Parking Management Strategies

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Contents

Introduction and Overview

This paper will cover general principles of parking management, existing conditions in the region, and potential parking management best practices covering both supply-side and demand-side solutions. Finally, the impacts of different strategies on various indicators will be evaluated. Planning for parking has traditionally focused on ensuring free and abundant parking spaces by setting minimum requirements based on peak user demand. A major shift to this approach has occurred. The complexities of parking and its effects on other factors have called into question the "free and abundant" parking policies. Specifically, concerns about air quality, traffic congestion, and financial feasibility have influenced this shift. Parking cost and convenience are important, but opinions vary as to how much should be provided, where, and who should pay for it.

There are many different interests and viewpoints to consider when making planning decisions with regards to parking management. Each municipality and its unique neighborhoods will have different needs; there is no single parking policy that will work for the entire region. Todd Litman suggests that planners use the following Parking Management Principles when making decisions to support parking management (2006):

1. **Consumer Choice**. People should have viable parking and travel options.
2. **User information**. Motorists should have information on their parking and travel options
3. **Sharing**. Parking facilities should serve multiple users and destinations.
4. **Efficient utilization**. Parking facilities should be sized and managed so spaces are frequently occupied.
5. **Flexibility**. Parking plans should accommodate uncertainty and change.
6. **Prioritization**. The most desirable spaces should be managed to favor higher-priority uses.
7. **Pricing**. As much as possible, users should pay directly for the parking facilities they use.
8. **Peak management**. Special efforts should be made to deal with peak-demand.
9. **Quality vs. quantity**. Parking facility quality should be considered as important as quantity, including aesthetics, security, accessibility and user information.
10. **Comprehensive analysis**. All significant costs and benefits should be considered in parking planning.

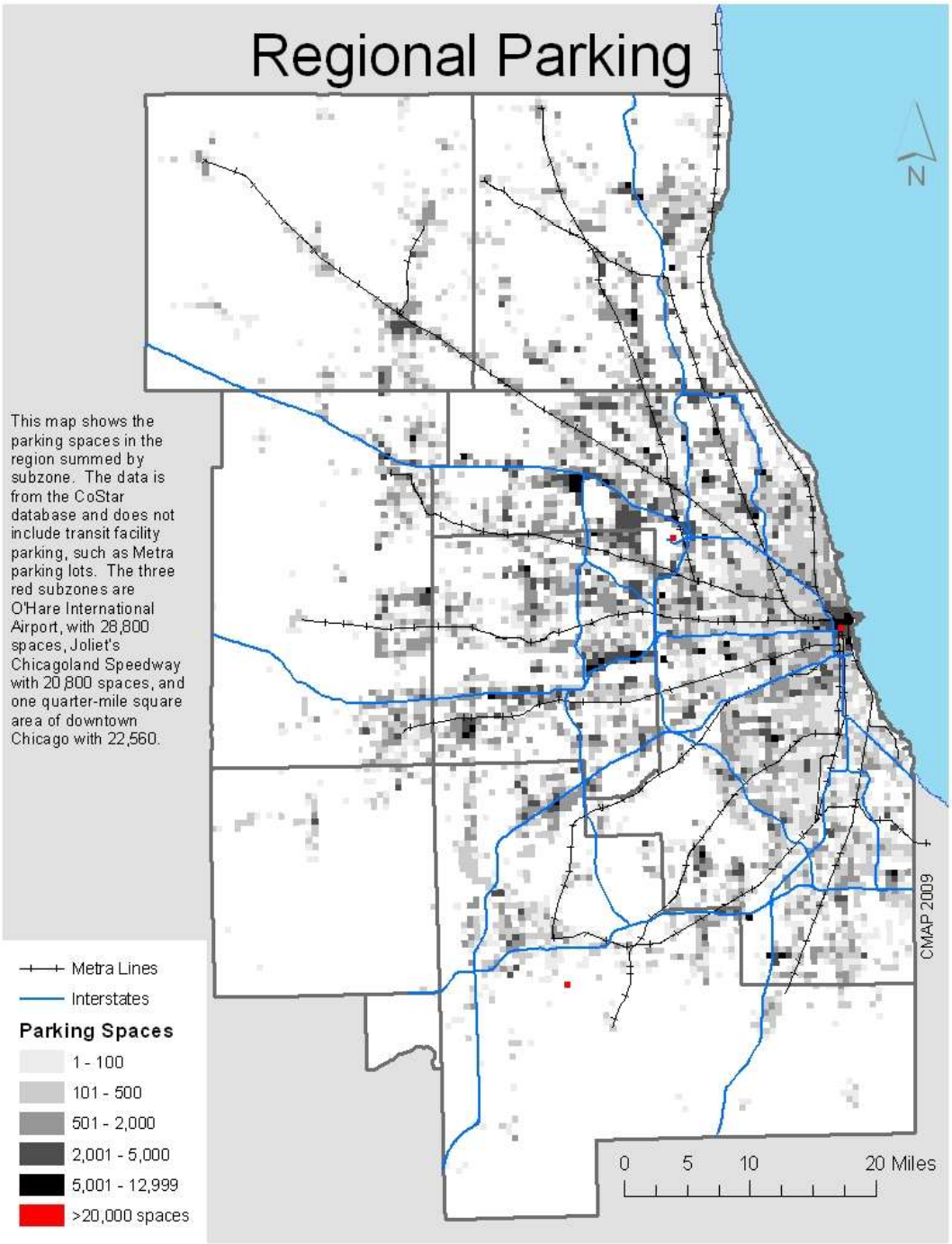
Every transportation system must have a parking component; it is a major land use in both urban and suburban communities. The design, location, quantity, and price of parking can significantly affect surrounding uses, property values, and quality of life. Parking has the potential to increase *or* reduce traffic congestion (Weant and Levinson 1990). When parking policies and programs are effectively utilized, they can increase efficiency of land use, which has many ancillary benefits. Reducing the number of spaces required can generate property tax revenue, reduce land consumption, improve walkability, increase viability of alternative transportation modes, reduce environmental degradation, and create more vibrant communities (Litman 2006).

Existing Conditions

Parking Inventory

CMAP's data for the regional parking inventory is primarily focused on off-street facilities, but a more thorough collection of the region's on-street parking inventory is underway and will be analyzed in the context of traffic flow.

Northeastern Illinois has over 3.2 million off-street commercial and industrial parking spaces in more than 32,000 facilities. The average number of spaces at a facility is 85. O'Hare is the largest parking supplier with 28,800 spaces, and Joliet's Chicagoland Speedway has 20,800. Chicago office spaces account for 117,704, while downtown offices (including 4 neighborhoods around the Loop) number 75,335. The Loop (or Central Business District, bounded on the west and north by the Chicago River, on the east by Lake Michigan, and on the south by Roosevelt Road) has 59,188 spaces, of which 33,652 are office spaces. *These numbers do not include spaces from Metra, CTA, or Pace (discussed in the following section).*



Transit parking

There are nearly 95,000 parking spaces at facilities owned by Metra, Pace, and the CTA. The vast majority of these – almost 87,700 spaces – are at Metra stations. Several Metra stations have no parking and these tend to be located closer to downtown Chicago; the greatest number of parking spaces are concentrated midway between the city and the urban fringe, some 20-40 miles from the Loop. While nearly every Metra station has parking available, only 18 of 143 CTA rail stations do. These stations are almost all at the end of the 'El' lines or along the Orange line (the system's newest line). Pace has 9 Park-and-Ride facilities, all served by at least one express bus route and often several local routes.

The chart below summarizes transit parking availability and usage in the Chicago region in lots owned and/or operated by the region's public transit agencies. For Metra and the CTA, most parking facilities have between 100 and 500 spaces, though 25 facilities have more than 1,000 spaces. A substantial portion of CTA and Metra lots are at or over capacity (and/or under-priced), though all are of different sizes (not just small lots or large lots) and are dispersed throughout the region. Pace lots are generally much smaller (80 spaces on average) than those served by rail transit.

Transit Parking in the Chicago Region

Agency	Total Spaces	Facilities w/ parking	Total facilities	Overall space usage	Median lot usage	Lot size (spaces) Low	Lot size (spaces) High
Metra[1]	87,699	205	238	81%	84%	7	4,089
CTA[2]	6,666	18	143	83%	91%	38	1,633
Pace[3]	876	11	25			41	150

[1] 2007 data [2] 2000 data [3] no date, utilization statistics unavailable
Source: Regional Transportation Asset Management System (RTAMS)

Existing parking strategy examples

Every community seems to have a parking problem – not enough, too much, over-priced, or under-priced. The nuances of parking problems are related to the nature of each community. Is it a commuter rail suburb? Are there many office parks? Is it a commercial hub by a highway? Many communities in the region are taking steps to confront their unique parking dilemmas.

The following examples of local endeavors to manage parking point to the need for a better regional understanding of parking policy.

- Plainfield recently enacted a Code of Ordinances, specifying several parking strategies to manage supply. Plainfield's Downtown Parking Zone (DPZ) has different regulations for the downtown area and the area around Village Hall. In the DPZ, developers are exempt from minimum parking requirements, with the intention of preserving older buildings and creating a pedestrian-friendly environment, while improving economic competitiveness of the area. Shared parking is allowed for non-residential uses, and placement of parking lots between streets and primary buildings is discouraged.
- Planners in Lake Forest realized that some parcels in the downtown area may be too small to effectively provide the required number of parking spaces, and decided to allow developers to pay in-lieu fees with a special use permit.

- Suburban communities along Metra rail lines are often faced with high demand for commuter parking and consequentially long waiting lists – up to 10 years at the downtown Naperville location (Naperville Finance Department, 2009). Some suburbs do not offer permits and just allow the lots to fill on a first come, first serve basis (often filled by 7:00 am). The shortage of such a high-demand commodity as commuter parking near transit should instigate price increases, but this is an unpopular solution. The Village of Northbrook even considered auctioning prime parking spaces (2006). Current low permit prices lead some residents to hold onto scarce and valuable permits even if they do not take the train on a regular basis. An auction of permits or increases in prices for stations with long waiting lists could save some people years of waiting.
- Kane County's Transit Opportunity Assessment Study has identified the impacts of parking on development. They have identified transit areas and transit corridors, and have policy recommendations for parking limitations by implementing fees or providing a maximum parking space allotment instead of the traditional minimum (Kane County).
- In 2008, the City of Chicago privatized the city's 36,000 metered parking spots for an upfront payment of $1.15 billion. A private firm receives the revenue that previously had provided the City with $20 million annually – in return for maintaining and operating the system. This move has been politically controversial, and the controversy can at least partially be attributed to the dearth of understanding of the value of parking. CMAP has not evaluated the pros and cons of this public-private partnership.

Parking Supply Management Strategies

Parking management embraces a variety of strategies that seek to either reduce parking spaces needed or to use parking spaces more efficiently. Parking management arose out of a concern that parking lots and off-street parking cover a significant proportion of urban areas, particularly high-demand regions such as central business districts. The Chicago CBD is thought to have over 975 acres of parking (Manville and Shoup, 2005). This coverage is viewed by some as an urban eyesore, reducing walkability, and depriving the city of additional property tax revenues (parking lots are often in high-demand areas where land has a high value). Parking management proponents argue that these vast amounts of high-value land could be put to better use.

Given the unique qualities of individual communities, it is difficult to say what the minimum or maximum parking requirements in our region should be, even if specified by land use. Litman considers 'optimal parking supply' to be "the amount that motorists would purchase if they paid all costs directly and had good parking and transport options" (2006). Many surveys measuring demand assume that parking is free and do not consider whether an area has alternative modes of transportation. Also, most people are unaware of problems that stem from excessive parking supply. Contemporary parking planners suggest shifting to *efficiency-based* standards that allow parking lots to become full, using management strategies to take care of overflow and address any potential problems (Litman, 2006 and Shoup, 2007).

Parking management strategies can also promote efficient use of existing parking, such as shared parking plans and improved information on the availability of parking. Parking management techniques are utilized in reforming city ordinances to reduce parking requirements for new development, which are typically designed to accommodate rare peak demand (occurring perhaps once a year) in an auto-only environment. Most parking management projects utilize a variety of strategies, employing each as needed to best address each unique situation. As mentioned in the introduction, it is important for the parking strategies to be flexible, so that they can be easily adjusted to the changing needs of a community.

Maximum and Minimum Requirements

Traditional parking requirements specify a minimum number of spaces to be provided for each land use. Alternatively, planners can use parking maximums to better utilize the space. Parking maximums can be used in addition to, or instead of, parking minimums.

The parking minimums set by most communities are often based on the idea that more parking is better. Too little parking can lead to spill over into neighborhoods and cars circulating unnecessarily looking for parking; most local governments and developers want to avoid such outcomes. Unfortunately, the data used to set minimum parking requirements is often limited and irrelevant. To conduct a full parking study of actual parking needs in a community is usually cost—and time—prohibitive. As a result, most cities either copy the parking codes of other cities or use the Institute of Transportation Engineers' *Parking Generation* handbook. Even in ITE's handbook, reported parking rates are not necessarily based on much data and the studies feeding into them may come from such varying situations as to have no relevance for the cities consulting the data (Shoup 2005). The existence of transit and/or provision of biking and walking infrastructure can greatly reduce parking needs, and the ITE handbook does not consider such variation between communities.

A 1998 study done for the RTA illustrates this gap between actual demand and supply. A survey of 6 suburban office buildings found that the average parking supply was 3.62 spaces/1,000 square feet (of office building), while the actual demand was 2.45 spaces/1,000 square feet. Building occupancy had a large influence on demand, but even after adjusting the numbers for full occupancy the authors determined that supply could be reduced by 17% and still meet all the existing parking demand. The study recommended that municipalities with more than requirements over 3.5 spaces/1,000 square feet of building revisit their regulations (Regional Transportation Authority 1998). In a nationwide study by Kuzmyak et al., the authors concluded that a parking ratio of 2.0 would sufficiently cover the needs of most business parks, but that each location would have to be analyzed individually to determine special situations or circumstances (2003).

The same study also found that the quantity of parking provided was almost always determined by municipal ordinance or zoning code. In a survey done for the study, most developers reported that they would reduce the amount of parking if they could get a higher return on investment via more development, or if incentives or bonuses were offered. Some developers also worry about the "marketability" of a building if their parking supply is restricted (Kuzmyak et al. 2003). The authors of the RTA study concluded that municipalities would see short-term fiscal benefit only if reduced parking led developers to construct more buildings. In the longer-term, reduced excess parking supply could help to raise land values, which would be to the municipality's benefit (Regional Transportation Authority 1998).

Shared Parking

Shared parking is defined as "the use of a parking space to serve two or more individual land uses without conflict or encroachment" (Smith 2005). This practice is already commonly seen in larger downtowns, where parking (usually in garages) is not necessarily tied to a particular building and its uses, but can be used by anyone visiting any of the nearby buildings. Shared parking is most commonly found in downtowns and larger activity centers, but it can be a vital component in good mixed-use or transit-oriented developments, or anywhere that place-making is a focus. The pedestrian environment of a site often benefits greatly from shared parking.

The key to shared parking is a mix of uses that require parking at different times of the day, or different days of the week. For example, an office building in the same development as a movie theater or other entertainment

venue would be a good candidate for shared parking. The peak parking demand for office workers will be from 8 to 5, Monday through Friday. Movie goers, on the other hand, will be looking for parking in the evening and on the weekends, when the office workers are not there. Instead of building one parking lot for the office building and another one for the movie theater, the two uses can share a lot. Fewer parking spaces can free up land for other development or for more landscaping and pedestrian amenities. Such arrangements can also encourage people to park once and walk between destinations served by the same parking facility, instead of driving between uses that would otherwise each have its own surface lot.

Shared parking works in any number of situations, and a methodology has been developed for analyzing how many spaces need to be built to fit the needs of a particular mix of uses. Shared parking is often coupled with many of the other parking management strategies discussed in this paper, such as pricing, overflow parking, and reserved parking. The other strategies are often necessary to ensure successful implementation of shared parking.

Not all municipal parking requirements allow for shared parking. Communities hoping to encourage place-making type developments, however, should consider more flexible parking standards. For communities and developers alike who are interested in shared parking, the Urban Land Institute's *Shared Parking* methodology (2005) has been recognized by the Institute of Transportation Engineers and is a valuable resource for those considering this type of parking management.

Employer / Institutional Parking (incl. schools and colleges)

Since the largest peak-period demand for parking comes from home-to-work trips, and a majority of commuters drive to work alone, employer parking management strategies can be very successful at reducing overall vehicle miles traveled (VMT). The goal of employer parking strategies is to reward people who carpool or take alternative modes of transportation and discourage or penalize single-occupant drivers, with the use of incentives and disincentives. Wilson and Shoup show that the greatest reduction in single-occupant drivers is seen when employers eliminate parking subsidies while implementing other incentives. If employers offer incentives to use other modes and continue to subsidize parking, it is difficult or impossible to reduce the number of single-occupant drivers (1990). If employers continue to provide free parking, there will always be a high demand for it. This has an influence on the development of municipal zoning laws and codes, which often require excessive parking spaces. There is a need to coordinate the efforts of reducing employer-subsidized parking and the changing of local zoning requirements. Studies have found that with the way parking is subsidized and the "effects of tax law," parking subsidies tend to benefit higher income groups (Wilson and Shoup, 1990).

There are various programs that offer financial incentives to commuters for reducing their automobile trips. Examples of programs include: *Parking cash-out* where commuters using subsidized parking can choose cash instead, *transit benefits* provides commuters with a subsidized transit pass, *universal transit passes* gives bulk discounts for transit passes, discounted or preferential parking for rideshare vehicles (Litman 2005). Shoup warns that some employees will take money offered in cash-out programs and still drive. They instead find on-street parking and/or other available commercial parking (cited in Kuzmyak et al, 2003).

To reduce the amount of employees that are congesting the roadways during peak hours, some employers may also allow employees to arrive at flexible hours, telecommute, or work alternative schedules. Similar to other strategies discussed in this paper, the employer programs are most successful when they are multi-faceted. Employers who are committed to reducing the number of employees arriving in single-occupant vehicles can provide transit benefits, park-and-ride passes, shuttle services, and/or preferential carpool spots, while increasing

the costs of parking. For more on this subject, please refer to the Transportation Demand Management strategy paper.

On-street Residential Neighborhood Parking

Some areas with high demand for parking and/or high parking fees may push demand for parking into nearby residential neighborhoods. This demand can be managed with parking permits for residents. Overly restrictive regulations in residential areas can, however, lead to increased public and private parking development costs, which can prevent transit-oriented and traditional neighborhood development. Local authorities should evaluate neighborhoods on a block-by-block basis, balancing the residential parking demand with employee and/or customer access, while considering the development goals of the municipality.

In areas of high parking demand, exploration of the possibilities for shared on-street parking should be a goal. Neighborhoods with residential permits often have many under-used spaces during the day – a problem that Shoup considers to be the result of an overreaction to parking spillover problems. Alternatively, he suggests creating a market in curb parking, calling them residential parking benefit districts (2004); this would allow residents to continue to park free but charge a fee to non-residents high enough to maintain 15% vacancy. The revenue could be returned directly to the residents in the form of street improvements.

On-street Commercial Area Parking

On-street parking, as close to a business as possible, is the most convenient type of parking for potential customers, and keeping those spots available for short-term use should be a high priority. If on-street commercial parking is not managed or priced, commuters, employees and spillover parkers avoiding fees will use the parking spaces and the desired patrons will not have a place to park. Shoup suggests that municipalities charge a price that will ensure that approximately 15% of the spaces are always vacant (2003). This could be in the form of variable pricing that maintains a high enough price so that there will always be some vacancy, but not so high as to send business to other locations. Prices and restrictions would vary by block, time-of-day, and day-of-week.

Managing parking in commercial areas typically involves "setting peak hour, daytime, or 24-hour parking restrictions; establishing parking time limits, and installing parking meters" (Kuzmyak et al, 2003). The most important factor influencing the behavior of single-occupant drivers is parking cost to user, not supply; there is also a less intense relationship for maximum time limits (Ibid). It is important for communities to develop contingency plans so that they can provide the minimum spaces, monitor results, and have strategies to provide more if necessary.

Many communities have established Parking Management Authorities (PMAs) to oversee parking management and to determine the prices. These PMAs can then return the increased revenue generated from on-street parking pricing to the community in the form of streetscape improvements: lighting, planters, security, etc. An improved street environment can attract pedestrians and bicyclists who add to commercial "foot-traffic" without congesting the roadways.

Peripheral Parking Lots

Parking lots placed outside of the central business district, usually with shuttle service to major destinations, are called peripheral parking. When within 1 mile of the activity center, however, most users will actually walk to their final destination. The primary goal of peripheral lots is to divert traffic from the central business district

(CBD) or major destinations where traffic bottlenecks might occur. Unlike other parking management strategies, the use of peripheral parking might change *where* people drive, but it is generally not an attempt to influence the mode choice or travel behavior of the driver.

Critics argue that peripheral parking can convert transit commuters to drivers or reduce usage of park-and-ride facilities further out from the destination. When given the choice, few developers will trade peripheral parking for less on-site parking and so the peripheral parking may not greatly reduce the amount of CBD parking. Some communities have used peripheral lots with limited success; the failure is usually attributed to "insufficient user cost savings to justify the loss in time or convenience relative to core area parking" (Kuzmyak et al, 2003). Peripheral lots can, however, foster carpooling if spaces in the CBD are reserved for carpools while others are shifted to the peripheral lots.

Structured Parking

The choice between surface and structured parking is generally driven by land costs. Where land costs are higher – usually in denser, more urban environments – it becomes more economical to build up than to build out. Excluding land costs, parking construction costs in 2006 were estimated to be (Bier et al 2006):

- $3,000/space for a surface lot,
- $20,000/space for an above-ground structure, and
- $35,000/space for an underground structure.

Similar estimates were found for Evanston's Northwestern University campus in 2006, with slightly higher numbers for surface lots (Northwestern University Newsletter, 2006). Factors affecting parking construction costs are listed in the appendix. The annual cost to own and operate a parking space (assuming a total capacity of 500 spaces) follows a similar hierarchy, and in 2004 ranged from less than $400 for a surface lot space to over $3,500 for an underground structure space. Structured parking is recommended for areas with higher land values and high demand for parking. The construction costs of structured parking per space diminish with scale, but consideration must be given to the ability to recover costs through parking fees.

Few parking operators (public or private) recover the full costs of owning and operating the garage because they set parking prices lower than the full cost of a space or otherwise subsidize the spaces. One result of these high costs coupled with inadequate revenue from parking charges is that parking structures are "seldom built as freestanding commercial ventures" (Shoup 2005). The "Public Parking Financial Strategies" section of this paper outlines several options for financing parking structures.

There are benefits to parking structures over surface parking lots, despite their higher costs. Contrary to the perception that building structured parking will increase congestion, "it has been shown that there is *less* congestion because people immediately go to the deck to park, rather than cruise through town *looking* for spaces" (How to Handle Parking 2007). Another benefit is that parking structures can include other uses within the same building. In more urban environments especially, it may be desirable to have retail space on the ground floor. The retail can wrap around the base of the garage and improve the local streetscape. In active areas – such as downtown, near transit, or in a shopping district – such retail space may be able to draw fairly high rents. Those rents can then be used to subsidize the building or maintenance costs of the entire facility.

Park-and-Ride

Park-and-ride facilities are parking lots near bus or rail stops that allow travelers to transfer from automobile (and other modes like walking and biking) to transit. These facilities are often an important part of a regional

transportation system because they can provide more travel alternatives by facilitating shifts from automobile to rail, bus, or carpool (especially for commuters); increase the effectiveness of transit systems; and help reduce the need for parking in the central business district. An extensive system of park-and-rides already exists in the Chicago region around many Metra and CTA rail stops, as was detailed in the Introduction section. In the Chicago region, as in most places, the park-and-ride facilities are oriented towards rail transit serving the central business district and are primarily used by commuters. Pace park-and-ride lots serve both local and express bus transit.

Most park-and-ride lots exist to support transit use by allowing transit to draw more riders from a wider area than if riders relied on local bus service or walking and biking to get to a transit stop with service to downtown (e.g. Metra or CTA rail).

In terms of the region's parking supply, park-and-ride lots can be considered a substitute for long-term parking in the central business district (the Chicago Loop). By allowing commuters who might otherwise drive downtown for work to park their cars further out and take transit in, there is less need for parking in the downtown. Park-and-ride lots thus promote a more efficient use of land in the region, because less of the valuable land in the downtown needs to be devoted to parking, which is a relatively unproductive use. It is important to note that park-and-ride lots are primarily useful for commute trips and are generally not an effective substitute for non-work trips. Some rail lines carry a substantial number of riders during peak commute times and the presence of a park-and-ride lot has the indirect effect of reducing highway demand and the need for lane expansions.

The parking costs associated with park-and-ride lots can also provide substantial benefits for users. The daily fee to park at a Metra lot varies, but it is generally around $1.25. The costs to park in the Chicago Loop can run as high as $300 per month and $30 or more per day. Even after factoring in transit fare, this is a substantial discount. The parking charges at park-and-ride lots are not meant to manage the parking supply. They may help to cover some operations and maintenance costs at the facility, but to make park-and-rides effective, the cost to park and take transit must be less (often substantially so) than the cost to drive and park downtown. But if a fee is charged, it is preferable to have a system that charges the user for each time he or she uses it so that there is an incentive to supplement travel with other modes if possible. If a driver knows that riding a bicycle will save her a few dollars that day, there is an incentive not to drive.

The provision of park-and-ride lots may also help to keep downtown areas more vibrant by eliminating the need for additional parking. Some commuter rail lines carry a substantial number of passengers during peak traffic hours, which reduces the need to add highway or expressway lanes.

With the increasing popularity of transit-oriented development (TOD), the place of the park-and-ride in a transit system is changing. In general, park-and-ride facilities are located with as much convenience as possible to the transit station in order to make using the facilities more attractive. The land close to a rail station is, however, the prime location for the higher density, mixed-use buildings that characterize TOD. There is a greater need in TODs to balance pedestrian and automobile needs. For example, instead of surface lots, parking could be in garage structures that incorporate other uses on the ground floor. Shared parking strategies (discussed above) can be an important tool to make parking work in a TOD (How to Handle Parking 2007). If a parking garage is built in a TOD, a portion of the spaces can be allocated to (or shared with) transit commuters. The structure would ideally contain a mix of uses, such as retail and office on lower levels. Also, not every train station will have transit-oriented development, and these locations may be more appropriate for park-and-ride lots.

A related parking strategy is park-and-pool lots. Unlike park-and-ride lots, these are not necessarily directly served by transit but are instead meant to facilitate carpool and vanpool activities. Suburban employment

centers are often difficult to serve with fixed-route transit (bus or rail) but are good candidates for carpooling. Park-and-pool lots are usually located near expressways and major highways in an urban area and are generally smaller than park-and-ride facilities. By increasing vehicle occupancy before drivers get on expressways or major highways, park-and-pool lots help reduce congestion on those roads. The lots also encourage carpool formation between commuters who otherwise live too far apart to consider carpooling. Finally, these facilities "demonstrate to the public that carpool [and] vanpool…alternates are being supported" (Nicholas 2004). Park-and-pool lots could be used in conjunction with Pace's vanpool program.

Bicycle Parking

Parking plans should also consider bicycle parking and bicycle facilities as a means to reduce the number of spaces necessary. Many lots will use irregular or small spaces for bicycle and motorcycle parking. When converting from parking meters to pay-box systems, planners should consider the potential bicycle parking that is lost with the removal of meters. Some cities have removed the top of the meter and replaced it with an ornamental decoration, enabling bicyclists to continue using the meter as a bike rack, and reducing costs associated with meter removal and construction of bike racks. In Chicago, where pay boxes have been installed, some meters have a sticker informing people to pay for parking at the box, and that the "meter remains as a courtesy to cyclists." For more on bicycle facilities and planning, see the bicycling strategy paper.

Parking Demand Management Strategies / Pricing

Researchers such as UCLA Professor Donald Shoup have emphasized that the provision of free parking only serves to perpetuate automobile dependency, increase congestion, and lead to economic inefficiencies. According to Shoup, an estimated 99% of parking in the United States is free (2005), although the true costs of parking (i.e. construction, maintenance, etc.) are passed along to consumers and taxpayers via increased taxes and higher prices for goods and services. Moreover, by driving up the perceived demand for parking, free parking and the surface lots that usually supply it have encouraged a pattern of low-density development. This low-density pattern is difficult to serve effectively or efficiently with transit. With each building surrounded by large parking lots, there is little incentive to walk or bike between or to buildings. With no good alternative, the demand for driving and parking is reinforced and the pattern of low-density development with ample free parking continues.

> *"In principle the charge [for on-street parking] should represent the short-run marginal social cost of occupying the space, consisting of the probable inconvenience imposed on others in terms of having to spend more time searching for a space or having to park further from one's destination, or to give up entirely on the use of a car for the trip"*
> *- (Vickrey, 1992 cited in Roth, 2004).*

Additionally, studies from abroad and in the US have concluded that the price of parking and the walking distance to destinations are the two most important factors in the decision to park or not (Shoup 2005). While decreasing single-occupant drivers in the CBD, a slightly increased parking price is not likely to reduce overall travel in the CBD (Ibid). Some people will simply change their mode or car pool.

Parking management strategies can use financial instruments to modify the price of parking to reflect its true market value, either by directly regulating prices or by imposing taxes and fees. Using such market mechanisms has been demonstrated to be quite effective in managing parking demand; in one study, it was found that a 1% increase in parking fees resulted in a 0.3% decrease in demand for parking (Kuzmyak et al. 2003). Also, allowing a reduction in required parking for developers who "unbundle" parking can reduce demand. Unbundling parking means that developers or landlords can sell or rent parking spaces apart from the units in a building, giving discounts to tenants who use fewer spaces.

From the developer's point of view, there are three primary reasons to charge for parking:

1. To recover some of the costs for developing and maintaining the parking
2. To manage the use of parking by different users (such as customers vs. employees, long-term vs. short-term parking)
3. To manage travel demand

The second reason – to manage parking use – is often the primary reason developers charge for parking. To make paid parking economical to the developer, however, the prices need to be high enough to cover the costs associated with collecting the parking fees (Smith 2005).

Variable rates

Like other parking management strategies, applying variable rates to parking can be used to influence traveler mode choice, time and amount of travel, and to shift drivers from a congested location. Since only 5% of US commuters pay for parking (Shoup 2005), applying a nominal fee to parking is sure to have a significant effect. Careful consideration should be given to each location as negative effects are possible. A parking price that is set too high may shift drivers to other locations, rather than to alternative modes. The goal is typically to reduce single-occupant car travel, but not to reduce the number of people who travel to a location. Balancing the characteristics of the site, with parking programs, incentives, and pricing is crucial to achieving that goal.

Some see the abundance of free or relatively cheap parking as a de facto subsidy to automobile drivers, encouraging greater automobile ownership and vehicle miles traveled via private automobiles. Variable pricing seeks to apply a free market-inspired pricing system to more efficiently allocate parking supply, with higher prices charged at times and locations of peak demand. Variable pricing has the promise of both effective congestion mitigation and the ability to raise considerable sums for the public sector.

In variable pricing scenarios, it is estimated that variable pricing could raise large revenues for northeastern Illinois. If there are over 3.2 million off-street spaces, and numerous on-street spaces, we can make the conservative estimate that 2 million of the spaces are free. Charging a nominal fee of $1 / day for weekdays only would provide $520 million annual revenues for the region. As mentioned previously, Shoup estimates that 99 percent of parking in the nation is free. If this statistic holds true for northeastern Illinois, the number of free spaces is probably closer to 3 million, which would bring our estimate of $520 million up to $780 million. These estimates are for illustrative purposes only; pricing should be determined on a local level, with consideration of transit facilities, biking and walking amenities, land value, and demand.

Favor short-term parking

Pricing fees should be designed to encourage short-term parking and high turnover of spaces within the central business district. Shoup compares under-priced on-street parking to rent-controlled apartments: "they are hard to find, and once you find a space you'd be crazy to give it up" (2007). Since these spaces are so hard to find (and desirable), people end up spending excessive time "cruising" for a spot. This leads to congestion and pollution, as well as increasing time spent getting to a destination. It is estimated that almost 1/3 of traffic in downtown New York consists of people "cruising" for a parking space (Ibid).

If parking is priced to encourage short-term parking, some travelers would reduce the amount of time spent at a location and many long-term parkers and commuters would go directly to a garage. With a goal of 15% vacancy, cities could minimize the amount of time spent searching for a space (i.e. traffic congestion) and encourage high turnover of spaces.

Elimination of Employer Parking Subsidy

The vast majority (87%) of commuters in the US drives to work and most of those commuters drive alone (American Community Survey 2005-2007). Researcher Donald Shoup estimates that 95 percent of all automobile commuters – driving alone or carpooling – park free at work. This parking is not actually free and in 2002 the estimated total annual subsidy for commuter parking paid by employers and/or developers was $36 billion (Shoup 2003). In our own region, a 1998 study commissioned by the RTA found that "free" parking at suburban office buildings actually costs $65-70 a month. In all of the cases studied, parking was free and generally was not even mentioned in the leases (Regional Transportation Authority 1998). Under current US federal tax law, it is possible for employers to subsidize employee parking as a deductible business expense; creating a controversial incentive to drive (Vaca and Kuzmyak, 2005). If we assume that 95% of the 3.2 million off-street commercial and industrial spaces in our region are free, and that these spaces are costing us about $65 a month, this amounts to a regional annual cost of $2.37 billion, subsidized by employers and most likely absorbed by consumers in the higher cost for goods and services.

Employers can help encourage their workforce to use other modes of transportation by converting the parking subsidy into cash payments for those employees who do not drive. There is an incentive not to drive – cash – but no actual charge for parking for those who do drive. They forgo the extra money but are not otherwise penalized. California law requires many employers to offer this option and in studies of before and after, parking cash out reduced driving to work by 11 percent (Shoup 2005). Federal tax law allows for parking cash out (the cash is taxable, the parking space remains tax exempt), so employers nationwide can take advantage of it (USEPA 2005).

Parking cash out can also save employers/developers money, particularly in the case of employers who lease their parking. With fewer employees driving, there is less need for parking spaces. In an analysis of eight parking cash-out programs in California, the programs helped to reduce commuter parking demand, solo driving, and vehicle miles traveled by 11, 17 and 12 percent, respectively (Shoup, 1997). Often the cost of providing a cash-out option is minimized by the reduced need for expensive parking. In addition to eliminating the parking subsidy for drivers, employers can also reduce the parking rate for carpooling employees.

Public Parking Financial Strategies

Constructing parking can be an expensive endeavor. Structured parking in particular involves significant up-front expenditures. Moreover, parking fees, where charged, may cover operating costs and a portion of the capital costs but structured parking rarely pays for itself in full. Public agencies who construct parking often need to find sources of financing and revenue beyond their general fund. Private entities looking to construct parking may partner with public agencies to take advantage of financing mechanisms and lower interest rates available only to public entities (Baron and Dorsett 2004).

Bonding and Debt

Taking on some form of debt is a common way for public (and private) entities to get the funds to build a parking facility. Bonds often offer the lowest interest rates of any public financing method. Bonds issued by public or non-profit organizations to construct public facilities are usually tax-exempt, which helps lower their interest rate. Two major considerations for bonds are who issues them and how they will be paid back. Among public entities, municipalities and other units of local government (i.e. schools, park districts, and other authorities) have the power to issue bonds.

The best rates are for general obligation bonds, which are issued by municipalities and paid back through their general fund. Parking facilities are one of many reasons to issue bonds; other purposes may take priority when issuing bonds. Revenue bonds are backed by a specific pool of money: the revenue from the project. To use these bonds, however, one needs to show that there is a stable demand for parking that can generate sufficient revenue to pay back the bond. Depending on the project and the local parking system, there may be other sources of parking revenues to cover the debt service. Other sources might include parking meters or parking fine revenue from on-street spaces or other lots; rent from ground-floor retail around the facility (if built); and air right or ground leases (Bier et al 2006).

Tax Increment Financing, Parking Benefit Districts, Business Improvement Districts

Local communities can also turn to the surrounding properties that stand to benefit from the parking in order to finance it. Tax Increment Financing (TIF) captures the increased property value generated by development in an area to create a pool of money that can be used for area improvements. When a TIF district is established, the current property taxes are defined as the "base" amount. In the succeeding years, for a set period of time, any additional property tax (over and above the base amount) generated within the district is set aside in a special fund. That money can then be used to fund further improvements within the district, including public parking facilities. TIF money can be used as it is generated or the municipality can issue bonds backed by the future revenues from the increment collected in the district. Depending on where a parking facility is being built, this may be a desirable financing mechanism.

A Parking Benefit District is a program through which a city or town agrees to return all or some parking revenue (generated through parking meters, assessments, and/or taxes) to area for improvements and/or beautification projects in the district. Returning parking money directly to the community often improves the general public's acceptance of the idea. "Key stakeholders such as businesses, developers, land owners, residents and government representatives need to work together to develop goals, objectives and a plan to create a parking district" (MTC, 2007). These stakeholders will also decide where and how funds should be spent. One example of a successful PBD is in Old Pasadena, where on-street pricing was raised to keep vacancy rates around 15% and

all parking revenue was used to purchase street furniture, trees, light fixtures, and to do street cleaning and maintenance. In Boulder, the PBD uses revenues to provide free universal transit passes, bicycle parking, other services that encourage the use of alternative travel modes.

Business Improvement Districts (BIDs), called Special Service Areas (SSAs) in some areas, levy a special assessment on commercial properties within a defined area. The additional money is used to fund improvements in the district – including a parking facility if the area businesses choose to construct one. Assessments are often on a uniform per unit basis (square footage, receipts, assessed value). With regard to parking funded by a BID, there is "typically no exemption or tax credit…provided to property owners who provide all or a portion of their required parking" (Baron and Dorsett 2004).

Another, less common method of developing parking is through a parking tax district. These districts are similar to BIDs and PBDs but they only address parking issues, not neighborhood improvement more generally. In situations where the municipality provides most or all of the area parking, the special assessment is levied on all commercial (and sometimes multifamily residential) properties on a standard per unit basis. Exemptions may be permitted for those businesses that provide most or all of their required parking already. Parking tax districts do not currently exist in Illinois, but they are found in several states, notably California (Baron and Dorsett 2004).

Public Enterprises: Authorities, Utilities

Municipalities can choose to create a separate public enterprise responsible for the provision and operation of parking in a community. Known as parking authorities or utilities, these can be found in many large cities around the country, such as Pittsburgh and Miami, and are quite common in some states. There are no such public entities in Illinois and their creation would require additional enabling legislation at the state level. Authorities or utilities are self-supporting entities with responsibilities for all aspects of public parking in a community, including on- and off-street parking in many cases. They can issue their own debt and have their own budget and governing board. Authorities are usually independent and autonomous from the municipal government and their governing board is usually appointed. Their independence can help insulate them from political influences around parking decisions, but they are also not very accountable to the public. Utilities are more under the control of local officials and so less independent but more accountable (Bier et al 2006). In both cases, the staffs of these entities will likely duplicate some elements of local government for management and administration. The interest rates on the bonds they issue are also higher than general obligation bonds the municipality issues.

A similar approach, used primarily by municipalities and universities, is to create a parking enterprise fund. This fund is self-sustaining and is separate from the general fund, but its administration is still within the local government (or university). The fund does not have the capacity to issue bonds on its own, but can raise revenue in a number of ways. These revenue streams are also available to public enterprises and include:

- Monthly leases or permit sales
- Parking meter revenues
- Parking violation revenues
- Short term (non-contract, non-monthly) parking fee revenues

The key to the fund's success is that while no one facility may cover all of its costs, multiple facilities together can. This is because the lifespan of a parking structure can range from 40-50 years or more, but development costs are

typically capitalized over a 20-30 year period. This means that most parking structures have useful lives after their debt is retired, thus freeing up parking revenue to help pay for newer facilities (Baron and Dorsett 2004).

Payment in Lieu of Parking

As discussed above, most municipalities require that a minimum amount of parking be provided as part of all new developments. As an alternative, some municipalities allow developers to pay a fee in lieu of constructing some or all of that parking. The fees collected are used to construct a public parking facility that serves that particular development, as well as surrounding uses.

Most cities set a uniform fee per space, with the number of spaces per development still dictated by the parking code. The fee itself is often less than the full cost per space for the public sector to provide the parking. Unless updated regularly, the fee may be considerably lower than the actual cost if the system has been around for awhile. Vancouver, British Columbia takes an interesting approach by setting the fee per space equal to the cost to construct that space in a public garage minus the expected revenue the city will get from that space (Shoup, 2005).

In most cases, the developer can choose whether or not (and for how many spaces) to pay the in-lieu fee. Some cities may offer payment in lieu of parking only in certain districts, such as in Lake Forest or Riverside where the option is available in downtown commercial / business districts. Other cities in northeastern Illinois that offer payment in lieu of parking are Libertyville and Highland Park. Both of the cities charge $15,000 per space in the downtown areas. Lake Forest has estimated the cost of providing a space at $18,000, but charges only $9,000 per space.

Beyond the financial aspects of payment in lieu of parking, there are a number of benefits to such programs. Donald Shoup (2005) identifies a number of advantages to payment in lieu of parking, including:

- Greater flexibility for developers , which can be a boon for historic preservation given the challenge parking can pose for adaptive reuse;
- More shared parking, thus potentially reducing the total number of spaces needed in the area;
- Fewer surface lots, because lots have been consolidated into one surface lot or possibly a structure; and
- Fewer zoning variances that need to be issued, which expedites the development process and levels the playing field for all developers.

Additionally, fewer surface parking lots lead to better access management and improved traffic operations.

Public-Private Partnerships

The financing mechanisms described above mostly involve the public sector taking on debt to provide public parking facilities. Public-private partnerships (PPP) are a way to reduce the public sector's direct debt burden while also providing needed infrastructure. A key element in this is the ability to enter into design-build contracts, but this is not currently an option in Illinois. Long-term leases, another form of PPP, are the current extent of PPPs in Illinois. See this strategy paper for more details on public-private partnerships.

One example of a public-private partnership, while controversial, shows how partnerships can be used in parking strategies. For an upfront payment of $1.2 billion, Chicago leased the city's meters to Chicago Parking Meters

LLC for 75 years. In return for operating and maintaining the system, the company receives all revenue from the meters. The city maintains control of meter rate increases, though they are supposed to be brought closer to market levels over the next five years (Chicago Receives $1.157 Billion Winning Bid for Metered Parking System, December 2008). *In the analysis of parking management strategies, this serves as one example; CMAP has not analyzed the pros and cons of this arrangement.*

Another form of PPP that has been applied to parking in a couple cases nationwide is the use of Design-Build-Operate-Manage (DBOM) to construct new facilities. An example from Connecticut can help to illustrate this innovative method. In 2000, the state issued bonds to cover the costs of constructing a new parking facility at the Bradley Airport in Hartford, Conn. Due to the structure of the agreement, the bonds are actually guaranteed by a private entity. The state's arrangement used the same entity to design and build the facility and then after construction, to operate and manage through a lease from the state. The lease payments cover the state's debt service and the facility revenues cover the lease payments. Excess revenues are split between the state and the private operator. Should the lease payments and revenue sharing prove insufficient to cover the debt service, the private operator is responsible for making up the difference (Bier et al 2006).

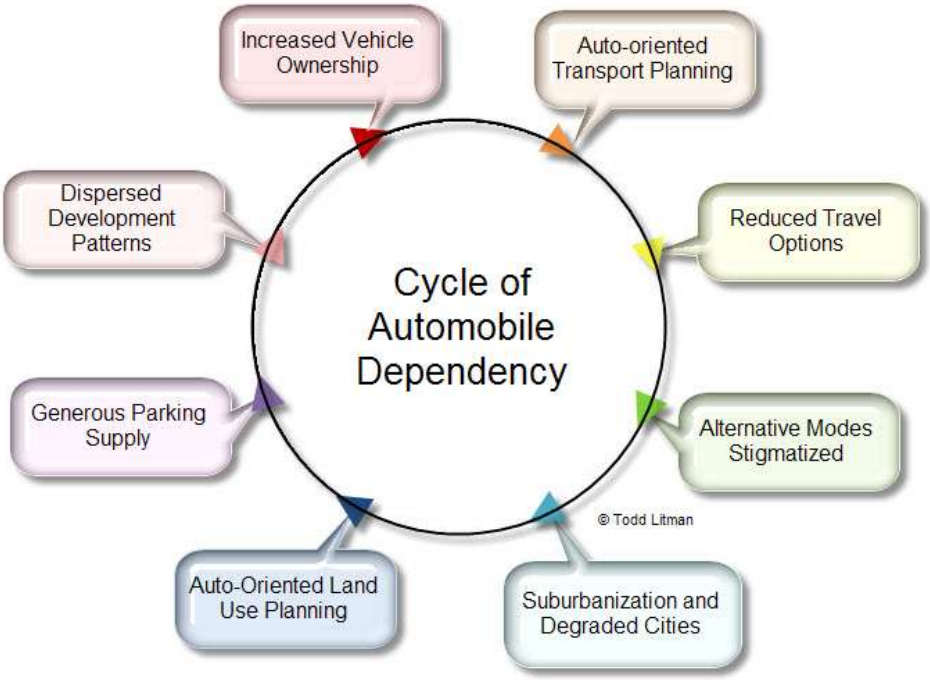
A similar strategy used to pay for parking facilities is called build-operate-transfer (BOT). A private entity may cover the costs associated with building public infrastructure, operate it until the costs are recovered, and then transfer ownership to a public agency. Early parking meters were often installed in this fashion with manufacturers of meters installing them and recovering costs until they were paid for (Shoup 2005).

Impacts / Effects of Parking Management

Providing a generous parking supply is costly, ranging from about $250 to $2,250 per space (direct, annualized cost calculated by Litman 2006). These costs, however, do not include the indirect costs that municipalities face, such as: "increased sprawl, impervious surface and associated stormwater management costs, reduced design flexibility, reduced efficiency of alternative modes (walking, ridesharing and public transit use), and increased traffic problems" (Ibid). In this section, we will examine how parking management can affect these different areas.

Our development patterns have created a landscape that is often dominated by the car. Since a car spends 95% of its life parked (Shoup 2005), much of the landscape has been turned into parking lots. In many cases, residents of auto-oriented communities would like to have more transportation options, but the low-density associated with a generous parking supply makes this unfeasible. Also, residents who are opposed to new developments with increased density often cite fears of increased traffic and parking difficulties. Unfortunately, the reality is that low-density development patterns preclude transit options and force more people to drive.

Todd Litman's "Cycle of Automobile Dependency" shows how auto-centric land use planning and excessive parking supply have created this situation. Parking management strategies can be used to break this cycle, by changing development patterns and improving travel options (2006).



The impacts of parking management strategies will vary depending on a number of factors, and they will be higher when travelers have alternative transportation options. But even in the absence of transit, it is still possible to use parking strategies to affect land use, congestion, and environmental degradation.

Traffic

If the provision of parking spaces were left entirely up to the market, we would live in a very different society today. The market would only supply parking where it is profitable, and there would be fewer spaces and people would probably live closer together, walk more, and drive less. A large under-priced supply of parking does not necessarily create traffic, but it does reduce the cost of travel by automobile. Parking management strategies, particularly pricing, will have the effect of forcing users to "economize" when it comes to parking. Many drivers will shift to different modes, different times of day, or combine trips. These actions will help to reduce traffic congestion, roadway costs, pollution, and more. At the low end, Shoup estimates congestion costs to be about $73 per month per parking space (2005), which would equal almost $3 billion in annual costs for the Chicago region.

Todd Littman has found that offering cash-out programs (such as $50 / month for not using a parking spot) typically reduces automobile commuting by 20% (2006). In another study, Litman found that shifting from free parking to cost-recovery parking (prices that reflect the full cost of providing parking facilities) typically reduces automobile commuting by 10-30% (2008). Wilson and Shoup found that, when employees are charged to park, 20% fewer drive solo (1990). At suburban locations with limited transit, it is still possible to reduce the number of single-occupant drivers by incentivizing carpooling, although the impacts will be less. Factors that affect the success of parking cash-out programs include: proportion of employees that are candidates for cash-out, availability of transit, and the presence of uncontrolled parking supplies (Vaca and Kuzmyak, 2005). Downtown San Francisco has developed a "Transit First" policy to encourage transit ridership that has no requirements for parking provision, but instead has implemented maximum parking ratios. In ten years, there has been no major increase in peak traffic despite "considerable office growth" (Kuzmyak, et al, 2003). Other studies have found a decrease in parking demand ranging from about 15% in areas with low transit to 38% in areas with some transit (Transportation Authority of Marin).

A combination of parking management strategies, tailored to specific neighborhoods could price on-street spaces so that they maintain 85% occupancy. Drivers who are willing to pay the cost of on-street parking will no longer find themselves "cruising" for a spot. This will significantly reduce traffic in CBDs. Programs that encourage alternative modes, while charging for parking, will also have the effect of reducing single-occupant drivers.

Economic Development

There are very few land uses that generate less revenue than surface parking lots; in fact, they are more likely to reduce the economic success of a downtown than to improve it (Robertson, 2001). From a regional perspective, limiting the parking supply would be a boon to the economy. Local municipalities, however, see the situation differently, because of the importance of retail tax revenue. If one municipality offers free parking at a shopping destination and the next one does not, customers will probably pick the former. But as municipalities compete, it becomes a zero-sum game at the regional level because increasing the parking supply everywhere does not increase the total regional sales volume, although there may be marginal changes near the region's boundaries.

An integrated parking management strategy, optimally organized by local PMAs, can be used to increase the attractiveness of a retail center by reinvesting the parking revenue into street improvements. The city of Pasadena used parking management to revitalize their downtown. With agreement from local merchants, they added parking meters and used the revenue to purchase new "street furniture and trees, more police patrols, better lighting, more street and sidewalk cleaning, pedestrian improvements, and marketing (including maps to show local attractions and parking facilities)" (Litman 2009). Local merchants actually saw an increase in business as the location became a more attractive place for customers to shop and spend time in "Old Pasadena." A city might have more than one PMA (separated by neighborhoods) but it is unlikely that a PMA would cover more than one town.

Environmental

The two biggest environmental impacts of parking are a result of vehicle miles traveled and increased impervious surfaces. As established in this paper, an over-supply of under-priced parking encourages driving and congests our roadways. Shoup estimates the cost of emissions alone to be about $44 per month per parking space (2005). Compact development with a mix of uses can reduce driving and the need for parking; design can be used to minimize the impacts of parking on impervious surfaces. Boston Metropolitan Area Planning Council recommends the following design improvements to reduce environmental impacts of parking (2007):

- Reduce the dimensions of parking stalls and encourage inclusion of compact car spaces
- Use pervious surfaces for low-volume parking areas to allow infiltration of stormwater
- Require landscaping to provide shade and improve air quality
- Use bio-retention basins or rain gardens to treat and infiltrate stormwater
- Build parking garages with green roofs to capture stormwater and mitigate heat island effects

Construction of parking often involves paving over land that once served as a filtration mechanism for rainwater. The paved area increases flood risks and degrades water quality, as oil and other pollutants are washed into the water system. Dark pavement absorbs heat from the sun and results in the "urban heat island" effect with increased air temperatures. Parking management strategies to encourage better utilization of existing facilities and pricing parking to match its cost will have the effect of reducing stormwater management costs, reducing the urban heat island effect, reducing land consumption as well as creating a possible cash infusion from parking

revenue. Many principles of conservation design can be used in the development of parking facilities. Conservation design is a design system that takes into account the natural landscape and ecology of a development site and facilitates development while maintaining the most valuable natural features and functions of the site. Conservation design includes a collection of site design principles and practices that can be combined to create environmentally sound development. The conservation design strategy paper has more information.

Costs

There are many costs associated with parking spaces. There are costs to developers to construct the spaces, costs to drivers who occupy them, 'opportunity costs' of the land used for parking, and external costs (which are covered in Traffic and Environmental sections). Most parking in the US is provided free, is highly subsidized, or automatically included with building purchases and rents. This forces consumers to pay for parking whether or not they use it, as businesses will often pass on the cost of parking lots to consumers in the prices of goods they sell (Litman 2006).

In his book, *The High Cost of Free Parking*, Donald Shoup calculates the direct and indirect cost of providing off-street parking spaces (2005), using 15 projects on UCLA's campus from the past 40 years. He estimates the average cost in 2002 dollars to be at least $22,500 per space, or about $127 a month per space for 40 years. He also cites other cities who quote monthly costs per space at $200, $138, and $160 for Seattle, Bellevue (WA), and Ann Arbor, respectively.

Prices per space vary significantly between the type of structure (surface lot, above-ground, or underground) and the efficiency with which it is built (See Appendix: Factors Affecting Cost of Parking Structure). The associate vice president for facilities management at Northwestern University estimates per-space parking construction costs to average $4,000 for surface parking lots, $20,000 for above-grade garages, and $30,000 to $40,000 for below-grade garages (Northwestern University Newsletter, 2006). An efficient structure with 300 square feet per space could cost $15,000 per space, while a less efficient structure with 400 square feet per space could cost about $20,000 per space (Shoup 2005). Superior quality and design will add to those costs.

Calculating on-street costs of parking is slightly more complex, as it is generally wrapped into the cost of road construction. Consider the example of a 36-foot wide residential street with two 10-foot wide travel lanes and two 8-foot wide parking lanes: curb parking takes up 44% of the road space (Shoup 2005). Since a car usually parks for free, and roads are a significant portion of public infrastructure costs, on-street parking is a major subsidy provided to drivers.

Using Mark Delucchi's research at estimating the high and low values of annual capital and operating costs of off-street parking, Shoup estimates the total subsidy in 2002 for off-street parking in the U.S. to be between $127 billion and $374 billion (2005). Shoup also calculates the following:

- Free parking is worth 22 cents per mile driven to work
- Free parking is worth more than $4 per gallon of gasoline
- Free parking reduces the cost of automobile commuting by 71 percent
- Total US parking supply is worth more than twice the value of the total vehicle stock

Reducing the requirements for parking spaces will equal a significant reduction in public expenditures; charging for the cost of parking would help many municipalities balance budgets. Reduced parking requirements will also encourage infill development since developers will typically encounter reduced development costs. Employers

will have a reduced burden of subsidizing parking. Also, some revenue from parking management strategies can be put toward the cost of providing parking facilities or transportation improvements (Litman 2006).

Design Considerations / Best Practices

Rather than focus our efforts on increasing the supply of parking, we need to better manage the supply that we have. Increasing the amount of parking that is shared, improving user information, and using pricing to curb demand are all strategies that can be implemented to improve the management of parking.

Good design features can help reduce negative impacts on a community and on the environment. The examples below show parking garages that maintain a pedestrian-friendly environment, with ground-level shopping and landscaping. Incorporating these elements around transit stations, and sharing the parking between uses has significant potential for creating a lively streetscape.

From EPA Smart Growth

From Flickr user La Citta Vita

Additionally, permeable paving, natural landscaping, and innovative stormwater management strategies can be used to reduce the environmental impact of parking and parking structures.

Each community around the region will need to evaluate specific goals for parking and design their strategy to promote their goals. The Transportation Authority of Marin has outlined parking design strategies tailored to various place types:

Place Type	Parking Design Strategies
Downtown Center	Parking is primarily structured or underground. Large surface parking lots should be considered opportunities for infill development.
Medium / High Density Neighborhood	Parking is primarily structured or underground. Large surface parking lots should be considered opportunities for infill development.
Mixed-use Corridor	Mix of structured parking and limited surface parking. Surface parking lots are located behind buildings. Conversion of larger surface lots to structures with infill development should be considered.
Town Center	Mix of structured parking and limited surface parking. Surface parking lots are located behind buildings. Conversion of larger surface lots to structures with infill development should be considered.
Medium- Density Neighborhood	Structured parking is rare; surface parking is screened by buildings and landscaping.
Local-serving commercial corridor	Structured parking is rare; surface parking is screened by buildings and landscaping; and use of on-street parking should be maximized.
Low / Med Density neighborhood	Parking needs are accommodated by on-site garages and on-street parking.
Suburban Corridor	Structured parking does not occur; surface parking lots are screened by buildings and landscaping.
Rural Center / "Crossroads"	Structured parking does not occur; surface parking lots are screened by buildings and landscaping; and use of on-street parking should be maximized.
Low / Rural Density Neighborhood	Parking needs are accommodated by on-site garages, work yards, and on-street parking.
Rural Corridor	Little demand for parking for uses typically provided by small surface parking areas, with short-term and emergency parking on road shoulders.

User Information

Parking operations are often criticized and rarely praised; this can be blamed on inadequate user information and a lack of understanding by the general public as to how parking systems work (Burns and Anderson, 2004). The former issue can be mitigated by providing maps, signs, brochures, websites, real-time information, etc. For the latter, some communities have had success with the publication of an Annual Parking Report. A report documenting parking inventory, utilization (or demand), anticipated changes in demand or supply, enforcement issues, and a financial overview of the costs of parking, can be very informative and help to alleviate or prevent problems.

Improved user information at the parking location is also helpful to improving ease of use and user satisfaction. New York City's mayor Bloomberg has expressed a desire for "smart meters" that will work with wireless PDAs to help drivers locate vacant spots, pay the meter, and to receive messages when the meter is about to expire (2009). Effective signage can improve parking management by making it easier for drivers to navigate both off-street and on-street parking facilities. Effective signage for off-street facilities can include:

- Directional signs at entrances from public streets
- Signs at exit to get back the street network
- Internal signs to direct parkers to parking for various land uses
- Internal signs to direct parkers to available spaces
- Way-finding within the facility so parkers can get back to their car

Instructional signs can also illustrate how to use innovative, safer on-street parking, such as back-in angled parking. Other signage can regulate which users can occupy on-street parking (i.e. residential permits). And automated parking guidance systems (APGS) and automated parking availability displays (APAD) can inform users of the number of available spaces in a facility, by level.

Enforcement

There is a direct correlation between the likelihood that a driver will pay for parking and the likelihood that the parking rules will be enforced. For a quick errand, almost everyone has had the internal debate: "Will I get a ticket in the next couple of minutes?"

The job of a parking enforcement agent is difficult; no one likes the person giving out tickets. Unfortunately, the enforcement of parking regulations is an essential element of a system that is designed to discourage illegal parking.

When instituting new parking policies, many cities will post warnings of upcoming changes and some will waive the first ticket so that citizens have a chance to adapt to the new system. An Annual Parking Report can include this information as well. Additionally, if the revenues from meters and tickets are returned to a Parking Management Authority or Parking Benefit District and the public can see the projects resulting from their money, animosity between enforcement agents and drivers may be reduced.

Informing drivers in Old Pasadena (photo by Flickr user mlinksva)

Conclusion / CMAP's role

There is no one solution to the parking problems across the region, but local parking management strategies can help. Parking should be considered an important land use—one that affects development patterns as well as travel behavior. Even the perception of available parking can influence mode choice and economic competitiveness of an area (Weant and Levinson, 1990). Communities should plan parking with consideration as to its external and indirect effects on nearby uses and travel behavior. Where possible, it should be planned to encourage transit use and support commercial activity; opportunities for shared parking should be pursued.

To reduce or eliminate parking requirements, a community should "examine economic issues, site and neighborhood characteristics, location features, and market issues" (MTC 2007). Considering key stakeholders is also important. Municipalities can change parking requirement to suit the local development goals. If a walkable, vibrant street is desired, the municipality can consider eliminating parking requirements and requiring

developers to "unbundle" any parking that is provided, so that those who use fewer spaces pay less. The effect of removing parking requirements will not create immediate changes, but it will be increased if developers are agreeable to selling parking "unbundled"—not included in rental agreements. Over time, the price of parking will rise toward the cost of providing it, developers will supply less, and cities will naturally become more compact. Imposing parking maximums would restrict developers, but it is a strategy that has been used successfully in cities like San Francisco and Portland.

The use of pricing, when paired with other parking management strategies, can be very successful at alleviating traffic congestion and freeing up parking spaces for short term use. Incorporating a transportation demand management program involves the use of strategies that increase transportation efficiency by changing travel behavior—which affects and is affected by parking. If a municipality wants to reduce congestion on high-activity streets where there is a perception of limited parking, they should consider increasing meter fees to maintain a vacancy of 15% to reduce "cruising." Leveling the significant price difference between on-street meter rates and off-street rates will have similar effects.

Managing the supply of parking in a community is no small task, and it will not help win popularity contests. Establishing Parking Benefit Districts can increase residents' acceptance of rate increases and policy changes – especially if they are involved in the decision-making process. Keeping residents involved and informed is a challenge, but makes the process much smoother. Making the process of paying for parking as simple as possible is important. "Smart parking technology" should be explored to provide users with real-time information to help drivers locate spaces efficiently. If residents are going to pay more for parking than they are accustomed to, it should be obvious that their money is being well-utilized.

Parking should not be considered a necessary element of other uses; it should be evaluated as a land use that will alter travel behavior and can have environmental impacts. Managing the supply and price of parking is an effective tool for communities to assist in the pursuit of development goals—whatever they may be. CMAP's role in improving parking policy in the region could include long-range planning studies, visioning, project studies, technical assistance, workshops, and the provision of data. Long-range planning studies (and reports such as this) can help spur discussion and educate the public on the inter-related issues that affect, and are affected by, parking. Where requested, CMAP can provide data and technical assistance to communities that are considering changes to their parking policy. In the appendix and bibliography, we have listed resources that can be used for developing and implementing parking management strategies. CMAP welcomes any comments or questions on this paper; please contact Lindsay Banks (lbanks@cmap.illinois.gov).

Appendix

This appendix provides information that can be useful to municipalities that are interested in evaluating parking strategies and creating new policies.

Parking Pricing Techniques

Todd Litman's Parking Pricing techniques offer a succinct version of many strategies presented in this paper (2008):

- Wherever possible, charge motorists directly for using parking facilities. If parking must be subsidized, offer comparable benefits for use of other travel modes, such as Cash Out payments.

- Manage and price the most convenient parking spaces to favor priority users. Charge higher rates and use shorter pricing periods at more convenient parking spaces (such as on-street spaces, and parking near building entrances) to increase turnover and favor higher-priority uses. Prime spaces suitable for short-term use should generally be at least twice as expensive per unit of time as less-convenient spaces suitable for longer-term uses. For example, in a central business district charge 25¢ for each 15-minute period with a two-hour limit, while at the fringe charge $4 per day. The ratio between short- and long-term spaces may need occasional adjustment to optimize use.

- Use variable rates that are higher for peak locations and times. Apply performance-based parking prices, which means that prices are set so that about 15% of parking spaces are unoccupied during peak periods (Shoup, 2006). For example, charge $1 per hour for parking downtown during weekdays, $0.75 per hour for parking downtown during evenings and weekends, and $0.50 per hour for parking in other locations.

- Improve Pricing Methods to make Parking Pricing more cost effective, convenient and fair. For example, use electronic pricing systems that accommodate various payment methods and rates, and allow motorists to pay for just the amount of time they will be parked. For short-term parking change by the minute rather than by the hour, and for long-term parking charge by the hour rather than by the day or month.

- Avoid discounts for long-term parking leases (i.e., cheap monthly rates).

- Use a progressive price structure in more convenient spaces to favor short-term users. For example, charge $1.00 for the first hour, $1.50 for the second hour, and $2 for each subsequent hour.

- To increase revenues, expand when and where parking is priced rather than raising rates at existing priced facilities. This is more efficient and equitable, reduces spillover problems, and usually raises more total revenue.

- Set parking prices to equal or exceed transit fares. For example, set daily rates at least equal to two single transit fares, and monthly rates at least equal to a monthly transit pass.

- Minimize discounts for long-term parking passes. For example, set daily rates at least 6 times the hourly rates, and monthly rates at least 20 times daily rates. Even better, eliminate unlimited-use passes altogether. Instead, sell books of daily tickets, so commuters save money every day they avoid driving.

- Eliminate early-bird discounts.

- Unbundle parking, so people who rent or purchase building space can choose how much parking is included.

- Avoid excessive parking supply. Use Parking Management to encourage more efficient use of existing parking facilities and address any spillover problems that result from pricing.

- Encourage businesses to price, cash out and unbundle parking by providing rewards to those that do, legislating it, or by imposing special property taxes on un-priced parking.

- Unbundle parking from housing, so apartment and condominium residents pay only for the parking spaces they need (Location Efficient Development).

- If parking must be subsidized, use targeted discounts and exemptions, rather than offering free parking to everybody. For example, to subsidize customer parking, allow businesses to validate parking tickets or provide free parking coupons to customers. To subsidize parking for people with low incomes or disabilities, provide discounts directly to those individuals.

- Tax parking spaces, and encourage or require that this cost be passed on to users. Reform existing tax policies that favor free parking. For example, tax land devoted to parking at the same rate as land used for other development.

- Charge a tax on curbcuts comparable to potential revenue foregone had the same curb area been devoted to priced on-street parking. This would encourage property owners to minimize the number and width of curb cuts, through access management and consolidation of driveways and parking facilities, which helps improve traffic flow and create more pedestrian friendly streetscapes.

- Price on-street parking in residential neighborhoods. Create Parking Benefit Districts, with revenues used to benefit local communities (Shoup, 1995).

- Allow motorists to lease on-street parking spaces (Solomon, 1995). For example, let residents and businesses lease the parking spaces in front of their homes or shops, which they could use themselves, reserve for their visitors and customers, or rent to other motorists.

- Use TDM Marketing and other information resources to provide information on parking prices and availability, and on alternative travel options.

- Develop and utilize Transportation Management Associations to provide parking management, user information and brokerage services in a particular area.

- Use parking pricing revenues to Fund Transportation Programs.

- Provide free or discounted parking to Rideshare vehicles

Parking Management Benefits

In *Parking Management: Comprehensive Implementation Guide*, Todd Litman lists the following benefits of Parking Management:

- **Facility cost savings.** Reduces costs to governments, businesses, developers and consumers
- **Improved quality of service.** Many strategies improve user quality of service by providing better information, increasing consumer options, reducing congestion and creating more attractive facilities
- **More flexible facility location and design.** Parking management gives architects, designers and planners more ways to address parking requirements
- **Revenue generation.** Some management strategies generate revenues that can fund parking facilities, transportation improvements, or other important projects
- **Reduces land consumption.** Parking management can reduce land requirements to help to preserve greenspace and other valuable ecological, historic and cultural resources

- **Supports mobility management.** Parking management is an important component of efforts to encourage more efficient transportation patterns, which helps reduce problems such as traffic congestion, roadway costs, pollution emissions, energy consumption and traffic accidents
- **Supports Smart Growth.** Parking management helps create more accessible and efficient land use patterns, and support other land use planning objectives
- **Improved walkability.** By allowing more clustered development and buildings located closer to sidewalks and streets, parking management helps create more walkable communities
- **Supports transit.** Parking management supports transit-oriented development and transit use
- **Reduced stormwater management costs, water pollution and heat island effects.** Parking management can reduce total pavement area and incorporate design features such as landscaping and shading that reduce stormwater flow, water pollution and solar heat gain
- **Supports equity objectives.** Management strategies can reduce the need for parking subsidies, improve travel options for non-drivers, provide financial savings to lower-income households, and increase housing affordability
- **More livable communities.** Parking management can help create more attractive and efficient urban environments by reducing total paved areas, allowing more flexible building design, increasing walkability and improving parking facility design

Effectiveness of Parking Policies to Reduce Parking Demand

San Francisco's Metropolitan Transportation Commission prepared a document called Parking Policies to Support Smart Growth: http://www.mtc.ca.gov/planning/smart_growth/parking_policies_flyer-web.pdf. They evaluated various strategies and their effectiveness at reducing parking demand:

Policy/Program	Potential Effectiveness (percent reduction in demand)
Parking Pricing	HIGH — TYPICALLY 5-30% Depending on the amount of the parking fee and the surrounding/controls on parking
Shared Parking	MEDIUM/HIGH — TYPICALLY 10-20% Depending on the mix of land uses and parking demand in relatively close proximity
Reduced Parking Requirements	MEDIUM — TYPICALLY 10-15% Depending on how close the requirements are to demand rates
Unbundling and Cash-Out Options	MEDIUM — TYPICALLY 10-15% Depending on the price, demand and convenience of parking
Transit Passes and Incentives	MEDIUM/LOW — TYPICALLY 5-10% Depending on how close the requirements are to demand rates. Depends on transit access + relative convenience between transit and destinations + price/income levels
Car Sharing	LOW/MEDIUM — TYPICALLY 3-5%+ Depending on the auto-ownership levels, density and level of mixed use development and transit quality — may be much higher in the right locations in coordination with other policies

Todd Litman has compiled a similar analysis:

Parking Management Strategies

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

(Litman, 2006)

Factors Affecting Cost of Parking Structures

All information in this section is taken directly from International Parking Design (IPD) firm's website: http://www.ipd-global.com/whats_it_cost/

Above-Grade

How much do parking structures cost? This is one of the first questions clients ask. Before we can respond, we need to know the answers to the following questions:

- How many spaces do you need?
- How many levels?
- What size is the site?

The answers have a major impact on the cost-per-space figure for a particular parking structure. Cost per space is dependent on two factors: Area per Space and Cost per Square Foot.

Area per Space

The area per space is affected by several factors, including the type of user, size of the site, shape of site, city parking requirements, and the type of flow system.

Type of User: Retail customer parking requires more generous parking dimensions than office employee parking, hence a higher area per space.

Size of Site: A narrow site may dictate a shallow angle of parking that results in a higher area per space than steeper angles or ninety-degree parking. A shorter site may require a speed ramp rather than a parking ramp, resulting in higher area per space.

Shape of Site: Irregular shapes create wasted areas within the parking structure.
Muncipal Parking Requirements: Some cities require wider spaces and aisles than others, no matter who the user is, resulting in a higher area per space.

Type of Flow: A level-floor structure with connecting express ramps will result in a higher area per space than one with sloping parking ramps.

Cost per Square Foot

To calculate the cost per square foot, the following considerations must be weighed.

- Geographical Location: Costs vary considerably by geographic region.
- Number of Levels: Taller structures have a higher average cost per square foot because elevated levels are more costly than the ground level.
- Shape of Site: The length of exterior facade per square foot of area is greater on small sites than on larger sites and greater on long, narrow sites than on square sites, resulting in higher costs.
- Topography: Sloping sites usually result in expensive retaining walls.
- Soil Conditions: Poor soil conditions result in higher foundation costs.
- Exterior Architectural Treatment: High-level architectural treatments can increase costs significantly.

Underground Parking Structures

Estimating costs for underground parking structures is considerably more complicated than costs for above-grade structures. Factors that contribute to the complexity include:

- The extent of shoring, if any, which will be required;
- Whether or not the parking is located below another use, which may dictate whether the structural system will be short-span or long-span;
- Location of water table in relation to the lowest level; and
- Whether or not the "lid" or plaza level over the parking is to be included in the cost of parking.

Shoring

The amount of wall to be shored depends primarily on the site. In some cases, the exterior walls may be far enough from property lines that slope cutting can be used on all sides instead of shoring. In other cases, all walls may be adjacent to property lines and require shoring. Any number of possibilities exists between these extremes. The unit cost of shoring depends on soil conditions and depth of excavation.

Other Uses above Parking

If the underground parking is part of a freestanding parking structure with no other uses above, the same long-span structural system can be carried below grade and there is no penalty in parking layout efficiency.

If office, retail, residential, or hotel uses are above the below-grade parking, the structural system of the use above is carried down through the parking levels and parking layout efficiency may be severely impacted. For example, if the columns are spaced 32'-0" apart and code-required space width is 8'-6", only 3 spaces can be placed between columns, resulting in a 25% penalty, compared to a layout with a long-span structural system.

If parking is placed below a plaza or park with heavy landscape loads, a short-span structural system may be necessary, but in this case, the parking layout can dictate the location of columns rather than the building above, and the penalty in efficiency compared to that of a long-span structure is closer to 15%.

Other efficiency penalties that occur when another use is placed above parking include losses for elevators, mechanical rooms or electrical rooms that serve the use above and are located in the parking facility.

Water Table Location

If the water table is above the bottom of foundations, additional costs will be incurred for dewatering during construction. Cost of dewatering is a function of the depth below the water table, the area to be dewatered and the length of time dewatering will be required.

If the structure gets deep enough into water, the walls and grade slab must be designed for hydrostatic pressures, and, in some cases, additional structure weight must be provided to prevent "floating." These measures can add significantly to structure cost.

Allocation of Cost of Plaza Level

When another use is built above the parking structure, there is a grade-level or plaza-level structural cost that must be allocated either to the parking or to the building above. This is a cost that would not occur if the two uses were built side-by-side and the top parking level was open to the sky. The office, hotel or retail building would only have the cost of a grade slab included, which is much less than the plaza-level elevated slab supporting landscape loads or other elements.

The cost of the grade-level slab will also be higher than the cost of a typical parking level because it is normally supporting added dead loads such as paving or landscaping, plus higher live loads than parking requires. The costs of paving or landscaping would be in addition to the structural cost.
Calculation of Cost per Space

Normally, the cost per space can be approximated by multiplying area per space by the average cost per square foot. In the case of underground facilities, the cost of the grade-level deck, which provides no parking spaces, must also be taken into consideration. The cost per square foot of the lowest level is calculated by including the slab-on-grade, foundations, exterior walls, ventilation, fire sprinklers, excavation and shoring costs, in addition to the normal lighting, signing, painting, stairs, elevators, etc. that are appropriate for that level.

The cost of the typical parking level would be calculated in a similar manner, using the cost of the elevated beam-and-slab system in lieu of the slab-on-grade.

The cost of the grade-level, or plaza level, slab is calculated using only the structural cost of the beam-and-slab system and any improvements above it that are appropriate.

The area per space, as mentioned above, will depend on whether column spacing is dictated by another use above, or whether a long-span structural system can be employed. Area per space is also dependent on standards for space size and aisle width dictated by local planning codes.

Other Resources

Transportation Authority of Marin's Parking Guidance Guide: http://www.tam.ca.gov/index.aspx?page=271

Toronto's Design Guidelines for 'Greening' Surface Parking Lots:
http://www.toronto.ca/planning/urbdesign/greening_parking_lots.htm

MTC's Developing Parking Policies to Support Smart Growth in Local Jurisdictions: Best Practices:
http://www.mtc.ca.gov/planning/smart_growth/parking_seminar/BestPractices.pdf

Litman's Parking Management: Comprehensive Implementation Guide:
http://www.vtpi.org/park_man_comp.pdf

EPA's Parking Spaces / Community Places:
http://www.epa.gov/dced/parking.htm

References

Baron, Philip J. and John W. Dorsett. 2004. "Parking Facility Economics and Approaches to Financing," in Haahs, Timothy H., ed. *Parking Management – The Next Level,* Parking 101 Vol. 2. Fredericksburg, VA: International Parking Institute.

Bier, Leonard, Gerard Giosa, Robert S. Goldsmith, Richard Johnson, and Darius Sollohub. 2006. *Parking Matters: Designing, Operating and Financing Structured Parking in Smart Growth Communities*. Airmont, NJ: the Urban Land Institute-Northern New Jersey. Online: http://nnj.uli.org/sitecore/content/District%20Councils/Sites/ULI%20N%20New%20Jersey/~/media/DC/N%20New%20Jersey/NNJ%20Docs/Parking%20Matters.ashx

Bloomberg, Michael. 2009. "My big parking promises: Mayor Bloomberg serves up a plan for N.Y.C drivers" in NYDailyNews.com, 9/13/2009. http://www.nydailynews.com/opinions/2009/09/30/2009-09-30_my_big_parking_promises.html (Accessed: 10/16/09)

Boston Metropolitan Area Planning Council. *Sustainable Transportation Toolkit: Parking,* 2007. http://transtoolkit.mapc.org/Parking/Strategies/mitigating_environmental_impacts.htm (Accessed: 09/09/09)

Burns, Dennis L. and Melinda Anderson. 2004. "Developing an Annual Parking Report," in Haahs, Timothy H., ed. *Parking Management – The Next Level,* Parking 101 Vol. 2. Fredericksburg, VA: International Parking Institute.

Chicago Receives $1.157 Billion Winning Bid for Metered Parking System. December 2008. Press release, City of Chicago. Online: http://199.253.140.81/city/webportal/portalContentItemAction.do?BV_SessionID=@@@@0313372174.1249681232@@@@&BV_EngineID=ccceadehmjhdefkcefecelldffhdfhm.0&contentOID=537022335&contenTypeName=COC_EDITORIAL&topChannelName=HomePage&blockName=Content&context=All+Archived+News%2F2008%2FDecember

How to Handle Parking. 2007. *Transit-Friendly Development Newsletter* 3 (1). http://policy.rutgers.edu/vtc/tod/newsletter/vol3-num1/TODParking.html Accessed 3 August 2009.

Kane County Transit Opportunity Assessment Study. http://www.co.kane.il.us/dot/COM/Transit/01execsum.pdf (Accessed 10/1/09).

Kuzmyak, Richard J., Rachel Weinberger, Richard H. Pratt and Herbert Levinson. 2003. *Parking Management and Supply: TCRP Report 95, Chapter 18.* Washington, DC: Transportation Research Board. http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rpt_95c18.pdf

Litman, Todd. 2008. *Parking Pricing: Direct Charges for Using Parking Facilities*. TDM Encylcopedia, Victoria Transport Policy Institute. http://www.vtpi.org/tdm/tdm26.htm, Accessed: 09/09/09.

Litman, Todd. 2006. *Parking Management: Strategies, Evaluation and Planning.* Summary of *Parking Management Best Practices.* Chicago: APA Planners Press. Online: http://www.vtpi.org/park_man.pdf

Manville, Michael and Donald Shoup. 2005. Parking, People and Cities. *Journal of Urban Planning and Development* 131 (4): 233-245.

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

Naperville Finance Department. Telephone interview, 1 October 2009.

Nicholas, Arthur C. 2004. *Non-Central City Expressway Park-n-Ride Lot Preliminary Site Analysis for Northeastern Illinois*. Working Paper 04-01, Chicago Area Transportation Study. Available online: http://www.catsmpo.org/workingpapers/04-01.pdf

Northwestern University Newsletter. 2006. Accessed 09/10/09. http://www.northwestern.edu/newscenter/stories/2006/01/parking.html

Regional Transportation Authority (Chicago). 1998. *Opportunity Costs of Municipal Parking Requirements*, Prepared by Fish & Associates, K.T. Analytics, and Vlecides-Schroeder Associates, Final Report, April.

Roth, Gary. 2004. *An Investigation Into Rational Pricing For Curbside Parking: What Will Be The Effects Of Higher Curbside Parking Prices In Manhattan?* Masters Thesis, Columbia University; at http://anti-bob.com/parking/Rational_Pricing_for_Curbside_Parking-GRoth.pdf.

Shoup, Donald. 2005. *The High Cost of Free Parking.* Chicago: APA Planners Press.

Shoup, Donald. 2003. "The High Cost of Free Parking." Presentation to the International Symposium on Road Pricing. November. www.trb.org/Conferences/RoadPricing/Presentations/Shoup.ppt

Smith, Mary. 2005. *Shared Parking*, Second Edition. Washington, D.C.: ULI-the Urban Land Institute and the International Council of Shopping Centers.

Transportation Authority of Marin, TPLUS TOD/PeD Toolkit. Accessed 09/09/09. http://www.tam.ca.gov/index.aspx?page=293

Turnbull, Katherine F., et al. 2004. *Park-and-Ride/Pool: TCRP Report 95, Chapter 3.* Washington, DC: Transportation Research Board, 2004. http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rpt_95c3.pdf

USEPA - Office of Air and Radiation. 2005. *Parking Cash Out: Implementing Commuter Benefits as One of the Nation's Best Workplaces for Commuters*^{SM}. Washington, DC: US Environmental Protection Agency.

Village of Northbrook Memorandum. http://www.northbrook.il.us/Government/BoardsCommissions/Passouts/2007/0319MAR/documents/MEMORANDUMparking3.pdf 13 March 2006.

Weant, Robert A. and Herbert S. Levinson. 1990. *Parking.* Washington, DC: ENO Transportation Foundation.

Wilson, Richard and Donald C. Shoup. "Parking Subsidies and Travel Choices: Assessing the Evidence." *Transportation, 17: 141-157.* Kluwer Academic Publishers, Netherlands: 1990.