

Overview of Implemented Parking Management Tactics

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The operating characteristics of parking management tactics that are being used by a variety of jurisdictions throughout the United States are identified and reviewed. The assessment is based on an extensive literature review, followed by telephone interviews and on-site investigations. Six categories of parking management tactics are identified: (a) on-street supply, (b) off-street supply in activity centers, (c) pricing, (d) enforcement and adjudication, (e) fringe and corridor parking, and (f) marketing tactics. These tactics are generally part of the overall transportation system management plan to meet local transportation, economic, and environmental goals. The tactics reviewed include policies that offer incentives for multi-occupant-automobile travel and short-term parking for shoppers. Disincentives such as parking tax surcharges are also evaluated. The first four categories of tactics are discussed in detail.

A number of reports and articles have been published on the general topic of transportation system management (TSM) and related tactics. However, relatively little information is available on the types and effectiveness of parking management tactics that have been and are being implemented by local governments in many parts of the nation. In response to this need for information, the Federal Highway Administration (FHWA) is funding a comprehensive study of parking management (1). This paper, which uses information and analyses from that study, has the following specific objectives: (a) to identify the types of parking management tactics in use in selected jurisdictions and (b) to discuss the operational characteristics and impacts of such parking management tactics. The jurisdictions discussed here are considered to have parking management tactics and programs that are among the most comprehensive, ambitious, and (in some instances) innovative ones currently in use.

The information and data used to describe implemented parking management tactics were compiled from three sources:

1. An extensive review of available literature on parking management was performed to describe the tactics and jurisdictions of interest. A particularly valuable source of information was a national survey of parking management activities conducted in 1977 by the Virginia Highway and Transportation Research Council (2).

2. Many telephone interviews were conducted to verify available information and to obtain additional information on parking management tactics implemented by local governments. The jurisdictions contacted were asked to provide reports, ordinances, and related materials describing their parking management tactics.

3. Jurisdictions that have particularly comprehensive and innovative tactics were the subject of on-site investigations. A total of 13 communities were visited to obtain first-hand information on their parking management activities.

PARKING MANAGEMENT

Although the term parking management is widely used in transportation planning and traffic engineering, a generally accepted definition of the term has not been developed. To many planners, engineers, elected officials, and others, parking management tactics appear to be viewed primarily as disincentives or restrictive actions intended to (a) discourage automobile travel, particularly travel by single-occupant automobiles; (b) control or reduce the

supply of parking; or (c) increase parking rates. This perception may be related to the parking management controls that gained widespread attention in the early 1970s through the promulgation of transportation control plans by the U.S. Environmental Protection Agency (EPA) for urban areas that did not meet air quality standards. This "restrictive" perception of parking management is only one aspect of such tactics and, in fact, is not consistent with the application of parking management tactics by many jurisdictions.

Simply stated, parking management tactics are actions taken to alter the supply, operation, and/or parking demand of a jurisdiction's parking system to further the attainment of local transportation, economic, environmental, and other objectives. A parking management program is an integrated set of parking management tactics designed to further the attainment of local objectives. For example, a parking management program could include a marketing program, strict enforcement of on-street parking regulations, construction of fringe parking facilities, and a residential parking-permit program.

It is important to note that a jurisdiction's parking management program may not be documented in a single, fully integrated planning study or policy statement. Nevertheless, for the purposes of this research, such combinations of tactics are considered parking management programs.

A key element of the above definition is the link between a parking tactic and the objectives of a jurisdiction. In some communities, parking management tactics and programs have been implemented to reduce or constrain automobile traffic and alleviate its negative impacts. In other communities, the tactics and programs are intended to encourage nonwork travel (e.g., travel by shoppers and tourists) to central business districts (CBDs) as a means of promoting economic growth. Some jurisdictions have used such tactics and programs to promote more efficient use of their existing parking facilities. Generally, many of these factors are of concern to local governments in planning, implementing, and operating a parking management program.

The above definition of parking management tactics is consistent with the broader concept of TSM, which includes both incentives and disincentives to encourage the efficient use of the existing transportation system and applicable local and regional objectives.

TYPES OF PARKING MANAGEMENT TACTICS

In order to focus the analysis, six categories of parking management tactics were identified:

1. On-street parking supply,
2. Off-street parking supply in activity centers,
3. Fringe and corridor parking,
4. Pricing,
5. Enforcement and adjudication, and
6. Marketing.

Specific tactics within these categories are described later in this paper.

STATE OF THE ART IN PARKING MANAGEMENT

Overview of Parking Management Tactics and Programs

This analysis examined parking management tactics

and programs in 20 communities: Alexandria and Arlington, Virginia; Baltimore and Montgomery County, Maryland; Boston and Cambridge, Massachusetts; Eugene and Portland, Oregon; Chicago, Illinois; Hartford, Connecticut; Honolulu, Hawaii; Madison and Milwaukee, Wisconsin; Seattle, Washington; St. Paul, Minnesota; Los Angeles, Palo Alto, and San Francisco, California; Washington, D.C.; and Vancouver, British Columbia.

Figure 1 identifies the parking management tactics used or under serious consideration by each of the 20 jurisdictions and details the various types of tactics that fall under the six broad categories of parking management tactics previously cited. The jurisdictions that have the most ambitious parking management programs are Baltimore; Boston; Montgomery County, Maryland; Portland; San Francisco; Seattle; and Washington, D.C. Each of these jurisdictions has implemented multiple tactics that generally cover each of the six categories of tactics cited.

On-Street Parking Supply

Our survey revealed that residential parking-permit programs (RPPPs) were the most widespread form of innovative on-street parking tactics. Some communities have operated RPPPs for more than five years, and it appears that many more areas will be giving serious consideration to the prohibition of nonresident parking. Another on-street tactic that is receiving attention is the policy of reserved parking spaces for carpools. Both of these tactics are described below.

Residential Parking-Permit Programs

Description

RPPPs were first initiated in the early 1970s and have become an increasingly popular method of preventing long-term parking by commuters in residential neighborhoods that are close to employment centers. The initiation of these programs was marked by numerous lawsuits that alleged unconstitutional discrimination between residents and nonresidents of such neighborhood areas. In 1977, however, the U.S. Supreme Court upheld the constitutionality of RPPPs, and it appears that many communities will be using this tactic in the near future (in addition to existing programs).

RPPPs are typically implemented to control the excess parking demand created by persons who live outside a neighborhood but park their vehicles there in order to shop, work, or attend school nearby. Major parking generators that have led to the use of RPPPs include employment centers, universities, hospitals, retail trade centers, and transit terminals.

Planning and Implementation

Planning responsibilities for an RPPP are usually vested in the city planning agency or traffic engineering department, depending on which agency is historically responsible for local parking management. In several communities, the planning function was transferred from the planning department to the traffic department after the overall program design was established and an ordinance providing for the creation of additional RPPP districts was passed. Although some communities have enacted ordinances that allow the city government to implement RPPPs at their administrative discretion (or based on criteria specified in the ordinance), other cities, such as Washington, D.C., and San Francisco, require

the mayor and/or the city council to approve each petition for an RPPP in a particular neighborhood.

With the exception of the citywide RPPP in Cambridge, Massachusetts, RPPPs have been implemented in specific neighborhoods or subareas within cities because of the local nature of the parking problems that RPPPs are designed to address.

Almost all of the ordinances that cities have adopted for creating residential parking-permit zones require occupancy counts before an area can be designated for permit parking. These ordinances typically contain usage criteria that must be met by a neighborhood or a district if it is to be eligible for an RPPP. The criteria generally require that a traffic survey conducted during peak parking periods reveal 75 percent overall use of available parking space and at least 15 percent nonresident use (these criteria vary by locale and range from 50 to 80 percent for overall occupancy and from 10 to 50 percent for nonresident occupancy).

Restrictions on nonresident parking range from complete prohibition to limited parking privileges. Some communities, such as Alexandria, Virginia, and Boston, permit nonresidents to park for 2 or 3 h during the time the RPPP is in effect. Communities that allow nonresident parking for limited periods are frequently trying to preserve short-term parking opportunities for shoppers and business clients while preventing long-term nonresident parking. A limitation of this approach is the increased level of enforcement required to monitor the duration of nonresident parking. If nonresident parking is allowed for as long as 3 or 4 h, commuters may try to circumvent the policy by moving their cars from one location to another within the zone during the day.

Costs

Start-up costs for RPPPs depend on the scale of the program and the administrative procedures adopted to implement it. The city of San Francisco allocated \$65 000 in its last budget to cover the costs of one full-time staff engineer, one part-time supervising engineer, and two technicians assigned to the RPPP. Material costs were about \$65/sign (installed) plus printing costs for designation materials and permits. San Francisco has three relatively large RPPP districts in operation and plans to implement 15-20 additional districts in the next few years. Alexandria, Virginia, on the other hand, implemented a much smaller RPPP (about 55 block faces in two districts) for about \$13 000. These start-up costs included signing, registration materials, and permits and a part-time administrative assistant to distribute the permits. Implementation of a 70-block-face RPPP in Montgomery County, Maryland, cost approximately \$4000 for personnel and \$2955 for sign fabrication and installation.

In Washington, D.C., the District of Columbia Department of Transportation (DOT) estimated annual costs for a typical 100-block RPPP zone as follows:

<u>Item</u>	<u>Cost (\$)</u>
Signs, labor, and materials (annualized)	5 000
Administration, computer support, and overhead	5 000
Clerical staff to issue permits and maintain records	3 000
Printing of permits and purchase of supplies	2 000
Total	15 000

The city DOT projects permit sales for the area to be 3000 permits at \$5 each for total revenues of

Figure 1. Parking management tactics in use by or proposed for 20 selected jurisdictions.

Parking Management Tactics	Jurisdiction																			
	Alexandria, Va.	Arlington, Va.	Baltimore	Boston	Cambridge, Ma.	Chicago	Eugene, Ore.	Hartford, Conn.	Honolulu	Los Angeles	Madison	Milwaukee	Montgomery County, Md.	Palo Alto, Calif.	Portland, Ore.	St. Paul, Minn.	San Francisco	Seattle	Vancouver, B.C.	Washington, D.C.
On-Street Supply																				
Residential Parking Permit Program (RPPP)	●	●	●	●	●	●						●	●	○			●	●	●	●
Carpool/Vanpool Preferential Parking															●			●		
Institutional TSM Plans																	●	●		
Off-Street Supply in Activity Centers																				
Expand or Restrict Supply in CBD and Activity Centers																				
Zoning Requirements																				
— Maximum and No Minimum Parking Requirements										○			●	●	●		●	●		
— Joint Use										○			●	●	●		●	●		
Constrain Normal Growth in Supply																				
— Maximum Ceiling (i.e., Freeze) on CBD Supply				●						○			●	●	●					
— Reduced Minimum Parking Requirements Through HOV and Transit Incentives		●				●				○			●	●	●					
— Restrict Principal Use Parking Facilities						●						●	●	●			●	●		
Construct New Municipally-Owned Parking																				
— CBD				●								●	●	●			●	●		
— Neighborhood Shopping Districts				●								●	●	●			●	●		
Carpool/Vanpool Preferential Parking	●		●	●			●			○		●	●	●			●	●		
Fringe and Corridor Parking																				
Fringe Lots																				
Park and Ride Lots			●				●								○		●	●		
Carpool/Vanpool Lots			●				●										●	●		●
Pricing																				
Increase Parking Rates																				
Differential Pricing Programs																				
— Rates Favor Short-Term Parker									●		○		●	●	●	●	●	●		
— Geographical Rate Differentials									●			●	●	●	●	●	●	●		
— Carpools/Vanpools												●	●	●	●	●	●	●		
Free Downtown Parking							●									●				
Parking Tax																	●	●		●
Surcharge on Parkers Arriving During "Prime Time" (i.e., 6:30 - 9:30 am)											○									●
Enforcement and Adjudication																				
● Aggressive Ticketing				●	●		●					●			●		●		●	●
● Booting				●	●														●	●
● Towing				●	●														●	●
● Administrative Adjudication																				●
● HOV Enforcement			●										●		●			●		●
Marketing																				
Monthly Parking Convenience Stickers																				
Advertising (Media Ads, Brochures, Maps)							●		●			●	●	●						

○ Increase Rates For City Employees

Key:
 ● - Implemented
 ○ - Planned

\$15 000. These estimates do not include the costs or revenues associated with program enforcement.

Impacts

Without exception, communities that have implemented RPPPs feel that the parking problems they hoped to correct were substantially or completely resolved. Usage studies conducted before and after the implementation of RPPPs in Washington, D.C., and San Francisco suggest the magnitude of the impacts generated by RPPPs.

The San Francisco Division of Traffic Engineering conducted a parking survey of RPPP area A in the fall of 1976. The survey discovered that, with 4191 legal on-street parking spaces, there were 4320 vehicles parked at 1:00 p.m., an occupancy rate of 102 percent. Fifty-two percent of all parking was composed of commuter vehicles. In October 1978, after the RPPP was implemented, another survey was conducted in which an overall occupancy of 94 percent was recorded and 35 percent of the parked vehicles lacked resident stickers (2-h nonresident parking is permitted in area A). A postcard survey of residents of area A conducted at the same time indicated that 74 percent of the respondents favored the continuance of the program (based on a 29 percent return).

The District of Columbia DOT conducted before-and-after surveys for the two permit areas of Friendship Heights and Georgetown. In Friendship Heights, parking-space occupancy fell from 96 to 42 percent. Because of the large number of illegal parkers, occupancy in Georgetown decreased from 109 to 91 percent. Both of these studies were based on the number of legal spaces in the area.

Preferential Parking for Carpools

Description

Portland, Oregon, and Seattle have implemented on-street parking programs for carpoolers. Basically, these programs allow participants to park downtown all day at specific metered locations, for relatively small monthly fees, by displaying permits that they have purchased. The objective of the program is to increase high-occupancy-vehicle (HOV) travel.

The two programs differ in several respects. In Portland, carpoolers purchase \$15 monthly permits that allow them to park at any of the 2615 specified meters. Other parkers may also use these spaces, but carpoolers are exempted from the 6-h parking limit and do not have to pay the meters. Essentially, the Portland permit is a "license to hunt" for a space. The incentives are monetary savings and relief from the 6-h parking limit. The city of Portland issues a maximum of 500 permits/month.

The Seattle program reserves 164 specified spaces for carpoolers between 7:00 and 9:00 a.m., after which time the spaces become available to the general public. Spaces are not assigned to individual carpools but, since the program has issued only 193 permits, carpoolers can reasonably expect to find a space in the morning. The monthly fee is \$5, and the carpool does not pay the meter.

Carpools are defined in both programs as groups of three or more people. One transferable permit is issued for each valid carpool application. Both Seattle and Portland carefully check and verify the information provided on applications. Workplace and location of residence are scrutinized as a further check. The permits are renewed either monthly or quarterly, and random checks are made to ensure that

the carpool information furnished is still valid.

Portland's expenditures between September 1977 and February 1978 for the 288 carpool permits sold were \$7564. Total costs for program promotion and application processing and verification were \$4827, and total materials costs were \$2736.

Impacts

Average vehicle occupancy for participants in the Portland program is 3.3 persons, and in Seattle the average is 3.18 persons. A survey of participants in the Portland carpool program produced the following results:

1. Of the 58 percent of the respondents who were new carpoolers, half were former bus riders and half formerly drove with fewer than three riders;
2. Forty percent were already in three-person carpools; and
3. Cost saving was the primary reason for becoming involved in the program.

These results indicate that about two-thirds of the people subscribing to the Portland program were already carpooling or previously used transit.

Off-Street Parking Supply in Activity Centers

Description

Table 1 summarizes the off-street parking management tactics used by the communities studied and identifies the responsible agency, area of application, operating characteristics, degree of compliance, and the impacts of the tactics. The following discussion reviews the planning, implementation, operation, and impacts of these off-street parking management tactics.

The cities of Portland, San Francisco, and Seattle are using development controls to restrict the growth of CBD parking supply. They have combined a "no-minimum" parking requirement with a low maximum parking limit to discourage increased parking construction. At 1 space/1000 ft², the limits in Portland and Seattle are comparable with those in most areas (Table 1). The San Francisco limit of 7 percent of the gross floor area translates to approximately 75 parking spaces for the average downtown high-rise development, according to local officials. The application of these zoning regulations occurs in the development review process. In Seattle, state environmental protection laws require the filing of an environmental impact statement (EIS) for new CBD developments. This step may increase development time and cost but gives the community more opportunity for comment.

The three examples of joint use of parking facilities in Table 1 are really a mixture of zoning and administrative actions. The proposed Los Angeles and existing Portland and Palo Alto codes allow developers to jointly use a parking facility to meet zoning requirements. In Los Angeles and Palo Alto, joint use is allowed only if the demand patterns do not conflict (e.g., daytime and nighttime use). Portland allows the pooling of spaces in one structure. Portland recently reached an agreement with a developer to increase the number of short-term spaces in an adjacent city garage to help meet the projected parking-supply requirements of the development. Finally, Montgomery County leases excess capacity in a public garage to a local college. If existing county-owned facilities are underused, joint use allows the county to increase facility use without increasing parking supply.

The two examples of maximum-supply ceilings given

in Table 1 are significantly different. Boston has frozen the total number of commercial spaces, and the ceiling does not affect free employee or customer spaces. The Portland ceiling places a limit on the total number of parking spaces in the CBD, including on-street, off-street, municipal, and private spaces. Further, the Portland CBD is divided

into sectors for the allocation of spaces. The Boston program is part of the air quality improvement plan, and parking space permits are issued by the Boston Air Pollution Control Commission. Although the ceiling in Portland is also partly an air quality measure, the program is enforced by the Portland Planning Commission as part

Table 1. Characteristics of various parking management tactics for off-street parking supply.

Tactic	Jurisdiction	Agency	Area	Operating Characteristics	Enforcement	Impact	
Expand or restrict parking supply in CBD and activity centers	Maximum and no minimum parking requirements	Portland, OR	Planning Commission	CBD	Maximum allowed parking for retail or office development = 1 space/1000 ft ²	Development review process	In conjunction with other tactics has resulted in 1 space/1350 ft ² for new developments
		San Francisco	City Planning Commission	CBD	Parking limited to 7 percent of gross floor area	Development review process	Moderate growth in private off-street parking versus high growth in downtown office and retail space
		Seattle	Department of Buildings	CBD	Depending on zone and use, range in maximum allowed parking = 1 space/1000 ft ² to 1 space/2000 ft ²	EIS review	Parking supply increasing in areas farther from retail core and decreasing closer in
Joint use	Los Angeles	Planning Commission	Entire city	Would allow developments within 1500 ft to share parking if demand patterns do not conflict	Land covenant; performance bond	Proposed action	
	Montgomery County, MD	Division of Parking	Suburban CBDs	Spaces rented by local college for use by students	Parking patrol checks for valid stickers	Impacts of student parking reduced	
	Portland, OR	Planning Commission	CBD	City has agreed to increase number of short-term spaces in city garage if developer reduces number of off-street spaces provided; code allows developers to share parking	Development review process	Development under construction	
Constrain normal growth in supply	Palo Alto	Department of Planning and Community Environment	Entire city	Reductions of up to 20 percent allowed for developers without conflicting demand patterns	Development review process	—	
Maximum ceiling (i.e., freeze) on CBD supply	Boston	Air Pollution Control Commission	CBD	Limit on total number of allowable commercial spaces; freeze does not apply to free employee and customer parking	Development review process	Development not hindered	
	Portland, OR	Planning Commission	CBD	Limit on total number of allowable parking spaces by sector	Development review process	Ceiling not reached; parking in desired sectors encouraged; development not hindered	
Reduced minimum parking requirements through HOV and transit incentives	Arlington, VA	Zoning Administration	Entire county	Developers located near rail rapid transit station may provide approximately 70 percent of required parking	Development review process	Should reduce commuter parking impacts	
	Chicago	Zoning Administration	CBD	Required parking reduced if developer meets certain conditions concerning transit stations	Development review process	1000 fewer spaces in CBD since 1975; 110-story building (Sears Tower) constructed with 150 spaces	
	Los Angeles	Planning Commission	Entire city	Parking requirements would be reduced if developer provides HOV and transit incentives; developer would be allowed to substitute on-site spaces for off-site park-and-ride spaces; developer would be able to reduce required parking by 1.5 spaces for each space reserved for HOVs	Land covenant; development review process; developer would contribute money for park-and-ride facility development and transit shuttle services	Proposed actions	
Reduced minimum parking requirements through HOV and transit incentives	Palo Alto	Department of Planning and Community Environment	Entire city	Up to 20 percent reduction in required parking allowed if transit and HOV incentives are used	Development review process; legal agreements	Agreement by several new developments to institute HOV incentives	
	Chicago	Zoning Administration	CBD	Construction of principal-use parking facilities prohibited	Development review process	1000 fewer parking spaces since 1975; increase in number of long-term parkers	
Restrict principal-use parking facilities	San Francisco	Planning Commission	CBD	Conditional use review of new principal-use parking facilities required	Development review process	—	
	Seattle	Department of Buildings	CBD	New parking lots prohibited; new parking structures prohibited in most of CBD	Development review process	No new principal-use facilities built since 1976; economics a major factor	

Table 1 continued.

Tactic	Jurisdiction	Agency	Area	Operating Characteristics	Enforcement	Impact
Construct new municipally owned parking facilities CBD	Baltimore	City	CBD	New facilities for tourists and shoppers in Capital Improvement Plan	NA	Facilities planned and under construction
	Montgomery County, MD	Division of Parking	Suburban CBDs	New parking structures constructed to meet long- and short-term demand	NA	Employers and shoppers encouraged to work and shop in suburban CBDs
	Portland, OR	Downtown Development Commission	Retail core of CBD	Recently completed 492-space garage, 752-space garage under construction; designed for short-term use only; \$0.60/h merchant stamp program	NA	Merchants pleased by increased supply of short-term parking
Neighborhood shopping districts	Los Angeles	City DOT	Various neighborhoods	More than 7000 spaces in more than 100 facilities provided	NA	Attractiveness of shopping districts increased
	San Francisco	Parking Authority	Various neighborhoods	Program begun to increase number of available short-term spaces	NA	Merchants supportive; less impact on surrounding neighborhoods
Preferential parking for carpools and vanpools	Alexandria, VA	City	CBD	Spaces reserved for ≥3-person city employee carpools; city vehicles available to carpools	Applications cross checked	15 pools in program
	Los Angeles	City	At city facilities	Free reserved spaces for city employees proposed	—	Proposed action
	Montgomery County, MD	Division of Parking	Suburban CBDs	55 spaces reserved for ≥3-person carpools at \$16/month versus normal fee of \$24/month	Vehicles must arrive with >3 occupants	48 pools in program

of the development review process.

Both Arlington, Virginia, and Chicago allow developers to reduce the amount of required parking if certain transit-related conditions are met. For example, developments located near Metrorail stations in Arlington have lower parking requirements than comparable developments located elsewhere in the county.

The proposed Los Angeles and existing Palo Alto zoning codes provide for reduced parking in exchange for developer-funded HOV and transit service incentives. The Los Angeles plan would allow substitution of on-site spaces for the development of off-site park-and-ride facilities and reductions in on-site spaces for dedicated HOV spaces and various mixtures of transit and HOV incentives. Palo Alto zoning codes allow developers to reduce total parking requirements by creating transit and HOV incentives. How to ensure the continued operation of HOV incentives and transit services offered by a developer is of concern to officials in Los Angeles. They have indicated that land covenants may be the most effective way of ensuring the long-term continuation of incentives at several new projects.

Chicago, San Francisco, and Seattle have implemented restrictions on the development of "principal-use" parking facilities. Both Chicago and Seattle have prohibited the development of principal-use parking facilities in all or most of their CBDs. In San Francisco, proposed new principal-use parking facilities must undergo a conditional use review.

Municipalities such as Baltimore, Montgomery County, and Portland are building new parking facilities in CBD locations, whereas Los Angeles and San Francisco are expanding parking supply in neighborhood shopping districts. In Baltimore, Portland, Los Angeles, and San Francisco, the parking facilities are intended primarily for short-term parking. Montgomery County is planning and constructing facilities for both short- and long-term parking. In the new municipal parking facilities in Portland,

the first level is dedicated to commercial and retail use.

Alexandria and Montgomery County are examples of communities that are reserving parking spaces in municipal parking facilities for carpools of three or more persons. However, it should be noted that the number of spaces involved in each jurisdiction is relatively small. Los Angeles has proposed to provide free reserved spaces in city parking facilities for city employees in carpools.

Impacts

The most comprehensive applications of parking management tactics involving off-street zoning and parking-supply constraints have occurred in Chicago, Portland, San Francisco, and Seattle. In all four of these cases, the growth of parking supply has been restricted. Supply in Chicago and Seattle has decreased by approximately 1000 spaces over the last several years.

Improvements in transit service in Portland and Seattle have resulted in increased ridership. Average daily transit ridership in Portland increased from 145 000 in 1975 to 180 000 in 1978. Air quality in Portland and Seattle has also improved. In all four cities, development of new commercial spaces has continued despite these restrictions. On the negative side, Chicago has experienced an increase in long-term parking, which implies a decrease in available short-term spaces. The Chicago CBD's share of regional retail sales has also declined from 66 to 58 percent during this time period. The lack of convenient, short-term parking spaces may have contributed somewhat to the decline. Merchants in downtown Seattle have also expressed this concern.

Pricing Tactics

Description

The review of pricing tactics for parking management indicated that the implemented tactics could be

categorized as follows: (a) general increases in parking rates, (b) preferential parking rates for short-term parkers, (c) preferential parking rates for carpools and vanpools, (d) parking taxes, and (e) other selected tactics, such as merchant parking validation programs and the elimination of monthly parking contracts. Montgomery County, Portland, and San Francisco have implemented multiple pricing tactics to reinforce and complement their other parking management and TSM tactics.

Preferential parking rates for HOVs are significantly less than the typical monthly parking rate for long-term parking. In Montgomery County, the monthly carpool sticker costs only \$16 whereas the standard parking sticker costs \$24. In Seattle, the \$5 monthly cost for an HOV on-street parking permit is dramatically below the comparable long-term monthly meter rate of approximately \$39. The same situation is found in Portland. In an effort to promote vanpools, the California Department of Transportation (Caltrans) instituted \$10 monthly parking rates (the standard monthly rate was \$60) for vanpools that used designated public parking facilities located under freeways adjacent to the San Francisco CBD.

Eugene, Oregon, and St. Paul each offer free downtown short-term parking in municipal parking facilities. The Eugene program involves 3000 spaces and is funded by a complex set of taxes on downtown businesses and professional people. Employees who work in the parking district are prohibited from parking there between 9:00 a.m. and 6:00 p.m. each weekday unless they have a monthly sticker. A limited number of monthly parking stickers are available to employees for \$16/month. Only employees who have valid stickers are exempt from the parking ban.

St. Paul recently developed a plan for the CBD that includes reduced parking rates for short-term parkers and increased rates for long-term parkers. The city is planning fringe parking facilities in conjunction with its proposed downtown people-mover system.

Considerable discussion in the TSM literature has been devoted to the potential benefits of employers not subsidizing employee parking. Increased parking rates are expected to promote transit ridership and the formation of carpools and vanpools and to reduce congestion, air pollution emissions, and energy consumption. Clearly, this is a sensitive labor-relations issue to both management and employees. Management provides such incentives as a way to attract employees and, in some cases, as a fringe benefit explicitly or implicitly built into labor agreements. Employees who have enjoyed free or low-cost parking are frequently strong opponents of proposals to eliminate this fringe benefit.

Two important examples of large employers who have substantially increased parking rates for their employees are the federal governments of Canada and the United States. In Canada, the rates were increased from "no monthly charge" to 70 percent of the applicable commercial rate (approximately \$20-\$24/month). In the United States, the federal government recently implemented a program that requires its employees to pay commercial parking rates in federal facilities. The city of Los Angeles is also considering raising parking rates for city employees.

Impacts

Parking taxes in San Francisco and Washington, D.C., have generated substantial revenues: \$5.4 million and \$8.0 million, respectively, in FY1978. Preferential HOV pricing tactics have generally been

successful in attracting carpools. The rate of use of the HOV spaces has generally exceeded 75 percent in Montgomery County and Seattle. A survey in Portland determined that 61 percent of the carpools using the on-street carpool spaces were formed as a result of the program.

In Honolulu, the doubling of municipal parking rates to discourage long-term parking resulted in a 6 percent increase in the total number of cars using municipal spaces, a doubling of available parking spaces during the lunch hour, and a 36 percent increase in monthly parking revenues.

In Montgomery County, the higher parking rates resulted in an increase in turnover in short-term parking spaces, from 3.39 to 3.78 vehicles/space. Data are not available on the impacts of higher rates on long-term parking demand and facility use. In the county's Silver Spring Parking Lot District, parking rates were not increased in selected underused off-street facilities in order to attract parkers from other, heavily used areas of the district, but the desired redistribution of parkers did not occur. County officials believe the price differentials may not have been large enough to compensate parkers for the less convenient parking locations.

Increasing parking rates for federal employees in the city of Ottawa had several important travel impacts, including (a) a 23 percent reduction in the number of employees driving to work; (b) an increase in average automobile occupancy, from 1.33 to 1.41 persons/vehicle; and (c) a 16 percent increase in transit ridership among Canadian federal employees.

Enforcement and Adjudication

In the past few years, several cities have initiated aggressive policies regarding the enforcement of parking regulations in order to increase their general revenues and to improve traffic circulation and the use of on-street parking. In particular, Boston and Washington, D.C., have increased the level of ticketing and have developed procedures to apprehend scofflaws who have not paid outstanding citations. Some cities have dealt with parking enforcement problems by transferring enforcement responsibilities from their police departments to their traffic departments. Unlike regular police, civilian parking patrol officers regard parking violations as their first priority, and they are less expensive to employ than uniformed police officers.

Aggressive Ticketing

The policy of aggressive ticketing, or strict enforcement of traffic regulations, has been adopted recently by several communities that have a history of lax enforcement and serious problems with illegal parking. Boston, for example, currently employs about 50 parking control aides (PCAs), civilians in the Boston Traffic and Parking Department who were hired largely to augment the police department in enforcing parking laws. The PCAs write about 80 percent of all parking citations (each writes about 100 tickets/day), and the city budgets \$1.24 million/year for them (including supervision and vehicles). In 1976, 1.4 million tickets were issued in Boston.

Washington, D.C., has also chosen to improve its parking enforcement capabilities through the use of civilian PCAs. After a two-week training course, Washington, D.C., PCAs are assigned to foot patrols or vehicles to monitor parking meters, hourly restrictions, and parking regulations. The PCAs are also responsible for identifying vehicles in

tow-away zones and notifying the towing dispatcher. The city DOT estimates that the PCAs will write an additional 1 million tickets/year in excess of the 1.5 million citations/year currently issued, for an approximate daily average of 75 tickets/PCA. For FY1979, the city DOT estimated related expenses for these activities to be \$1.03 million and anticipated gross revenues from fines of \$6.4 million, for a net of \$5.37 million. Studies of parking turnover in the CBD were conducted before and after the enforcement program was initiated. The results showed that the number of legal hours parked at metered spaces increased from 13 to 56 percent and the number of illegal hours decreased from 84 to 31 percent. Turnover increased from 1.2 to 2.9 vehicles/h. In a comparison between the three-month period of November 1977 to January 1978 and the same period in 1978-1979, meter revenues had increased 39 percent.

Another city that has instituted strict enforcement policies is Portland, Oregon. The city employs 24 civilian PCAs in its Bureau of Traffic Engineering. Sixteen PCAs are assigned to the CBD, which is covered at least four times each day. The city budgets \$0.4 million for the enforcement patrol and collects about \$1 million/year in fines. Enforcement of parking-meter regulations and other parking regulations has a high priority in the Portland Bureau of Traffic Engineering because the meter revenues are used to finance the bureau's operations.

Towing

Many communities have towing operations to remove illegally parked cars that seriously affect traffic circulation or prevent access of emergency vehicles. Boston originally towed the vehicles of scofflaws who had five or more outstanding citations, but capacity constraints in the impoundment lots and the introduction of "Denver boots" led the city to adopt booting as a more cost-effective way to deal with the problem. Boston continues to tow vehicles that are parked in areas such as loading zones and at fire hydrants. But this is an unprofitable activity for the city, since state legislation limits the maximum towing fine to \$12.50 and the estimated cost to the city of towing an automobile is \$39.

In Washington, D.C., city towing is performed by a contractor, who is required to have 25 cradle cranes available for use and must be able to tow approximately 200 cars/day between 7:00 a.m. and 7:00 p.m. The contractor is paid \$19.35/h/crane. This is a substantial saving for the city, since the Police Department estimates that each tow performed by the city costs \$29. The locations of vehicles parked in tow zones or on restricted rush-hour streets are relayed to the towing dispatcher by the PCA, and the vehicle is then marked with a bright orange sticker. The PCA continues on patrol, and the contractor tows the vehicle to an impoundment lot. To retrieve the vehicle, the motorist must pay a \$50 fine plus all outstanding tickets. From January 8, 1979, when the towing program began, through February 1979, 5096 vehicles were towed. The average vehicle towed had \$25 in outstanding fines in addition to the \$50 towing fine. The city expected to net \$4.2 million from this program in FY1979.

Booting

Booting programs designed to apprehend scofflaws have been implemented in the past few years in Washington, D.C., and Boston. If a motorist has a certain number of outstanding parking citations (five or more in Boston and four or more in Washington), the vehicle is immobilized by clamping

a boot on a front wheel. Boston estimates that there are 52 000 scofflaws on its records; in Washington, D.C., 80 000 vehicles have been issued four or more tickets that have not been paid.

Both cities use teams of spotters who patrol the streets with lists of automobiles whose owners are scofflaws. Boston uses 15 employees from the Comprehensive Employment and Training Act program and Washington sends out 10 teams/day. After a scofflaw's car has been identified, a van carrying boots is notified and an operator comes and attaches the device. Violators must then pay all outstanding fines plus the \$25 booting fine.

In Washington, D.C., gross revenues from the booting program were \$4.1 million in FY1979. Expenses are estimated at \$0.6 million; the net revenue is \$3.5 million. Boots cost \$250 each, and the average ticket value on booted cars in Washington has been \$175. In Boston, the average ticket value has declined from about \$750/automobile when the program was first implemented to about \$160 (this is attributable to the policy in Boston of going after the worst offenders first). Boston currently owns 150 boots and has an additional 100 on order. On an average day in early 1979, 140 cars were booted in Boston.

Administrative Adjudication

Along with increased enforcement efforts, several communities have investigated the idea of transferring adjudication responsibilities from city criminal courts to traffic departments. The advantage of this transfer, like that of using civilian PCAs, is that the traffic department will place a higher priority on parking enforcement. In addition, the records can be centralized in one agency. Another advantage of this concept is that it allows the traffic department to administer penalties that are consistent with its ticketing policies. According to local officials, traffic departments in Boston and in Madison, Wisconsin, have been "frustrated" in their parking enforcement efforts by the courts, which fail to impose serious fines on blatant scofflaws and parking violators. Boston has proposed the creation of a Bureau of Parking Violations but has been unsuccessful in getting the necessary enabling legislation from the Massachusetts State Legislature.

Washington, D.C., recently organized two new bureaus within the city DOT: the Bureau of Parking and Enforcement and the Bureau of Traffic Adjudication. The Bureau of Traffic Adjudication is responsible for the processing of all parking tickets and minor traffic violations (major traffic offenses are still tried in criminal court). The program of traffic adjudication was recently implemented, and data on its operation (e.g., violations processed) are not available at this time.

SUMMARY

The objective of this paper has been to identify, assess, and document the use of new and innovative parking management tactics in urban areas. The information compiled in this project and that available in the literature indicate that there is considerable interest and experience in the use of parking management tactics around the country. Many different types of parking management tactics have been implemented or are under serious consideration for implementation in the near future. Some local jurisdictions have implemented comprehensive parking management programs that include changes in onand off-street parking supply; restrictive zoning provisions on new parking construction; pricing changes

to encourage short-term, carpool, and vanpool parking; construction of fringe and park-and-ride lots; stricter enforcement; and the use of RPPPs. Communities that have implemented such comprehensive programs include Boston, Portland, San Francisco, Seattle, and Washington, D.C. Other communities around the nation have implemented selected new and innovative tactics to meet local objectives and problems.

Based on the detailed assessment of the 20 communities cited earlier in this paper, the most widely used innovative parking management tactic is the RPPP. Extensive use has also been made of park-and-ride lots; preferential parking spaces and rates for carpools and vanpools; zoning changes to reduce the growth of parking supply; supply, pricing, and marketing incentives to encourage short-term (e.g., shopper) parking; and aggressive enforcement tactics, such as ticketing, towing, and booting.

Many factors have contributed to the growing interest in parking management tactics. In some areas, including Boston, Portland, San Francisco, Seattle, and Los Angeles, EPA requirements in the early 1970s to develop parking management plans led to the development and application of new parking policies and tactics. Many communities have shown great interest in implementing actions to discourage work-trip commuting by automobile, particularly by single-occupant automobile. The joint FHWA/Urban Mass Transportation Administration TSM regulations have also encouraged local jurisdictions and regional agencies to develop coordinated TSM plans and programs to achieve transportation and related objectives.

The ruling of the U.S. Supreme Court upholding the legality of the Arlington, Virginia, RPPP has given a major impetus to the implementation of such tactics throughout the nation. Other factors that are generating interest in parking management tactics and programs include the nation's efforts to conserve energy and improve air quality in urban areas.

Local governments are primarily responsible for initiating, planning, implementing, and operating tactics of interest. The types of agencies actively involved in parking management activities include

local parking authorities, traffic engineering departments, city planning departments, zoning and planning commissions, carpool agencies, and, in selected instances, transit agencies. Although many metropolitan planning organizations are interested in parking management, most acknowledge that the power to plan and implement such tactics rests primarily with local governments. The highly localized impacts of many parking management tactics also suggest that local governments must take an active role in initiating and implementing such tactics.

Although many jurisdictions are attempting to slow the growth of downtown parking facilities, many of these same jurisdictions are endeavoring to increase the supply and attractiveness (e.g., the location and rates) of short-term parking. Such parking is considered to be highly important to maintaining and encouraging the economic development of CBDs and other older commercial areas. In some jurisdictions, such as Los Angeles, there is strong feeling within the city government and the business community that an attractive parking system must be available to promote CBD development that might otherwise occur in suburban areas.

The implementation of transit and HOV incentives in conjunction with parking management disincentives is a growing practice that helps to encourage support by community members. Some communities contacted during the project were reluctant to implement "strong" parking management tactics unless alternative transportation modes and service were improved.

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Impact on Commuters of a Residential Parking-Permit Program in Alexandria, Virginia

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The results of the first empirical assessment of the impact of residential parking zones on commuter behavior are discussed. Residential parking zones, areas where on-street parking is short-term (usually 2-3 h) for all cars except those owned by people who live in the zones, have been adopted in at least 40 communities where there is competition between residents, commuters, and others for on-street parking spaces. Some policymakers appear to believe that such measures may induce commuters who used to park in curbside spaces to change to transit or to carpool. In a survey of drivers who commuted to the central business district of Alexandria, Virginia, it was found that, after residential parking zones were adopted in that area, only 12 percent of the sample changed commuting modes from single-occupant automobiles to either transit or carpools. Most commuters continued to drive alone but changed location to either off-street parking (frequently subsidized by their employer) or streets outside the districts.

A number of urbanized communities in the United States have, over the past few years, delineated residential parking districts to grant residents of certain neighborhoods special on-street parking privileges and to restrict on-street parking by all others. This has typically been done in neighborhoods that have suffered from parking shortages or other traffic-related problems because of their proximity to major trip attractors. Within districts that have implemented such parking policies, streets where parking previously had been unregulated are usually limited to short-term parking except for residents of the area, who may purchase