
Parking Management

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■ Introduction

Two of the transportation control measures identified in Section 108(f) of the Clean Air Act involve managing an area's parking facilities so as to encourage certain kinds of travel and discourage travel by other means. These are:

- (vii) programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use; and
- (xiv) programs and ordinances to facilitate non-automobile travel, provision and utilization of mass transit, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to..... centers of vehicle activity.

Parking policies, especially the pricing of both on-street and off-street parking, have long been developed so as to influence the mix of short- and long-term parking. A variety of other parking-related actions have been used, as well, to influence other aspects of parking supply and demand.

Parking management, defined in a broad sense, can be an effective tool for local government to reduce traffic and associated emissions in congested areas by encouraging travelers to use modes other than driving alone. In this chapter, four parking strategies are examined that can be applied within the public sector:

- Preferential parking policies for high occupancy vehicles (HOVs);
- Public sector pricing policies;
- Parking requirements in zoning codes; and
- Control of parking supply.

In general, parking management strategies are most effective when implemented in dense CBDs that have limited available parking. Patterns of dispersed development diminish the effectiveness of the strategies. In addition, if there is an excess of parking supply, then implementing strategies that only affect a portion of the spaces may simply result in a reallocation of where people park, not whether they choose to drive alone.

■ Preferential Parking Policies for High Occupancy Vehicles

Parking policies may be implemented that directly encourage the formation of carpools and vanpools. Preferential parking programs reserve proximal and attractive spaces for HOVs, and may also offer lower parking fees than for single occupant vehicles. This strategy is predominantly applied in CBDs or large activity centers where there is a shortage of easily accessible and convenient all day parking, the walking distance from the parked car to work is noticeably time consuming and/or the commuter parking rates are high. Preferential parking policies could also be applied in other locations if these same conditions exist.

Preferential parking programs that promote HOV use can accomplish three objectives:

- Reduce auto congestion;
- Decrease the level of vehicular air pollutant emissions; and
- Reduce the demand for long-term single occupant vehicle parking.

These programs, however, could be in conflict with other demands on the parking supply if not carefully designed. For example, there may be a desire to use any potentially available spaces for short-term parking that supports retail establishments. In some cases, it appears that the location of preferential parking spaces is a strong incentive to rideshare.

The impact of preferential parking programs on traffic congestion and air quality depends on the number of carpools and vanpools formed as a result of their implementation, and on the previous mode of travel that was used. By combining a number of solo drivers into carpools or vanpools, there is a reduction in both the number of vehicle trips made as well as in the total VMT. If, on the other hand, the new carpools and vanpools are formed with individuals who previously used transit, then there could even be an increase in the number of vehicle trips and VMT.

Examples of Strategies

The following are examples of where preferential parking programs have been applied. Where the data are available, the impact on carpool formation is summarized.

San Francisco, CA

In 1977, the California Department of Transportation (Caltrans) provided 480 carpool spaces for 3+ carpools at a subsidized rate of \$10 per month, as compared to the standard monthly charge of \$35 to \$60 per month. The spaces were filled almost immediately. However, 85-90 percent of the spaces were used by exiting carpools. Of the new carpools formed, approximately two-thirds previously used transit. As a result, there was an increase of fifteen to twenty vehicles entering the CBD and a loss of 110 to 220

transit riders at a cost of \$110,000 per year. In 1979, Caltrans modified the program so that only 8+ person vanpools were eligible for the reserved spaces and subsidy. As of 1980, close to 150 vanpools were using the lots, the majority of which were newly formed, and the number of vanpools participating was increasing at a rate of ten to fifteen per month.

Minneapolis, MN

Preferential parking locations were offered to carpoolers at parking garages in addition to reduced parking rates. Carpoolers were charged \$10 per month as opposed to \$90 per month for single occupant vehicles.

Baltimore, MD

Reserved metered spaces are provided for carpoolers in a municipal parking lot under I-83 on the eastern edge of the CBD. Carpoolers are issued a permit at no cost to allow them to use the metered spaces and they must pay the regular \$2 per day meter rate.

San Antonio, TX

For city employees, a 200 space lot was designated for exclusive use by carpools and vanpools. A permit is required at a cost of \$6 per month. This program resulted in 100 new carpools involving 250 employees.

Washington, DC

At most federal facilities in downtown Washington, DC, parking supply is constrained and spaces are allocated primarily to car and vanpools. This has led to a high rate of both pooling and transit.

Costs and Other Important Impacts

There are costs associated with administering and enforcing a preferential parking program. Administration costs primarily deal with operating the permitting process. In parking facilities where an attendant is already present, the increased cost to accommodate the carpools and vanpools is minimal, especially in terms of enforcement. If an attendant must be hired as a result of these policies, however, then there will be an increase in labor cost equivalent to the attendant's wages and benefits. In Seattle, the cost for administration and enforcement (which does not include the cost for an additional attendant) is estimated to be \$20 per space per year, based on an enforcement method of spot checks five to six times per year. If a subsidy is offered to carpools and vanpools, then there will be a loss in revenue equal to the amount of subsidy times the number of participating vehicles.

An additional benefit of a preferential parking program is that it makes more efficient use of the existing parking facilities and may help to delay the construction of additional ones. This could result in a significant cost savings to the city and could make land available for other uses.

Reserving parking spaces for carpools and vanpools, as mentioned above, may be in conflict with other parking-related goals being pursued. Retailers are often asking development agencies for more convenient and less expensive short term parking in an effort to lure shoppers away from suburban shopping malls. Employers may feel that the use of special parking incentives could hinder their ability to obtain quality employees. Both of these groups should be involved early on in the process to obtain their cooperation.

Implementation Requirements

A number of factors should be considered in determining whether a locality is a good candidate for a preferential parking program. There should be a shortage of parking supply near the employment center, with parking a noticeable walking distance away and at relatively high rates. The preferential spaces should be located and priced to offer a clear advantage over those for single-occupant vehicles. An assessment of the current mode split should be made so that preferential parking is not provided only for existing carpools. This assessment also can be used to determine if the transit share is significantly larger than the drive alone share, which would indicate that new carpool formation could disproportionately draw from transit and lead to an increase in the overall number of vehicles. In addition, competing demands on the existing parking supply should be identified as a potential obstacle to the implementation of a preferential parking program.

Once it is decided to pursue a preferential parking program, a number of specific guidelines can be followed.

- The parking spaces should be located as close as possible to the destination end of the trip and should be located near an exit or elevator in the parking facility.
- The price per vehicle, not per person, should be substantially less than for single-occupant vehicles so that it is obvious that it is less expensive to carpool than to drive alone.
- Preferential spaces should be well marked as being reserved for carpools and vanpools. This will assist in enforcement of those spaces as well as provide advertising that there is preferential treatment for carpools and vanpools.
- The availability of preferential parking spaces in specific parking facilities should be well marketed to further encourage ridesharing. This could be done by posting signs at the entrance to the particular parking facility, and by providing a map of parking facilities that provide preferential parking spaces in the ridesharing information distributed by employers.
- Enforcement of preferential parking spaces is extremely important to ensure their effectiveness, but also can be difficult. Many cities use a permit system. Once a

permit is purchased, however, there is no guarantee that the vehicle is actually used for a carpool on any given day. The best method for enforcement is to have an attendant at the entrance to the garage who provides a card to be placed in the vehicle window that states that it is eligible for the preferential parking spaces. These cards would be valid only for the day they are issued.

■ Public Sector Parking Pricing

Cities, counties and parking districts can price on and off-street parking, in association with the use of operating strategies, to reduce congestion and solo driving. The following strategies are candidates for consideration:

1. **Altering rates at facilities already priced:** Parking charges in public garages and lots as well as on street can be set higher for peak periods, for long term versus short term parkers and for solo drivers versus carpools.
2. **Imposing new prices:** Priced parking permits can be required for parking in congested zones. Such permits might be required not only at public facilities but private facilities as well.
3. **Tax the receipt of free private parking:** This would help offset the advantage of employer provided free parking benefits. Workers would have a more balanced choice than at present to use transit or rideshare, and not be encouraged to drive alone.

Of course the effectiveness of applying these pricing strategies will depend on the parking and travel characteristics of the locality. The key variables to consider are:

- Proportion of parking supplies controlled by the public versus private sector;
- Proportion of commuters whose employers pay for parking;
- Proportion of traffic bound for parking facilities versus through traffic not bound for any parking in the area; and
- Availability of transit and other alternatives to solo driving, as well as the availability of uncontrolled parking supplies (e.g. neighborhood streets, vacant lots, utility and train right of ways) where commuters may be diverted under pricing strategies.

Localities with the best prospects for reducing congestion and emissions will have the least through traffic; the highest proportion of parking under public control; the least amount of employer subsidized parking; the best transit and ridesharing services; and the least supply of uncontrolled parking available to commuters. Localities will differ considerably along these important variables. For example, private off-street parking makes up from 15 to 60 percent of all off-street parking. Likewise, through trips make

up anywhere from 30 to 60 percent of auto trips made into central business districts, though the percent is 15 to 30 percent for downtown areas taken as a whole. Finally, the proportion of commuters with employers paying for all or part of parking may be over 50 percent.

Examples of Strategies

Experience with changes in public parking prices suggests mixed results. Effects on solo driving depend on the degree of pricing changes, the status of key variables previously discussed and implementation particulars. Some cases of relevance:

Madison, WI

The City imposed a peak period surcharge of \$1.00 at four parking facilities combined with new shuttle service. Only five to eight percent of commuters switched to transit, 22 percent shifted parking location, and six percent parked after the peak.(4)

Seattle, WA

The City reduced parking charges for carpools at two Seattle parking facilities downtown, from \$25 to \$5 per month at one facility and \$0 at another. The largest effect was to attract bus riders from transit: 45 percent of the participants in the discount program switched from transit, 29 percent previously car-pooled and 25 percent were previously solo drivers.(18)

San Francisco, CA

The City increased rates at public (and commercial) facilities through a 25 percent tax and found a large variation in the decline of vehicles parked at the facilities. Elasticities ranged from +.40 to -2.65, suggesting high variability depending on location. The number of cars parked declined at seven facilities but increased at six others. Overall, the number of parked cars declined less than two percent. Parking duration declined. It is not known what proportion of parkers turned to transit, carpooling or other alternatives to auto use.(13)

U.S. Federal Government

The federal government charged employees for parking at selected federal facilities. Rates varied from mostly free to one-half the rates at nearby commercial lots. Results were highly variable. The reduction in the number of autos commuting ranged from one to 10 percent in central city areas, and between two and four percent in suburban locations.(15)

Federal Government of Ottawa

The Canadian federal government began charging near market price for employee parking in Ottawa. Solo driving decreased by 21 percent (from 35 percent to 28 percent), with large shifts to transit even among higher income employees. Overall, about seven percent of workers changed mode of travel.(16)

Chicago, IL

The City raised rates from 30 to 120 percent, bringing fees up to levels at nearby commercial space. The number of cars parked declined 35 percent and parking duration decreased. The number of all day parkers arriving before 9:30 a.m. dropped 72 percent. Local planners inferred that most former long term parkers switched to transit or pooling, or simply parked for shorter durations. However, no hard evidence was gathered on mode shifts. Parking at nearby commercial parking facilities did not change significantly. Revenues from municipal facilities increased.(14)

Honolulu, HI

The City doubled parking rates to discourage long term parking and encourage short term parking availability. The number of cars parked increased by six percent and the number of available lunch hour spaces doubled. Parking revenues increased 36 percent. No mode shifts were noted.(6)

Santa Cruz, CA

Required priced on-street parking permits for non-resident summer parking on street along three miles of beachfront. Parkers could purchase daily permits for \$3.00 while residents and retailers parked for free. Non-resident beach user car parking declined at least 30 percent. A free shuttle failed to attract beach goers. Most diversions were to other beach areas not priced.(16)

Eugene, OR

Raised rates at two municipal garages and several surface lots. Rates at garages went from \$16 to \$30 over about one year. Surface lot rates went up from between \$6-16 to \$16-34. Meter rates did not change, but fines were increased for commuter parking in short term stalls for shoppers. Monthly parking permit sales declined from 560 to 360 parkers. About half the parkers became carpoolers or rode a free shuttle, the other half apparently changed parking locations.(20)

An examination of these empirical results indicates that there is no overall clear conclusion of the effect that parking pricing may have on total tripmaking, with the individual results being highly dependent on many local variables. Pricing will not always divert parkers to alternatives to solo driving. Parkers may well go to alternative parking facilities (e.g. Santa Cruz, Madison) or mostly shorten their parking stay (Honolulu, Chicago, San Francisco) or switch among alternative modes (Seattle) or combinations of all these.

From an air quality standpoint, the net effect of parking pricing can be either positive or negative. In the best case, pricing will divert a proportion of parkers to transit (e.g.

Chicago, Eugene, Ottawa). However, pricing also may decrease parking duration. The primary negative effect of shorter parking duration is the increase in vehicle starts within the affected area. Increased turnover means less cruising to find space, but more short term parking could mean more cold or near cold starts. Local officials need to weigh these effects and decide on balance whether pricing is worth pursuing.

Cost and Financial Implications

Costs for implementation will depend on whether pricing is merely a change in existing pricing or a whole new pricing scheme. Much also depends on whether or not pricing is packaged with other strategies such as expanded rideshare and transit services. Usually there is minimal cost in implementing parking price hikes at municipal facilities with pricing already in place. Costs for changes in notices and accounting operations are minimal. Implementing new pricing schemes, especially when combined with increased transit or carpool services, can be much more costly. New off-street pricing will entail attendants or meters, and may require new enforcement and accounting procedures. Both Eugene and Santa Cruz implemented comprehensive programs in the early 1980's costing between \$30,000 and \$50,000 per year in administration and enforcement alone. Additional costs included expanded transit service. However, both programs covered their operating costs in parking revenues and citations.

While the direct costs of implementing parking pricing strategies may not be very great, financial effects may be substantial. For example, when San Francisco implemented the parking tax, gross revenues from the tax amounted to 5.5 million per year. Likewise, price increases in Chicago at municipal facilities resulted in increased revenues even though the City controls only 14 percent of parking space in the CBD. Parkers did not divert to commercial facilities and reduce City revenues because the price hikes brought prices on a par with commercial facilities.

Implementation Requirements

Because the effect of parking pricing is very dependent on local parking and traffic conditions, implementation should begin with an assessment of certain key variables. Planners should estimate the proportion of through traffic in the area considered for pricing. The amount and use of available parking supplies should be assessed. Use should be assessed in terms of overall demand as well as proportion of long versus short term use and shoppers versus commuters. Availability of parking nearby the priced zone also should be surveyed to assess spillover parking potential. Public parking supplies and rates should be compared to commercial rates since some parkers may simply shift to commercial facilities if public rates exceed commercial rates. The degree of subsidized parking also should be determined. Finally, the quality and capacity of transit services, carpool matching programs, bicycling facilities and other alternatives to solo driving should be appraised.

With this information in hand, planners can then devise possible alternatives for consideration. For example, if public sector rates are below commercial rates; if through traffic is not a large proportion of traffic entering the zone; if employees generally are not subsidized for parking; if transit capacity and carpool matching services are good or about to improve; then it may be worthwhile increasing and altering the structure of public parking rates.

The simplest option may be to increase rates to near commercial rates without altering rate structure. A more aggressive policy would be to increase rates more for long term parkers while promoting transit and carpooling. A parking surcharge for a.m. entry might also be considered, though the surcharge should be applied to most facilities because commuters are likely to simply shift parking destinations if surcharges are in place at only a few facilities. For maximum effect, priced parking permits can be required for parking in the zone both on and off street.

In devising these options, attention should be given to revenue implications and other considerations. Public and private officials will want to know where increased revenues will go; whether shoppers will find more or less parking available; whether parkers will shift to unprotected neighborhood streets; whether low income workers are disadvantaged. Thus, planners should consider collateral actions such as increased transit and carpool services; preferential parking for residents in nearby neighborhoods; set aside or validated parking for shoppers; preferential parking by location and rate for carpools; and increased enforcement funded by increased revenues. If priced parking permits are proposed (as in Eugene or Santa Cruz), businesses might be allowed to sell permits on a concession basis. The approach provides some revenue and exposure for local businesses and creates a decentralized permit distribution system. Both Eugene and Santa Cruz demonstrated the feasibility of business concessions for permit distribution.

Finally, any parking pricing scheme should be monitored and evaluated. Parking managers should track mode shares of commuters into the zone. They also should track parking utilization and turnover at priced facilities and at nearby facilities and streets. Parking violations and meter feeding also should be tracked. Some commuters can be expected to feed meters and shuffle cars in time restricted zones. Parking revenues also should be monitored along with any increased costs associated with the program.

■ Parking Requirements in Zoning Codes

Localities can control the number of parking spaces provided at new developments through requirements in parking codes. They also can encourage traffic reduction strategies through flexible parking codes. In particular, localities can:

1. Set maximum and minimum requirements: Parking codes establishing the amount of parking developers must provide ("minimum" required) can be set with low

minimums and/or maximums ("maximum" which can be provided) to insure overly ample supplies are not provided.

2. Allow reductions in minimum requirements ("flexible" requirements) in return for traffic mitigation: developers can be offered reductions in the minimum amount of parking required in return for supporting transit, carpooling, cycling and other alternatives to solo driving.

The effectiveness of these strategies depends on several conditions:

- The amount of parking developers and lenders prefer to provide in the absence of parking requirements and the necessary generation of a revenue stream to repay loans.
- The amount of mixed uses planned for a community wherein parking supply might be shared across uses.
- The degree to which employers subsidize parking and plans to reduce or remove such subsidies.
- The amount and use of commercial and public parking available within the same zone as the parking requirements apply, and the amount of available peripheral parking near the zone.
- The costs and benefits to developers of providing less than the minimum required parking in return for traffic mitigation strategies.
- Availability of transit and other alternatives to employees who will commute to the development, as well as the availability of uncontrolled parking supplies (e.g. neighborhood streets, vacant lots, utility and rail right of ways).

Localities with the best prospects for realizing reductions in auto use through reduced or flexible parking requirements are those where some or all of the following conditions apply: developer and lender preferences or minimum parking codes result in more parking than is utilized; mixed uses are available or planned where parking can be shared; employer subsidies for parking are or will be curtailed or cashed out in the form of travel allowances; nearby commercial and public parking is well utilized (limiting opportunities for parkers to simply shift parking locations as supplies are tightened); the costs of providing parking are high compared to traffic mitigation alternatives; transit capacity is not saturated; uncontrolled supplies are at a minimum or new controls are planned.

Where are the best candidate localities for these strategies? Suburban communities may present one of the best opportunities for reduced minimum parking requirements or new maximum requirements. Supplies in these communities tend to exceed demand. Surveys of suburban office parks show supplies between 3.5 and 4.0 spaces per 1,000 square feet of floor space and surveys of usage in California and Texas found office workers only required about 2.2 spaces per 1,000 square feet. These same communities

may also be sites for new mixed use developments where parking can be shared across uses.

Urban communities may be opportunities for other strategies. Here, the high cost of parking may encourage developers to seek reduced parking in return for traffic mitigation strategies. Or, if parking subsidies are to be reduced or matched by transit subsidies (as through proposed legislation in Los Angeles), parking requirements might be reduced to be more in line with new anticipated parking demand. Zoning codes also can be modified so as to require provisions for bicycle parking and storage. Finally, parking requirements may be reduced in proximity to transit stations where employee transit use may well reduce parking demand.

Examples of Strategies

Portland, OR

Program: The parking code sets a maximum number of parking spaces allowed depending on proximity to transit, with no minimum except for residential uses. Requirements in most areas are 1 space per 1,000 square feet of development, but ranges to a low of 0.7 spaces per 1,000 square feet. The maximum parking requirement has brought both desirable and unexpected results. In accordance with the goals of the maximum policy, many developers have provided parking at or under the allowable level. However, several buildings have provided considerably less than the maximum, raising the issue of whether the maximum is perhaps still set too high. Several developers provide one space per 1,200 square feet where the maximum is one space per 1,000 square feet. Some large projects that are close to transit have provided one space per 2,000 square feet or less. Exceptions include small projects farther from transit where developers provide exactly the maximum allowed.

Results: The City is generally satisfied with its parking policies and believes it has helped maintain high transit usage. As many as 48 percent of commuters into the downtown have used transit in past years, though the proportion fell to 43 percent in 1987. The carpool rate is 17 percent. City managers attribute the decline in transit usage to falling gas prices and some reduction in transit service due to fiscal constraints.(8)

Seattle, WA

Program: Various City policies are set with the intent of discouraging solo driving. The City imposes a maximum requirement of one space per 1,000 square feet. Excess supply above this amount is allowed only through administrative review. Minimum requirements also are established by code and vary by proximity to transit. At least 20 percent of the minimum number of parking spaces that must be provided have to be reserved for carpools. Each carpool space provided (set aside for carpool use from 6:00 a.m. to 9:30 a.m.) above the minimum gains a reduction in parking requirement of 1.9 spaces. The same reduction in parking requirement may be obtained by subsidizing parking rates for carpools by at least 30 percent of monthly market rates. Provision of free transit passes (for at least five years) reduces the parking requirement by fifteen percent.

Results: There have been very few developers opting to reduce minimum parking requirements for additional carpool stalls or transit pass sales. Where there are traffic mitigation programs in effect, the results are mixed. According to City staff conducting recent evaluations of mitigation programs, much seems to depend on proximity to transit, the size of employers, types of employees (clerical versus professional) and parking availability nearby. Successes are found at First Interstate and Seafirst. Failures at One Union Square and Weston.(8)

San Francisco, CA

Program: The City's "Transit First" policy influences both the supply and price of parking. The newest Downtown Plan aims at keeping parking supplies very tight and emphasizes short term parking over long term. There is no code required parking in the downtown area, and only up to seven percent of a building's gross floor area can be devoted to parking. Under the Downtown Plan, new buildings must have an approved parking plan prior to receiving an occupancy permit. In some cases, only short term parking is approved; in another, a mix of long, short and carpool parking was approved. The City has identified potential fringe parking lots for private developers to develop park-and-ride facilities as an alternative to providing parking on site.

Results: For now, no developers have come forth with proposals to implement peripheral parking as a way to beat the high price of providing parking on site, as planners believed might happen. However, City planners are generally satisfied that parking management strategies have helped maintain good transit use and kept auto use to a minimum. Planners indicate there has been no major increase in peak traffic over the past ten years in spite of considerable office growth. Local transit ridership is steady. Ridership on Golden Gate Transit into San Francisco has increased during the past three years after declines in the previous two-year period. A 1983 survey of workers in the downtown showed 60 percent ride transit, 16 percent rideshare and 17 percent drive alone.(8)

Los Angeles, CA

Program: City parking policies are changing to encourage more use of transit and ridesharing. Parking requirements are a minimum of two per 1,000 square feet of development, but a lesser requirement is imposed in the "exception area," the downtown business district. There the minimum requirement is reduced to one space for each 1,000 square feet. The City waives the requirement for property located adjacent to publicly owned parking lots. The City also allows developers to provide up to 75 percent of required parking at remote locations provided. In this case, shuttle or transit service must be provided between the lot and the destination and sufficient open space must be set aside to provide a parking structure to meet full requirements if the City finds it necessary. Another parking policy allows the parking requirement to be reduced by up to 40 percent for specific traffic mitigation programs. Again, sufficient open space must be set aside to meet full requirements if found necessary.

Results: No developers have opted to provide off-site parking as allowed by code. Developers are discouraged by the possibility that additional parking on-site may be

required by the City at a future date depending on the effect of the peripheral parking. Similar problems beset the provision allowing reductions in parking for traffic mitigation measures. City requirements are considered minimal, so there is little incentive to reduce them for any reason; and developers do not like the possibility of providing more on-site parking if mitigation measures fail.(8)

Hartford, CT

Program: Several policies in Hartford aim at encouraging transit, ridesharing and traffic mitigation. The office parking requirement downtown is one space per 1,000 square feet. Parking requirements can be reduced by up to 30 percent for discounted carpool parking, rideshare promotions, subsidized transit passes and shuttle service from off-site parking. Additionally, through administrative review procedures rather than code, the City requires office developers to put new parking underground. The intent is to encourage parking off-site, shuttle service, transit and ridesharing. At its own parking facilities, the City maximizes short term parking and minimizes long term parking.

Results: To date, the Hartford incentive for reduced parking requirements has not been utilized. In particular, there have been no requests for reduced parking requirements since 1984 when reductions were offered for rideshare and transit encouragements. The problem seems to be that developers and lenders believe parking is in very short supply in Hartford and want to provide more than the minimum required. Thus, the possible relaxation in requirements has not turned out to be a meaningful incentive. City encouragements for developer provision of peripheral parking and shuttle systems also have not yet been utilized. City planners hoped developers would provide peripheral parking and shuttles as a result of requirements for underground parking and transportation management programs. Instead, developers lease nearby surface parking where available and provide it to tenants.(8)

Bellevue, WA

Program: In the early 1980's, Bellevue reduced its minimum parking requirement from a range of 3-5 spaces per 1,000 for office use to 2 spaces per 1,000. A flexible minimum also was instituted. Developers were encouraged to reduce the minimum (up to 50 percent) provided they agreed to promote carpooling and transit.

Results: The requirements had unexpected results. Developers requested parking supplies less than the minimum or at the minimum without proposing rideshare programs. Since these codes were put in place, the City has revised requirements downward and has required traffic mitigation measures independent of parking requirement policies.(17)

Chicago, IL

Program: The City offers a 10 percent reduction in the amount of required parking for buildings with direct connection to underground transit stations. A 15 percent reduction is granted for providing underground pedestrian circulation. Developers often take advantage of the transit-related reduction, but do not often take advantage of the 15 percent reduction for pedestrian circulation claiming it is too expensive to do so. Overall effects on transit ridership have not been evaluated.(21)

Orlando, FL

Program: Under the 1982 downtown "parking district overlay ordinance," a developer could avoid construction of up to 20 percent of required parking in exchange for contributions to a transportation management trust fund. Contributions were based on 80 percent of the construction cost of parking stalls not built.

Results: No contributions had been made to the trust fund as of 1986. Developers and lenders claimed it was important to provide at least the minimum required parking to stay competitive in the office market place.(7)

Cost and Financial Implications

Implementation of new parking maximums and flexible parking requirements will have cost and financial implications for both the public and private sector. For the public sector, there will be only minimal cost implications of reduced minimum or maximum parking requirements. In this case, the same review of developer project proposals must take place as previously. However, flexible requirements will require more administrative review of proposed traffic mitigation strategies and plans. Plans must be reviewed as to probable effectiveness of proposed strategies and commitment on the part of developers to carry out actions. In addition, some additional costs may be incurred to enforce undesired spill-over of parking to nearby on-street locations. Finally, as nearly all the cases reviewed suggest, localities should devote resources to monitoring flexible requirement programs as the approach by no means brings assured results. Key variables to monitor include:

- The proportion of developers taking advantage of reductions;
- Compliance with requirements to implement the traffic mitigation strategies; and
- Effects of such strategies as designated carpool stalls, transit pass sales, on-site transportation coordinators and others.

For the private sector, cost implications are greater. On the one hand, if and where developers provide less parking due to new minimums, maximums or flexible requirements, there will be cost savings in parking spaces provided. The savings vary with the price of parking construction and operation in localities. A recent evaluation of costs and benefits of employer traffic mitigation programs and reduced parking requirements in King County ("King County Transportation Management Ordinance Cost Benefit Analysis, Technical Memorandum, Task 4," July, 1990, K.T. Analytics, Inc. and TDA Inc.) estimated savings in construction costs for structural lots at \$4,200 per space and annual operation and maintenance at \$200 per year.

The cost side for the private sector depends on the intensity of the traffic mitigation program put in place. A few bike racks, new bus pad, lobby display for promotion of transit and carpooling might cost only a few thousand dollars in one time costs. The cost of securing and staffing existing lots, if necessary, together with the enforcement of

new requirements can be more significant. An on-site coordinator, regular personalized carpool matching on-site, regular surveying of employees and reporting to a locality may entail an expenditure of several thousand dollars per year. One recent review of employer-based traffic mitigation programs at suburban sites found a range of annual costs up to \$50 per employee for the most extensive programs. The most extensive programs involved shuttle systems. More typically, costs range from \$5 to \$20 per employee.(1)

Implementation Requirements

The zoning examples reviewed suggest several implications regarding implementation of parking policies. Certainly one lesson is cities have a difficult time setting parking requirements in support of policy objectives. For example, Portland's maximum is set sufficiently high that many developers provide less than the maximum. Several cities have provided for optional relaxations in parking requirements for various purposes (support of peripheral parking, ridesharing and transit encouragements, in lieu funds) only to find developers not taking advantage of relaxations. Los Angeles, Hartford, Seattle, Bellevue and Orlando all provide examples.

The difficulties of setting maximums, minimums or relaxations so as to serve public purposes are understandable. Knowing what developers and lenders prefer to provide in the way of parking supply and setting requirement policy accordingly is not a simple task. Even if planners are able to determine the market demand and supply levels at any one time and place, the demand/supply equation is constantly varying due to everything from the state of the economy to the price of gasoline to the level of transit service.

Another conclusion is that limited and costly parking certainly appears to be associated with the highest transit use. San Francisco with the most expensive and least parking downtown compared to the number of employees shows the highest transit share (60 percent). Portland and Seattle come in next (43 and 45 percent respectively), as do their average parking prices and relatively tight supplies. The anomaly is Hartford with tight and expensive parking, but a relatively low transit share (20 percent). Perhaps the result can be explained by the relatively high rideshare rate in Hartford, 22 percent.

Based on these findings, the following guidelines for localities are suggested:

1. While the relationship between parking supply and use of alternatives to solo driving is complex, the evidence suggests tight supplies and higher prices are associated with higher use of transit and ridesharing. Consequently, localities are advised to keep parking on the tight side compared to demand in pursuit of the goal of increased transit and ridesharing for improved air quality. In some cases, this may mean allowing the market alone to determine parking requirements. Local developers and lenders left to their own may prefer to provide limited parking.

However, if the market provides ample parking (as appears the case in many suburban areas) and if prices are relatively low, then local governments may wish to intervene through parking requirement policies.

2. Localities should use maximums, reduced minimums and flexible parking requirements as supporting policies to other more direct traffic mitigation actions. If support of ridesharing, or transit is desired, it probably should be required directly (e.g. through ordinances or developer agreements) rather than tied to optional reductions in requirements. It is important, therefore to carefully consider the level of available transit service in developing a new parking management program. Likewise, any plans for fringe park-and-ride probably should not be tied to in-lieu financing as anticipated funding may not develop. The main role of parking requirements is to insure parking supplies are not overly ample so as to support other direct requirements for traffic mitigation. In this light, minimums and maximums should be set on the low side of estimated demand. Flexible requirements should allow for reductions only where other policies (e.g. demand management ordinances) require traffic mitigation actions. Flexible requirements then become an incentive and support mechanism rather than the main vehicle for encouraging traffic mitigation.
3. Maximum or minimum requirements should be set only after careful assessment of what developers and lenders perceive as the parking market. There always will be some developers who will provide much less than the maximum or much more than the minimum. Planners should be prepared to constantly monitor the parking demand and supply market, and adjust requirements over time by zones within urban and suburban areas.
4. Given the experience of cities in regulating supply through code provisions, localities should proceed step by step and evaluate policies along the way. One approach to consider might be a maximum requirement in the immediate vicinity of transit corridors and major terminals. Again, the maximum must be set after careful market assessment and should be periodically reviewed.
5. Implementing parking management policies in existing localities and developments requires consideration of complex dimensions. In addition to the above recommendations, other issues such as the desired utilization of existing parking infrastructure must be considered in order to develop workable policies.

■ Control of Parking Supply

Local government also can control the total number of parking spaces that are available within a given area, such as a downtown, and thereby influence the number of automobile drivers that will be attracted to the area. Most cities require a minimum number of parking spaces be constructed per thousand square feet of new development and

have no ceiling on the total number of parking spaces that are built in the downtown. As one means of limiting congestion and air pollution, these policies can be revised so as to encourage travelers to a center of major vehicle activity to use modes other than driving alone. One way of managing the parking supply is through zoning requirements. Another method is to limit the total number of parking spaces. A parking freeze is a limit that has already been reached, whereas a maximum ceiling is a specified limit that allows growth. A ceiling can be defined in either absolute or relative terms, incorporating a flexibility to respond to future development conditions.

While limiting the number of available parking spaces can achieve transportation and air quality goals, this strategy if not sensitively designed may be in conflict with other goals for the downtown. It may be perceived as a factor that will limit future new development in the downtown, because developers will be skeptical about whether they can lease a building that does not provide adequate parking. Downtown merchants may also be concerned that a limit on parking may serve to decrease the number of short-term parking spaces that are available, and therefore reduce the relative attractiveness of shopping in the downtown as compared to suburban shopping malls.

Examples of Strategies

Three examples of cities that have a number of years of experience with parking limitations are summarized below.

San Francisco, CA

Any new long-term parking facilities in the downtown core should be limited to the number of spaces needed to replace parking previously eliminated. This policy was put into effect so that the number of parking spaces in existence in 1984 became a ceiling. This policy does not directly restrict development because there are no parking requirements for new developments in the downtown, and a maximum for a given development has been set. San Francisco has three zones in its downtown area: the downtown core, the short-term parking belt, and the peripheral zone. The overall goal is to encourage travelers to the downtown area to use transit and, if necessary, to locate new commuter parking in the peripheral zone. It appears that San Francisco has been successful in achieving this goal. Between 1977 and 1985, San Francisco experienced its heaviest period of growth, with approximately twenty-five million square feet of new development in the downtown. The number of parking spaces only increased by approximately 1200 spaces during this same period and the traffic volume on the major corridors has not increased by a great deal. During this same period, San Francisco has had a large increase in transit capacity due to the completion of the regional rail system, BART, and there has been a large increase in transit ridership to accommodate the growth.

Portland, OR

In 1975, the City of Portland adopted its Downtown Parking and Circulation Policy (DPCP), which has been updated several times. The DPCP has been incorporated into the State of Oregon's State Implementation Plan. The key elements of the plan include:

- Preference for public transit over private automobile transport;
- A ceiling on the total number of parking spaces in the downtown; and
- Ratios used to allocate parking to new development.

A total of 43,914 spaces are allowed in downtown Portland; this ceiling includes all parking spaces except those devoted to residential use and lodging. As of October 1988, there were 39,761 non-exempt spaces. In order to continue adding parking spaces for new development in a controlled way, parking is not required for non-residential development and a maximum is set on the number of spaces that is allowed for new development. This maximum is typically one parking space per 1,000 square feet, but ranges from 0.7 to 1.5 spaces to 1,000 square feet. Portland also has excellent transit service, both bus and light rail, to the downtown, which provides an accessible alternative to driving an automobile.

Boston, MA

The Boston Air Pollution Control Commission is responsible for the administration of the parking freeze in the City of Boston, which has been in effect since 1977. The parking controls only apply to commercial parking and do not apply to those parking spaces reserved for particular individuals or for a company, i.e., monthly parking. The maximum number of commercial parking spaces has been frozen at the number that existed in 1973, that is, 35,503 spaces. New parking spaces can only be constructed if old spaces have been eliminated. As of 1979, this policy led to a net reduction of 242 commercial spaces. While the number of commercial parking spaces has not increased, there has been a twenty-six percent increase in private, exempt parking spaces between 1984 and 1987. In addition, traffic has increased dramatically along the major corridors.

Costs and Other Important Impacts

The costs associated with implementing a parking freeze or ceiling are those incurred in administering the policy through the permitting process for new development and in surveying the downtown on a regular basis to keep track of the number of parking spaces that exist at any given time. In none of the examples described above have the costs for implementing this policy been tracked separately and quantified.

The primary impact that a parking freeze or ceiling could have aside from the transportation-related and air quality impacts is on new development in the downtown. Developers could view the parking freeze as either an opportunity to avoid using expensive real estate for parking purposes or as a barrier to attracting tenants who

require more parking than is provided. The more expensive the land is in the area with the parking freeze or ceiling, the more likely the developers will view it in a positive way.

Implementation Requirements

Implementing a parking freeze or ceiling is an example of a very aggressive parking management program that is most likely to be successful and accepted in highly developed areas where congestion and parking are major issues. The area should be densely developed, with very high land values and a strong economic development climate that result in disincentives for devoting land to parking. Relatively good transit access that provides an alternative to driving alone is also required. In addition, as illustrated by the Boston example, a parking freeze or ceiling should be applied to all non-residential development in order to increase effectiveness.

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