

Impacts of Municipal Parking-Fee Increases in Downtown Chicago

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The results of a study that investigated the impacts of substantial fee increases at Chicago's eight downtown city-owned parking facilities are reported. Changes in parking patterns were determined for each of the municipal facilities from data routinely collected by the Bureau of Parking and surveys of time-stamped parking receipts. The effects on parking fees and use at nearby privately owned facilities and on transit ridership were also explored by using data from surveys of parking tax returns submitted by commercial facilities, a historical review of their rate schedules, and discussions with private operators. The January 1978 fee increases stimulated a drop-off in overall use at each of the municipal facilities, although slightly more revenue was generated. Vehicles, usually driven by commuters, that enter on weekdays before 9:30 a.m. and park all day decreased by 72 percent (this drop-off was still evident one year after the increase). Apparently, most parkers increased their use of transit rather than divert to other parking facilities. Because of the availability of space in the midday hours and new short-term fees that remained lower than those at nearby, privately owned facilities, short-term parking increased at the municipal facilities. These effects are consistent with the city's objectives for its central area—i.e., lowering peak-period congestion and pollution, providing parking space for business patrons, and increasing transit use. It is concluded that the restructuring of parking fees has potential benefits if parking is in short supply, if local government controls a major portion of the supply, and if good transit service is available.

Facilities for automobile parking are an essential component of the transportation network in a city's central business district (CBD). Without convenient and reasonably priced parking, trips that require the convenience or security of an automobile will be diverted to other locations or eliminated, thus threatening the profitability of CBD shops and businesses. However, because of either environmental concerns or economic pressures that force a higher use of the land, only a limited amount of the CBD can be devoted to parking. Consequently, how this parking capacity is used affects the economy of the core area, the quality of its environment, and the use of transit facilities that serve the downtown.

Beneficial effects are likely to be realized if the trip makers who are most dependent on the automobile have priority access to core-area parking supply. These trip makers are patrons of commercial and retail services. Patrons who lack access to convenient and reasonably priced parking are more likely than commuters to alter their destination than to switch to a transit or ridesharing alternative. Although some existing parking capacity must be accessible to commuters, providing too much for these parkers may needlessly reduce the space available to business patrons, aggravate peak-period congestion and pollution, and reduce transit ridership and revenues.

The local government has most control over its municipal parking facilities. By adjusting fees at these facilities, the municipality can discourage the use of its facilities by commuters and thereby maximize the availability of space to business patrons. This may be particularly important where parking capacity is in short supply. Unfortunately, certain circumstances may result in relatively low fees that bring about just the opposite result. Revenues needed to meet expenditures generated by a municipal facility are likely to be much less than those required of a comparable, privately owned facility. This is because the municipality typically exempts its facility from paying property taxes, is not interested in a return on its

investment in the facility, and can finance its construction more cheaply than can the private sector. In addition, some costs (administrative costs, for example) may not be reflected in the facility's budget. As a result, municipalities can and often do charge less for parking than the private sector. These lower fees encourage additional automobile trips and divert ridership and revenues from transit. The more commuters are motivated to drive, the less they will patronize transit services and the fewer spaces will be open to patrons.

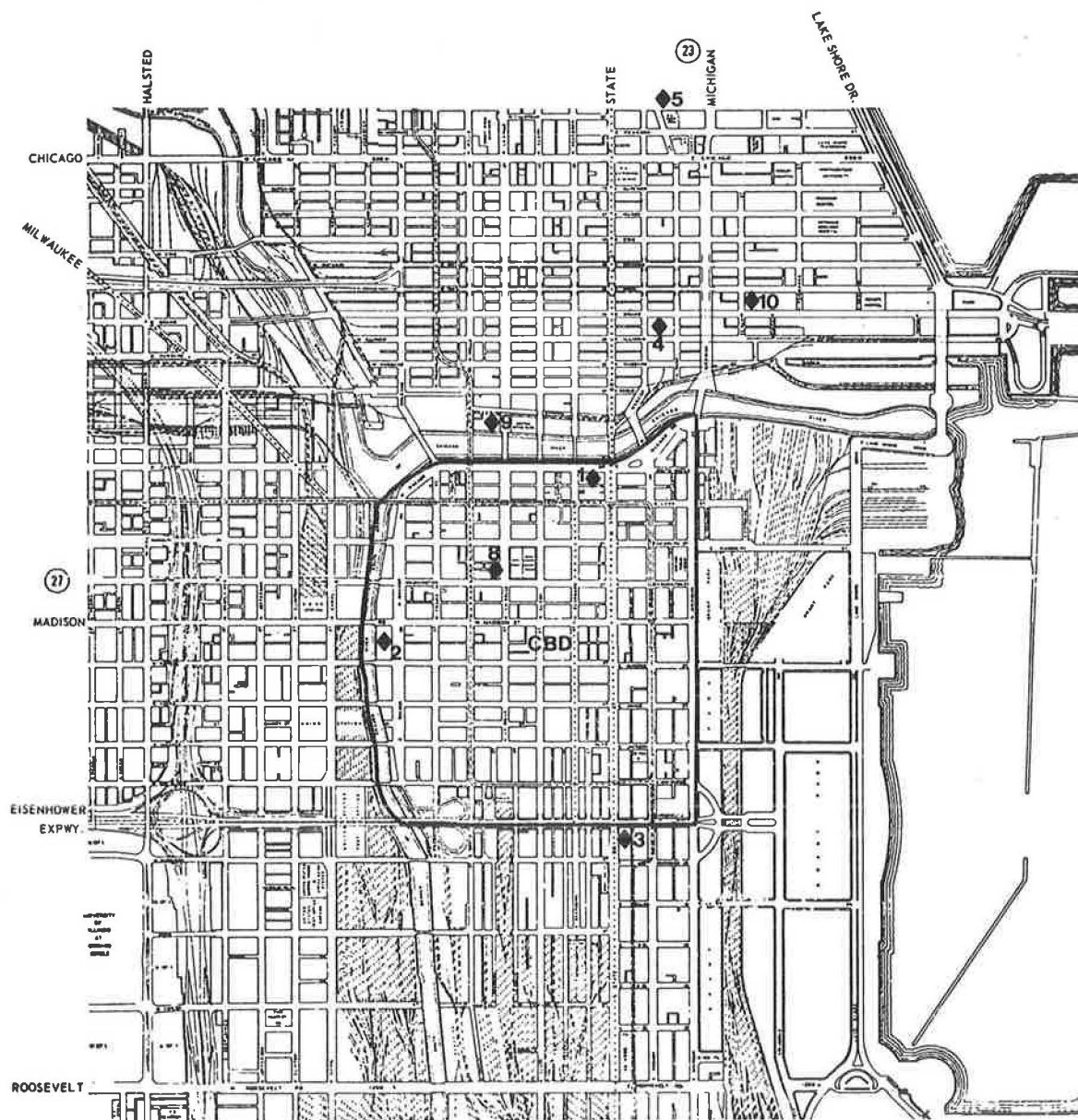
The situation described above prevailed at municipal facilities located in the downtown area of Chicago. For a period of 10 years, fees at these facilities were unchanged. In 1977, fees for all-day parking and monthly parking permits were typically 50 percent less than comparable fees at nearby, privately owned facilities. Commuters made heavy use of the city facilities; they were filled to near capacity by the end of the peak travel period. Although fees for short-term (patron) parkers were also low, most spaces were taken by all-day parkers. Fees for all-day parkers ranged from about \$1.50 to \$2.80. For many commuters, this cost was comparable to the cost of using public transit or commuter rail.

On January 1, 1978, the city raised fees at its downtown facilities with the intention of increasing revenues. As part of a comprehensive evaluation of the city's parking policies, the impacts of these fee increases on parking and travel patterns were investigated. Analysis of the rate change was considered important because rates increased dramatically and because the increases considerably reduced the differential between the parking rates at city facilities and those at privately owned commercial facilities. Downtown Chicago is well served by transit, especially during the morning and evening peak periods. Since the number of all-day parkers at the eight facilities was large and fees increased the most for these parkers, a fee-induced diversion to transit by all-day parkers could be expected.

The findings of this study indicate a substantial drop-off (72 percent) in the number of vehicles parked all day (6–12 h) during the week. Since increased use was not evident at neighboring private parking facilities, many of the former all-day parkers at city-owned facilities may be using transit. Small increases in short-term parking (vehicles parked for a maximum of 3 h) were observed, however, at five of the eight municipal downtown facilities, apparently as a result of the increased availability of space after the morning peak period and because fees for short-term parkers, although increased, remained lower than those at nearby commercial facilities.

The results reported in this paper should have relevance for municipalities and public agencies that provide parking facilities, especially for cities in which a large portion of the total downtown parking supply is in municipal facilities, parking capacity is in limited supply, and peak-hour transit service is good.

Figure 1. Chicago central area showing location of eight downtown city parking facilities.



◆2: Facility Location and Identification Number

BACKGROUND

Chicago's eight downtown city-owned parking facilities are located in an area commonly referred to as the "central area" (see Figure 1). Most are found in or within walking distance of the CBD. The Chicago CBD is a 1-mile² area that is intensely used by business and government offices, retail shops, restaurants, and theaters. Currently, there are about 37 000 theater seats, 8200 dwelling units and hotel rooms, and 85 million ft² of other types of floor space. Employment, which continues to grow, exceeds 325 000.

Surveys conducted in 1970 still provide an accurate picture of travel patterns to the CBD. Of the more than 400 000 automobile and transit trips made to the CBD on a typical weekday, transit is the predominant mode. Approximately 250 000 of these

trips are work trips, of which 75 percent are made on transit (1). This extensive use of transit can be attributed to roadway congestion, costly parking, and the exceptionally high level of CBD-oriented transit service. The public transit user has a variety of modes from which to choose: Six rapid transit lines, 12 commuter railroad lines, and 50 bus routes cover the CBD. Peak-hour headways are quite small, averaging about 5 min for buses, less than 4 min for rail rapid transit lines, and less than 10 min for most commuter rail lines.

In spite of the predominant importance of transit, many automobiles converge on the CBD. About 50 percent of the people who come to the CBD for purposes other than work use an automobile. On a typical weekday, 30 000 private automobiles enter the CBD between 7:00 and 9:00 a.m. (2). Because of the large number of automobiles converging on the

Table 1. Parking fees at eight city facilities before and after fee increase.

Facility No.	Address	No. of Parking Stalls	Time Period	Fee (\$)		
				Before Increase	After Increase	Change (%)
1	11 West Wacker	717	1 h	0.80	1.25	56
			8 h	2.65	4.25	60
			Monthly permit	33.00	63.00	91
2	20 South Wacker	1247	1 h	0.90	1.15	28
			8 h	2.15	3.65	70
			Monthly permit	33.00	63.00	91
3	535 South State	650	1 h	0.90	1.15	28
			8 h	1.90	4.15	118
			Monthly permit	28.00	53.00	89
4	506 North Rush	969	1 h	0.75	1.15	53
			8 h	1.75	3.90	123
			Monthly permit	28.00	58.00	107
5	875 North Rush	420	1 h	0.90	1.25	39
			8 h	2.15	4.25	98
			Monthly permit	33.00	65.00	97
8	120 North Lasalle	495	1 h	0.90	1.25	39
			8 h	2.40	4.25	77
			Monthly permit	43.00	58.00	35
9	320 North Lasalle	622	1 h	0.80	1.15	44
			8 h	2.65	3.65	38
			Monthly permit	28.00	58.00	107
10	535 North St. Clair	198	1 h	0.90	1.15	28
			8 h	2.15	3.65	70
			Monthly permit	28.00	58.00	107

CBD, there is considerable congestion throughout the peak travel period. Although air quality in the central area has improved in recent years, the area is a "nonattainment area" with respect to U.S. Environmental Protection Agency standards for carbon monoxide.

The service areas of the city-owned facilities on the CBD fringe are somewhat less intensely used than the CBD. Like the CBD, however, these areas exhibit a high level of transit use, peak-period traffic congestion, and problems with air quality.

There are about 70 000 off-street parking spaces in the area shown in Figure 1, approximately 18 000 in the CBD. The vast majority (85 percent) are available to the public for a fee. Accessory parking, which is private and serves a particular building or land use, makes up the remainder. In addition, there are at most a few thousand curbside metered spaces. The maximum duration of parking permitted at these meters is 2 h; in the CBD, it is 30 min. There are very few unrestricted curbside spaces in the central area. Parking facilities are heavily used on weekdays, partly because of continued growth in office space throughout the central area and the prohibition on the construction of new commercial parking facilities in the CBD. This prohibition, which has been in effect since 1972, has contributed to a reduction of 10 percent, or 2000 spaces, in CBD parking supply.

The eight city-owned garages account for 5300 parking spaces. This amount is a relatively small proportion of the total central-area parking supply. For example, the three city facilities located in the CBD account for only about 15 percent of the total off-street spaces. The city facilities vary in capacity from 198 to 1247 spaces. Except for garage 10, the smallest garage, these facilities are larger than nearby privately owned garages. Thus, each city facility does account for a large portion of the parking supply within a few blocks of that facility. Because a majority of the neighboring land use is office space, use of these facilities during the day on weekdays is quite high in comparison with use during evenings and weekends (except at garage 5, which, although it is near offices, is also near restaurants, nightclubs, and residences).

On January 1, 1978, municipal parking fees were

raised for the first time in 10 years. Fees for short-term parking were increased less than those for long-term parking. For example, the increases ranged from 38 to 56 percent for 1 h of parking, from 38 to 123 percent for 8 h, and from 35 to 107 percent for a monthly parking permit (see Table 1). The median 8-h parking fee at the eight facilities was \$2.15 before the increase and \$4.05 after the increase. Although the increases were large, on the average the new short-term fees were less than, and the new long-term fees were about equal to, comparable fees at nearby parking facilities. A survey of 65 public off-street parking facilities in the CBD—about 40 percent of the total—indicated a median 1-h parking fee of \$1.75, compared with \$1.15 for the eight municipal facilities. The median fee for 8 h was \$4.15, compared with \$4.05 for the city facilities. Although the major reason for raising rates was to increase local revenues, another consideration was the need to continue to provide the short-term parker, who is most often a patron of a commercial or retail establishment, with a lower fee than that found at other parking facilities.

DATA SOURCES

The primary purpose of this research was to assess the effect of increases in municipal parking fees on the number, duration, and accumulation of vehicles parked at city-owned facilities. Data for this purpose were readily available from the Bureau of Parking. These data included semimonthly revenue summary sheets, daily revenue reports, and time-stamped parking-receipt stubs for each facility.

The semimonthly summary sheets for a month provide the total number of parkers for each day of the month, the number of monthly parking tickets sold, the number of parkers for each fee level for that month, and the revenue collected. Fee levels were broken down to parking-duration equivalents (e.g., \$1.25 is 2-3 h) to derive the number of parkers who parked for various lengths of time. Semimonthly summary sheets were collected for the month of May for the years 1976 through 1979.

Time-stamped receipts from the midweek days of the second week in May of 1977 and 1978 were surveyed. These receipts permitted more thorough analyses of rate-induced changes in parking-duration

patterns than did the semimonthly and daily revenue sheets, since daytime parkers could be separated from evening parkers. Furthermore, the receipts could be used to determine the level of accumulation of vehicles and occupancy of parking spaces throughout the day both before and after the rate changes. To check the accuracy of the data obtained from the time-stamped receipts, comparisons were made between these data and the daily and semimonthly revenue sheets. The number of time receipt stubs was within 5 percent of the total number of parkers indicated by Bureau of Parking records, and the number of vehicles parked for various durations of time, as indicated by the receipts, differed by no more than 10 percent from that indicated by the daily revenue sheets.

The analysis of May data was emphasized for a number of reasons. Since May 1978 was four months after the date of the rate change, any rate-induced changes would have had time to stabilize. In addition, other traffic data, such as CBD cordon counts, are conducted in early May, and weather-induced changes in parking patterns were less likely to occur in May than at other times, particularly December through February. By using these data, both the immediate and long-term changes in parking duration could be investigated.

Additional data on parking patterns at city parking facilities were obtained from the quarterly parking tax returns submitted to the city's Department of Revenue by all commercially operated parking facilities. These returns provided the total number of hourly and monthly-permit parkers at each facility for each month during the 1976-1978 period. These data made it possible to study past trends in use of the city facilities and the immediate and long-term effects of the fee increase on these trends.

Although the rate-induced effects on use of privately owned parking facilities and on transit ridership were an important concern, precise determination of these effects was not possible because data could not be readily collected. The parking tax returns of nearby, privately owned parking facilities were surveyed to determine the extent to which these facilities picked up any of the large numbers of parkers who stopped using the city's parking facilities. At best, these data would only reveal a major shift from city facilities to nearby facilities. To investigate the immediate effect of the parking-fee increases on rates at privately owned facilities, surveys of parking rates were conducted immediately before and immediately after the rate change--in December 1977 and early February 1978, respectively.

Transit ridership to the central area of Chicago is so high and passenger estimation so imprecise that it would be impossible, by using existing transit data, to detect whether or not there were shifts from parking in public garages to riding transit. Nevertheless, the extent of the diversion to transit could be indirectly inferred from changes in use at parking facilities near the city facilities, from the nature of the changes that did occur at the city facilities, and from discussions with operators of parking facilities.

In this paper, short-term parking refers to vehicles parked for a maximum of 3 h, and long-term parking refers to vehicles parked for at least 5 h (both hourly and monthly parking). When long-term parking is more narrowly defined, it is so indicated. Monthly parking refers to parking on a monthly permit. At the eight downtown city-owned facilities, these monthly parkers are almost exclusively weekday parkers who park their vehicles for a few hours or more during the day.

IMPACTS OF RATE INCREASE

Use of City-Owned Facilities

For each of the eight city-owned parking facilities, four impacts of the rate change were investigated: changes in use during 1978 in comparison with 1977, changes in parking duration (overall and by time of entry), changes in levels of vehicle accumulation and occupancy throughout the day, and sales of monthly parking tickets.

Parking Patterns Before the Fee Increase

All eight city facilities were heavily used before the fee increase. By the end of the morning peak travel period, 75 percent or more of the spaces were occupied. By late afternoon, occupancy levels began to decrease rapidly. Only facilities 3 and 5 had much weekday evening use. Only facility 5 had a level of weekend use comparable to that for a typical weekday. The weekday pattern--high occupancy levels between 9:00 a.m. and 3:00 p.m.--resulted from considerable use of these facilities by long-term parkers, especially those that arrived before 9:30 a.m. and parked for 6-12 h (see Tables 2 and 3).

At six of the eight facilities, considerably more than 50 percent of all vehicles parked in a month were parked on a long-term basis. This included vehicles parked 3 h or more on an hourly basis and vehicles parked with monthly permits, most of which are used by all-day parkers during the day (Table 2). The two exceptions, facilities 8 and 9, attracted a large number of short-term parkers (49 and 40 percent, respectively) because of their close proximity to buildings that house government functions.

The high proportion of long-term parkers at these eight facilities was greater than the proportions found at nearby, privately owned commercial parking facilities. The heavy use of the city facilities and the high proportion of long-term parkers are attributable largely to the rate structures at these eight facilities: Fees were much lower than at nearby facilities (at least 25 percent less), especially fees for monthly parking permits and long-term hourly parkers.

Changes in Parking Patterns

After the fee increases, there were decreases in the number of parkers and in the average length of time a vehicle was parked. These decreases, which were still evident 17 months after the increase, were the result of decreases in vehicles parked 3 h or more and in the sale of monthly parking permits.

Sales of monthly parking permits in May 1978 averaged 27 percent less than in May 1976 and May 1977. Permit sales in May 1979 were 24 percent less than sales before the fee increases. Other months showed comparable drop-offs (see Figure 2). At five of the eight facilities, the drop-offs in the second half of 1978 were equal to or greater than the drop-offs that occurred in the first few months after the January 1, 1978, increase. One facility (facility 8) did, however, show an overall increase in monthly ticket sales after the January 1, 1978, fee increase. To increase the occupancy of space vacated by hourly parkers after the rate increases, the operator of facility 8 increased the availability of monthly parking permits, which, before the fee increases, were in heavy demand but sold in limited quantities. The 35 percent increase in the monthly permit fee at facility 8 was also much less than the increases at the other facilities (at least 89 percent).

Table 2. Use of city parking facilities: 1976-1979.

Time Period	Change from Use in Base Years (%)		Percentage of All Cars Parked		
	1978	1979	Base ^a	1978	1979
Facility 1					
0-3 h	-21	-34	40	51	50
3-5 h	-36	-51	15	16	15
5-24 h	-59	-65	25	16	16
Monthly ^b	-42	-43	17	16	18
Total ^c	-39	-48			
Facility 2					
0-3 h	+24	+58	19	32	34
3-24 h	-43	-42	60	44	39
Monthly ^b	-13	-12	21	23	20
Total ^c	-23	-10			
Facility 3					
0-3 h	-12	-22	39	59	57
3-24 h	-68	-78	58	34	26
Monthly ^b	-32	-29	5	7	7
Total ^c	-45	-50			
Facility 4					
0-3 h	+42	+46	9	20	17
3-5 h	+9	+67	6	10	12
5-24 h	-62	-48	53	32	35
Monthly ^b	-24	-12	32	38	36
Total ^c	-36	-21			
Facility 5					
0-3 h	-27	-12	39	50	55
3-5 h	-35	-33	22	26	24
5-24 h	-71	-74	29	15	12
Monthly ^b	-43	-32	9	9	9
Total ^c	-43	-37			
Facility 8					
0-3 h	+16	+12	51	64	64
3-5 h	-16	-21	14	13	13
5-24 h	-52	-58	30	16	14
Monthly ^b	+46	+74	4	7	8
Total ^c	-8	-11			
Facility 9					
0-3 h	+14	+5	60	72	72
3-5 h	-12	-5	7	6	7
5-24 h	-37	-35	11	7	8
Monthly ^b	-38	-49	22	14	13
Total ^c	-5	-9			
Facility 10					
0-3 h	+26	+14	13	23	20
3-5 h	+15	-2	8	14	11
5-24 h	-64	-59	35	18	20
Monthly ^b	-27	-19	43	44	47
Total ^c	-29	-19			
All Facilities					
0-3 h	+2	+1	34	49	47
3-24 h	-50	-50	47	32	32
Monthly ^b	-27	-24	18	18	19
Total ^c	-27	-24			

^aBase = (May 1976 + May 1977)/2.^bMonthly parkers = monthly permit sales X assumed average use of 20 times/month.^cIncludes vehicles parked with special permits and vehicles parked more than 24 h.

Most vehicles that park at the city facilities are parked on an hourly basis. At the end of 1978, all city facilities had significantly lower levels of hourly parking than they had one year earlier. At five of the eight facilities, the sustained

decreases in hourly parkers (determined by comparing levels of use at the end of 1978 with those at the end of 1977) were equal to or greater than the decreases in the first few months after the fee increases. An upward trend in use is evident during 1978 at the other three facilities, however. At facility 4, where the upward trend is quite dramatic, fee increases for long-term hourly parkers were greater than those at the other facilities; consequently, the large initial drop-offs (more than 40 percent less than 1977 levels) may reflect an initial reluctance on the part of many parkers to pay the large increases. This reluctance may have subsided among those who eventually found that the new fees were comparable to those at nearby, privately owned facilities (Figure 2). In spite of these upward trends, the number of hourly parkers in May 1979, 17 months after the fee increase, was still 24 percent less than the number before the fee increase (Table 2).

Most of the decrease in hourly parkers is attributable to the decrease in vehicles parked 3 h or more. The number of these vehicles in both May 1978 and May 1979 was 50 percent less than the average number parked in May 1976 and May 1977 (Table 2). The drop-off in long-term parking for vehicles that arrived before 9:30 a.m. and parked 6-12 h was particularly large: 72 percent (Table 3). The drop-off for vehicles that arrived after 9:30 a.m. and parked 6-12 h was only 46 percent. Although long-term parkers experienced the largest fee increases (generally 90 percent or more), this drop-off of 72 percent still approximates an elasticity of at least -0.75, which suggests that demand by the long-term, daytime parker is quite sensitive to price. The large fee increases for long-term parkers and the availability of other travel alternatives (transit, carpool, and other parking facilities) were probably responsible for this greater-than-expected drop-off.

Before the fee increases, daytime, long-term parking fees at the city facilities were clearly a bargain in comparison with fees at nearby, privately owned facilities. This was reflected in occupancy levels, which were generally near capacity by the end of the morning peak travel period. As Figure 3 shows, more space was available after the fee increase (May 1978) than before (the days shown for each facility are the same day of the week for 1977 and 1978). Since the plots in Figure 3 exclude vehicles parked with monthly parking permits, the decrease in occupancy levels was even greater than that indicated. For all eight facilities, the peak occupancy level on a weekday in May 1978--45 percent--was more than 50 percent less than the peak occupancy level on a weekday in May 1977--about 97 percent. The occupancy levels in May 1979 were probably somewhat greater than those for May 1978 because of slight increases in monthly and long-term hourly parking that occurred after May 1978.

The apparent increase in vehicles parked for a maximum of 3 h after the fee change was probably a result of the greater availability of space and new short-term rates that remained less than those at nearby facilities. The number of short-term parkers in May 1978 was 2 percent higher than the number before the fee increase. There was an increase at five of the facilities. The greatest increase occurred at facility 9, partly because of an unusually high number of weather-related court cases at the traffic court across from the facility. Nevertheless, there was more short-term parking in May 1979 than there was before the fee increase (Table 2). The slight increase in short-term parkers includes not only short-term parkers who did not previously use the city facilities but also

Table 3. Parking duration at city facilities for vehicles arriving before 9:30 a.m.: 1977 and 1978.

Facility	Year	Number of Vehicles by Length of Time Parked					Total Before 9:30 a.m.		Total After 9:30 a.m.	24-h Total ^a
		0-3 h	3-6 h	6-9 h	9-12 h	> 12 h	Number	Percent		
1	1977	53	39	93	73	11	269	29	646	915
	1978	35	23	24	14	8	104	20	417	521
2	1977	215	59	247	521	56	1098	85	199	1297
	1978	160	41	116	206	49	572	62	345	917
3	1977	55	56	164	227	32	534	49	563	1097
	1978	26	23	18	19	9	95	22	343	438
4	1977	10	34	249	308	56	657	81	152	809
	1978	31	24	78	41	15	189	46	223	412
5	1977	11	17	71	40	13	152	26	433	585
	1978	4	1	7	5	5	22	10	208	230
8	1977	59	51	95	53	21	279	35	512	791
	1978	84	31	41	23	6	185	26	537	722
9	1977	245	44	72	33	5	399	33	805	1204
	1978	263	29	40	16	2	350	31	783	1133
10	1977	4	12	59	48	12	135	71	55	190
	1978	5	5	13	10	1	34	34	65	99
All (% change)		-6.7	-43.3	-67.9	-74.4	-53.9	-56		-13.2	-35.1

Note: Same two days of the week (Tuesday, Wednesday, or Thursday) were used for each facility. Numbers of vehicles for a particular time period are averages of the number parked for that length of time on each of the two weekdays.

^aExcludes vehicles parked with monthly parking permits.

Figure 2. Percentage change in use of city parking facilities in 1978 compared with 1977.

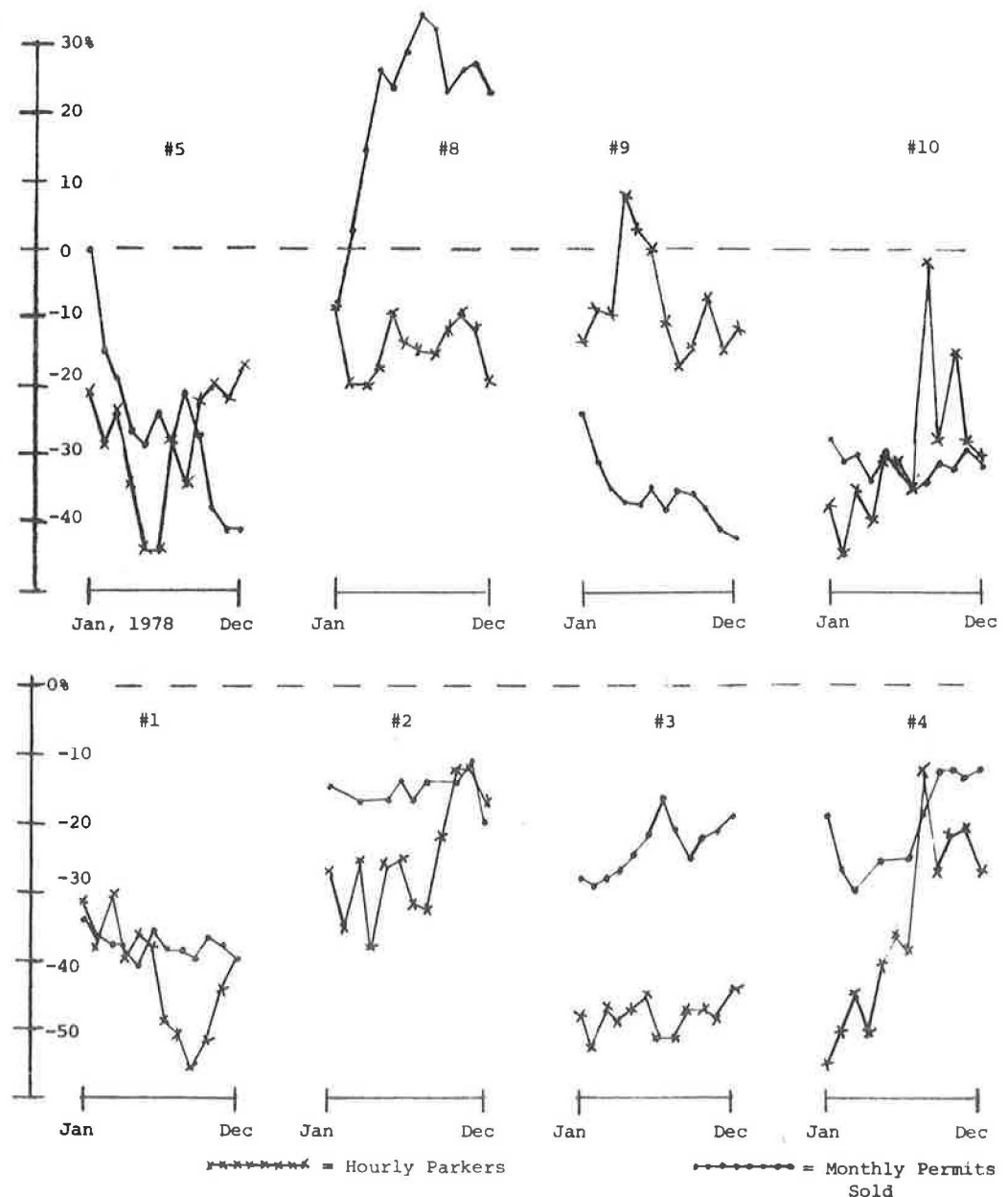
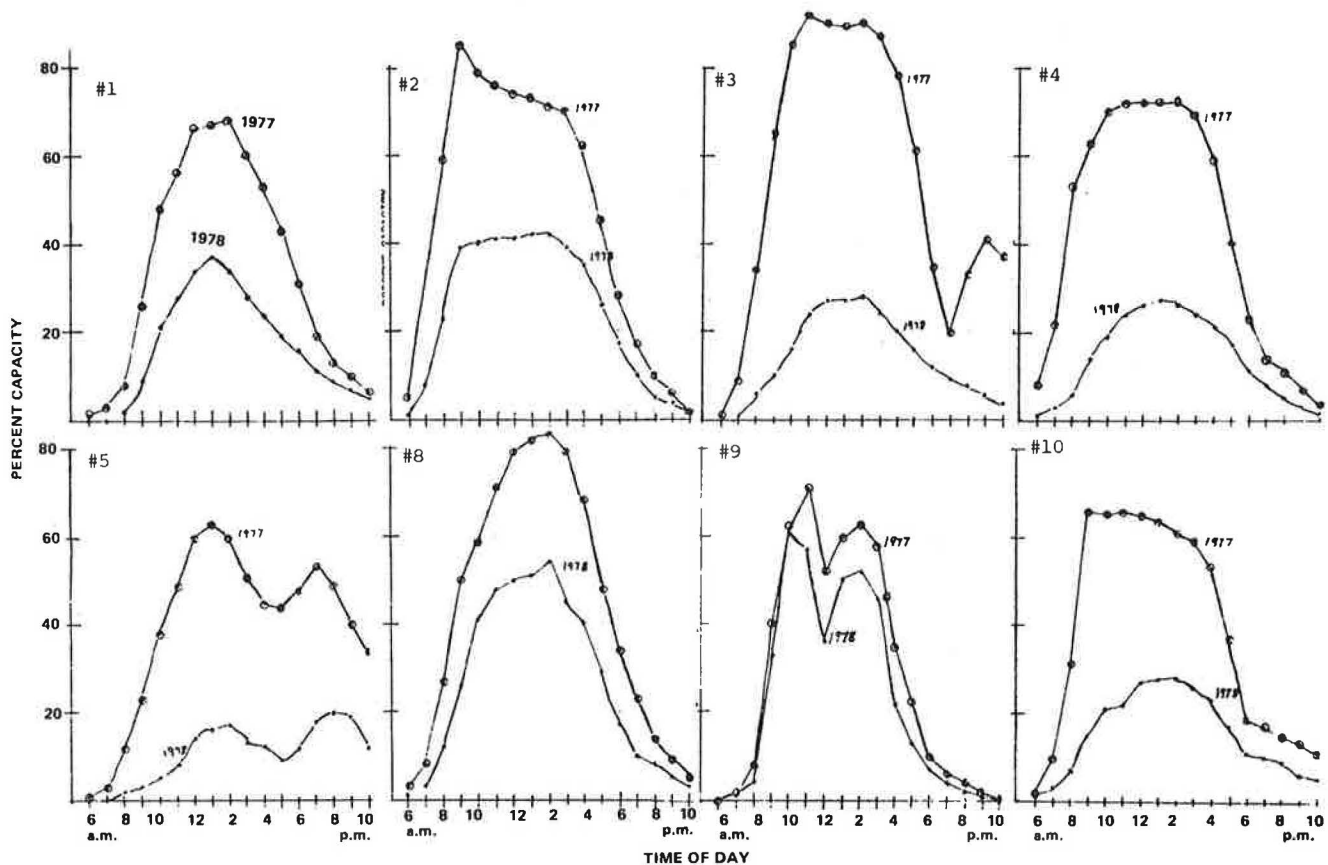


Figure 3. Accumulation of parked vehicles at city facilities: 1977 and 1978.



perhaps some regular users of these facilities who shortened their length of stay in order to save money.

Although the increase in short-term parkers after the rate increase was small, the proportion of vehicles parked for a maximum of 3 h increased substantially because of the large drop-offs in monthly parking and long-term hourly parking. The proportions of vehicles parked for a maximum of 3 h were 34 percent before and 49 and 47 percent after (May 1978 and May 1979, respectively) the fee increase (Table 2).

Use of Privately Owned Facilities

In 1968, rate structures at city-owned and privately owned CBD parking facilities were comparable. In the next 10 years, while city rates remained the same, rates at private facilities steadily increased, escalating rapidly in recent years. By 1978, fees at city parking facilities located in or near the CBD generally averaged no more than 75 percent of comparable fees at nearby privately owned facilities. Lower city fees attracted a higher proportion of commuters (i.e., long-term hourly and monthly parkers). Occupancy levels at the end of the morning peak period were higher at city facilities than at private facilities. Although short-term parkers could also get cheaper rates at city facilities than at privately owned facilities, relatively few spaces were available after the morning peak travel period. Because the fee increases implemented at city facilities were large and the overall drop-off was substantial (28 percent, or 54 000 vehicles, in May 1978), it was decided to investigate what impacts the changes in fees at

municipal facilities had on rates and use at privately owned facilities. By analyzing patterns of use at privately owned facilities, the study might be able to determine the extent to which long-term parkers were diverted to transit.

Fees at privately owned parking facilities are adjusted periodically to reflect increased operating costs, a large proportion of which goes to labor. Surveys of parking fees were conducted to determine whether parking operators made special adjustments to their fees in response to the city's fee increases. Most often they did not. Of 201 facilities surveyed, 6.5 percent (13) of the facilities raised their rates within six weeks after the city implemented its new rates. This finding was consistent with the comments made by several operators of parking facilities, who stated that what the city did with regard to its rates had little bearing on their rates.

There appear to be two exceptions, however. The first was one operator who stated that he would (and did) adjust his rates as a result of the city's action. This apparently affected several facilities in the downtown area. In the other case, 7 of the 13 facilities that did adjust their rates were located within three blocks of city facility 3. It is not certain that these increases were in response to the fee increases at facility 3, but it is possible since, in contrast to the situation at other city garages, rates at facility 3 were now higher than those at surrounding privately owned facilities. The all-day rate at facility 3 increased from \$1.90 to \$4.15, and the monthly rate increased from \$28 to \$53. The median all-day parking rate at the 7 private facilities located near facility 3 was approximately \$3.15 before the

Table 4. Change in use at privately owned parking facilities near city facilities 2 and 3.

Item	Facility 2 ^a		Facility 3 ^b	
	Monthly Ticket Sales	Hourly Parkers for Month	Monthly Ticket Sales	Hourly Parkers for Month
Number of times 1978 month was				
Higher than same month in 1977	29	31	30	38
Same as same month in 1977	2	0	7	0
Lower than same month in 1977	41	41	47	46
Total number of comparisons	72	72	84	84

Note: Total months compared = 12 times the number of facilities surveyed.

^aSix private facilities were surveyed.

^bSeven private facilities were surveyed.

increase and \$3.65 after the increase. Perhaps operators at these 7 facilities expected increased demand by all-day parkers at their facilities because of the radical increases in the all-day and monthly fees at facility 3. Because of this expected increase in demand relative to supply, rates were adjusted upward but usually not above those at facility 3. Analysis of use at facility 3 for January 1978 and subsequent months does indicate a large drop-off in all-day parkers but little or no change in short-term parkers.

Over the long term, the fee increases at city facilities might have had more of an effect on fees at nearby private facilities if the increases had affected use at these nearby facilities. But this did not appear to happen.

Data on the number of hourly parkers and sales of weekly and monthly parking permits were collected for 13 private parking facilities within a two- to three-block radius of city facilities 2 and 3. These two city facilities were chosen because each had a large absolute decrease in the number of parkers. It was assumed that, if a large proportion of the parkers who stopped using the city facilities switched to nearby private facilities, it should be evident in the levels of use at private parking facilities in the vicinity of city facilities 2 and 3. Apparently a large proportion of the parkers who stopped using city facilities did not switch to nearby parking facilities. In a comparison between 1977 and 1978 levels of use at neighboring facilities, there were more parkers in most months in 1977 than in 1978 (see Table 4). Unfortunately, the data are inadequate to determine relatively small changes at nearby facilities that may be related to changes in fees or use at the city facilities.

The tentative conclusion is that most of the former users of city facilities 2 and 3, and probably most of the former users of the other city parking facilities, switched to transit or possibly to carpools rather than drive and park at a facility near the city facility at which they formerly parked. This conclusion appears to be supported by the 72 percent reduction in vehicles that arrived during the morning peak period and parked all day. The availability of transit and other alternatives (such as carpooling) is greatest for these parkers. Furthermore, few of these parkers are likely to have discontinued their trips to the central area, since most are employed there and are unlikely to change their jobs because of an increase in parking costs. In addition, because commuters travel regularly,

their increased outlay for parking would be more conspicuous in comparison with that of the noncommuter, who faces less of an increase and would likely have paid the increase less often than a commuter. Parkers at other times, however, have fewer alternatives to the automobile, and they had little to gain by switching to another parking facility, since the new fees at city facilities were generally not greater than those at nearby facilities. A major operator of parking facilities in the central area reinforced this conclusion by stating that noticeable increases in the use of those of his facilities located near the municipal facilities were not evident and that most of the parkers who stopped using these facilities probably changed to transit.

There were perhaps some small changes in the pattern of use at private parking facilities in the vicinity of the municipal facilities:

1. Some short-term parkers may have been diverted from nearby commercial facilities to city facilities because of the greater availability of space and slightly lower short-term parking fees.

2. Some long-term parkers who used a city facility before the fee change may have decided to patronize a facility that was more convenient to their destination, since after the fee increases there was little difference between the fees at municipal and nearby privately owned facilities.

3. A relatively small number of parkers may have been able to realize a saving in their parking fees by switching from a city facility to a nearby privately owned facility. This may have occurred at city facility 3 because the new fees for long-term parking at this facility were higher than those at a few of the nearby private facilities. Facility 3 showed the largest drop-off in parking of any of the city's facilities.

Unfortunately, the data at hand were not appropriate for determining such relatively small changes.

CONCLUSIONS AND DISCUSSION

The major effects of restructuring the fees at city parking facilities were the following:

1. Long-term parking decreased overall by about 50 percent and by 72 percent for vehicles arriving before 9:30 a.m. on weekdays.

2. There was slightly more short-term parking after the fee increase than before.

3. The fee-induced changes in parking patterns were still evident 17 months after the increase.

4. Although the absolute number of parkers decreased, revenue generated by the eight city facilities increased.

5. The effects on the amount and duration of parking, rate structures, and revenues at privately owned facilities were minimal.

6. There is evidence to indicate that former long-term parkers shifted from parking at city facilities to using transit.

The manner in which fees at city facilities were increased and the impacts these fee increases had on parking and travel patterns in the Chicago central area are consistent with the goals of enhancing the economic viability of the central area, improving environmental quality, and augmenting transit ridership and revenues.

As a result of the large drop-off in long-term daytime parking, there is capacity for further increases in short-term parking. Short-term parkers are frequently dependent on the automobile, re-

quiring a car for package delivery, shopping purchases, banking large amounts of cash, and trips to or from areas that are inaccessible by transit. But, as patrons of retail and commercial establishments, they are essential to the economic health of the CBD. In addition, since they typically travel in the off-peak period, the environmental effects of their trips are less damaging.

The fee increases at city parking facilities apparently motivated automobile drivers to shorten the length of time they parked or to use other alternatives such as transit. Reducing the number of automobile trips to the central area during the morning peak periods reduced pollution, energy consumption, and interference with bus and pedestrian flow. In the aggregate, the reduction in peak-period automobile congestion in the CBD was small. City facilities in the CBD (facilities 1, 2, and 8) experienced a total decrease of about 850 in vehicles parked before 9:30 a.m. Even if all of these vehicles no longer entered the CBD during the morning peak period, the number of private automobiles entering the CBD during this period (35 000-40 000) would have decreased by not more than 2 percent. The number of all vehicles--i.e., private automobiles, taxis, and buses--would have decreased by less than 1 percent.

Nonetheless, if the focus is narrowed to the roadways surrounding a particular municipal facility, the reduction in vehicles is evident. For example, before the increase there were long waiting lines at facility 8, which is located across from City Hall. The lines often extended north beyond the intersection of LaSalle and Randolph Streets, interfering with pedestrian and vehicle flows on both streets. The noticeable reduction in the number of waiting vehicles after the fee increase resulted in improved traffic flow, particularly for pedestrians and buses. Southbound buses on LaSalle Street, which could rarely unload passengers at the northwest corner of LaSalle and Randolph because waiting cars blocked access to the curb, can usually do so now.

The increase in the availability of parking space after 9:30 a.m. was, however, more significant. Since almost all of the 850 vehicles would have remained in the CBD after 9:30 a.m., this loss represents about a 6 percent decrease in the approximately 14 000 private automobiles that accumulate in the CBD by about 9:30 a.m. (2). The impact on the availability of parking after the peak period is more significant because, although the city parking facilities account for only about 15 percent of the CBD supply, they accommodated a more-than-proportionate share of the vehicles that entered and parked in the CBD during the morning peak period.

The impacts of the fee increase on commercial parking facilities and their customers appear to have been minimal. Although some short-term parkers at these facilities may have diverted to city facilities, the number is small and has probably been compensated for to some degree by the diversion of long-term parkers from city facilities to private facilities. Perhaps, since rates are now more similar in a given sector, there will be a more even distribution of available spaces and less "cruising" to find a cheaper or an open parking space.

Although revenues generated by the eight city facilities increased after the fees increased, the increase was not as much as anticipated because the decrease in use was greater than expected. It is possible that, if rates had been increased gradually over the preceding 10 years, the drop-off in use would have been less and revenues greater.

Rates should perhaps be reviewed and adjusted at

least every two years so that they will assist in promoting the city's goals for the central area. Fees for long-term parking should be made comparable to those at nearby commercial facilities; fees for short-term parking should continue to be somewhat less than fees at nearby facilities. Such a rate structure would favor the central-area patron, who is often dependent on the automobile for travel, rather than the central-area employee, who generally has greater access to high-level transit service.

Consideration might be given to experimenting with the rate structure at one or two city parking facilities. Short-term fees could actually be reduced and long-term fees significantly increased on weekdays when the competition for space is heaviest. The impacts on parking and travel patterns at both city and nearby private parking facilities could then be studied, and the results could be useful as input to future decisions on parking fees for the central area. For example, the results might be useful in deciding how to structure rates in relation to existing or new facilities that are intended to revitalize the downtown area (e.g., the State Street Transit Mall, currently under construction in downtown Chicago). By picking only one or two facilities in areas of heavy parking demand, the potential adverse impacts on the revenues of any parking facility would probably be small.

Although impacts on peak-period congestion and the availability of midday parking in Chicago were small, fee increases could have a much greater impact in other downtown areas where a large portion of the parking capacity is found in municipal facilities. This would be especially true if transit alternatives were available and if other parking management strategies were applied. Zoning can be used to limit or prohibit new parking facilities (as previously mentioned, the city of Chicago has prohibited the development of any new parking in the CBD, and the amount of spaces is being reduced by attrition). As this research indicates, restructuring of municipal parking fees can possibly contribute to better use of the existing parking supply, including both off-street and on-street parking.

Other, more radical strategies for reducing the problems of peak-period automobile congestion in the CBD are available. The harmful effects of peak-period congestion are the product of trips made both to and through the CBD. Kulash (3) collected information on the level of through traffic in about a dozen major cities and suggested some programs for reducing through trips, including increasing the absolute cost of the through trip by means of gasoline taxes and various road pricing schemes, reducing the time and dollar costs of alternative modes, and prohibiting private automobiles from using delineated zones. Such programs will, however, probably be more difficult to implement than more conventional approaches to traffic management.

It is unlikely that the changes in parking fees at municipal facilities in Chicago would have resulted in such a drastic drop in long-term parkers had there not been an extensive network of high-quality transit service available. The attractiveness of transit can be enhanced if interceptor parking is provided along major corridors, either in outlying areas or on the fringe of the CBD, and if transit fares are relatively low in comparison with the cost of the automobile trip. Consequently, adequate transit services and incentives should be incorporated with strategies aimed at better parking and traffic management. In the interests of the downtown economy, the overall program, while providing for an improved environment, should enhance or

maintain accessibility to the core by automobile.

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Employer-Subsidized Parking and Work-Trip Mode Choice

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The widespread practice of employer-subsidized parking is a significant but often overlooked determinant of mode choice for the journey to work. Experiences in several major cities are examined, and estimates are made as to how many of those who are offered employer-paid parking decide to drive alone to work rather than commute by other modes. It appears that approximately 20 percent of those who now drive alone and receive free parking would form carpools or begin using public transit if they were required to pay for parking at the workplace. This estimate is derived from comparisons of the behavior of commuters of similar characteristics who park free and who pay to park and from the results of the imposition of parking charges for parking formerly provided free. The major incentive for employers to provide free parking appears to be the fact that, as a fringe benefit, free parking escapes income taxation. Enforcing the reporting and taxation of its cash value, however, is a difficult and predictably unpopular task. Two policies intended to extend employer parking subsidies to work travel by modes other than the single-occupant automobile are recommended: tax-exempt travel allowances and carpool parking subsidies. Both policies could lead to significant increases in carpooling and transit use at very low or no public expense.

In metropolitan areas throughout the United States, offering employees either free or partly paid parking is a common practice of both private and government employers. Nationwide, as many as 85 percent of all those who commute by automobile in urban areas park free of charge (1), and most of those who park at their employers' expense work in downtown areas, where parking is most costly to provide. In the Los Angeles central business district (CBD), for example, almost one-third of the 100 000 employees who arrive daily by automobile report that they pay nothing to park, and another quarter pay only the nominal cost of participating in an employee permit system. Advertised parking rates in the Los Angeles downtown area average almost \$35/month. This suggests that parking subsidies offered by private and government employers in the area total almost \$30 million annually (2).

In a 1977 memorandum to the Secretary of Transportation, acting administrator Charles F. Bingman of the Urban Mass Transportation Administration reported that in Washington, D.C., the federal government alone provides free parking for about 30 000 of the 140 000 automobiles that enter the central em-

ployment district daily as well as partly paid parking (at \$5-\$20/month) for another 10 000 cars. In an area where posted rates average almost \$50/month (3), this amounts to a continuing federal subsidy for automobile travel of well over \$20 million/year, half the combined capital outlay for building the Shirley Highway Busway and for acquiring nearly 100 specially equipped buses intended to attract commuters out of their automobiles (4).

The federal government may be the most generous provider of parking subsidies in the Washington, D.C., area, but it is by no means the only one: When subsidies offered by private employers are included, almost 40 percent of all parking facilities (some 65 000 spaces) in the metropolitan area are made available at no charge to their users (3). This brings the total cash value of employer-provided subsidies for automobile travel to almost \$40 million/year.

Employer-subsidized parking also appears to be commonplace in Canadian urban areas. Transport Canada (5) reports that 85 percent of all Canadian automobile commuters working in urban areas are provided with free parking at their places of employment. In Ottawa, for example, the federal government provided free parking for almost 40 000 employees until 1975, when fees equal to 70 percent of downtown commercial rates were imposed in federal parking facilities.

FREE PARKING AND WORK-TRIP MODE CHOICE

The surprisingly widespread practice of subsidized parking is a significant but generally overlooked influence on commuters' choices among travel modes. In both downtown and suburban employment centers, the cost of parking can be a substantial component of the total cost of the trip to work by automobile. Daily parking rates as high as \$3.50 are common in some areas of downtown Los Angeles, for example, and rates as high as twice this figure prevail in other urban areas such as Washington, D.C., and New York City. When such charges are paid