Smart Growth Alternatives to Minimum Parking Requirements

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Abstract. Many fights over new and changed development center on traffic and parking. Low-density, single-use development causes degradation of the built and natural environments. Its consequences include increased emissions, runoff, and loss of habitat. Many communities have responded by encouraging new development in mixed-use, compact ways that provide housing and travel choices, a style commonly known as smart growth. Because of their characteristics, smart growth developments can typically be served with less parking. However, many municipalities rely on inflexible minimum ratios, which do not recognize the wide variety of urban development types. Proven techniques can increase availability without increasing supply by changing parking management and pricing strategies, and improving alternatives to parking. The minimum standards can be made more context-specific, and include on-street and other shared parking as part of the required supply. Minimum requirements can be replaced by maximums and transferable entitlements. Car-sharing and improvements to pedestrian, bike and transit service can decrease the demand for parking at developments. Unbundling pricing from other costs, and balancing costs to reflect costs of service can produce more economically efficient use of all modes. Separately and in combination, these methods reduce the amount of parking required and thereby support better development and improved environmental outcomes. In 1999, EPA developed a report “Parking Alternatives” that documented work to that date; an update will be released in June 2003 as “Parking Spaces / Community Places: Finding the Balance through Smart Growth Solutions”. This paper provides highlights from the forthcoming update.

INTRODUCTION

Nationwide, haphazard sprawl development is consuming open space near metropolitan areas and increasing automobile dependency. This trend is resulting in destruction of natural habitat, air and water pollution, excessive public and private expenditures on infrastructure expansion, increased transportation and travel costs, and shifts in jobs out of cities. Simultaneously, abandoned properties in once thriving urban areas are left behind with an underutilized public infrastructure, thus feeding the cycle of disinvestment in urban areas. Many interrelated factors influence this, including the cost and ease of development. As the cycle of automobile dependency has accelerated, providing parking in urbanized areas has become a significant expense and deterrent to infill and brownfield redevelopment—development intended to reduce suburban sprawl and protect the environment by encouraging developers to invest within existing urban infrastructures. Providing parking in outlying greenfield areas is less burdensome because of the availability of land for low cost parking facilities, but no less injurious to the environment.

In many instances, efforts to accommodate parking have overextended actual need. An important case in point, and a focus of this guide, is the approach used by many cities to establish minimum parking requirements—typically a generic formula based on satisfying maximum demand for free parking. Although this practice may allow city planners to err on the side of caution, it has some serious drawbacks. In practical terms, this practice increases the cost of development and creates disincentives with respect to smart growth development and redevelopment. In addition, generic parking requirements create excess parking spaces that consume land and resources, encourage automobile use and associated pollution, and degrade water quality. The oversupply of parking is of particular concern for smart growth development in urban areas where the existing parking infrastructure can be better utilized and parking alternatives, such as shared parking and increased use of transit and pedestrian modes, can be more readily implemented.

With the shifting trend to urban revitalization over the past decade, the timing is opportune for instituting changes in parking requirements and transportation behavior. An important way to reduce the demand for parking and the need to supply parking to meet maximum demand is to provide transportation choices. This can be achieved by reducing the supply of parking in areas where transportation choices exist and by providing incentives for making other choices. Such changes will encourage infill redevelopment and reduce vehicle miles traveled, mobile source emissions and congestion. They will also increase ridership for public transit and, in turn, provide the additional revenues needed to support public transit improvements.

There are, of course, potential drawbacks to reducing the supply of parking. Lenders, for example, may be unwilling to approve loans because plans do not meet their minimum parking requirements; developers may be concerned about the long-term marketability of their property; and residents may fear that parking will spill over into surrounding residential neighborhoods. Such concerns can be more readily addressed if: the factors that affect parking demand are understood; walkable, pedestrian-oriented development design is implemented; and viable transportation choices exist. Concerns are also alleviated when developers, employers, and employees are aware of programs that balance the attractiveness of other transportation choices. The Transportation Equity Act for the 21st Century (TEA-21), for example, allows businesses to give their employees up to $100 per month in tax free transit subsidies. TEA-21 also allows employees who commute by public transit or vanpool to deduct the cost of commuting from their taxable income if they do not receive a subsidy.

The longer and forthcoming report will include substantial detail on the application case studies. The focus of this paper is to disseminate knowledge and understanding of these issues. Specifically, this paper will:

- Portray how parking requirements are currently set;
- Discuss the environmental impacts of parking;
- Describe alternatives to generic minimum parking requirements and provide examples of successful implementation.

ESTABLISHING PARKING REQUIREMENTS

In setting parking requirements, planners typically use generic standards that apply to general land use categories (e.g., residential, office, retail). Such standards have been developed and published by professional organizations, including the Institute of Transportation Engineers (ITE), based on experience in many locations. Much of the data on which these standards are based comes from low-density, single-use developments with limited transportation choices. Therefore, the generic parking rates can not take into account the mix of context-sensitive, community-specific variables—density, demographics, availability of transportation choices, or the surrounding land-use mix—all of which influence demand for parking and *should* be reflected in parking requirements. Instead, requirements are based on maximum demand for parking, when parking is provided at no charge to users, and walking, biking, and transit are not available choices. This formula yields a surplus of parking area that is costly for developers to provide, and it subsidizes personal automobile use and encourages auto use even in areas where convenient transportation choices exist. Because of the way in which they are typically established, parking requirements are remarkably consistent across different cities, despite varying levels of economic vitality, population size, and development density.

Alternatively, parking requirements can be established using methods that are better tailored to specific development projects. This approach entails careful consideration of the following land use characteristics that relate to parking demand:

- **Development type and size.** Takes into account the specific characteristics of the project. Parking demand is influenced by the size of the development (typically measured by total building square footage), as well as the type of land use (e.g., retail, industrial). Generic parking formulas address these factors to some extent.
- **Population and development density**. Considers the density and demographic characteristics of the people using the building, including employees, customers, residents, and visitors. Information on income, car ownership, and age distribution also helps in projecting total parking demand.
- **Availability of transportation choices**. Takes into account the modes of transportation available to employees, visitors, and residents. Proximity of public transportation to a particular development, for example, will reduce parking demand. Walkable neighborhoods and bicycle amenities will also reduce parking demand.
- **Surrounding land use mix.** Considers the surrounding land uses and density to better understand parking needs, and evaluates whether overall peak demand is lower than the sum of peak demands for different uses. This concept takes the timing of parking demand into account in determining the aggregate demand of multiple uses. The type of community in which a development is located will also affect parking demand. For example, if a project is located in a city's central business district, the availability of general use parking will reduce on-site parking demand. On the other hand, if the development is located in a residential area, on-street parking may be unacceptable to local residents, increasing the need for off-street parking at the development.

Land use and demographic information are important tools for establishing project-specific parking requirements that create a better match of supply and demand for parking than do many generic requirements. Moreover, adjusting parking requirements downward to reflect realistic demand helps reduce the total cost of development, particularly in urban areas. By reducing cost, a potential deterrent to smart growth development and redevelopment can be removed.

ENVIRONMENTAL IMPACTS OF PARKING

The significant environmental costs associated with parking are not typically factored into development decisions, and only recently have begun to be considered in setting parking requirements. Construction of unnecessary impervious surfaces increases the impacts of stormwater runoff, either on the storm sewer system or the surrounding land. Paved surfaces can also result in water pollution and flooding, resulting in a decline in adjacent property values. Heat islands, or areas of artificially raised temperatures, also are exacerbated by unnecessary pavement.

Consuming land for parking also reduces the land available for greenspace or other, more productive development. Land preserved as part of the green infrastructure allows stormwater to percolate into the soil, provides wildlife habitat, provides air quality and noise reduction benefits, and is aesthetically desirable. Land developed for living, working, and shopping rather than just parking provides more intensive use. This lowers the demand to develop other land nearby or elsewhere in the region. Intensifying uses also creates a more supportive environment for transit and walking, and potentially for bicycling as well.

Providing more parking than demanded, and at artificially low prices, contributes to several harmful environmental impacts. First, this subsidy of automobile use leads directly to excess driving. This results in increased auto dependency and air pollution, accidents, and congestion. Second, it indirectly degrades the attractiveness of walking and biking, by increasing distances between activities and creating uninteresting routes. Third, it indirectly undermines the potential for transit service by decreasing the density of development possible.

All of these environmental costs tend to be greater for parking built in greenfield areas where there is more inexpensive but ecologically-sensitive open space available and where development densities are lower thus requiring more and longer automobile trips. Because these environmental costs are not realized by developers, they do not influence development decisions which are driven primarily by the direct financial costs that are typically lower in greenfield areas.

For more detailed information about the impacts of alternative development patterns, see "Parking Alternatives" (*1*) and "Our Built and Natural Environments" (*2*).

INNOVATIVE ALTERNATIVES TO MINIMUM PARKING REQUIREMENTS

Some local governments have implemented alternatives to generic parking requirements that increase availability from existing supply, reduce the demand for parking, or create more cost-effective and environmentally sensitive parking structures that preserve pervious surfaces. By lowering total development costs, some of these parking alternatives have consequently encouraged smart growth development and redevelopment. This section presents these proven alternatives and includes discussion of their establishment, advantages, and potential concerns. The alternatives are organized according to their influence on parking supply, parking demand and pricing.

Increasing Availability from Existing Supply or Limited Expansion

Frequently, the supply of parking in developed areas is sufficient to meet parking demand, but a combination of reasons limit the availability of that supply. For example, reserved parking in or around office buildings may not be available for nearby evening cultural or entertainment activities. Similarly, residential parking emptied by commuters could serve daytime users of that area, but is typically "24-hour reserved". Several strategies can make this parking more available without requiring more be built. Similarly, policies that result in limiting the supply of parking are an effective way to reduce the costs of constructing and providing parking. Limiting supply can also reduce the environmental impacts associated with increased impervious surface of parking facilities, and can influence automobile use and reduce associated air pollution impacts. The alternatives discussed below ensure parking availability while reducing the supply provided under generic minimum requirements.

Context-specific Minimum Requirements

As discussed in the Introduction, generic minimum requirements are typically set based on maximum observed demand for free parking in areas with no transportation choices. However, parking demand is determined by a range of factors that lead to significant variations within and across jurisdictions, meaning that a single standard for each land use may not be appropriate. For residential developments, the most important factor is density. Each time residential density doubles, auto ownership falls by 32 to 40 percent (*3*). Higher densities mean that destinations are closer together, and more places can be reached on foot and by bicycle—reducing the need to own a car.

Other factors that are strongly correlated with lower vehicle ownership in urban areas are frequent transit service, small household sizes, low incomes, a high proportion of seniors, and rental housing (*4*). Obviously, many of these factors tend to go together; frequent transit and lower-income households tend are typically found in the most dense parts of a city.

Similarly, at commercial developments, transit access, mix of uses, and density are good predictors of parking demand. Often developers are interested in finding ways to reduce the vehicle trip generation calculations for their expected development, so that they can demonstrate fewer impacts on the surrounding roadway network, while they may not always be so eager to reduce the amount of parking to supply. Linking these two and offering trip reduction credits to developments that lower their parking ratios is a strategy that could encourage commercial developments, especially those on the urban edge, to take a more innovative approach to parking supply.

A major challenge for cities is how to convert this research and data, together with experience from other settings, into local parking requirements or planning approvals for specific developments. Some of the mechanisms being used are:

Transit zoning overlays. Many cities reduce minimum parking requirements citywide for certain types of uses that are within a specified distance of a rail station or frequent bus route. Montgomery County, Maryland, for example, grants reductions of up to 20 percent, depending on distance from a Metrorail station. Transit zoning overlays often go beyond parking to address issues such as density, design, and allowable uses.

New zoning districts or specific plans. Parking requirements can be lowered in specified neighborhoods, through the use of designated zoning districts or neighborhood specific plans. Most commonly, this applies to the downtown, where cities such as Milwaukee, Wisconsin, lower parking requirements or waive the minimums altogether. However, the same technique can be applied to other high-density, mixed-use neighborhoods that offer frequent transit, such as Seattle's Pike/Pine district. Specific Plans are particularly useful to encourage infill development in older neighborhoods or on brownfield sites.

Parking freezes. The amount of parking required can be directly reduced through parking freezes that cap the total number of parking spaces in a particular metropolitan district. Such freezes have been implemented in various areas

of the country in response to nonattainment of environmental standards, traffic congestion, or other urban planning considerations. Parking freezes need to be implemented in conjunction with viable public transportation options. Cities with successful parking freezes generally have strong economies and are attractive to tenants, customers, and visitors. Such cities can attract businesses because the benefits of the urban location outweigh the potential drawback of limited parking, and because public transit offers a viable choice.

Reductions for affordable and senior housing. Citywide reductions in parking requirements can be granted for below-market-rate units and senior housing, recognizing that residents are less likely to own vehicles. Los Angeles, California grants a reduction of 0.5 spaces per unit for deed-restricted affordable housing units, with further reductions if they are within 1,500 feet of mass transit or a major bus line.

Case-by-case evaluation. Codifying reductions in parking requirements provides the greatest certainty for developers, and enables them to plan for less parking from the outset. It also reduces the risk of developments being held up in the permitting process, or being challenged by local residents who may be reluctant to see the project built at all. Where this is not possible, however, reductions in parking requirements can be granted on a case-by-case basis, often on the condition that mitigation measures such as car-sharing are provided. Cities such as Eugene, Oregon, specify in their zoning codes that such reductions will be granted subject to a parking study showing that the proposed provision will be adequate to meet demand.

Land banking and landscape reserves. These acknowledge the uncertainties in projecting demand, by setting aside land that can be converted to parking if demand is higher than expected, or to cope with future expansions. In many cases, landscaping can be used to turn this set-aside land into an attractive amenity for the development or wider community. Such policies have been implemented in cities throughout Oregon, and others such as Palo Alto and Carmel in California; Cleveland, Ohio; and Iowa City, Iowa. Palo Alto, for example, allows reductions of up to 50 percent in minimum parking requirements provided that the difference is made up through a landscape reserve. None of the city's landscaped reserves have subsequently been required for parking.

Data on variations in parking demand comes from many sources. The U.S. Census readily provides ownership information, and can be used to set baseline parking requirements for residential uses. Local surveys can reveal parking occupancy at below-market-rate developments. Alternatively, mathematical models can quantify the expected reduction in parking demand by lower-income households (*3*). While commercial parking demand is often derived from trip generation models, information from aerial photographs, field observations of parking occupancy at existing developments, and surveys of staff and customers can also provide data. As a further incentive, parking requirements should be linked to the provisions of a Transportation Demand Management (TDM) Plan. For example, if a site's TDM plan calls for a 20 percent reduction in employee commute trips, then the developer should be permitted to build less parking than would otherwise be required.

However, the exact parking demand will still depend on many factors, including the specific design and location of pedestrian and vehicle entrances, the price of parking, and any TDM programs. Supply and demand are also intertwined due to self-selection—developments with less parking will tend to attract tenants or purchasers who need fewer spaces. Parking demand is not a fixed number, and should not be treated as a physical law (*5*).

One approach is for cities to simply acknowledge these uncertainties, and abolish all parking requirements in neighborhoods that are served by a range of travel options and where surrounding residential areas are protected from spillover (*6*). This leaves it up to developers—who have a financial interest in meeting tenants' needs while not oversupplying parking—to determine how many spaces are needed.

Maximum Limits and Transferable Parking Entitlements

In contrast to generic minimum parking requirements, maximum limits restrict the total number of spaces that can be constructed rather than establish a minimum number that must be provided. Planners set maximum limits much like they set minimum requirements. Typically, a maximum number of spaces is based on square footage of a specific land use. For example, the City of Portland, Oregon restricts offices in the central business district to 0.7 parking spaces per 1,000 square feet, and retail to 1.0 space per 1,000 square feet of net building area. Contrary to what might be expected, the maximum limits in Portland have not led to a parking shortage because of the balance of transportation choices available.

One option to make maximum parking requirements more flexible is to introduce transferable parking entitlements, as in Portland, Oregon. The allowed number of parking spaces for a particular development are an

"entitlement" that can be transferred or sold to another development if they are unused. This policy enables cities to control the parking supply, without restricting developments that would not be feasible without additional parking. From a financial standpoint, both developers benefit. Projects that require more parking can proceed, while those that need less parking can benefit by selling their rights, or negotiating shared parking agreements for their employees or customers.

Planners establish maximum limits instead of minimum requirements for various reasons. By managing the supply of off-street parking and reducing automobile use, Portland's planners hope to "…improve mobility, promote the use of alternative modes, support existing and new economic development, maintain air quality, and enhance the urban form of the Central City" (*7*). Both planners and developers benefit from restricting the number of parking spaces allowed.

From the planner's perspective, maximum limits improve the urban environment by preserving open space and limiting impervious surfaces; reduce congestion; encourage attractive, pedestrian-friendly urban design; and promote transportation choices. From the developer's perspective, maximum limits minimize costs for parking construction, operations, and maintenance; reduce traffic and traffic related costs; and increase leasable space within a given floor-to-area ratio. However, when limiting the supply of parking, planners must consider possible spillover parking in surrounding residential neighborhoods. To avoid such spillover, developers must understand the factors that affect parking demand and ensure that viable transportation choices exist. Residential permits can help prevent spillover into residential areas.

With restrictive maximum limits on the number of parking spaces, developers may worry about the long-term marketability of a property. Marketability should not be a concern for competing developments in the same locale since all developments must adhere to the maximum limits. With regard to competing developments outside the region with maximum limits, amenities other than parking such as convenient access to services and places of employment, attractive streetscapes, or pedestrian-friendly neighborhoods, can have a strong influence on tenant preferences. City governments and developers should incorporate these elements to attract businesses and residents.

Maximum requirements are not ideal for all locations. It is crucial for municipalities that employ maximum requirements to have accompanying accessible and frequent public transportation. It is also important for the area to be sufficiently stable economically to attract tenants without needing to provide a surplus of parking. A number of cities have implemented maximum parking requirements, including San Francisco, California; Portland, Oregon; and Seattle, Washington. The appendix provides an example of maximum limits as written in Portland's Title 33 Planning and Zoning Code (*7*).

Shared Parking

Different types of land uses attract customers, workers, and visitors during different times of the day. Shared parking is another alternative that city planners can employ when setting parking requirements in mixed-use areas. An office that has peak parking demand during the daytime hours, for example, can share the same pool of parking spaces with a restaurant whose demand peaks in the evening. This alternative also reduces overall development costs.

By allowing for and encouraging shared parking, planners can decrease the total number of spaces required for mixed-use developments or single-use developments in mixed-use areas. Developers benefit, not only from the decreased cost of development, but also from the "captive markets" stemming from mixed-use development. For example, office employees are a captive market for business lunches at restaurants in mixed-use developments.

Shared parking encourages use of large centralized parking facilities and discourages the development of many small facilities. This results in more efficient traffic flow because there are fewer curb cuts, and turning opportunities on main thoroughfares. This has the added benefits of reducing accidents and reducing emissions from idling vehicles stuck in traffic.

Establishing shared parking requirements involves site-specific assessment or use of time-of-day parking utilization curves. Montgomery County, Maryland allows for shared parking to meet minimum parking requirements when any land or building under the same ownership or under a joint use agreement is used for two or more purposes. The county uses the following method to determine shared requirements for mixed-use developments:

- Determine the minimum amount of parking required for each land use as though it were a separate use, by time period, considering proximity to transit.
- Calculate the total parking required across uses for each time period.
- Set the requirement at the maximum total across time periods.

Many available sources document procedures for calculating shared parking requirements, from 1983's "Flexible Parking Requirements" (*8*) to 2003's SmartCode (*9*).

In-Lieu Parking Fees and Centralized Parking

Municipalities establish in-lieu parking fees as an alternative to requiring on-site parking spaces. With in-lieu fees, developers are able to circumvent constructing parking on-site by paying the city a fee. The city, in return, provides centralized, off-site parking that is available for use by the development's tenants and visitors. The fees are determined by the city and are generally based on the cost of providing parking. Cities set fees in one of two ways, either by calculating a flat fee for parking spaces not provided by a developer on-site or by establishing development-specific fees on a case-by-case basis. Shoup (*10*) reports that in-lieu fees in the United States range from $5,850 to $20,180 per parking space. These fees can be imposed as a property tax surcharge.

In-lieu parking fees provide advantages to both planners and developers. Allowing developers to pay fees in-lieu of constructing parking has the following benefits:

- Overall construction costs may be reduced;
- Construction of awkward, unattractive on-site parking is avoided;
- Redevelopment projects involving historic buildings can avoid constructing parking that would compromise the character of the buildings;
- Planners can ensure that existing parking facilities will be more fully utilized; and
- Planners can encourage better urban design with continuous storefronts that are uninterrupted by parking lots.

In establishing in-lieu parking fees, planners must be cognizant of potential developers' concerns about the impact of a lack of on-site parking on the attractiveness of developments to tenants and visitors. This can be an issue if available public parking is insufficient, inconveniently located, or inefficiently operated. Planners must carefully consider the parking demand for each participating property and provide enough parking to meet this demand in order to avoid creating a perceived or real parking shortage. Planners must also work to ensure that public parking facilities are centrally located and operated efficiently.

Centralized parking facilities can reduce the costs of parking because large facilities are less expensive on a per space basis to build and maintain than small facilities. Centralized parking, as an alternative to on-site parking, also improves urban design and preserves the historic nature of communities. Some cities mandate centralized parking facilities and finance them through development impact fees in lieu parking fees or negotiated contributions established during the environmental review process.

Increasing Availability by Decreasing Demand

Demand reduction can be achieved through a variety of programs and policies that attempt to reduce the automobile transportation demand, and thus reduce the needed supply of parking. While these programs are typically developed by local governments, their success often depends on the commitment of businesses to implement them effectively. Demand reduction programs include: car sharing, subsidies for transit, transit improvements, pedestrian and bicycle amenities, and vehicle trip reduction programs. When employers allow telecommuting and/or flexible work schedules that reduce commuting, demand is also reduced.

Car sharing

Car sharing is a neighborhood-based, short-term vehicle rental service that makes cars available to people on a pay-per-use basis. Members have access to a common fleet of vehicles on an as-needed basis, gaining most of the benefits of a private car without the costs and responsibilities of ownership. In programs with the most advanced technology, members simply reserve a car via telephone or the Internet, walk to the nearest lot, access the car using an electronic card, and drive off. They are billed at the end of the month.

Car-sharing dramatically reduces the need to own a vehicle, particularly a second or third car that is driven less than 10,000 miles per year. In San Francisco, nearly 60 percent of those who owned a vehicle before joining the

car-sharing program have given up at least one of them within a year, and another 13 percent are considering it (*11*). Zipcar, which operates in Boston, New York and Washington, DC, reports that 15 percent of members sell their private car. In Europe, which has a far longer experience with car-sharing, each shared vehicle takes between four and ten private cars off the road (*12*).

This means that parking provision can be significantly reduced at residential developments that incorporate car-sharing, although developers may need to contribute towards setup costs and/or provide parking spaces to secure car-sharing as part of a project. Car-sharing can be provided as part of a mitigation agreement with the local jurisdiction on a case-by-case basis, in return for a reduction in minimum parking requirements. Alternatively, the parking reduction can be codified through zoning ordinances, as is being considered in Portland, Oregon; San Francisco, California; and Seattle, Washington.

In commercial developments, car-sharing can also be a useful tool to reduce parking demand. Employees can use a shared vehicle for errands and meetings during the day, allowing them to take transit, carpool, walk or bicycle to work. Car-sharing works best in compact, mixed-use neighborhoods, where firms with corporate memberships tend to use the vehicles during the day and residents use them in the evenings and on weekends.

As well as reduced parking demand, car-sharing brings a broad range of other benefits, including fewer vehicle trips, and improved mobility for low-income households who may not be able to afford to own a car. Formal car-sharing programs have been established in many cities including Boston, Massachusetts; Washington, DC; San Francisco, California; Oakland, California; Portland, Oregon; Seattle, Washington; and Boulder, Colorado. Many others are in the process of establishing operations. Alternatively, developers can provide shared vehicles themselves, or facilitate informal car-sharing among residents.

Improvements to Transit Service, Pricing, and Information

Transit subsidies can be provided by employers, by cities, or by residential property managers. In the case of employer-paid transit pass schemes, the employer pays the cost of employees' transit, converting the fixed cost for parking spaces into a variable cost for the public transportation subsidy. This fringe benefit for employees reduces the demand for parking at the workplace, which in turn reduces traffic, air pollution, and energy consumption. It also reduces the cost associated with providing parking, as transit subsidies are generally less expensive than providing parking. A transit pass in Los Angeles, California, for example, costs $42 per month, whereas the average cost for a parking space is $91 per month (*13*). To promote transit subsidies, the 1998 Transportation Equity Act for the 21st Century eliminates the tax burden for both employers and employees; these subsidies are not taxed as payroll or as income.

In some cases, city planners respond to employer paid transit subsidies by lowering minimum parking requirements. For example, included in Montgomery County, Maryland, office zoning requirements is a 15 percent reduction in minimum parking requirements if businesses offer reimbursed transit passes (*8*). By offering subsidies for public transportation use, employers enable the reduction of parking space requirements, thus decreasing total development costs and making urban development opportunities more inviting.

Transit subsidies can also be useful for residential developments. Property managers in Boulder, Colorado and Santa Clara County, California, for example, can bulk-purchase transit passes for all their residents at deeply discounted rates. The principle is similar to that of insurance—transit agencies can offer lower rates on passes on the basis that not all residents will actually use them regularly. Residents can in effect take transit for free, meaning they are less likely to own a vehicle. Another benefit of pre-paid transit programs is that they encourage residents to take transit spontaneously. A person does not have to commit to transit full-time in order to be able to reduce their demand for vehicle travel and parking. Developers who agree to fund transit passes can thus be rewarded with lower parking requirements.

Local government officials can also improve transit service quality to decrease auto dependence and associated parking needs. Improvements to consider include new transit modes, such as light rail, expanded transit service hours, increased bus lines, and revitalized transit stations. Portland, Oregon's MAX light rail system exemplifies the widespread benefits of transit improvements. The light rail system encourages transit-oriented development, decreases automobile commuting, and eases demand for parking. In fact, the light rail improvements

eliminated the need for six downtown parking towers (*14*). These improvements are also partially responsible for $1.3 billion in new development in Portland over the last 10 years.

Improvements to Pedestrian and Bicycle Service

Demand for parking can be reduced by providing pedestrian and bicycle amenities that make it easier and more pleasant for people to walk or bicycle rather than drive. These amenities and design changes can alleviate traffic congestion. In particular, improving the walkability and pedestrian orientation of employment centers can address the increasingly common "drive to lunch" syndrome. For example, the auto-orientation of Tyson's Corner, Virginia has resulted in terrible traffic at lunch time because people cannot walk to eating establishments or to do errands.

These low cost amenities can be as simple as providing bicycle racks and walkways. For example, officials in Schaumburg, Illinois, a suburb of Chicago, have incorporated provisions for bicycle use directly into their zoning ordinance to encourage balanced transportation choices. The ordinance requires all retail centers to have a minimum of 10 bicycle spaces located at each main building entrance. To increase awareness, the ordinance requires that bike racks be located in a place where they are highly visible; to promote safe bicycle use, the ordinance requires bicycle parking areas to be separated from automobile parking. Providing shower and locker facilities also encourages bicycling, rollerblading, and walking to work.

Promoting bicycle and pedestrian transport modes can also be accomplished through simple design changes, some of which can be implemented at no additional cost. Instead of locating parking between the street and the buildings, requiring pedestrians and bicyclists to navigate through parking lots, parking should be set back behind buildings. The Downtown Master Plan for Kendall, Florida (Miami-Dade County), discusses several design concepts to improve pedestrian and bicycle access. Some of the key elements promoted, but not required, by this program include access via new sidewalks and paths, plantings facing streets and sidewalks, parking in garages or behind buildings, and minimal curb cuts (*15*).

Vehicle Trip Reduction Programs

Another direct form of demand reduction involves instituting vehicle trip reduction programs. Vehicle trip reduction programs combine several types of demand reduction components to meet explicit vehicle trip reduction goals. Thus, instead of capping the number of parking spaces, local officials limit the number of vehicle miles traveled in a particular region. These types of programs attempt to decrease the number of trips by single occupancy vehicles (SOVs) and increase the use of a variety of commuting alternatives, including transit, carpooling, walking, and bicycling.

To increase the effectiveness of vehicle trip reduction programs, cities or employers can incorporate an assortment of complementary program elements to balance transportation choices. The following are some examples:

- "Guaranteed ride home" services that allow employees who use public transit to get a free ride home (e.g., via taxi) if they miss their bus or if they need to stay at work late.
- Company fleet cars that can be used for running errands during the workday (e.g., doctor appointments).
- Preferential and/or reserved parking for vanpools/carpools.
- Carpooling and/or vanpooling with ride matching service. Ride matching can facilitate the identification of people who live close to one another. This service can be accomplished by providing "ride boards" or by using an employee transportation coordinator.
- Cellular phones for car and vanpooling to facilitate timing of pickups.

There is little incentive for employers to implement vehicle trip reduction programs if they are not granted reductions in minimum parking requirements. They would not be able to realize the potential cost savings from providing less parking, but would simply be faced with a large number of empty spaces. Several cities, such as South San Francisco, have acknowledged this through ordinances that reduce parking requirements for projects that include vehicle trip reduction programs.

Efficient Pricing

Although it is often provided at no charge to the user, parking is never free. Each space in a parking structure can cost upwards of $2,500 per year in maintenance, operations and the amortization of land and construction costs. Even on-street spaces incur maintenance costs and an opportunity cost in foregone land value.

The cost of parking is generally subsumed into lease fees or sale prices for the sake of simplicity and because that is the more traditional practice in real estate. However, providing anything for free or at highly subsidized rates encourages overuse and means that more parking spaces have to be provided to achieve the same rate of availability. Charging users for parking is a market-based approach by which the true cost of parking can be passed through to parking users. If the fee charged to users of parking facilities is sufficient to cover construction, operation, and maintenance costs, it will likely cause some users to choose not to park. Even where there are few alternatives to driving, parking pricing can encourage employees to seek out carpooling partners. In addition to reducing the cost of parking provision, pricing strategies bring major environmental and congestion benefits, particularly since they tend to reduce peak-period vehicle trips the most.

Parking charges have been found to reduce employee vehicle trips, and thus daily parking demand, by between 7 percent and 30 percent or more, depending on factors such as the level of charges and the availability of alternatives to driving alone. Parking price elasticities generally range from –0.1 to –0.6, with the most common value being –0.3, meaning that each 1 percent rise in parking fees is accompanied by a 0.3 percent decrease in demand (*16*).

Cash-Out Programs

Cash-out programs provide alternatives to directly charging users for parking. Under such programs, employers offer employees the choice of free or subsidized parking, a transit/vanpool subsidy equal to the value of the parking (of which up to $100 is tax-free under current federal law), or a taxable carpool/walk/bike subsidy equal to the value of the parking.

Employees who opt for the non-parking subsidies are not eligible to receive free parking from the employer, and are responsible for their parking charges on days when they drive to work. The cost savings associated with cash-out payments depend on the amount of the payments. If the full cash equivalent is provided, this demand reduction program does not reduce the total costs of providing parking. However, employees may accept cash payments lower than the full equivalent of the parking subsidy. If partial cash payments are used, employers face lower overall transportation subsidy costs and employees still benefit.

Cash-out programs provide significant environmental, social and broader economic benefits. For example, in response to California's mandatory cash-out requirement, eight firms reported an average 17percent reduction in the total number of solo drivers (*17*). Thus, another benefit of cash-out programs is a reduction in traffic congestion and associated pollution.

Cash-out programs are often easier to implement than direct charges, as they are generally more acceptable to employees. However, their impact on travel behavior is usually lower, due to the administrative burden on employees, inertia in changing travel habits, and the fact that cash-out payments can be a taxable benefit whereas free parking is not.

Differential Pricing by Trip Type

Parking pricing can be used as a sensitive tool to prioritize some types of trip over others, according to their purpose and duration. It allows managers to cater for desirable trips, such as short-term shoppers, while discouraging undesirable commuter trips, which add to peak-hour congestion and occupy a parking space for an entire day. These pricing strategies allow the overall supply of parking to be minimized, while ensuring spaces are available for critical users. They can also alleviate pressure to provide more parking from retailers and businesses, who may be concerned that poor parking availability discourages shoppers. Examples include:

- Lower or zero rates for short-term parking encourage shopping trips, while proportionally higher rates for long-term parking discourage all-day commuter parking, freeing up spaces for customers. Short-term parking allows many people to use a single space over the course of a day, rather than a single commuter, and generates revenue for businesses and sales tax dollars for cities.

- Parking charges that are levied by the hour or day, with no discounts for monthly parking, remove the financial disincentive to take transit occasionally. There is no perverse incentive to drive every day to "get your money's worth" from the monthly parking pass.
- Parking charges at transit stations that only apply before a certain time (such as 9 or 10 am) encourage off-peak transit ridership where spare capacity is available, rather than contributing to crowding in the peak.

Residential Parking Pricing

Parking charges can also be introduced at residential developments, through separating or "unbundling" the cost of parking from rents or sale prices. Rather than being provided with a set number of spaces whether they need them or not, residents can choose how many spaces they wish to purchase or rent. An alternative to direct charges is to provide "rent rebates" or discounts to residents who own fewer vehicles and do not use their allocated parking spaces.

Parking Benefit Districts

Parking pricing strategies can also be implemented through Parking Benefit Districts. Under this concept, revenue from meters and residential permits is returned to local neighborhoods. Once administrative costs are covered, all money goes to transportation and neighborhood improvements such as undergrounding of utility wires (*18*). Parking Benefit Districts allow developments to be built with less parking, while addressing potential spillover problems through market pricing of curb parking. Earmarking revenue to directly benefit the neighborhood or commercial district helps to generate support for charges from local residents and businesses, who might otherwise resist charging for parking that used to be free. Cities such as San Diego and Pasadena, California, have implemented Parking Benefit Districts in their downtown business districts, using parking meter revenue.

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