrative Code Title 5 Chapter 21: Residential Site Improvement Standards (RSIS). 2007.

The SmartCode, a model form-based unified development ordinance (which folds zoning, subdivision regulations, urban design, and optional architectural standards into one document), promotes a sustainable urban pattern while protecting landscapes that are considered ecologically and culturally valuable.

The SmartCode is a transect-based code. A "transect" is a continuous cross section of natural habitats for plants and animals, ranging from shorelines to wetlands to uplands. The specific transect that the SmartCode uses is based on the human habitat, ranging from the most rural environments to the most urban environments. This transect is divided into a range of "Transect Zones" or "T-Zones," each with its own complex character. It ensures that a community offers a full diversity of building types, thoroughfare types, and civic space types, and that each has appropriate characteristics for its location. The six T-Zones are: T1 Natural, T2 Rural, T3 Sub-Urban, T4 General Urban, T5 Urban Center, and T6 Urban Core.

The latest version of the new urbanist SmartCode (version 9.0) sets standards for parking and density calculations for each of the different transect zones. Table 4 indicates the requirements for residential, lodging, office and retail. The requirements are flexible because they recognize that the intensity of land development entails different parking requirements. Overall, the SmartCode parking requirements are lower than the requirements shown in Table 1 and are more sensitive to the surrounding land use pattern and character.

TABLE 4: SMARTCODE PARKING REQUIREMENTS

	T2 Rural T3 Suburban	T4 General Urban	T5 Urban Center T6 Urban Core
RESIDENTIAL	2.0 / dwelling	1.5 / dwelling	1.0 / dwelling
LODGING	1.0 / bedroom	1.0 / bedroom	1.0 / bedroom
OFFICE	3.0 / 1000 sq. ft.	3.0 / 1000 sq. ft.	2.0 / 1000 sq. ft.
RETAIL	4.0 / 1000 sq. ft.	4.0 / 1000 sq. ft.	3.0 / 1000 sq. ft.

Source: Table 11: SmartCode Version 9.0, 2007

In addition, the SmartCode includes some innovative ideas on parking requirements, including:

- Allowing on-street parking to count in T4, T5 and T6 zones
- Exempting liner buildings (a specialized building, parallel to the street, which is designed to conceal an area such as a parking lot or loading dock) less than 30 feet deep and no more than two stories high from parking requirements in T4, T5, and T6 zones
- Exempting accessory units from counting toward density calculations in T4, T5, and T6 zones (thus, parking is not required specifically for these accessory uses).

The SmartCode includes some innovative ideas on parking location, including:

- Parking shall be accessed by rear alleys or rear lanes, when such are available on the regulating plan, in T2, T3, T4, T5, and T6.

- Open parking areas shall be masked from the frontage by a building or streetscreen in T2, T3, T4, T5, and T6.
- For buildings on B-Grids (streets that by their use, location, or absence of pre-existing pedestrian-supportive qualities may meet a standard lower than A-Grid streets), open parking areas may be allowed to be unmasked on the frontage by warrant, except for corner lots at intersections with the A-Grid (streets held to the highest standards because of their pre-existing pedestrian-supportive qualities or their future importance to pedestrian connectivity) in T2, T3, T4, T5, and T6.
- Open parking areas shall be located at the second and third lot layers (layer meaning "range of depth of a lot within which certain elements are permitted), except that driveways, drop-offs and unpaved parking areas may be located at the first lot layer, for T2 and T3.
- Garages shall be located at the third layer except that side-or rear-entry types may be allowed in the first or second layer by warrant in T2 and T3.
- Driveways at frontages shall be no wider than 10 feet in the first layer in T3 and T4.

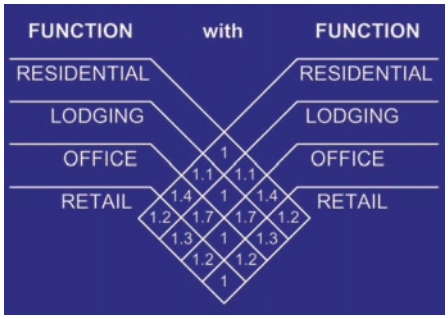
- All parking areas and garages shall be located at the second or third layer in T4.
- All parking lots, garages, and parking structures shall be located at the second or third layer in T5 and T6.
- Vehicular entrances to parking lots, garages, and parking structures shall be no wider than 24 feet at the frontage in T5 and T6.
- Pedestrian exits from all parking lots, garages, and parking structures shall be directly to a frontage line (i.e., not directly into a building) except underground levels that may be exited by pedestrians directly into a building in T5 and T6.
- Parking structures on the A-Grid shall have liner buildings lining the first and second stories in T5 and T6.
- A minimum of one bicycle rack place shall be provided within the public or private frontage for every 10 vehicular parking spaces in T5 and T6.

Table 5: SmartCode's Shared-parking Factor represents the SmartCode required parking when land uses are shared. The shared-parking factor allows parking requirements to be adjusted when more than one land use type (function) share a parking facility. Instead of requiring the maximum parking requirements for each land use from Table 3, the shared-parking factor allows for flexibility, resulting in an overall reduction in the amount of parking. For example, an office use requires 60 spaces and a retail use requires 40 spaces. The total number of spaces required for both uses is 100. Multiply that by 1.2 (the shared-parking factor for office combined with retail or vice versa) and it equals 120,

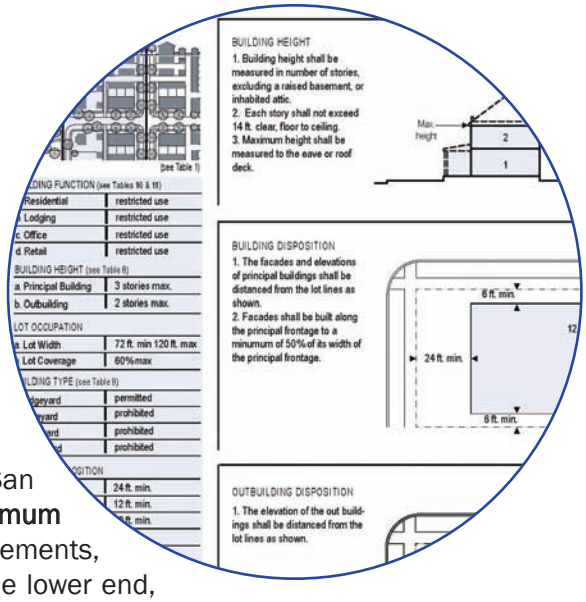
Image: Parking for Spring Arts Point in Philadelphia is accessible through alleys leading to rear garages.
Source: DVRPC

a difference of 20, Therefore, subtract 20 from the original required parking of 100. The number of spaces now required for both uses is 80. This prevents double counting of parking demand between uses amenable to captive trips. The Shared-parking Factor is available for any two functions within any pair of adjacent blocks in the transect zones T4, T5, and T6.

TABLE 5: SMARTCODE'S SHARED-PARKING FACTOR



Source: Table 11: SmartCode Version 9.0, 2007



Some cities, such as Los Angeles, Portland, Seattle, and San Francisco, have taken the extra step of **abolishing all minimum parking requirements** and only using maximum parking requirements, letting the market decide how much parking to provide on the lower end, coupled with parking management programs to relieve congestion.

In addition to the SmartCode, the American Planning Association has published model smart land development regulations, including a model mixed-use zoning ordinance, a model live/work zoning ordinance, and a model town center zoning ordinance, all of which contain language on parking requirements. See Appendix B for a sample of this language.

BARRIERS TO UPDATING OUTDATED PARKING STANDARDS

As municipal leaders gain more control over the supply of parking, they may face potential challenges to updating their outdated parking standards, including:

- Limited and/or confusing information in technical resources on parking requirements
- Political pressures from commercial and development interests to either increase the supply if they perceive a burden to their operations, or to broaden the exemptions, particularly if they only apply to some geographic areas.
- Difficulty in precisely predicting maximum parking amounts
- Possibility of parking spillover if mitigation, enforcement, and monitoring are lacking
- Resident opposition if abundant neighborhood parking is desired
- Overcoming the assumption that society benefits from a maximum supply of free or low-priced parking (see pricing parking section)

Image: The SmartCode is a graphic-intensive, model form-based zoning code. Source: DPZ & Co.

Additionally, parking supply measures may not work if an area is relatively homogeneous or where most properties draw people to the area at the same time of day (Atlanta 2003). Cities need stakeholder input and community buy-in to effectively understand the implications of past changes in parking policy and the perceived potential effects of new policies.

PARKING SUPPLY

The location and supply of parking can have far reaching influences on development opportunities, property values, urban design, and residential density. The availability of parking, or *parking supply*, is largely dependent on the intensity of development and the cost of land. In many central business districts (CBDs), the limited availability of parking spaces results not necessarily in a parking shortage, but in higher parking prices. Urban planners will argue that there is plenty of CBD parking if one is willing to pay high prices or to walk a few blocks to the destination. High parking prices usually reflect the success of a CBD in providing an environment in which people are willing to pay for parking. Congested CBD streets and poor parking 'advertising' also contributes to the perception of parking scarcity.

By guiding the supply of off-street parking, planners can improve mobility, promote the use of alternative modes, support existing and new economic development, maintain air quality, and enhance the urban form of the CBD. From the planner's perspective, influencing the parking supply improves the urban environment by:

- Preserving open space and limiting impervious surfaces.
- Reducing congestion.
- Encouraging an attractive, pedestrian-friendly urban design.
- Promoting transportation choices.

From the developer's perspective, regulating the supply of parking:

- Minimizes costs for parking construction, operations, and maintenance.
- Reduces traffic and traffic related costs.
- Increases leasable space within a given floor-to-area ratio (EPA 2006).

Because developers may worry about marketability and concerns over competing suburban developments, amenities other than parking should not be underestimated. Convenient access to services and places of employment, attractive streetscapes, or pedestrian-friendly neighborhoods can have a strong influence on tenant preferences (EPA 2006).

Image: The location and supply of parking can have far reaching influences on development opportunities, property values, urban design, and residential density. Source: DVRPC

PARKING DEMAND

Parking demand varies based on density and design, development type and size, demographics (such as income and household size), transit access, adjacent land uses, and the amount of nearby or off-site parking. It is also affected by trip purpose, parking duration, parking turnover, vehicle accumulation, and walking distances incurred (Kuzmyak 2003).

Trip purpose is the most significant factor of parking demand. For many urban areas, the distribution of trip purpose can be categorized into three major categories: home-based work, home-based other, and nonhome-based. The home-based work trips typically are the largest component of trip purpose. Home-based other trips includes shopping, school, and recreation, among other types of trips. Nonhome-based trips are almost always part of a chain of trips that usually starts or ends at the trip maker's place of residence or work.

The length of time parked, or **parking duration**, is largely dependant on trip purpose. The duration directly affects the choice of facility and the walking distance acceptable to the parker. Work trips typically have the longest time parked of any trip purpose. Parking duration, combined with parking demand, determines parking turnover.

Parking turnover is the number of cars actually accommodated per parking space during the time span of the survey used to obtain the data. Data collected from parking turnover surveys reinforces the role of on-street parking's association with high turnover, while off-street parking is shown to be oriented toward long-term parking.

Vehicle accumulation is the amount of vehicles using any given parking facility at any given time. This data reflects the temporal variation of parking activity. The accumulation of vehicles by time of day measures the percentage occupied for any given facility and is key to gauging parking demand.

Walking distances incurred are most relevant in a central business district (CBD), as drivers are willing to walk farthest for work trips. There is also a relation between the population of the urban area and the average distance walked from a parking space to a CBD destination. The larger the population of the urban area, the farther the drivers walked. This has implications for public transportation having a competitive edge over auto travel in CBDs.

Image: Parking duration directly affects the choice of facility and the walking distance acceptable to the parker.
Source: DVRPC

CHAPTER 2:
PARKING MANAGEMENT

CHAPTER 2: PARKING MANAGEMENT

The adjustment of parking supply outside the normal processes of the private marketplace to achieve strategic objectives is often referred to as **parking management**. It is essentially one or more strategies that result in more efficient use of land devoted to automobile storage. **Often when communities feel they do not have enough parking, they actually do, though it is just not managed properly.**

The benefits of a parking management system can be far reaching, including (Osborne 2003):

- Enables a community to meet economic needs by allowing a higher density of parking than would otherwise be accommodated by conventional parking requirements or land use strategies. The higher densities in turn make real estate development projects more financially viable, especially in urban infill locations.
- Educates drivers about the true costs of parking and driving.
- Promotes environmental sustainability.
- Reduces the amount of land required for parking.
- Develops a more aesthetic and holistic approach to parking allocation by reducing the amount of parking in an area to a more human scale.
- Supports transportation infrastructure by spreading out the types of access trips to include walking, bicycling, carpooling, and transit.
- Enables investment in streetscapes.
- Can make housing more affordable by relaxing parking standards for residential developments (cost savings obtained by the builder can be passed on to the buyer).

Problems that parking management can help alleviate include:

- Inadequate parking supply.
- Inefficient use of existing parking capacity.
- Inconvenient pricing.
- Excessive automobile use.
- Inadequate parking causing unwanted spillover in other locations.

Parking management can be used to **reduce demand** by (further described in this chapter):

- Reducing parking requirements.

Image: Municipalities can reduce parking requirements for areas that are within a specific distance of transit. This image shows SEPTA's Thorndale Station (R5 Line).

- Setting parking maximums.
- Implementing travel demand management (TDM) programs that improve other transport choices.
- Developing bicycle and pedestrian facilities.
- Introducing parking fees and taxes.

Parking management can be used to **improve supply** by (further described in this chapter):

- Introducing or expanding shared-parking facilities.
- Designing facilities better to accommodate more cars.
- Developing more convenient payment options.
- Responding to parking spillover effects.
- Improving enforcement.

Conventional parking policies are managed simply for motorist convenience, whereas smart growth parking policies are enacted for the efficiency of the entire transportation system. Conventional parking standards stress minimum parking requirements, free parking, and dedicated parking facilities, and they favor low-density development. Conversely, smart growth emphasizes optimal parking supply, priced parking, shared parking, and more compact development (Litman 2007).

PARKING MANAGEMENT TECHNIQUES

There are a variety of techniques that communities can implement to promote and advance a successful parking management program. These techniques can include:

REDUCTION IN PARKING REQUIREMENTS

Municipalities can update their zoning codes to reduce the required amount of parking in all or specific zoning districts, depending on the circumstances. Municipalities can reduce parking requirements for areas that are within a specific distance of a rail station or major bus route, such as within a quarter to a half mile, assuming that some percentage of trips will be taken by transit, lessening the need for overall car ownership and parking. This is commonly known as transit-oriented development zoning. Similarly, citywide reductions in parking requirements can be granted for below-market-rate units and senior housing, recognizing that these residents are less likely to own vehicles.

EFFICIENCY-BASED STANDARDS

Efficiency-based standards size parking facilities for optimal utilization. This means that parking lots are allowed to fill, provided that management strategies can insure user convenience and address

Image: Smart growth emphasizes optimal parking supply, priced parking, shared parking, and more compact development. Source: DVRPC

any problems. Efficiency-based standards take into account geographic, demographic and economic factors that affect parking demand. They also reflect the relative costs and benefits of different options, so less parking is supplied where parking supply is relatively costly to provide, as in a central business district, or where management programs have already been established or are easy to implement. Efficiency-based standards should also reflect strategic planning objectives such as a desire for more compact development or to reduce traffic (Litman 2007).

RESERVE PARKING

Rather than building all parking based on future demand numbers, a municipality can instead choose to adopt a reserve parking strategy, whereby land is banked or a landscaped area is preserved for this future demand. This allows the municipality to be prepared for unforeseen changes in parking demand, but in the interim lessen the amount of impervious surface created by a development and add to the greenspace within the development. Municipalities can allow developers to build less than the minimum amount of parking at the outset, provided that open space is reserved which, if needed, can be converted into parking at a later date. Upper Merion Township, Montgomery County, allows developers to construct 75 percent of the minimum number of spaces, with the understanding that the remaining 25 percent will be added if the township's building official determines the existing parking to be inadequate at a specified time period (usually one year).

UNBUNDLED PARKING

Traditionally, most residential apartment and condo buildings have bundled parking. That is, the price of parking is absorbed into tenant leases or sales prices. This practice assumes that all tenants have the same parking demand and therefore must bear the cost of parking through increased rents or inflated purchase prices. In this regard, bundled parking actually encourages automobile ownership.

When parking is *unbundled*, there is a separate payment for parking from the rent payment or purchase price. This provides a more equitable allocation of costs by allowing tenants and owners to pay only for the parking they use (Maryland 2005). Renters are offered a discount in some capacity to use fewer spaces. Rather than renting an apartment with two spaces for a fixed price per month, the apartment would rent for less and charge a flat rate for each parking space. This creates a financial incentive on behalf of the renter to use fewer parking spaces (WSA 2007). Likewise, a housing unit would sell for less if parking was not automatically included, giving the consumer the choice to purchase parking or not to.

Unbundling parking can be a valuable step in implementing pricing policies. It gives individuals an opportunity to make decisions based on the price of parking as a commodity rather than a free good (WSA 2007). This notion is an important step in getting people to understand the true cost of parking.

Outside of a few cities on East and West coasts, building housing and condo developments without parking is by far the exception to the rule. Local governments require developers to provide a minimum

Image: The Hub on Chestnut, a new mixed-use building in West Philadelphia, was constructed without on-site parking. Source: DVRPC

number of parking spaces for each unit, where the cost of the space is rolled into the housing price. Skyrocketing housing prices and the move toward higher density development are changing the way cities and developers manage the relationship between parking and residential development. In 2005, the city of Seattle reduced parking requirements for multifamily housing in several commercial corridors. In 2006, San Francisco replaced minimum requirements downtown with maximum standards of .75 parking spaces per unit (Baker 2006). The reduced requirements for parking has given developers a market advantage by lowering the cost of housing and has created incentives to build housing in locations that were once parking-prohibitive.

PARKING FREEZES

Parking freezes set a determined number of parking spaces allowed in a particular district. Parking freezes have been implemented in various areas of the country in response to nonattainment of environmental standards, traffic congestion, or other urban planning considerations (EPA 2006). Successful parking freezes work best in neighborhoods that have strong local economies with the ability to attract tenants and customers, areas with viable public transportation options, and areas where the attractiveness of a given location outweighs the drawback of limited parking, such as in a downtown shopping district.

SETTING PARKING MAXIMUMS

Some communities place a maximum limit on the number of parking spaces allowed in their zoning ordinances, particularly for downtown or commercial areas. These can be in addition to, or instead of, the minimum parking space requirements. The city of Seattle, for instance, allows a maximum of one parking space per 1,000 square feet of downtown office space.

TRAVEL DEMAND MANAGEMENT PROGRAMS (TDM)

Travel demand management programs (TDM) encourage people to use alternatives to driving. TDM programs are implemented through employers or through the development process (such as requiring TDM measures with new development). Such programs could include:

- Carpool matching
- Bicycling facilities, such as parking and shower/changing rooms
- Preferred parking for carpoolers
- Financial incentives, such as free or subsidized transit passes
- Parking cash-out programs (employees can choose between transit subsidy, parking subsidy, or cash benefit)
- Emergency ride home programs

Image: TransitChek is a commuter benefit program, administered by DVRPC, that employers can offer to their employees to help pay for transit. It is an example of a Travel Demand Management tool. Source: DVRPC

focus on widening existing sidewalks, completing missing links in sidewalks, adding bike lanes, or implementing a multi-use trail to link different land uses (EPA 2006).

Even simple measures such as providing bicycle parking or storage can be an effective way to promote bicycling. Municipalities can require bicycle parking in their zoning ordinances and reduce minimum parking requirements given the provision of bicycle parking over the required amount. The Municipal Code in Portland, Oregon requires a minimum number of short-term and long-term bicycle spaces for residential and non-residential uses (Maryland 2005). Furthermore, bicycle parking may substitute for up to 25 percent of the required automobile parking. This means that for every five nonrequired bicycle parking spaces, the automobile requirement is reduced by one space.

Municipalities can incorporate provisions for bicycle use directly into their zoning ordinance. Ordinances can require all major retail centers to have a minimum number of bicycle spaces at each main entrance. To increase awareness, the ordinance should require bike racks be located in a place where they are highly visible. To promote safe bicycle use, the ordinance can require bicycle parking areas to be separated from automobile parking (EPA 2006). Other ordinances state that bicycle parking must be provided with new automobile parking facilities. Bicycle parking can also be provided in lieu, by providing bicycle parking at an alternative location that is more suited to meet the needs of the users (Litman 2006).

Municipalities should update their zoning codes to require the inclusion of bicycle parking. One example of including bicycle parking in a municipal ordinance is the Mixed-Use Special Transit (MUST) district in Lower Merion Township, which requires, “one bicycle space or locker for each three dwelling units” for residential development, and “one bicycle space or locker for every twenty (20) automobile parking spaces” for commercial development.

PARKING TAXES

Taxes can be collected through a variety of ways. Taxes can be levied on user-paid parking transactions, on parking facilities, and on unpriced parking. This can be done by charging stormwater management fees, by offering tax discounts to households that do not own an automobile, and by levying property taxes on land dedicated to parking (Litman 2006).

IN-LIEU PARKING FEES

In-lieu parking fees are established by municipalities as an alternative to requiring on-site parking facilities, whereby developers are able to mitigate their parking costs by paying a fee to the local municipality “in-lieu” of providing parking. The municipality in turn provides off-site parking. The in-lieu fee is set at a level below the cost of constructing parking spaces by calculating a flat rate for each parking space not provided, or by determining appropriate development-specific fees on a case-by-case basis. Typically, the accrued money from the municipal parking fund helps finance municipal-

Source: One low-cost method of reducing parking demand is to provide more pedestrian and bicycle facilities, such as bike lanes. Source: DVRPC

EMPLOYER PARKING PROGRAMS

Employers can play an important role in parking management. Employer parking management programs are most commonly designed to reduce single-occupancy vehicle usage. The incentives for employer participation in parking management can range from mitigating traffic, responding to air quality regulations, maximizing existing parking spaces to avoid parking expansion, and controlling costs.

Site-specific employer parking programs may include preferential parking for high-occupancy vehicles, or price incentives or disincentives to allocate parking supply, such as imposing parking fees on single-occupancy vehicle users. To increase the effectiveness of vehicle trip reduction programs, employers can incorporate an assortment of complementary program elements to balance transportation choices. These include guaranteed ride home programs, company fleet cars, and ride matching services. However, there is little incentive for employers to implement these types of programs without the municipality also granting a reduction in minimum parking requirements to the employer, thereby saving them some of the costs of supplying parking (EPA 2006).

Many employers provide free parking to their employees, and this cost is usually passed on to all employees in the form of lower wages. Regardless of journey-to-work mode, employees pay for parking facilities in some form or another. Newer programs allow employers to implement a cash-out program which allows employees a choice to receive free parking or give up their free parking in exchange for a cash payment. The payment equals the cost of commuting via an alternate mode. As more employees opt for the cash-out, employers require less parking. Cash-out programs are more effective where the availability of transit is prevalent (Maryland 2005).

BICYCLE AND PEDESTRIAN FACILITIES

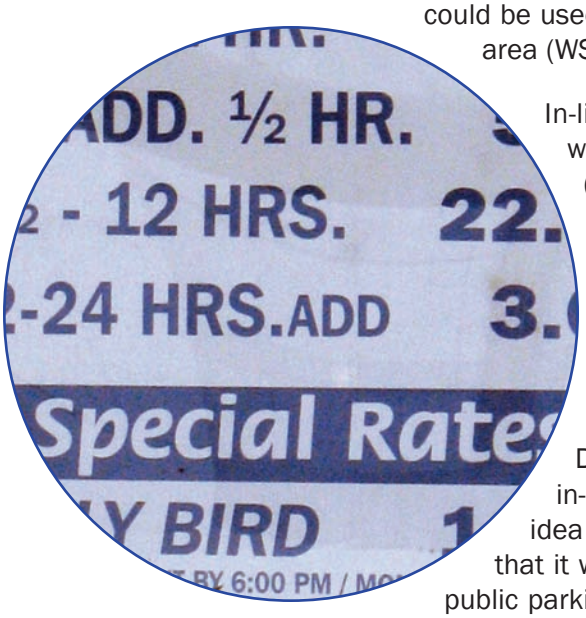
One low-cost method of reducing parking demand is to provide more pedestrian and bicycle facilities. These low-cost amenities can be as simple as providing bicycle racks, designated bike lanes, and walkways. This in turn increases the mobility of the traveling public and also creates a pleasant, healthy way to get around. Unfortunately, most new commercial districts and modern office parks are disconnected from residential areas by a network of congested roadways and a sea of parking lots. Simple tasks such as running lunch time errands almost always require a vehicle trip.

Improved walking conditions can expand the range of parking facilities that serve a destination, if it is easier to walk further. It increases the feasibility of shared-parking facilities and enables parking in one location to serve multiple destinations ("park once" environments). This reduces vehicle trips and the amount of parking required at each destination (Litman 2007).

Promoting bicycling and walking can be accomplished through a variety of methods. Some municipalities have gone as far to require "complete streets" policies that require safe access to all road users, including transit users, bicyclists, and pedestrians. Other less elaborate methods can

Image: One low-cost method of reducing parking demand is to provide more pedestrian and bicycle facilities, such as bicycle lockers. The image above is from Los Angeles, CA. Source: Flickr.com

owned, centrally located, off-site parking facilities. A municipality could use the in-lieu fund to construct and/or manage new parking or contract out this responsibility. In certain instances, the fees could be used to pay for other transportation improvements in the project area (WSA 2007).



In-lieu parking fees could be optional (developers choose whether to provide parking or pay the fee), mandatory (developers are prohibited from constructing new parking themselves, but instead pay a fee to allow publicly owned spaces to be constructed), or flexible (fee pays for other transportation improvements, such as parking guidance systems, retrofitting existing garages to make shared parking more feasible, improved transit, or pedestrian and bicycle facilities).

Developers, however, are often reluctant to accept the idea of in-lieu parking fees. The business community may perceive the idea of the lack of on-site parking as a deterrent to tenants and that it will negatively impact the marketability of the project. Nearby public parking that is insufficient, inconveniently located, or inefficiently operated can exacerbate developers' reluctance. It is important for planners to consider the parking demand for each property to ensure that there is enough public parking to meet the demand (EPA 2006).

In-lieu parking can be very beneficial when parking can compromise the integrity of a historic building, for example, as it gives the developer the ability to circumvent on-site parking and improve site design. The town of Westport, Connecticut's Zoning Regulations allow for developers to pay fees-in-lieu for projects in a designated Historic Design District. The fee-in-lieu of parking is set at $2,000 per deficit parking space and must be paid in full by the applicant prior to the issuance of a zoning permit (Maryland 2005).

In the Delaware Valley region, the Borough of New Hope adopted an ordinance in 2006 that contains provisions for alternative parking. It states that within the Central Commercial, Highway Commercial, Mixed Use, Limited Commercial, and Light Industrial zoning districts, any existing or new use that cannot meet the parking requirements of the ordinance within the lot or boundary lines of the principal use may meet the parking requirements in one of three ways, one of which is in-lieu parking. The applicant must pay New Hope Borough a fee-in-lieu for each required parking space. The fee amount is to be determined on a case-by-case basis and will be used for the acquisition, construction, and maintenance of public parking and for related parking management services. The fee-in-lieu option may be used to meet up to 100 percent of the parking requirement. Other municipalities, such as Gloucester City and Haddonfield, also allow for fees-in-lieu.

In-lieu parking fees can be beneficial in the following ways (EPA 2006):

- Reduces construction costs for developers in cases where providing all the required parking spaces would be difficult or extremely expensive.
- Gives developers more options to meet the parking requirements, allowing them to

Image: There is a relationship between parking supply and parking demand, particularly when pricing parking.
Source: DVRPC

undertake infill projects without having to assemble a larger site to accommodate on-site parking.

- Gives architects greater freedom to design better buildings and enables municipalities to encourage better urban design with continuous storefronts uninterrupted by parking lots.
- Gives municipalities funds to make sure that public parking facilities will be used more efficiently.
- Gives municipalities increased control over parking management, making it easier to implement such strategies as real-time information and market pricing.
- Gives municipalities greater leverage in relocating parking lots and structures to where they have the lowest impact on vehicle and pedestrian circulation.
- Enables municipalities to treat all developers consistently and lessens the need for parking variances (Shoup 1999).

PARKING PRICING

There is a relationship between parking supply and parking demand, particularly when pricing parking. When the amount of available parking is scarce, whether this is due to market conditions or municipal regulations, there are usually fees for parking (Kuzmyak 2003). Probably the simplest way of reducing parking demand is to charge the users directly for the cost of parking. Parking prices for meters and off-street parking facilities can be set to alter the cost of driving alone relative to travel alternatives.

Parking pricing means that motorists pay directly for using parking facilities. Pricing strategies can be used to (Litman 2006):

- Reduce parking problems in a particular location.
- Reduce vehicle traffic in an area.
- Recover parking facility costs.
- Generate revenue for other purposes (such as a local transportation program or downtown improvement district).

Cost-based parking pricing, with prices set to recover the full cost of a parking facility, typically reduces parking demand from 10 to 30 percent (Litman 2006). Charging motorists directly for parking is more economically efficient and fair (horizontal equity) than unpriced parking, which results in cross-subsidies from consumers who drive less to those who drive more than average (VTPI 2007). When parking is priced monthly, it is usually discounted compared to short-term or daily pricing. This practice encourages motorist to drive in order to get their money's worth. A more efficient strategy is to prorate monthly leases by the portion of days the parking facility is used.

Image: Probably the simplest way of reducing parking demand is to charge users directly for the cost of parking. Source: DVRPC

The most common type of pricing strategy is **time-based pricing**. Time-based pricing can be implemented in on-street parking and off-street parking facilities to encourage turnover, which can aid parking facilities in covering costs and earning a reasonable return. To this end, parking prices can be set to increase with each additional hour. Additional fees can also be imposed for larger vehicles to encourage the use of compact cars, which, in turn, demand a smaller area of land for parking (Maryland 2005).

As expected, there are obstacles to implementing parking pricing. The general public is accustomed to receiving subsidized parking, so they oppose parking pricing. They see pricing as an additional cost rather than as a payment for a service that they use. Most often, municipal leaders, when faced with a parking problem, react by increasing parking supply, usually through changing the requirements in zoning ordinances. Because these conventional views have been the rule for so long, reversing this way of thinking poses challenges.

Businesses use **free parking** to attract customers, and customers are accustomed to free parking. There is little incentive for businesses to encourage their employees and customers to reduce their parking demand and even consider parking to be an attractive employee benefit or a service. Businesses think that parking pricing puts them at a competitive disadvantage with other businesses that offer abundant, free parking (VTPI 2007).

However, parking is never "free." Its initial construction and its ongoing maintenance costs are subsumed into the price of leases or property sales. Free parking encourages overuse and requires more parking spaces. Setting parking fees may foster greater use of alternate modes of transport, including greater carpooling, or may enable more customers to access retail establishments by preventing all-day parking.

Parking management also benefits the community by promoting fairness in the cost of parking. Typically, the cost of parking is passed on to developers and employers through higher land rents. As a result, most of the traveling public requires and uses far more parking than necessary without understanding parking's true value. This climate of abundant free parking encourages excessive driving, which also has air quality implications and environmental costs. Communities can use market strategies to help drivers understand the implications of their actions by requiring them to pay an appropriate cost for the parking spaces they consume.

Much of the public's resistance to parking pricing is highlighted in Donald Shoup's innovative book, *The High Cost of Free Parking.* Shoup advocates pricing on-street parking at market rates and eliminating minimum off-street requirements. These policies would reduce congestion, reduce emissions, and help capture the true cost of parking.

Overall, parking pricing can provide a wide range of benefits, including reduced parking facility costs, less sprawl, increased revenues for municipalities, reduced energy consumption and emissions, and

Image: Is free parking really free? Source: DVRPC

reduced traffic accidents (Litman 2006). This strategy is most effective in areas with high land values, traffic congestion, and limited parking options. It is also important to understand the primary objective of a parking pricing program in order to determine how the pricing will be structured. For traffic management, peak period prices should be set high enough to divide travel modes. For parking management, prices during peak periods should be set to balance. If prices are set too low, parking supply becomes saturated, causing drivers to cruise around in search of a parking space. If prices are too high, the parking supply is underutilized. For revenue generation, prices should at least be set to exceed the cost of recovery, ideally as high as the market will allow (Litman 2006).

The 2006 Philadelphia City Planning Commission's study, *Center City Parking Policy Evaluation*, found that compared to other cities, all-day parking is inexpensive in Center City, while short-term parking is disproportionately expensive. Based on findings in 2000, parking rates averaged $6.11 for one hour and $12.16 for all day. This pricing scheme discourages the use of public transit for the work commute, while expensive short-term parking discourages other types of trips, such as shopping trips.

MORE CONVENIENT PAYMENT OPTIONS AND BETTER USER INFORMATION

Much of the public's resistance to pricing parking results from inconvenient payment methods. Many systems require payment in specific dominations of coins or bills. It requires a motorist to predict exactly how long he or she will be parked, and provides no refund for leaving early. Payment methods can be confusing or slow to use and typically cannot handle multiple price structures or discounts. There can be high equipment, personnel, and enforcement costs associated with payment systems. Finally, the general public often sees enforcement as excessive or arbitrary (Litman 2007).

Fortunately, better payment methods are now available. Newer electronic systems are more convenient, accurate, flexible, and increasingly cost effective. They can accommodate various payment methods (coins, bills, credit and debit cards, and payment by cellular telephone or the internet), charge only for the amount of time parked, incorporate multiple rates and discounts, automatically vary rates by day and time, and offer convenience to use. Some can be integrated with payment systems for other public services, such as transit, road tolls, and telephone use. Some employ contactless technology that automatically deducts payment. Newer systems produce printed receipts and record data for auditing, which prevents fraud and increases convenience for customers, operators, and local governments. They can also automatically record data on utilization and turnover, which improves planning and administration (Litman 2007).

It is important to provide user information on parking availability, regulations, pricing, lot capacity, overflow parking options, walking directions, payment methods, alternate travel options, and enforcement practices. Information can be disseminated via the internet, maps, brochures, visitor materials, and signs. Providing good user information can increase the efficiency of parking supply, reduce vehicle mileage and driving costs when searching for parking, reduce traffic congestion, and reduce driver frustration.

Image: Off-street parking options should always be less expensive than on-street options. This image shows on-street, angle parking at Suburban Square in Ardmore (Lower Merion Township). Source: DVRPC

ON-STREET PARKING MANAGEMENT

It is important to coordinate the pricing of on-street and off-street parking alternatives. Off-street options should always be less expensive than on-street options. Visitors should be encouraged to park their cars once and proceed on their journey as a pedestrian. When on-street parking is more affordable, drivers are incentivized to seek a spot right in front of their destination, rather than embracing this "park-once" mentality. By encouraging drivers to prefer the off-street option, municipalities may cut down on congestion from drivers circling the block, searching for a space, and may also reduce potentially dangerous behavior caused by drivers who are more intently searching for a space than paying attention to the road. The remaining on-street spaces should be priced higher to encourage short-term use, which increases storefront business potential.

SHARED PARKING

Shared parking is when two or more land uses share the same parking spaces. Shared parking evolves around different land uses having their respective peak demand for parking at different times of the day. Sharing parking spaces typically accommodates 20 to 40 percent more users compared with assigning each space to an individual motorist, since some potential users are usually away at any particular time (VTPI 2007). 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 for a portion of the day, this policy leads to the underutilization of many parking facilities. At any given time, a significant portion of parking spaces are vacant.

Table 6 shows the typical peak parking demand periods for different types of land uses.

TABLE 6: PEAK PARKING DEMAND PERIODS FOR DIFFERENT LAND USES

Weekday Peaks	Evening Peaks	Weekend Peaks
Banks	Hotels	Religious Institutions
Schools	Auditoriums	Parks
Distribution Facilities	Restaurants and Bars	Retail Shops
Factories	Theaters	Malls
Offices	Meeting Halls	
Professional Services	Residences	

Source: Pennsylvania Housing Research/Resource Center. Pennsylvania Standards for Residential Site Development. April 2007.

Shared parking works best when planners conduct a land use assessment and review time-of-day parking utilization data. This analysis would take into account the physical layout of the development, the number of spaces for each individual land use, and the type of parking user throughout the course of a day (EPA 2006). An office building that has peak demand during normal daytime business hours could share the same parking spaces with a restaurant whose demand peaks in the evening. This allows for a decrease in the total number of spaces required to fill both demands. By encouraging shared parking, a municipality can reduce the total number of spaces required relative to the total number of spaces needed for each land use.

Businesses that share parking benefit from having a captive pool of patrons close by. In the previous

example, employees at the office building would be likely to patronize the restaurant, supplying a core of customers. Developers benefit from lower construction costs by having to provide fewer parking spaces. Parking demand can also vary by day of the week. A typical peak parking period for most professional services is on a weekday. Most religious institutions see parking demand peak on the weekend. Sharing parking for different land uses can be as easy as creating an arrangement between sites located close together. For example, SEPTA has agreements with several churches for weekday use of their parking lots.

One of the greatest benefits of shared parking is that it allows for a more efficient use of land, by significantly reducing the amount of land devoted to parking, creating more opportunities for other land uses. The saved land could be used for landscaping or other design enhancements. Shared parking may allow new infill developments to occur without the need for additional parking. By incorporating new innovations and technology, shared parking can increase the cost effectiveness of smaller parking lots. Rather than single use parking lots, shared parking can significantly improve the economics of constructing new parking by providing greater turnover in the facility that serves multiple users (WSA 2007).

Implementing shared-parking guidelines in zoning ordinances can be achieved several ways (Maryland 2005):

- **Off-Site:** Some municipalities allow for shared parking facilities to be located off-site, usually specified by a maximum distance from the structure. This location requirement is typically based on acceptable walking distances.
- **Maximum Total Across Time Periods:** Another method is to determine the minimum amount of parking by time period required for each land use as though it were a separate use, by time period. From this, calculate the total parking required across uses for each time period and set the requirement at the maximum total across time periods. Other jurisdictions allow the parties involved to determine the appropriate number of spaces by certifying that the parking area will be large enough to accommodate the anticipated demand and submitting an analysis that demonstrates that peak parking for each land use occurs at different times of the day.
- **Contingency Plan Required:** Some ordinances require a contingency plan to demonstrate that additional parking, if necessary, can be accommodated in the future.

Having multiple businesses share parking encourages walking and reinforces the idea that centralized parking is a benefit to urban areas. Shared parking also requires fewer driveways and access points, resulting in more efficient traffic flow, reduced driver conflicts due to fewer turning vehicles, and reduced emissions from idling vehicles sitting in traffic (EPA 2006).

The model form-based code, the SmartCode, includes shared-parking calculations (see Chapter 1),

Image: One of the greatest benefits of shared parking is that it allows for a more efficient use of land. This image shows a shared parking facility in Hatboro Borough. Source: DVRPC

and the Pennsylvania Standards for Residential Development includes recommendations on shared-parking standards. New Jersey's required Residential Site Improvement Standards (RSIS) permits shared parking in mixed-use developments.

TRANSFERABLE PARKING ENTITLEMENTS

This practice allows for a number of parking spaces to 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 unless additional parking were added. From a financial standpoint, both developers benefit. 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.

DESIGNING FACILITIES TO BETTER ACCOMMODATE MORE CARS

Through a variety of techniques, the capacity of existing parking facilities can be increased without requiring more land. This can be achieved by reducing the size of the parking spaces, allowing tandem parking (two cars parked in front of each other, lengthwise), modifying on-street parking orientation from parallel to angled, providing small spaces for motorcycles and scooters, introducing valet parking during peak periods, and using car stackers and mechanical garages (Litman 2006). In addition, municipalities can redesign and consolidate parking lots, if beneficial.

RESPONDING TO PARKING SPILLOVER EFFECTS

Parking spillover refers to the undesirable use of off-site parking facilities. It can occur when business customers and employees (or commuter train riders unable to find station parking) park on nearby residential streets or use other businesses' parking lots. Parking management strategies can alleviate spillover in a couple of ways. First, the municipality should provide information to motorists about where they can and cannot park through **user information** programs. Second, **residential permit programs** can ease spillover on streets near activity centers by not allowing nonresidents to park there. Third, **charging nonresidents for parking** can increase turnover and prevent all day parking. Fourth, **overflow parking** can be useful for special events, seasonal peak shopping periods, or a temporary reduction in parking supply.

Municipalities that have an overflow parking plan can significantly reduce the amount of parking needed. Overflow plans can include signs to alternate parking, encourage mode shifts during peak periods, design courtyards or lawns so they may be used for occasional overflow, give priority to transit and high-occupancy vehicles during peak periods, and provide extra parking staff during special events (Litman 2006).

PARKING ENFORCEMENT

Improving enforcement supports parking management by increasing regulatory and pricing effectiveness. Proper enforcement and control techniques can go a long way to improving the success of a parking management program. It means that parking regulations and pricing requirements are

Image: Spillover parking can occur when commuter train riders are unable to find station parking. This image shows the jam-packed Ft. Washington SEPTA (R5) Station. Source: DVRPC

enforced more frequently, effectively, and considerately (Litman 2007). To be politically acceptable, the enforcement process must be perceived as efficient, considerate, and fair. The need for fines should be minimized by providing adequate user information (Litman 2006).

PERIPHERAL PARKING

Many municipalities have initiated or encouraged peripheral parking facilities adjacent to their central business districts (CBDs). These types of facilities are close enough to the central core that users can usually walk or take a shuttle to their final destination, yet they are located far enough from the downtown so they can be inexpensively priced. A distinction must be made between this type of fringe parking and more remote parking facilities, such as park-and-ride transit service or park-and-pool ridesharing, which are usually located some distance from the CBD (Kuzmyak 2003). The goal of peripheral parking is to capture trips headed into the central business district before they enter the downtown grid system and contribute to core traffic congestion. Unlike typical park-and-ride facilities, peripheral parking is not intended to change the primary mode of travel (Kuzmyak 2003).

The decision to employ peripheral parking as a part of an area's parking strategy may be motivated by either a shortage of parking in the built-up core area itself, or conversely, by a desire to tighten the core area parking supply as a part of a policy to manage land use, traffic, or travel demand. In areas with parking shortages, the failure to provide adequate and fairly priced parking can be detrimental to businesses, potentially turning away customers to areas with fewer restrictions. In areas with a current or developing parking surplus, a policy of restricting on-site parking and replacing it with peripheral parking offers the potential for encouraging travel by transit and other modes for at least the final distance into the CBD (Kuzmyak 2003).

Several variables can affect the success of peripheral parking. Those unsuccessful are most notably a result of inefficient user cost savings in terms of convenience or time savings. In several demonstration projects, a substantial number of peripheral parking users preferred walking, rather than transit service, for the final leg of their trip, (Kuzmyak 2003).

CAR-SHARING

Car-sharing is a vehicle rental service that makes cars easily available to residents on a pay-per-use basis, usually for short-term use (one hour to several hours, for example). Vehicles are typically parked at various sites throughout a neighborhood or at transit stations and can be reserved via a phone call or through the internet. Car-share members pay for use through some combination of hourly, overhead, and mileage-based rates. The rate typically covers the cost of gas, maintenance, insurance, and parking. A member simply walks to the reserved space (called a "pod") and opens the door via an electronic key.

The car-share system works with all of the benefits of a private car without the cost and responsibilities of ownership. The car holds a reserved parking space, so the need to search for

Image: PhillyCarShare began in 2002 and is now the world's largest regional car-sharing organization.
Source: DVRPC

parking once the trip is over has been eliminated. Car-sharing can be a useful tool to reduce parking demand in commercial areas. Employees can share a vehicle for meetings and running errands. Car-sharing can also improve the mobility of low-income households who may be unable to otherwise afford a car. More importantly to planners, parking demand can be reduced in residential areas, as car-sharing can eliminate the need to own a second or third vehicle (EPA 2006).

PhillyCarShare began in 2002 and is now the world's largest regional car-sharing organization, with 35,000-plus members and more than 400 vehicles located all over the city in 209 pods (car-sharing locations), serving 40 neighborhoods in the city and eight outside of the city. Of these pods, there are 125 pods in parking lots, 42 in on-street spaces, 32 in garages, and 10 in private driveways. PhillyCarShare prefers to locate pods in highly visible, easily accessible locations with strong PhillyCarShare membership and usage. PhillyCarShare's research demonstrates that it takes 30-50 members to support a vehicle.

In April 2004, the City of Philadelphia opted in to the program, becoming the first government worldwide to share cars with local residents in a major fleet reduction effort. The pioneering project helped replace 330 municipal vehicles, saving taxpayers $6 million (so far). Berkeley (CA), Portland (OR), and Minneapolis (MN) soon followed Philadelphia's lead.

By the end of 2008, PhillyCarShare estimates that it will have a fleet of 800 vehicles at 400-500 pods, essentially doubling their fleet and pods. By 2010, PhillyCarShare's goal is to remove 40,000 cars from the road, reducing carbon emissions by 200 million pounds of carbon dioxide.

The vision of PhillyCarShare is to reduce private vehicle ownership and dependence. Ultimately, PhillyCarShare hopes to help reduce the amount of space devoted to parking through policies that support transit, biking, and walking for most trips, with only occasional car use. PhillyCarShare estimates that, for each PhillyCarShare vehicle deployed, between 26 and 31 privately owned vehicles are removed from the streets.

PhillyCarShare believes that it cannot be successful without an effective transit system because members will only get rid of their cars if alternative transportation options are available. PhillyCarShare partners with SEPTA to provide convenient pods and reduced costs to members. There are pods at 10 SEPTA rail stations, and PhillyCarShare members can be reimbursed for rides on SEPTA rail to access their reservations at over 40 pods.

PhillyCarShare is working with developers and local governments to achieve more flexible parking standards where car-sharing is provided. The HUB development in University City was able to get a variance for a 100 percent parking reduction by agreeing to support a PhillyCarShare pod and by agreeing to rent parking at nearby garages for tenants who require parking. In Center City, the Bancroft Green development in the Graduate Hospital neighborhood was able to avoid off-street parking requirements by deeding a lot to PhillyCarShare and creating a pocket park.

Image: By the end of 2008, PhillyCarShare estimates that it will have a fleet of 800 vehicles at 400-500 pods. Source: DVRPC

Currently, PhillyCarShare users enjoy preferred parking at the Philadelphia IKEA store, and PhillyCarShare is working with other retail property owners to implement additional preferred parking arrangements. PhillyCarShare offers resident and business memberships. Rates start at $2.90/hour or $29/day, including gas and insurance.

In 2007, the privately owned Flexcar expanded into the Philadelphia market. In Spring 2008, Zipcar, another privately owned firm, and Flexcar will complete a merger and operate under the Zipcar brand. Combined, these companies will have 180,000 members in more than 50 markets in the United States, Canada, and the United Kingdom. In the Philadelphia area, the companies offer a combined fleet of more than 100 vehicles. Zipcar offers extra value plans from $50 per month, with rates of $6.16 per per hour and $46.75 per day, as well as an occasional driving plan, with a $50 annual fee and rates of $7.25 per hour and $55 per day.

Uhaul's U Car Share service offers car-share vehicles at its Philly Central, South Philly, Havertown, Roxborough, Center Horsham, and Roosevelt Boulevard locations. Rates for U Car Share are $10 per hour and $65 per day, with a $50 annual membership fee.

There are several ways local governments can get involved and participate in the benefits of car-sharing. First, municipalities can use car-sharing to reduce the number of fleet vehicles they own and operate, as the City of Philadelphia did. They may also provide marketing or administrative funds to kick-start the program in their areas. Providing funding for locating beneficial sites for car-sharing or financing parking spaces could also be undertaken. Lastly, municipalities can rely on car-sharing to justify a reduction in the number of parking spaces required for new developments (Millard-Ball, et al. 2005).

PARKING MANAGEMENT IMPLEMENTATION: WHO WILL MANAGE PARKING?

Municipalities may choose to form their own parking management district, parking benefit district, or partner with their local transportation management association.

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, and at the same time promote transit use, ridesharing, and other alternative modes of transportation. The parking management district's purpose is to promote economic development and encourage a balanced transportation system through the management techniques described in this chapter. By reducing the amount of land used for parking (supply), more land is available for tax-generating purposes. The management district's pricing policies are established to influence individual travel behavior and encourage alternative modes of transportation.

Image: The Delaware Valley is home to two car-sharing companies, Philadelphia-based PhillyCarShare and Cambridge, MA-based Zipcar, shown above. Source: DVRPC

In a parking management district, each property is levied a fee based on the assessed value of the property. This, in turn, is used to support the functions of the district, such as parking-related maintenance, security, utilities, taxes, enforcement, etc. Fee collection can be as simple as including a separate line on the property tax bill.

There are many successful management techniques used by parking management districts, including these additional ideas (Capitol Region Council of Governments 2002):

- Build and operate a municipal centralized shared-parking facility, alleviating the need for individual projects to provide on-site parking. This also gives municipalities greater control of overall parking supply while supporting the comprehensive development of the central business district.
- Charge for parking. When parking for a desirable destination is in short supply, paid parking can generate revenue for the management district. This also encourages other modes of travel and creates greater parking space turnover.
- Establish new development guidelines to coincide with changes in the parking regulations. Should a business owner want to expand, the implications on parking ought to be overseen and coordinated by the parking management district.
- Manage on-street parking. Initiating a parking management district is not without its share of challenges. The initial parking supply projections for a specific project may not be accurate. Additionally, economic conditions can change parking demand over time, even with consistent land use. Changes in tenants and ownership can also alter demand. Policies must be flexible and regularly updated to ensure that an adequate level of parking is supplied.

PARKING BENEFIT DISTRICTS

While it does not assist in funding the construction of parking, municipalities have also looked at how to capture value from parking by creating Parking Benefit Districts (PBDs), where the revenue from parking lots, meters, and/or residential parking permits within a specified geographical area goes to support other neighborhood investments within that same area. In some cases, such as the PBD in Austin, Texas, the revenue is spent specifically on “improvements in the neighborhood that promote walking, cycling, and transit use, such as sidewalks, curb ramps, and bicycle lanes.”

TRANSPORTATION MANAGEMENT ASSOCIATIONS

Transportation Management Associations (TMAs) are nonprofit agencies that can provide parking and mobility management programs to municipalities, usually with better cost efficiency. TMAs can help municipalities implement parking management programs to reduce total parking demand. TMAs can coordinate parking planning, perform parking utilization surveys, manage overflow programs, provide bicycle parking, coordinate enforcement services, monitor parking problems, maintain an inventory of

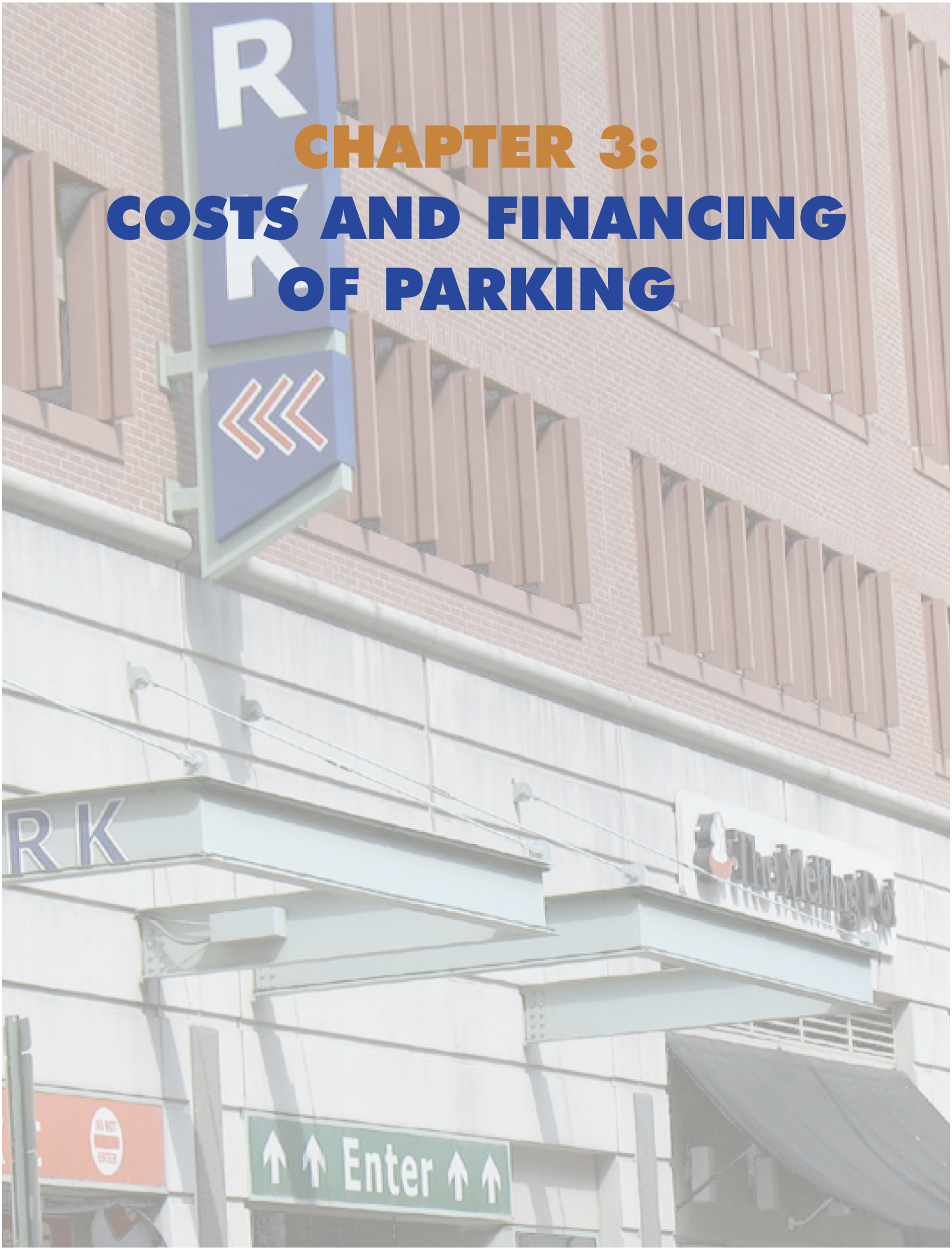
Image: Shown above is the Old Pasadena Parking Management District, in Pasadena, CA.
Source: Flickr.com

facilities, distribute user information, and coordinate shared parking (Litman 2006). There are eight TMAs serving the Delaware Valley, and they are: the Central Philadelphia TMA, serving Center City Philadelphia; Bucks County TMA; Delaware County TMA; Greater Valley Forge TMA, serving the US 422 Corridor in Montgomery and Chester counties; the Partnership TMA, serving Montgomery County; the TMA of Chester County; the Greater Mercer TMA; and the Cross County Connection TMA, serving Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Salem counties.

FACTORS AFFECTING SUCCESS OF PARKING MANAGEMENT

Generally speaking, the success of parking management policies over the long run depends on three primary factors, which are:

- The integral attractiveness and uniqueness of the place where parking is being managed. For example, shoppers may opt for the convenience of a shopping mall with abundant free parking for certain needs, but for special purchases may seek stores that are not so easy to access.
- The availability of travel alternatives, or the extent to which accessibility is enhanced or impeded.
- The ease with which travelers and the business community affected by the parking management policy can evade it by moving or conducting the activity somewhere else. Much depends on what factors are being balanced in the particular decision and how important driving and parking is to that decision (Kuzmyak 2003).



CHAPTER 3:
COSTS AND FINANCING OF PARKING

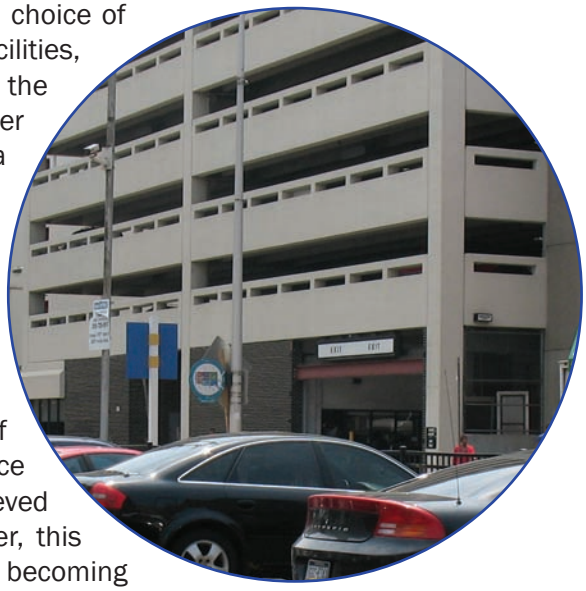
CHAPTER 3: COSTS AND FINANCING OF PARKING

LAND, CONSTRUCTION AND MAINTENANCE COSTS OF PARKING

Despite the fact that most parking in the United States is provided at no charge to the user, it is not really free. Each parking space, whether in a lot or garage, can cost upwards of $2,500 per year in maintenance, operations, and the amortization of land and construction costs (Shoup 2005). This cost is passed on to the consumer in the form of rental fees, the price of real estate, and in the cost of goods and services. Unfortunately, the practice of providing anything for free only encourages overuse. To curb this trend, it is not unreasonable for people to pay market rates for parking.

The construction cost of parking facilities is highly dependant on two factors: parking efficiency, defined as the floor or surface area of a facility per parking space (Cowley and Spillette 2001); and the amount of structural considerations and the extent of architectural finishing.

Generally speaking, **surface parking** is considerably cheaper to provide in most suburban locations. This is mainly due to relatively lower land costs compared to high-density urban areas. Efficiency of the suburban parking lot depends on the shape, the choice of angled versus 90 degree parking stalls, stall size, and the amount of screening and landscaping within the lot. In most areas, parking lots must adhere to local zoning ordinances, requiring more land that must be purchased, and taking away land from revenue-producing uses, such as retail or office buildings. Architectural and structural factors can also affect cost. The choice of asphalt or concrete paving, the provision of drainage facilities, lighting, curb cuts, pedestrian and bicycle amenities, and the presence of slopes can all impact cost. Estimates of lot area per parking space are typically around 350 square feet for a surface lot. Estimates of surface parking costs range from $1,000 to $3,500 per space (Cowley and Spillette 2001).



Structured parking is more expensive and has a wider range of development costs. Parking efficiency in a structure depends largely on the type of ramps, the size of supporting columns, and stall size. These factors are in turn affected by the shape of the site, code requirements, and the presence of other uses within the structure such as retail or office space (Cowley and Spillette 2001). Recently built garages have achieved efficiencies as tight as 200 square feet per space. However, this generally requires the use of compact-only spaces, which are becoming increasingly impractical. The more common average efficiency is 315 square feet per space with a high end of 350 square feet for garages with sloped parking areas. Added construction constraints and the level of architectural finishing can lower efficiency to 450 square feet per space (Cowley and Spillette 2001).

Image: Structured parking is more expensive and has a wider range of development costs. Source: DVRPC

For parking structures, architectural and structural costs can depend on a variety of factors including stairwells, elevator shafts, storage and maintenance areas, ventilation, and sprinkler systems. Estimates of stand-alone garages range from $7,000 to $15,000 per space (Cowley and Spillette 2001). Wood-frame structured parking above a concrete podium costs about $5,000 per space. An above-grade steel-frame structure costs about $8,500 per space. Steel-frame podium parking can cost about $15,000 per space (Schmitz 2003). The threshold at which structured parking becomes economically feasible is generally considered when property values exceed $30 per square foot (Bier 2006).

Underground structures are the most expensive to construct and are limited to the geological conditions of the site. According to *The Dimensions of Parking*, costs per space in subterranean garages increase exponentially with every floor level below the surface. Estimates for these structures range from $10,000 on up to $20,000 per space.

TABLE 7: COMPARISON OF PARKING COSTS

Type of Facility	Land Costs	Construction Costs	Operational and Maintenance Costs	Total Annualized Cost
	Per Space	*Per Space*	*Annual, Per Space*	*Annual, Per Space*
Suburban, Surface	$455 - $1,818	$1,500 - $3,000	$100 - $300	$284 - $755
Suburban, 2-Level Structure	$227 - $909	$6,000 - $15,000	$200 - $300	$788 - $1,802
Urban, Surface	$2,083 - $8,333	$2,000 - $5,000	$150 - $500	$535 - $1,759
Urban, Underground	0	$20,000 - $25,000	$350 - $500	$2,238 - $2,860
CBD, Surface	$7,692 - $38,462	$2,500 - $5,000	$200 - $400	$1,162 - $4,502
CBD, 4-Level Structure	$1,923 - $9,615	$10,000 - $20,000	$300 - $500	$1,425 - $3,295
CBD, Underground	0	$22,000 - $35,000	$400 - $500	$2,288 - $3,503

Source: Typical Parking Facility Costs (Parking Pricing) VTPI, 2007 and Parking Costs, Pricing and Revenue Calculator VTPI, 2003

Table 7 indicates typical base costs of providing parking facilities over a variety of facility types and locations. Costs per space are lower in suburban and rural areas due to lower land costs, but there tends to be more spaces per vehicle in such areas, so per vehicle parking costs are probably very similar. The land cost for structured parking is divided among all users, while underground parking is assumed to have no incremental land costs. The construction costs per space take into account parking facility planning, permits, and construction costs. Operation and maintenance costs include repairs, cleaning, lighting, property taxes, insurance, administration, access control, and enforcement.

The Third Edition of *Parking Generation*, published by the Institute of Transportation Engineers, also provides estimates on construction costs and consumed land. Based on year 2002 cost data, a typical parking space can cost between $1,000 to $3,000 per space for surface parking, $8,000 to $15,000 per space for structured parking, and $20,000 to $35,000 per space for underground parking. These estimates are consistent with the data shown in Table 7. According to Parking Generation, parking spaces consume between 325 to 400 square feet per space. Given the wide range of land costs between $1 and $25 per square foot, the cost of land consumed by parking, whether surface or structured, can range from $300 to $10,000 per space.

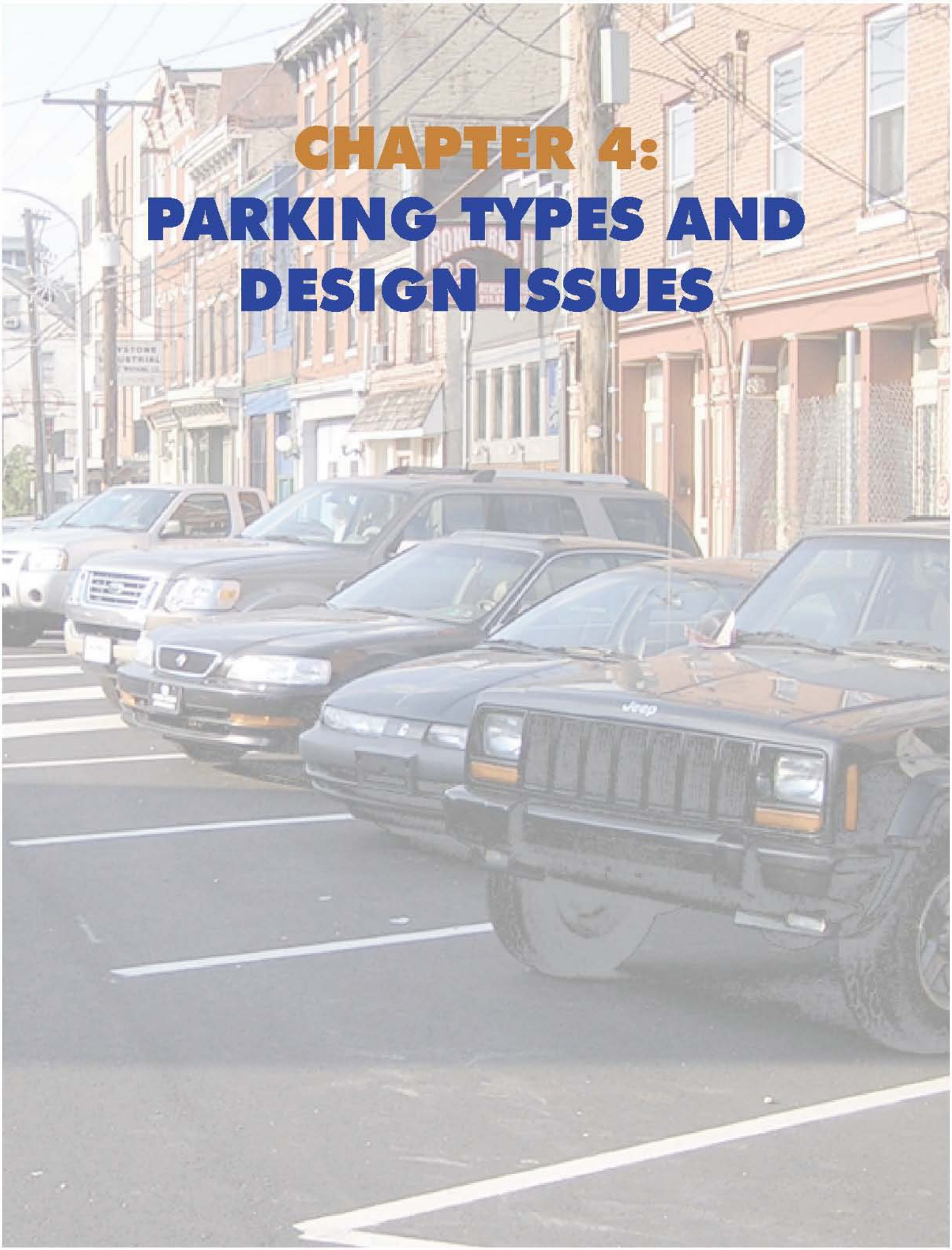
FINANCING AND ENCOURAGING STRUCTURED PARKING

In an area with high demand for parking, parking fees can be higher than in areas where it is plentiful. Still, income from parking rarely is high enough to defray the much higher costs of building structured parking. When given the option to develop by-right, most developers, regardless of the context will avoid hybrid or underground parking simply because the financing can be very difficult. The one exception is in extremely high-market areas where land is at a premium, in which case creative parking solutions may allow developers to maximize the value of a limited parcel. Another issue is that many developers are accustomed to greenfield development and may not have the experience to attempt a more complicated type of parking project.

The spectrum of sources for creative financing has grown over the past decade or so-highly documented in *Parking Matters* (by the New Jersey Economic Development Authority and the New Jersey Institute of Technology) and **The Dimensions of Parking** (by the Urban Land Institute and the National Parking Association). Some of these financing sources that may be combined include **bond financing**, **tax-increment financing**, **rental income subsidy**, and **sale of development rights**. Municipalities have sometimes adopted tax-increment financing as a source of supporting a public parking facility. This has often proven successful, especially when the project is sited in an area that is increasing in value and development activity and where the value capture area is larger than just the project itself.

Municipalities can also use incentives to encourage structured parking, such as **density bonuses** or **reduced parking requirements**, attracting some developers to take the costlier route if the incentive is adequate.

Image: In high-market areas where land is at a premium, creative parking solutions may allow developers to maximize the value of a parcel. Combining ground-floor retail with structured parking (above) is one solution. Source: DVRPC



CHAPTER 4:
PARKING TYPES AND DESIGN ISSUES

CHAPTER 4: PARKING TYPES AND DESIGN ISSUES

PARKING TYPES

It is often a challenge for municipalities to incorporate parking in a way that provides for the existing demand, while not negatively impacting the quality of communities and the pedestrian environment. Significant progress has been made in this arena through innovative new concepts and design solutions for parking facilities.

Surface parking lots, in particular, present a challenge for municipalities. How can we provide enough parking that is convenient to local businesses and destinations in a cost-effective way, while not detracting from our local character? The financial burdens of building structured parking are significant. The key is to find a middle ground that accommodates vehicle demand, while being sympathetic to the existing look and feel of a community in a way that meets the needs of citizens, visitors, and developers.

There are several types of parking that will be addressed in this section. They include: on-street, surface, structured, hybrid, underground, bicycle, and motorcycle/scooter parking.

ON-STREET PARKING

On-street parking refers to spaces along the side of the roadway that are either parallel or angled. Angled parking fits more spaces onto the street than parallel parking. On-street parking is generally free, metered, or restricted to vehicles with permits. It is typically found in denser contexts and the capacity is limited by the amount of available space along the roadway with proximity to destination areas.

On-street parking may not provide nearly enough spaces to accommodate demand, so it may not be able to serve as the primary parking solution, and it should be complemented with off-street surface or structured parking. On-street parking is often embraced in urban areas or suburban downtowns, offering parking spaces close to shopping and restaurants.

On-street parking is also often a component of a traffic calming or context-sensitive approach. Studies have demonstrated that on-street parking serves to physically narrow the roadway, which has been shown to slow down driver speeds. With vehicles entering and exiting parking spots, it serves as an additional traffic calming tool, as drivers must always be aware of the activity taking place in the parking lanes. On-street parking can be enhanced with curb extensions, clearly marking the parking lane, and providing shorter crossings with better visibility for pedestrians at an intersection.

SURFACE PARKING

Surface parking facilities, or traditional parking lots, are the most prevalent and inexpensive means

Images: This six-level garage in Miami Beach, developed by Goldman Properties, includes ground-floor retail as well as a gridded fiberglass trellis and irrigated planter boxes with three types of native foliage. Source: cnunextgen.org

of providing a large number of parking spaces in most contexts. Surface parking can take many different forms. It can refer to a large lot in front of a shopping center, smaller lots to provide parking for individual businesses, schools, or other uses, or stand-alone facilities to accommodate business parks, airports, and train stations. Surface parking is often discouraged in an urban or smart-growth context because it takes up a lot of space, disturbing the continuity of residential or retail streets, and it can be unsightly. However, many of the issues related to surface parking have much to do with the design of the facility, the landscaping and screening, and its placement in the front, side, or rear of a property.

STRUCTURED PARKING

Structured parking refers to any enclosed or multitiered facility for parking that is partially or fully above grade. Structured parking is often touted as the solution for accommodating parking in dense areas where surface parking may not be appropriate or cost effective. However, structured parking comes with its own issues, especially related to aesthetics and design. Structured parking facilities can also be very unsightly. As a result, designers and municipalities have begun encouraging either placing facilities off major roadways or masking them with some sort of architectural treatment. Ultimately, the solution for integrating structured parking with dense, urban, or main-street suburban areas comes in the form of hybrid facilities.

HYBRID PARKING

Hybrid parking is a variation on structured parking, in which the facility is either wrapped in other uses-generally along the ground floor-or is integrated into a mixed-use development. For example, a hybrid facility along a main street may have retail locations on the ground level, so that for the pedestrian, the structure blends into its surroundings and does not detract from the continuity of the storefronts. Some mixed-use buildings contain parking as a platform or podium for residential development above, sometimes with ground-floor retail, and most often with multiple stories of parking on lower floors. This type of platform design, while not that common in the Philadelphia region, has been criticized in other cities for devoting too many lower stories to parking, detracting from the overall architectural design, or adding significant height to buildings, since none of the parking is underground. Hybrid parking is an example of a creative solution for resolving the conflict between the demand for parking and the aesthetics and economic development needs of a community to keep parking facilities as inconspicuous as possible.

UNDERGROUND PARKING

Underground parking is located fully or partially below grade. It is the most inconspicuous solution for containing a large capacity of parking spaces with minimal impact on the surrounding context. However, it is also by far the most expensive solution. Underground parking also has its own concerns, largely relating to the siting of access points. Underground parking is generally only feasible in areas with very high land prices, very restrictive land development regulations, or significant developer incentives.

Image: Shown above is a hybrid facility in Philadelphia, with a structured parking garage wrapped in ground-floor retail uses. Source: DVRPC

BICYCLE, MOTORCYCLE, SCOOTER PARKING

Bicycle parking includes conveniently located bicycle racks and lockers and even garages. It is a topic that deserves much more attention than it currently receives in the Delaware Valley region. Many new developments are constructed, and municipal investments allocated, without adequately addressing bicycling. However, the Delaware Valley sees approximately 133,000 daily bicycle trips, including a significant number of daily and semiregular commuters. A recent DVRPC study of bicycling in the region discovered that 25 percent of respondents reported "no place to park bicycle securely" as a discouragement to biking (DVRPC 2007).

Motorcycle and scooter parking is also an area that deserves attention, although motorcycles and scooters can generally be accommodated in the same types of facilities as automobiles, with dedicated, smaller spaces at key locations.

PARKING DESIGN

There are many factors that influence parking design, and this section covers parking space sizes, density, siting, pedestrian access, landscaping, lighting, access management, ADA accessibility, sustainability, and overall aesthetics issues. It does not cover the very specific fire code, security, technological, and wayfinding requirements of modern parking lot and garage design, which is beyond the scope of this study. For more in-depth information on environmental impacts and sustainable design of parking, see Chapter 5.

DIMENSIONAL REQUIREMENTS: PARKING SPACE SIZES

The typical size of a parking space is eight to 10 feet wide and 18 to 20 feet deep, totaling 144 to 200 square feet. However, for maximum parking efficiency, the size of a parking space should be customized to the needs of the users. *The Dimensions of Parking* recommends minimum parking stall widths for different parking characteristics. For low turnover, eight feet six inches is appropriate. For moderate turnover, a width of eight feet six inches to eight feet nine inches is suitable. For high turnover, a stall width of nine feet is appropriate. It is important to note that a smaller stall usually requires a wider aisle to provide an adequate turning movement.

Off-street parking, whether in a surface lot or garage, requires driveways and access lanes for circulation, and therefore normally requires 300 to 400 square feet per space, resulting in 100 to 150 spaces per acre. On-street parking spaces are usually seven to eight feet wide and require 20 to 22 feet of curb, requiring less land because it does not require access lanes or driveways (Litman 2006).

In any urban area, a significant portion of land is devoted to parking. In commercial and industrial areas, streets often cover five to 15 percent of the land, while driveways and off-street parking typically cover 30 to 50 percent of the land. More land is often devoted to parking than to the building it serves (Litman 2006).

Image: Bicycle and motorcycle parking deserves attention. The image above shows a motorcycle parked on the sidewalk, for lack of adequate, designated parking options. Source: DVRPC

RESIDENTIAL DENSITY AND PARKING DESIGN

The ability to build different types of parking for residential uses is closely tied to the density of development and building types. With one to five houses per acre, parking within each parcel is feasible (the conventional single-family home attached or detached garage, carport, and driveway). At nine housing units per acre and above, dedicated parking spaces next to the unit becomes difficult, except for townhouses. For townhouses, parking may be achieved through a **center parking court**, or through **"tuck-under"** parking, whereby the house is raised half a level above the street in the front, with a rear-accessed garage half a level down, reached through a rear-access alley (Campoli 2007). Densities of 25-30 units per acre can be achieved with tuck-under parking. With nine to 20 units per acre, a **shared surface lot** is possible. At over 20 acres, higher-density solutions, such as **structured and underground parking**, become necessary (DVRPC 2004).

DESIGN OF ON-STREET PARKING

A recent innovation in on-street parking is the concept of **back-in-angle** parking, which allows drivers to exit moving forward, rather than backing out into traffic, which is a more dangerous option. Examples of back-in-angle parking in the Delaware Valley can be found in downtown Pottstown and along North Second Street in the Northern Liberties neighborhood of Philadelphia.

With on-street parking, it is important to ensure that drivers have safe access when exiting their cars onto the nearest sidewalk, by making sure that "street furniture," such as newspaper boxes, utility poles, and benches, do not "trap" them in. This is not to say that street furniture should not be used; rather, its placement in relation to parking spots should be considered. Likewise, for drivers exiting their cars into the roadway, some on-street parking is designed with a striped or decoratively paved buffer area between the parking lane and the nearest travel lane. Curb extensions are also effective at creating a physical buffer to delineate the parking lane.

DESIGN OF OFF-STREET PARKING

One of the major concerns regarding off-street parking (surface, structured, hybrid, underground) is its impact on its context. A large parking lot, or garage structure, cannot only be unsightly, but can detract from the attractiveness and economic development advantage of a community.

There are several alternative parking designs for both surface and structured parking that can more effectively support communities' needs than conventional surface parking lot designs. In all cases these design solutions need to be measured based on the needs of the context, the amount of existing parking, the amount of land available, the cost of land, the square footage cost of other uses (such as commercial, residential, and retail), the local zoning requirements and development incentives, and the financial realities to support the most desirable type of project.

Image: Back-in, angled parking on North 2nd Street in the Northern Liberties section of Philadelphia allows drivers to leave their parking spaces traveling forwards. Source: DVRPC

to drivers how to park to access local businesses. Well-placed signage and well-planned access are critical in reducing driver confusion.

The siting requirements of parking on a parcel are usually found in a municipality's Subdivision and Land Development Ordinance, or in a unified development ordinance. The SmartCode, the model form-based unified development ordinance, discusses the placement of parking according to "lot layers" (a range of depth of a lot within which certain elements are permitted). The SmartCode includes first, second, and third layers, with the first being closest to the frontage of the lot.

Pedestrian Access

Surface parking lots should contain well-marked and visible sidewalks along parking lanes, well-marked and visible crosswalks, and appropriate signage for drivers advising them of pedestrian crossing points. Surface parking lots may also use some of the same traffic calming techniques used on roadways to make them more pedestrian friendly, including horizontal, vertical, and narrowing speed control measures (such as speed tables, raised crosswalks, median islands, and chicanes).

Landscaping and Screening

Landscaping (such as trees, shrubbery, or sloped berms) and screening elements (such as evergreen plantings, low walls or fencing), can enhance the aesthetics of a surface parking lot as it meets the street or sidewalk and within the lot itself. These make the parking lot more attractive and/or less conspicuous.

Landscaping can serve to break up large surface parking lots into more meaningful areas, with islands, attractive planted areas, and gateway features. Landscape strips break up unsafe diagonal movements through large parking lots and can be used as locations for pole lights and stormwater facilities. **Linear planting strips** are encouraged rather than numerous small one-tree islands, as these are better for tree health and snow removal and other maintenance. According to a recommended Pennsylvania land development standard (PHRC 2007), a minimum 10-foot wide continuous planted median is recommended for off-street parking lots at approximately every third parking "module" (bay of cars). Other design options can be substituted as long as they "break up" large areas of parking. Saving existing interior trees in the lot can be credited toward this requirement.

Tree preservation in parking lots should be encouraged in local ordinances by offering a small reduction in the number of spaces required as a tradeoff, if practical. Pennsylvania recommends a five to 20 percent reduction in required number of parking spaces, if the corresponding reduction in the amount of pavement will preserve existing healthy trees in an undisturbed, natural condition (PHRC 2007).

Pennsylvania standards also recommend that parking lots larger than 18 spaces and/or 5,500 square feet shall provide at least one shade tree for every nine parking spaces, as well as screening along all public street frontages. Trees should be planted on

Image: Landscaping and screening elements can enhance the aesthetics of a surface parking lot as it meets the street or sidewalk and within the lot itself. The facility shown above is in West Philadelphia. Source: DVRPC

Parking should try to:

- Be convenient to major destinations.
- Effectively respond to the actual demand.
- Be shared and its access points managed.
- Be masked from view of major corridors as much as possible.
- Be combined with other uses (such as ground-floor retail).
- Be unobtrusive and architecturally sympathetic to an area's surroundings.

DESIGN OF SURFACE PARKING

Surface parking can be enhanced through sidewalks, crosswalks, landscaping, screening, lighting, banners, signage, and other streetscaping features.

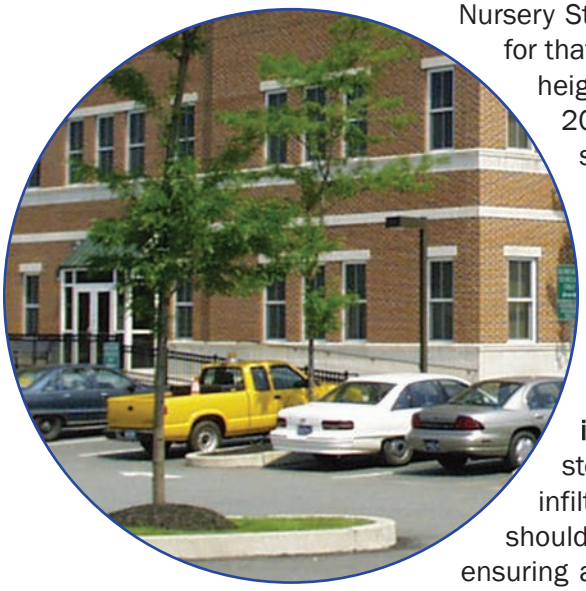
Siting of Surface Parking

Surface parking does not have to be incompatible with a dense, urban, or main-street context. It is generally the most cost-effective solution to parking demand, and in many cases structured parking is neither warranted nor feasible. However, it is still not desirable to locate a surface parking lot in the middle of a shopping street, where it may detract from the attractiveness and continuity of the street's character. An alternative solution may be to **locate the parking facility off the main street, with pedestrian pathways that are convenient to major destinations leading from the parking areas to the street.** Examples of this solution can be found in Chestnut Hill in Philadelphia and Haddonfield in New Jersey. Such facilities may be private or municipal lots. Another similar approach is to locate the parking in a mixed-use structure or lot on the periphery or edge of the town's center, creating a **"park once"** environment for a suburban downtown, for instance, that encourages people to walk past storefronts to reach their destination.

Another solution for surface parking is to **move it from the front to the side or rear of buildings**. This preserves the pedestrian experience but does not hinder automobile access. To increase customer traffic, businesses can provide two entrances, one on the sidewalk and one facing the rear parking. Although additional entrances present a design and security cost to retailers, tenants have found that their patronage is increased by the additional exposure (Cowley and Spilette 2001). Rear or side parking can improve **access management** by reducing the number of turning points from high-volume roadways and encouraging access from side streets or rear-access parallel roadways. It may allow businesses to develop shared parking more easily behind the stores rather than each parcel having its own private front lot. The disadvantage of this approach is that with parking facilities in front, parking is clearly visible to drivers passing by. With less visible parking, it is not immediately apparent

Image: This Wawa, sited up to the street wall, with parking located on the side (rather than along the entire frontage) contributes to a more walkable community. Source: DVRPC

islands or liner strips or along the perimeter of the lot, and these planting areas shall be no less than 160 square feet per tree with a minimum width of six feet. Trees should be noncolumnar, shade trees with an expected height at maturity of at least 30 feet (avoiding low canopies that may interfere with vehicles), and a minimum caliper width of two inches at installation. Pennsylvania recommends that the standards for all trees and shrubs conform with the American Standard for Nursery Stock, published by the American Association of Nurserymen, for that type of tree or shrub. These standards include the minimum height, root ball size, number of branches, and width (PHRC 2007). Often trees that drop a high quantity of seeds or have shallow root structures are not ideal for parking lots. Tree species that thrive in the DVRPC region and are appropriate for use in parking lots include: Hedge maple, Amur maple, Ginkgo biloba (male only), European Hornbeam, and Thornless Cockspur. In general, landscaping should consist of local plant species as much as possible.



In addition, **parking lots should be graded so that landscape islands do not impound water** (unless that is part of the stormwater plan), rather landscape islands can be depressed to infiltrate stormwater. The landscaped islands or planting strips should also be cultivated to support healthy plant growth, along with ensuring adequate drainage, mulching, and irrigation. All landscaping should be planned with a maintenance strategy.

Parking should be partially **screened** from the view of public streets by evergreen plantings, fencing, or walls. This screening should not be so high as to fully screen the area behind it, which could cause unsafe conditions for pedestrians and confuse drivers trying to find parking. The Pennsylvania standards recommend that municipalities adopt a requirement that screening be a minimum of three feet in height, and that plantings must attain this height within three years of installation (PHRC 2007).

Municipalities should require landscaping and screening of large surface parking lots in their appropriate zoning, subdivision and land development, and/or unified development codes.

Lighting

Surface parking lots should be adequately lit for drivers and pedestrians. Keeping pedestrian movement patterns and visibility in mind may impact the lighting design scheme. For example, separate pedestrian light poles may be useful, marking sidewalks, crosswalks, and other pedestrian paths. It is important to be sure that pedestrian pathways leading to and from parking facilities are clearly marked and that drivers have clear sight of pedestrians at crossings and other conflict points.

Some municipalities specify the **required candle strength** for parking lots. In all cases, the goal should be to provide illumination sufficient to provide driver visibility and make pedestrians feel safe. At the same time, parking lots are often the culprits behind serious light pollution, which can be detrimental to the quality of life of a community. Typically, a candle standard of two is considered the minimum for parking lot lighting, while many municipalities and parking lot developers insist on closer to five. There are also variations, with greater candle strength at the front end of parking lots by retail or

Image: Pennsylvania standards recommend that parking lots larger than 18 spaces and/or 5,500 square feet shall provide at least one shade tree for every nine parking spaces. Shown is Pottstown Borough Hall. Source: DVRPC

street areas, and lower levels in most of the rest of the lot. There are many examples of parking lots with five to 10 candle strength cover; however, this is probably excessive, resulting in light pollution and undue energy usage.

DESIGN OF STRUCTURED/HYBRID/UNDERGROUND PARKING

With higher density or higher land prices, structured parking may become feasible. Structured parking, though removing some of the negative elements of surface parking, can still have negative impacts if it is located on a main street. For this reason, it may also be desirable to **locate structured facilities off the main street so they become less obtrusive.**

In the case that structured parking is on a main street or primary destination area, it should be combined with other uses, especially at the ground floor. This "hybrid" parking is integrated into a **mixed-use building**, with ground-floor retail and parking (and possibly other uses) above. Mixed-use buildings with parking garages do pose design challenges due to fire code issues, particularly when combining parking with residential or hospital uses.

Structured parking can also be fronted with **liner buildings**. A liner building is a specialized building, parallel to the street, which is designed to conceal an area such as a parking lot or loading dock. While liner buildings may include commercial or residential uses, their limited depth (from front to back usually 40 feet or less) makes them more disposed to residential use. Liner buildings should be as tall as is required to serve their purpose of screening.

Another similar option is to locate the structured parking garage in the center of a building, with a building or group of buildings, often multifamily residential, wrapping around it. This is colloquially referred to as a **"Texas doughnut."**

Another option for integrating parking garages into a main street setting is to design the building's massing with a **taller section set back, with a shorter (e.g., three-story) section on the streetfront.** Large structures should also contain enough façade differentiation to "break down" the scale of the building.

Parking garages can be **clad or masked** with decorative tiles, screens, or plantings to add interest, whimsy, art, or ecological benefits to the exterior of the structure. Garages can also have **green (vegetated) roofs.**

In terms of general **aesthetics** of parking garage design, a good general goal is to make the design as unobtrusive as possible, with architecture that is either neutral or sympathetic with the surrounding design palette of colors, materials, dimensions, and forms. Attention should be paid to the design of the upper stories, which will be seen from a distance. This is not to say that parking garages cannot be beautiful or architecturally detailed, but in general they are usually "background" buildings, not "foreground." Others may argue that given our car-obsessed culture, public parking garages are now

Image: The structured parking garage of the St. James apartment building in Philadelphia is wrapped in historic and new facades with active retail uses along the street. Source: DVRPC

"foreground," or civic buildings, that deserve more attention as gateway buildings. Likewise, the design of stairs and elevator cores and signage/wayfinding may deserve more attention.

As mentioned previously, **underground parking** is generally the most desirable solution for accommodating a large number of vehicles with minimal negative impact on its context, while allowing more intense use of street-level or above-grade areas, or creating park space or a green roof above. Important design considerations with underground parking include enhancing security with good lighting, introducing daylight, particularly near entrances/exits, and providing logical wayfinding and visual links to the outdoors. Underground parking is by far the most expensive solution, so it is usually found in urban areas and/or those with high density and land prices.

DESIGN OF BICYCLE PARKING

In urban and suburban contexts, it is important to provide adequate parking for bicyclists, in the form of **bike racks, lockers, or even garages** (though these are much more common in Europe). Especially in areas with schools or major employers along bicycle-friendly roadways, there may be demand for a significant volume of bicycle parking. Without appropriate planning and regulations, bicyclists may be frustrated by a lack of options, and may end up locking bicycles to trees, lamp poles, or private property. In addition, the lack of adequate bicycle parking has been shown to discourage people from riding their bicycles to travel and commute (APBP 2002).

Providing bicycle parking options is not as simple as just installing a bicycle rack. It is important first to consider whether more elaborate parking facilities, such as lockers, may be warranted, as well as selecting the necessary number and design of racks, as per the demand. It is also important to consider the location of bicycle racks as related to probable destinations. Most bike racks are placed on sidewalks; however, another option is to **place bike racks in designated on-street parking spaces. Portland, Oregon has permanently installed large bicycle racks in on-street parking lanes.**

Certain kinds of bike racks are more effective and secure than others. Racks should be made of solid materials that cannot be cut with standard tools. They should generally be able to accommodate two bicycles and should support the frame in at least two locations. Racks such as the "comb" or "toast" that support the bicycle from the wheel rather than the frame should be avoided (APBP 2002).

Bicycle lockers are container units, about 6.5 feet deep, which generally accommodate from one to 24 bicycles. These facilities are secure and operated with a key locking mechanism, similar to those used in other types of public lockers. These facilities are much more secure than a simple bicycle rack and are more appropriate for all-day storage of bicycles. Schools, libraries, transit stations, and businesses may consider bicycle lockers as a safer and more durable alternative to bicycle racks. The downside to lockers, of course, is the increased cost for the facility. Businesses that have enclosed

Image: The "U"-shaped bike rack is one of the most secure and efficient, keeping bicycles parallel with the curbline.
Source: DVRPC

garages or lobby areas should be required to provide facilities for locking bicycles. Some employers also offer showers and changing rooms for bike commuters.

Some cities have installed bicycle garages: full facilities devoted to bicycle parking. Such facilities are appropriate at major recreational areas and commuting stations. The best example of such a facility in the United States is the Cycle Center at Chicago's Millennium Park. The Cycle Center contains parking for 300 bicycles, lockers and showers, bicycle rentals, a repair shop, and bicycle tours. Major bicycle garages also exist in Japan and the Netherlands. Such facilities show a major public investment in bicycling as a viable means of transportation.

DESIGN OF MOTORCYCLE AND SCOOTER PARKING

Motorcycle and scooter parking needs are much closer to those of automobiles than of bicycles. Motorcycles and scooters should not be permitted on sidewalks, as they usually take up too much of the pedestrian right of way, and they cannot be accommodated by individual racks. Motorcycles and scooters are generally permitted in on-street parking spots. Off-street facilities should take motorcycles and scooters into account by creating designated parking areas with smaller spaces. This strategy maximizes the number of full spots for automobiles and prevents the haphazard parking of motorcycles and scooters in inappropriate or unsafe locations. In order to ensure adequate parking for motorcycles and scooters, municipalities may consider converting on-street parking spots into a series of designated motorcycle/scooter spots. Typically, one on-street automobile parking space can be converted into six motorcycle/scooter spaces.

OTHER DESIGN ISSUES WITH PARKING

ACCESS MANAGEMENT

An important element in the design of parking is addressing vehicle and pedestrian access to the parking facility. Poor access management can result in vehicles exiting onto high-speed roadways, contributing to congestion, negatively impacting local character, and creating conflicts with pedestrians or other vehicles. When planning access, priority should be given to reducing the number of access points for vehicles, while ensuring efficient routes for pedestrians to access the facility.

There are several key rules of thumb for designing access to parking facilities. Generally parking design should **reduce the number of access points** to as few as possible. Vehicles should be directed to make their **ingress and egress onto side streets**, rather than main streets, whenever possible. Parking facilities should be combined or integrated to **share access points**. Vehicles should not access parking facilities in the middle of a dense or urbanized context. Rather they should be directed around the block to access facilities from side streets or rear alleys. The goal is to site parking facilities so that they can accommodate the demand of vehicles and are located near major destinations, but not to value the driver's convenience at the expense of the pedestrian or the overall community context.

Image: Bike racks can be integrated into public art, like the one shown above in the Kensington section of Philadelphia. Source: DVRPC

INTELLIGENT TRANSPORTATION SYSTEMS (ITS) APPLICATIONS IN PARKING

Intelligent transportation systems (ITS) refer to the application of advanced information and communications technologies to transportation systems to improve safety, mobility, and productivity. ITS applications include electronically monitoring traffic volumes, automated incident response, and digital transit management. The application of ITS to parking is often called advanced parking management systems (APMS).

APMS applications include **pretrip parking information systems**, such as a website with a map of where parking facilities are found relative to major access routes and attractions. Such websites also provide information on capacity, hours, and cost. The Philadelphia Parking Authority (PPA) website (www.philapark.org) has a map of all of their public parking facilities, as well as the PPA Parking Locator, a lookup tool that includes all public and private parking facilities near an address, along with distance to nearby destinations, capacity, and estimated cost.

APMS applications can also include **lot-specific parking information systems**, which notify drivers of parking space availability at one or more facilities. This technology monitors spaces available in a parking facility and updates variable message signs (VMS), or digital messaging (that can be viewed online or on a cell phone or PDA), in real time, as spaces fill or empty in a particular facility. The message signs can have both permanent and variable components (such as the permanent name of the parking facility but a variable parking space capacity field). The Chicago Metra transit system uses such a system for its parking facilities. Such systems reduce the amount of time spent by drivers searching for available parking. Such systems are more common in Europe, though they have been utilized in the United States in cities such as St. Paul, Pittsburgh, and Baltimore.

More advanced APMS applications include **floor-, aisle-, and space-specific parking information systems**, where there are signs on every floor (number of spaces available on that floor), at the start of every aisle (number of spaces available in that aisle), and sometimes in front of every space that indicate availability (green or red light). Such a system can be found at Baltimore-Washington International (BWI) Airport, Portland International Airport (PDX), and soon Philadelphia International Airport (PHL).

Parking reservation systems allow the driver to reserve and pay for a parking space using the telephone, internet, or wireless handheld devices. The California Department of Transportation (Caltrans) is testing such a system at the Rockbridge BART (Bay Area Rapid Transit) park-and-ride facility in Millbrae, California, working with the University of California at Berkeley, BART, ParkingCarma™, and Quixote Corporation. Electronic sensors in the east lot of the park-and-ride facility communicate space availability to commuters on the freeway using two temporary dynamic message signs. These 50 spaces can be reserved by telephone, internet, or wireless handheld devices (such as a PDA) up to two weeks in advance, and cost $4.50 rather than the usual $1.00 for a space found upon arrival. Consumers are so far willing to pay more for the peace of mind of a reserved space.

Image: ITS systems in structured parking facilities can direct drivers to vacant parking spaces, reducing the time spent searching for a spot. Source: ITS Decision, http://www.calccit.org/itsdecision/

Private online parking reservation companies, such as MobileParking LLC and SpotScout™, allow drivers to check parking availability in select cities using their computer, cell phone, or PDA. MobileParking LLC covers 400 parking facilities in 50 U.S. cities and allows drivers to call a toll-free number to check parking availability at a destination, whereby the operator will direct the driver to the closest available space. The first reservation is free, while users will pay $1.75 for each additional reservation. Some MobileParking garages also allow the driver to pay the actual parking fee over the phone. SpotScout™ allows drivers to reserve and pay for parking spots online or through web-enabled cell phones. SpotScout™ launched in 2004 and is thus far only in New York and Boston. SpotScout™ sends a text message confirming a parking reservation with a confirmation code and directions to the facility. It also allows users (called "SpotCasters") to sell their personal parking spaces to others for short-term use. SpotCasters set the price and time parameters of the space they are selling themselves.

In addition, XM Satellite Radio in 2005 demonstrated a potential service called "Dynamic Parking Information," providing XM radio users with the number of available parking spaces at specific lots. Parking sensors within the specific parking lots transmitted availability information to in-vehicle navigation systems. Demonstration cities included San Francisco, Los Angeles, and Detroit.

Another ITS application to parking is the **automated parking facility**. This is a robotic mechanism that transports vehicles to available parking spaces. Although these systems are extremely expensive, there are several major advantages over conventional parking facilities. The mechanism can, with precision, pack many more vehicles into the same space than would be safe for human drivers to attempt to do. It also reduces the time spent parking and retrieving a vehicle and may lower the staff costs needed for some city garages with valet service. Such facilities have not been widely developed in the United States.

ITS can also be used for **automated payment systems in parking facilities**. Automated payment systems work like "EZ Pass" at a toll booth, whereby drivers have an electronic reader device on their vehicle and a sensor in the facility registers the vehicle passing and electronically charges a credit card or draws down from a prepaid fund. There is no physical transfer of money or time spent waiting in line to take tickets or pay upon departure. This type of system can significantly improve efficiency of parking facilities.

Other technologies exist to assist municipal officials and police in **parking enforcement**. ITS has been used with smart parking meters that electronically transmit data on how much time is left in a meter and whether or not a vehicle parked there has a special use permit (e.g., handicapped or official vehicle). This allows police and parking authorities to selectively dispatch staff, saving the time of constantly patrolling all available parking spaces.

Image: ITS systems can also include automated parking that saves on time and space needed for facilities.
Source: Parkmatic, http://www.parkmatic.com/

ADA ACCESSIBILITY

Another important element is to ensure that parking facilities are accessible as per the U.S. Department of Justice's Americans with Disabilities Act (ADA) Standards for Accessible Design, as well as any additional state- or municipal-level regulations and guidelines to ensure accessibility. The ADA regulations, as they pertain to parking, include, but are not limited to:

- A minimum number of accessible spaces (in relation to the total number).
- Parking spaces designated (with visible signage) for persons with disabilities.
- Spaces to be serviced by a "van accessible" access aisle.
- Accessible valet loading zones.
- At least one accessible entrance to structured parking facilities.
- Minimum width of 96 inches for accessible parking spaces.
- Maximum access aisle slopes.
- Minimum vertical clearance.
- Suggested adoption of "universal parking space design" (every space is accessible).

SUSTAINABILITY

Features and/or strategies to create more sustainable surface parking and structured parking include:

- Avoid siting facilities on sensitive environments; site in existing growth centers or brownfields.
- Build the lowest possible number of spaces.
- Create mixed-use buildings with parking.
- Create shared parking.
- Dedicate parking for bicycles, car-sharing and carpooling vehicles.
- Include permeable surfaces and better stormwater management practices, as well as landscaping.
- Reduce light pollution, heat islands, and energy usage.
- Use recycled materials in the core and shell and/or recycled concrete and asphalt.

The U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system currently makes it difficult to attain a LEED certified parking structure. As LEED continues to

Image: Another important element is to ensure that parking facilities are accessible as per the U.S. Department of Justice's Americans with Disabilities Act (ADA) Standards for Accessible Design. Source: DVRPC

develop and as USGBC creates new rating systems, it will be important to continue to focus on parking structures and parking treatments and their ability to attain sustainable benchmark standards.

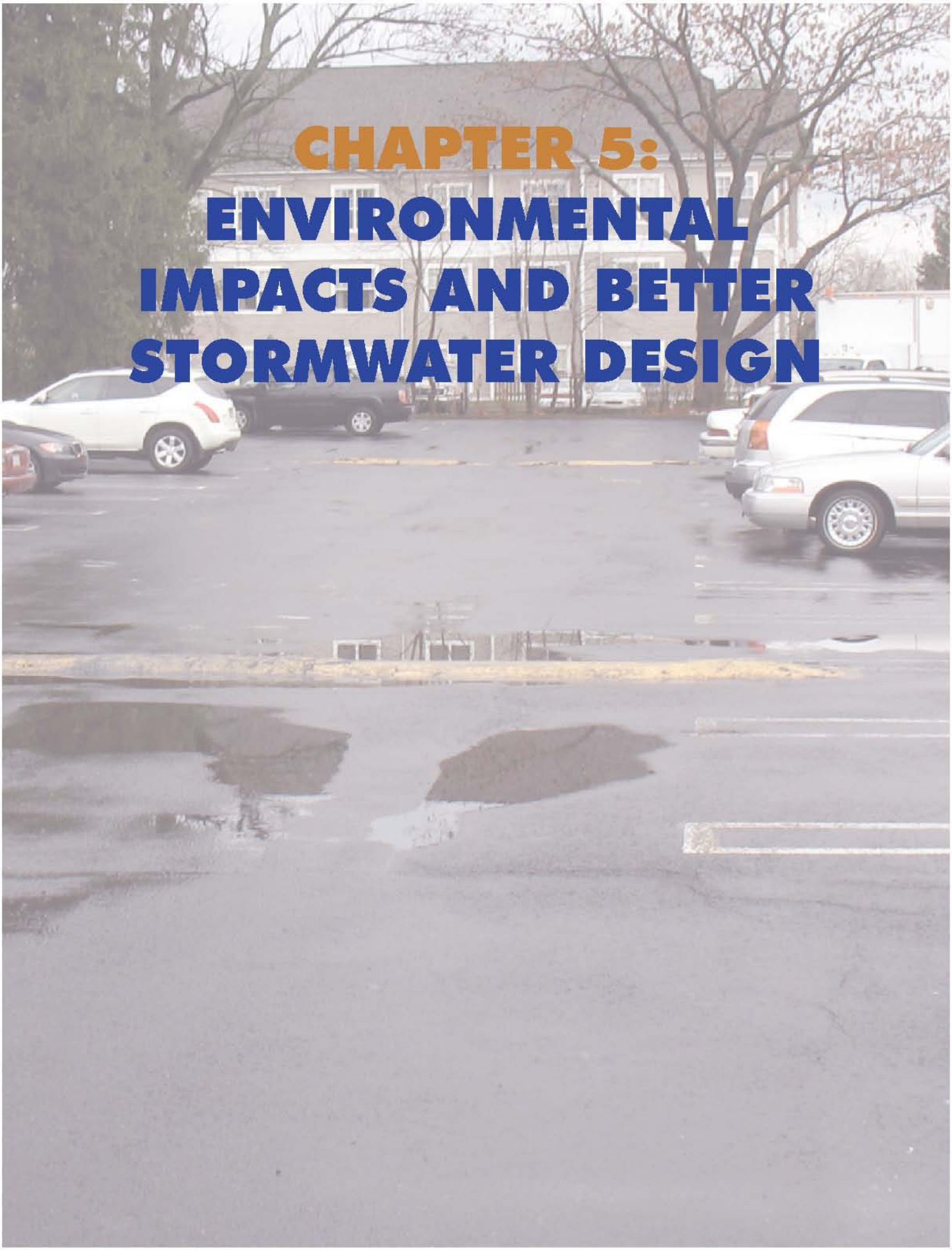
Parking in general is addressed in several of the potential credit areas in the LEED rating system for New Construction (LEED-NC). These include:

- Sustainable Sites (SS) Credit 1: Site Selection places the same requirements on parking as on other types of construction, namely that it shall not be built on farmland, areas within the 100-year floodplain, threatened habitats, and wetlands.
- SS Credit 4.3: Alternative Transportation: Low Emitting and Fuel Efficient Vehicles requires preferred parking for "low-emitting and fuel-efficient vehicles."
- SS Credit 4.4: Alternative Transportation: Parking Capacity requires parking not to exceed the existing zoning and to "provide preferred parking for carpools or vanpools."
- SS Credit 5.1: Site Development: Protect or Restore Habitat requires limiting site disturbance of parking lots.
- SS Credit 7.1: Heat Island Effect: Nonroof requires treatments such as shade, open grid paving, and materials with a Solar Reflective Index of at least 29 for "50 percent of the nonroof impervious site landscape (including roads, sidewalks, courtyards, parking lots, and driveways)," or "Place a minimum of 50 percent of parking spaces under cover."

Parking is also addressed in the pilot rating system for LEED- Neighborhood Development (LEED-ND). These include:

- Smart Location and Linkage (SLL) Credit 5: Bicycle Network requires bicycle parking and storage calculated in relation to the number of automobile parking spots.
- Neighborhood Pattern and Design (NPD) Credit 6: Reduced Parking Footprint requires the placement of "all off-street surface parking lots at the side or rear of buildings" for multifamily and nonresidential development
- NPD Credit 7: Walkable Streets requires that "On-street parking is provided on 70 percent of both sides of all new streets."
- Green Construction and Technology (GCT) Credit 10: Heat Island Reduction requires treatments such as shade, open grid paving, and materials with a Solar Reflective Index of at least 29 for "50 percent of the nonroof impervious site landscape (including roads, sidewalks, courtyards, parking lots, and driveways)."
- GCT Credit 17: Recycled Content in Infrastructure requires a percentage of recycled concrete and asphalt for "roadways, parking lots, sidewalks, and curbs."

Image: Parking lots should be designed with permeable surfaces and better stormwater management practices. Source: DVRPC



CHAPTER 5:
ENVIRONMENTAL IMPACTS AND BETTER STORMWATER DESIGN

CHAPTER 5: ENVIRONMENTAL IMPACTS AND BETTER STORMWATER DESIGN

Outdated parking standards that require too much parking exacerbate negative environmental impacts and can also force businesses to provide parking that wastes space and money.

IMPACTS OF PARKING ON THE ENVIRONMENT

Air quality is particularly affected by sprawling development and large amounts of surface parking that necessitates and encourages private automobile use. This generates increased air pollutants such as carbon dioxide, carbon monoxide, and ground-level ozone. These pollutants in turn are major contributors to **asthma and other health problems**. Other impacts of the increased volume of roads, driveways, and parking facilities come from the exacerbated **heat island effects** of dark paving that raises air temperatures, and to the **loss of green infrastructure and open land** that would otherwise absorb pollutants and moderate temperatures.

Paved surfaces also have a heavy impact on regional waterways because they prevent the natural absorption of stormwater into the ground, shunting it instead through manmade systems to local streams and rivers. **Water quantity and quality** are particularly affected by parking. Paving over land that could infiltrate and filter rainwater **reduces recharge to area aquifers**, which are often the primary or only source of drinking water for a community. A fall in aquifer level can also lower the low flow level of an area stream. Most streams are fed by groundwater. If the water table drops due to insufficient recharge, drought conditions, or overpumpage of wells, the normal level of a stream may fall too low to support its aquatic life.

Stormwater runoff is also increased and concentrated by excessive paving. This means that stormwater from paved areas has **greater potential for flooding**. Additionally, the greater volume and concentration of the runoff carries oil and other pollutants through the drainage system to area waterways. Indeed, stormwater runoff is the chief cause of **impaired water quality** in all urbanized or partially urbanized areas in the U.S.

The greater the amount of impervious cover in a region, the greater the quantity of contaminants that are washed into local streams, rivers, and lakes by stormwater runoff, which is collectively known as **"nonpoint source pollution."** This correlation has been well documented at the scale of a subwatershed-the five to 10 square miles of land that drains to a stream or to a portion of a river. Where impervious cover, consisting of all paving plus buildings, is greater than 10 percent, there is almost always a corresponding decline in the condition of the waterways in the subwatershed. When impervious cover is greater than 25 percent, area waterways are found to be heavily impaired due to

Image: Paved surfaces have a heavy impact on regional waterways because they prevent the natural absorbtion of stormwater into the ground. Source: DVRPC

both the quantity of stormwater generated and to the pollutant load that the stormwater carries (Center for Watershed Protection 1994).

In areas developed prior to the 1970s, stormwater drainage systems were designed to remove runoff from developed surfaces as quickly and fully as possible. Drainage pipes in these systems empty directly into waterways and the large amounts of stormwater they carry can "blow out" a stream, cutting its banks and reshaping the channel. The results will be either a **downcutting of the channel**, which separates it from its floodplain, or a **widening of the stream channel** so that its overall water level is reduced to the point that it **cannot support fish and other aquatic life**. Rainwater from subsequent storms will then erode the streambanks further, increasing the total dissolved solids in the water and silting over and smothering aquatic organisms or their habitats.

Separating a stream channel from its floodplain reduces the value of the floodplain as a "storage" mechanism during heavy or extended downpours. Instead of spreading out over the flood zone, the downcut channel carries the water more quickly downstream where flooding may be the consequence. Plants that ordinarily take up nutrients cannot perform their pollution-reducing action if the flow of water doesn't reach them.

Beginning in the 1970s, better controls over the rate of stormwater flowing from paved surfaces were mandated and **detention basins came into use**. Additional requirements in the 1980s improved standards for these facilities to some degree, and they are still the primary method of reducing stormwater volume impacts from development in both residential settings and on commercial sites. However, **detention basins only "meter" the flow into local waterways**. Some infiltration into the ground can occur in these systems but heavy rainfall still reaches the nearest stream, although it does so at a slower rate. The runoff also still carries whatever pollutants were washed into it from the surrounding land.

Some of the pollutants in stormwater come directly from paved surfaces and include hydrocarbons, metals, and surfactants ("surface acting agent," or wetting agents that lower the surface tension of a liquid, allowing easier spreading) from leaking automobiles and trucks, tire and brake pad wear, and car washing. Others, such as nitrates, phosphorus, pesticides, and fecal coliform bacteria derive from lawn treatments and animal waste (both pet and geese populations) that wash to paved surfaces and then to the storm drain systems that discharge this surface runoff to waterways.

In older urban areas such as parts of Philadelphia and Camden, the piping of the stormwater drainage is combined with the sanitary drainage system (wastewater). Here, stormwater runoff is carried to the sanitary sewer treatment system and cleansed before being discharged to a river. When rainfall is heavy, however, the system cannot accommodate the large volume of water. To prevent backups into homes and businesses, the system is designed to "overflow" directly to the river, carrying both stormwater and sanitary sewer discharges into the water.

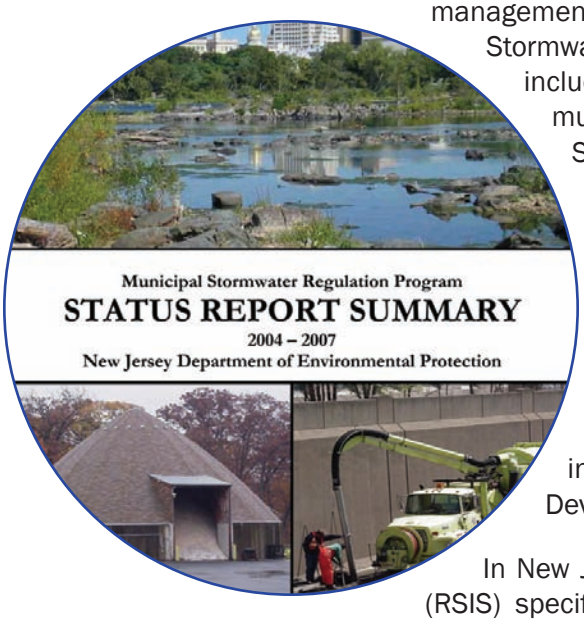
Image: Above is a parking facility flooded due to a clogged storm drain.
Source: Flickr.com

MUNICIPAL STORMWATER PROGRAMS

Reduction and filtration of stormwater is key to the improvement of water quality, which can be achieved in built-up areas as well as in new development. Within the past two decades, the U.S. Environmental Protection Agency mandated a reduction in water pollution consistent with the requirements of the Clean Water Act of 1970 for all urbanized and semiurbanized municipalities in the U.S. Phase I of this program, begun in 1990, involved reduction and elimination of combined sewer system overflows of the type found in Philadelphia and Camden. This has been a difficult and expensive requirement and is still underway in all older cities.

Phase II of the EPA program applied to the Municipal Separate Stormwater Sewer Systems (known as MS4) of smaller or newer municipalities (US EPA 2005). It requires all urbanized and semiurbanized municipalities to adopt practices such as regular street cleaning, removal of leaf debris that can clog storm drain inlets, repair of stormwater discharge pipes (outfalls), and several other measures. It also mandates education to the public about stormwater contaminants that can be reduced by individual practices and requires that new development reduce the quantity of runoff and control its quality through design measures.

In Pennsylvania, local governments have the authority to establish standards for the design and construction of stormwater management facilities. Also, counties are required to prepare stormwater management plans for designated watersheds under Pennsylvania's Stormwater Management Act of 1978 (Act 167). These county plans include stormwater ordinances that must be adopted by the municipalities in each specific watershed. The Pennsylvania Standards for Residential Site Development (PHRC 2007) recommends stormwater standards that are generally applicable on a statewide basis (except for those Act 167 ordinances mentioned above, which are based on unique watershed characteristics and supersede the general standards). Pennsylvania DEP recommends that municipalities update their development ordinance to include the Best Management Practices for stormwater management discussed in this chapter. For more specific information, see Pennsylvania Standards for Residential Site Development.



In New Jersey, the required Residential Site Improvement Standards (RSIS) specifies stormwater standards for all municipalities unless the municipality has alternative stormwater standards under a regional stormwater management plan, adopted in accordance with the New Jersey Department of Environmental Protection rules. These alternative standards must be as protective as the RSIS standards. The New Jersey standards include the Best Management Practices (BMPs) discussed in this chapter.

Development of a **municipal stormwater management plan** that incorporates BMPs, as well as the requirements of the EPA stormwater programs, provides the best approach for a municipality to achieve real improvements in water quality. According to the Delaware Riverkeeper Network's

Image: PA and NJ Departments of Environmental Protection each have recommended stormwater standards for municipalities. Source: NJDEP

Stormwater Runoff: Lost Resource or Community Asset? manual, such a comprehensive plan should include:

- Implementing an open space design approach to new development and redevelopment projects that incorporates minimum disturbance.
- Protecting and reforesting open space areas.
- Protecting existing native vegetation, including woodlands and meadows, and reforesting lawnscapes on public and private lands.
- Protecting and creating forested buffers along greenways.
- Encouraging site designs that preserve the natural properties of a site.
- Adopting more stringent municipal ordinances that require infiltration first and detention if and only if infiltration is not possible.
- Retrofitting detention basins to encourage stormwater infiltration and/or retention.
- Establishing a comprehensive floodplain protection, buyout, and restoration program if flooding is a consistent problem in the community.
- Establishing a comprehensive education program for residents that includes education about reducing fertilizers and pesticides, revegetating lawnscapes, using rain barrels to capture and allow reuse of rainfall, and creating rain gardens, among other measures.

REDUCING IMPACTS OF STORMWATER FROM PARKING FACILITIES

There are many ways that parking facilities can be designed and managed so as to reduce their contribution to stormwater pollution. The following Best Management Practices (BMPs) include **reductions in the amount of impervious paving on a site, better design of the drainage from a site, and improved maintenance of parking surfaces already on a site**. While BMPs are more easily implemented in new construction, there are many possible retrofits of existing parking facilities that can have major benefits.

MINIMIZING THE SIZE OF PARKING LOTS AND THE AMOUNT OF PAVING

The smaller the size of a parking lot, the less impervious cover created. This requires that parking demand needs to be estimated more accurately and that municipal standards allow fewer required parking spaces and/or restrict impervious cover levels. Specific measures include:

- Encouraging structured parking rather than large surface lots to reduce the amount of impervious surface consumed, land used, and runoff created.
- Locating smaller parking lots strategically so that one lot can serve several businesses.

Image: An important strategy for reducing impervious cover is increasing landscaping that reduces the heat island effects of paved parking lots. Source: DVRPC

- Reducing the overall size of the lot by creating smaller spaces for compact cars.
- Using one-way angled parking, which decreases total lot size.
- Differentiating between primary parking that meets daily needs and spillover parking for times of maximum use. The paving requirements of these two areas can be treated differently, with alternative pavers such as grid pavers, grass, or porous paving being used on the spillover parking at or near a site.
- Increasing natural landscaping that can serve as part of the stormwater management system and also enhance the appearance of the parking lot.
- Increasing landscaping that reduces the heat island effects of paved parking lots.

IMPROVING STORMWATER MANAGEMENT (DRAINAGE) DESIGN

The best stormwater management practices are those that increase the amount of infiltration of rainwater into the ground. This can be achieved through interruptions in the paved surface that break up the stormwater runoff and infiltrate it at various points. **Stormwater from smaller rainstorms can often be handled entirely by various low-impact or nonstructural designs.**

Smaller storms consist of the one- and two-year storms up to the five-year storm. Storm size is defined in terms referring to probability of occurrence. So a one-year storm has a 100 percent chance of occurrence in a given year, a two-year storm has a 50 percent chance of occurring in a given year (or once in two years), and a five-year storm has a 20 percent chance of occurring in a given year (or once in five years). It is the runoff from smaller storms that tends to have the greater effect on waterways and water quality because of the greater frequency of these storms and the fact that they are not detained in **detention basins, most of which are designed to control only the larger 10- to 100-year frequency storms** (a 10-year storm has a 10 percent chance of occurring in a given year, or once every 10 years, and a 100-year storm has a one in 100, or one percent, chance of occurrence in a given year, or once in 100 years). In terms of rainfall produced, more rain falls in a two-year storm than in a one-year storm within the same time frame (typically measured in 24-hour periods). The two-year storm is “bigger” (and probably more intense).

For instance, a one-year storm is equivalent to 2.5 inches of rainfall within 24 hours, while a two-year storm is equal to 3.2 inches of rain within 24 hours.

Specific measures to manage stormwater from smaller storms rely on utilizing the natural contours and features of the land on a site whenever possible. The best designs often use a mix of many small solutions, including:

- Designing or redesigning vegetated islands, which are usually on raised beds in parking lots,

Image: Increasing permeable surfaces and reforesting landscapes improves stormwater mangement.
Source: Flickr.com

so that they capture and recharge rainfall. Using appropriately vegetated sunken beds just below the parking lot surface will allow rain from adjoining paved surfaces to infiltrate rather than run off.

- Incorporating filter strips to receive runoff and removing or slotting curbs to allow stormwater to reach these strips.
- Designing or replacing drain pipes with infiltration trenches.
- Creating bioretention facilities in existing natural depressions.
- Installing or utilizing existing roadside swales.
- Replacing macadam/asphalt with gravel or granular materials or porous paving where practical.
- Designing or redesigning parking lot detention basins so that low-flow channels are eliminated or replaced with meandering vegetated swales, or designing a wetland area near the outfall or throughout the basin.

The following are descriptions of several best management practices. For extensive details on these, an excellent resource is the Delaware Riverkeeper Network's Stormwater Runoff, Lost Resource or Community Asset? (2001) manual.

Rain Gardens

Rain gardens are small bioretention areas-shallow depressions made up of a mixture of sand and soils that are planted with native vegetation-that serve as small islands to filter stormwater runoff from their immediate surroundings. They can be positioned to capture the first level of runoff while being part of the naturalistic landscaping of a site. In parking lots, these can be created along the edges of smaller paved areas, such as the walkways in front of buildings.

Vegetated Filter Strips

Strips of close-growing grasses or forest along the perimeter of an impervious area allow stormwater to be slowed and, for a certain percentage of it, to infiltrate. This can reduce runoff volumes by up to 40 percent in some areas. Although a filter strip cannot handle high levels of stormwater, it can be part of a series of stormwater control measures and can reduce the size of a receiving detention basin or other structure.

Filter strips work best where slopes are less than 15 percent and they should be located as close to the runoff source as possible. Incoming flows may need to be spread out before reaching the strip. The proper vegetation and avoidance of soil compaction are key to successful filter strip operation.

Image: Porous paving is effective in capturing and infiltrating stormwater.
Source: Flickr.com

Bioretention Facilities

These facilities can be utilized to capture stormwater runoff from a diversion structure in a traditional drainage system or large grassed area. They can also be designed as part of the drainage system itself, as a measure to enhance pollution removal from the stormwater by settling and infiltration. They can be installed in median strips, parking lot islands, lawn areas, grass swales or other conveyance systems. They typically have several parts including an energy dissipation area that reduces runoff velocity, a ponding or treatment area, and a mulch layer, a permeable soil layer and a sand layer. Native plants are a necessity and trees and shrubs should be included.

Drainage Swales

Swales are long, grassed, shallow depressions designed to intercept sheet flow (runoff that flows over the ground as a thin, even layer rather than concentrated in a channel) from surrounding land. Unlike curbs and gutters, which concentrate runoff, swales reduce the volume and the speed of runoff and will capture the coarser sediment. Grassed swales can be designed to convey large storm events (10-year storms) as well as small ones. Dry swales filter runoff through 30 inches of soil before collecting it in an underdrain. Wet swales can be used where the water table is close to the surface and they are planted with wetland plants.

Swales work best where slopes are less than two percent and vegetation must be tough and preferably native. Soil permeability is a factor in swale design, so check dams (earthen, rock, or log structures) or other features to improve infiltration may be needed along the length of a swale.

Infiltration Trenches

An infiltration trench is a stone-filled subsurface trench in which stormwater is collected and percolates slowing into the soil from the trench. They reduce both the volume of runoff and peak flows. In addition, the particulates in the stormwater are filtered out as the water moves slowly through the soil below the trench.

Infiltration trenches generally can capture and treat water from an area no larger than five to 10 acres and work best when combined with some other pretreatment technique, such as a grassed swale or vegetated filter strip that can filter coarser sediment. They require periodic low level maintenance so that sediments do not build up and clog the drainage.

Porous Paving

There are several types of porous paving surfaces, including a conventional asphalt mixture with reduced fine particles so that there are invisible, small openings for rain to penetrate (“porous asphalt”); porous cement; open-celled pavers filled with soil or other porous aggregate; spaced impervious pavers; pavement blocks or grids; compacted gravel; and permeable interlocking concrete paving blocks. All but the first are generally appropriate only for lightly traveled areas, but are useful for overflow parking areas and in certain other conditions.

Image: Vegetated swales can increase filtration and reduce runoff.
Source: Flickr.com

The porous asphalt mixture is not limited to low travel sites. It has been extensively used in stormwater management and described by Cahill Associates in several reports and in *The Use of Porous Paving for Groundwater Recharge in Stormwater Management Systems*. This type of porous paving is combined with an underground recharge bed filled with crushed stone of a uniform size, which provides storage capacity until the rainwater can percolate into the soil. A special filter fabric is also placed under the paving.

Such paving with an underground recharge bed has been found to be effective in capturing and infiltrating stormwater for the whole range of storm sizes, from the one-year storm on up to the 100-year storm. This paving system has a long life and requires no more repair or maintenance than conventional paving. Although it tends to cost about 10 percent more for installation and maintenance, other savings in the storm drain system can actually reduce the overall costs of a project by 12 to 38 percent.

Detention Basin Redesign or Replacement

Parking lots generally require fairly large detention basins to capture peak stormwater flows from the extensive paved surfaces, which then channel the stormwater to an outflow structure and out to a waterway. There are several alternatives to the conventional dry detention basin, depending on conditions at a site. These include constructed wetlands which can be built as part of the stormwater treatment plan, wet ponds (retention ponds with a permanent pool) that hold and slow peak flow and remove pollutants, and infiltration basins. The last allow gradual infiltration through the soil of the bed and the sides of the basin. A stormwater management design can include several small infiltration basins to accomplish the same aim as one larger basin.

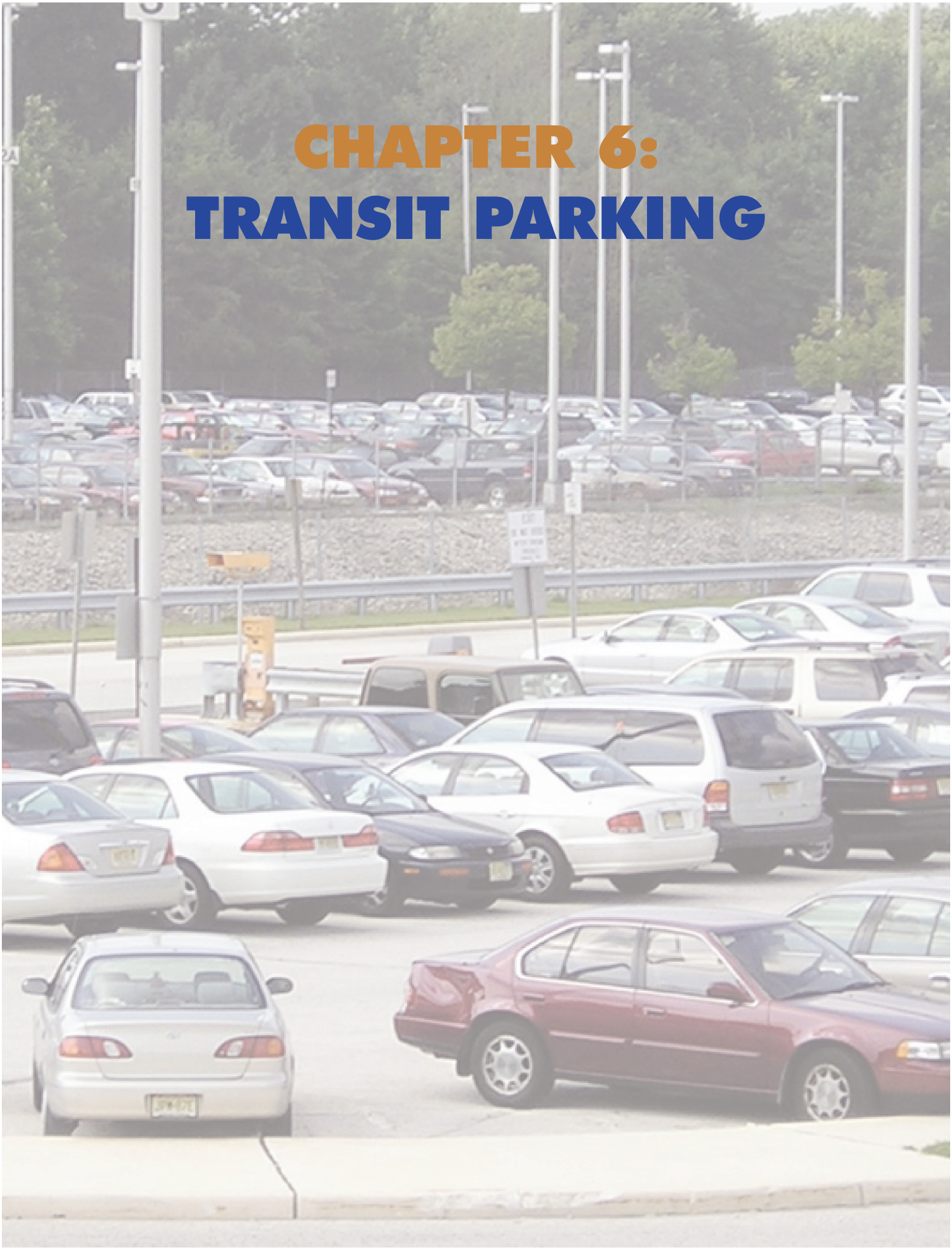
USE OF MULTIPLE BMPS

Good stormwater management uses a combination of these BMPs in a treatment train (the combination of different treatment technologies). These BMPs form a series of small to large structures and devices that will capture, break up, and infiltrate the stormwater throughout the site. Not only is it essential that the design take site contours, soils, and ultimate use into account, but it must also assure that the construction of a parking lot and associated buildings does not damage these features by extensively grading or compacting the soils or otherwise reducing natural permeability.

INSPECTION AND MAINTENANCE OF PARKING LOTS

Finally, an effective and well-implemented inspection and maintenance program for any parking lot design is critical. This should be part of the stormwater management plan that is part of the site plan approved by a municipality, with standards for permanent maintenance outlined in site plan requirements. In addition, a municipality can impose a requirement in its ordinance that makes an owner responsible to make corrective measures if any stormwater management facility is eliminated, altered, or improperly maintained.

Image: There are several alternatives to the conventional dry detention basin, depending on conditions at a site.
Source: Flickr.com



CHAPTER 6:
TRANSIT PARKING

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At the core of the Delaware Valley region is Center City Philadelphia, home to many of the region's jobs, highest land values, and most significant public spaces, civic institutions, and cultural and historical resources. Extending out from Philadelphia's dense urban fabric, the Delaware Valley region includes walkable older suburbs built along rail and trolley routes, an array of new suburban communities built near major roadways, and remote rural communities. The diversity of places and transportation issues in the region make transit parking a complex matter, with numerous challenges and opportunities.

Three major public transportation systems serve the Delaware Valley region. The Southeastern Pennsylvania Transportation Authority (SEPTA) primarily serves Philadelphia and its suburbs in Bucks, Chester, Delaware, and Montgomery counties through a mix of rail, trolley, and bus service. It also extends into Trenton and West Trenton (Ewing Township, New Jersey) in Mercer County, and Claymont, Wilmington, Churchman's Crossing, and Newark, in the State of Delaware. With more than 280 stations and an average weekday ridership of approximately one million, SEPTA is the most widely utilized public transportation system in the Delaware Valley region. The New Jersey Transit Corporation (NJ Transit) serves the State of New Jersey with connections in Philadelphia and New York. In the Delaware Valley region, NJ Transit operates the Northeast Corridor train line with stops at Trenton, Hamilton, Princeton Junction, and Princeton. Also in our region, NJ Transit operates the Atlantic City train line with stops at 30th Street Station, Cherry Hill, Lindenwold, and Atco. The PATCO Speedline (PATCO) is a rapid transit system with a single train line that runs between Philadelphia and Camden County, New Jersey. PATCO makes four stops in Center City Philadelphia. In the City of Camden, PATCO stops at City Hall, Broadway, and Ferry Avenue, then continues into Camden County with stops at Collingswood, Westmont, Haddonfield, Woodcrest, Ashland, and Lindenwold.

Parking has a profound impact on the Delaware Valley region, affecting travel behavior, traffic congestion, access, equity, development patterns, and the quality of urban spaces. Many of these impacts can be understood by examining the relationship between parking and public transportation systems. **The availability, cost, and convenience of parking impacts commuters' decisions about whether to take transit or drive.** Likewise, some transit solutions-such as transit-oriented development-reduce the need for parking, while others-such as park-and-ride-generate local demand for parking, even if they function to reduce vehicle miles traveled for a region overall. What follows is an overview of the major issues and policies related to transit parking, followed by an examination of the particular challenges and opportunities for transit parking in the Delaware Valley region.

Parking for public transportation presents an array of issues, with different challenges and benefits at the local and regional scales. At the regional scale, well-designed parking that supports the use of public transportation systems can improve the quality of our urban spaces, reduce congestion,

Image: Parking for public transportation presents an array of issues, with different challenges and benefits at local and regional scales. The image above shows the NJ TRANSIT Trenton Station. Source: DVRPC

promote "best use" development, help prevent environmental degradation, and provide healthier, more equitable transportation choices. At the local scale, transit parking provides convenient options for commuters at park-and-ride stations, potentially reducing community automobile trips. In addition, transit parking can be designed and managed to complement public parking and support trips to local businesses.

PLANNING FOR TRANSIT-ORIENTED DEVELOPMENT VS. PARK-AND-RIDE

TRANSIT-ORIENTED DEVELOPMENT

Perhaps the most widely discussed and increasingly implemented strategy related to transit parking is transit-oriented development (TOD). TOD is characterized by compact, mixed-use, and pedestrian-friendly development designed to encourage transit ridership and reduce automobile dependence. TOD is one of an array of "smart growth" strategies that promote efficient land use and support alternatives to single-occupant vehicle trips. There is no one-size-fits-all approach to TOD. TOD can be located in urban or suburban areas. Although most TODs are located next to rail stations, there are also examples of TOD projects near bus and ferry facilities. TODs exhibit diverse densities, designs, and mixes of uses.

A national survey indicated that the primary goal of TOD projects is to boost ridership, thereby supporting the overall viability of the transit system and growing revenue income for transit agencies (Cervero et al. 2004). Increased ridership on public transit creates an array of public benefits, including reductions in fuel consumption, pollution, and congestion. Secondary goals for TOD include economic development and smart growth. The ability of TOD to boost transit ridership and property values is well documented. Residential, office, and retail property near transit stations demands premiums in metro areas including Philadelphia, Boston, Portland, San Diego, Chicago, Atlanta, Washington D.C., and Dallas. Although more difficult to measure, TOD is purported to create an array of quality-of-life benefits, including increased physical activity, reduced obesity, lesser crime, increased social capital, and conserved open space (Cervero et al. 2004).

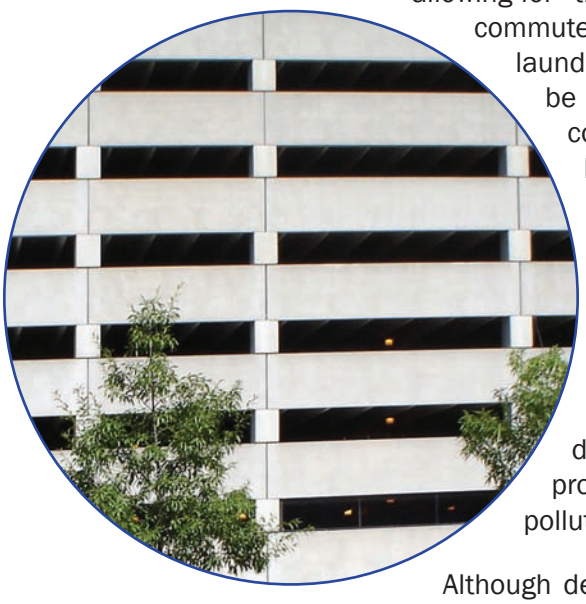
Unlike transit-adjacent development, which is physically near transit but fails to capitalize on this proximity to promote transit ridership and foster economic development, TOD leverages its locational advantage. TOD is intended to encourage transit ridership and take advantage of the property value premium resulting from transit proximity. This means supporting linkages between the transit facilities and the community and ensuring that area land uses are transit-supportive. The automobile is accommodated, but bicycle and pedestrian access is given equal importance.

Due to its emphasis on multimodal access and pedestrian activity, TOD calls for a unique set of strategies related to transit parking. TOD planning efforts should focus on creating places for people-not parking. Surface parking lots should be avoided at TOD sites because they discourage pedestrian

Image: TOD is characterized by compact, mixed-use and pedestrian-friendly development designed to encourage transit ridership and reduce automobile dependence. Source: DVRPC

activity and diminish the sense of place. If necessary, they should be appropriately placed to allow mixed uses closer to the station or they should be visually screened. Pedestrians should not have to traverse large surface parking lots to access the station. For this reason, structured parking-often with first-floor retail-is a typical component of TOD. In dense, urban areas where the majority of transit users access station areas by foot, bike, or connecting public transportation, transit parking may not be necessary at all. For example, many of Philadelphia's Center City transit stations serve hundreds of users each day without parking.

The mix of land uses and alternatives to driving at TOD can decrease the amount of trip-making by allowing for "trip-chaining," or access to multiple destinations in one trip. If commuters can access services such as childcare, groceries, and laundry at the same location where they park for transit, there may be opportunities to provide flexibility in parking standards compared to those that would apply at non-transit accessible locations. Strategies such as parking maximums, reduced parking standards, and shared parking are recommended for TOD (see Chapters 1 and 2 for more information). A study by PB Placemaking, Robert Cervero, the Center for Transit-Oriented Development, and the Urban Land Institute for the Transit Cooperative Research Program (TCRP) indicates that many large-scale housing projects near urban rail stations provide more parking than necessary. These "over-parked" developments decrease housing affordability and project profitability while increasing land consumption, environmental pollution, and congestion (PB Placemaking et al 2008).



Although developers are likely to favor flexible parking standards, they may resist parking maximums if they perceive that provision of ample parking will increase the marketability of a project. **Unbundling the price of housing and parking** is a solution that can increase the affordability of housing at TOD projects, promote car-sharing, and reduce the total amount of parking required at a site. When housing and parking prices are unbundled, parking spaces are rented or sold separately from residential space. Because parking spaces are not automatically included, residents pay for the amount of parking they use. Households that choose to own fewer vehicles can spend more money on housing if desired. Another option is to offer rent rebates to households with fewer vehicles.

One barrier to TOD is the **high cost of structured parking**. Structured parking frees up land for development and improves the walkability of a site, but can cost $20,000 or more per space to construct. Reduced parking standards and shared-parking strategies help reduce some of these costs. Public transit agencies typically do not have the budgets or authority to fund structured parking on their own, so structured parking is often built as part of a TOD plan facilitated through public-private partnerships. However, the private sector will develop TOD only where the real estate market supports returns sufficient to cover the cost of constructing structured parking. Developers will seek to build at a density that, at a minimum, matches lease income to parking structure debt-service costs.

Another barrier to TOD is that **it can create spot congestion around a transit station**. This problem can

Image: One challenge for TOD is the high cost of structured parking. Source: DVRPC

be mitigated through good design principles that separate commuter traffic from residential uses. Communities can take advantage of a station's destination function by zoning for suitable commercial uses in close proximity to the station. Commuter trips to the area can boost local businesses, jobs, and property values. Also, these traffic-generating uses are then directed away from areas designated for protection from development. Municipalities can also institute residential parking permits on side streets near the station, if they desire to protect local residents from spillover parking.

Although local residents may be concerned about possible spot congestion from TOD, there is evidence that TOD can help decrease congestion and vehicle miles traveled by promoting public transit ridership and alternative forms of transportation. The above-referenced TCRP study shows that **residential TOD produces up to 50 percent fewer car trips than conventional residential development.** The study was based on vehicle trips counted in case study locations in the Philadelphia, Washington D.C., San Francisco, and Portland metropolitan areas. Reductions were greatest during peak travel periods. The results of the study suggest that, because TOD generates fewer traffic impacts compared to conventional development, impact fees for TOD development projects should be reduced to match the lesser traffic and roadway impacts they produce. These savings can be passed on to consumers in the form of more affordable TOD housing (PB Placemaking et al 2008).

Communities may be more likely to support density near transit stations if they understand that TOD causes less traffic compared to conventional development. Local political leadership is needed to help communities understand the benefits of providing alternatives to vehicle trips and fostering development patterns that support transit and economic development.

Issues of transit parking are not limited to TOD. Park-and-ride facilities are an important component of many transit systems, and they present a unique set of challenges and opportunities. Park-and-ride facilities are usually constructed to accommodate a large number of users who drive to the station and park, then continue their commute using transit. Park-and-ride facilities usually serve suburban locations where most riders do not live within walking distance of a transit station. Park-and-ride stations can help reduce demand for parking in urban areas and employment destinations, alleviate congestion, and boost transit system ridership. However, the large swaths of land devoted to parking and the high volume of automobile movement at these stations can disrupt community continuity and make stations unfriendly for use by pedestrians.

Intermodal transit facilities also present unique parking issues. Transit stations where bus, rail, and shuttle services connect must accommodate these vehicles in temporary parking areas for purposes of loading and unloading passengers. If passengers are regularly dropped off or picked up by private vehicles (often referred to as "kiss-and-ride"), parking lots should be designed to accommodate the temporary parking of attended vehicles. Drop-off queue areas should be designed to minimize conflict with pedestrian access and commuter parking.

Image: "Kiss-and-ride" parking lots should be designed to accommodate the temporary parking of attended vehicles. Source: DVRPC

accommodate automobiles, many of the same principles utilized in planning TOD should be applied for park-and-ride transit parking. In fact, a number of park-and-ride TOD projects have been developed or are being planned. These projects combine park-and-ride facilities-usually in structured lots-with mixed land uses and pedestrian-friendly, human-scale design.

Park-and-ride lots can support a variety of transit services. Commuters are more likely to use park-and-ride if transit service is faster or nearly as fast as driving. For this reason, park-and-ride lots are often located along light rail, commuter rail, or express bus routes. Implementing high-speed bus service with park-and-ride lots can be an effective way to begin retrofitting auto-dependent corridors for more walkable, transit-oriented development patterns.

Park-and-ride stations often present **opportunities for shared parking**. Typically, park-and-ride lots attract commuters during weekday business hours, leaving parking spaces available on weekends and evening hours. These parking spaces can be shared with uses that attract visitors at "off-peak" times, such as churches, movie theaters, or restaurants.

There are several challenges to providing shared parking. Often, shared parking is precluded by local ordinances that require that a designated minimum number of spots be made available around-the-clock for various uses. Municipalities should review their ordinances and develop ways to provide flexible parking standards that allow for shared parking. For example, parking minimums could be calculated based on shared demand over time for a mix of uses, or a process could be identified to permit owners of underutilized retail or commercial parking spaces to provide opportunities for commuter parking.

Property owners will be reluctant to permanently dedicate any portion of their parcel for shared parking. Rather, municipalities or transit agencies should consider entering into a lease-usually for one-year terms-to offer shared commuter parking facilities. Leases should include an indemnification clause that protects the landowner from liability related to commuter use of the parking facilities. Businesses and property owners may be reluctant to share parking without such an agreement. A sample lease between a municipality and owner/business tenant for commuter parking is included in Appendix C.

In some instances, surface park-and-ride lots can be redeveloped to create TOD. Transit authorities will often seek or require a minimum of **one to one replacement of the original parking capacity** in order to maintain ridership. Communities seeking to limit parking according to TOD best practices must weigh their place-making objectives against the ridership goals of the transit system. Shared parking may be an appropriate strategy for balancing these interests.

Pathways for pedestrians, bicyclists, and commuters connecting from other transit services should be integrated into park-and-ride station design plans to ensure multimodal access. If mixed uses are present on site, residential and pedestrian uses should be buffered from automobile uses. To best achieve environmental goals, park-and-ride lot development on greenfields should be avoided and

Image: Shown here is PATCO's Woodcrest Station -- one of the largest park-and-ride stations in the region.
Source: DVRPC

PARK-AND-RIDE

Transit stations located in suburban and rural areas often attract riders who rely on automobiles for part of their commute. In addition to providing a convenient way for riders to access transit, these park-and-ride stations can play an important role in mitigating congestion in urban and employment centers. In general, **the purpose of park-and-ride stations is to reduce vehicle miles traveled in a region, promote transit ridership, and decrease congestion** by providing ample parking for commuters accessing transit stations.

To help achieve these goals, park-and-ride lots must be planned for as part of a comprehensive regional transportation strategy. Complementary policies include limiting the availability of low-cost, long-term parking in employment centers and ensuring that park-and-ride fees compare favorably to the cost of driving and parking in the central city. The cost and convenience of accessing transit through park-and-ride should be balanced so as to attract users without undercutting nonautomobile access options, such as walking or connector transit services.

There are many challenges to implementing effective park-and-ride transit parking. The most significant problem with park-and-ride systems is that these facilities can extend sprawl. Park-and-ride can contribute to sprawl by making car travel more convenient and promoting auto-oriented development in communities further away from urban centers. Unlike TOD, park-and-ride systems do not require transit authorities and municipalities to work together to coordinate transit service with local development patterns. Unless transit and land uses are integrated to create walkable, human-scale places with a mix of meaningful transportation options, the benefits afforded by park-and-ride will be limited.

Another challenge in planning park-and-ride is ensuring that park-and-ride systems contribute to reduced vehicle miles traveled and decreased congestion. If park-and-ride stations are priced or located such that they encourage commuters to drive further distances than they might have otherwise, park-and-ride will not help decrease congestion or improve air quality. On the other hand, if park-and-ride helps the auto-dependent reduce the amount of time and miles they spend driving, park-and-ride produces economic, environmental, and transportation benefits for the region by reducing pollution, congestion, and inefficient land use.

Modern metropolitan areas are increasingly less dense, which means that fewer residents and workers live within walking distance to transit. Although planners, local leadership, and citizens must work to promote land use patterns that make non-automobile transportation options more viable and fully overcome car dependency, **park-and-ride is an important option for increasing transit ridership and reducing vehicle miles traveled in certain development contexts**.

Like TOD, park-and-ride stations must be carefully planned to integrate with local land uses, reduce congestion impacts, and maintain community sense of place. Although park-and-ride is designed to

Image: Park-and-ride is an important option for increasing transit ridership and reducing vehicle miles traveled in certain development contexts. Source: DVRPC

appropriate stormwater management implemented.

In thinking about policies for transit parking, local leadership and community stakeholders must consider the particular land use context surrounding each station, as well as the role each station plays in the regional transportation system. Transportation engineers and planners sometimes describe transit system functions in terms of **"nodes" or "places."** Transit nodes typically serve a regional transit function and are adjacent but not linked to local land uses. Transit places generate activity related to transit, but are also important destinations. Transit places can range from busy station areas with a mix of uses to neighborhoods located in close proximity to stations. Placemaking strategies such as creating a pedestrian-friendly, walkable environment can transform nodes to places and enrich communities.

Both TOD and park-and-ride can serve important environmental, transportation, and economic goals including reducing vehicle miles traveled, decreasing congestion, improving the quality of urban places, and promoting the efficient use of existing infrastructure. The best practices for planning and managing transit parking-whether for TOD or park-and-ride-include supporting multimodal access, fostering trip-chaining and reducing car dependency by promoting a mix of land uses and implementing flexible parking strategies, such as reduced parking standards, shared parking, or parking maximums.

CHALLENGES AND OPPORTUNITIES WITH TRANSIT PARKING IN THE DELAWARE VALLEY

Many communities in the Delaware Valley region took shape prior to the widespread use of the automobile. The **development patterns** in the region's urban and older suburban communities reflect a history where foot traffic, trolleys, and trains were primary ways to get from place to place. Today, this legacy of dense, walkable communities and extensive transit infrastructure contributes to a thriving, well-utilized system of public transportation that extends throughout the region. Trains, trolleys, and buses serve travelers in urban and suburban areas, while buses are the primary transit option in rural communities.

While the region's urban fabric has advantages for public transportation, its historical legacy also poses problems in the current era. Development around many suburban stations predates the automobile era. Thriving residential neighborhoods and popular business districts are located adjacent to stations, supporting pedestrian and bicycle access. However, these stations also attract users from surrounding communities that must rely on vehicle travel for a portion of their commute. This creates conflict between users who view the station as a transit-oriented place and users who employ the station as a park-and-ride facility.

Also at many of the region's suburban transit stations, **parking is at or approaching capacity**. At several stations, there are **multiyear waiting lists for parking permits**. Commuter demand for expanded

Image: At many of the region's suburban transit stations, parking is at or approaching capacity. Shown above is the SEPTA West Trenton Station. Source: DVRPC

park-and-ride parking often outstrips the **supply of available land or conflicts with the preferences of nearby residents**. If there is enough land available for a parking structure, for instance, it may not be feasible given **construction costs**. In many cases, the historical evolution of the rail system resulted in a **mix of land ownership** at station areas. Today, the transit agency may not own enough land to develop expanded parking facilities.

For example, Amtrak owns the land surrounding several SEPTA and NJ Transit stations, while in other areas municipalities or private entities may own the land. Although transit agencies would like to add more parking to meet demand and increase ridership, they may find it physically, financially, or politically infeasible to do so.

Even in communities where neighborhoods are not located next to existing or planned transit stations, communities will be reluctant to permit increases in transit parking that they perceive will increase local congestion. If new transit parking is planned as part of a TOD, there are likely to be further objections to the intensified development.

LEARNING FROM TRANSIT-ORIENTED PLACES IN THE DELAWARE VALLEY

In Center City, most transit stations fit within the pedestrian-oriented urban fabric and parking for transit is appropriately limited. The result is a place designed for people-not parking. Center City's vibrant public areas, high property values, and social vitality testify to the advantages of transit-oriented places. Parking is accommodated, but it does not dominate the landscape. Mixed uses and multimodal access provide interest and opportunities for a diverse mix of residents, employees, businesses, and visitors. Although TOD alone does not create great places, best practices for TOD such as promoting activity near transit stations, developing a mix of uses, and designing for pedestrian movement contribute to creating places where people like to be.

TOD provides an appropriate model for thinking about transit parking in the Delaware Valley region's urban and downtown areas. Center City-where all major transit routes originate-is clearly transit-oriented. Policies related to transit parking in Center City should preserve the urban fabric and continue to promote alternative modes of travel. In much of the City of Philadelphia, nonautomobile travel options are readily available and affordable for a wide range of users. **Strategies such as pricing long-term parking to promote transit usage or implementing shared parking strategies fit Center City's urban context.**

TOD is recognized as a transit-supportive parking reduction and economic development strategy in several Delaware Valley communities. Lower Merion Township actively supports TOD planning. At the Ardmore station on the SEPTA R5 Regional Rail Line, Lower Merion Township began planning for TOD in 2002 and adopted the Mixed-Use Special Transit (MUST) Overlay District Zoning Ordinance in 2006. This overlay includes provisions for flexible parking provisions, fosters mixed-use development, and promotes well-designed public spaces.

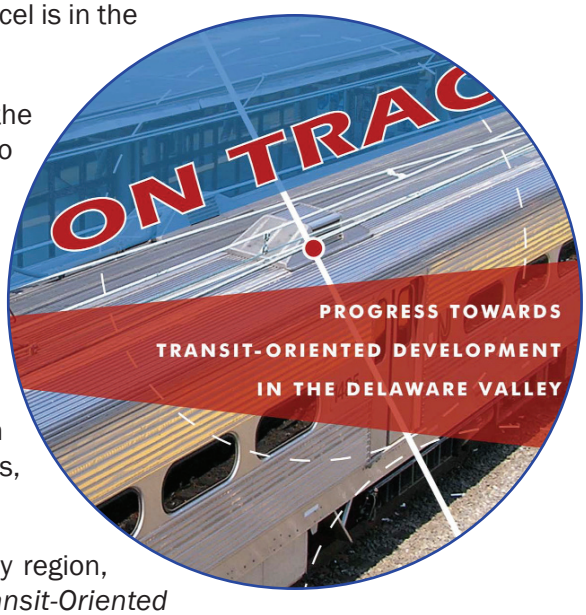
Image: In Center City, most transit stations fit within the pedestrian-oriented urban fabric and parking for transit is appropriately limited. Source: DVRPC

NJ Transit's RiverLINE-which connects the cities of Trenton and Camden with 20 stops in Burlington, Camden, and Mercer counties-was designed to fit within South Jersey's mixed-use, walkable downtown areas, with unobtrusive parking areas and multimodal access. To fit within the walkable context, parking is not available at the four RiverLINE stops in downtown Camden, the Cass Street station in Trenton, and the Burlington Towne Centre station. At the Delanco, Riverton, and Palmyra stations, there are 50 or fewer parking spaces. These stations cater to access by pedestrians, bicyclists, and kiss-and-ride travelers. The RiverLINE catalyzed new development in South Jersey. Many downtown areas or business districts located near transit stations in communities across the region can function as TOD and enjoy its economic, environmental, transportation, and quality-of-life benefits.

Communities where transit parking serves a large number of park-and-ride users face a unique set of challenges. Again, TOD strategies can offer solutions that integrate the community with the station area while providing commuting options for persons who do not live within walking distance of transit stations.

In Hamilton, New Jersey, redevelopment is transforming the area surrounding one of the busiest NJ Transit park-and-ride stations into a thriving TOD. The former American Standard factory, located adjacent to the station, was redeveloped into the American Metro Office Center. This former brownfield site now includes office space for more than 800 professionals. In addition, a 680-unit housing development on an adjoining parcel is in the works.

Plans for SEPTA's Paoli Station, one of the busiest in the Regional Rail system, call for a structured parking garage to house approximately 1,000 park-and-ride spaces combined with a walkable mix of land uses to complement Paoli's existing business district. Restaurants, offices, and residential uses are envisioned for the site, much of which is currently a surface park-and-ride lot and former rail yard. **The plan for the Paoli Transportation Center demonstrates how park-and-ride can be accommodated while creating a more pedestrian-friendly community**, relieving congestion caused by poor access, boosting property values, creating jobs, and better utilizing the existing transportation infrastructure.



For a complete listing of TOD projects in the Delaware Valley region, see the DVRPC report, *On Track: Progress Toward Transit-Oriented Development in the Delaware Valley*. This report can be obtained by contacting DVRPC or downloaded at www.dvrpc.org/asp/pubs/publicationabstract.asp?pub_id=07030.

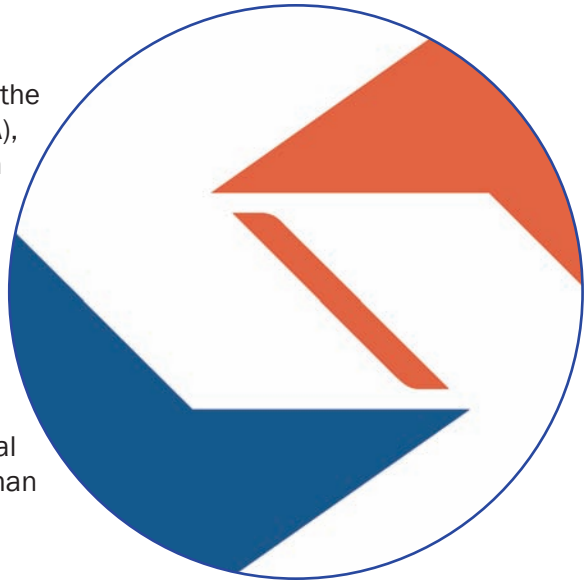
TRANSIT AGENCY PERSPECTIVES

This section summarizes the issues and policies related to transit parking for each of the Delaware Valley region's three leading public transportation agencies. It provides an overview of each agency's parking system, fees, policies for shared parking, multimodal parking and access strategies, and TOD planning efforts.

Image: For a listing of TOD projects in the Delaware Valley, see the DVRPC report *On Track: Progress Toward Transit-Oriented Development in the Delaware Valley.* Source: DVRPC

SEPTA

Center City and suburban Philadelphia are served by the Southeastern Pennsylvania Transportation Authority (SEPTA), a regional quasi-public state agency. SEPTA operates in Philadelphia, Delaware, Montgomery, Bucks, and Chester counties, as well as New Castle County in Delaware and Mercer County in New Jersey. SEPTA has three main operating divisions. The City Transit division serves the City of Philadelphia with a mix of bus, subway, elevated rail, and trolley routes. The Suburban division operates bus, trolley, and light rail based out of the 69th Street Terminal and the Norristown Transportation Center. SEPTA's Regional Rail division operates 13 commuter rail lines with more than 150 stations.



PRIORITIES, OPPORTUNITIES, AND CHALLENGES

SEPTA is focused on expanding ridership. Many of SEPTA's parking lots are at or approaching capacity. SEPTA views this as a constraint on ridership and would like to expand parking to meet demand. However, SEPTA faces constraints on parking expansion, including:

- Limited capital development/improvement budgets.
- Community concerns about increased congestion.
- Lack of available land.

SEPTA is a stakeholder in several TOD plans that help increase ridership while providing parking for commuters, but none of these are in the development phase.

PARKING SYSTEM

The majority of parking for the SEPTA system is located at Regional Rail stations, although parking is also provided at some light rail and subway stations. Nearly all of SEPTA's parking is in surface lots contiguous to or within walking distance from stations. There are two structured parking garages in the SEPTA system. The Frankford Transportation Center, located at the Bridge Street and Frankford Avenue terminus of the Market-Frankford line, includes 1,000 parking spaces. It opened in 2006 and was the first parking structure built for a SEPTA transportation facility. SEPTA's second parking structure is located at the Norristown Transportation Center, the final stop of the Norristown High Speed Line. SEPTA opened this facility in April 2008. The 530-space structure replaced a 130-space SEPTA surface lot. The garage is targeted for commuter use, but is also available for public use.

Table 8 provides a summary of available free and metered parking spots by stations along SEPTA's Regional Rail lines.

Image: SEPTA operates in Philadelphia, Delaware, Montgomery, Bucks, and Chester counties, as well as New Castle County in Delaware and Mercer County in New Jersey. Source: SEPTA

TABLE 8: SEPTA PARKING LOT CAPACITIES

	SEPTA Owned, Leased & Operated - Fee & Free					City, Township, Municipalitiy, or Private	Municipality, Private, or Other Ownership	Total Parking Availability
	Fee			Free		Metered/Fee	Free	Fee & Free
Station	Daily Spaces	Permit Spaces	Total Fee Spaces	Total Free Spaces	Total Fee and Free	Spaces	Spaces	**Total Daily Spaces**
City Transit Division	911	80	991	-	991	217	150	1,358
R2 Wilmington	425	65	490	72	562	42	937	1,541
R2 Warminster	896	269	1,165	24	1,189	-		1,189
R3 Elywn	1,241	211	1,452	-	1,452	48		1,500
R3 West Trenton	1,624	402	2,026	854	2,880	-	127	3,007
R5 Paoli	2,813	1,817	4,630	236	4,866	321	50	5,237
R5 Doylestown	3,387	784	4,171	372	4,543	-		4,543
R6 Norristown	711	44	755	726	1,481	-		1,481
R6 Cynwyd	-	-		188	188	-		188
R7 Trenton	400	-	400	747	1,147	331	1,933	3,411
R7 Chestnut Hill E	104	26	130	253	383	-		383
R8 Chestnut Hill W	191	58	249	225	474	-	61	535
R8 Fox Chase	-	-		113	113	384		497
TOTAL	**12,703**	**3,756**	**16,459**	**3,810**	**20,269**	**1,343**	**3,258**	**24,870**

Source: SEPTA

PARKING FEES

For most of its lots, SEPTA charges a daily rate of one dollar. At some stations, users can purchase monthly parking permits for comparable rates. Fees for parking in structured garages are slightly more. At the Norristown Transportation Center parking garage, parking is aimed at SEPTA riders, but available for both public and transit users. Parking fees for public users is higher for consistency with local municipal parking lot rates and to help preserve the availability of parking for commuters.

SHARED PARKING

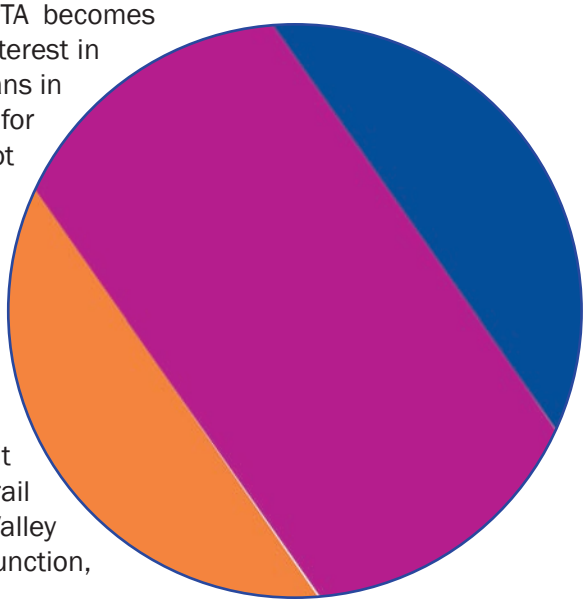
SEPTA participates in a limited number of shared-parking arrangements. Leveraging their reverse-peak parking needs, SEPTA contracts to use the parking lots of churches located within walking distance of some transit stations. Stations where parking is shared with churches include Marcus Hook, Strafford, and Chalfont. At Ardmore, SEPTA allows a restaurant to use some of its parking spaces on nights and weekends, when commuter parking needs taper off. Additionally, SEPTA does not enforce parking fees on daily use lots during the weekend. This means that the public can park in these spaces at no cost to access local businesses.

MULTIMODAL PARKING AND ACCESS

SEPTA provides free bicycle parking at several of its stations. Bicycle rack installation occurs on an ad hoc basis and is not systematic. SEPTA does not have plans to provide bicycle lockers at stations at this time due to security concerns. SEPTA works closely with PhillyCarShare to provide transit riders access to shared cars. Currently, there are PhillyCarShare cars at 10 SEPTA rail stations. In addition, PhillyCarShare will reimburse members for rides on SEPTA to access their reservations at more than 40 pods (car-share parking locations). SEPTA is also working to incorporate improved designs for bus access and kiss-and-ride drop offs. Bus access is a key issue being addressed in the planning process for improvements at SEPTA's Croydon station.

PARKING AND TOD

SEPTA typically does not initiate TOD studies. Rather, SEPTA becomes involved as a stakeholder following developer or municipal interest in TOD planning. SEPTA is likely to support joint development plans in which a developer pays for a structured parking garage for commuters as part of a TOD strategy, though this has not happened to date.



NJ TRANSIT

The New Jersey Transit Corporation (NJ Transit) is a statewide public transportation system serving the State of New Jersey and linking major points in New Jersey, New York, and Philadelphia. In the Delaware Valley region, NJ Transit operates the Northeast Corridor, Atlantic City, and RiverLINE rail lines. On the Northeast Corridor Line, stops in the Delaware Valley region are 30th Street Station, Trenton, Hamilton, Princeton Junction,

Image: In the Delaware Valley region, NJ Transit operates the Northeast Corridor, Atlantic City, and RiverLINE rail lines. Source: NJ Transit

and Princeton. For the Atlantic City Line, stops in our region are 30th Street Station, Cherry Hill, Lindenwold, and Atco. The RiverLINE makes 20 stops in southern New Jersey from Camden to Trenton. NJ Transit also operates a number of bus routes throughout the Delaware Valley region.

PRIORITIES, OPPORTUNITIES, AND CHALLENGES

For the NJ Transit system as a whole, roughly half of users drive and park at stations. However, in the Delaware Valley region, more than two-thirds of riders drive and park. In particular, ridership and parking demand is high and continues to grow for the Northeast Corridor line, creating pressure to continuously expand parking capacity. At Hamilton, a new parking garage was built in 2006 and is now operating at near capacity. At Princeton Junction, there is a five-to-seven-year waiting list for reserved parking. At several Northeast Corridor stations, plans for joint development TOD have been presented as a way to provide parking and enhance station access, while also creating TOD.

PARKING SYSTEM

In the Delaware Valley region, NJ Transit's Northeast Corridor and Atlantic City rail stations function primarily as park-and-rides. On the Northeast Corridor line, NJ Transit provides 1,932 parking spaces at Trenton, 2,816 spaces at Hamilton, and 2,660 spaces at Princeton Junction. Structured parking is provided at Trenton and Hamilton, where planning efforts recommend TOD strategies to better integrate stations with the surrounding community. Private parking providers and municipal lots provide parking opportunities at Princeton Station and supplement parking at Trenton and Princeton Junction. On the Atlantic City line, NJ Transit owns 196 spaces at Atco and 358 spaces at Cherry Hill. At Lindenwold, there are 271 spaces available, all owned by PATCO.

With the exception of three park-and-ride stations, stops on the RiverLINE provide more modest numbers of parking spaces and are designed to integrate with existing small downtowns, such as Palmyra and Riverton. These are alternately called "kiss-and-ride" or "walk-up" stations. On the RiverLINE, all parking is free, with the exception of the 109 spaces at Trenton. RiverLINE parking in town or urban centers ranges from zero to 375 spaces (Hamilton Avenue in Trenton has 70 spaces, Bordentown 200, Roebling 220, Beverly/Edgewater Park 205, Delanco 50, Riverside 300, Riverton 40, Palmyra 25, and 36th Street 375). Of the park-and-ride lots, Burlington South has 415 spaces, Pennsauken/Route 73 has 457 spaces, and Florence has 625 spaces.

PARKING FEES

Parking fees at stations on the Northeast Corridor line reflect the high demand and higher costs of providing parking at these locations. On the Northeast Corridor line, NJ Transit's parking fees are $5 per day or $95 a month at Hamilton; $9 per day or $100 a month at Trenton; and $4 per day or $55 a month at Princeton Junction. The same rate structure applies for weekdays and weekends. Demand is comparatively low along the Atlantic City line and RiverLINE, where most of the parking is offered for free to foster ridership.

Image: Bike parking at Trenton Station. Source: DVRPC

SHARED PARKING

NJ Transit has created demand models that demonstrate the viability of reduced parking requirements for residential developments located near NJ Transit stations. In a few instances, New Jersey Transit has agreements with shopping centers to allow for commuter use of underutilized parking.

MULTIMODAL PARKING AND ACCESS

Bicycle racks or lockers are provided at 85 percent of NJ Transit stations, for a total of 2,300 bike parking spaces. The only stations without bicycle parking on the NJ Transit system are those where the station context is such that bicycle parking does not make sense. NJ Transit resolves security concerns related to bicycle lockers, which are offered at 28 stations, by separating lockers from stations by the distance of one vehicle and requiring a one-year lease, which means that locker rentals are not anonymous. NJ Transit recently put out a Request for Proposals seeking a car-sharing service to provide shared vehicles at NJ Transit stations. A number of shuttles, some funded through NJ Transit, provide connector services at several stations.

PARKING AND TOD

A number of plans for TOD have been developed for NJ Transit stations along the Northeast Corridor line. Hamilton Township created a redevelopment plan featuring TOD in the Hamilton station area (designated a Transit Village by NJ DOT and NJ Transit). Although the township later rescinded the redevelopment plan, projects near the station-including the recent redevelopment of the former American Standard factory into office space, a planned housing project, and the Transit Village designation-ensure that the future of this area will be transit oriented. At Princeton Junction, a vision plan calling for TOD redevelopment has been the subject of ongoing controversy. At Trenton, developer interest on both sides of the station, combined with the station redevelopment, should improve the transit-friendliness of the area. The RiverLINE was designed using TOD strategies and is widely acclaimed for triggering economic development, including new residential, restaurant, and retail activity, around RiverLINE stations.

PATCO

The PATCO Speedline is a rapid transit system with a single line that runs between Philadelphia and Camden County, New Jersey. PATCO is operated by the Port Authority Transit Corporation, which is owned and controlled by the Delaware River Port Authority (DRPA). Stops on the line in Philadelphia are 15-16th and Locust streets, 12-13th and Locust streets, 9-10th and Locust streets, and 8th and Market streets. Stops in Camden County are City Hall, Broadway, Ferry Avenue, Collingswood, Westmont, Haddonfield, Woodcrest, Ashland, and Lindenwold.

Image: The PATCO Speedline is a rapid transit system with a single line that runs between Philadelphia and Camden County, New Jersey. Source: PATCO

PRIORITIES, OPPORTUNITIES, AND CHALLENGES

Reinvigorated communities and developer interest prompted PATCO to look into opportunities for TOD at its stations. In 2006, the design firm Wallace, Roberts, and Todd produced a plan for TOD at the seven PATCO stations around which PATCO owns real estate. With strong interest in TOD from developers and local leadership, PATCO is optimistic that the process of creating more transit-friendly station areas will move forward. Given PATCO's large number of park-and-ride users, PATCO will seek one-to-one replacement of all parking spaces if redevelopment occurs. PATCO would like to expand parking opportunities wherever parking capacity limits ridership. Currently, parking at Haddonfield and Collingswood tend to fill up.

PARKING SYSTEM

Parking is available at all PATCO stations outside of the City of Philadelphia and City of Camden urban areas. Stations with parking are Ferry Avenue, Collingswood, Westmont, Haddonfield, Woodcrest, Ashland, and Lindenwold. Each of these stations includes at least some free parking spaces, complemented by gated and/or metered parking. See Table 9 for a listing of paid and free parking spaces at each PATCO station with parking.

TABLE 9: PATCO PARKING LOT CAPACITIES

Station	Paid Parking Spaces	Free Parking Spaces	Total Parking Spaces
Ferry Avenue	377	1,523	1,900
Collingswood	119	586	705
Westmont	226	923	1,149
Haddonfield	961	60	1,021
Woodcrest	1,243	1,430	2,673
Ashland	1,509	332	1,841
Lindenwold	578	2,759	3,337
Total	5,013	7,613	12,626

Source: PATCO, Parking Lot Capacities, 10/21/99

PARKING FEES

All PATCO parking lots include some free parking, usually located at a further distance from the station area. At most stations, gated parking lots are available closer to the stations. The fee to park in these gated lots is one dollar per day during the morning rush (6 AM to 10 AM), with free parking after 10 AM. Metered parking is also available at some stations. This pricing system is designed to encourage off-peak ridership.

SHARED PARKING

PATCO has a yearly agreement with Haddonfield to allow for free public use of a portion of their PATCO parking lot on weekends. This agreement has been renewed for the past three years. At Lindenwold, PATCO owns all available parking, which is shared by NJ Transit.

MULTIMODAL PARKING AND ACCESS

Bicycle racks are available at all above-ground PATCO stations. At this time, PATCO does not have any relationships with car-sharing organizations.

PARKING AND TOD

Although TOD plans have been created for seven PATCO stations, some are more likely to attract redevelopment in the near future. Currently, the greatest interest in TOD is at Collingswood, where there is developer, municipal, and community support and interest. Due to its more recent development history, PATCO owns more land around its stations, giving it more control over TOD and redevelopment planning compared to SEPTA and NJ Transit. TOD projects are likely to include a conversion to structured parking. PATCO will require developers to finance garage construction and would like to keep parking fees at garages similar to those currently charged at gated surface lots. PATCO acknowledges that developers will be challenged to create an economically viable redevelopment plan including a parking structure that will not require significantly higher parking fees.

RECOMMENDATIONS AND RESOURCES

Transit allows residents and visitors in the Delaware Valley region to reduce their dependency on automobiles, helping to lessen congestion and improve air quality. TOD can yield a host of environmental, economic, and transportation benefits for our area, including decreased vehicle trips. Together, these transit solutions reduce the need for parking, along with the following strategies:

- **Zone for a mix of uses and transit-supportive densities** near transit stations.
- Update ordinances to promote flexible parking standards, including **shared parking and reserve parking**.
- Allow for **reduced parking requirements** to promote a pedestrian-friendly environment, where public parking alternatives are available and/or where alternative transportation modes such as transit and car-share are present.
- Promote shared parking in commercial districts and park-and-ride locations through the use of leases with indemnification clauses shifting liability from private property owners to local governments or transit agencies.
- Ensure that there are **viable walking, bicycle, and connecting transit options** that allow for multimodal station access.
- Plan new or redeveloped transit stations to be **transit-oriented**, not transit-adjacent, to help reduce congestion and vehicle miles traveled.

Image: Due to its more recent development history, PATCO owns more land around its stations, giving it more control over TOD and redevelopment planning compared to SEPTA and NJ Transit. Source: DVRPC

Park-and-ride lots help increase transit ridership and reduce the number of vehicle miles traveled. However, park-and-rides also create increased localized demand for parking and traffic congestion. Strategies for park-and-rides include:

- **Redevelop and/or minimize development of "seas of parking,"** where surface parking lots dominate park-and-ride facility land uses.
- **Locate park-and-ride commuter parking in structured garages designed to fit within a walkable, mixed-use setting**. Where possible, integrate first-floor retail or design elements to support an interesting, inviting streetscape.
- Recognize that the costs of constructing structured parking are high and, in many cases, must be offset by increased parking fees or complementary development plans that produce sufficient rent to at least match these costs. Communities must implement and **support zoning that allows adequate density to make projects with structured parking financially viable for developers**.
- Even where a station serves mostly park-and-ride users, **ensure that multimodal access is available**, so that those who prefer to walk, bicycle, or ride transit to the station areas can safely and conveniently utilize these options.

A number of programs are available from federal, regional, state, county, local, and nonprofit sources to help support these strategies. Examples include New Jersey's Transit Village Initiative, lead by the New Jersey Department of Transportation and NJ Transit, and Pennsylvania's Transit Revitalization Investment District (TRID) program, managed through the Pennsylvania Department of Community and Economic Development.

The Transit Village Initiative aims to bring more housing, businesses, and people into communities with transit facilities to reduce dependence on automobiles, improve air quality, and make more efficient use of existing infrastructure. To participate in the program, communities must earn the Transit Village designation by meeting special criteria. The criteria are:

- A commitment to growth in jobs, housing, and population.
- A transit facility, which can include a rail or light rail station, ferry terminal, bus hub, or bus transfer station.
- Vacant land and/or underutilized buildings within walking distance of transit where redevelopment can take place.
- An adopted land-use strategy for achieving compact, transit-supportive, mixed-use development within walking distance of transit; can be in the form of a redevelopment plan or zoning ordinance.
- Housing options within walking distance of transit.

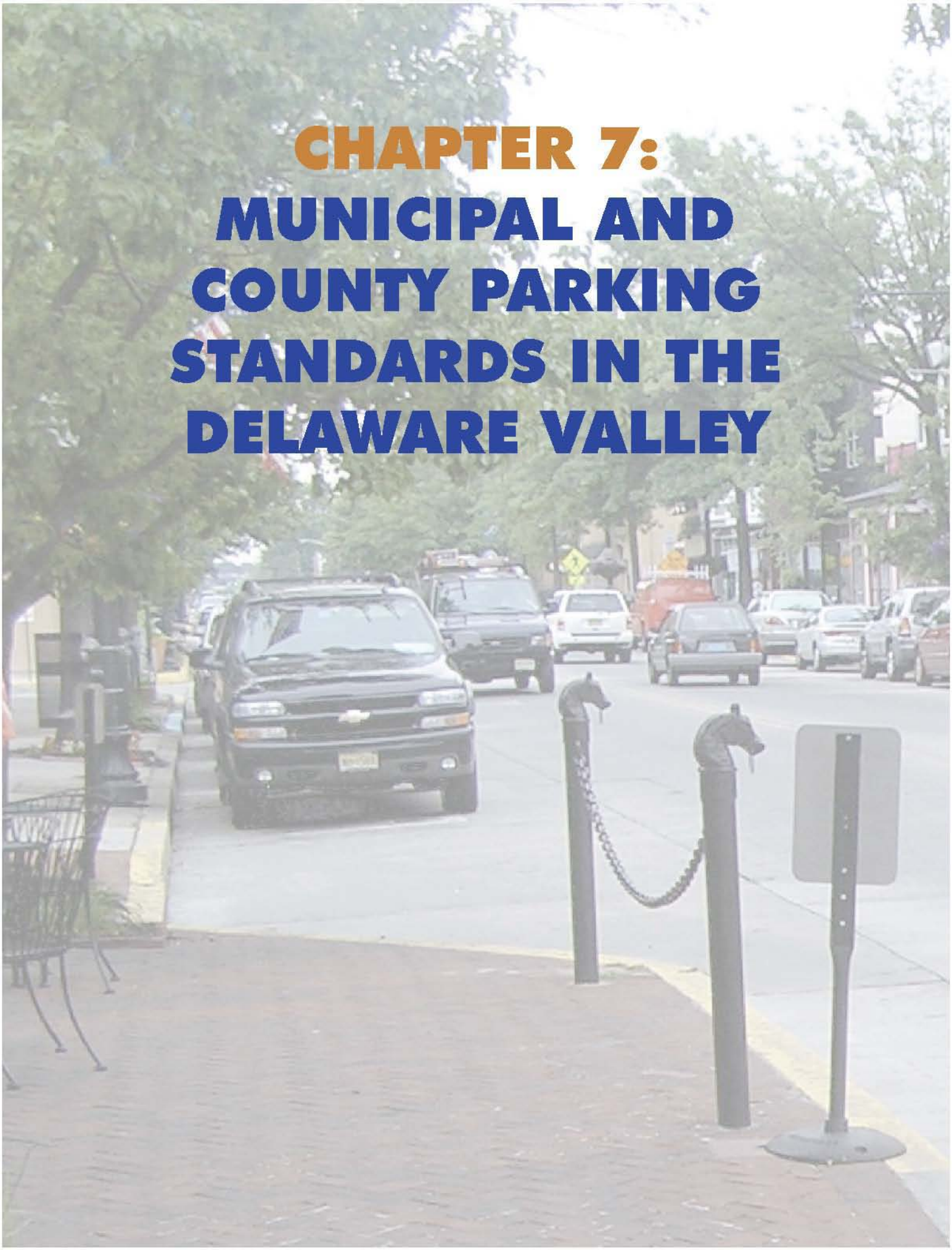
Image: New Jersey's Transit Village Initiative aims to bring more housing, businesses, and people into communities with transit facilities. Source: NJ TRANSIT

- "Ready-to-go" projects, meaning at least one transit-oriented project that can be completed within three years.
- Pedestrian and bicycle friendliness.
- Transit station should serve as focal point for community.
- Station area management plan.
- Efforts to minimize automobile use.
- Transit-oriented parking policies.
- Support for local arts and culture.
- Support for historic and architectural integrity of community.
- Consideration of how to incorporate affordable housing near transit.

The benefits of becoming a designated Transit Village include a commitment and coordination among state agencies to support the municipality's vision for redevelopment, technical assistance, priority funding, and eligibility for grants from the annual $1 million NJ DOT Transit Village funding.

TRID is 2004 enabling legislation that offers municipal officials and the development community a flexible approach to planning, implementing, and developing TOD. TRID permits the voluntary creation of a district that allows value capture through the reinvestment of tax revenues into TRID area improvements. TRID allows transit agencies to share in real estate tax revenues to support capital projects and maintenance in TRID areas, while helping to boost ridership and build partnerships with local governments and developers. TRID gives local governments, transportation authorities, and transit agencies priority access to certain state programs and capital resources. Partnering with SEPTA to develop the TRID plans is required.

More information on DVRPC's work with transit-oriented development can be found on DVRPC's website at www.dvrpc.org.



CHAPTER 7: MUNICIPAL AND COUNTY PARKING STANDARDS IN THE DELAWARE VALLEY

CHAPTER 7: MUNICIPAL AND COUNTY PARKING STANDARDS IN THE DELAWARE VALLEY REGION

This chapter provides an overview of parking practices utilized by local governments throughout the Delaware Valley region. Through interviews with local planning staff and a review of all ordinances available at the zoning and planning ordinance website *www.ordinance.com*, DVRPC gauged trends and best practices in parking policy among the diverse communities that make up the nine-county region. Please see Appendix A for the complete Municipal Parking Standard Inventory (published separately). The review included in this chapter highlights selected practices. It is for illustrative purposes and is by no means exhaustive.

This chapter includes several references to shared-parking provisions, which refer to parking policies that allow for a reduction in the total number of required parking spaces when two or more uses share parking on a single lot. This is sometimes called joint parking. Shared parking should be distinguished from provisions for common parking lots. Some municipalities allow common lots, in which uses can share a single parking lot but the total number of parking spaces in that lot must be equal to the sum of required spaces calculated for each use separately. Unlike common parking, shared-parking strategies recognize opportunities to reduce the number of spaces due to differences in use times/days or because users can park once and walk to several destinations. See Chapter 1 and 2 for a detailed discussion of shared parking.

The chapter concludes with recommendations for ways that local governments can improve their parking ordinances. This discussion is grounded in the review of practices currently in use-both the out-of-date and the innovative-to guide local governments toward approaches that are implementable and help create better communities.

BUCKS COUNTY

A number of Bucks County municipalities are working on new or revised ordinances to promote innovative parking policies. Langhorne Borough is working on a Village Commercial overlay that will give its downtown district a village character. It promotes a mix of uses, pedestrian walkability, farmstands, and **shared parking**. Another municipality reviewing its ordinance with an eye to updating parking policies is Bristol Borough. Bristol Borough currently allows for a range of innovative parking practices, including shared and reserve parking and use of natural, pervious materials for parking in the Conservation District.

Chalfont Borough, Doylestown Borough, Doylestown Township,

Image: Chalfont Borough is one of several municipalities in Bucks County that provides reduced parking requirements within its central business district. Source: DVRPC

and Morrisville Borough provide for reduced parking standards in Central Commercial Districts. In Perkasie Borough's Town Center District, a 10 percent reduction in parking minimums is allowed for shared-parking facilities. Tullytown Borough calls for reduced parking standards in its Borough Center, as does Yardley Borough for its Pedestrian-Oriented Commercial District.

Several other Bucks County municipalities endorse pioneering parking strategies. New Hope Borough permits developments to pay an impact **"fee in lieu"** rather than provide parking on-site. Fees fund the creation of public parking facilities. Consistent with its Sustainable Solebury initiative, Solebury Township promotes use of **porous paving** in parking lots.

Shared parking is permitted where uses have demand on different days or at different times in Bristol Borough, Doylestown Borough, Dublin Borough, Newtown Borough, Richland Township, Richlandtown Borough, Sellersville Borough, Silverdale Borough, Solebury Township, Trumbauersville Borough, Tullytown Borough, Upper Southampton Township, and Warminster Township. Plumstead Township offers a 20 percent reduction in parking and New Britain Township offers a 10 percent reduction in parking if two adjoining business uses on separate adjoining lots develop shared driving and integrated parking. Bridgeton Township also allows for shared parking.

Reserve parking is permitted in Bristol Borough, Bristol Township, Doylestown Township, Durham Township, East Rockhill Township, Falls Township, Haycock Township, Hilltown Township, Langhorne Borough, Lower Makefield Township, Middletown Township, Morrisville Borough, New Britain Township, Newtown Borough, Newtown Township, Nockamixon Township, Northampton Township, Plumstead Township, Richland Township, Riegelsville Borough, Silverdale Borough, Solebury Township, Springfield Township, Trumbauersville Borough, Upper Makefield Township, Upper Southampton Township, Warrington Township, Warwick Township, West Rockhill Township, Wrightstown Township, and Yardley Borough.

BURLINGTON COUNTY

In Burlington County, several local governments allow for reserved or shared parking. The City of Bordentown and Delran Township permit reserved parking to be held as open space. Shared parking is encouraged for mixed use developments in Medford Lakes Borough and Chesterfield Township. Fieldsboro Borough and Washington Township allow for shared use of parking spaces among uses with different attendance times. Mount Laurel Township calls for shared parking for larger developments. North Hanover Township and Bass River Township also allow shared parking.

CAMDEN COUNTY

In several Camden County communities, visions for renewed business districts with a transit orientation prompted new, creative approaches to parking. In Collingswood Borough, **Main**

Image: In Collingswood Borough, Main Street businesses are exempt from ordinance parking requirements unless buildings expand. Source: DVRPC

Street businesses are exempt from ordinance parking requirements unless buildings expand. This policy promotes a pedestrian-friendly, transit-oriented downtown. **Gloucester City** created an **off-street parking variance fund** used to finance future public parking facilities. This allows developers to pay a fee-in-lieu if a site plan does not provide sufficient parking spaces to meet parking minimum requirements. Voorhees Township is one of several Camden County municipalities that allow for **reserved parking**. If an applicant believes his or her development will not necessitate the number of spaces required under the ordinance, they must designate future paved spaces on a site plan but do not have to develop the spaces unless demand occurs.

Shared parking is allowed in Cherry Hill Township, Gloucester City, Gloucester Township, Haddonfield Borough, Pennsauken Township, Somerdale Borough, and Voorhees Township. Reserved parking is permitted by Gloucester City, Haddon Heights Borough, Lawnside Borough, Lindenwood Borough, and Voorhees Township.

HADDONFIELD BOROUGH

Haddonfield Borough is aggressively rethinking how to accommodate off-street parking in its downtown. The borough is proposing revisions to its downtown parking regulations that would be implemented as a supplement to the Downtown Master Plan and Zoning Framework. To retain Haddonfield's walkable, pedestrian-scaled downtown, the strategy prioritizes parking close to destinations for persons with disabilities, shoppers, residents, and visitors, while requiring employees to park in further-away locations.

Shared parking is permitted under the proposed revisions. One-third of all parking requirements in a designated zone may be met through shared parking. To satisfy parking requirements using shared parking, a land owner or lessee must submit a parking analysis report. The total amount of parking provided must be 10 percent greater than the projected peak-hour parking accumulation rate calculated using shared parking. **A portion of parking requirements can also be satisfied through the use of borough lots**. If this option is used, a **parking impact fee** is paid to the borough and dedicated to improving parking in the downtown.

Haddonfield's proposed ordinance revisions require that any application for development or land use changes in the downtown include a parking analysis report. The application and report may be subject to a parking review process. Where shared parking or arranged off-site parking is utilized, updated parking analysis reports are required for submittal every two years.

Also included in the proposed revisions are **requirements for bicycle parking**. The number of bicycle spaces required for nonresidential uses is equal to the required number of vehicle parking spaces divided by 10. As an example, retail uses must provide three vehicle spaces per 1,000 square feet, so a 7,000 square foot retail store would be required to provide 21 vehicle parking spaces and 2.1 bicycle spaces. One bicycle parking space is required per unit for all residential uses except townhouses and single-family homes.

Image: Haddonfield Borough is aggressively rethinking how to accommodate off-street parking in its downtown.
Source: DVRPC

Another innovative parking practice in Haddonfield Borough is **shared parking at the PATCO train station on weekends**. Haddonfield participates in an agreement with PATCO that allows for public use of a portion of PATCO's parking lot on weekends, when PATCO ridership is lower. The public parking allows weekend visitors and shoppers free and convenient access to Haddonfield's downtown. Likewise, SEPTA has a policy that permits free use of its Regional Rail station parking on the weekends.

CHESTER COUNTY

Many of Chester County's municipalities are rethinking parking to create downtown areas that are friendly for visitors, shoppers, and pedestrians. A number of local governments have developed special or overlay districts with flexible, reduced, or innovative parking requirements. East Bradford Township lowers parking minimums for its University District. North Coventry Township's Historic Overlay District discourages front yard parking and encourages rear yard and shared parking. In Elverson Borough, municipal parking spaces may count toward off-street parking requirements in the Historic Village Center District.

In other communities, parking strategies reflect efforts to minimize the environmental impacts of parking, such as stormwater and flooding. Newlin Township forbids provision of off-site parking in the Floodplain-Conservation Overlay District. Pennsbury Township, New Garden Township, and Schuylkill Township include provisions for permeable parking areas and roads in Flood Hazard Districts. Pervious surfaces are allowed for reserve or overflow parking in Downingtown Borough. The Chester County Economic Development Council provides **preferred parking areas for hybrid vehicles** at its office in Exton.

Shared-parking provisions are included in ordinances for Atglen Borough, East Brandywine Township, East Pikeland Township, East Vincent Township, East Whiteland Township, Honey Brook Borough, Honey Brook Township, Kennett Square Borough, London Britain Township, Lower Oxford Township, Malvern Borough, New London Township, Newlin Township, Phoenixville Borough, Schuylkill Township, Spring City Borough Treddyffrin Township, Upper Oxford Township, Upper Uwchlan Township, Valley Township, Warwick Township, West Caln Township, West Chester Borough, West Sadsbury Township, and Westtown Township.

Reserve parking is permitted in the City of Coatesville, East Brandywine Township, East Marlborough Township, East Nantmeal Township, East Pikeland Township, East Vincent Township, East Whiteland Township, Franklin Township, Honey Brook Township, Kennett Square Borough, Kennett Township, North Coventry Township, Penn Township, Pennsbury Township, Phoenixville Borough, Sadsbury Township, Schuylkill Township, Upper Oxford Township, Upper Uwchlan Township, Uwchlan Township, Warwick Township, West Caln Township, West Chester Borough, West Fallowfield Township, West Pikeland Township, West Vincent Township, West Whiteland Township, Westtown Township, and Willistown Township.

Image: West Chester Borough is one of a number of municipalities in Chester County with shared-parking provisions.
Image: DVRPC

area. Developers may submit a parking study demonstrating that they need less than the required number of parking spaces. **Reductions of up to 50 percent of parking requirements** may be authorized using shared parking . Developers can also pay to construct public parking at an alternate site.

Tredyffrin Township has also been involved in planning efforts for the Paoli Transportation Center, envisioned to include a new station integrated with compact, mixed-use development and expanded parking for commuters. Tredyffrin has set policies to encourage development of parking facilities that support a walkable, human-scale streetscape at the Paoli Transportation Center area. Supporting this effort, the Paoli Community Master Plan calls for **reduced parking requirements in the Paoli SEPTA station area**.

WEST BRADFORD TOWNSHIP

West Bradford Township's Traditional Neighborhood Development (TND)/Village Overlay District regulates parking to maintain the character of the village. For general parking, spaces may be located on-street, parallel to the curbline. Parking on a lot should be at the alley or to the rear of a building. Shared parking is permitted and adjacent parking lots are required to include internal vehicular connections.

For residential land, parking must be located in garages at the side or rear of buildings or in alleys. Specific design requirements for garages are included in the ordinance. For commercial and civic land, 75 percent or more of required parking spaces must be located to the rear or side of buildings.

DELAWARE COUNTY

Delaware County includes examples of both county and municipal strategies to improve parking policies. The County provides planning technical assistance to municipalities, including preparation of ordinances. Recent municipal ordinances produced with county assistance include sections on **off-site and shared parking**. The county is proposing a Town Center District for the Borough of Norwood that would provide the required number of spaces through **use of on-street spaces, shared parking, off-site parking areas, and municipal parking lots**.

A number of Delaware County municipalities include parking provisions designed to minimize the environmental impacts of parking. Chester Heights Borough's Floodplain District includes provisions for permeable parking areas and driveways. Glenolden Borough's Floodplain Conservation District and Marple Township's Conservation Overlay District allow for permeable parking lot surfaces.

Delaware County also participates in a number of parking management strategies. The county offers its employees **TransitChek**, a tax benefit for commuters who take public transit. There is evidence that offering TransitChek increases the number of trips employees take on public transit and cuts single-occupancy

Image: Sharon Hill Borough is one of a number of municipalities in Delaware County that allows for shared parking. Source: DVRPC

CALN TOWNSHIP

Caln Township developed a Thorndale Station Overlay District that promotes transit-oriented development and parking practices. The District includes a parking maximum of no more than 10 percent of minimum parking requirements. Off-street parking spaces may be reduced by up to 50 percent if applicants demonstrate that employees or patrons will utilize public transportation or other alternatives to private automobiles. In addition, off-street parking requirements may be satisfied in off-premises parking at other facilities. Consolidating parking in a common lot can support walkability in the core TOD district.

DOWNINGTOWN BOROUGH

In its C-2 Central Commercial District, Downingtown Borough employs an array of parking strategies to ensure that development is in harmony with the area's village character. Parking requirements only apply to new construction, building or outdoor expansions of more than 25 percent of existing floor area, or changes in use from residential to nonresidential. Also, parking requirements for these uses can be reduced by as much as 50 percent, subject to certain requirements. Off-site fulfillment of parking requirements is allowed for employee parking. For an annual fee, borough-owned or Parking Authority-owned facilities may be used to meet off-site parking requirements. Alternately, a fee-in-lieu may be paid as an alternative to the direct provision of off-street parking. The fees are placed in the Borough Parking Fund, which is used to improve local parking.

PHOENIXVILLE BOROUGH

As part of efforts to support revitalization, communities in the area around Phoenixville are rethinking parking requirements. The Phoenixville Borough Comprehensive Plan, currently in draft form, includes strategies to support and improve the downtown character of traditional commercial districts. Complementing this plan, Phoenixville Borough is conducting a study of parking supply and demand to identify parking improvements to support office and retail uses.

A goal of the Phoenixville Borough Comprehensive Plan is to develop parking strategies that will enable revitalization efforts. Plan recommendations include **reducing the number of parking spaces required per residential unit in downtown areas and locating parking along the sides or behind buildings** to support the pedestrian environment. Anticipating development of the proposed Schuylkill Valley Metro / R6 Extension project (not funded at this time), the plan calls for transit-oriented development in the station area as well as a commuter park-and-ride facility.

TREDYFRRIN TOWNSHIP

Tredyfrrin Township created an overlay district to encourage compact development and protect the special character of Paoli's central business district. Recognizing that many shoppers and visitors to the area will park once and walk to nearby shops, Tredyffrin allows for **shared parking** in the overlay

Image: The Phoenixville Borough Comprehensive Plan, currently in draft form, includes strategies to support and improve the downtown character of traditional commercial districts. Source: Chester County

vehicle usage. The county also provides **reserved, preferred parking spaces for carpoolers** in county garages.

Local government that allow for shared parking include Aldan Borough, Aston Township, Bethel Township, Chester Township, Clifton Heights Borough, Colwyn Borough, Darby Borough, Edgmont Township, Lansdowne Borough, Media Borough, Middletown Township, Milbourne Borough, Prospect Park Borough, Ridley Park Borough, Sharon Hill Borough, Springfield Township, Swarthmore Borough, Tinicum Township, Upper Chichester Township, Upper Providence Township, and Yeadon Borough.

Reserved parking is permitted in Aldan Borough, Edgmont Township, Marple Township, Middletown Township, Newtown Township, Springfield Township, Tinicum Township, Upper Chichester Township, and Upper Providence Township.

MEDIA BOROUGH

The Borough of Media is undertaking a study of parking and transportation improvements, to reduce the demand for parking through strategies such as promoting use of public transit, carpooling, and bicycling. In 2007, Media implemented a number of changes to its parking policies designed to decrease congestion and address the needs of residents in the downtown area, as well as to encourage public transit usage. The changes included an **increase in parking meter fees, introducing parking debit cards, encouraging long-term parkers to use a municipal parking garage, altering meter enforcement hours, and increasing parking fines**. Additionally, Media **raised parking permit fees**. Separate parking permit rate structures are available for general use, for residents, and for high-occupancy vehicles.

RADNOR TOWNSHIP

Radnor Township produced the Wayne Master Plan and the Wayne Business District Overlay Zoning and Subdivision (SALDO) ordinances to continue to improve the vitality of downtown Wayne. Located near the SEPTA Wayne train station, the Wayne Business District boasts a traditional Main Street character. The Wayne Master Plan identified as an essential character of the community the building front setback/sidewalk/parking configuration, which creates a pleasing appearance and comfortable pedestrian experience. For this reason, the plan focuses on enhancing the business district's streetscape, which is the area's most valuable asset. Plan recommendations include **bringing parking closer to the sidewalk** where appropriate, implementing **landscaping features to break up parking areas**, directing future parking to **rear yards** for downtown outlying development, and providing **structured parking** if determined to be necessary.

Image: In 2007, Media implemented a number of changes to its parking policies, to decrease congestion and address the needs of residents in the downtown area. Source: DVRPC

GLOUCESTER COUNTY

Shared parking is permitted in Clayton Borough, Logan Township, Wenonah Borough, and Woolwich Township. Woodbury City offers free parking to the public in a municipal garage. South Harrison Township limits the provision of parking beyond required minimums except where a need is demonstrated. Glassboro Borough encourages the use of bicycle parking racks where appropriate. South Harrison Township recommends that bicycle parking facilities be installed close to major entrances to buildings and in view of working personnel to prevent damage to bikes and for overall security.

MERCER COUNTY

The City of Trenton experiences high parking demand, due to its role as a major government, cultural, and transportation destination. The Mercer County Improvement Authority undertook a study of parking demand that identified **shared and structured parking** as a solution for providing ample parking opportunities while maintaining the walkable urban character of the downtown. The study, conducted by Desman Associates, included a parking market analysis in a section of Trenton referred to as "The Opportunity Triangle." This section includes three study areas: the Capital District, the Arena/Roebling District, and the Waterfront Park District. The study demonstrated that, while some uses generate nearly 100 percent capacity of parking facilities during peak demand periods, different temporal demand cycles present opportunities for shared parking. For example, the Capital District requires large numbers of parking spaces during weekday business hours, while the Waterfront and Arena Districts see peak demand during weekends and evenings.

The report concludes that, **by considering the entire Opportunity Triangle area as a single parking district**, greater efficiencies in land use and cost are created. To support shared parking in the Opportunity Triangle, the study includes a number of recommendations. First, the report recommends that leadership think about the mix of current and proposed land uses and related parking needs across the Opportunity Triangle area, not within the three study area districts. Second, the report calls for the **management of parking by a single authority**. Third, the plan recommends the **development of parking facilities in strategic locations** to serve several uses. Three suggested locations for future structured parking garages are provided. Fourth, the study calls for an array of strategies that make parking, transit use, and walking in the Opportunity Triangle safer and more convenient.

Bicycle parking provisions are included in ordinances for East Windsor Township, Hamilton Township, Robbinsville Township, and West Windsor Township. Lawrence Township allows up to 35 percent of parking to be held in reserve.

Image: Mercer County experiences high parking demand in the City of Trenton, a major government, cultural, and transportation destination. Source: DVRPC

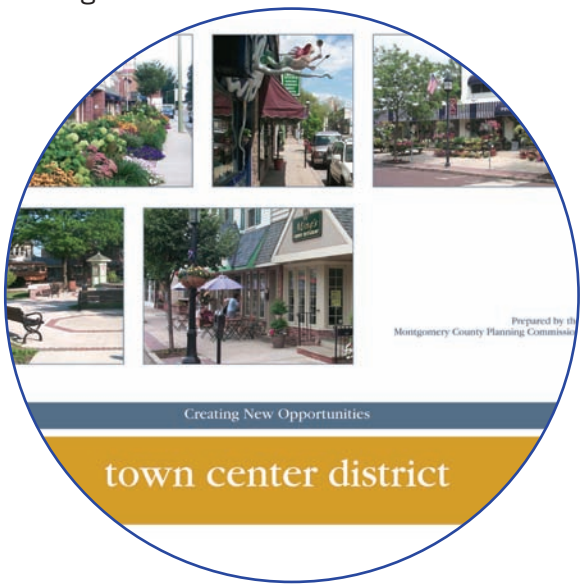
WEST WINDSOR TOWNSHIP

West Windsor Township provides a number of innovative parking policies. In the designated Business District, off-street parking should be interspersed to encourage visitors to park once and walk to different destinations. West Windsor allows for reserved parking, and reserved areas must be landscaped and improved only with materials that will lessen stormwater runoff. West Windsor's extensive provisions for bicycle parking include requirements for bicycle parking location and design.

MONTGOMERY COUNTY

Montgomery County has produced a variety of planning documents on best practices related to parking. In Shaping Our Future: A Comprehensive Plan for Montgomery County, an overall vision for the county through 2025 is established. The plan, which won a Pennsylvania Planning Association "Certificate of Merit Award for a Plan," includes goals of controlling sprawl, limiting traffic congestion, preserving open space, and revitalizing older areas. Major strategies related to parking identified in the plan are:

- Utilize **interconnected parking lots** to reduce trips on abutting roads.
- Allow shared parking where appropriate.
- Implement good design in parking lots for safety, walkability, and aesthetic value.
- Place parking **behind buildings or in alleyways** to preserve on-street parking, promote walkability, and preserve community character.
- Provide adequate parking in existing older areas to attract shoppers and visitors.
- **Convert parking lots** in vacant shopping centers to open space or new development.
- **Size retail center parking for reasonable demand**, not seasonable high demand.



- Use **on-street parking** as part of traffic calming strategies.
- Provide adequate off-street parking outside of downtown areas.
- Provide **park-and-ride lots** to encourage carpooling.
- Avoid development of large surface parking lots at big boxes and other regional destinations because such lots contribute to sprawl.

Montgomery County created its Town Center District Model Ordinance in recognition of the unique opportunities and challenges presented by the county's traditional downtown commercial areas. Although many of these communities experienced periods of decline, their historical character and mixed-use town centers make them ripe for renewal. The Town Center District Model Ordinance is a

Image: The Town Center District Model Ordinance is designed to support ongoing revitalization efforts in the downtown and Main Street areas identified in Montgomery County's comprehensive plan. Source: Montgomery County

flexible zoning ordinance designed to support ongoing revitalization efforts in the approximately 35 downtown and Main Street areas identified in Montgomery County's comprehensive plan. The Town Center District Model Ordinance is a distinct set of zoning regulations intended to be adopted as a stand-alone, separate zoning district that could replace existing zoning in Main Street or downtown areas, perhaps complemented by additional zoning districts to address transitional areas between Town Centers and surrounding communities. The Town Center District Model Ordinance promotes good design, an enhanced pedestrian experience, and protection of the traditional downtown character.

The Town Center District Model Ordinance includes several elements related to parking. A section on surface parking indicates that parking should be permitted at the **rear and sides of buildings only**. It also specifies that **surface parking should not extend more than 70 feet in width along any pedestrian street frontage without pedestrian amenities**. The ordinance recommends interior landscaping for parking lots with more than 20 spaces and perimeter landscaping for lots visible from the street. For structured parking, **screening and first-floor retail uses** are recommended.

The ordinance includes language to encourage the **reduction of parking and shared parking**. A 100 percent parking reduction is permitted when a use is within walking distance of public parking, sufficient on-street parking is available, shared parking meets ordinance requirements, and a transit facility is located nearby.

The ordinance includes **suggested walking distances from parking spaces to various uses and design standards for parking garages, alleys, and driveways**. Walking distances of less than 100 feet are recommended for people with disabilities, deliveries and loading, emergency services, fast food restaurants, and convenience stores. Walking distances of less than 800 feet are suggested for residents, grocery stores, professional services, and medical clinics. Uses recommended for walking distances of less than 1,200 feet are general retail, restaurant, employees, entertainment center, and religious institutions. Walking distances between 1,200 and 1,600 feet are listed as appropriate for major sport or cultural events and overflow parking.

Also included are suggested parking standards for various uses, maximum parking guidelines, and formulas for assessing parking requirements where shared and reduced parking is applicable. **The parking maximum policy specifies that no more than 120 percent of the required minimum parking is permitted**. A multiplier table demonstrates how to calculate parking requirements where shared parking is utilized based on types of uses, time of day, and day of week.

Image: The Town Center District Model Ordinance recommends that parking should be permitted at the rear and sides of buildings only. Source: DVRPC

TABLE 10: SHARED-PARKING CALCULATIONS IN THE MONTGOMERY COUNTY TOWN CENTER DISTRICT MODEL ORDINANCE

Uses	Monday-Friday			Saturday and Sunday		
	8AM– 6PM	6PM–Midnight	Midnight–8AM	8AM– 6PM	6PM–Midnight	Midnight–8AM
Residential	60%	100%	100%	80%	100%	100%
Office	100%	10%	5%	5%	5%	5%
Commercial	90%	80%	5%	100%	60%	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%
Institutional	100%	40%	5%	10%	10%	5%
Religious Institution	20%	40%	5%	100%	50%	5%

Source: Montgomery County Planning Commission (Pennsylvania). Town Center District Model Ordinance. 2006.

In part due to its leadership, Montgomery County is home to a number of municipalities utilizing innovative parking practices. Many local governments utilize the county's peak demand formula to provide shared parking based on day and time of use. Shared parking is permitted in Abington Township, Ambler Borough, Bryn Athyn, Cheltanham Township, Collegeville Borough, Conshohocken Borough, East Greenville Borough, Franconia Township, Green Lane Borough, Limerick Township, Lower Frederick Township, Lower Gwynedd Township, Lower Merion Township, Montgomery Township, Norristown, Pennsburg, Perkiomen Township, Plymouth Township, Red Hill Borough, Royersford Borough, Telford Borough, Towamencin Township, Borough of Trappe, Upper Dublin Township, Upper Hanover Township, Upper Pottsgrove Township, Upper Salford Township, West Norriton Township, and Whitemarsh Township.

Upper Merion Township permits reserve parking as part of its unified development overlay, which is designed to provide a mix of housing choices and uses, promote walkability, and coordinate development. Other local governments that allow reserve parking include Abington Township, Ambler Borough, Collegeville Borough, Conshohocken Borough, Douglass Township, East Greenville Borough, Green Lane Borough, Hatfield Borough, Hatfield Township, Limerick Township, Lower Frederick Township, Lower Gwynedd Township, Lower Merion Township, Lower Providence Township, Marlborough Township, Montgomery Township, Norristown, Pennsburg, Perkiomen Township, Plymouth Township, Borough of Rockledge, Royersford Borough, Salford Township, Schwenksville

Borough, Springfield Township, Towamencin Township, Upper Dublin Township, Upper Frederick Township, Upper Gwynedd Township, Upper Hanover Township, Upper Moreland Township, Upper Pottsgrove Township, Upper Providence Township, Upper Salford Township, West Conshohocken Borough, West Norriton Township, West Pottsgrove Township, and the Township of Worcester.

Abington Township includes a bicycle parking provision that requires multiple use centers and planned business complexes greater than 100,000 square feet in total gross building area to provide bicycle storage areas near the principal building entrance.

LOWER MERION TOWNSHIP

Lower Merion Township has created a number of planning documents and utilized a mix of strategies to promote improved parking practices.

Lower Merion's Zoning Code includes a provision for **reserve parking**. Under the code, Lower Merion mandates that required parking spaces be identified in site plans, but it does not require that all spaces be paved unless the need is determined. Up to 50 percent of parking spaces may be held in reserve. Until developed, reserve parking should be planted with vegetative materials.

In 2001, Lower Merion Township produced a parking study that recommended **improved parking pricing and shared parking approaches**. As a result, Lower Merion implemented a meter strategy, with two-hour time limits for short-term meters and 12-hour time limits for long-term meters. Short-term meters are located on-street and in municipal lots, while long-term meters are located primarily in municipal lots. A **parking signage system** and meters color-coded by time limits help direct users to appropriate parking areas. The system promotes turnover of high-demand on-street parking, helping to support retailers in commercial centers and improving the attractiveness of downtown areas for visitors. The parking study also recognized a strong demand for permit parking in municipal lots, prompting the township to **expand the availability of permit spaces and adjust permit parking fees**. Lower Merion Township has a Parking Services Department that oversees the township's parking management program.

In 2006, Lower Merion adopted the Mixed Use Special Transit (MUST) District Zoning Ordinance. This new zoning overlay district applies to all commercial-zoned property within 1,500 feet of the SEPTA Ardmore train station. The MUST ordinance supports the ongoing Ardmore Transit Center and Business District Revitalization effort, which aims to improve transportation facilities, revitalize the Ardmore Business District, and develop transit-supportive uses around the Ardmore train station. The overlay is designed to decrease auto dependency and promote a transit-oriented mix of land uses, while providing sufficient off-street parking for uses in the vicinity of the MUST district.

The most innovative feature of the MUST ordinance related to parking is its provisions for parking for mixed-use structures, which reflect the **shared-parking standards** set forth in Montgomery County's

Image: The Lower Merion MUST ordinance supports the ongoing Ardmore Transit Center and Business District Revitalization effort. Source: Flickr.com

Town Center District Model Ordinance. The MUST ordinance includes a multiplier table describing peak-time demand for various uses. For a mixed-use structure, the required number of parking spaces is calculated by determining the highest total hour figure for all combined uses in the development. Whereas conventional parking ordinances might require a total number of parking spaces equal to each use's peak for a 24-hour period, the MUST ordinance allows for temporal sharing of parking. Additionally, **parking is not required for smaller mixed-use structures** and additional public parking spaces are required for larger mixed-use structures. This provision helps guarantee availability of parking while ensuring that parking uses are distributed across the district without dominating the pedestrian environment. There are also **incentives for construction of below-grade parking at mixed-use structures**.

Other parking provisions in the MUST ordinance focus on encouraging the development of attractive, convenient off-street parking facilities to reduce congestion and facilitate vehicular and pedestrian circulation. Building setback requirements establish that **pedestrian access points to buildings are located at the build-to-line, rather than through parking lots**. On-site parking may occupy no more than one-third of a lot's frontage and should include landscaping, buffers, and pedestrian amenities. Bicycle parking facilities are required.

UPPER MERION TOWNSHIP

Upper Merion Township permits **reserve parking** in which up to 25 percent of required minimum parking can be held as open space. If the township decides that existing parking is inadequate, reserved parking will be converted. While held as open space, the reserve parking reduces the amount of impervious surface in the township, provides greenspace within developments, and enhances pedestrian amenities.

POTTSTOWN BOROUGH

The Borough of Pottstown implemented **back-in angle parking** along High Street in its central business district in 2003. Prior to implementation of back-in angle parking, High Street had two travel lanes in each direction that were no longer needed, parallel parking that was not meeting demand, and a shortage of parking close to destinations.

A 1995 study looked at a variety of scenarios to update parking and the road configuration in Pottstown's central business district, including head-in parking on both sides of the street, head-in parking on one side of the street, parallel parking down the center of the street, and a mix of parallel and head-in parking. The evaluated scenarios produced little improvement in parking capacity or produced insufficient travel lane widths.

In 2001, the Borough Planning Commission established one 11-foot travel lane in each direction and a 10-foot center turn lane as the minimum acceptable, and sought to include six-foot bicycle lanes on both sides of the street. This left 30 feet

Image: The Borough of Pottstown implemented back-in angle parking along High Street in its central business district in 2003. Source: DVRPC

available for parking, which was insufficient to support angle parking on both sides.

Back-in angle parking on both sides of the street was determined to best meet the requirements of the Commission while increasing the availability of parking and proximity of parking to businesses. Compared to parallel parking, back-in angle requires one less movement because backing up is not necessary. Back-in angle parking also requires smaller turning movements and quicker entry into traffic. The Borough Council, PennDOT, and Montgomery County approved the back-in angle design, and construction began in 2003.

Today, Pottstown's back-in angle parking strategy provides for a 21 percent increase in parking capacity, accommodates more parking in front of stores, decreases pedestrian crossing time by 12 percent, and creates a perception of a more intimate street environment.

PHILADELPHIA COUNTY/CITY OF PHILADELPHIA

As the economic and cultural heart of the Delaware Valley region, Philadelphia wears many hats, creating several challenges related to parking. Some examples of innovative parking practices in Philadelphia include **back-in angle parking** on North Second Street in the Northern Liberties neighborhood and **shared-parking** allowances in Chestnut Hill's business district.

The Philadelphia City Planning Commission engaged Nelson/Nygaard Consultants to conduct a study of parking in Center City, Philadelphia. The report, Center City Parking Policy Evaluation, was released in 2005. The report describes current parking conditions in Center City, where there has been a 40 percent increase in the supply of off-street parking spaces and a 45 percent increase in parked cars since 1980. The overall peak-hour occupancy rate for off-street parking in Center City is 79 percent, just below the 80-90 percent range preferred by parking operators. Parking supplies are tightest in the area around City Hall. Low occupancy rates on weeknights and weekends indicate that off-street parking is used primarily by commuters. The report finds that parking rates average $6.15 for one hour and $12.16 for all day, which means that visitors parking for a two-hour errand will pay more than a commuter parking all day. Short-term parking is disproportionately expensive in Center City compared to other major cities and Philadelphia has the lowest long-term parking rates compared to peer cities.

The report recognizes that there are four competing views or themes related to parking in Center City. Each theme corresponds to assumptions about parking pricing, public provision of parking facilities, parking supply and new development, parking demand management, design of parking facilities, information strategies related to parking, and on-street parking management. The four themes and their related parking assumptions are described:

- Great Place to Live - Center City should reinforce its advantage as a premier residential

Image: The Philadelphia City Planning Commission supports parking requirements for new residential development that minimize the impact of driveways and garage frontage on the pedestrian environment. Source: DVRPC

location and preserve the residential urban fabric. Good parking management, rather than parking requirements, can ensure that residents have access to convenient parking.

- Commuter Convenience - To support economic growth, the benefits of cheaper all-day parking should outweigh the negative impacts of increased auto use and loss of land to parking.
- Destination City - Short-term parking needs to be cheap and convenient to support Center City's function as a visitor destination. Under this theme, increased availability and lower-costs for short-term parking are desirable, along with strategies to minimize the impacts of garages on the urban fabric.
- Metropolitan Center - This growth-oriented theme seeks to maximize the total attractiveness of Center City by leaving parking issues to the market. However, the public sector is envisioned as taking a role in mitigating the long-term consequences of excessive or inadequate parking.

The report does not select among these themes, but rather concludes with eight recommendations that are generally consistent with all approaches.

- Lower short-term parking rates.
- Uniform signage at parking garages.
- Bicycle parking and car-sharing requirements for new development.
- More incentives for below-ground parking.
- Greater enforcement of design regulations.
- Creation of a traffic and parking task force.
- Implementation of transit improvements, including better signage and increased frequencies and service hours.
- Greater enforcement of on-street parking regulations with higher fines.

As a follow-up, in June 2006, the Philadelphia City Planning Commission adopted a Center City Parking Policy Statement that addresses 11 policies targeted at creating an integrated and balanced transportation system.

- Design controls for parking facilities - The Commission encourages the use of incentives to encourage developers to build below-grade or "wrapped" parking located within a building's core to enhance the streetscape and support walkability.
- Residential off-street parking - The Commission supports parking requirements for new

Image: The Center City Parking Policy Evaluation recommends car-sharing requirements for new development.
Source: DVRPC

residential development that minimize the impact of driveways and garage frontage on the pedestrian environment.

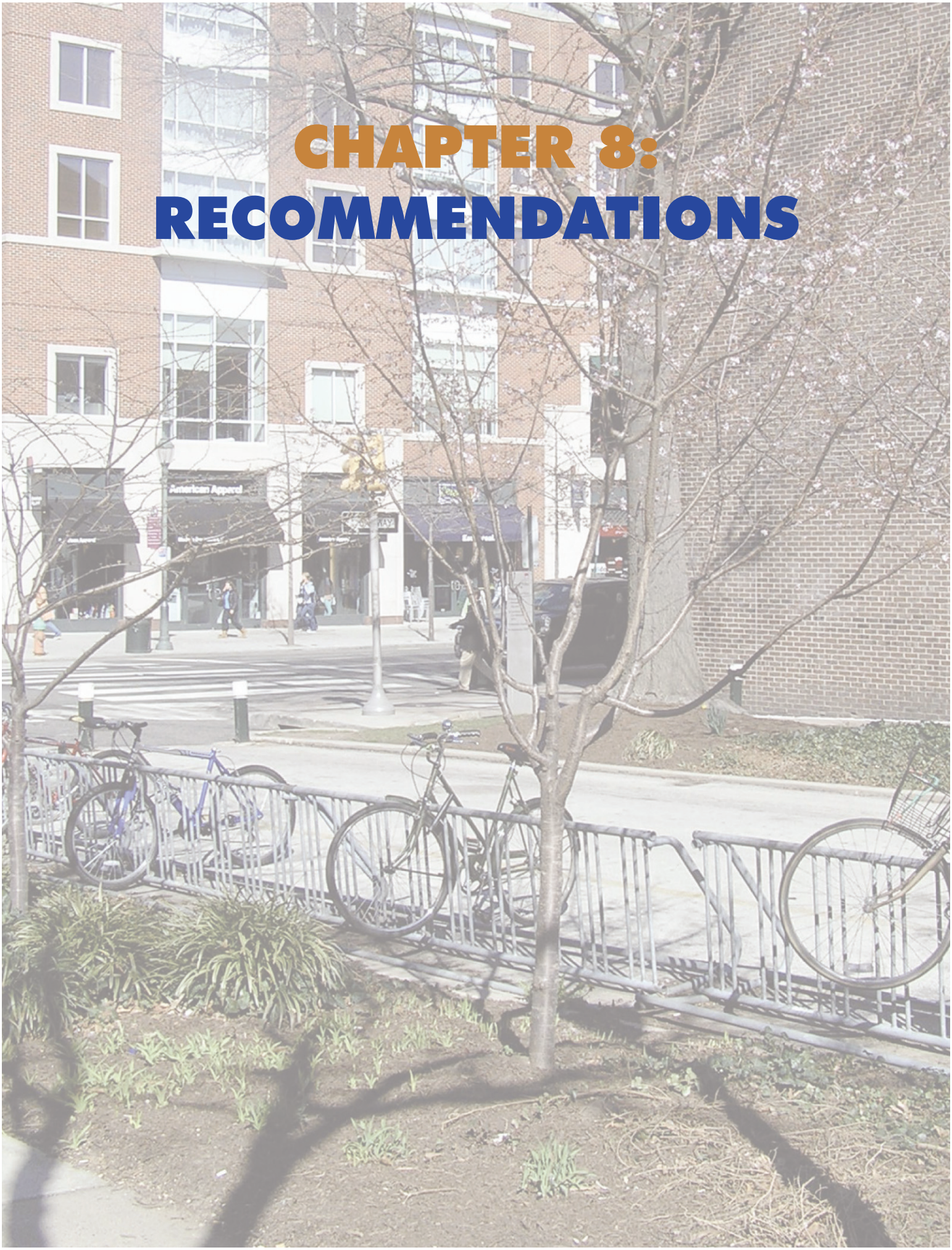
- Shared parking - The Zoning Code should encourage the maximization of the parking supply.
- Other modes of transportation - The City and Commonwealth must work to provide dedicated funding sources for transit and should require that new parking facilities accommodate car-share vehicles and bicycles.
- Commuter travel - Commuters should be encouraged to utilize public transit and parking should not be managed to cater to peak-hour commuters.
- Off-street parking rate structure - The disparity between short- and long-term parking rates should be reduced to encourage shoppers, tourists, and other short-term visitors to come to Center City.
- On-street parking - The Commission advocates setting metered rates to encourage regular turnover and availability of on-street parking on every block.
- Remote parking for commuters - Because Center City's land values do not support a strategy of "remote" commuter parking at the periphery of Center City, "remote" parking for commuters is best provided by supporting SEPTA and the Parking Authority in the development of park-and-ride options at outlying transit stations.
- Parking information - The Commission calls for the promotion of the Parking Authority website and use of technology to provide real-time information about road conditions and the availability of parking.
- Parking rate signage - Simplify and standardize parking rates and ensure that signage is easy to view and interpret.
- New parking technologies - Evaluate mechanized parking technologies.

In 2007, the Philadelphia Parking Authority (PPA) installed six new combined parking meters on a trial basis in Head House Square. The six meters served 44 parking spaces on South Second Street between South and Lombard Streets, replacing the conventional individualized meters found elsewhere in Philadelphia. The new meters accept PPA Smart Cards, bills, credit cards, and change, making them more convenient for users. Drivers pay for parking at the kiosk-like solar-powered meters, which print parking receipts for display on the vehicle windshield indicating the parking expiration date and time. While more convenient for users, the new meter system has advantages for PPA. The meters can be monitored via computer and the collection of payment is easier and less costly.

In 2002, the Philadelphia Parking Authority updated all parking meters throughout the city to accept PPA SmartCards, which are prepaid cards, in addition to coins. SmartCards are available in $5, $10, $20, and $50 denominations and may be purchased at the PPA's website or at retail locations throughout Philadelphia. SmartCards are inserted into parking meters, and, using microchip

Image: In 2007 the Philadelphia Parking Authority (PPA) installed six new combined parking meters on a trial basis in Head House Square. Source: DVRPC

technology, the card automatically adds time to the meter in 25 cent increments. When the desired amount of time is reached, the card is removed from the meter. Currently, the SmartCard is not reloadable, meaning that when the value on a SmartCard runs out, a new one must be purchased. PPA is planning to offer a card to pay for a wider array of transportation needs, such as parking garage fees and cab fares.



CHAPTER 8:
RECOMMENDATIONS

CHAPTER 8: RECOMMENDATIONS

This report provides details on a wide range of best practices in parking policy. These practices, drawn from the planning, engineering, urban design, and public finance literatures, provide strategies for regulating, designing, managing, and financing parking facilities. This section presents key recommendations to enhance parking facilities and the way these facilities fit within communities and the region.

PARKING STANDARDS, SUPPLY, AND DEMAND

- Conduct an inventory of parking usage at various locations, times, and days to gauge whether excess parking is supplied for certain uses.
- Revisit minimum parking standards to ensure that required parking supply does not exceed demand and is sensitive to the local context.
- Provide alternatives to conventional parking standards by allowing by-right, flexible parking provisions such as shared parking, reserve parking, and fee-in-lieu parking.
- Identify areas where a unique context, such as proximity to transit or an historic village setting, indicates the need for specialized standards such as parking maximums or the use of a public parking garage.

PARKING MANAGEMENT

- Manage demand for vehicle parking by developing bicycle and pedestrian facilities and supporting transit and car-sharing options.
- Implement pricing and metering strategies in locations where the amount of available parking is scarce and/or parking turnover is encouraged.

COSTS AND FINANCING OF PARKING

- Recognize that structured parking cannot be economically feasible for developers to build unless market demand and zoning will produce adequate rent.
- Leverage real estate values to fund public parking facilities through tools such as tax increment financing, or utilize market-based strategies to require users to pay for parking (e.g., unbundled parking).

Image: Parking maximums should be considered for downtowns, historic areas, and/or areas well-served by transit. Source: DVRPC

PARKING TYPES AND DESIGN ISSUES

- Design parking facilities to better accommodate more cars.
- Design and site parking facilities to fit within local contexts and to support walkability.
- Promote enhanced parking areas through landscaping, lighting, and aesthetic standards.
- Provide dedicated and/or preferred parking for bicycles, vanpools, carpools, car-sharing, and low-emitting and fuel-efficient vehicles.
- Encourage sustainable practices in parking design, including the use of recycled concrete and asphalt, stormwater best practices, and heat-island preventing treatments.

ENVIRONMENTAL IMPACTS AND STORMWATER DESIGN

- Develop a municipal stormwater management plan.
- Actively maintain stormwater facilities and enforce local stormwater provisions.
- Promote the use of pervious paving materials and stormwater management design in parking areas.

TRANSIT PARKING

- Revisit zoning to encourage real estate development near transit stations; encourage a mix of land uses, transit-supportive densities, and reduced/shared parking.
- Allow shared parking to enable park-and-ride/commuter use of parking facilities that are underutilized during business hours.
- Educate residents about the benefits of transit-oriented development.
- Ensure that viable walking, bicycle, and connecting transit opportunities and facilities are available at transit stations to reduce the demand for parking.

TRENDS AND NEXT STEPS FOR MUNICIPALITIES

Local governments in the Delaware Valley region are utilizing some parking best practices. In many cases, however, local ordinances force developers to adhere to outdated standards that do not correspond to patterns of use or desirable development patterns. This section highlights policies that can be used to update ordinances for improved parking design and management.

Parking cannot be planned or regulated with a “one size fits all” approach. Municipalities should compare their current requirements

Image: Provide dedicated and/or preferred parking for bicycles, vanpools, carpools, car-sharing and low-emitting and fuel-efficient vehicles. Source: DVRPC

to the identified best practices and recommendations-keeping in mind that their local context, needs, and goals create a unique set of considerations that ordinances must be tailored to. The recommendations provided here are based on a synthesis of national, state, and local best practices, and can serve as a starting point for municipalities looking to update their ordinances. Municipalities should consult state guidelines for recommended and required parking standards. In addition, parking provisions should be sensitive to the local context.

PARKING MINIMUMS - SINGLE-FAMILY RESIDENTIAL

For single-family housing, two off-street parking spaces per dwelling unit is a typical standard in the Delaware Valley region. Many municipalities provide more spaces for larger dwelling units. For example, three off-street spaces may be required for three- and four-bedroom units. These increasing standards are likely to be excessive given today's demographics of smaller household units.

Municipalities should avoid requiring more than two spaces per dwelling unit. Allowing reduced standards for smaller dwelling units may be appropriate. **For example, one or 1.5 parking spaces may be sufficient for homes with one or two bedrooms.** In some contexts, it may be desirable to regulate the design and location of parking areas. For example, parking can be directed to alleys in villages or neotraditional neighborhoods, or in new subdivisions.

PARKING MINIMUMS - MULTIFAMILY RESIDENTIAL

For multifamily housing, many Delaware Valley municipalities require two spaces per unit. Another common practice is requiring one space for studio apartments and two spaces for other units. A handful of municipalities require three spaces per unit. This is far in excess of the likely number of drivers for a single unit. **Municipalities should limit parking to no more than two spaces per multifamily unit.** These standards should be reduced if many residents are likely to use alternative forms of transportation (e.g., student and retirement housing, or apartments located near major transit stations). In core urban areas with a wide range of alternative transportation options, parking should be reduced, unbundled, or eliminated.

PARKING MINIMUMS - OFFICE

A common standard for office parking in the region is four to five spaces for every 1,000 square feet of office space. These high standards create a sea of parking and make office projects extremely expensive to build. **With a revised standard of two to three spaces for each 1,000 square feet**, developers could be free to construct more spaces in response to market demand, but they will have the flexibility to build less when appropriate. Opportunities for shared and reserve parking should be available by-right based on identified standards. In downtown settings, workers should be encouraged to park in public lots through pricing strategies. Developers can pay a fee-in-lieu of directly providing parking, which can be used to finance municipal parking efforts.

Image: In some contexts, it may be desirable to regulate the design and location of parking areas, such as requiring parking at the rear of homes. Source: DVRPC

PARKING MINIMUMS - RETAIL

Four to five spaces for every 1,000 square feet of gross floor area is a typical standard for retail in the region; **however, three to four spaces may be more reasonable**. Codes should allow shared and reduced parking for retail, and mixed uses. Design standards, in particular siting parking to the rear and side of buildings and including landscaping, should be implemented to improve pedestrian comfort in shopping areas. Communities with TOD, Main Street, village, and traditional commercial districts should utilize a zoning overlay that allows for reduced and shared parking to support walkability and to preserve the context of these unique places.

PARKING MINIMUMS - INDUSTRIAL

A common parking standard for industrial uses is one space for each employee on the largest shift or one space per 500 to 1,500 square feet of gross floor area. Industrial uses often require far more space than employees, which means that basing standards on employees is likely to fit parking demand best. However, it may be difficult to gauge the number of employees likely to use an industrial space. In general, **no more than one space per 1,000 square feet is necessary**, and many Delaware Valley municipalities require far less. Likewise, employee-based parking standards can typically be scaled down to one space for every two employees on a given shift, or three spaces for every four employees on a shift.

PARKING MAXIMUMS

Very few Delaware Valley region municipalities recommend parking maximums; however, they can be an effective tool to limit over supply of parking. **Many municipalities in other regions are updating their zoning ordinances to include parking maximums**. Parking maximums-such as the one in Caln Township (Chester County), which limits parking to no more than 10 percent of required minimums in the Thorndale Station Overlay District-are appropriate for TOD and village districts where alternative forms of transportation are encouraged. Conservation and flood districts are also appropriate contexts for the use of parking maximums because impervious surfaces should be limited in these areas.

PARKING SPACE DIMENSIONS

Many Delaware Valley municipalities regulate the size of parking spaces, with required dimensions typically in the range of nine feet by 18 inches to 10 feet by 20 inches. **Parking space width requirements should vary based on turnover**, with less width required for low turnover uses, such as park-and-ride lots. For low turnover, eight feet six inches is an adequate width. For moderate turnover, eight feet nine inches is appropriate. For high turnover uses, a width of nine feet is suitable.

BICYCLE PARKING PROVISIONS

Very few municipalities in the Delaware Valley region require bicycle parking facilities. **Bicycle parking**

Image: Communities with traditional commercial districts or TOD should utilize a zoning overlay that allows for reduced and shared parking to support walkability and to preserve the context of these unique places. Source: DVRPC

Table 11 provides a summary of the recommended parking standards for Delaware Valley municipalities.

TABLE 11: TREND AND RECOMMENDED PARKING PROVISIONS FOR DELAWARE VALLEY MUNICIPALITIES

Parking Standard		Typical Delaware Valley Provisions	Recommended Provision
Parking Minimums	Single-Family Residential	2 spaces per dwelling unit	1-2 spaces per dwelling unit, depending on unit size, with flexible or reduced standards, based on context – urban, suburban, rural
	Multifamily Residential	2+ spaces per dwelling unit	No more than 2 spaces per unit, with reduced and/or flexible standards where residents are likely to use alternative forms of transportation or not own more than one vehicle
	Office	4-5 spaces for every 1,000 square feet of office space	Require no more than 2-3 spaces for every 1,000 square feet of office space and allow developers to determine market for additional space; include flexible standards for downtown and mixed-use settings
	Retail	4-5 spaces for every 1,000 square feet of gross floor area	Require no more than 3-4 spaces for every 1,000 square feet of GFA. Allow for shared, reserve, and reduced parking by-right, especially for mixed-use and downtown settings
	Industrial	1 space for every 500 to 1,500 square foot of gross floor area OR 1 space for each employee on greatest shift	Require no more than 1 space for every 1,000 square feet of gross floor area OR require no more than three spaces for every four employees on greatest shift
Parking Maximums		Seldom used in this region (though used in others and regarded as a best practice)	Place limits on amount of parking that can be developed in TOD and village settings and in conservation and flood hazard districts, along with other areas where over supply is harming the livability of an area. Should be extended to most contexts. Required parking ratios should be enforced as both a maximum and a minimum in order to curb excess parking construction.
Parking Space Dimensions		9' x 18" to 10' x 20"	Depth of 18 inches is sufficient for most uses; Width: 8'6" for low turnover; 8'6" to 8'9" for moderate turnover; 9" for high turnover
Bicycle Parking Provisions		Seldom used	Require bicycle parking for larger office, retail, and residential buildings, and where alternative forms of transportation are available or encouraged (such as TOD). Should be extended to most contexts.
Pervious Parking		Sometimes required for conservation or flood hazard districts	Require pervious parking in conservation and flood hazard; require or incentivize broader use of pervious paving materials, particularly in parking spillover areas
Shared Parking		Allowed, but usually only with special approval	Permit shared parking by-right based on temporal combined peak use or other identified standards
Reserve Parking		Allowed, but usually only with special approval	Allow by-right with site plan identifying reserved spaces and Letter of Agreement to develop when required
Overlay Districts		Selective use	Apply where alternative parking standards are appropriate (examples of overlay districts that feature special parking policies include TOD, Village, Commercial Center, Flood Hazard, Conservation, and University)

Source: DVRPC, 2008.

should be provided in large office, retail, and multifamily residential buildings. In areas where alternative forms of transportation are encouraged, which should be the entire region, not just what heretofore has been traditionally recommended (such as in TODs or villages), bicycle parking should be required.

PERVIOUS PARKING AREAS

Only a handful of Delaware Valley municipalities encourage the use of pervious paving materials for parking areas, and usually this application is limited to Conservation or Flood Hazard Districts. However, stormwater runoff is a major issue throughout the Delaware Valley and use of pervious parking materials is appropriate in many settings. **Municipalities should consider offering incentives for the use of pervious paving materials.** Pervious surfaces should at the least be required for all parking areas held in reserve.

SHARED PARKING

Many municipalities in the region allow shared parking, but only with special approval. These requirements often place the burden on the applicant to prove that standard parking requirements should be modified in a particular instance. However, without an established policy in place by which municipalities will decide these cases, applicants may not wish to risk expending time and money pursuing this process.

Specific provisions for shared parking should be clearly established in municipal ordinances. The shared-parking calculations in the Montgomery County Town Center District Model Ordinance are an excellent example of how municipalities can foster shared parking without requiring special approvals. Municipalities may wish to consider creating different shared-parking provisions for select zoning districts.

RESERVE PARKING

Like shared parking, many local governments allow reserve parking but require applicants to go through an approval process to implement it. **Reserve parking can be allowed without special exception** by requiring that applicants submit a site plan identifying reserved parking areas along with a Letter of Agreement stating that the parking will be developed as necessary. If not preserved in a natural state or landscaped, reserve parking areas should be surfaced with pervious materials.

OVERLAY DISTRICTS

The use of overlay districts to implement special land use practices is widespread in some counties and less well utilized in others. Goals for overlay districts vary widely. In the Delaware Valley region, innovative parking requirements are utilized in TOD, Village, Commercial Center, Flood Hazard, Historic, Conservation, and University districts. Municipalities are encouraged to consider where special parking and development standards may be appropriate.

Image: Bicycle parking should be provided in large office, retail, and multifamily residential buildings.
Source: DVRPC

CONCLUSION

The "automobile at rest" is a fact of life in our society that will not disappear. This report reveals the complexity of design, financial, environmental, and social considerations that must be balanced when local governments create parking policies. Abundant free surface parking is rarely the best solution. Parking will not solve a community's problems and rarely if ever revitalizes a downtown or brings shoppers there without an attractive destination in the first place. There is no "if we build it they will come" for parking if there is no attractive destination to come to. Some of the best designed and loved cities and streets in the world are exactly those areas where parking is scarce, and often that is because parking is minimized, hidden, underground, and/or priced competitively. Rarely do these attractive places contain large surface parking lots, which detract from the overall appeal of the area.

The design of parking is critical. Perhaps the best mantra is that parking should be known but hidden. It should be known so that shoppers, residents, tourists, and workers know where it is, but should be hidden or integrated so that it does not dominate a street or detract from the overall aesthetics and walkability of an area. Well-integrated and managed parking adds to the commercial competitiveness and economic development potential of an area.

Through institutional inertia, lack of awareness of modern techniques, and fear of unintended consequences, many municipal ordinances err on the side of providing more parking than less, when often there are more creative management solutions. Sharing, unbundling, pricing, holding some parking in reserve are all ways to better manage the supply and demand of parking rather than simply adding more capacity. This report recommends that the region's municipalities update their individual zoning ordinances to include parking maximums, lower minimums, management solutions, and better site design for parking, including environmental considerations, such as the amount of pervious pavement. Rather than "they paved paradise, put up a parking lot," the modern response could be "they saved paradise, put in a smaller pervious lot."

The report equips the reader with information and tools to craft better parking solutions tailored to local needs and opportunities. Updated, modern parking policies can accommodate the automobile while creating more livable communities.

Source: DVRPC

BIBLIOGRAPHY

American Planning Association. Model Smart Land Development Regulations. Chapter 4: Model Smart Growth Ordinances with Commentary, Section 4.2 Model Live/Work Ordinance. 2006. http://www.planning.org/smartgrowthcodes/phase1.htm#1

American Planning Association. Model Smart Land Development Regulations. Chapter 4: Model Smart Growth Ordinances with Commentary, Section 4.1 Model Mixed-Use Zoning District Ordinance. 2006. http://www.planning.org/smartgrowthcodes/phase1.htm#1

American Planning Association. Model Smart Land Development Regulations. Chapter 4: Model Smart Growth Ordinances with Commentary, Section 4.3 Model Town Center Ordinance. 2006. http://www.planning.org/smartgrowthcodes/phase1.htm#1

American Planning Association. Planning and Urban Design Standards. 2006.

Association of Pedestrian and Bicycle Professionals. “Bicycle Parking Guidelines.” 2002.

Atlanta Regional Commission. Parking Management. Prepared by the Urban Design Collaborative. 2003.

Baker, Linda. No Parking: Condos Leave Out Cars. The New York Times. 2006.

Bier, Leonard, Gerard Giosa, Robert S. Goldsmith, Richard Johnson, Linda P. Morgan, and Darius Sollohub. Parking Matters: Designing, Operating, and Financing, Structured Parking in Smart Growth Communities. New Jersey Economic Development Authority and New Jersey Institute of Technology. 2006.

Cahill Associates. Stormwater Management Systems, Porous Pavement System with Underground Recharge Beds, Engineering Design Report. 1993.

Cahill, Adams, Horner, Cahill Associates. The Use of Porous Paving for Groundwater Recharge in Stormwatrer Management Systems. 1988.

Campoli, Julie and Alex S. MacLean. Visualizing Density. Cambridge, MA: Lincoln Institute of Land Policy. 2007.

Capitol Region Council of Governments. Livable Communities Toolkit: A Best Practices Manual for Metropolitan Regions. 2002.

Center for Watershed Protection. “The Importance of Imperviousness.” Watershed Protection Techniques, Vol. 1, No. 3. 1994

Cervero, Robert with PB Placemaking. Does TOD Housing ‘De-Generate’ Trips? A Comparison of Empirical Evidence on Vehicle Trip Generation Rates for TOD Housing with ITE Rates. 2007.

Cervero, Robert. Are TODs Over-Parked? Exploring Housing, Neighborhood, and Environmental Impacts. Transportation Research Board, Research in Progress. http://rip.trb.org/browse/dproject.asp?n=15173

Cowley, Jennifer S. and Steve R. Spillette. The Role of Parking in Texas Commercial Real Estate Real Estate Center, Technical Report 1516, Texas A&M University. 2001.

City of Austin. Parking Benefit District Pilot Program. Information available online at: https://www.ci.austin.tx.us/parkingdistrict/default.htm.

Davidson, Michael and Fay Dolnick, Editors. Parking Standards. American Planning Association. Planning Advisory Service Report No. 510/511. 2002.

Delaware Riverkeeper Network. Stormwater Runoff, Lost Resource or Community Asset? A Guide to Preventing, Capturing and Recovering Stormwater Runoff. 2001.

Delaware Valley Regional Planning Commission. Bicycling in the Delaware Valley in 2005: Use, Safety and Demographics. Report #07050. November 2007.

Delaware Valley Regional Planning Commission. Municipal Implementation Tool Brochure #6: Parking Management Strategies. May 2004.

Delaware Valley Regional Planning Commission. Realizing Density. Report #05009. 2004.

Duany, Andres, Sandy Sorlien, and William Wright. SmartCode Version 9.0. Duany Plater-Zyberk & Company. 20070

Forinash, Christopher V., Adam Millard-Ball, Charlotte Dougherty, and Jeffrey Tumlin. Smart Growth Alternatives to Minimum Parking Requirements. Proceedings from the 2nd Urban Street Symposium, July 28-30, 2003.

Institute of Transportation Engineers. Parking Generation, 3rd Edition. 2004.

J. Richard Kuzmyak, Rachel Weinberger, Richard H. Pratt and Herbert S. Levinson. Parking Management and Supply, Chapter 18, Report 95, TCRP, TRB. 2003.

Litman, Todd. Parking Management Best Practices. American Planning Association. 2006.

Litman, Todd. Parking Management Strategies, Evaluation and Planning Victoria Transport Policy Institute. 2007.

Maryland Governor's Office of Smart Growth. Driving Urban Environments: Smart Growth Parking Best Practices. 2005.

Metropolitan Council/Barr Engineering Co. "Parking Lot Design: Impervious Surface Reduction." Metropolitan Small Sites BMP Manual. 2001.

Millard-Ball, Adam, Gail Murray, Jessica ter Schure, Christine Fox and John Burkhardt. Car-Sharing: Where and How It Succeeds. Nelson-Nygaard. Transportation Research Board. 2005.

Montgomery County Planning Commission (Pennsylvania). Town Center District Model Ordinance. 2006.

Nelson\Nygaard Consulting Associates. City CarShare Vehicle Ownership Survey. Unpublished survey for City CarShare, San Francisco. 2002.

Ordinance.com website. www.ordinance.com

Osborn, Lynn. Parking Management Programs as Effective TDM Land Use Strategies. 2003.

Parking Wars (television series). Arts and Entertainment Television. 2008.

Pennsylvania Housing Research/Resource Center. Pennsylvania Standards for Residential Site Development. April 2007.

Schmitz, Adrienne, et al. The New Shape of Suburbia: Trends in Residential

Development. Urban Land Institute. 2003.

Shoup, Donald C. "The High Cost of Free Parking." Journal of Planning Education and Research 17: 3-20. 1997.

Shoup, Donald C. The Trouble With Minimum Parking Requirements Transportation Research A, Vol. 33, No. 7/8. 1999.

Shoup, Donald C. The High Cost of Free Parking. American Planning Association. 2005.

Shoup, Donald C. and Willson, Richard. Employer-Paid Parking; The Problem and a Proposed Solution. Transportation Quarterly. 1992.

State of New Jersey. New Jersey Administrative Code Title 5 Chapter 21: Residential Site Improvement Standards (RSIS). Adopted 1997, revised 2007.

Timothy Haahs & Associates, Inc. Parking: What You Need to Know to Get it Right. Presentations from conference, October 26, 2006.

University of Illinois. "Multifunctional Landscaping: Putting Your Parking Lot Design

Requirements to Work for Water Quality." Local Community Resources. 2007.

Urban Land Institute and The National Parking Association. The Dimensions of Parking. Third Edition. 1993.

Urban Land Institute and The National Parking Association. The Dimensions of Parking, Fourth Edition. 2005.

U.S. Air Force. "Parking Design Considerations." USAF Landscape Design Guide. 1998.

U.S. Environmental Protection Agency. Factsheet (EPA 833-F-00-002) Phase II Final Rule.

Small MS4 Program Overview. January 2000 (revised December 2005). http://www.epa.gov/npdes/pubs/fact2-0.pdf

U.S. Environmental Protection Agency. National Pollution Discharge Elimination System

(NPDES) National Menu of Stormwater Best Management Practices website. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

U.S. Environmental Protection Agency. National Pollution Discharge Elimination System (NPDES) Urban BMP Performance Tool website: www.epa.gov/npdes/urbanbmptool

U.S. Environmental Protection Agency. Parking Places/Community Spaces: Finding the Balance Through Smart Growth Solutions. 2006.

Vaca, Erin and J. Richard Kuzmyak. Parking Prices and Fees: Traveler Response to Transportation System

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Changes. Chapter 13, TCRP Report 95, Transit Cooperative Research Program, Transportation Research Board. 2005.

Victoria Transport Policy Institute. Parking Management: Strategies for More Efficient Use of Parking Resources. 2007.

Victoria Transport Policy Institute. Parking Pricing: Direct Charges for Using Parking Facilities. 2007.

Wilbur Smith Associates. Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices. Prepared for the Metropolitan Transportation Commission. 2007.

Wilbur Smith Associates. Existing Bay Area Parking Polices. MTC Smart Growth Parking Policy Study. 2006.

APPENDIX A: MUNICIPAL PARKING STANDARDS INVENTORY

Published separately is an inventory of parking requirements contained in the zoning ordinances of the region's 353 municipalities as of March 2008. Data was obtained from the website www.ordinance.com, a subscription website that contains over 3,000 municipal zoning ordinances, from the following areas: New Jersey, Metro Philadelphia, Metro New York, Massachusetts, Connecticut, Rhode Island, Metro Chicago, Metro Washington, DC, California, and Washington State. While ordinance.com updates their data monthly by contacting each municipality and asking for updates, it is possible there may be errors or some outdated information contained herein, depending on the responsiveness of the municipality. Readers are cautioned to check with the pertinent municipalities for specific standards.

The first set of charts contain the parking minimum, maximum, and dimensional requirements, while the second set of charts contains various parking provisions, such as bike and shared parking. The charts are arranged alphabetically by county, then alphabetically by municipality. For any municipality that does not have a zoning ordinance on ordinance.com, that is noted in its row of data. If the municipality does not have a zoning requirement for a specific category (such as shared parking) that cell is left blank in the chart.

The charts contain the following municipal zoning requirements for parking:

- Parking minimums (# of parking spaces) by zoning district
- Residential (single-family detached)
- Residential (single-family attached)
- Multifamily
- Office
- Retail
- Industrial/Wholesale
- Parking space dimensions
- Bike parking provisions
- Paving specifications
- Common, public, or shared-parking provisions
- Reserved parking provisions
- Parking policies for special districts or overlays
- Other

APPENDIX B: MODEL LANGUAGE ON PARKING IN ZONING ORDINANCES

The American Planning Association's Model Smart Land Development Regulations (2006) is a guide to the development of model smart growth ordinances. Several model smart growth ordinances are included, containing language for a mixed-use zoning district, live/work zoning district, and a town center zoning district. Excerpts from the parking requirements for each of these three model zoning districts are included below, along with commentary about the model itself and remarks concerning the locally adopted ordinances used as a basis for drafting them.

For the full model ordinances, not just their parking requirements, see:

http://www.planning.org/smartgrowthcodes/phase1.htm#1.

MODEL MIXED-USE ZONING DISTRICT ORDINANCE

OFF-STREET PARKING

(1) No off-street parking is required for nonresidential uses in mixed-use zoning districts unless such uses exceed 3,000 square feet of gross floor area, in which case off-street parking must be provided for the floor area in excess of 3,000 square feet.

Comment: Exempting small retail businesses from compliance with off-street parking requirements will help promote pedestrian-oriented character and encourage use/reuse of storefront retail space. Communities should also examine off-street parking ratios with an eye toward reducing the amount of off-street parking required overall and encouraging shared and off-site parking arrangements.

(2) Off-street parking spaces must be located to the rear of the principal building or otherwise screened so as to not be visible from public right-of-way or residential zoning districts.

MODEL LIVE/WORK ZONING DISTRICT ORDINANCE

PARKING

For live/work units of less than 2,500 square feet, one parking space is required for each unit. For live/work units greater than 2,500 square feet, required parking will be based on the applicable parking standard for the nonresidential use or the closest similar use as determined by the zoning administrator.

Comment: The relatively relaxed parking standards provided here reflect the fact that a person occupying a relatively small live/work unit may have less use for a car given that he or she works on the premises. Larger units may have additional residents as well as employees, and thus must provide more parking.

MODEL TOWN CENTER ZONING DISTRICT ORDINANCE

The following ordinance model establishes a town center that serves as a high-density, high-intensity mixed-use employment center, with three types of districts. These are TC-1 Town Center Core Subdistrict (for town center core area), TC-2 Town Center Mixed Use Subdistrict (for areas within a

one-quarter mile of the TC-1 district), and TC-3 Town Center Residential Subdistrict. The number of districts needed to implement town center planning objectives will vary from community to community, such that TC-2 and TC-3 may be combined, if the distinctions between them are perceived as too fine or not needed.

OFF-STREET PARKING

(1) One off-street parking space must be provided for each dwelling unit.

(2) No off-street parking is required for nonresidential uses in TC-1 district unless the gross floor area of such uses exceed twice the area of the lot, in which case off-street parking must be provided at a minimum ratio of one or two spaces per each 1,000 square feet of gross floor area in excess of twice the lot area.

(3) No off-street parking is required for nonresidential uses in TC-2 district unless the gross floor area of such uses exceeds the area of the lot, in which case off-street parking must be provided at a minimum ratio of one or two spaces per each 1,000 square feet of gross floor area in excess of twice the lot area.

(4) No off-street parking is required for nonresidential uses in TC-3 district unless the gross floor area of such uses exceeds 5,000 square feet of gross floor area, in which case off-street parking must be provided at a minimum ratio of one or two spaces per each 1,000 square feet of gross floor area in excess of 5,000 square feet.

(5) All off-street parking spaces must be located to the rear of the principal building or otherwise screened so as to not be visible from the public right-of-way or residential zoning districts.

Comment: Although many ordinances require 1.5 or two parking spaces per dwelling unit, the nature of most Town Center-style districts warrants consideration of lower residential parking ratios, such as one space per unit (lower perhaps for affordable units, elderly housing, and areas with excellent transit accessibility). Exempting certain sizes of nonresidential uses from compliance with off-street parking requirements will help promote pedestrian-oriented character and encourage use/reuse of storefront retail space.

APPENDIX C: SAMPLE LEASE AGREEMENT FOR SHARED PARKING

This is a sample lease agreement between a municipality and an owner/business tenant for commuter use of a parking lot (shared parking).

SAMPLE LEASE AGREEMENT BETWEEN (OWNER) AND THE (TOWNSHIP/BOROUGH/CITY) OF _____ FOR A PORTION OF (OWNER/BUSINESS TENANT) PARKING LOT FOR COMMUTER AREA

This Lease Agreement ("Lease") is made this ____ day of _____, 200__ between (Owner) with an office located at _____, _____, _____ (hereinafter "_____") and the Township/Borough/City of _____, a Municipal Corporation of the State of New Jersey, with an office located at _____, _____, New Jersey (hereinafter "(Municipality)").

(Owner) hereby leases (on a non-exclusive basis) to the (Municipality) of the Demised Premises in consideration of the rents to be paid and the covenants and other good and valuable consideration contained herein. (Owner) and the (Municipality) hereby agree as follows:

1. **DEMISED PREMISES:**
   The area of the existing (Owner/Business Tenant) parking lot (Block ____ Lot ____) located in the _____ corner, consisting of approximately ____ stalls more particularly as shown on Exhibit A attached hereto and made part hereof (hereinafter "Demised Premises").

2. **TERM:**
   The term of the Lease shall be for a period of one (1) year commencing on _____, 200___ and terminating on _____, 200__. This lease shall automatically continued and be renewed by successive terms of one (1) month (unless terminated by either party by providing thirty (30) days written notice).

3. **USE/OPERATING PERIOD:**
   (a)The Demised Premises may only be used for the parking of motor vehicles under the supervision and auspices of the (Municipality) for train station commuters. At the benefit of (Owner), the (Municipality) shall paint the lines of the parking stalls within the Demised Premises in yellow paint to differentiate them from the parking stalls not within the Demised Premises. The (Municipality) will install and maintain appropriate signs to direct traffic flow, parking and days of operation so as not to interfere with the operation of the (Owner/Business Tenant) business. The (Municipality) will obtain the approval of the owner in writing prior to the fabrication and installation of any signs or pavement markings, as to their type and

location. [The (Municipality) shall also have the right to pick up and drop off occupants of said vehicles by use of a small shuttle bus or van] (Optional).
(b) The (Municipality's) use of the Demised Premises shall be limited to the period of time between the hours of 6:00 A.M. through 10:00 P.M. Monday through Friday. Notwithstanding anything to the contrary contained herein, the (Municipality) acknowledges that customers of (Owner/Business Tenant) may park in the parking stalls located within the Demised Premises.

4. **RENT:**
(a) Rental Schedule: $_____ per year; payable $_____
on _____, _____, _____, _____. (suggest quarterly)

(b) Place of Payment: (Owner)

5. **SURRENDER OF DEMISED PREMISES ON EXPIRATION DATE:**
On the expiration date of this Lease or the last automatically renewed one month term, the (Municipality) shall quit and surrender the Demised Premises in the same condition as received. Upon or prior to surrender, the (Municipality) shall repair, at its sole cost, any damage to the Demised Premises except for the normal wear and tear and remove all signs and other markings put up by (Municipality).

6. **INDEMNIFICATION:**
The (Municipality) shall be responsible for maintenance and policing of the Demised Premises, including ice control, snow removal, customary mechanical sweeping or debris policing. The (Municipality) has inspected the Demised Premises and has found that it is in suitable condition for the intended use as a parking lot for commuters. The (Municipality) agrees to defend, save harmless and indemnify (Owner/Business Tenant) and its agents and employees from any action, claims, expenses and/or liability resulting from the use of the Demised Premises by the (Municipality) or patrons or vehicles of the commuter lot under this lease.

7. **TERMINATION BY THE PARTIES:**
Either party may terminate this lease upon thirty (30) days written notice at the end the term or thereafter.

8. **NOTICE:**
All notices required by this Lease shall be sent by certified letter, return receipt requested, to the parties at the address listed below, unless either party shall inform the other party in writing of any change in designated parties or addresses:

Owner:

Municipality:

9. ENTIRE AGREEMENT AND SEVERABILITY:

This Lease embodies the entire agreement between the parties. It may not be modified or terminated except as provided herein. If any provision is invalid, it shall be considered deleted herefrom and shall not invalidate the remaining provisions. This lease may be modified only by written agreement of the parties.

10. INSURANCE:

The (Municipality) shall provide the following insurance coverage through its self-insurance program during the term of this lease covering the Demised Premises:

(a) Workers' Compensation Insurance covering all costs, statutory benefits and liabilities under State Workers' Compensation and similar laws for employees of the (Municipality) with a waiver of subrogation in favor of (Owner), and Employer's liability Insurance with limits of $_____ per accident or disease. In addition, the (Municipality) agrees to require and warrants that all contractors hired by the (Municipality) will maintain the same Workers' Compensation Insurance and Employer's Liability Insurance for such contractor's employees and will require all subcontractors to maintain such insurance and the (Municipality) agrees to indemnify, defend and hold (Owner) harmless from any loss, injury, damage or liability which the (Municipality) may suffer as a result of any such contractor or subcontractor failing to maintain such insurance.

(b) Commercial General Liability Insurance covering the (Municipality's) operations on the Demised presides with coverage premises/operations, products/completed operations, contractual liability and personal/advertising injury liability with combined single limits of $_____.00 per occurrence for bodily injury, and property damage, including Landlord as an additional insured.

(c) Motor Vehicle Liability Insurance with coverage for all owned, non-owned and hired vehicles with combined single limits of liability of $_____ per occurrence for bodily injury and property damage.

11. DEFAULT:

(a) If the rent herein provided for, or any part thereof, to be paid by the (Municipality) pursuant to this lease shall be unpaid on the date when due and remain so for a period of ten (10) days after Owner shall have given to the (Municipality) written notice of such default, then Owner shall have all rights and remedies available to Owner at law or in equity. Should the term of this lease at any time be terminated under the terms and conditions hereof, or in any other way, the (Municipality) hereby covenants and agrees to surrender and deliver up the Demised Premises peaceably to Owner immediately upon the termination of the term hereof.

(b) If the (Municipality) shall be in default in performing any of the terms or provisions of this lease other than the provision requiring the payment of rent and Landlord shall give to the (Municipality) notice of such default, and if the (Municipality) shall fail to cure such default within thirty (30) days after service of such notice, or if the default is of such character as reasonably to require more than thirty (30) days to cure, and the (Municipality) shall fail to commence to cure the same within such period or shall fail to use reasonable diligence in curing such default after service of such notice, then and in any such event (Owner) may cure such default for the account of and at the cost and expense of the (Municipality), and the full amount so expended (Owner) shall be immediately be owing by the (Municipality) to (Owner), together with interest at ten percent (10%).

12. ASSIGNMENT AND SUBLETTING:
The (Municipality) shall not assign this Lease or sublet the Demised Premises.

IN WITNESS WHEREOF, the parties hereto have caused this Lease to be duly executed and to be effective on the date first above written.

ATTEST: OWNER

BY: _____

DATED: _____

ATTEST: (TOWNSHIP/BOROUGH/CITY) OF _____ WITNESS:

BY: _____ _____

_____, _____

Mayor Municipal Clerk

DATED: _____

THE AUTOMOBILE AT REST: TOWARD BETTER PARKING POLICIES IN THE DELAWARE VALLEY

Publication Number: 08081A

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Geographic Area Covered: DVRPC 9-county region

Key Words: parking supply, parking demand, parking generation, parking standards, parking management, transit parking, transit-oriented development, park-and-ride, kiss-and-ride, parking requirements, SmartCode, model ordinance, minimum parking, maximum parking, spillover, reserve parking, unbundled parking, parking freeze, travel demand management (TDM), employer parking, parking taxes, in-lieu parking fees, free parking, shared parking, parking entitlement, parking permits, overflow parking, parking enforcement, peripheral parking, car-sharing, parking management districts, parking benefit districts, transportation management association (TMA), surface parking, structured parking, on-street parking, hybrid parking, underground parking, bicycle parking, motorcycle and scooter parking, center parking court, tuck-under parking, back-in angle parking, "park once", access management, landscaping, screening, lighting, liner building, "Texas doughnut", green roof, intelligent transportation systems (ITS), advanced parking management systems (APMS), pre-trip parking information system, lot-specific parking information system, automated payment system, parking reservation system, automated parking facility, accessibility, sustainability, LEED-NC (New Construction), LEED-ND (Neighborhood Development), air quality, water quality, stormwater, flooding, nonpoint source pollution, detention basin, Best Management Practices (BMP), pervious, impervious, rain garden, filter strips, bioretention, swales, infiltration trenches, porous paving, tax-increment financing.

Abstract: The Automobile at Rest: Toward Better Parking Policies in the Delaware Valley presents an overview of parking policies and requirements in the Delaware Valley region, along with strategies for managing and designing parking better. Each of the region's 353 municipalities set their own parking requirements within their municipal zoning ordinance, usually based on national standards from the Institute of Transportation Engineers and/or the Urban Land Institute. These requirements are detailed in a separately published Appendix titled Municipal Parking Standards Inventory. These standards often assume that all trips will be made by car and that destinations will be isolated and single use in character. The standards fail to recognize the different types of parking provisions that may be desirable or cost appropriate for different contexts, such as downtowns, suburban shopping districts, or rural areas. Municipal parking ordinances therefore often result in too much parking or requirements that are not flexible for mixed-use settings. These requirements have a strong influence on the built and natural environment and how the community grows or redevelops. The report also examines ways to reduce parking demand and improve parking supply where appropriate or necessary through parking management strategies, such as pricing, car-sharing, and shared parking, among others. Different types of parking are examined, from surface parking to underground parking to bicycle parking, along with innovative design treatments. The report also examines the environmental impacts of parking with a focus on the critical issue of stormwater. Lastly, the relationship between parking and transit is considered, particularly park-and-rides and transit-oriented development. This report provides planners, local leadership, and citizens with information about best practices for designing, managing, and regulating parking.

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