CHANGE-OF-MODE PARKING

A STATE OF THE ART

U.S. DEPARTMENT OF TRANSPORTATION/FEDERAL HIGHWAY ADMINISTRATION

APRIL 1971

CHANGE-OF-MODE PARKING

A STATE OF THE ART

Prepared by the Institute of Traffic

Engineers Committee 6H-PA

COMMITTEE 6H-A

Highway Transit Transfer Facilities

Steiner M. Silence, Chairman

Frank Barker
Theodore A. Bratz, Jr.
Martin E. Bruening
Stephen E. Butterfield
G. W. Campbell
Richard J. Carlson
Thomas B. Deen
Edward G. Gilcrease, Jr.
William D. Heath
George W. Heinle
E. M. Kahoe
John N. LaPlante
Harold A. Lenske
Paul Loepp
Henry M. Mayer
William R. McGrath
Robert A. Olmsted
Harry L. Parrish, Jr.
J. B. Rushing
Sheldon Schumacher
Clyde W. Scott
Richard L. Strickland
Joseph J. Wozniak

FORWARD

The urban commuter facing high parking costs and congested streets and highways may not want to drive all the way to work in the city center. Change-of-mode parking offers the commuter an alternative to automobile travel which uses both the automobile and public transit to best advantage.

The Institute of Traffic Engineers undertook a study in several cities with experience in change-of-mode operations to determine the availability of change-of-mode parking, its usage, factors contributing to its success, and the potential for further application. Members of ITE Committee 6H-PA provided information on current applications in their respective cities. This report reflects these findings.

The technical analysis included in the early portions of this report was done by persons in the Traffic Engineering and Parking Branch of the Federal Highway Administration.

Persons participating directly in this effort were Mr. Eugene C. Gobbo, Mr. Steven A. Ronning, Mr. Donald J. Cameron, and Mr. Perry A. Davison.

CHANGE-OF-MODE PARKING

A STATE OF THE ART

CONTENTS

A State of the Art

I. Introduction

The private automobile and public transportation are two primary means of moving people in our larger metropolitan areas. An urban commuter traveling to the urban core may find both of these means available to accomplish his journey. The provision of change-of-mode parking in convenient locations near transit stops may allow the commuter to use each of these travel modes to his best advantage.

The number of change-of-mode parking spaces is increasing as urban areas try to improve their transportation systems. The user of change-of-mode parking avoids high central business district (CBD) parking costs and driving on congested streets. Community benefits are realized, including a reduction in the number of vehicles using the highways and entering the CBD, a reduction in CBD parking demand, and the possible revitalization of transit service.

This report reflects the current practices and utilization of various change-of-mode parking operations. Information on factors contributing to the success or failure of change-of-mode parking were collected and analyzed. These factors were then related to the effectiveness of existing change-of-mode operations to offer guidance for potential application in other urban areas.

The need for change-of-mode parking is influenced by a number of factors such as traffic congestion, high CBD parking costs, car availability, and trip purpose. Change-of-mode parking is most likely to emerge successfully under these conditions and where transit service is not reaily available at the suburban trip end, but can be reached by auto and where a major share of work trips are concentrated in the CBD. In these cases the trip maker can drive to a change-of-mode parking facility, park his car or be dropped off, and use public transit for the remainder of his trip. Convenient low-cost parking in such locations can contribute to the effectiveness of the urban transportation system by assembling trip makers in sufficient concentrations to make travel by transit feasible.

Successful change-of-mode operations must offer advantages over comparable travel by automobile. Free or low-cost parking at the change-of-mode facilities offers the first important incentive in attracting a potential change-of-mode parker. Ideally, the two-way transit fare and the change-of-mode parking cost (if any) should be less than the CBD parking. Although these do not represent all of the costs involved, they are the most relevant in the commuter's mind.

The type of transit service to change-of-mode lots has a definite effect on the overall operation.

BUS

The opportunity for change-of-mode parking already exists in many cities since free onstreet spaces are available near many suburban bus stops. Drivers take advantage of such opportunities, often to the displeasure of the local residents who desire places to park near their homes. Since change-of-mode parking is already available, offstreet change-of-mode facilities must, therefore, offer certain advantages over those already available. These advantages might include:

1. Express bus service. Large offstreet parking facilities often provide the large concentrations of passengers needed for express bus service.
2. Extra protection. Patrolled or guarded off-street parking provides extra protection for the commuter's car.
3. Assurance of a parking space. Offstreet parking usually offers the commuter more assurance of finding a place to park.
4. Increased convenience. In urban areas where onstreet parking is troublesome and where the difficulty in finding a space can produce longer walking distances, change-of-mode facilities can increase convenience by reducing walking distance.

RAIL

Change-of-mode parking is most widely associated with urban rail transit. Since rail transit operates over a fixed route with limited coverage (the rail line cannot go past everyone's door), it has always been necessary to use some other mode of travel for getting to the rail station, whether on foot, by private automobile, or public transit. As the use of the private automobile became more widespread, the need for a place to store the cars became apparent. Change-of-mode parking at suburban rail transit stations, therefore, has become a necessary part of rail operations. The advantages given for bus operations also apply for rail.

Data for this report were collected from nine urban areas across the country from persons with considerable experience in change-of-mode operations. Section II summarizes the findings of the survey in three main areas--(a) parking facilities, (b) quality of transit service, and (c) cost considerations. Sections III and IV give the details of present operations and proposed future application. Section V presents a summary of findings, and Section VI (the appendix) contains tables which summarize the data by type of transit service, lots, spaces, and parkers.

Unfortunately, this study was limited to physical characteristics of change-of-mode operations and did not include user or trip purpose characteristics which would be desirable for a comprehensive study of change-of-mode operations, including their role in the urban transportation system.

The economic analysis portion of Section II, while not entirely relevant in the commuter's mind, provides a good indication as to the economic advantages of the use of change-of-mode parking.

II. Characteristics of Change-of-Mode Operations

Inducing the commuting public to use change-of-mode parking requires that the entire system be an attractive competitive alternative to the use of the automobile. For the purpose of this report, the ingredients or characteristics which contribute to a successful operation are divided into three basic areas: (a) the parking facilities; (b) the quality of transit service; and (c) the user cost considerations.

Data were collected from nine cities across the country with experience in change-of-mode parking, including Boston, Chicago, Cleveland, Fort Worth, Miami, Milwaukee, New York, Philadelphia, and Washington. The analysis of these data is based on characteristics of 37 bus-serviced lots and 139 rail-serviced lots. In some cases all of the lots included in the survey could not be used in the analysis of this section because of incomplete information. Furthermore, it is likely that other facilities are not included simply because the reporters were unable to identify them.

A. Parking Facilities

Characteristics of change-of-mode parking facilities influence the success of change-of-mode operations. These characteristics, excluding parking cost, include lot location, adequate parking spaces to meet the demand, an uncomplicated operation, and protection for the commuter's car. Costs are discussed in Section II-C.

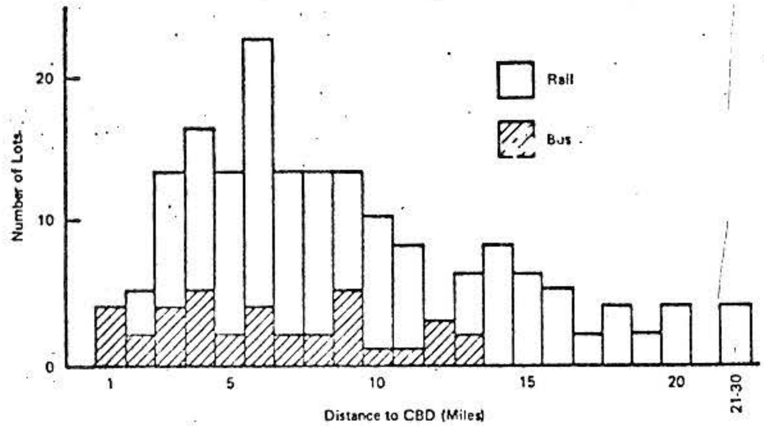
Location

Successful change-of-mode parking must be conveniently located for easy commuter access and use. Ideally, the change-of-mode parking facility should be located at a point on the approach to the CBD where it is no longer convenient for the commuter to drive the rest of the way downtown. At this point, the commuter could maximize his time savings by driving in light traffic to a change-of-mode parking facility, and then maximize cost savings and peace of mind for the remainder of his trip by avoiding high CBD parking costs and the stress of driving in heavily congested traffic.

In practice, change-of-mode parking is dispersed throughout the urban area. The facilities included in the survey were located from 1 to 30 miles from the CBD in municipally and transit-owned facilities, as well as multipurpose facilities such as shopping centers, parks, and stadiums. Many types of currently available offstreet parking could provide convenient change-of-mode points for bus transit (or rail if located near rail stations.) These include parking at shopping centers, parks, and stadiums plus parking at churches, theaters, bowling alleys, and other recreational facilities which would not normally be used during the work day.

Change-of-mode lots served by bus were generally located closer to the CBD than lots serviced by rail. Figure 1 shows that bus-serviced lots were located within 13 miles of the CBD while rail-serviced lots were located up to 30 miles away. The bus-serviced lots showed no particular trend for location, but the greater concentration of the rail-serviced lots were located from 3 to 9 miles from the CBD.

Figure 2 shows that bus-serviced lots generally were better used when located closer to the CBD. In fact, the figure shows that there were more parkers than spaces at these close-in lots, indicating a

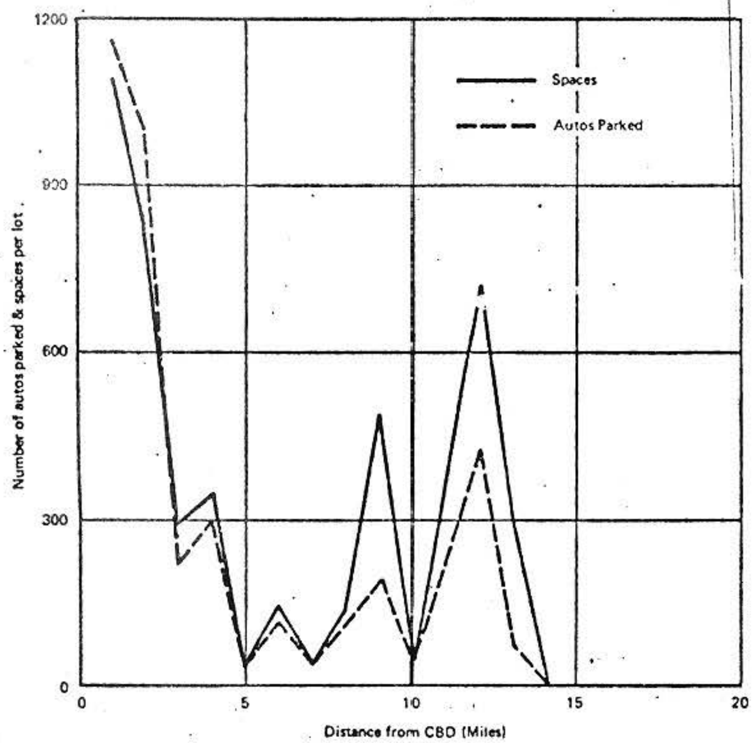


NUMBER OF LOTS BY DISTANCE TO CBD AND BY TYPE OF TRANSIT SERVICE

FIGURE 1

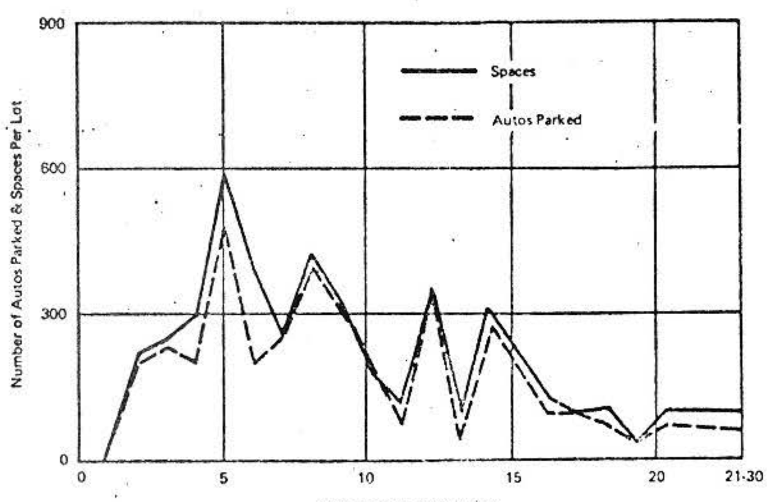
turnover of parkers. This results from use by shoppers and other short-term midday parkers. Rail lots (Figure 2b) were not influenced as much by distance from the CBD and were generally well used; however, turnover was practically nonexistent.

Figures 2a and 2b also show that bus-serviced lots had the greatest number of spaces per lot when located closer to the CBD with a smaller peak at the 11 to 13 mile range. Rail-serviced lots provided most of their space at a distance of 5 miles from the CBD.



NUMBER OF AUTOS PARKED & NUMBER OF SPACES AT BUS-SERVICED LOTS BY DISTANCE FROM THE CBD

FIGURE 2a



NUMBER OF AUTOS PARKED & NUMBER OF SPACES AT RAIL-SERVICED LOTS BY DISTANCE FROM THE CBD

FIGURE 2b

Parking Spaces

Potential change-of-mode parkers must have some assurance of finding a parking space. However, it is not normally practical to provide a great surplus of spaces. Table 1 shows the ratio of autos parked to spaces for bus and rail-serviced lots by various types of ownership. Numbers close to 1,000 indicate good utilization and a good balance between supply and demand.

TABLE 1

RATIO OF AUTOS PARKED TO NUMBER OF SPACES BY TYPE OF TRANSIT AND BY LOT OWNERSHIP

OWNERSHIP	BUS	RAIL
Municipal	0.905	0.787
Transit	1.188	0.855
Parks or Stadium	0.855	0.372
Shopping Center	0.264	0.116
Other (Private)	0.870	0.855

Change-of-mode parking at shopping centers appears to have poorest use, but this must be weighed by the fact that shopping centers actually provide ideal locations because they have an abundance of parking which already exists and is provided free to the transit user.

Use of change-of-mode parking at parks and stadiums served by rail also appears low. This is due to one lot included in the survey, a 7,000-space stadium used by 2,600 autos. Actually, 2,600 change-of-mode autos parked at one location indicates a very successful operation. Municipal, transit, and other privately owned lots appear to have the best balance between supply and demand. Those lots with low utilization have the greatest reserve for expanded usage.

TABLE 2

PERCENT OF LOTS BY OWNERSHIP AND BY TYPE OF TRANSIT

OWNERSHIP	BUS	RAIL	OVERALL PERCENT
Municipal	60	43	46.
Transit	2	18	15
Park or Stadium	8	1	2
Shopping Centers	22	1	6
Other (Private)	8	37	31
TOTAL	100	100	100

As shown in Table 2, the largest overall percentage of change-of-mode lots were municipally owned. Other privately owned were next for rail-serviced lots. Shopping centers were next for bus-serviced lots. Rail-serviced change-of-mode lots are of limited number at parks, stadiums, shopping centers or other existing parking areas as the demand probably did not originally exist at these points. When a new concentration of transit demand develops, buses have an advantage over rail in that their routes can be altered to satisfy the new demand.

Table 3 shows the average number of spaces per lot by lot ownership and transit type. The average was 356 spaces, with a range from 10 to 7,000.

TABLE 3

AVERAGE SPACES PER LOT BY OWNERSHIP

OWNERSHIP	BUS	RAIL	OVERALL
Municipal	372	284	307
Transit	1600	480	624
Park or Stadium	450	7000	2088
Shopping Center	387	365	383
Other (Private)	82	365	218
OVERALL	415	341	356

Operation

Table 4 shows that overall about three-fourths of the lots operated on a self-park basis without attendants which helps reduce operating costs. Another 23 percent were self-park but had attendants who collected parking fees, checked parking stickers, or sold transit tickets. Only 3 percent of the lots were not self-parking.

TABLE 4

OPERATIONAL CHARACTERISTICS BY PERCENT OF LOTS

	SELF-PARK	SELF-PARK WITH ATTENDANT	ATTENDANT ONLY
Bus	60	35	5
Rail	78	20	2
Overall	74	23	3

Other Characteristics

Many change-of-mode lots had other characteristics which offered advantages to their users. Nearly half provided shelters for shade and inclement weather protection, 89 percent were paved, and 82 percent of the lots provided lighting for additional night protection. The actual percentages of lots with these conveniences are shown in Table 5.

TABLE 5

OTHER CHARACTERISTICS BY PERCENT OF LOTS

	Shelters	Paved	Lights
Bus	51	97	92
Rail	45	87	19
Overall	47	89	82

B. Transit Service

The quality of transit service to change-of-mode parking locations is obviously an important element in the overall success of a change-of-mode operation. Ideally, transit service should occur for enough hours to cover a normal working day, with sufficiently short headways to satisfy the demand. Also, the line-haul traveltime should approximate or be better than that by private automobile.

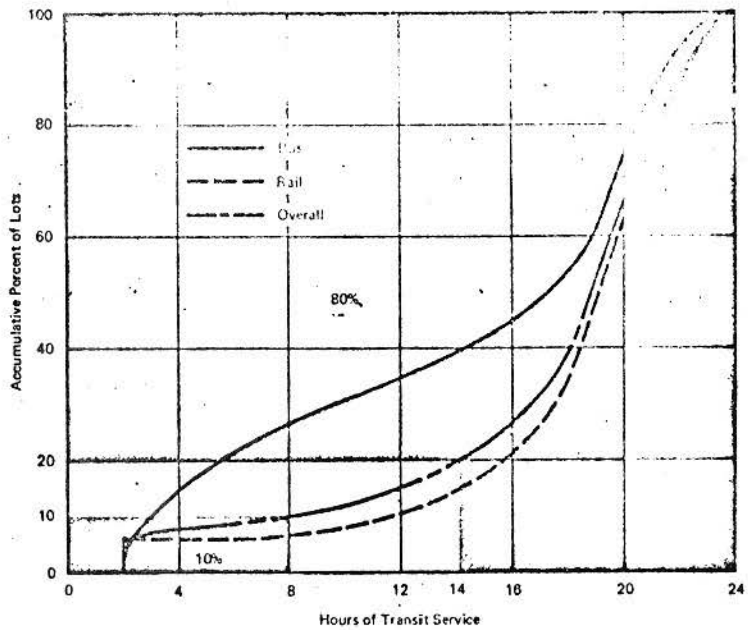
The best transit service will occur where there are large concentrations of trip ends. Express service from these points to the CBD or other employment areas offers a better alternative than a local transit route which makes frequent stops.

Hours of Transit Service

Since change-of-mode parking serves mostly work trips, it is important to have above average service during the peak periods. It is also important to have service on a more limited scale during the off-peak hours for those who may leave work early or those who might want to use change-of-mode parking for shopping or other nonwork trip purposes.

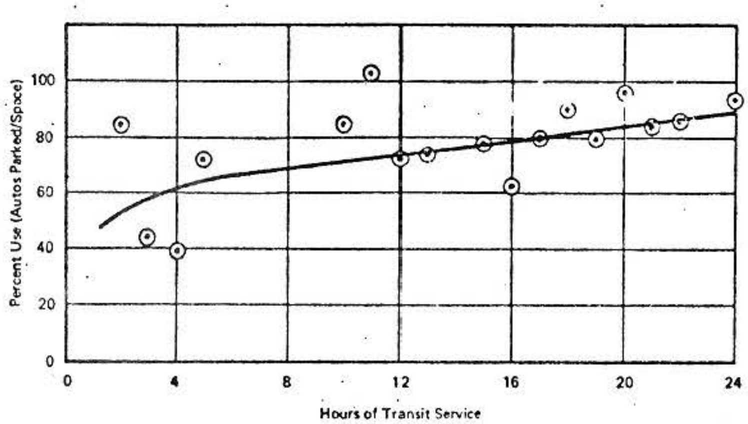
Figure 3 shows the accumulative percent of lots by hours of transit service and by type of transit service. All of the lots provided at least two hours of service--one hour for the morning peak and one hour for the evening peak. Overall, most of the lots provided between 14 and 24 hours of service; in fact, 80 percent of the lots provide daily service for 14 or more hours. Overall, less than 10 percent of the lots had service for less than 8 hours per day.

While use of available parking spaces actually depends upon a combination of factors, change-of-mode parking lots with more hours of transit service were consistently more fully utilized as shown in Figure 4.



ACCUMULATIVE PERCENT OF LOTS BY HOURS OF TRANSIT SERVICE AND BY TYPE OF TRANSIT SERVICE

FIGURE 3



PERCENT USE OVERALL BY HOURS OF TRANSIT SERVICE

FIGURE 4

Peak-Hour Headway

Closely connected with the hours of transit service is the time between service or headway. During the morning and evening peak periods, headways should be more frequent to meet the added demand. Many hours of service with infrequent headways will not generally provide transit service as good as a few hours of service with more frequent headways during peak periods.

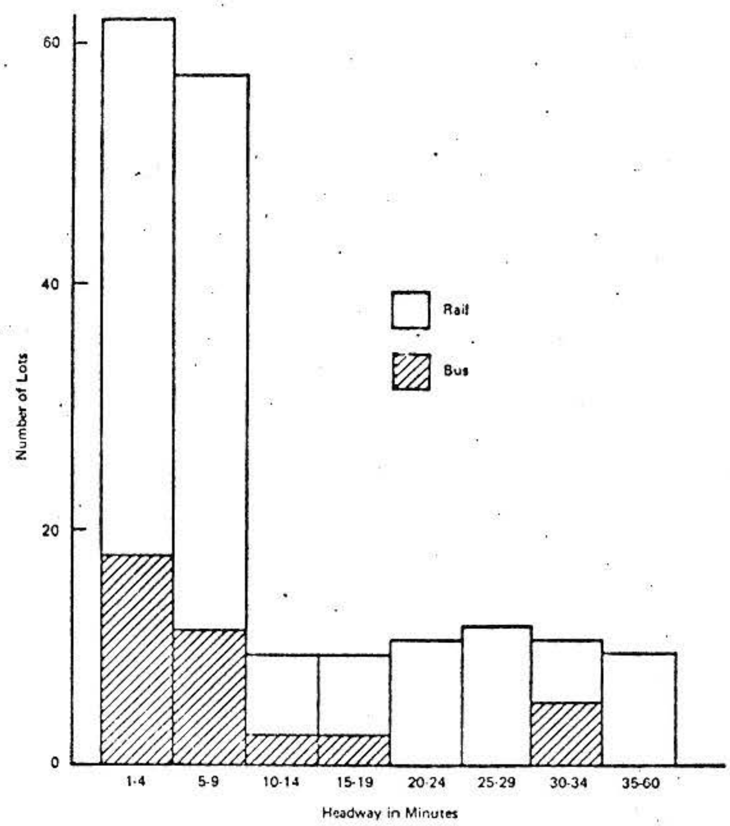
Recent research on factors influencing transit usage has shown that time spent waiting for transit is about 2.5 times as irritating to riders as time spent riding transit.[1] Therefore, the frequency of bus service, especially during the peak hours, is one of the critical factors affecting the use and success of change-of-mode operations.

Figure 5 shows that peak-hour headways for the lots included in the survey ranged from 1 to 60 minutes. Where service occurred once during the peak hour, it was considered as having a 60-minute headway. Eighty-five percent of the bus-serviced lots had peak-hour headways of 20 minutes or less, and 85 percent of the rail-serviced lots had peak-hour headways of 25 minutes or less.

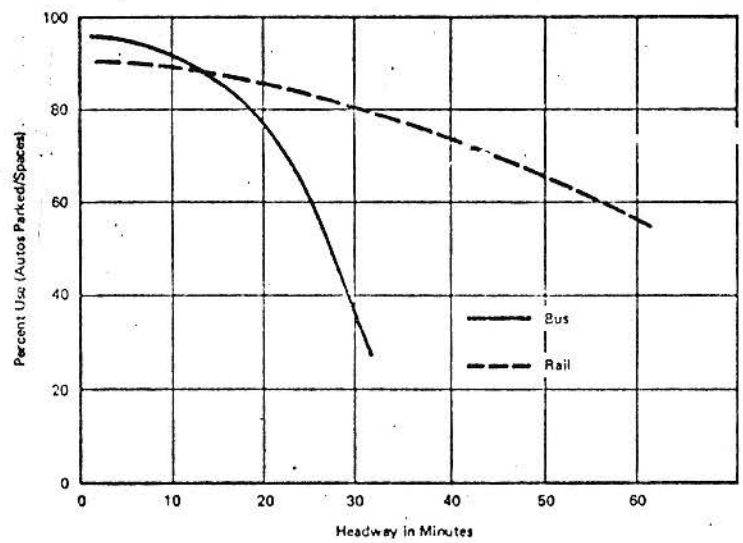
Use of bus-serviced lots decreased rapidly when peak-hour headways were greater than 20 minutes, as shown in Figure 6. Use of rail-serviced lots also decreased at an increasing rate, but much more gradual than for bus-serviced lots.

---

[1] Pratt, Richard H. and Thomas B. Deen. ESTIMATION OF SUB-MODAL SPLIT WITHIN THE TRANSIT MODE, Highway Research Record No. 205, 1967.



PEAK HOUR HEADWAY BY NUMBER OF LOTS AND
BY TYPE OF TRANSIT SERVICE
FIGURE 5

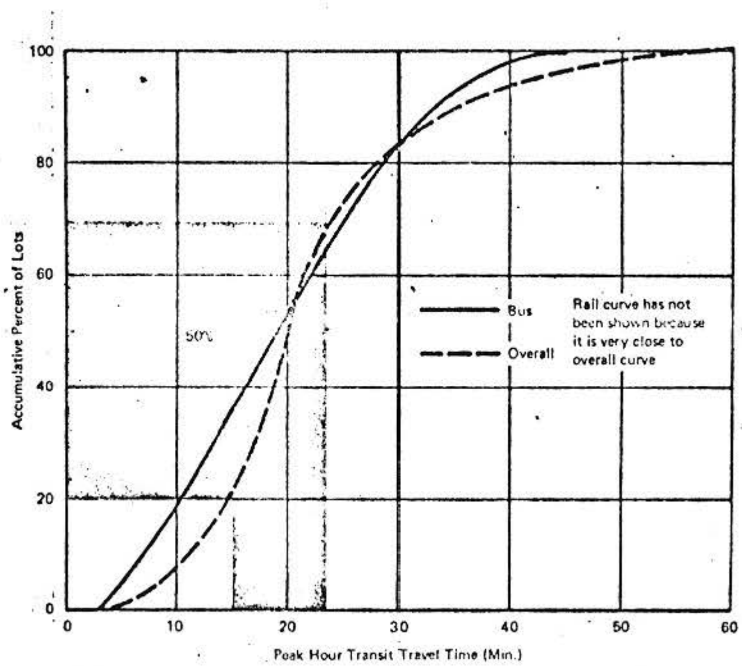


PERCENT USE BY PEAK HOUR TRANSIT HEADWAY
FIGURE 6

Peak-Hour Transit Traveltime

Transit traveltime is an important element affecting change-of-mode usage. If transit traveltime greatly exceeds auto traveltime, utilization of change-of-mode operations will suffer.

Figure 7 shows the accumulative percent of lots by peak-hour transit traveltime (between the lot and the CBD) and by type of transit service. (The accumulative percent curve for rail transit service has not been shown because it so closely duplicates the overall curve.) Eighty-five percent of the lots surveyed had transit service with peak-hour traveltime of 30 minutes or less. One-half of the lots had transit service with peak-hour traveltime from 15 to 25 minutes.

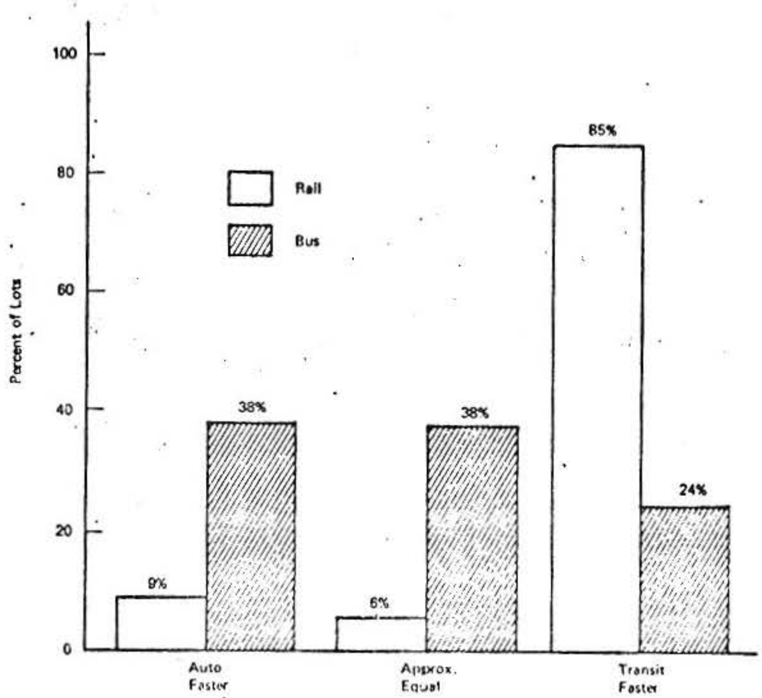


ACCUMULATIVE PERCENT OF LOTS BY PEAK HOUR TRANSIT TRAVEL TIME AND BY TYPE OF TRANSIT SERVICE

FIGURE 7

Figure 8 shows the percentage of rail and bus-serviced lots which have traveltime less than, equal to, or faster than automobile traveltime from the respective lots. Auto travel to the CBD was faster than transit for 38 percent of the bus-serviced lots and only 9 percent of the rail-serviced lots. Traveltimes were approximately equal for 38 percent of the bus-serviced lots and only 6 percent of the rail-serviced lots. Transit travel was faster for 24 percent of bus-serviced lots and 85 percent of the rail-serviced lots.

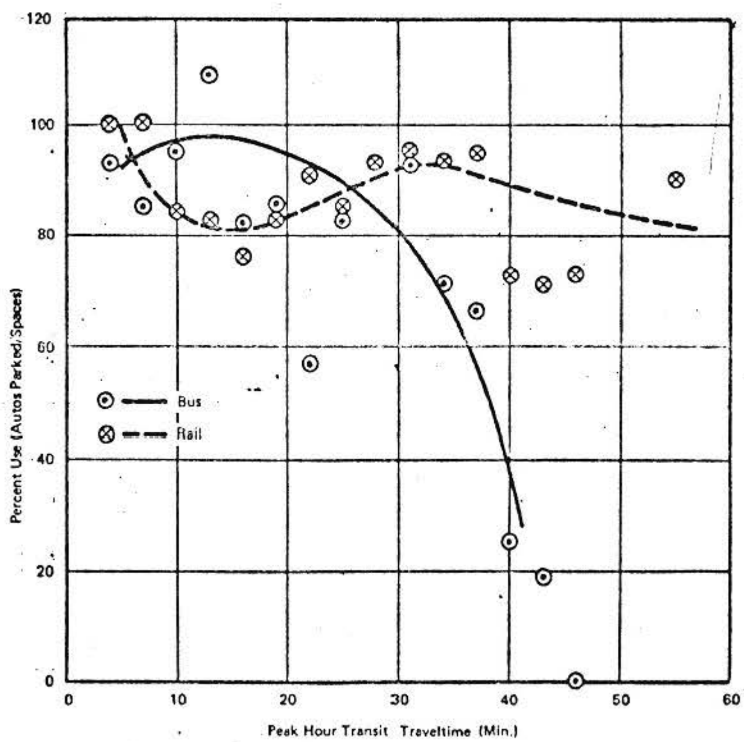
The traveltimes considered here are line-haul times. The majority of the rail-serviced lots provided transit traveltimes which were faster than auto, because rail transit operates on its own right-of-way and is



RELATIVE TRAVEL TIME BY PERCENT OF LOTS AND BY TYPE OF TRANSIT SERVICE

FIGURE 8

not directly influenced by congestion on urban streets. The 24 percent of the bus-serviced lots with transit service faster than auto is not too easily explained. Since these times are line-haul times, express bus service in some instances might provide faster travel for that portion of the trip. Or perhaps some of the transit traveltimes were taken from schedules rather than actual traveltime.



PERCENT USE BY PEAK HOUR TRANSIT TRAVELTIME
AND BY TYPE OF TRANSIT SERVICE
FIGURE 9

Figure 9 shows the percent use of available parking spaces as it relates to peak-hour transit traveltimes by type of transit service. The figure shows that the use of spaces at bus-serviced lots declines rapidly when transit traveltimes are greater than 30 minutes. However, it is important to remember the use of available spaces is not necessarily a good measure of the success of a change-of-mode operation.

C. Cost Considerations

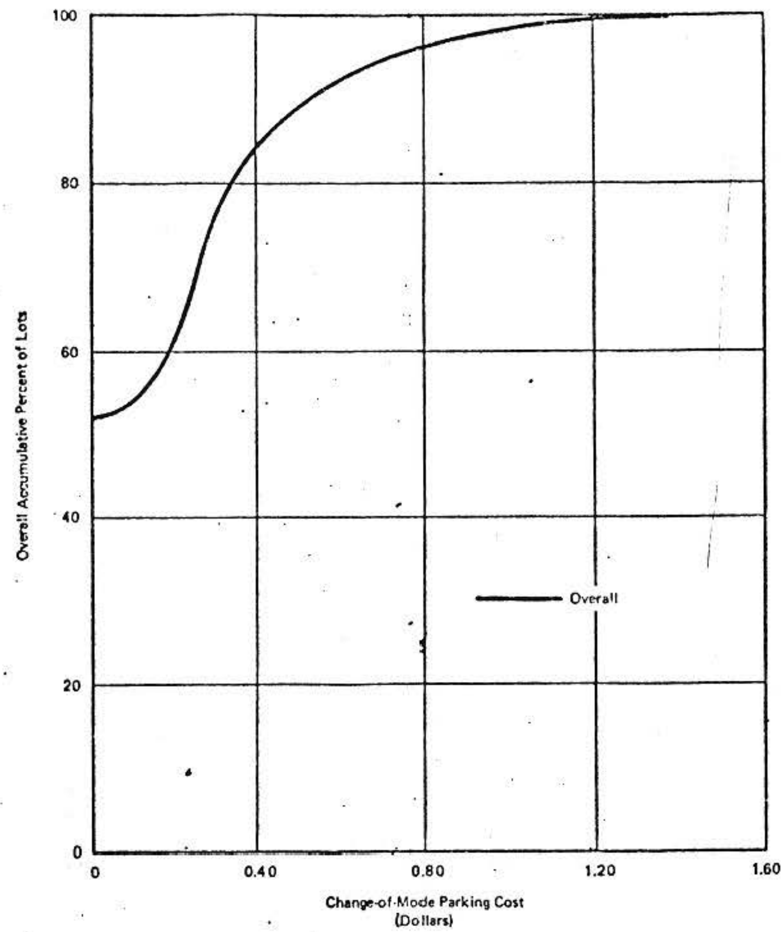
Travel costs are an important consideration in selecting a mode of travel. Out-of-pocket costs such as those for parking, tolls, or transit fare probably carry more weight in the decision than hidden costs such as auto operating expenses and personal time costs. However, all of these costs are important for a meaningful analysis of travel costs. The various costs are discussed separately and are then combined for an analysis which compares auto and change-of-mode travel costs.

Change-of-Mode Parking Cost

The cost of change-of-mode parking is one of the immediate considerations to a potential change-of-mode parker. This cost, combined with the round-trip transit fare, is an everyday out-of-pocket cost that he compares with out-of-pocket cost for parking in the CBD.

Figure 10 shows the range of change-of-mode parking costs by accumulative percent of lots. Some of the lots had parking fees of over $1; however, as the figure shows, 85 percent of the lots had a fee of less than $.40 and over one-half were free.

Of those lots charging a parking fee, most charged between $.20 and $.40. Although there was no set pattern, those facilities which charged a fee tended to be located nearer the CBD.



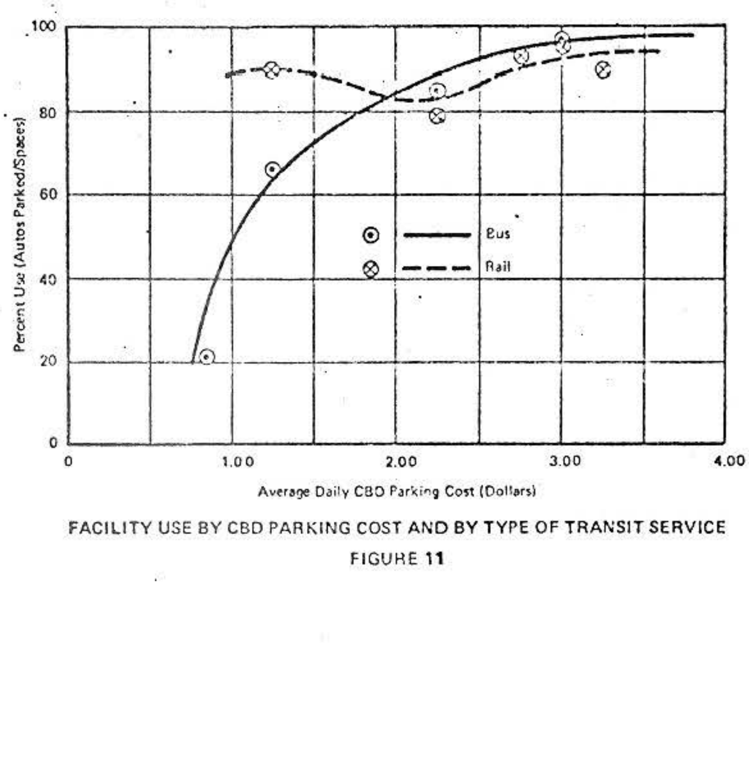
ACCUMULATIVE PERCENT OF LOTS BY CHANGE-OF-MODE PARKING COST

FIGURE 10

Free change-of-mode parking generally had less complete use of available spaces than those lots which charged a parking fee. However, it is important to note that free lots generally have a large number of available spaces, and all spaces need not be used for successful operation. Lots which charge for parking normally depend upon the income to help support the operation, and therefore, must keep the parking supply closer to the demand, thereby reflecting better utilization values.

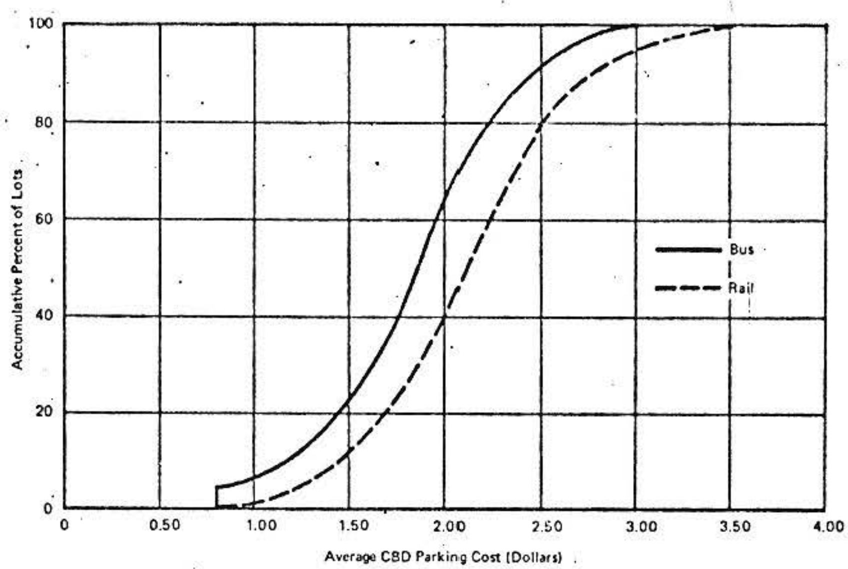
CBD Parking Cost

One compelling reason for using change-of-mode parking is to avoid CBD parking costs. This is one of the out-of-pocket costs which a commuter would like to avoid, especially when it is high. This reasoning seems to hold true for bus-serviced lots because, as shown in Figure 11, usage increased as CBD parking costs increased. The same relation did not hold, however, for rail-serviced lots. The rail-serviced lots generally have a well-established clientele and offer the commuter advantages even when the average CBD parking cost is not excessive. The average daily CBD parking cost ranged from $.80 to $3.50.



FACILITY USE BY CBD PARKING COST AND BY TYPE OF TRANSIT SERVICE

FIGURE 11



ACCUMULATIVE PERCENT OF LOTS BY AVERAGE CBD PARKING COST AND BY TYPE OF TRANSIT SERVICE

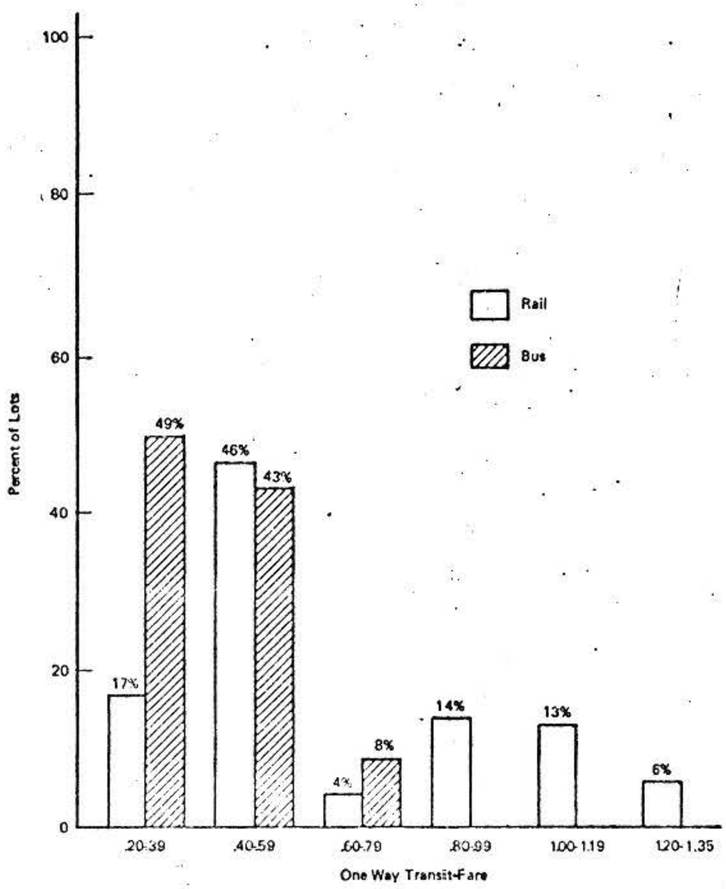
FIGURE 12

Figure 12 shows the range of average CBD parking costs by accumulative percent of lots and by type of transit service. A larger percentage of the rail-serviced change-of-mode lots tended to be located in cities with higher CBD parking cost. About 60 percent of the rail-serviced lots were located in cities with average CBD parking costs in excess of $2, whereas only 36 percent of the bus-serviced lots were located in cities with average CBD parking costs in excess of $2.

Transit Fare

Transit fare is another out-of-pocket cost which influences the choice of a potential change-of-mode parker. Ideally, this cost, combined with change-of-mode parking cost, should be equal to or less than the CBD parking cost.

Figure 13 shows the range of costs for one-way transit fare from the change-of-mode lots to the CBD. The transit fare for bus-serviced lots was never more than $.75. Approximately 92 percent of the bus-serviced lots had one-way transit fares from $.20 to $.59. Rail fares ranged upward to $1.35 with nearly half of the rail-serviced lots showing a one-way transit fare of $.40 to $.59.

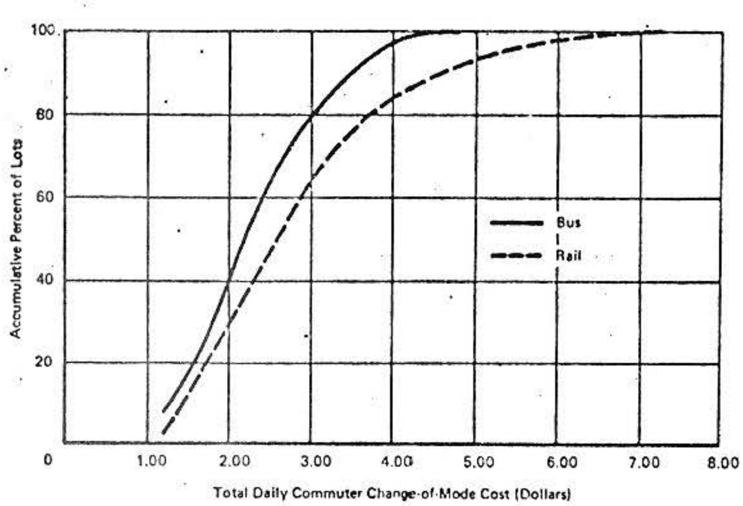


ONE WAY TRANSIT FARE BY PERCENT OF LOTS
BY TYPE OF TRANSIT SERVICE
FIGURE 13.

Total Change-of-Mode Cost

The total daily tangible commuter costs associated with the use of a change-of-mode operation include: the change-of-mode parking cost, round-trip transit fare, and personal time cost while riding transit. The value of personal time was assumed to be $2.35 per hour.[1] To put change-of-mode cost in proper perspective, a comparison was made with costs of comparable travel by automobile, which includes CBD parking costs, auto operating cost for the two-way trip ($.12 per mile,)[2] and personal time cost.

Figure 14 shows the distribution of total daily commuter change-of-mode cost by accumulative percent of lots for bus and rail service. The cost for bus-serviced lots ranged from $1.20 to $4.74 with 85 percent less than $3.25. The cost for rail-serviced lots had a higher cost range



ACCUMULATIVE PERCENT OF LOTS BY DAILY COMMUTER CHANGE-OF-MODE COST AND BY TYPE OF TRANSIT SERVICE

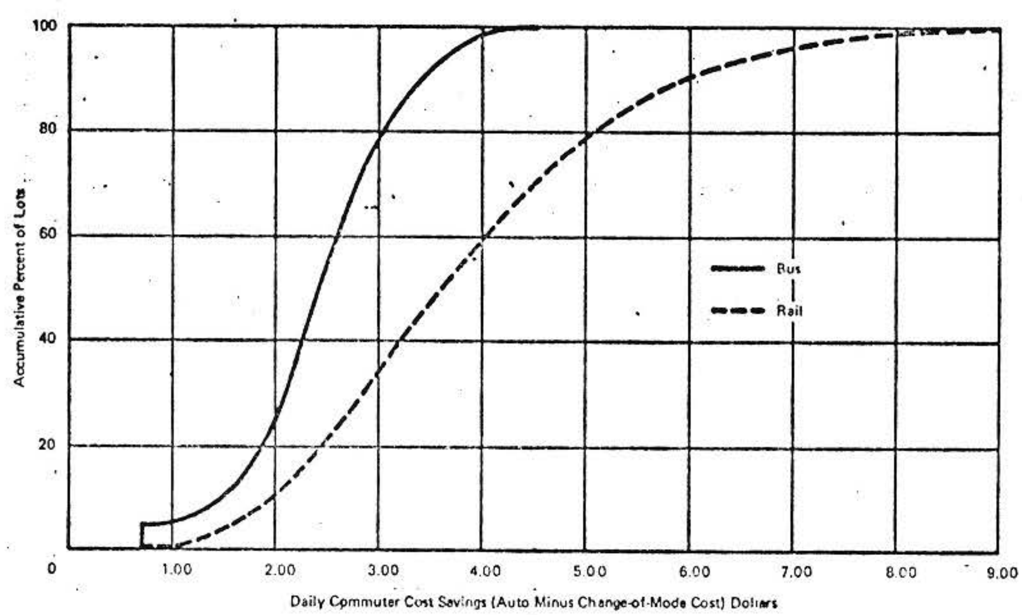
FIGURE 14

[1] TRANSPORTATION RESOURCE ALLOCATION STUDY - DEVELOPMENT OF THE PROTOTYPE MODEL, U.S. Department of Transportation, FHWA, January 1970.

[2] Cope, E. M. and C. L. Cauthier, COST OF OPERATING AN AUTOMOBILE, U.S. Department of Transportation, Federal Highway Administration, February 1970.

($1.20 to $7.25) because some of these lots were located further from the CBD requiring higher transit fares and longer traveltimes. About 85 percent of the rail-serviced lots had total daily commuter cost of less than $4.10.

A comparison was made between the change-of-mode daily commuter costs and the cost for similar travel by automobile between the same points. In every case the travel via the change-of-mode operation was less costly. Figure 15 shows the distribution of cost savings, auto cost minus change-of-mode cost, by accumulative percent of lots and by bus and rail service. Cost savings for bus-serviced change-of-mode ranged from $.50 to $4.50 with 85 percent showing a savings from $.50 to $3.20 per round trip. Cost savings for rail-serviced change-of-mode range from $1 to $9.01, with 85 percent showing a savings from $1 to $5.40 per round trip.



ACCUMULATIVE PERCENT OF LOTS BY DAILY COMMUTER COST SAVINGS
AND BY TYPE OF TRANSIT SERVICE

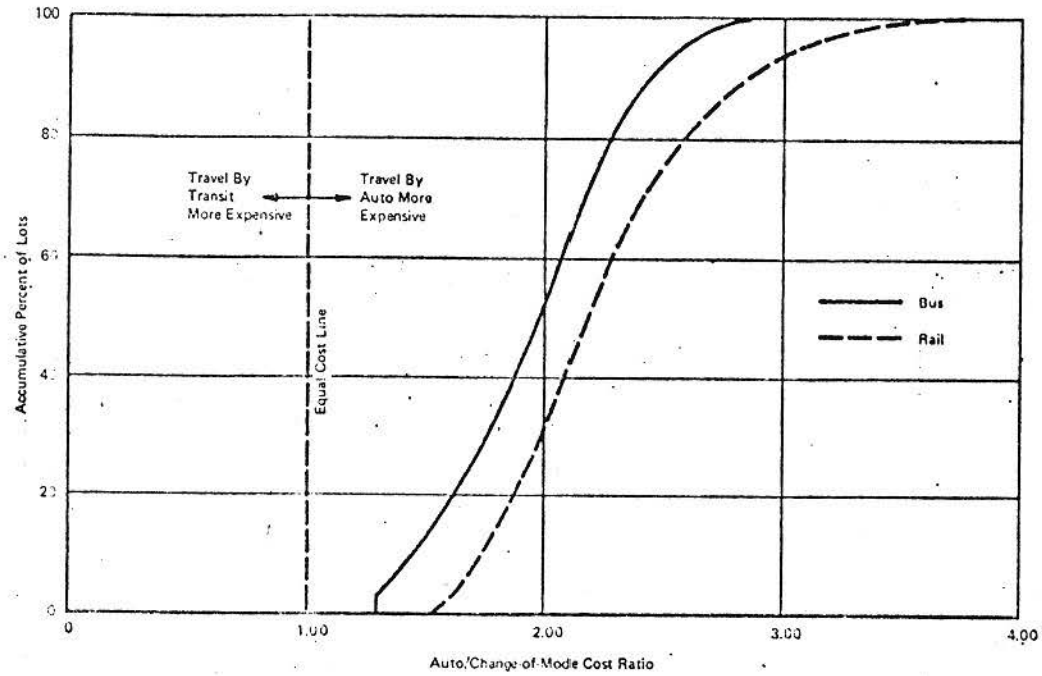
FIGURE 15

The cost savings potential (auto mode cost minus change-of-mode cost) was greater with rail service even though the actual rail-serviced change-of-mode costs ranged higher than bus-serviced change-of-mode costs. The savings potential is greater partly due to personal time cost savings (rail has faster travel speed,) and partly due to operating cost savings (transit fare is less than auto operating costs.) In most every case auto operating cost was at least twice as expensive as the transit fare, in some cases more than six times as expensive.

Based on the data included in the survey, the method of cost analysis, and comparable travel by automobile, over 85 percent of the change-of-mode operations had an individual daily cost savings potential of at least $2. Assuming 250 work days per year, this amounts to an annual savings of at least $500 to the commuter.

Every change-of-mode operation in the survey showed cost savings over comparable travel by automobile. The ratio of these costs, auto mode cost to change-of-mode cost is shown in Figure 16. The larger the value of the ratio, the greater the cost advantages for using change-of-mode parking and riding transit for a portion of the CBD bound trip. Forty-seven percent of the bus and 69 percent of the rail-serviced change-of-mode lots provided service that was at least twice as economical as comparable travel by auto.

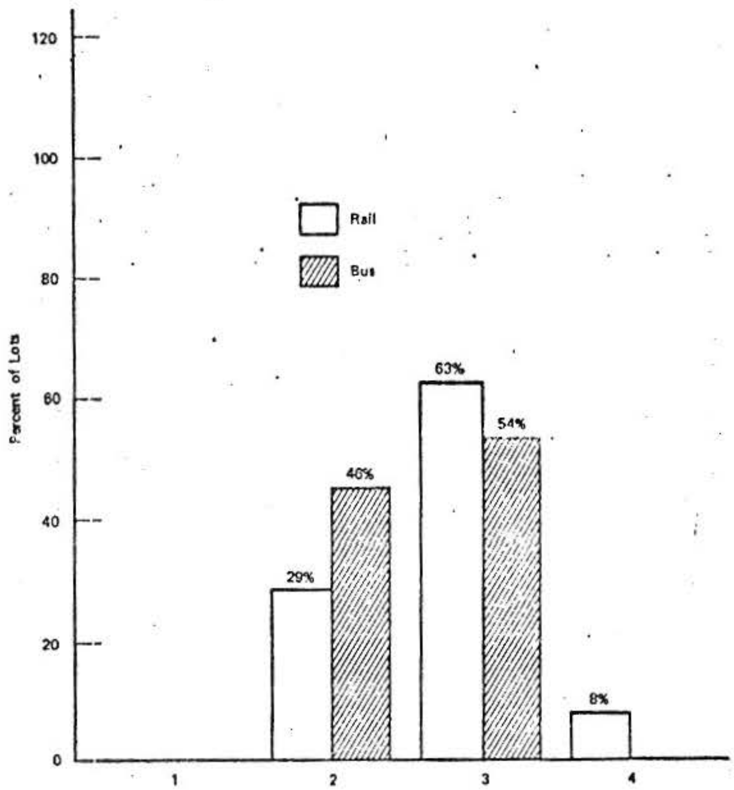
It is important to note, however, that these are costs incurred by each individual traveler. Persons riding together in an automobile sharing costs equally could probably incur individual costs less than or equal to



ACCUMULATIVE PERCENT OF LOTS BY AUTO/CHANGE-OF-MODE COST RATIO AND BY TYPE OF TRANSIT SERVICE

FIGURE 16

change-of-mode transit costs. An analysis of this consideration is shown in Figure 17. The cost for change-of-mode transit travel from 32 percent of the surveyed lots could be equaled by two persons equally sharing auto expenses, 60 percent of the lots by three persons, and 8 percent of the lots by four persons.



Number of auto occupants, equally sharing expenses, required to have individual costs less than change-of-mode transit cost.

COMMUTER COST COMPARISON
FIGURE 17

III. Case Histories

To present a more detailed picture of current change-of-mode parking operations, case histories of the systems used by the nine cities included in the survey are discussed. Some of these cities have change-of-mode operations which have not been included in this report because data concerning their characteristics and use were not available. As indicated in Section II, all of the lots included in the survey could not be used in the analysis because of incomplete data; however, data from all of the surveyed lots are tabulated at the end of the discussion for their respective city. Maps and photographs further illustrate the operations for some of the cities.

Boston

Change-of-mode parking in the Boston area occurs at about 80 railroad stations, 30 Massachusetts Bay Transportation Authority (MBTA) stations, and one bus terminal. Change-of-mode parking occurs here primarily for one or more of the following reasons:

1. Lack of available, suitable CBD parking.
2. High cost of CBD parking.
3. Cost differential between auto and change-of-mode trip to CBD.
4. Congestion on roads.

It does not result from advertising, convenience, or the attraction of exceptional transit service per se.

The one change-of-mode parking facility at a bus terminal is an exception which occurs because this corridor is without adequate through highways to the CBD, congestion is high, the distance is long, and travel-time is significant. The service from this lot is of a limited operation, however. It is local to a point and then express to a rapid transit terminal where parking is not available, but a quick ride to the CBD is.

Over 70 percent of the lots and spaces are located more than five miles from the CBD (40 percent are even greater than 10 miles.) Sixty-six percent of the change-of-mode parkers utilize these change-of-mode parking lots (i.e., those greater than five miles from the CBD.)

Kiss and ride plays a prominent part at these same facilities, too. Unfortunately, figures on the riders involved are not available, but they are significant.

Change-of-mode parking could be greatly encouraged in the Boston area by:

1. Increasing the availability of parking space at existing lot locations.
2. Building new lots at other locations.
3. Making lots attractive by paving, lighting, signing, and providing shelters.
4. Providing guards throughout the length of the day.
5. Lowering costs as much as possible. (Free?)
6. Improving quality of transit, particularly the transit trip time.
7. Making transit reliable at all times regardless of weather or travel demand.

8. Advertising, particularly to let people know of location, cost, availability, and transit schedules.
9. Supplying associated services (towing, battery charging, etc.).

The accompanying map (Figure 18) shows the extent of change-of-mode operations in the Boston area, and Table 6 summarizes the data.

TABLE 6

PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	TIME CBD TRANSIT (AUTO) Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. MINUTES Peak	TRANS. FREQ. MINUTES Off-Peak	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
Wonderland MBTA #1	1960	20	15	0.50	6	26(27)	26(16)	0.25	2½	9	19 Hours	A,L,W,S,P	
Ocean Ave., Wonderland #2		180	180	0.25	6	26(27)	26(16)	0.25	2½	9	19 Hours	A,W,S,P	
Ocean Ave., Wonderland #3		300	10	0	6	26(27)	26(16)	0.25	2½	9	19 Hours	A,L,S,P	
Ocean Aven., Wonderland MBTA #4		3000	200	0	6	26(27)	26(16)	0.25	2½	9	19 Hours	S,P	
Walley St., Suffolk Downs MBTA		100	50	0	4	20(23)	20(14)	0.25	2½	9	19 Hours	S,P	
Bennington St., Orient Heights		40	25	0	4	19(20)	19(12)	0.25	2½	9	19 Hours	S,P	
Bennington St., Wood Island		150	110	0	3	16(18)	16(10)	0.25	2½	9	19 Hours	W,S,P	
Asticou Rd. Forest Hills		150	150	0.40	5	27(33)	25(27)	0.25	2½	6	19 Hours	A,W,S,P	
3699 Washington, St., Forest Hills		50	50	0.75	5	27(33)	25(27)	0.25	2½	6	19 Hours	A,W,S,P	
3688 Washington, St., Forest Hills		253	253	0.75	5	27(33)	25(27)	0.25	2½	6	19 Hours	A,L,W,S,P	
Forest Hills		180	150	0.60	5	27(33)	25(27)	0.25	2½	6	19 Hours	A,W,S	
Green/Washington Sts., Green St.	1964	100	100	0.50	4	25(30)	23(25)	0.25	2½	6	19 Hours	A,S	
3409 Washington St., Green St.		50	50	0.20	4	25(30)	23(25)	0.25	2½	6	19 Hours	A,W,S,P	

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. MINUTES Peak	Off-Peak	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
Beaconsfield, MBTA Green Line			50	0	5	18(34)	14(23)	0.50	4½	9		S,P	
Butler, MBTA Red Line		125	125	0	6	24(40)	22(30)	0.25	2½	10	20 Hours	S	
1950 Dorchester Ave., Ashmont		160	145	1.00	6	21(35)	19(24)	0.25	2½	10	19 Hours	A,L,W,S,P,G	
Fields Corner, MBTA Red Line		700	75	0	4	16(30)	15(20)	0.25	2½	10	19 Hours	L,S,P	
Savin Hill, MBTA Red Line		31	25	0	3	13(27)	12(18)	0.25	2½	10	19 Hours	S,P	
Columbia, MBTA Red Line		287	287	1.00	3	11(20)	10(13)	0.25	2½	10	19 Hours	A,L,W,S,P	
Tremont Street	11-1-65	45	36	1.00		2	2	0.25	1½	3	20 Hours	A,L,S,P	
Ashmont	7-1-61	140	140	0.75	6	15	15	0.25	3	6	19 Hours	A,L,S,P	
Auditorium	1-1-65	22	21	1.50	2	7	7	0.25	3	8	20 Hours	A,L,S,P	
Mattapan	10-30-53	200	184	0.35	8	25	25	0.25	1½	8	20 Hours	A,L,W,S,P	
Milton	10-30-53	48	48	0.35	7	20	20	0.25	1½	8	20 Hours	A,L,S,P	
Cedar Grove	10-30-53	29	25	0.35	6	16	16	0.25	1½	8	20 Hours	A,L,S,P	
Central Avenue	10-30-53	20	20	0.35	7	18	18	0.25	1½	8	20 Hours	L,S,P	
Butler Street	10-30-53	320	294	0.15	6	19	19	0.25	1½	8	20 Hours	A,L,W,S,P	
Beaconsfield	7-3-59	20	20	0	5	19	19	0.50	5	8	20 Hours	L,S,P	

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. MINUTES Peak	Off-Peak	HOUR OF SERVICE	SERVICES PROVIDED IN LOT*	REMARKS
Brookline Hills	7-3-59	12	12	0	4	15	15	0.50	5	8	20 Hours	L,S,P	
Chestnut Hill	7-3-59	55	55	0.35	6	24	24	0.50	5	8	20 Hours	A,L,S	
Longwood	7-3-59	18	18	0	3	12	12	0.50	5	8	20 Hours	L,S,P	
Eliot	7-3-59	57	51	0.35	9	30	30	0.50	5	8	19 Hours	A,L,S,P	
Waban	7-3-59	45	44	0.35	10	32	32	0.50	5	8	19 Hours	A,L,P	
Woodland	7-3-59	390	249	0.25	11	36	36	0.50	5	8	19 Hours	A,L,S,P	
Riverside	7-3-59	1600	1120	0.10	12	38	38	0.50	5	8	19 Hours	A,L,S,P	
Centon Junction		200	200	0	15	26		1.02	14		9 Hours	L,S,P	
Centon		10	10	0	14	30(60)		1.04	24		10 Hours	L,S,P	
Route 128		500	300	0.93	15	19(47)		0.93	15		9 Hours	A,L,S,P	
Readville		40	25	0	13	16		0.87	30			L,S,P	
Sharon		300	225	0	16	40(66)		1.12	45			L,S,P	
Mt. Hope						14(20)		0.80			10 Hours		
Needham Hts. #42		20	20	0	16	55(33)	36	0.99	27	60	15 Hours	L,S,P	
Needham #43		50	50	0.25	15	32(31)	33	0.96	27	60	15 Hours	L,S,P	
Needham Jct.		200	200	0	14	28(29)	29	0.93	27	60	15 Hours	L,S,P	
Birds Hill		200	200	0	14	25(35)	26	0.90	27	60	15 Hours	L,S,P	

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. MINUTES Peak	Off-Peak	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
West Roxbury		50	25	0	11	20(25)		0.84	27	60	15 Hours	L,S,P	
Highland		75	30	0	11	18(25)	19	0.81	27	60	15 Hours	L,S,P	
Bellevue		75	30	0	10	16(20)	17	0.81	27	60	15 Hours	L,S,P	
Roslindale		50	50	0	10	14(20)	15	0.80	27	60	15 Hours	L,S,P	
Franklin		100	75	0	30	58(85)		1.35	45	50	13 Hours	L,S	
Norfolk		40	20	0	25	20(80)	43	1.24	46		13 Hours	L,S	
Walpole		75	50	0	20	43(70)	36	1.15	46	306	13 Hours	L,S	
Plimptonville		25	1	0		39(70)	38	1.10		247		S	
Norwood Central		150	150	0	17	30(62)	31	1.02	25	247		L,S,P	
Norwood		35	35	0	17	28(40)	27	1.02	22	247		L,S,P	
Islington		10	10	0	15	25(40)	24	0.96	22	247	12 Hours	L,S,P	
Hyde Park		50	25	0	11	17(25)		0.84	35			L,S,P	
Everett #58	1-1-54	425	425	0.35	3	18	18	0.25	3½	6	19 Hours	A,L,S,P	
Everett #59	1-1-39	80	52	0.35	3	18	18	0.25	3½	6	19 Hours	A,L,S,P	
Sullivan Sq.	10-30-53	200	180	0.50	2	14	14	0.25	3½	6	19 Hours	A,L,W,P	
Lechmere Sq.	10-30-53	358	358	0.50	1	9(14)	9	0.25	2½	4	20 Hours	A,L,S,P	
Kendall Sq.	12-9-53	79	74	0.50	1	3	3	0.25	3½	6	19 Hours		

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. Peak	Off-Peak MINUTES	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
Forest Hills Jamaica Plan	10-30-53	120	86	0.35	6	20	20	0.25	3½	6	19 Hours	A,L,W,S,P	
Forest Hills	10-30-53	150	121	0.40	6	20	20	0.25	3½	6	19 Hours	A,W,P	
Arlington Heights	10-30-53	60	55	0.35	8	35	35	0.45	2	6	20 Hours	A,L,S,P	
Wood Island Park	10-30-53	341	341	0.15	2	10	10	0.25	3½	5½	20 Hours	A,L,W,S,P	
Orient Heights	10-30-53	454	400	0.25	3	12	12	0.25	3½	5½	20 Hours	A,L,W,S,P	
Suffolk Downs	6-18-54	120	83	0.15	4	14	14	0.25	6½	11	20 Hours	A,L,W,S,P	
Beachmont	6-18-54	210	205	0.15	4	15	15	0.25	6½	11	20 Hours	A,L,W,S,P	
Ocean Avenue	7-1-54	220	213	0.25	5	20	20	0.25	6½	11	20 Hours	A,L,W,S,P	
Wonderland	6-18-54	500	470	0.25	6	20	20	0.25	6½	11	20 Hours	A,L,W,S,P	
Prides Crossing		20	15	0	18	43(47)	45	1.25	30	60	17 Hours		
Monteserrat		50	35	0	18	39(42)	41	1.19	30	60	17 Hours		
Route 1A		80	70	0	23	45(43)	45	1.25	29	120	17 Hours		
North Beverly		12	12	0	19	41(39)	41	1.18	28	60	18 Hours		
Beverly													
Route 1A		180	125	0	20	25(30)	27	1.05	11	60	18 Hours	L,S,P	
Salem Center		108	100	0	20	31(40)	33	1.14	11	60	19 Hours	L,S,P	
Lynn		333	75	0	11	22(27)	24	1.03	11	60	19 Hours	L,S,P	

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. Peak (MINUTES)	Off-Peak (MINUTES)	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
Beverly Farms		50	30	0	18	45(40)	47	1.16	11	60	16 Hours	L,S,P	
Center, Manchester		150	80	0	23	50(52)	52	1.31	30	60	17 Hours	L,S,P	
West Concord		150	75	0	16	40(40)	40	1.23	20	60	18 Hours		
Concord		73	70	0	16	37(40)	37	1.21	20	60	18 Hours		
Lincoln		110	75	0	13	32(30)	32	1.14	20	60	18 Hours		
Kendall Green		30	30	0	13	27	27	1.08	20	60	18 Hours		
Center, Waltham		45	45	0.25	10	21(30)	21	1.09	20	60	18 Hours		
Route 129		20	20	2.00 pv	15	24(34)	29	0.94	45	120	19 Hours		
Center, Woburn		100	100	0	11	28(39)	26	0.99	15	60	17 Hours		
Cross Street		13	13	0	11	25(39)	23	0.99	15	60	17 Hours		
Center, Winchester		135	100	0	9	21(35)	19	0.94	15	60	18 Hours		
Wedgemere		194	150	0	8	19(34)	17	0.94	15	60	18 Hours		
Center, Reading		200	200	0	12	26(30)	32	1.03	15	60	18 Hours	L,W,S,P	
Center, Wakefield		180	180	0	10	21(32)	27	0.99	15	60	18 Hours		
Highlands		97	70	0.25	7	22(32)	22	0.94	20	60	18 Hours		
Center, Melrose		75	65	0.25	7	20(29)	20	0.93	20	60	18 Hours	L,W,S,P	
Tremont Street	11-1-65	45	36	1.00		2	2	0.25	1½	3	20 Hours	A,L,W,P	

CONTINUED

TABLE 6
PARK AND RIDE FACILITIES

BOSTON

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO [illegible]	TRANS. FREQ. MINUTES Peak	Off-Peak	HOURS OF SERV.	SERVICES PROVIDED IN LOT *	REMARKS
Ashmont	7-1-61	140	140	0.75		15	15	0.25	3	6	19 Hours	A,L,S,P	
Auditorium	1-1-65	22	21	1.50		7	7	0.25	3	8	20 Hours	A,L,S,P	
High Street		15		0		9	9		20				

*A = Attendant on duty
L = Lighting
P = Paved
S = Self-Park
W = Shelter

Chicago

Chicago's municipally owned transit system serves the city and 34 of its adjacent suburbs. Operation of the system is under the direction of the Chicago Transit Authority (CTA.)

Additional bus service, primarily suburban, is furnished by several small bus companies. Six suburban railroads operate between the suburbs and downtown Chicago with intermediate stops within the city. The rail routes are shown on Figure 19.

Ninety-nine percent of Chicago's residents are within three-eighths mile of at least one of the nine rapid transit and 129 bus lines that comprise the CTA system. CTA has also established direct connections to suburban buses and commuter trains wherever feasible. Excellent examples of the latter are the new transportation centers at the end of the Dan Ryan and Kennedy Rapid Transit lines as shown in Figure 20.

In an effort to foster the use of mass transit by the business community, CTA operates a comprehensive network of reduced fare shuttle buses to serve the central business district. Special transit lanes at two of the three major suburban rail terminals, adjacent to Chicago's "Loop," facilitate the movement of buses transporting commuters to the central business district and near north side. Figures 21 and 22 are photos of the transit lanes at the North Western and Union Stations, respectively. The shuttle bus system also serves the Soldier Field and Monroe parking lots on the lake front, and the Grant Park garage under Michigan Avenue. The three locations offer a combined total of 10,200 parking spaces.

CTA provides change-of-mode parking for a total of 2,579 autos at seven rapid transit terminals. Figure 23 shows a typical CTA Park-N-Ride location. Several municipalities and/or private operators provide supplemental parking at a few of the terminals and at several on-line stations. A considerable amount of Kiss-N-Ride activity also occurs at the rapid transit terminals. It has become a major problem at the Congress terminal because of the traffic congestion which results from Kiss-N-Ride traffic movement during the evening rush period.

The Skokie Swift project on the CTA has been a particularly successful new service. The ridership increased to 8,200 per day from the 1,500 per day on the interurban railway that formerly served this corridor. To encourage use of the facility, over 500 parking spaces were provided in addition to feeder bus service. The speed and frequency of this service is a particularly attractive feature.

Most Chicago suburbs served by commuter trains provide parking facilities at or near railroad stations in cooperation with the railroads. In many instances, land is leased from a railroad by the community which, in turn, uses it to provide commuter parking on a fee basis. Lot capacities in many cases are quite substantial. A recent survey of commuter railroad parking in the Chicago metropolitan area indicates that approximately 20,000 such spaces are available.

In order to encourage greater use of Chicago and North Western suburban trains, a direct connection was established between the railroad's downtown terminal and the CTA's West-South rapid transit route on June 29, 1970. This weather-free pedestrian tunnel (Figure 24), constructed with the aid of a two-thirds Federal grant from the U.S.

Department of Transportation, provides the connecting link in a traffic-free trip via commuter railroad and rapid transit to the far south and west sides of the city. A total of 1,723 persons used the connection during the 16-hour period from 6 a.m. to 10 p.m. on a weekday in mid-July 1970.

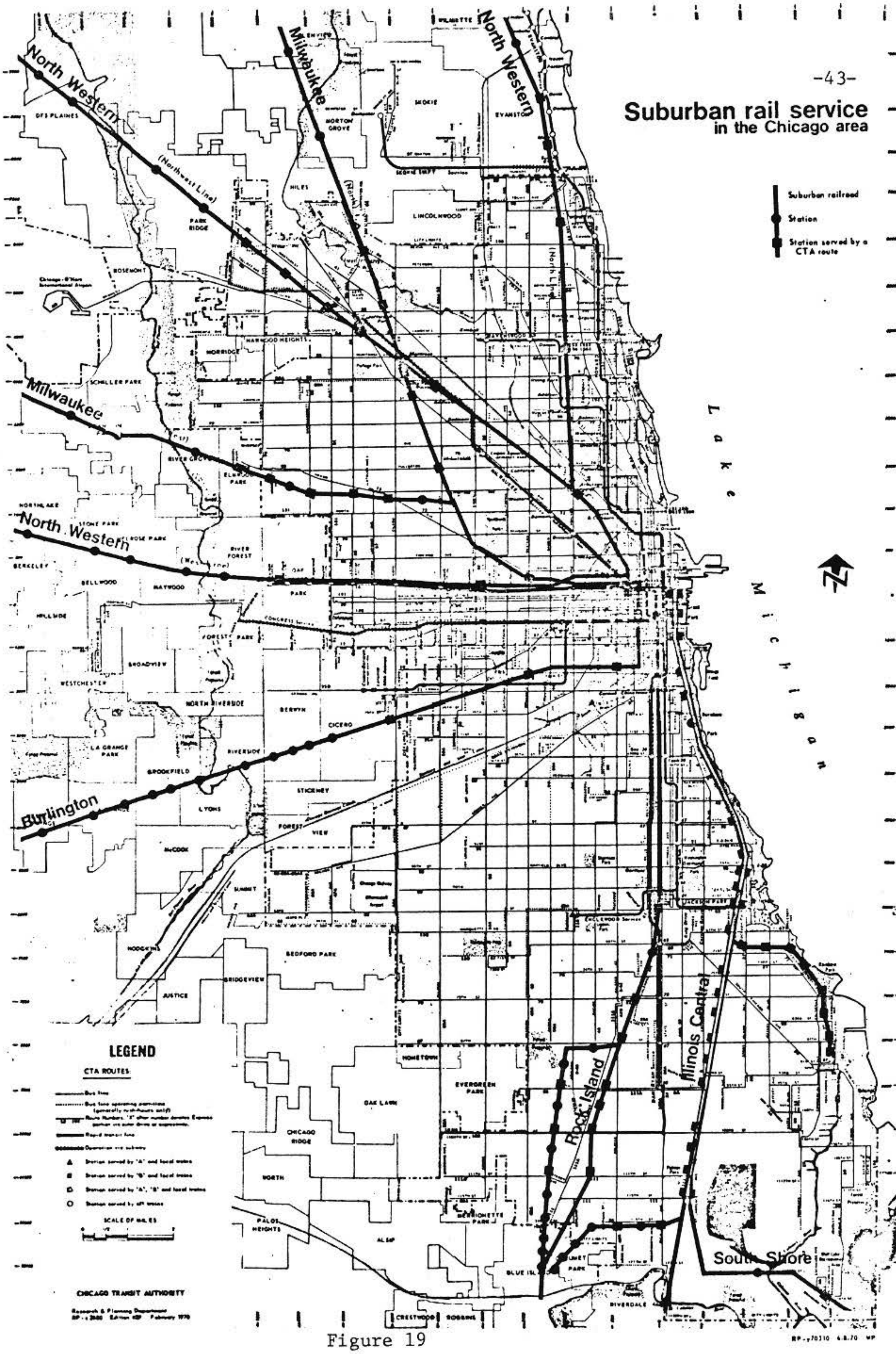

Suburban rail service
in the Chicago area
Suburban railroad
Station
Station served by a CTA route
North Western
(Northwest Line)
Milwaukee
(North Line)
North Western
(North Line)
Milwaukee
North Western
Burlington
Rock Island
Illinois Central
South Shore
Lake Michigan
LEGEND
CTA ROUTES
CHICAGO TRANSIT AUTHORITY

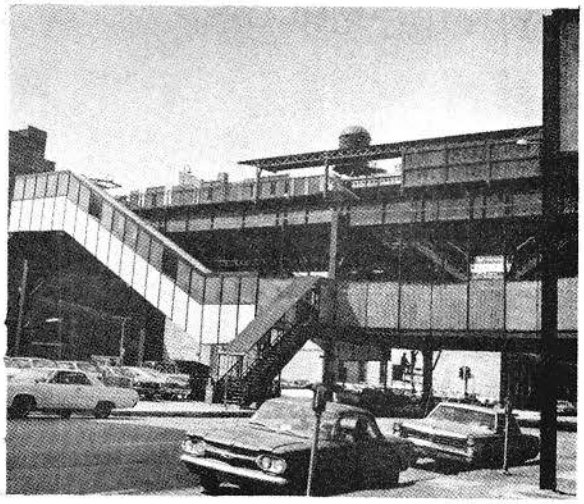
Figure 19

Figure 20

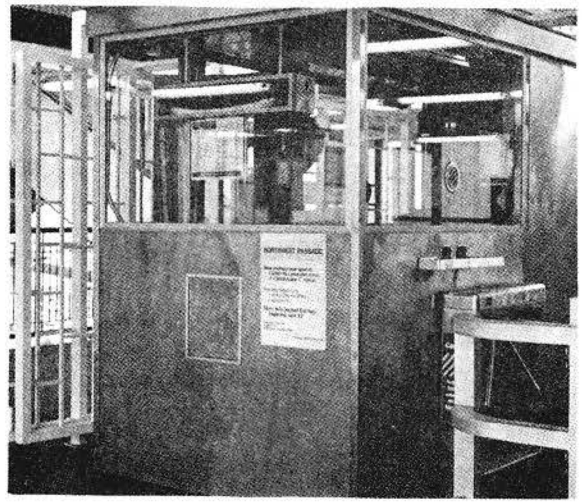
Figure 21

Figure 22

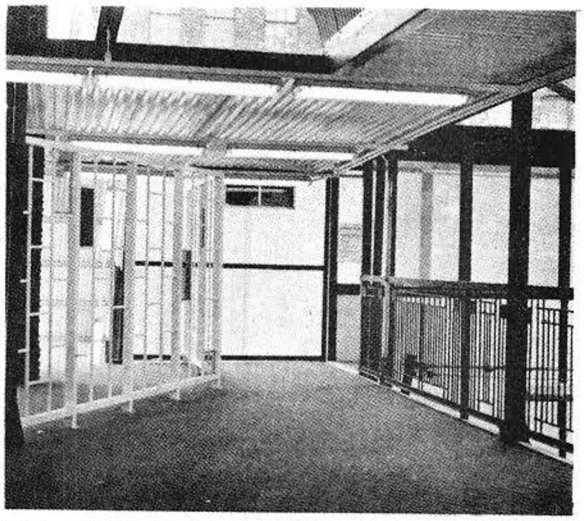
Figure 23



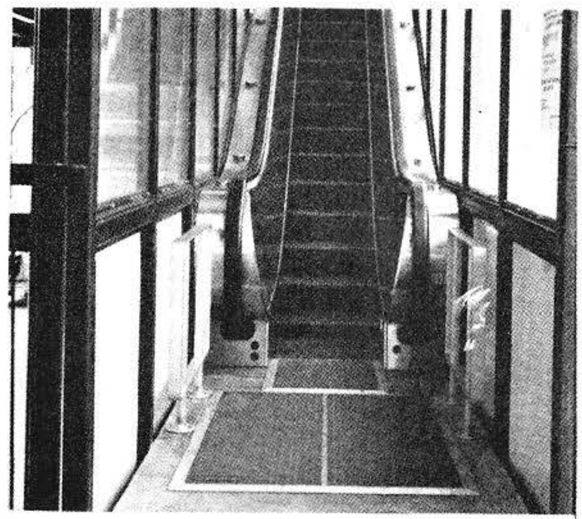
Clinton/Northwest Passage, CTA station showing escalator from mezzanine to eastbound platform UTG-3



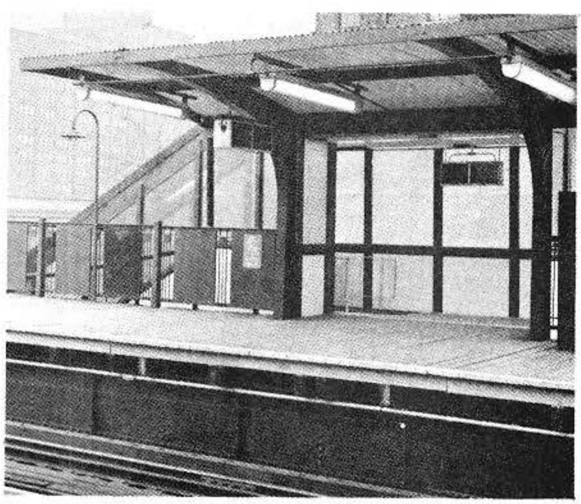
New two agent booth at mezzanine level of CTA station UTG-3



Clinton/Northwest Passage, CTA station mezzanine leading to escalator UTG-3



Escalator entrance from mezzanine CTA station UTG-3

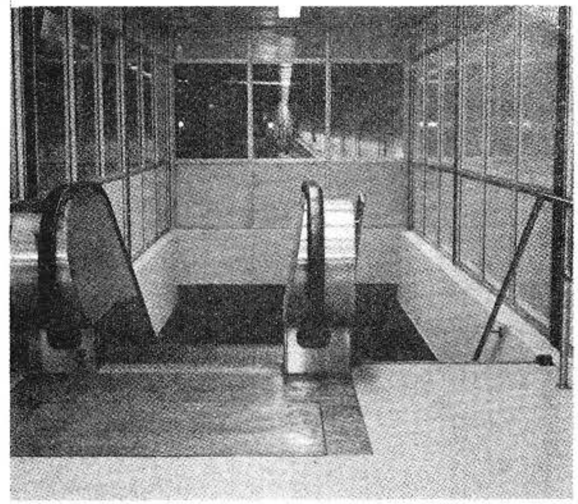


Escalator landing on eastbound platform UTG-3

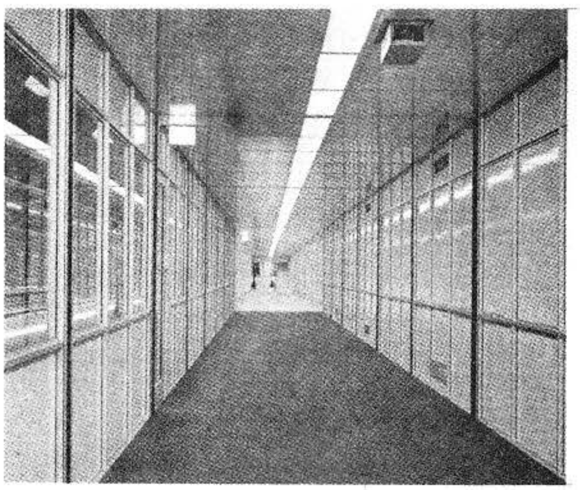
CTA eastbound Lake/Dan Ryan train of 2000 series cars entering station UTG-3

Figure 24

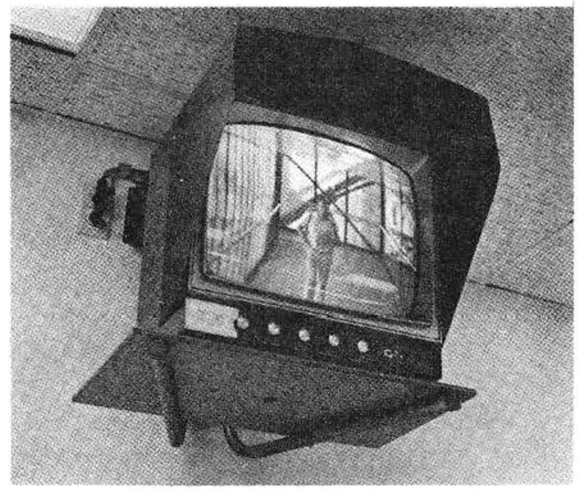
Escalator at passageway entrance at ground level in C&NW station MTD-5



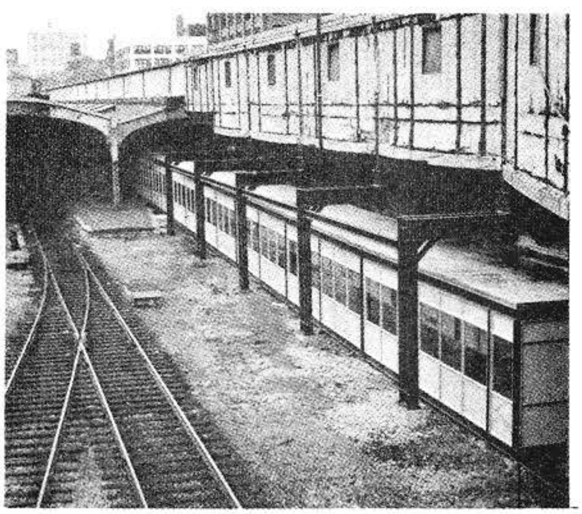
Escalator at track level in C&NW station MTD-5



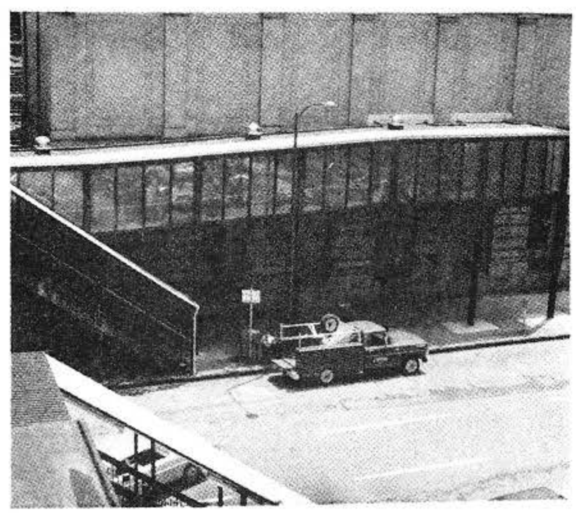
Passageway in C&NW station showing carpeting and one of three closed circuit TV cameras (note 'Muzak' speaker behind camera on ceiling) MTD-5



TV Monitor in C&NW Security Police office MTD-5



Exterior view of passageway along former location of C&NW track #1 MTD-5



Passageway connection between C&NW and CTA stations -- from rapid transit platform MTD-5

Chicago's experience with change-of-mode operations has fostered the conclusion that when parking is provided in sufficient quantity and coupled with fast, convenient mass transit service, the public can be lured from their autos.

The location, capacity, and usage of the CTA Park-N-Ride lots are tabulated on the first seven lines of Table 7. Other change-of-mode locations comprise the remainder of the Table.

TABLE 7
PARK AND RIDE FACILITIES

CHICAGO

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DIST. TOWN (MILES)	TIME CBD TRANSIT (AUTO) Peak	Off-Peak	TRANSIT FARE TO CBD	TRANS. FREQ. MINUTES Peak	Off-Peak	HOURS OF SERV.	SERVICES PROVIDED IN LOT*	REMARKS
Linden-Wilmette	11-1-63	466	266	25	14	39(70)	39(55)	55	3	7	24 Hours	LSP	
Dempster-Skokie	4-20-64	522	509	25	15	33(50)	33(35)	60	3	15	6 AM-11 PM	LSP	
Howard Street	11-1-63	295	306	25	10	27(40)	26(35)	40	2	4	24 Hours	LSP	
Kimball Avenue	3-7-55	211	206	25	9	29(45)	27(35)	40	3	7	24 Hours	LSP	
Desplaines Ave., Forest Park	10-15-58	540	538	25	9	23(45)	23(30)	40	5	7	24 Hours	LSP	
54th Avenue, Cicero	2-25-52	310	238	0	7	24(55)	22(35)	40	5	7	24 Hours	LS	
Ashland Avenue & 63rd	5-6-69	235	218	25	9	25(35)	22(25)	40	4	8	24 Hours	LSP	

CONTINUED

TABLE 7
PARK AND RIDE FACILITIES
CHICAGO

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAIL-ABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE (DOLLARS)	DISTANCE FROM CBD (MILES)	TRAVELTIME TO CBD		ONE-WAY TRANSIT FARE (DOLLARS)	TRANSIT HEADWAY (MIN)		HOURS OF SERVICE	LOT CHARACTER-ISTICS*	REMARKS
						PEAK TRANSIT (AUTO)	OFFPEAK TRANSIT (AUTO)		PEAK	OFFPEAK			
Park Forest	1961	335	335	.25	28.0	42(60)	50(50)	1.45	9	40	24	LSP	
Wilmette	1967	319	200	.25	14.3	24(50)	31(25)	.95	15	60	20	SP	
Winnetka (Indian Hill)	-	50	48	0	15.8	33(55)	35(30)	1.00	15	60	18	SP	
Winnetka Sta.	-	210	200	0	16.6	35(60)	37(30)	1.00	12	60	18	SP	
Winnetka Hubbard Woods Sta.	-	140	135	0	17.7	39(65)	40(30)	1.05	20	60	18	SP	
Lake Bluff	1968	100	100	0	30.2	55(72)	64(51)	1.30	15	60	19	SP	
North Chicago	-	150	150	-	33.2	66(70)	70(60)	1.40	15	60	18	WS	
Waukegan	-	300	225	0	35.9	65(90)	75(50)	1.55	12	60	18	LSP	
Des Plaines	-	1332	-	.50	27.1	35(50)	35(40)	1.05	7	60	16	LSP	
Des Plaines	-	800	750	.35	27.0	90(90)	60(50)	.75	15	60	12	LSP	
Arlington Heights	1950's	820	750	.25/.35	27.8	46(60)	47(40)	1.15	10	60	16	LSP	
Barrington	1940's	800	750	.35	32.0	46(90)	60(50)	1.45	9	60	18	LSP	
Oak Park	1955	700	500	.75	8.5	20(40)	20(30)	.75	20	60	17	ALWSP	
Villa Park	1967	500	400	.20	17.8	42(60)	42(40)	1.10	12	60	20	SP	
Lombard	-	150	-	.35	20.1	34(45)	40(40)	1.10	12	60	17	LSP	
Oak Forest	-	250	250	0	20.4	46(60)	45(35)	1.10	12	120	18	LWS	
Riverside	-	169	169	.20	11.1	30(60)	26(40)	.60	15	150	19	LSP	
Brookfield	-	200	200	-	12.3	34(30)	30(22)	.60	15	65	18	S	
Lagrange	-	520	520	.50	14.0	30(40)	25(20)	.65	12	60	18	LSP	
Western Springs	1967	60	60	.25	15.5	35(60)	38(40)	.80	10	60	20	LSP	
Downers Grove	-	437	400	.50	21.2	51(90)	50(45)	1.05	9	65	19	LSP	
Downers Grove	1966	130	115	.50	20.4	45(90)	48(45)	1.00	10	65	16	LSP	
Lisle	-	200	250	0	24.5	53(45)	56(38)	1.20	10	85	18½	S	
Aurora	-	370	300	0	38.0	50(60)	65(55)	1.95	20	75	18	LS	
Lement	-	40	40	0	25.3	30(30)	30(30)	1.44	ONE ROUND TRIP		2	S	
Wooddale	-	125	100	.25	19.3	28(60)	35(45)	1.00	12	60	16	SP	
Deerfield	-	275	260	0	23.9	45(70)	35(45)	1.25	10	120	17	LSP	
Glen Ellyn	1952	184	175	0	22.6	36(-)	44(-)	1.15	12	60	16½	LSP	
Glen Ellyn	-	259	245	.25	22.6	36(-)	44(-)	1.15	12	60	16½	LSP	
Glen Ellyn	1965	274	274	.25	22.6	36(-)	44(-)	1.15	12	60	16½	LSP	

*A-Attendant on Duty
L-Lighting
W-Shelter
S-Self-Park
P-Paved
G-Guard

Cleveland

Rail Service

The Cleveland Transit System (CTS) is a municipally owned and operated system providing urban transportation service in Cleveland and 41 adjacent suburban communities. The service began in March 1955 with the most recent modification completed in April 1969. The area served covers approximately 140 square miles and has an estimated population of approximately 1,700,000.

The CTS rapid transit line is a completely grade-separated, high-level platform, rail operation constructed on mainline railroad right-of-way. A map of the line is shown in Figure 25. Figure 26 shows an example of one of 17 stations which are spaced on the average of more than one mile apart. The transit system is designed principally as a high-speed mass hauler between downtown Cleveland and various collection and distribution stations to the east and west. At all of these stations, convenient transfer is provided with surface lines. At nine of the 17 stations, special offstreet bus terminals have been constructed adjacent to the rapid transit line so as to provide a sheltered connection. Fifty-seven CTS bus lines and one private bus route provide bus feeder service to the 17 rapid transit stations.

Even with these convenient transit-to-transit interface facilities, the automobile is recognized as the important feeder to the CTS rapid transit line as is evident through the provision of extensive Park-N-Ride lots. A total of 6,719 parking spaces (6,642 free, plus 77 metered spaces) are provided at nine rapid stations. In addition, Kiss-N-Ride facilities are provided at eight stations so that passengers may be conveniently dropped off or picked up at the rapid transit stations.

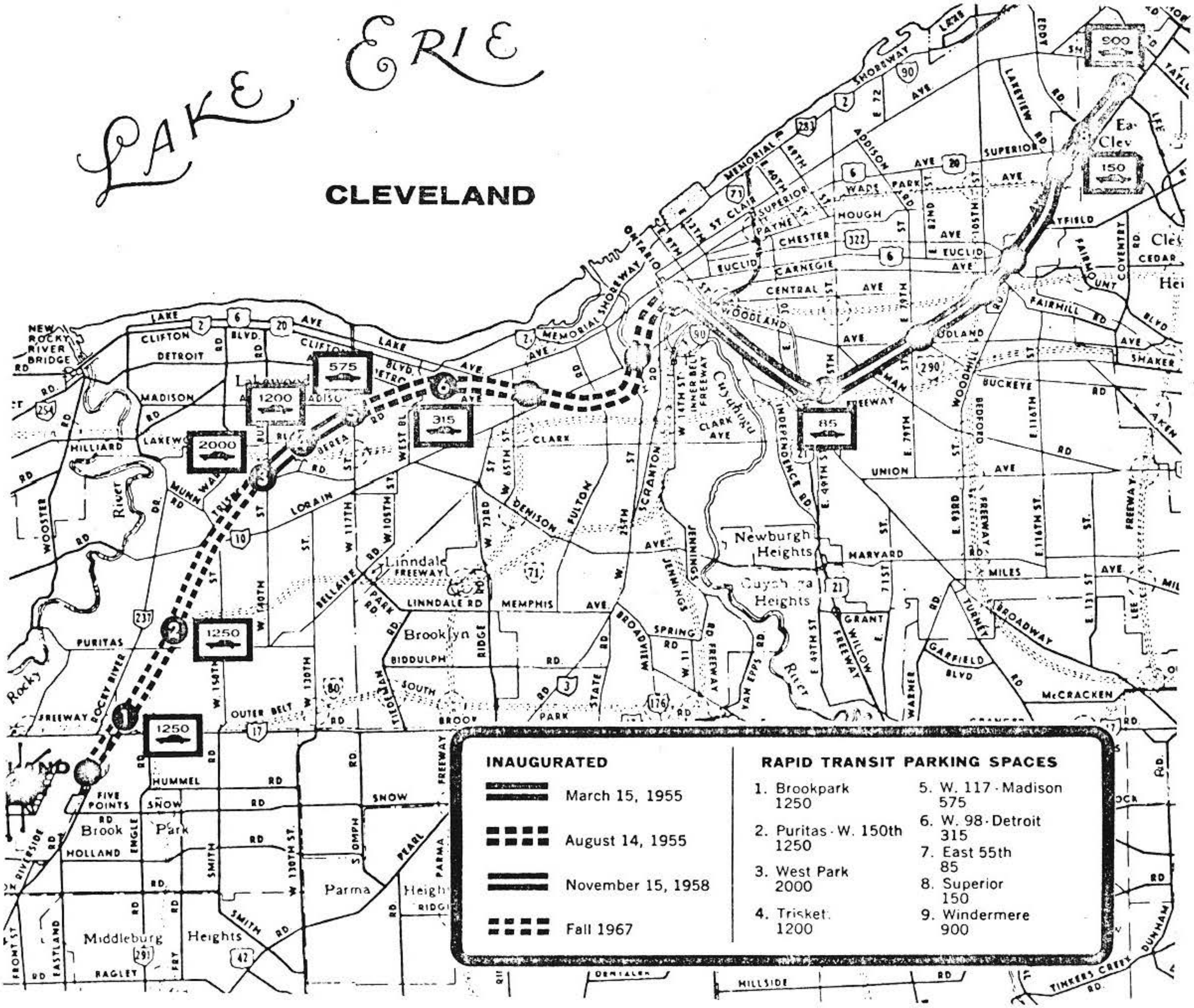

LAKE ERIE
CLEVELAND
INAUGURATED
March 15, 1955
August 14, 1955
November 15, 1958
Fall 1967
RAPID TRANSIT PARKING SPACES
1. Brookpark 1250
2. Puritas - W. 150th 1250
3. West Park 2000
4. Trisket 1200
5. W. 117 - Madison 575
6. W. 98 - Detroit 315
7. East 55th 85
8. Superior 150
9. Windermere 900
Lakewood
Linndale
Brooklyn
Newburgh Heights
Cuyahoga Heights
Parma
Middleburg Heights
Brook Park

Figure 25

Figure 26

TRISKETT RAPID TRANSIT STATION FACILITIES FOR PARKING
1, 200 AUTOS AND SEPARATE LANES FOR 20 KISS 'N RIDE CUSTOMERS

It was determined that if parking facilities for the system could be kept below $500 per car space, free parking could be offered. It was also felt that free parking would make the facilities more attractive and, therefore, generate the patronage required to operate a successful system. Since cost per car space averaged $300 to construct, free parking was provided except for some limited metered parking at one station for short-term shoppers parking nearest the station point.

The recent completion of the 4-mile extension to the system to the Cleveland Hopkins International Airport has resulted in the first modern rapid transit line in the Nation, serving both the downtown area and the airport. This extension to the west performs a reverse Park-N-Ride and Kiss-N-Ride function because a large number of airline customers now board at the east side Windermere Station for the 19-mile trip to the airport in 36 minutes.

The CTS rapid transit line has relieved much of the traffic congestion in traffic corridors it serves and has helped cut parking demand in the CBD. Table 8 gives pertinent information regarding the CTS rapid transit line change-of-mode service.

Bus Service

In addition to the park and ride rail transit service offered by the CTS, an active bus transit service is provided through its downtown loop system. This service consists of two fringe municipal parking lots handling a total of 4,100 cars daily linked to a bus loop route to the CBD with 5-minute headways during the peak hours. Although not actively promoting park and ride bus service in outlying areas, the CTS and other local bus companies also offer routing between the CBD and various shopping centers surrounding Cleveland. These change-of-mode lots are tabulated in Table 8. A very significant use of a change-of-mode operation is experienced on Cleveland Browns game days by using shopping centers and rapid transit lots (both CTS and Hoher Heights.) The combined rapid transit facilities carry approximately 7,500 people to the downtown terminal, from which point these people walk to the stadium. Also, an average of 95 "Football Special" buses (not charter,) originating primarily in the shopping center lots carry approximately 5,500 people to the games. The majority of such riders drive to the rapid transit and shopping center lots and then take the trains or buses to the games.

With 80,000 plus crowds for every game, this greatly relieves traffic and parking problems in the vicinity of the stadium.

TABLE 8
PARK AND RIDE FACILITIES
CLEVELAND

LOCATION OF LOT	DATE SERVICE BEGAN	No. OF PARKING SPACES	CARS PARKED DAILY	ALL DAY PARKING FEE	DISTANCE TO CBD	TIME TO CBD TRANSIT (AUTO) PEAK (Minutes)	TIME TO CBD TRANSIT (AUTO) OFF-PEAK (Minutes)	TRANSIT FARE TO CBD	TRANSIT PEAK	FREQUENCY OFF-PEAK	HOURS OF SERVICE	SERVICES PROVIDED IN LOT *	REMARKS
W 178th Street	April 69	954	900	0		20(28)	19(21)						
W 154th Street	Nov. 68	1027	763	0		17(25)	16.5(20)						
W 143rd Street	Nov. 58	1936	1139	0		14(22)	13(1)						
W 134th Street	Nov. 58	1138	912	0		12(20)	11(15)	0.40	2.5	6-10	4:45-1:00a.m.	L,W,S,P	
W 117th Street	Aug. 55	526	526	0		10(15)	9.5(10)						
W 98th Street	Aug. 55	176	176	0		8(13)	7.5(7)						
E 55th Street	Mar. 55	86	86	0		5(7)	5(5)						
Superior Avenue	Mar. 55	145	145	0		15(20)	14(15)		5	6-10			
Windermere	Mar. 55	711	650	**		16(22)	15(17)		5	6-10			
Van Aken Blvd. at:													
Farnsleight Rd.	Pre WWII	369	369	0		22.8	22.8					L,W,S,P	
Lynnfield Rd.	Pre WWII	100	100	0		22.0	22.0					W,S	
Kenmore Rd.	Pre WWII	72	72	0		21.2	21.2					W,S,P	
Avalon Rd.	Pre WWII	131	131	0		20.5	20.5	0.40	5-10	15	5:45-1:30a.m.	W,S,P	
Ashby Rd.	Pre WWII	40	40	0		19.7	19.7					W,S	
Onawau Rd.	Pre WWII	40	40	0		19.0	19.0					W,S	
S. Wooland Rd.	Pre WWII	30	30	0		17.2	17.2					W,S	
Drexmore Rd.	Pre WWII	114	114	0		16.3	16.3					W,S,P	
Shaker Blvd. at:													
Woodhill Rd.	Pre WWII	61	49	0		15.8	15.8					L,W,S	
Southington Rd.	Pre WWII	24	24	0		18.0	18.0					W,S	
Warrensville	Pre WWII	116	116	0		20.4 (35)	20.4(25)					W,S,P	
Green Rd.	Pre WWII	744	825	0		23(38	23(28)					L,W,S,PP	

*A = attendent on duty
L = lighting
W = shelter
S = Self park
P = paved
PP = partially paved
G = guard

**77 spaces are metered, others are free

TABLE 8
PARK AND RIDE FACILITIES
CLEVELAND

LOCATION OF LOT	DATE SERVICE BEGAN	NO. OF PARKING SPACES	CARS PARKED DAILY	ALL DAY PARKING FEE	DISTANCE TO CBD	TIME TO CBD TRANSIT (AUTO) PEAK (Minutes)	TIME TO CBD TRANSIT (AUTO) OFF-PEAK (Minutes)	TRANSIT FARE TO CBD	TRANSIT PEAK	FREQUENCY OFF-PEAK	HOURS OF SERVICE	SERVICES PROVIDED IN LOT *	REMARKS
BUS FRINGE LOTS													
Pleasant Valley Shopping Ctr.		1097		0		45(33)	40(25)	0.50	10	30-40	6:00am-1:00am	L,W,S,P	
Dunham Plaza Shopping Ctr.		450		0		44(33)	44(25)	0.40	5-10	30	5:15am-12:45am	L,W,S,P	
Eastgate Sh. Ctr.		1577		0		56(40)	60(30)	0.70	5-8	20	5:15am-12:00am	L,W,S,P	
Fairview Sh. Ctr.		2000		0		42(29)	42(24)	0.50	15	30	5:00am-11:15pm	L,W,S,P	
Great Northern Shopping Ctr.		5000		0		52(43)	52(35)	0.55	15	30	5:00am-11:15pm	L,W,S,P	
Lake Shore Sh. Ctr.		3420		0		35(24)	32(20)	0.50	6-8	60	6:30-10:30am(IN) 3:30-6:15pm(OUT)	L,W,S,P	
Mapletown Sh. Ctr.		530		0		30(28)	30(21)	0.45	10-15	30	5:20am-7:00pm	L,W,S,P	Park and ride is not actively promoted in these shopping centers
Parmatown Sh. Ctr.		5500		0		36(25)	32(21)	0.50	4-8	20	5:15am-1:00am	L,W,S,P	
Richmond Mall Shopping Ctr.		6000		0		55(40)	50(35)	0.60	20	50	5:30am-6:00pm	L,W,S,P	
Severance Ctr		5000		0		40(25)	35(20)	0.40	6-7	20-25	5:30am-11:00pm	L,W,S,P	
Shoregate Sh. Ctr.		5500		0		45(38)	40(32)	0.80	8-10	45-60	6:00am-6:00pm	L,W,S,P	
Southgate Sh. Ctr.		7500		0		50(35)	50(28)	0.45	15-30	60	6:30am-8:00pm	L,W,S,P	
Southland Sh. Ctr.		7620		0		48(30)	42(25)	0.50	8	40	5:15am-12:00am	L,W,S,P	
Turneytown Sh. Ctr.		1500		0		33(26)	32(21)	0.40	5-10	30	5:15am-12:45am	L,W,S,P	
Westgate Sh. Ctr.		3898		0		52	47	0.50	6-9	10-20	6:15am-11:30pm	L,W,S,P	
Lakefront Munic Lot	1956	2525	2600	0.25		10	5	0.20	6-7	4-6	7:00am-6:00pm	L,W,S,P,G	The CTS serves these facilities with the Loop Bus Downtown distribution system
St. Vincent Munic Lot	1963	1450	1500	0.25		10	5	0.20	5-7	10	6:40am-6:00pm	L,W,S,P,G	

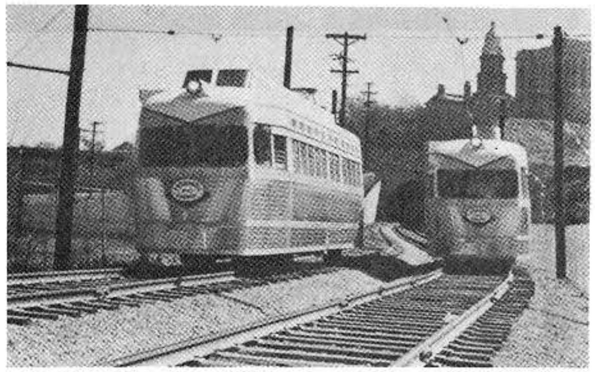
* A = attendant
L = lighting
W = shelter
S = Self park
P = paved
G = guard

Fort Worth

A private subway is helping to relieve Fort Worth's traffic congestion problems. This unique transportation system is owned and operated by Leonards Department Store, a large downtown shopping complex. This store, failing to arouse enthusiasm of other downtown businesses, constructed the system at its own expense in 1963.

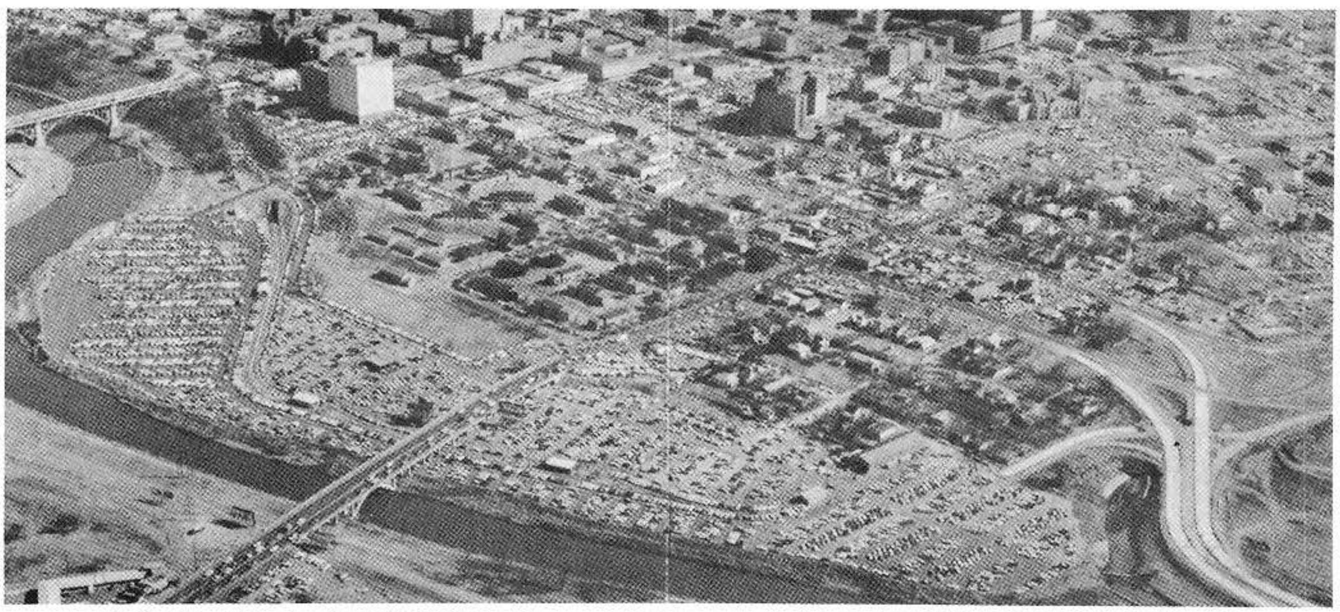
The 3/4-mile long system, using electrically operated 100-passenger cars, connect a 24-acre free parking lot to a terminal located at the store. The lot which can accommodate more than 5,000 vehicles is located one mile northwest of the CBD and is in close proximity to major arterial highways and its use is not limited to patrons of the store. The average walking distance to one of the four convenient stations in the lot is 200 feet. The five cars used in the system can deliver approximately 500 passengers to the store and back every 8 minutes. Between 12,000 and 24,000 commuter customers use the system on weekdays, often before the store opens.

The lot provides almost 20 percent of the total city CBD parking demand, relieving the congested CBD streets of approximately 10,000 cars. The City Planning Department, eyeing additional benefits, is studying the feasibility of expanding the system through the downtown CBD.



--Two cars pass each other as passengers are delivered to and from Leonards.

Figure 27



Aerial view of the parking lot showing highway construction connecting the parking lot with the East-West Freeway.

Figure 28

Miami

In April 1964, the Dade County Metropolitan Transit Authority began a semi-express bus route, the South Dixie Express, to the Miami CBD. Local service precedes pickup at the Perrine Shopping Center Park-N-Ride lot with five additional express stops prior to arrival in Miami. The Perrine Shopping Center has 500 parking spaces of which 125 are used by change-of-mode commuters to park their automobiles free. The bus fare from this lot is $.60 for a 16.4-mile ride to the CBD with 30-minute headways during the peak hours.

Similar service is provided for the Levitz Shopping Center Park-N-Ride lot; however, after pickup at this lot, the bus enters the expressway for direct CBD service. The Levitz Shopping Center has 1,400 free parking spaces of which 225 are used by commuters. The bus fare from this lot is $.40 for a 9-mile ride to the CBD with 30-minute headways during the peak hours. Although the average $.80 daily rate for CBD parking in Miami is relatively low for the commuter, change-of-mode parking is well used due to low transit fare, free change-of-mode parking, and competitive traveltime.

Although this service is not strictly park and ride, direct cooperation with outlying shopping centers is evident. It also shows that one pickup station is not a necessary prerequisite for a successful change-of-mode operation. A series of fringe parking lots can be established along freeway arteries to furnish intermediate interface points for commuters. By instituting these limited express stops with parking, many more arterial streets can be linked into a park and ride express system.

Table 9 tabulates the data for change-of-mode parking lots operated in Miami.

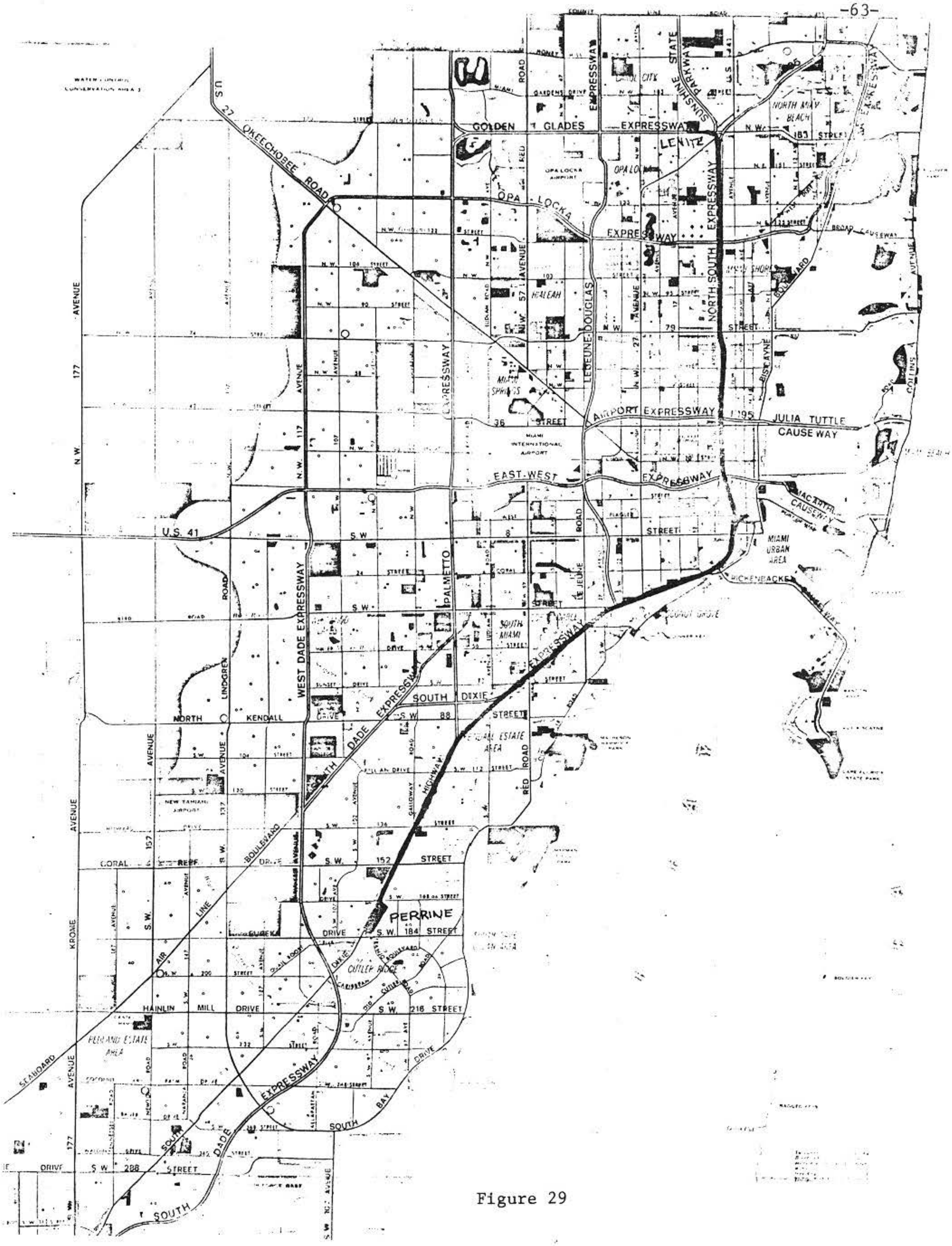

GOLDEN GLADES EXPRESSWAY
OKEECHOBEE ROAD
US 27
OPA LOCKA EXPRESSWAY
NORTH SOUTH EXPRESSWAY
SUNSHINE STATE PARKWAY
LENITZ
OPA LOCKA AIRPORT
HIALEAH
MIAMI SPRINGS
LEJEUNE DOUGLAS
AIRPORT EXPRESSWAY
I 195
JULIA TUTTLE CAUSEWAY
MIAMI INTERNATIONAL AIRPORT
EAST-WEST EXPRESSWAY
MACARTHUR CAUSEWAY
MIAMI URBAN AREA
RICKENBACKER CAUSEWAY
U.S. 41
PALMETTO EXPRESSWAY
WEST DADE EXPRESSWAY
SOUTH DADE EXPRESSWAY
SOUTH DIXIE HIGHWAY
NORTH KENDALL
LINDGREN ROAD
RED ROAD
PERRINE
S.W. 184 STREET
CUTLER RIDGE
S.W. 152 STREET
CORAL REEF DRIVE
AIR LINE BOULEVARD
HAINLIN MILL DRIVE
S.W. 216 STREET
SEABOARD
KROME AVENUE
N.W. 177 AVENUE
S.W. 288 STREET
SOUTH BAY DRIVE
NEW TAMIAMI AIRPORT
COLLINS AVENUE
BISCAYNE BOULEVARD

Figure 29

TABLE 9
PARK AND RIDE FACILITIES
MIAMI

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE (DOLLARS)	DISTANCE FROM CBD (MILES)	TRAVELTIME TO CBD		ONE-WAY TRANSIT FARE (MIN)	TRANSIT HEADWAY (MIN)		HOURS OF SERVICE	LOT CHARACTERISTICS*	REMARKS
						PEAK TRANSIT (AUTO)	OFFPEAK TRANSIT (AUTO)		PEAK	OFFPEAK			
Perrine Shopping Center	1964	500	125	None	16.4	39(35)	- -	.60	30	-	4	W	
Levitz Shopping Center	1968	1400	225	None	9.0	35(35)	- -	.40	30	60	4	W	

*A = attendant on duty
L = lighting
W = shelter
S = self-park
P = paved
G = guard

Milwaukee

In the spring of 1964, a modified bus transit system was inaugurated in the metropolitan Milwaukee area. This new look at bus transit service provided the commuter with direct nonstop service during the peak weekday commuting hours between an outlying area shopping center and the downtown Milwaukee CBD. The shopping center, the Mayfair, set aside 300 parking spaces for this express bus service without cost to the rider or the transit company, the Milwaukee and Suburban Transport Corporation.

The shopping center, located seven miles from the CBD, was strategically located less than a half-mile from a freeway connecting the northwest suburban area to Milwaukee. Use of the service, named the "Freeway Flyer," grew from 290 passengers per weekday to about 1,000 passengers by 1967. Patronage for this facility has now dropped to 850 passengers per weekday because another park and ride facility was inaugurated two miles away.

Additional shopping centers are now being used as fringe lots supplementing the successful Mayfair venture. Figure 30 shows the routings of the "Freeway Flyers" in the Milwaukee area.

The Bay Shore Shopping Center, located about 5 1/2 miles north of downtown Milwaukee, has provided 150 spaces for this service. The line was originated in November 1965 with 200 daily riders and by June 1969 was carrying about 650 one-way trips per day. Round-trip running time, excluding layover for the 14.2-mile run, is about 42 minutes.

The County Fair Shopping Center is situated approximately 9 1/2 miles southwest of Milwaukee's CBD and provides 50 parking spaces. This is the most recent addition to the "Freeway Flyer" service. It started in

April 1969. They carried 135 passengers on the first day and are now carrying 175 per day. Round-trip traveltime, excluding layover, is 56 minutes for the 28-mile run.

The Treasure Island Department Store in the vicinity of South Highway 100 and North Cleveland Avenue is about 7 1/2 miles from the CBD. One hundred parking spaces have been provided for this service which started operation in November 1967. The first day count of 200 passengers has now increased to 350 per day. The round-trip mileage is 19.6 miles and the operating time is approximately 60 minutes.

The Treasure Island Department Store in the northwest portion of Milwaukee is located on West Capitol Drive and North 124th Street, outside the Milwaukee County limits and 8 3/4 miles from the CBD. Approximately 100 parking spaces have been provided for this service which started operation in April 1968. The first day the service carried 140 passengers. It is approximately 65 minutes excluding layovers for the 25-mile round trip.

Figures 31 to 34 illustrate some of the characteristics of operation from parking lot to downtown.

Table 10 details the services offered by the change-of-mode facilities associated with Milwaukee's "Freeway Flyers."

As "Freeway Flyer" service has been developed within the Milwaukee urbanized area, annual ridership on these lines has increased steadily from 78,000 in 1964 to over 515,000 in 1968. This increased "Freeway Flyer" utilization stands in sharp contrast to the overall decline of mass transit utilization within the region. The continued growth in "Freeway Flyer" utilization is particularly encouraging in terms of regional transportation plan implementation considering that studies conducted in Milwaukee indicate that more than half of the "Freeway Flyer" riders have been attracted to the transit service from private automobiles.

Promotion

The flyer operations were started with the distribution of specially printed public schedules on a house-to-house canvass in the immediate area. Ads describing the new service, schedules, routing, etc. were placed in the weekly suburban newspapers in the communities that would be served by the flyers. In addition to this paid publicity, there were in both cases substantial amounts of free publicity--newspapers, radio and television. The company started each flyer with a "continental" breakfast for the new riders--juice, sweet roll and coffee--and a free morning paper. This resulted in front page news stories and pictures and film clips on all TV stations. Periodically, since then the newspapers report the progress of the flyers as to the level of riding or for increases in service.

On the anniversary dates of the inauguration of the services, the company has again offered a free "continental" breakfast for the morning riders and additional front page publicity has resulted. Publicity of this nature seems to encourage riding on both flyers even though the publicity is only about one of them. There has been no paid advertising since the inauguration of the service.

Experience

Surveys of the users of the service reveal the following facts:

a. Four out of five users are licensed drivers and two out of three have one or more automobiles available for use.

b. Age distribution is a normal cross section of downtown employees with some high school and college students.

c. Home to work and home to school, and reverse, are almost the only trip purposes.

d. Of the users who formerly made this trip by either driving or as a bus passenger, over 60 percent had been auto drivers.

e. Fifty percent of the riders indicate that they have increased their shopping at the shopping center providing the parking because of this service.

Summary of Milwaukee Experience

1. Standard city buses can operate safely and without hindering other traffic on city freeways.

2. Buses operated on the freeway can operate as fast as automobile traffic, and when taking into account parking time, may provide a faster door-to-door service than the automobile itself.

3. Passengers are willing to change mode, that is, transfer from an automobile to a bus in commuting to downtown. They do not appear to be as willing to transfer from one transit vehicle to another.

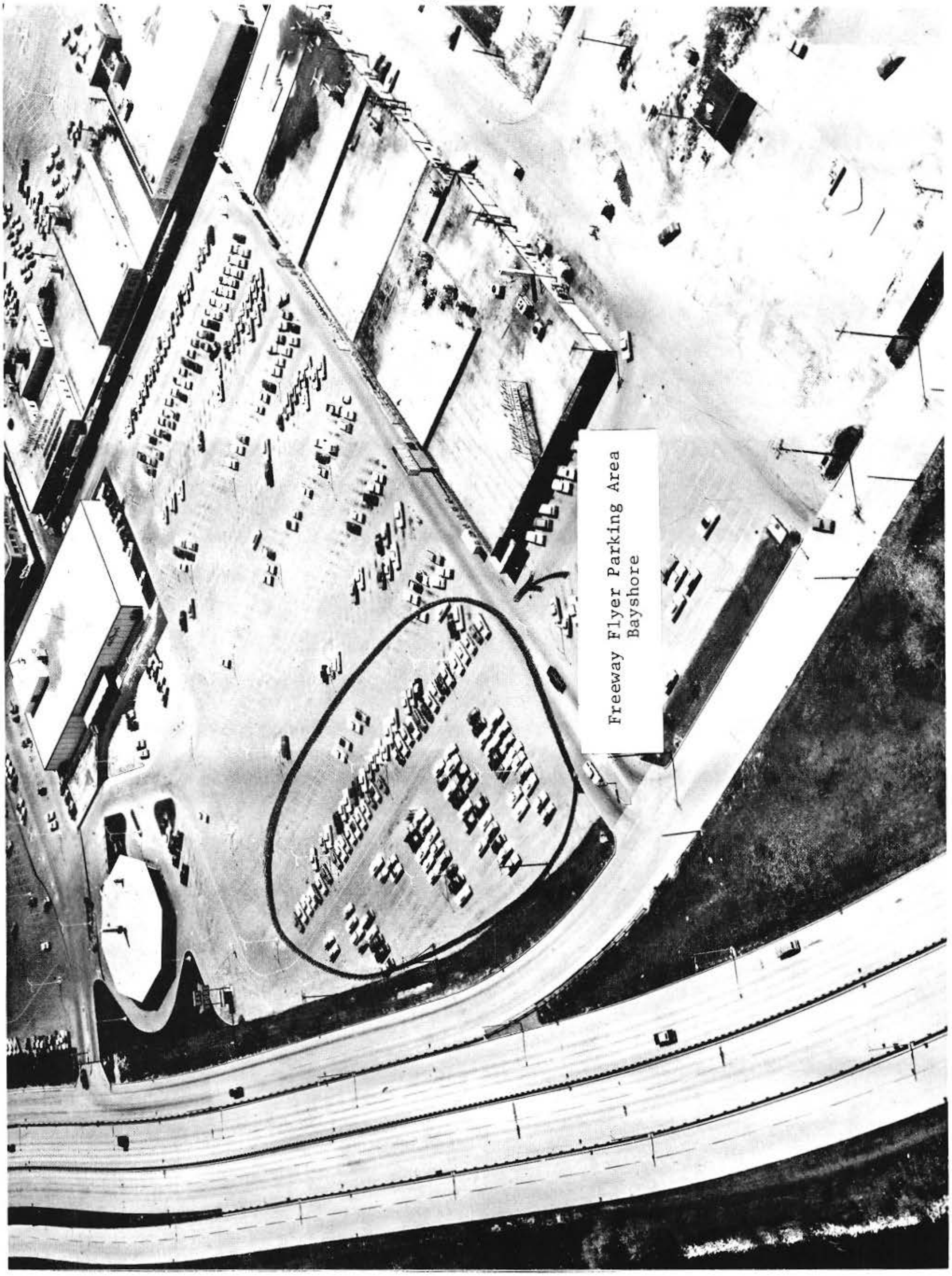
4. Shopping centers have available parking space not used during peak commuter parking hours which can efficiently be used in a park-ride bus service, resulting in increased business for the shopping center.

5. Bus rapid transit making use of existing freeways can be financially successful and can convert auto drivers to bus riders.


CENTRAL BUSINESS DISTRICT:
FREEWAY FLYER ROUTES IN CBD
1969
FREEWAY
FLYERS
(FIVE ROUTES)
⊗SHOPPING CENTERS PERMITTING FREE-ALL-DAY PARKING
MILWAUKEE COUNTY
Completed Freeway Routes with Interchanges
1969
LEGEND:
Freeway
Other Streets & Roads
Grade Separations
Ramp Connections and Direction of Traffic
Interstate Route Number
U.S. Route Number
State Route Number
County Lines
Street Numbers 1 Mile Apart
FREEWAY FLYER RTE.
COMMUTER TRAIN "CANNON BALL"
DEPOT PARKING
BAYSHORE
RT.#42
TREASURE ISLAND
RT.#45
RT.#41
MAYFAIR
TO BROOKFIELD & ELM GROVE
TREASURE ISLAND
RT.#44
HALES CORNERS
COUNTRY FAIR
RT.#43
MICHIGAN
LAKE

Figure 30

Figure 31



Freeway Flyer Parking Area
Bayshore

Figure 32

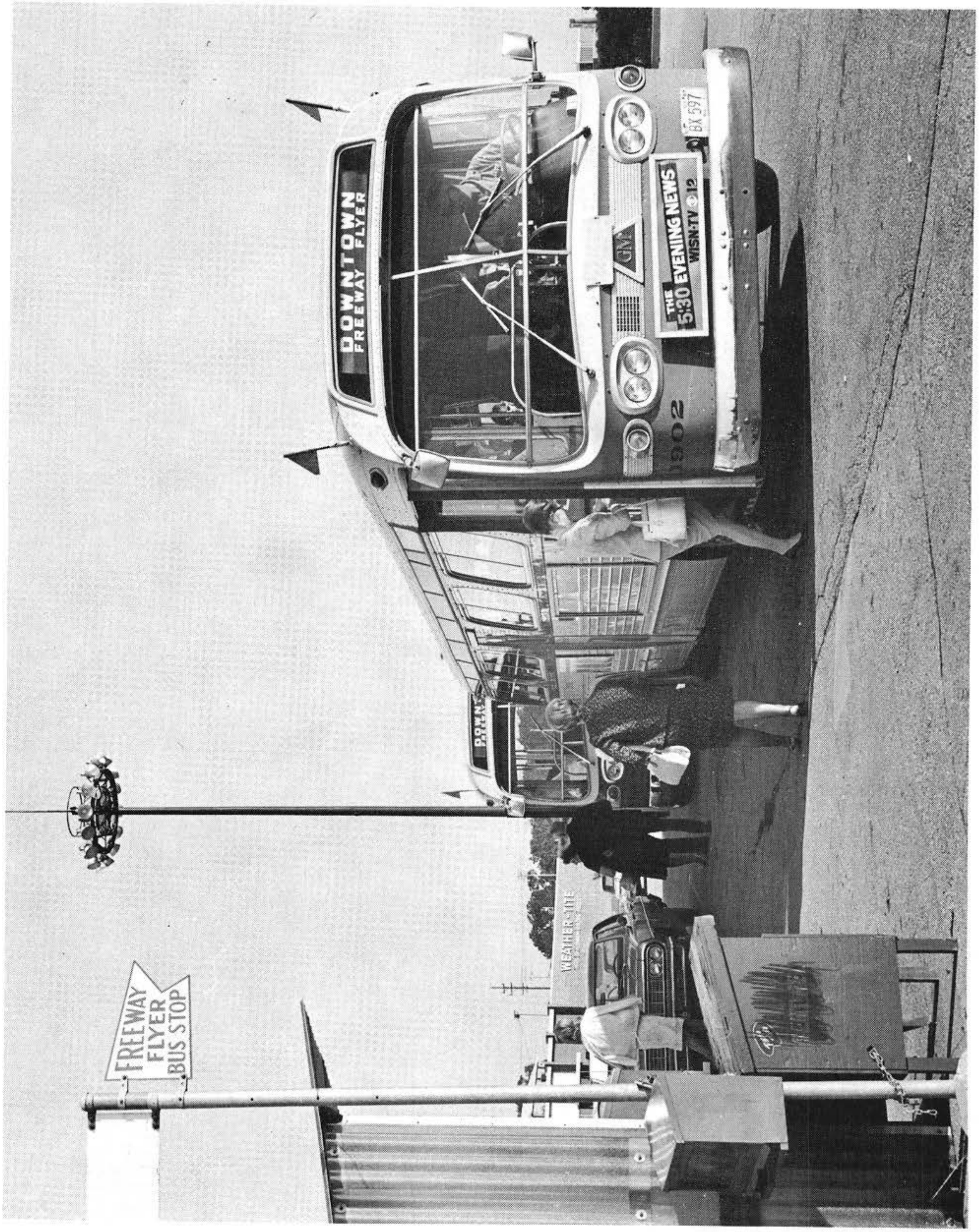
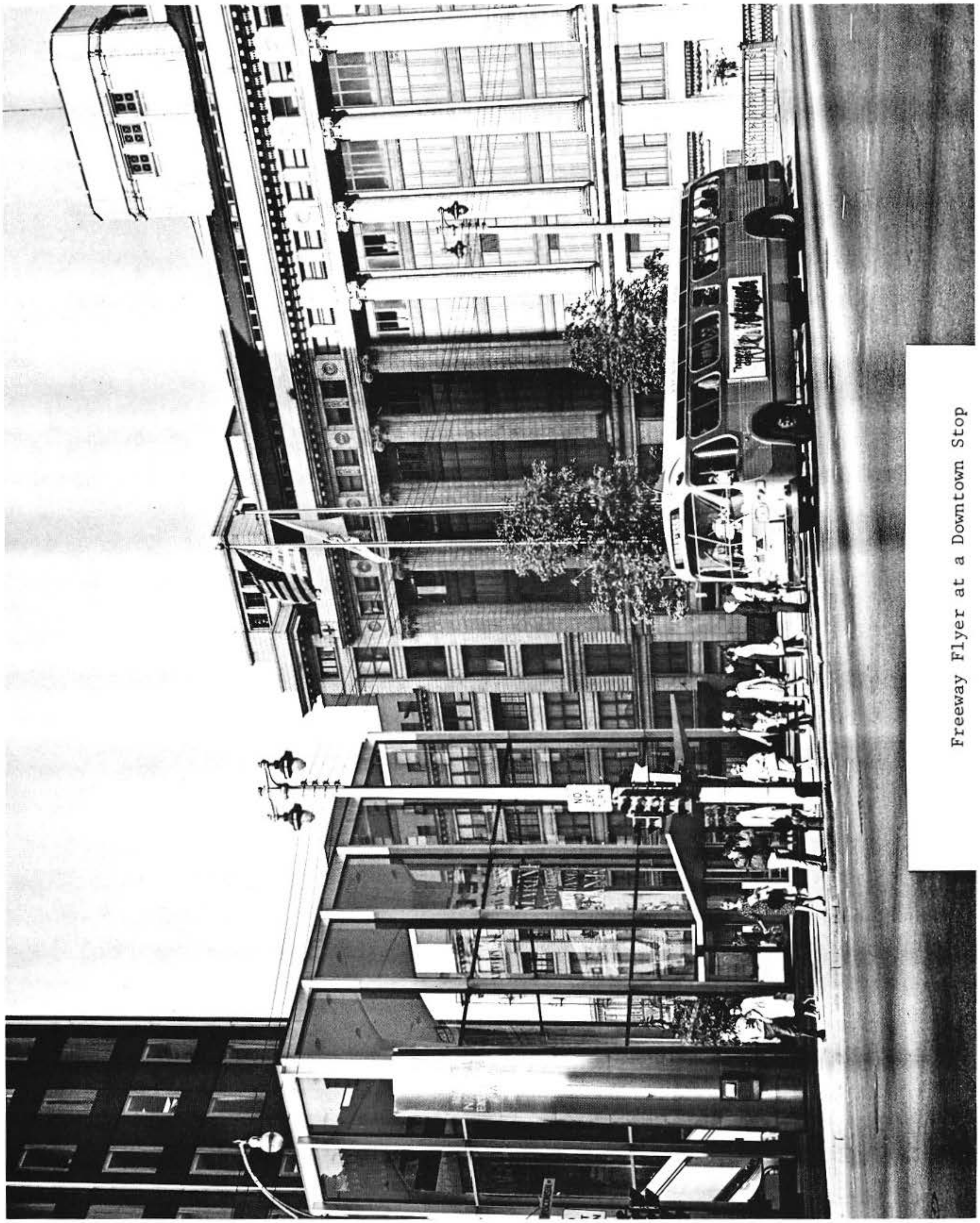

DOWNTOWN
FREEWAY FLYER
THE 5:30 EVENING NEWS
WISN-TV 12
FREEWAY
FLYER
BUS STOP

Figure 33

FREEWAY FLYER ON EAST-WEST FREEWAY

Figure 34



Freeway Flyer at a Downtown Stop

TABLE 10 PARK AND RIDE FACILITIES
MILWAUKEE

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DISTANCE TO DOWNTOWN (MILES)	TIME TO CBD TRANSIT (AUTO) PEAK	TIME TO CBD TRANSIT (AUTO) OFF-PEAK	TRANSIT FARE TO CBD	TRANSIT FREQUENCY PEAK (Minutes)	TRANSIT FREQUENCY OFF-PEAK (Minutes)	HOURS OF SERVICE	SERVICES PROVIDED IN LOT*	REMARKS
Mayfair Shopping Center	3-20-64	300	150	0	7	21(21)	None	0.40	5-10	0	6:20-8:25a.m. 4:15-5:45p.m.	LWSP	
Bay Shore Shopping Center	11-29-65	150	115	0	6	10(10)	None	0.40	10-15	0	6:45-9:00a.m. 4:15-6:05p.m.	LWSP	
County Fair Shopping Center	4-14-69	50	25	0	10	20(20)	None	0.50	30	0	6:23-8:27a.m. 4:15-5:30p.m.	LWSP	
Treasure Island Shopping Center (West Allis)	11-6-67	100	50	0	8	20(20)	None	0.40	20-30	0	6:15-8:20a.m. 4:15-5"35p.m.	LWSP	
Treasure Island Shopping Center (Capitol Dr.)	4-22-68	100	30	0	9	22(22)	None	0.40	30	0	6:40-8:25a.m. 4:00-5:30p.m.	LWSP	

* A-attendent on duty
L-lighting
W-shelter
S-self park
P-paved
G-guard

New York City

Rail Transit

The New York City Traffic Department operates 14 municipal parking facilities for change-of-mode commuters which are linked to the city's major transportation system, the subway. Usage of these facilities by commuters is high during a typical weekday. All of these parking facilities charge for parking in addition to a separate transit fare. Table 11 shows pertinent data for each of these lots.

Bus Transit

At the west end of the Lincoln Tunnel in North Bergen, New Jersey, the Port of New York Authority operates a highly successful park and ride facility (see Figure 35) in conjunction with a bus transit system operated by the Public Service Coordinated Transport Company. The lot, which offers 1,600 parking spaces, is utilized by more than 1,900 vehicles. Commuters are induced to use the facility by a \$.50 tunnel toll, high CBD parking rates, and a time saving via preferential entry to the Lincoln Tunnel on the return trip. This time savings amounts to 10 minutes or more over an auto trip from a midtown parking lot. Both commuters and shoppers are served by the lot. Of the 1,900 average week-day parkers, 1,250 park before 9 a.m. and 650 park after 9 a.m.

Other Transit

The New York City Traffic Department also operates a parking lot which is served by a ferry shuttle between Staten Island and lower Manhattan. The 388 space paved parking lot is used to capacity for the 22 minute ride between these two points. Commuters, shoppers, and others can use this system which operates 24 hours a day, costing \$.05 for the ferry ride.

Figure 35

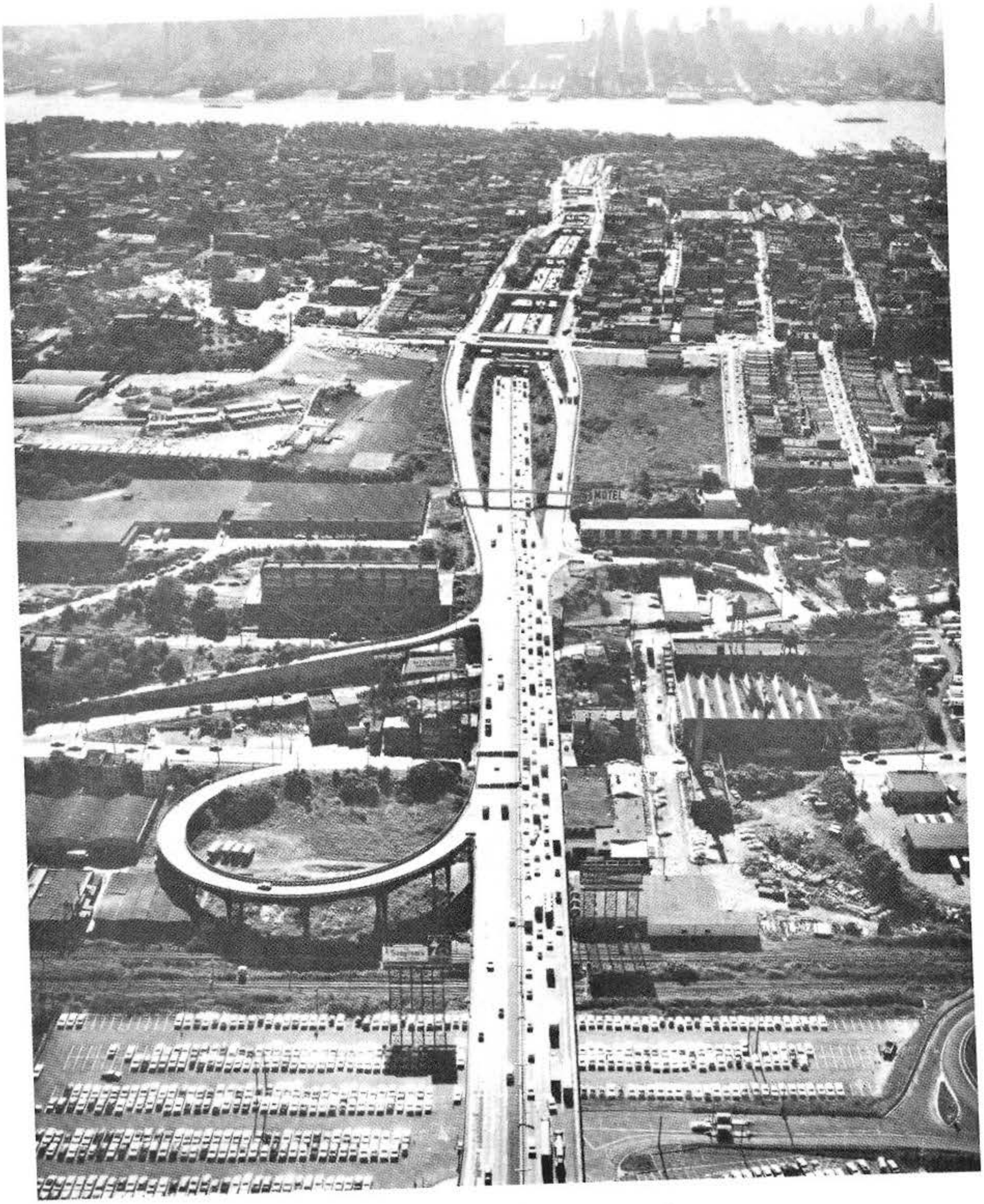


Photo Credit: Port of New York Authority

Seven hundred peak-hour auto drivers leave their cars in the Secaucus Park-Ride lot and take the shuttle bus to Manhattan. Around 10 a.m. the lot is filled to its 1,950 vehicle capacity.

Other Change-of-Mode Facilities

Many other change-of-mode facilities are in operation in the metropolitan New York City area; however, all do not necessarily provide direct service to the Manhattan CBD.

TABLE 11
PARK AND RIDE FACILITIES
NEW YORK CITY

LOCATION OF LOT	DATE SERVICE BEGAN	NO. OF PARKING SPACES	CARS PARKED DAILY	ALL DAY PARKING FEE	DISTANCE TO CBD	TIME TO CBD TRANSIT (AUTO) PEAK MIN.	OFFPEAK	TRANSIT FARE TO CBD	TRANSIT FREQUENCY PEAK MIN.	OFF-PEAK	HOURS OF SERVICE	SERVICES PROVIDED IN LOT *
SUBWAY STATIONS												
Kingsbridge, Bronx Westchester	11-3-65	107	107	0.60		31(45)	31(30)	0.20	5	10	24 hours	P,L,S
Zerega Ave., Bronx	7-12-62	59	59	0.75		32(45)	32(30)	0.20	5	10	24 hours	P,L,S
Canarsie, Brooklyn	6-26-66	248	248	0.60		35(50)	35(40)	0.20	5	10	24 hours	P,L,S
Grant Ave., Brooklyn	12-7-60	200	200	0.60		30(50)	30(40)	0.20	5	10	24 hours	P,L,S
Far Rockaway, Queens #1	7-6-62	70	70	0.40		50(70)	50(55)	0.40	5	10	24 hours	P,L,S
Far Rockaway, Queens #2	6-13-62	42	42	0.25		50(70)	50(55)	0.40	5	10	24 hours	W,P,L,S
Flushing, Queens	4-20-54	467	467	0.85		20(40)	20(30)	0.20	5	10	24 hours	W,P,L,S
Queensboro Hall, Queens	11-15-62	607	607	0.60		25(40)	25(30)	0.20	5	10	24 hours	W,P,L,S
Rego Park, Queens #1	3-20-59	829	829	0.60		21(30)	21(20)	0.20	5	10	24 hours	W,P,L,S
Rego Park, Queens #2	3-20-59	143	143	0.75		21(30)	21(20)	0.20	5	10	24 hours	P,L,S
Rockaway Park, Queens	6-2-57	67	50	0.25		50(70)	50(55)	0.25	5	10	24 hours	W,P,L,S
Sunnyside, Queens	7-13-55	447	447	0.75		11(15)	11(10)	0.20	5	10	24 hours	W,P,L,S
Rosedale, Queens	6-21-66	356	300	0.25		40(55)	30(45)	1.20	5	(1/2 - 2 hrs)	21 hours	P,L,S
BUS FRINGE LOT												
Lincoln Tunnel lot	Nov. 1955	1600	1900	0.35		14(12)	12(10)	0.45	4	12	6 am - 1 am	A,W,P,L,S,G
STATEN ISLAND FERRY												
St.George, Richmond	10-28-57	388	388	0.75		22(22)	22(22)	0.05	10	20	24 hours	W,P,L,S

* A = attendant, L = lighting, W = shelter, S = self park, P = paved, G = guard

Philadelphia

The Southeastern Pennsylvania Transportation Authority's (SEPTA) transit division operates a coordinated system of more than a hundred bus lines, having a round-trip route length of more than 1,600 miles. Its operations cover the entire city of Philadelphia, with some routes extending into adjacent areas of Delaware, Montgomery, and Bucks Counties.

SEPTA operates nearly 200 change-of-mode parking lots serving the rail commuter system in the Philadelphia area. They range in capacity from 25 to 200 or more spaces. Unfortunately, information for only five of these lots was available. Data for these five indicate exceptional usage. The change-of-mode parking lots and rail transit stations are also served by bus transit. SEPTA's capital improvement program includes proposals to construct new or expanded commuter station parking facilities at an estimated cost of $20.5 million over the next six years, and new change-of-mode parking facilities at rapid transit stations at an estimated cost of nearly $12 million.

In New Jersey, the Port Authority Transit Corporation provides rapid rail service between Lindenwold and downtown Camden and Philadelphia. This line provides over 4,400 spaces located at seven stations which are paved and lighted. These parking facilities are served by the newest rail transit operation in the United States. Every five minutes at the height of the rush hours automated stainless steel electric trains streak at speeds up to 75 miles per hour between suburban Lindenwold, New Jersey and downtown Philadelphia, a 14 1/2 mile trip that takes 22 minutes and costs $.60.

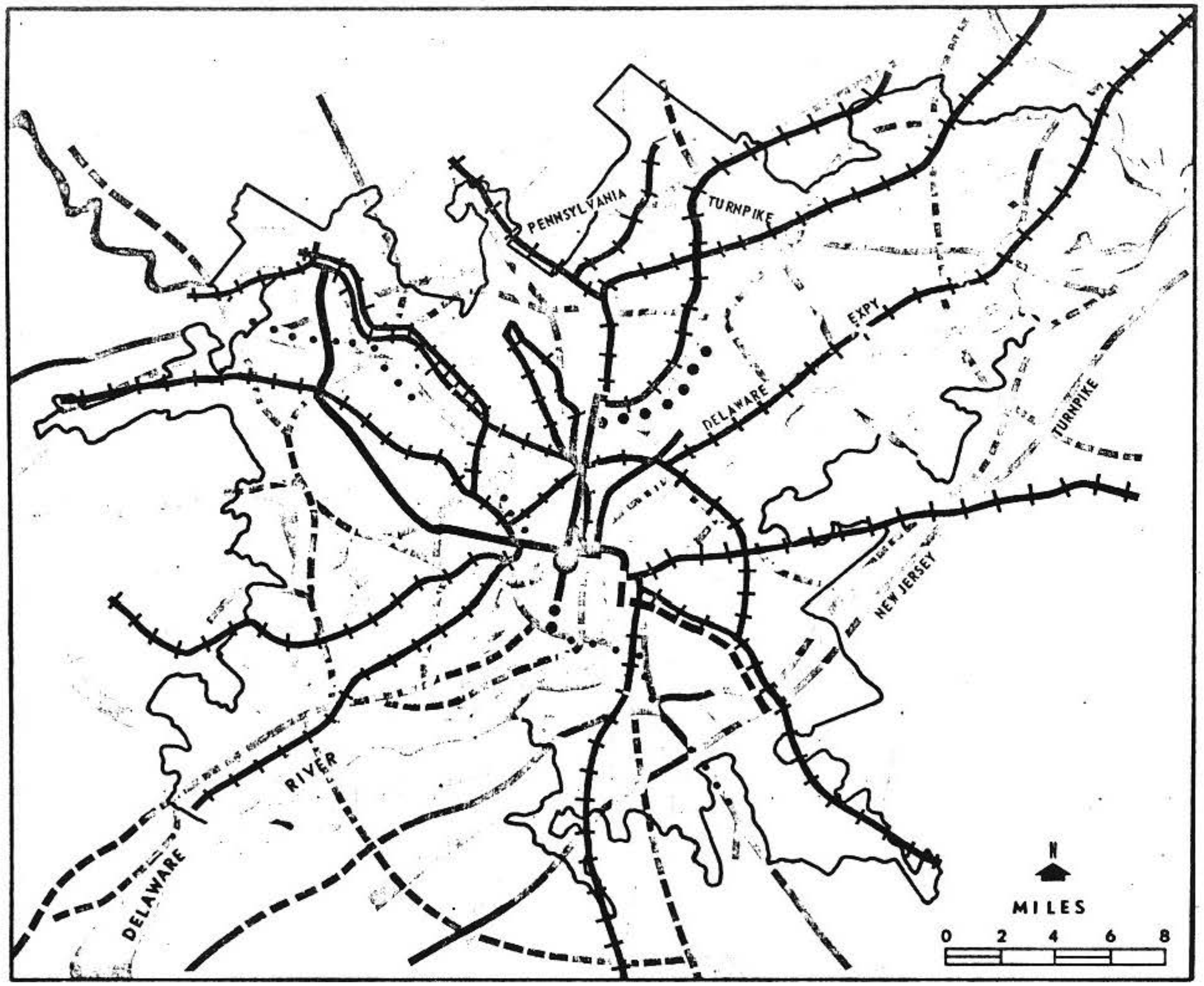
The line carries 15,000 passengers in each direction on a typical weekday. This is roughly 15 times the number who rode commuter trains that formerly served the area, an increase partly due to the intensive land development that the new line induced. The use of this line has even caused a modest dip in automobile usage over the Delaware River toll bridges.

The present ridership on the trains is far less than their potential capacity. The line is capable of carrying more passengers in an hour than they now carry all day.

Since many of the riders use automobiles to get to the rail stations, the severest restriction on train ridership results from the limited capacity of the parking lots at the line's six suburban stations outside Camden. Since the line's inauguration in 1967, some of the lots have been enlarged once from their original size and are scheduled for new expansion in the near future.

One possibility for increased usage of this high-speed rail line would be the use of feeder buses from additional change-of-mode locations. A map locating the present line and parking locations is shown in Figure 36.

Table 12 summarizes the data for change-of-mode parking facilities included in the survey.



PHILADELPHIA URBANIZED AREA

1960 POPULATION

	Persons	Persons/sq. mile
Central City	2,002,000	15,743
Urbanized Area	3,635,000	6,092

1966 TRANSIT DATA

Annual Revenue Passengers[1]	334 million
Annual Revenue Vehicle Miles[2]	72 million
Total Equipment Operated[2]	2,705 units
Buses	1,552
Rail Rapid Cars	548
Streetcars and Trolley Coaches	605
Commuter Railroad Cars	Data not available

[1]PTC, PSTC, commuter RR
[2]PTC, PSTC

Rail Rapid Transit
Existing
Under Construction
Initial Proposed*
Ultimate Proposed*
Bus Rapid Transit
Existing
Proposed*
Bus Transit Service Area
Freeways
Existing
Proposed*
Commuter Rail

*Included are existing and planned facilities of the Philadelphia Transportation Company, Philadelphia Suburban Transportation Company, Public Service Coordinated Transport, Reading Company, the Baltimore and Ohio Railroad Company, Pennsylvania New York Central Transportation Company, Pennsylvania Department of Highways, Delaware Valley Regional Planning Commission and the City of Philadelphia.

Inclusion of these plans does not imply full endorsement by all parties concerned or that the plans are, at the present time, either financially feasible or a definitive part of a future construction program.

Figure 36

TABLE 12
PARK AND RIDE FACILITIES
PHILADELPHIA

LOCATION OF LOT	DATE SERIVCE BEGAN	PARKING SPACES AVAIL-ABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE (DOLLARS)	DISTANCE FROM CBD (MILES)	TRAVELTIME TO CBD PEAK TRANSIT (AUTO)	TRAVELTIME TO CBD OFFPEAK TRANSIT (AUTO)	ONE-WAY TRANSIT FARE DOLLARS	TRANSIT HEADWAY (MIN) PEAK	TRANSIT HEADWAY (MIN) OFFPEAK	HOURS OF SERVICE	LOT CHARACTER-ISTICS*	REMARKS
Bridge-Bratt Sts. Terminal	1920	540	757	.35	8.0	21(-)	22(31)	.30	2	7	24	LSPG	
Church Sta.	1963	100	100	.25	7.0	18(-)	19(31)	.30	2	7	24	LSP	
Fern Rock Terminal	1956	410	450	.35	7.0	21(-)	23(29)	.30	2	7	24	LSPG	
Fern Rock Terminal	1959	255	275	.25	7.0	20(-)	23(29)	.30	3	7	24	LSP	
46th Str. Sta.	1959	150	150	.25	3.0	6(-)	6(13)	.30	2	7	24	ALSP	
69th Str. Ter.	1920	340	425	.35	5.0	14(-)	15(22)	.30	2	7	24	LSPG	
Lindenwold	1969	851/302	851/302	0/.25	14.0	23(40)	23(30)	.60	5	10	24	LSP	
Ashland	1969	583/247	583/247	0/.25	12.0	21(37)	21(28)	.60	5	10	24	LSP	
Haddenfield	1969	674/228	674/228	0/.25	9.0	18(32)	18(24)	.50	5	10	24	LSP	
Westmont	1969	593/155	593/90	0/.25	8.0	17(30)	17(23)	.50	5	10	24	LSP	
Colungswood	1969	419/108	419/40	0/.25	7.0	15(27)	15(21)	.50	5	10	24	LSP	
Camden (Ferry Ave.)	1969	618/254	618/175	0/.25	6.0	13(25)	13(19)	.40	5	10	24	LSP	
Camden	1969	130	65	.25	4.0	9(14)	9(11)	.30	5	10	24	ASG	

*A = attendant on duty
L = lighting
W = shelter
S = self-park
P = paved
G = guard

Washington, D.C.

Change-of-mode operations began within the Washington metropolitan area in February 1955. The first facility used as a fringe lot was the Carter Baron Amphitheater located in the northwest section of D.C. The D.C. Motor Vehicle Parking Agency provided a roadway for buses, a shelter for passengers waiting service, signing for the facility, and agreed to pay for operation and maintenance costs associated with the lot operation. Of the 800 free parking spaces in the lot, 746 are currently used on a typical weekday. Buses pick up passengers at 3-minute intervals for the 22-minute run downtown during the peak commuter hour. Additional public transportation is provided near the lot by local bus routes for those desiring other services.

Additional parking lots are located in key traffic corridor points--the Soldiers' Home lot in the northeast, the Robert F. Kennedy Stadium lot in the east, the South Capitol Street lots 1 and 2 in the southeast, and the Columbia Island Marina lot in the southwest. The Prince George's Plaza Shopping Center, begun in June 1969 with space for 500 cars, is presently utilizing 100 of these spaces, but a key motive of this service was to provide inner core residents the opportunity of shopping outside the downtown area. Two additional shopping center interface lots will be implemented in the near future to supplement the existing system.

A bus lane experiment on a five mile stretch on I-95, Shirley Highway, in Virginia leading into Washington began on September 22, 1969. This two-lane busway, although not linked to a current fringe lot, is estimated to save northern Virginia 15 minutes on their morning commuter trip into the

District. The busway is located within the reversible lane median strip of the highway and is used by various bus routes serving the area. Figures 37 and 38 show the effect that can be expected if the experiment proves successful and can gain the ridership required to generate a new outlying change-of-mode facility. Table 13 summarizes the data for change-of-mode operations in the Washington metropolitan area.

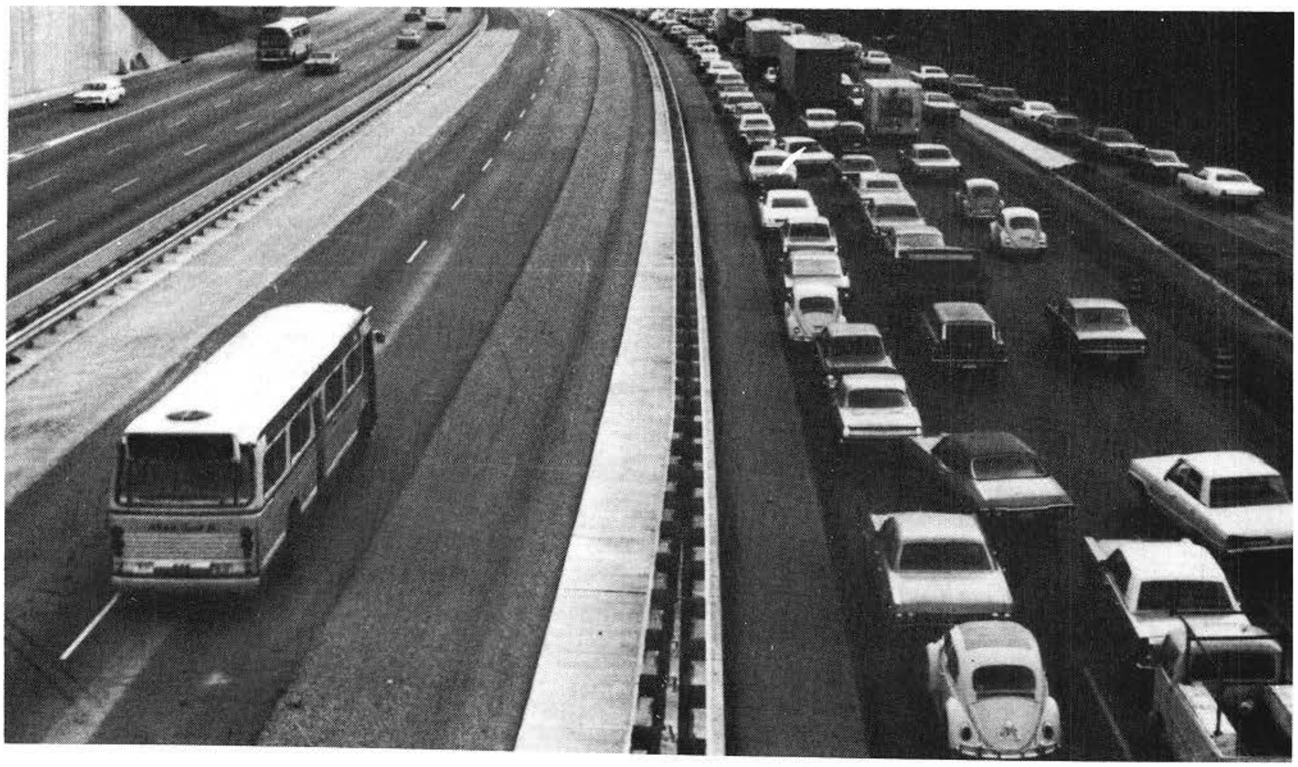


Figure 37

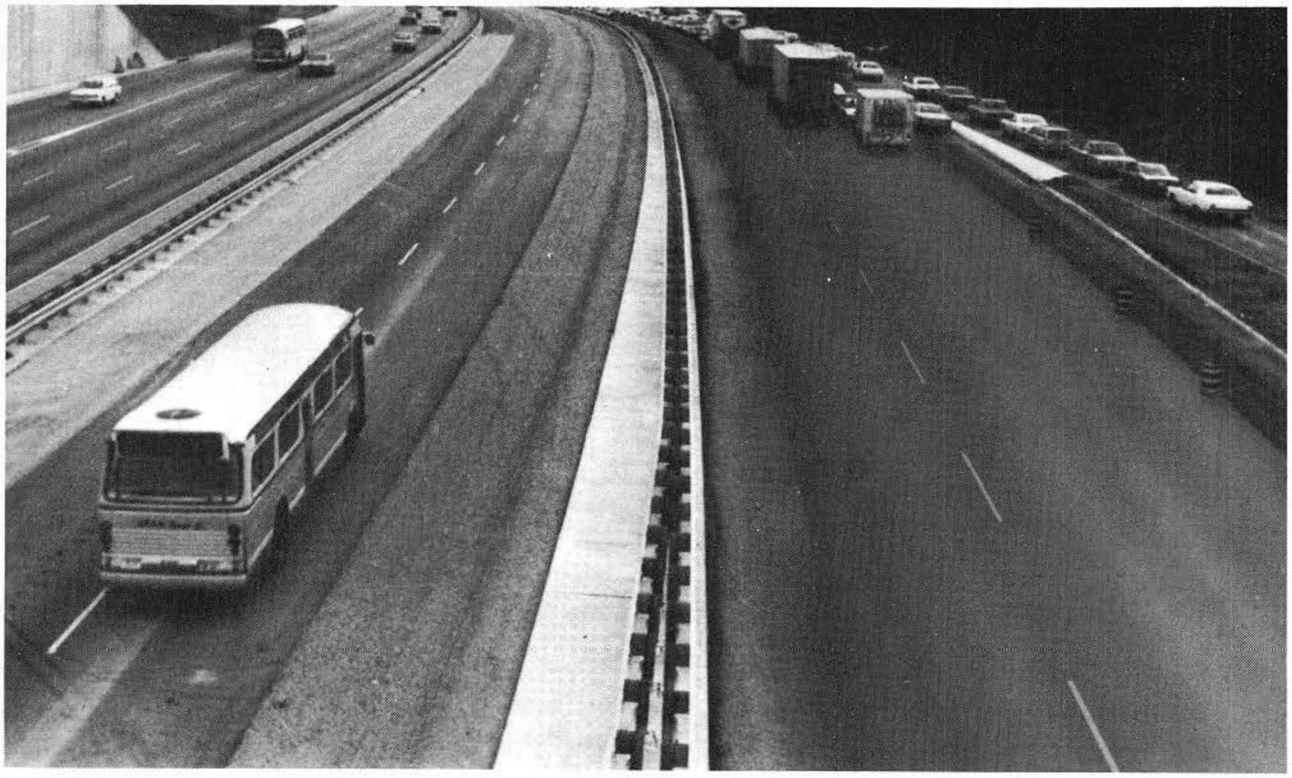


Figure 38

TABLE 13
PARK AND RIDE FACILITIES
WASHINGTON, D.C.

LOCATION OF LOT	DATE SERVICE BEGAN	PARKING SPACES AVAILABLE FOR FRINGE PARKING	CARS PARKED DAILY	ALL DAY PARKING FEE	DISTANCE TO DOWNTOWN	TIME TO CBD TRANSIT (AUTO) (min)		TRANSIT FARE TO CBD	TRANSIT FREQUENCY (MINUTES)		HOURS OF SERVICE	SERVICES PROVIDED IN LOT*	REMARKS
						PEAK	OFF-PEAK		PEAK	OFF-PEAK			
Columbia Island Marina	11/14/65	300	301	0		15(15)	12(12)	0.30	15	60	6:34am-7:25pm	L,W,S,P,G	
S. Capitol St. #1	6/1/65	321	396	0		25(25)	20(20)	0.30	2	30	6:49am-10:25pm	L,W,S,P,G	
S. Capitol St. #2	5/10/66	250	122	0		25(25)	20(20)	0.30	2	30	6:49am-10:25pm	L,S,P,G	
Prince George Plaza	June 1969	500	100	0		42(42)	47(35)	0.65	10	**	7-9am - 4-6pm	L,S,P	
E. J. Korvette	Oct. 1969	800	-	0		55(55)	70(48)	0.85	20	30**	6:45-8:20am 4:30-6:00pm	L,S,P	Job bus demonstration route encourage D.C. residents to reach jobs in outlying areas.
Tyson's Corner	Oct. 1969	-	-	0		45(45)	55(40)	0.60	20	60**	7:00-8:15am 4:45-6:15pm	L,S,P	
D. C. Stadium	?	250	106	0		17(17)	15(15)	0.30	4	10	6:49am-6:05pm	L,W,S,P,G	
Carter Baron Amphitheater	2/28/55	800	746	0		22(22)	18(15)	0.30	3	7	7:08am-6:10pm	L,W,S,P,G	Off-peak service is via 16th St. pick-up
Soldiers' Home	11/23/59	290	227	0		34(25)	30(20)	0.30	3-5	5-10	6:00am-6:40pm	L,W,S,P,G	

*A = Attendant on duty
L = Lighting
W = Shelter
P = Paved
G = Guard
** = No special service provided

IV. Future Application

The intent of this report has been to analyze existing change-of-mode facilities and to attempt to establish certain characteristics of these systems. To broaden this sphere without deviating from the State of the Art restraint on this report, this section hopes to stimulate the interest of other cities by seeing what some cities are currently considering to enhance their total transportation network. The cities included in this section are Milwaukee, Los Angeles, and San Francisco.

Milwaukee

Based on the success of the "Freeway Flyer," the regional land use--transportation study for southeastern Wisconsin was updated to include a proposal for increased transit service to meet the anticipated movement of people in the area. The local officials recognized that unless improvements to mass transit parallel the building of a city's freeway system, transit would be placed in a far less favorable position and that delayed action to improve the transit system would probably be far less effective than action taken immediately.

Under the proposed system, buses would pick up passengers at one or more outlying parking lots. The loaded buses would then enter the regular freeway system where, in outlying areas, traffic moves freely at all times. As the buses approach the more intensely urbanized areas they would leave the freeway system and enter the exclusive busway (Figure 39) for fast uninterrupted passage to the central business district.

As the Milwaukee area continues to grow in population, people living at greater distances from the city center would find the system increasingly valuable for trips to and from downtown, and will make extensive use of change-of-mode parking.

Figure 39

Los Angeles

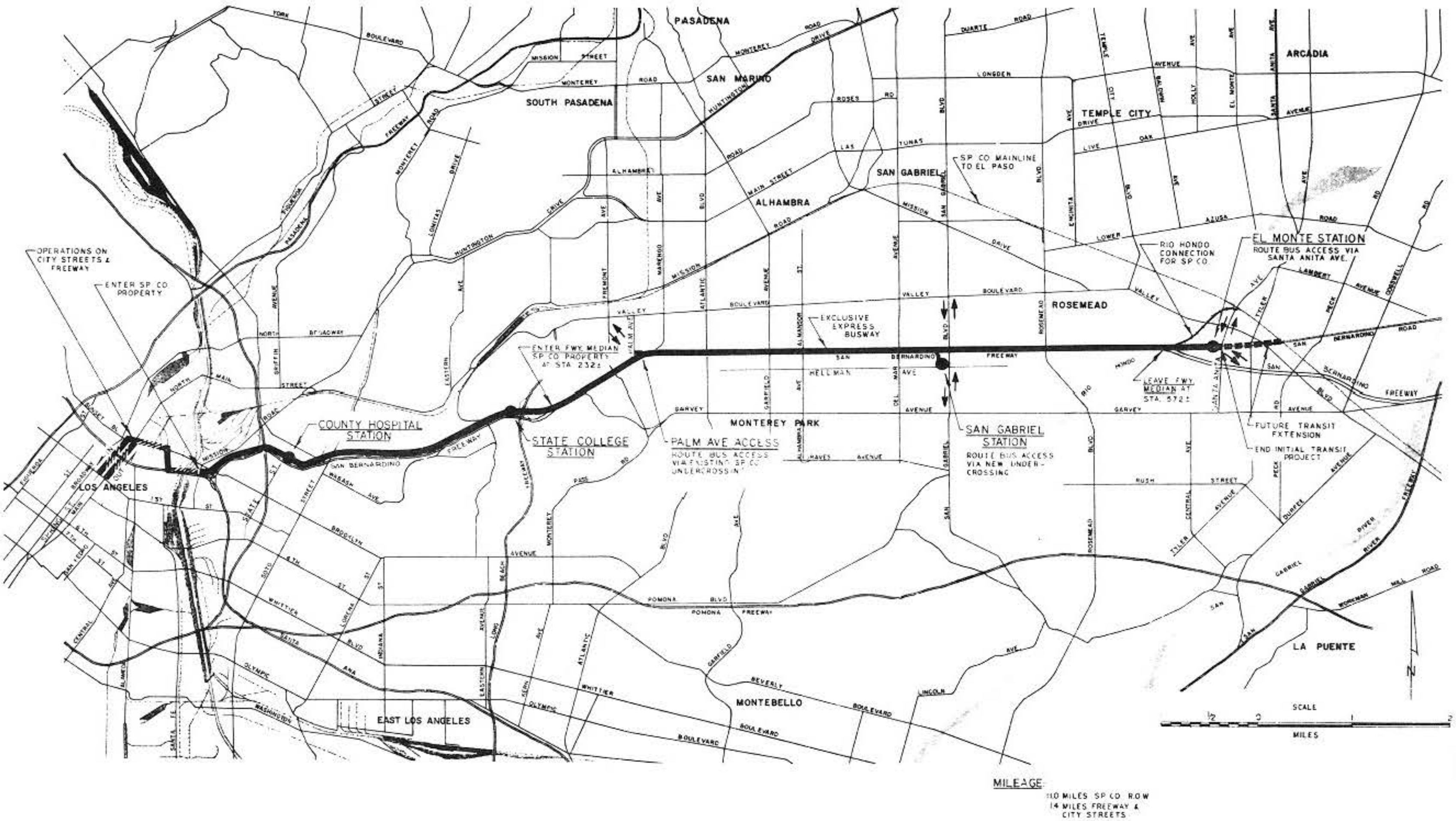
Proposed Busway

The Southern California Rapid Transit District (SCRTD) is presently engaged in a study to establish and operate an express busway on exclusive lanes between El Monte and the Los Angeles Civic Center (Figure 40.) This busway would be constructed in the median strip of the San Bernardino Freeway and would require the construction of approximately 11.0 miles of two-lane roadway, with appropriately spaced passing lanes. In addition, provision would be made for buses to enter or leave the busway via a special underpass and ramp at San Gabriel Boulevard and a modified, existing underpass at Palm Avenue in Alhambra. Two additional stations are proposed along the busway proper; one would serve a State college and the other, the County General Hospital complex. Change-of-mode parking is proposed at the El Monte and San Gabriel Boulevard stations.

The major objectives of this study include: (1) to demonstrate to the public the advantages and conveniences of such a service; (2) to accelerate the initiation of a comprehensive rail-bus transit system; and (3) to develop a flexible mass transit facility over which new types of transit vehicles and communication and control systems may be tested without interference to the peak-hour commuter flow.

Proposed Rapid (Rail) Transit System

The SCRTD has also performed an extensive study of the total transportation needs of the region and has developed a five-corridor rail rapid transit system (Figure 41) in conjunction with an extensive system of local and express feeder buses. The preliminary design of this system was completed



REV	DATE	BY	APP	DESCRIPTION
A	7-28-69	CA	GG	NEW DRWG TO ELIMINATE BACKGROUND

DES. BY ___
DR. BY D. C. ALLEN, JR. 7-10-69
CK. BY ___

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
LOS ANGELES, CALIFORNIA 90015

ENGINEERING DEPARTMENT
APPROVED: Richard Gallagher DATE 7-28-69
ASST. GEN. MGR. FOR ENGINEERING

EXCLUSIVE EXPRESS BUSWAY
SAN GABRIEL VALLEY CORRIDOR
DEMONSTRATION PROJECT
INVOLVING USE OF SP CO. PROPERTY

DATE	DRAWING FILE NO.	DWG TYPE/NO.	REV.	SHEET
7-10-69	SG-001 (F)	GP-1	A	1 OF 9

Figure 40

in May 1968, and in-depth reports were issued as a preliminary to a bond election failed to get the required number of votes to enable the construction of the proposed system. What is described here is that system which the District's study indicated would best meet the transportation needs of the county at the same time the studies were made.

As part of this study, considerable effort was devoted to the interface between other transportation modes and the rail rapid transit system at the various stations. These mode changes include walk to rail; bus to rail; auto to rail, both park and ride and kiss and ride; and at the airport station, air to rail.

Thirty of the system's 66 stations were designed to provide extensive parking facilities. In all, these stations are to have some 28,500 parking spaces. All of the parking areas were designed for ground level parking at the initial stage, thus providing the ability to expand with multilevel structures should demand increase.

It has been estimated that 51,600 passengers, or 11 percent of total originating passengers, use the park and ride facilities. Table 14 shows the estimated number of spaces required at the various stations.

It is intended that the majority of the parking be free with a nominal charge of $.25 being made for those spaces closest to the rail rapid transit station. The size and design of the parking facilities were based upon traffic studies that indicated the potential demand at the various station areas. Also taken into account were the ability to provide parking spaces convenient to the station proper, and the surface street patterns approaching the station. In one case, a speed-walk is proposed to carry persons from the parking area to the station proper since there was an indicated need in excess of 4,000 parking spaces at this station. In addition to these 30 parking areas which were to have been owned and operated by the Rapid Transit District, the Department of Airports has proposed to provide a multilevel parking structure at the Metroport Station.

This proposed design of the rapid transit system recognizes the important role that change-of-mode plays in today's mass transit facilities and use of such a system in any automobile-oriented community would be of extreme value.

Figure 41

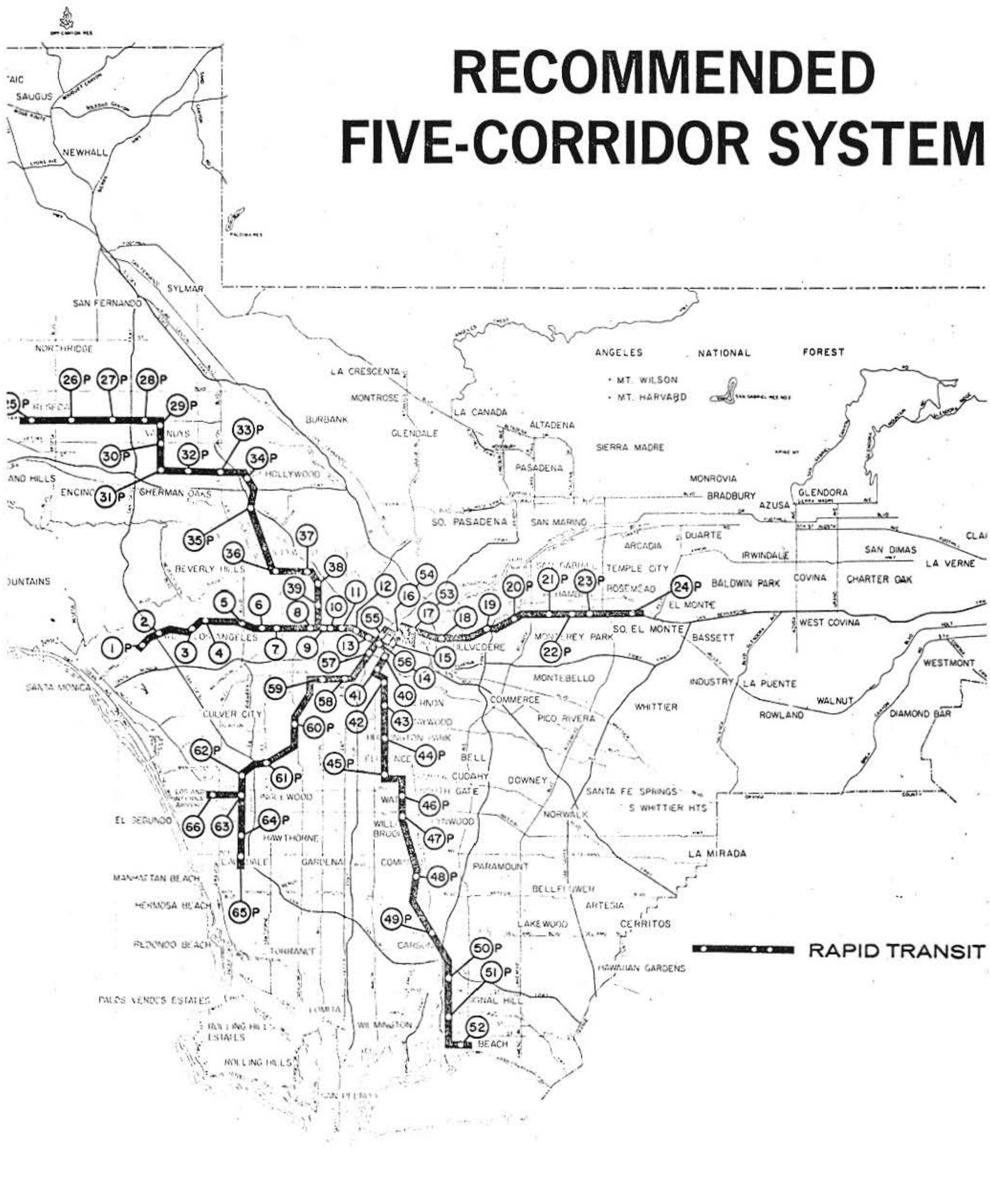

RECOMMENDED
FIVE-CORRIDOR SYSTEM
RAPID TRANSIT
SAUGUS
NEWHALL
SYLMAR
SAN FERNANDO
NORTHRIDGE
ENCINO
SHERMAN OAKS
HOLLYWOOD
BURBANK
GLENDALE
LA CRESCENTA
MONTROSE
LA CANADA
ALTADENA
PASADENA
SIERRA MADRE
ANGELES
NATIONAL
FOREST
MT. WILSON
MT. HARVARD
MONROVIA
BRADBURY
AZUSA
GLENDORA
SO. PASADENA
SAN MARINO
ARCADIA
DUARTE
IRWINDALE
SAN DIMAS
LA VERNE
TEMPLE CITY
ROSEMEAD
BALDWIN PARK
COVINA
CHARTER OAK
EL MONTE
SO. EL MONTE
WEST COVINA
BEVERLY HILLS
BASSETT
MONTEBELLO
INDUSTRY
LA PUENTE
WESTMONT
SANTA MONICA
COMMERCE
WHITTIER
WALNUT
ROWLAND
DIAMOND BAR
CULVER CITY
PICO RIVERA
BELL
CUDAHY
DOWNEY
SANTA FE SPRINGS
S WHITTIER HTS
NORWALK
EL SEGUNDO
HAWTHORNE
LA MIRADA
GARDENA
PARAMOUNT
MANHATTAN BEACH
HERMOSA BEACH
ARTESIA
LAKEWOOD
CERRITOS
REDONDO BEACH
TORRANCE
HAWAIIAN GARDENS
PALOS VERDES ESTATES
WILMINGTON
ROLLING HILLS
BEACH
1 P
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20 P
21 P
22 P
23 P
24 P
26 P
27 P
28 P
29 P
30 P
31 P
32 P
33 P
34 P
35 P
36
37
38
39
40
41
42
43
44 P
45 P
46 P
47 P
48 P
49 P
50 P
51 P
52
53
54
55
56
57
58
59
60 P
61 P
62 P
63
64 P
65 P
66

Table 14

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT

RECOMMENDED FIVE-CORRIDOR RAPID TRANSIT SYSTEM

ESTIMATED NUMBER OF AUTO PARKING SPACES AT RAPID TRANSIT STATIONS

Rapid Transit Station		Estimated Auto Parking Spaces
Barrington		1,800
Fremont		840
Garfield		1,140
San Gabriel		950
Rosemead		1,760
El Monte		4,300
Universal City		680
North Hollywood		900
Laurel Canyon		640
Fulton		575
Burbank Blvd.		640
Van Nuys		500
Sherman Circle		700
Sepulveda		585
Balboa		500
Lindley		500
Tampa		2,000
Gage		500
Firestone		500
Watts		385
Imperial		650
Compton		760
Del Amo		500
Wardlow		700
Pacific Coast		575
Crenshaw-54th		950
Inglewood		780
Manchester		670
El Segundo		500
Rosecrans		2,000
30 Stations	Total	28,480

<u>Source</u>: Kaiser Engineers/DMJM and SCRTD.

San Francisco

Description of the BART System

The San Francisco Bay Area Rapid Transit District was established by the State of California in 1957 to provide rapid transit for the residents of the San Francisco Bay Area. It was estimated for 1975 that the system will attract from 200,000 to 300,000 fares per day. Trains will operate on this 75-mile intraurban rapid transit system at average speeds of between 45 and 50 miles per hour with maximum speeds up to 80 miles per hour. Station platforms will be 700 feet long to accommodate trains of that maximum length. Control of trains and collection of fares will be fully automated. There will be a total of 33 stations on the system, consisting of 18 subway, 3 surface, and 17 aerial. Twenty-three stations will have parking spaces provided representing all 20 surface and aerial stations and three of the subway stations. Stations will also have accommodations for buses and kiss-ride autos. Under present plans, there will be no charge for parking for BART patrons. Figure 42 shows a map of the system and its station locations and preliminary estimates of traveltime.

Estimation of Parking Requirements

The size of parking lots of the BART system is of interest because it points up practical limitations that are encountered in this type of endeavor.

Patronage estimates were initially developed for the BART system using conventional estimating techniques to determine the number of patrons who will arrive at the stations by various modes of transportation such as walking, feeder transit, and automobile. The automobile arrivals were

PEAK-HOUR TRAVEL TIMES IN MINUTES

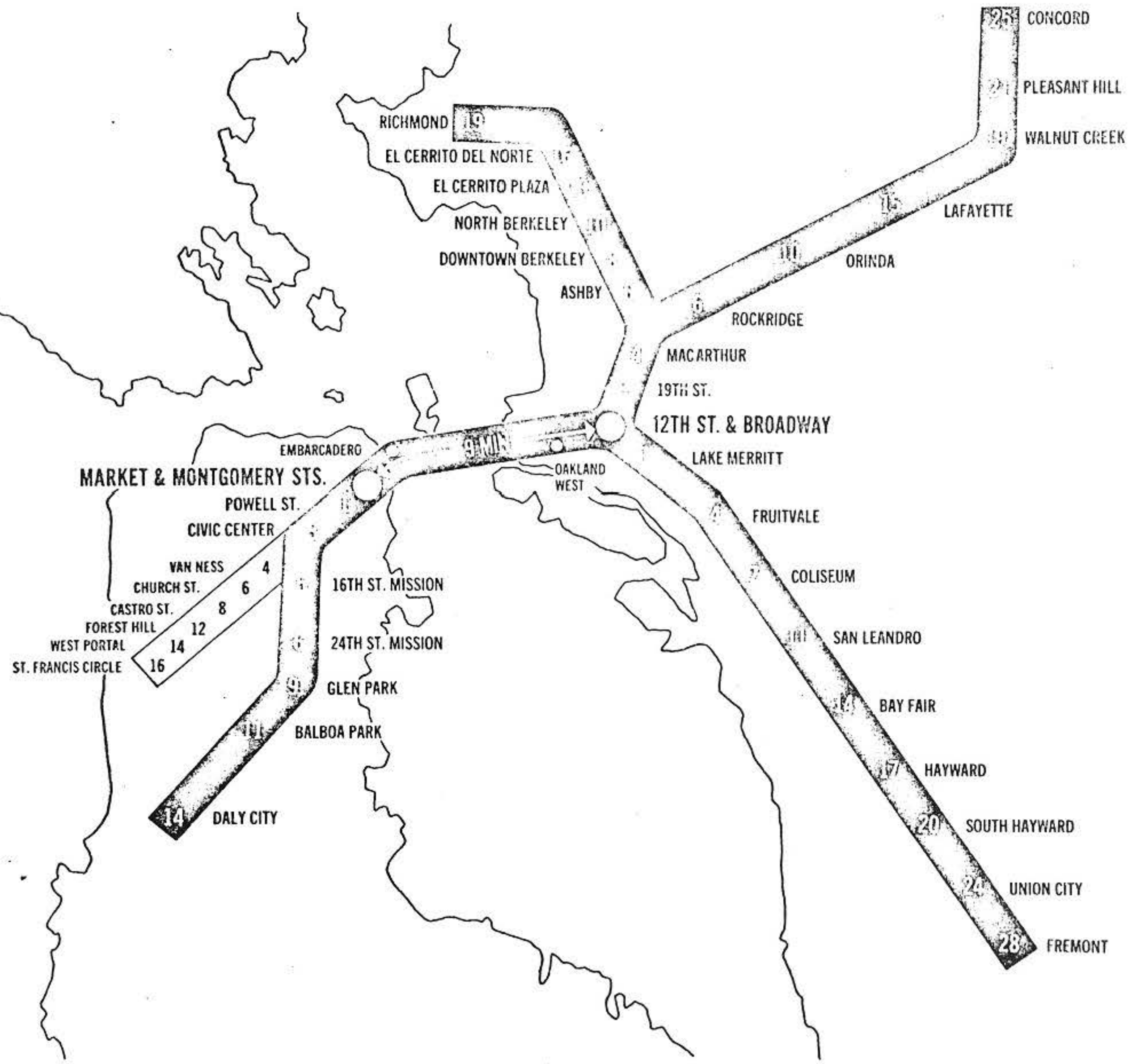


Figure 42

subdivided into parked auto, kiss and ride, or taxi. Consideration was given to auto occupancy and to the maximum accumulation of vehicles over a day's time. These calculations were made for 1975, 1980, and projected to the year 2000. These estimates were made prior to the time actual funding was authorized for the BART system.

When funding was authorized, it was necessary to take a more realistic look at the parking capacity planned in order to conform to the constraints imposed by the funding. In determining the parking to be provided at each station consideration was given to the potential demand at each station, the relative demand, and the capital costs on a square foot basis. Two other significant factors considered were the relative magnitude of property acquisition problems at the various locations, and the desire to attract to the system the longest possible lengths of trips. This objective emphasized the outer, more regional stations of the system where auto access and parking is proportionately of much greater importance. Also, parking is not generally provided at central stations in downtown areas, principally because they are delivery rather than collector stations and because parking capital costs in these areas are relatively high.

There have been continued changes made since 1957 in accordance with revised patronage estimates, land acquisition costs, funding availability, etc. Many parking area designs remain subject to review and change at this writing.

Table 15 shows the change which has taken place since the original parking estimates were made.

Table 15

Station	Original Estimate Prior to Funding	First Revision After Funding Known	Present Design Provisions
1. Fruitvale	3010	850	608
2. Coliseum	2610	950	892
3. San Leandro	2190	1150	980
4. Bayfair	3570	1550	1511
5. Hayward	1830	1250	727
6. So. Hayward	320	850	504
7. Union City	360	850	500
8. Fremont	520	850	500
9. MacArthur	1880	850	450
10. Rockridge	910	750	786
11. Orinda	920	950	900
12. Lafayette	1710	1150	820
13. Walnut Creek	1410	1350	850
14. Pleasant Hill	1350	1250	1341
15. Concord	1350	1350	1350
16. Ashby Place	1830	850	643
17. North Berkeley	1180	1050	508
18. El Cerrito Plaza	880	950	470
19. El Cerrito Del Norte	2120	1450	995
20. Richmond	1150	1050	930
21. Lake Merritt	1880	500	234
22. Oakland West	1180	650	401
23. Daly City	1990	1650	692
TOTAL	36,150	24,100	TOTAL 17,592

Provisions for Small Cars

Another area of particular concern was whether or not provisions should be made specifically for foreign or compact cars in the BART parking lots. Although a trend toward greater development of the small car market exists in the United States, it was felt that the parking lots should provide parking for standard sized automobiles for the most part, and if any spaces worked out to be less than standard size, these would be specifically designated for compact and foreign car use only.

Another consideration was that a small car driver, given a free choice, might well park in a larger space since more of them would be available, and it would be easier to enter and leave the vehicle at these spaces. Also there would be less chance of a person having his small car damaged if he parked in a big space. In addition, the majority of small cars that BART can anticipate will be driven by commuters who will be in a hurry to catch a train and will undoubtedly tend to select the closest space available.

Should very much of this hijacking of standard spaces take place by the compact vehicles it would follow that the effectiveness of the lot capacity would be reduced since the standard size cars would not fit into the smaller available spaces and an unnecessary amount of disruption and inconvenience would occur.

Entrances and Exits

A balance was sought between the number of entrances and exits and the inconvenience that these accesses caused to sidewalk traffic. It was also felt that street disruptions could be better handled on side streets where possible delays in entering the parking lots could be reduced. It was felt that continuous curb access to parking lots should not be permitted in any case. Most design problems in this area had to be worked out with local officials.

Control and Security

Control and security measures to be used at BART parking lots are in many cases unresolved at this writing. Since, according to present planning, BART parking will be free, the need for fencing around the lots is reduced. If a measure of control is going to be achieved with respect to non-BART parkers, however, and if reserved parking and preferred parking are to be used, some form of barriers may have to be erected.

BART parking lots will be well lighted for security and convenience purposes. Light pole design will not afford convenient concealment for criminals, nor will surrounding shrubbery. Trees and shrubs will be planned so as not to decrease the effectiveness of the lighting.

Change-of-Mode Bus to BART

BART has made extensive provisions for changing mode from bus to rapid transit. Parking facilities and other arrangements have had to be made for buses. BART's consultants have estimated that roughly two-thirds of the riders will be former transit riders, and one-third will come from the automobile. Thus, BART has worked with the local governments and feeder agencies to insure that both autos and buses are provided for.

Areas of mutual concern have been that adequate service is being planned for; that the buses come close to the station; that headways are adequate to attract riders; that traffic lights are provided for turns in and out of stations, and for passenger protection if they must cross a street after leaving a bus; that bus riders do not get off buses and walk across kiss-ride lanes; that there is storage space available for midday storage of some buses and perhaps overnight storage; that curb space is adequate for all the bus routes serving the station; that shelters were provided for waiting passengers; that good lighting was planned for, etc.

V. Summary of Findings

As the previous sections of the report have indicated, the success of change-of-mode operations depends upon a combination of several factors including: (1) a demand for change-of-mode parking, (2) a convenient parking location, (3) good transit service, and (4) reasonable costs.

Cities with successful change-of-mode operations are experiencing traffic congestion and high CBD parking costs. Conveniently located lots with adequate transit service and reasonable costs offer the commuter a means to avoid these two problems.

The present use of change-of-mode parking can best be summarized by listing the findings of the survey under the major headings of demand, parking facilities, transit service, and commuter costs.

A. Factors which create a demand for change-of-mode operation and justify the need.

1. Lack of available suitable CBD parking.
2. High cost of CBD parking. Cities with high CBD parking costs had the most extensive use of existing change-of-mode parking; 81 percent of the change-of-mode lots were located in cities with average daily CBD parking costs in excess of $2.
3. A desire to avoid driving in highly congested traffic.

B. Change-of-mode parking facilities.

1. Location

a. change-of-mode lots were located from 1 to 30 miles from the CBD.

b. bus-serviced lots were located within 13 miles.

c. rail-serviced lots were usually located a greater distance from the CBD.

d. bus-serviced lots were more heavily used when located closer to the CBD.

2. Ownership

a. the majority of change-of-mode parking lots were municipally owned.

b. several bus-serviced lots were owned by shopping centers.

c. several rail-serviced lots were owned by private organizations.

3. Other Characteristics

a. many change-of-mode parking lots were self-park, paved, and lighted.

b. many lots operated during off-peak hours for shoppers, other non-work trip purposes, and for those who might leave work early.

c. there were an average of 350 spaces per lot with range of 10 to 7,000.

d. over one-half of the change-of-mode lots offered free parking.

e. those lots which did charge a fee tended to be located closer to the CBD.

C. Transit service to change-of-mode parking.

1. Most change-of-mode lots were provided with transit service for 14 or more hours of service per day.

2. Most lots reported peak-hour transit service with headways of 25 minutes or less.

3. Most rail-serviced lots were reported to have transit travel-times less than auto.

4. Most bus-serviced lots were reported to have transit travel-times greater than auto.

5. Lots with shorter transit headways were more fully used.

D. Commuter Costs.

1. Use of change-of-mode parking and public transportation offered the commuter a cost saving over comparable travel by automobile for each lot in the survey.

2. The total cost saving potential was the greatest with rail-serviced change-of-mode parking, even though rail service was slightly more expensive than bus service.

3. Sixty percent of the bus and 75 percent of the rail-serviced change-of-mode lots provided service that was half the total cost of comparable travel by automobile.

Although the provision of change-of-mode parking appears to be increasing, there is a tremendous potential benefit from establishing new operations and expanding old ones. The individual benefits by avoiding high CBD parking cost and driving in congested traffic. The community also benefits by having fewer vehicles on the highway, reduction of all-day parking demand in the CBD which leaves spaces for shoppers and others, and the revitalization of its transit services.

VI. Conclusions and Recommendations

Change-of-mode parking operations provide the commuter a competitive alternative to travel by private automobile. Extensive use of change-of-mode parking operations can help relieve CBD traffic congestion and can help free CBD parking spaces for non-work trip purposes. It is a necessary part of effective intermodal urban transportation. Change-of-mode parking operations, therefore, serve an important function of the goal to establish a balanced transportation system.

The findings of this study should not limit innovation or obscure the need for the development of change-of-mode parking operations. Exceptions exist to almost every rule stated. There is all too little effective use of this principle at this time due to such factors as lack of funds, legal and administrative restraints, other pressing priorities, and a lack of interest or apathy on the part of potential developers of such operations. In short, no one takes the responsibility for providing this service.

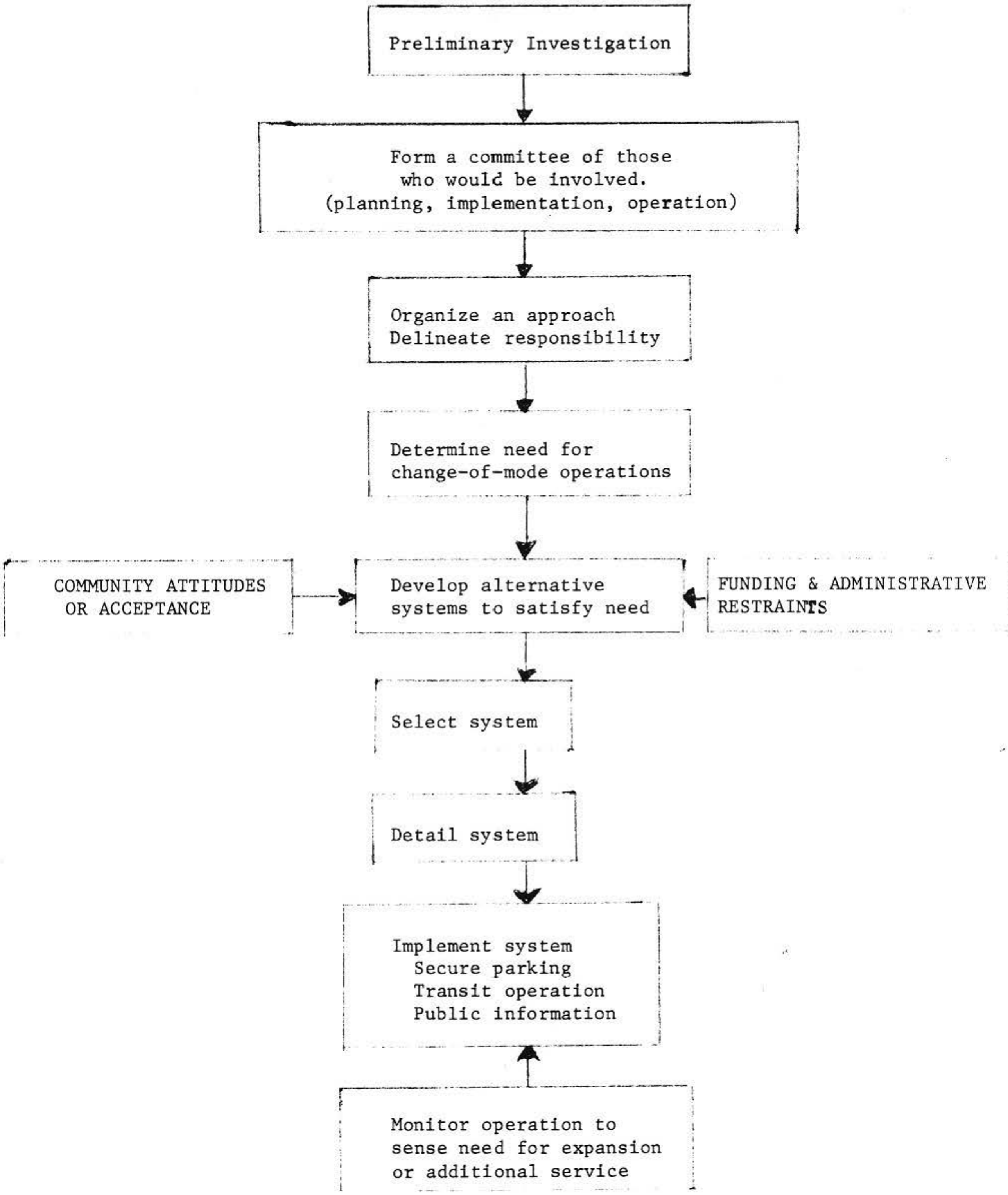
The committee recommends that change-of-mode parking be developed wherever there is a reasonable expectation of success, but keeping in mind the fact that parking is only one part of a change-of-mode operation. Other components include a reliable transit service, between the facility and the user's trip end or beginning; economic advantages; and overall convenience for the users. It becomes increasingly obvious that change-of-mode operations should be designed with these components in mind, rather than simply put together piecemeal, and that these components be closely coordinated into a unified whole.

Figure 43 suggests one schematic approach to the development of a change-of-mode operation. The joint approach involving planning, implementing, and operating agencies is vital to the development of a viable system. Once the need for the service has been determined, alternative systems can be developed with the inputs of community attitudes and legal and financial constraints, also giving due consideration to the overall improvement of the door-to-door trip. An aggressive public information campaign is vital to the success of newly established services, especially at new bus-serviced change-of-mode parking. Once the change-of-mode system is operative, it is important to monitor it to uncover changes that might be needed and to gauge the need for additional service in other areas.

Change-of-mode operations can serve an important function in relieving traffic congestion and reducing CBD parking demand. The principle is simple--instead of each person driving to the CBD and parking his car, have him park his car in the suburbs at a convenient location and ride public transit to the CBD. Consider for a moment that a bus with 50 seated passengers takes up 40 feet of a traffic lane and requires no downtown parking. Forty automobiles with an equivalent 40 drivers and 10 passengers requires a moving traffic lane approximately one-quarter of a mile in length

Figure 43

An Approach to the Development of a Change-of-Mode Operation



and a downtown surface parking lot of over 12,000 square feet. The traffic lane could provide more efficient service and the CBD parking spaces could serve a more productive land use.

Obviously, everyone is not about to leave his car for transit service; however, by making the entire change-of-mode trip as convenient as possible, a certain number of commuters may be attracted.

Change-of-mode parking at suburban rail stations provides an extremely convenient alternative to travel by private automobile. Travel by rail on exclusive rights-of-way bypasses highway congestion completely. Additional parking at many established stations or stops could attract many potential change-of-mode parkers. In fact, modern high-speed rail service may be underused because of the lack of parking space at the stations and insufficient patrons within walking distance. Such is the case in the Philadelphia area, where the Lindenwold, New Jersey, line could handle as many passengers in an hour as they now handle in a day; and their present severest constraint is the limited number of parking spaces available at the stations. It appears that there is a great untapped potential for additional change-of-mode parking to increase ridership on existing rail rapid transit.

Change-of-mode parking serviced by bus transit, while not as widespread as that serviced by rail, is playing a vital role in urban areas without rapid rail transit systems. Successful operations, such as the Milwaukee "Freeway Flyer Service" from shopping center parking to the CBD via the city's freeway system, have proved to be a competitive alternative to commuting by private automobile.

Because of the flexibility of bus routing and operations, change-of-mode parking serviced by bus is much easier to establish. Readily available parking exists at shopping centers, churches, bowling alleys, movie theaters, civic centers, stadiums, and other places not normally used to capacity during the work day. Securing such parking, which can most likely be offered free to the users, can be a first important incentive to the establishment of a change-of-mode operation. Such parking, coupled with express bus service to the CBD, offers the urban resident an alternative mode of travel which can prove very beneficial especially when CBD parking costs are high.

It is certain that change-of-mode parking operations will not be developed or even improved without support and hard work on the part of transit operators, traffic engineers, and transportation planners. The goals of change-of-mode operations are several as discussed in the introduction of this report. They can be realized only if each individual relates these findings to his own particular city or area(s) of responsibility.

VI. Appendix

Included in the appendix are 11 tables which summarize and are comparable to the data included in the analysis of Section II. Each table stratifies the data by ranges of the selected variable indicating its effects on the number of lots, spaces, autos parked, and the use of available space. The selected variables are listed below:

Table A. Distance of CBD

Table B. Change-of-Mode Parking Cost

Table C. Average CBD Parking Cost

Table D. Hours of Service

Table E. Peak-Hour Transit Headway

Table F. Peak-Hour Transit Traveltime

Table G. Time Savings (Auto-Transit)

Table H. One-Way Transit Fare

Table I. Total Daily Change-of-Mode Commuter Cost

Table J. Cost Savings (Change-of-Mode Auto)

Table K. Auto/Change-of-Mode Cost Ratio

TABLE A

DISTANCE TO CBD BY TYPE
OF TRANSIT SERVICE

DISTANCE TO CBD (MI.)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
0- 0	0	0	0	0	0	0	0	0	0	.00	.00	.00
1- 1	4	0	4	4412	0	4412	4532	0	4532	.99	.00	.99
2- 2	2	3	5	1622	627	2249	1921	607	2528	1.06	.96	1.00
3- 3	4	9	13	1158	2200	3358	801	2072	2873	.74	.89	.85
4- 4	5	11	16	1688	3205	4893	1477	2140	3617	.86	.72	.77
5- 5	2	11	13	70	6373	6443	70	5184	5254	1.00	.92	.93
6- 6	4	18	22	554	6974	7528	489	3428	3917	.88	.81	.82
7- 7	2	11	13	68	2858	2926	68	2755	2823	1.00	.95	.96
8- 8	2	11	13	260	4436	4696	239	4314	4553	.91	.89	.89
9- 9	5	8	13	2353	2597	4950	972	2538	3510	.61	.95	.82
10- 10	1	9	10	45	1589	1634	44	1535	1579	.97	.86	.87
11- 11	1	7	8	390	821	1211	249	468	717	.63	.66	.65
12- 12	3	3	6	2200	1030	3230	1275	1030	2305	.41	1.00	.70
13- 13	2	3	5	550	180	730	125	130	255	.34	.77	.60
14- 14	0	8	8	0	2400	2400	0	2141	2141	.00	.90	.90
15- 15	0	6	6	0	1302	1302	0	1089	1089	.00	.93	.93
16- 16	0	5	5	0	651	651	0	490	490	.00	.82	.82
17- 17	0	2	2	0	185	185	0	185	185	.00	1.00	1.00
18- 18	0	4	4	0	425	425	0	305	305	.00	.69	.69
19- 19	0	2	2	0	79	79	0	62	62	.00	.87	.87
20- 20	0	4	4	0	367	367	0	287	287	.00	.84	.84
21- 30	0	4	4	0	370	370	0	245	245	.00	.66	.66
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE B

CHANGE-OF-MODE PARKING COST
BY TYPE OF TRANSIT SERVICE

CHANGE-OF-MODE PARKING COST (DOLLARS)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
Free	19	77	96	7016	21285	28301	3838	14948	18786	.65	.80	.77
.10- .19	1	5	6	320	798	1118	294	756	1050	.91	.93	.93
.20- .29	3	27	30	4365	6284	10649	4349	5600	9949	.89	.87	.88
.30- .39	9	10	19	2114	2305	4419	2382	2374	4756	.97	.96	.96
.40- .49	0	0	0	0	0	0	0	0	0	.00	.00	.00
.50- .59	3	10	13	933	2991	3924	928	2736	3664	.98	.91	.92
.60- .69	0	0	0	0	0	0	0	0	0	.00	.00	.00
.70- .79	0	6	6	0	1092	1092	0	1092	1092	.00	1.00	1.00
.80- .89	0	1	1	0	467	467	0	467	467	.00	1.00	1.00
.90- .99	0	0	0	0	0	0	0	0	0	.00	.00	.00
1.00- 1.50	2	3	5	622	3447	4069	471	3032	3503	.00	.92	.89
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE C

AVERAGE CBD PARKING COST
BY TYPE OF TRANSIT SERVICE

AVERAGE CBD PARKING COST	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
.80– .99	2	0	2	1900	0	1900	350	0	350	.21	.00	.21
1.00– 1.49	7	25	32	4675	8715	13390	4470	7289	11759	.66	.90	.85
1.50– 1.99	0	0	0	0	0	0	0	0	0	.00	.00	.00
2.00– 2.49	25	74	99	6099	13776	19875	4596	8406	13002	.85	.79	.80
2.50– 2.99	0	19	19	0	6957	6957	0	6860	6860	.00	.93	.93
3.00– 3.00	3	14	17	2696	6642	9338	2846	6169	9015	.97	.96	.94
3.01– 3.50	0	7	7	0	2579	2579	0	2281	2281	.00	.90	.90
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE D

HOURS OF SERVICE BY
TYPE OF TRANSIT SERVICE

HOURS OF SERVICE	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
2- 2	1	8	9	50	720	770	50	542	592	1.00	.70	
3- 3	3	0	3	250	0	250	105	0	105	.43	.00	.43
4- 4	5	0	5	2850	0	2850	715	0	715	.37	.00	.37
5- 5	0	1	1	0	305	305	0	225	225	.00	.73	.73
6- 6	0	0	0	0	0	0	0	0	0	.00	.00	.00
7- 7	0	0	0	0	0	0	0	0	0	.00	.00	.00
8- 8	0	0	0	0	0	0	0	0	0	.00	.00	.00
9- 9	0	0	0	0	0	0	0	0	0	.00	.00	.00
10- 10	0	3	3	0	710	710	0	510	510	.00	.86	.86
11- 11	3	0	3	4775	0	4775	4846	0	4846	.99	.00	.99
12- 12	1	1	2	250	10	260	106	10	116	.42	1.00	.71
13- 13	2	3	5	590	215	805	528	145	673	.89	.64	.74
14- 14	0	0	0	0	0	0	0	0	0	.00	.00	.00
15- 15	2	8	10	576	720	1296	418	605	1023	.70	.79	.11
16- 16	0	5	5	0	400	400	0	225	225	.00	.61	.61
17- 17	0	6	6	0	1228	1228	0	892	892	.00	.79	.79
18- 18	0	15	15	0	2181	2181	0	2033	2033	.00	.89	.89
19- 19	7	24	31	3826	6974	10800	3493	2979	6472	.90	.76	.79
20- 20	11	27	38	1107	9680	10787	1055	8103	9158	.96	.93	.94
21- 21	0	1	1	0	356	356	0	300	300	.00	.84	.84
22- 22	0	1	1	0	3000	3000	0	2600	2600	.00	.86	.86
23- 23	0	0	0	0	0	0	0	0	0	.00	.00	.00
24- 24	2	36	38	1096	12170	13266	946	11836	12782	.88	.95	.94
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE E

PEAK-HOUR TRANSIT HEADWAY
BY TYPE OF TRANSIT SERVICE

PEAK HOUR HEADWAY (MIN.)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
1- 1	1	0	1	496	0	496	496	0	496	1.00	.00	1.00
2- 2	9	25	34	1011	10711	12322	1402	6606	8008	.89	.83	.84
3- 3	3	11	14	1422	7381	8803	1217	5812	7029	.88	.87	.88
4- 4	4	8	12	1979	2005	3984	2130	1823	3953	.88	.85	.86
5- 5	11	46	57	6462	12627	19089	5896	12051	17947	.91	.93	.91
10- 14	2	7	9	800	1986	2786	250	1666	1916	.34	.81	.71
15- 19	2	7	9	450	1322	1772	416	1043	1459	.88	.87	.87
20- 24	0	10	10	0	635	635	0	485	485	.00	.87	.87
25- 29	0	11	11	0	962	962	0	837	837	.00	.83	.83
30- 30	5	5	10	2150	310	2460	455	185	640	.34	.64	.49
31- 59	0	6	6	0	585	585	0	415	415	.00	.69	.69
60- 60	0	3	3	0	145	145	0	82	82	.00	.57	.57
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE F

PEAK-HOUR TRANSIT TRAVELTIME
BY TYPE OF TRANSIT SERVICE

PEAK-HOUR TRANSIT TRAVELTIME (MIN.)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
3- 5	1	1	2	79	86	165	74	86	160	.93	1.00	.97
6- 8	2	2	4	622	326	948	471	326	797	.85	1.00	.97
9- 11	4	5	9	4483	1731	6214	4573	1666	6239	.95	.84	.97
12- 14	2	11	13	1618	5271	6889	1918	4067	5985	1.09	.83	.87
15- 17	4	18	22	591	4728	5319	444	3503	3947	.82	.76	.77
18- 20	7	25	32	608	8558	9166	507	7607	8114	.85	.84	.85
21- 23	3	20	23	1200	6710	7910	926	6509	7435	.57	.91	.86
24- 26	4	17	21	831	5750	6581	657	2511	3168	.83	.84	.83
27- 29	0	11	11	0	1519	1519	0	1492	1492	.00	.97	.97
30- 32	2	8	10	102	794	896	95	751	846	.93	.95	.95
33- 35	4	4	8	2246	1095	3341	1003	1002	2005	.71	.93	.82
36- 38	2	1	3	1990	73	2063	1369	70	1439	.66	.95	.76
39- 41	1	6	7	500	1334	1834	125	913	1038	.25	.73	.66
42- 44	1	2	3	500	95	595	100	65	165	.19	.71	.71
45- 47	0	2	2	0	130	130	0	100	100	.00	.73	.73
48- 49	0	0	0	0	0	0	0	0	0	.00	.00	.00
50- 60	0	6	6	0	469	469	0	337	337	.00	.90	.90
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE G

TIME SAVINGS (AUTO. T.T. - TRANSIT T.T.)
BY TYPE OF TRANSIT SERVICE

TIME SAVINGS (MIN)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
(-7)-(-9)	3	3	6	395	705	1100	326	657	983	.89	.84	.87
(-4)-(-6)	4	1	5	4530	100	4630	4280	60	4340	.83	.59	.78
(-1)-(-3)	7	8	15	2593	537	3130	2746	462	3240	.96	.83	.89
0-0	14	9	23	5148	2106	7254	2737	1830	4567	.65	.81	.71
1- 3	5	17	22	2197	5033	7230	1671	1745	3416	.87	.76	.78
4- 6	3	25	28	457	4393	4850	452	3749	4201	.98	.85	.87
7- 9	0	15	15	0	7697	7697	0	6319	6319	.00	.85	.85
10- 12	0	12	12	0	2416	2416	0	2225	2225	.00	.89	.89
13- 15	0	19	19	0	4619	4619	0	3784	3784	.00	.88	.88
16- 18	1	7	8	50	2841	2891	50	2823	2873	1.00	.99	.99
19- 21	0	8	8	0	1851	1851	0	1979	1979	.00	1.02	1.02
22- 24	0	4	4	0	1380	1380	0	1413	1413	.00	1.01	1.01
25- 27	0	4	4	0	515	515	0	375	375	.00	.70	.70
28- 30	0	3	3	0	550	550	0	330	330	.00	.70	.70
31- 33	0	3	3	0	926	926	0	654	654	.00	.78	.78
34- 36	0	1	1	0	3000	3000	0	2600	2600	.00	.86	.86
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE H

ONE-WAY TRANSIT FARE
BY TYPE OF TRANSIT SERVICE

ONE-WAY TRANSIT FARE (DOLLARS)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
$.20-.29	11	14	25	4685	12199	16884	4933	7949	12882	1.05	.65	.76
.30-.39	7	10	17	2816	5175	7991	2248	4780	7028	.80	.92	.88
.40-.59	16	64	80	6373	13479	19852	4360	11782	16142	.67	.87	.81
.60-.79	3	6	9	1496	2520	4016	721	2504	3225	.48	.99	.80
.80-.99	0	20	20	0	2134	2134	0	1663	1663	.00	.78	.78
1.00-1.19	0	17	17	0	2193	2193	0	1622	1622	.00	.74	.74
1.20-1.39	0	8	8	0	969	969	0	705	705	.00	.73	.73
TOTAL	37	139	176	15370	38669	54039	12262	21005	43267	.79	.85	.84

TABLE I

TOTAL DAILY CHANGE-OF-MODE COMMUTER COST BY TYPE OF TRANSIT SERVICE

CHANGE-OF MODE TRAVEL COST (DOLLARS)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
1.20- 1.49	3	4	7	4054	753	4807	4174	753	4927	1.03	1.00	1.02
1.50- 1.74	2	8	10	508	3279	3787	473	2196	2669	.88	.69	.72
1.75- 1.90	3	7	10	568	3110	3678	425	2241	2666	.81	.79	.80
2.00- 2.24	4	12	16	961	3666	4627	781	3277	4058	.88	.91	.90
2.25- 2.49	8	21	29	2938	5160	8098	2984	4910	7894	.89	.89	.89
2.50- 2.74	5	13	18	748	7085	7833	494	4014	4508	.63	.82	.77
2.75- 2.99	1	11	12	200	3821	4021	184	3742	3926	.91	.90	.90
3.00- 3.24	1	11	12	55	4529	4584	55	3995	4050	1.00	.80	.81
3.25- 3.49	1	7	8	290	1030	1320	227	978	1205	.78	.93	.91
3.50- 3.74	2	6	8	1457	897	2354	276	852	1128	.53	.93	.83
3.75- 3.99	2	5	7	105	953	1058	99	468	567	.94	.71	.77
4.00- 4.24	3	9	12	2490	1502	3992	1494	1434	2928	.52	.96	.85
4.24- 4.49	1	4	5	496	656	1152	496	456	952	1.00	.89	.91
4.50- 4.74	1	3	4	500	178	678	100	170	270	.19	.97	.78
4.75- 4.99	0	3	3	0	219	219	0	167	167	.00	.81	.81
5.00- 5.24	0	2	2	0	375	375	0	295	295	.00	.86	.86
5.25- 5.49	0	3	3	0	423	423	0	330	330	.00	.79	.79
5.50- 5.74	0	3	3	0	237	237	0	137	137	.00	.72	.72
5.75- 5.99	0	3	3	0	426	426	0	345	345	.00	.73	.73
6.00- 6.24	0	1	1	0	80	80	0	70	70	.00	.87	.87
6.25- 6.49	0	1	1	0	40	40	0	20	20	.00	.50	.50
6.50- 6.74	0	1	1	0	150	150	0	80	80	.00	.53	.53
6.75- 6.99	0	0	0	0	0	0	0	0	0	.00	.00	.00
7.00- 7.24	0	1	1	0	100	100	0	75	75	.00	.75	.75
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE J

COST SAVINGS
BY TYPE OF TRANSIT SERVICE

COST SAVINGS (DOLLARS)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
.50– .74	2	0	2	3975	0	3975	4100	0	4100	1.02	.00	1.02
.75– .99	1	0	1	22	0	22	21	0	21	.95	.00	.95
1.00– 1.24	0	2	2	0	186	186	0	146	146	.00	.80	.80
1.25– 1.49	0	2	2	0	261	261	0	229	229	.00	.85	.85
1.50– 1.74	1	3	4	290	681	971	227	653	880	.78	.88	.81
1.75– 1.99	3	3	6	526	670	1196	491	670	1161	.92	1.00	.96
2.00– 2.24	7	5	12	4246	1720	5966	2841	1464	4305	.75	.96	.83
2.25– 2.49	3	6	9	330	3291	3621	181	2440	2621	.77	.91	.87
2.50– 2.74	7	12	19	2121	2294	4415	1700	1884	3593	.76	.90	.80
2.75– 2.99	0	13	13	0	3772	3772	0	3560	3560	.00	.86	.86
3.00– 3.24	4	9	13	506	1264	1770	400	1146	1546	.74	.88	.81
3.25– 3.49	5	7	12	814	4218	5032	773	810	1583	.88	.51	.67
3.50– 3.74	1	7	8	390	705	1095	249	555	804	.63	.80	.78
3.75– 3.99	1	7	8	50	1514	1564	50	705	755	1.00	.63	.68
4.00– 4.24	2	6	8	2100	987	3087	1220	851	2071	.44	.82	.72
4.25– 4.49	0	8	8	0	1577	1577	0	1657	1657	.00	1.00	1.00
4.50– 4.74	0	9	9	0	2305	2305	0	2222	2222	.00	.89	.89
4.75– 4.99	0	3	3	0	1285	1285	0	1249	1249	.00	.97	.97
5.00– 5.24	0	5	5	0	672	672	0	645	645	.00	.96	.96
5.25– 5.49	0	9	9	0	5121	5121	0	4631	4631	.00	.91	.91
5.50– 5.74	0	6	6	0	1863	1863	0	1869	1869	.00	1.00	1.00
5.75– 5.99	0	5	5	0	1701	1701	0	1411	1411	.00	.79	.79
6.00– 6.24	0	2	2	0	740	740	0	738	738	.00	.99	.99
6.25– 6.49	0	0	0	0	0	0	0	0	0	.00	.00	.00
6.50– 6.74	0	1	1	0	310	310	0	238	238	.00	.76	.76
6.75– 6.99	0	3	3	0	747	747	0	709	709	.00	.88	.88
7.00– 7.24	0	0	0	0	0	0	0	0	0	.00	.00	.00
7.25– 7.49	0	0	0	0	0	0	0	0	0	.00	.00	.00
7.50– 7.74	0	1	1	0	466	466	0	266	266	.00	.51	.51

TABLE J (CONT.)

COST SAVINGS (DOLLARS)	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
7.75- 7.99	0	0	0	0	0	0	0	0	0	.00	.00	.00
8.00- 8.24	0	3	3	0	177	177	0	140	140	.00	.75	.75
8.25- 8.49	0	1	1	0	42	42	0	42	42	.00	1.00	1.00
8.50- 9.01	0	1	1	0	100	100	0	75	75	.00	.75	.75
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.79	.85	.84

TABLE K

AUTO/CHANGE-OF-MODE COST RATIO
BY TYPE OF TRANSIT SERVICE

AUTO CHANGE-OF-MODE COST RATIO	BY LOTS			BY SPACES			BY AUTOS PARKED			BY UTILIZATION		
	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL	BUS	RAIL	TOTAL
1.29-1.33	1	0	1	22	0	22	21	0	21	.95	.00	.95
1.34-1.37	2	0	2	3975	0	3975	4100	0	4100	1.02	.00	1.02
1.38-1.47	0	0	0	0	0	0	0	0	0	.00	.00	.00
1.43-1.47	0	0	0	0	0	0	0	0	0	.00	.00	.00
1.48-1.53	2	0	2	790	0	790	352	0	352	.51	.00	.51
1.54-1.59	1	0	1	60	0	60	55	0	55	.91	.00	.91
1.60-1.66	2	3	5	1455	410	1865	280	315	595	.58	.72	.66
1.67-1.73	1	6	7	45	888	933	44	736	780	.97	.75	.78
1.74-1.81	1	6	7	496	250	747	496	222	718	1.00	.88	.90
1.82-1.89	5	12	17	3147	1693	4840	2750	1284	4034	.73	.85	.81
1.90-2.00	3	14	17	50	2024	2074	50	1898	1948	1.00	.93	.94
2.01-2.10	5	11	16	2576	1160	3736	1738	1046	2784	.62	.89	.80
2.11-2.21	3	17	20	1308	7338	9146	1219	6333	7552	.90	.84	.85
2.22-2.34	4	15	19	600	4765	5365	345	1450	1795	.53	.70	.67
2.35-2.49	2	10	12	348	2416	2764	349	2231	2580	1.00	.84	.91
2.50-2.66	4	10	14	419	1803	2222	389	1444	1833	.94	.83	.86
2.67-2.85	1	15	16	79	7349	7428	74	6618	6692	.93	.90	.90
2.86-3.07	0	12	12	0	5284	5284	0	5259	5259	.00	.94	.94
3.08-3.32	0	5	5	0	2298	2298	0	1756	1756	.00	.87	.87
3.33-3.64	0	3	3	0	491	491	0	413	413	.00	.85	.85
TOTAL	37	139	176	15370	38669	54039	12262	31005	43267	.75	.85	.84