PARKING DESIGN

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

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

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

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

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

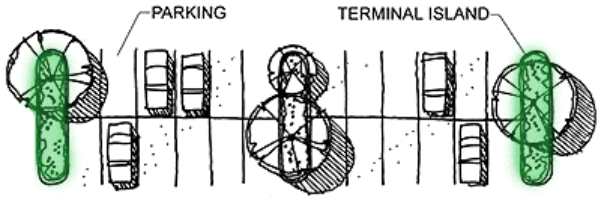
No one wants acres of pavement or blank walls dominating the streetscape, yet parking needs to be convenient, safe, and accessible. Given the adverse impacts of the visual prominence of parking facilities, local jurisdictions and developers alike should seek innovative design strategies to ensure that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

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

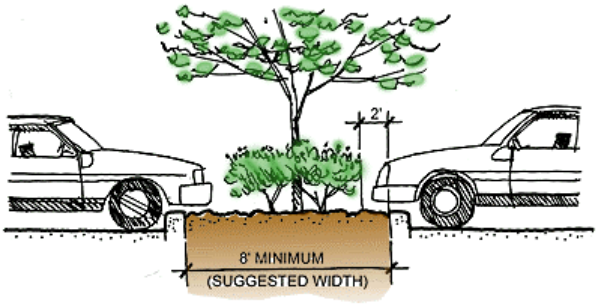
This parking structure in Bethesda, Maryland, is embedded in the block, obscured from street activity by more active uses.

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

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



Terminal Islands



Divider Medians

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

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

OBJECTIVE: Provide necessary parking without large expanses of pavement.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

OBJECTIVE: Encourage vibrant street level activity.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Challenges to Smart Parking Design

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

Possible Strategies

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

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

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

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