Table 2. Site Characteristics of Office Buildings

Metrorail Station	Office Building	Distance[1] to Station (ft.)	Gross Square Feet (1000)	Leasable Square Feet (1000)	Percent Occupied	Number of Employees	Number of Parking Spaces	Parking Cost per Month[2]	Year Constructed
Farragut West	1701 Pennsylvania (6)[3]	700	175	175	85	680	175	$120	1963
Crystal City	Crystal Square 2 (7)	1000	490[4]	414	98	1550	550	$40-70	1980
Bethesda	East-West Towers, North Building (28)	2000	180	180	100	700	1600	$75	1978
	Bethesda Office Ctr. (47)	800	168	168	98	600	--	--	1980
	Bethesda Metro Ctr. (30)	100	378	377	99	1500	1400[5]	--	1985
Ballston	Ballston One (20)	2000	240	238	78	1000	450	$60	1986
Courthouse	Bell Atlantic (24)	1500	353	--	100	1300	690	--	1982
Twinbrook	Parklawn (40)	2000	1035[6]	--	--	6800	362 in Bldg 2650 outside	--	1969
	Twinbrook Office Center (36)	800	165	--	75	700	--	--	1980
Silver Spring	Silver Spring Metro Center (17)	200	150	--	60	300	26	(7)	1986

[1] Distance to station is defined as the walking distance from the surveyed building to the nearest Metrorail station portal.

[2] Monthly parking cost refers to cost at garage.

[3] Numbers in parentheses refer to location maps in Figures 2 to 13.

[4] Based on LSF = 0.85 x GSF.

[5] Total parking for project.

[6] Government offices only -- does not include retail.

[7] $30/2 pers; $25/30--4; free-5 or more.

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EXHIBIT NO. 50A2

was distributed through the internal mail systems. At the Bell Atlantic building a mail back survey was used and at Parklawn, surveys were deposited in containers provided in the lobbies.

The surveys were distributed on Tuesdays, Wednesdays and Thursdays to maximize the chances of receiving responses for the most typical travel days.

Data on visitors to office buildings was collected by intercepting persons as they entered the building. If persons were employees no questions were asked; if persons were visitors, they were asked questions concerning their trip. This approach, combined with the cordon counts, allowed not only the trip characteristics of visitors to be determined but also the establishment of a relationship between the number of employees entering and the number of visitors. The number of persons intercepted was recorded to allow the percent of visitors to be determined and then factored by the total count to determine the percent of visitors interviewed.

Analysis

The workplace survey form was designed to request information about the respondent, trips to and from the building, parking or transit costs, linked trips,[1] and the respondent's attitude towards transit. The completed survey forms were keypunched on microcomputer diskettes using a database program (dBase III Plus). The microcomputer version of the statistical package, SPSS, was then used to compute frequencies and/or means for each variable and crosstabs of selected variables. Many frequencies and crosstabs were created and are available as an appendix, contained in a separate volume.

The following summary tables were derived from the dBase III and SPSS outputs:

Work trip mode shares[2]

Work trip mode share by location of residence

Mode share by gender

Mode share by age

Mode share for non-walk, mid-day trips by destination

---

[1] Linked trips refer to trips with intermediate destinations.

[2] Mode share refers to the percent of persons using that particular mode of travel for the trip in question.

Mode share for non-walk, mid-day trips by purpose

Mode share for mid-day trips by destination

Mode share for mid-day trips by purpose

Mode share for visitors

It is important to understand the statistical limitations of the data prior to discussing the results. Because the surveys only represent a sample of all trips to and from a building, there is a degree of error associated with the results. Assuming a distribution of the data and knowing the sample size, estimates of this error can be made. Appendix A explains the statistical aspects in more detail and provides a table indicating the 95 percent confidence limits that can be placed on various values and sample size combinations. The smaller the sample, the wider the confidence. Particular caution is needed in interpreting cross-tabulated data as the number of responses for one variable may be very small. Sample size varies question by question since not all respondents answered every question.

Results

The first several questions on the survey form asked for information regarding the individual respondent. The tabulation of these questions reveals several factors that influence mode share although they are not the prime factors in determining ridership.

Table 3 summarizes mode share for trips to and from work by location of employee's residence. Examination of the residence locations indicate that at least a third of employees for an individual office come from outside the jurisdiction in which the office is located. Further study indicates that employees who cross jurisdictional lines are more likely to use transit than those who live and work within the same jurisdiction. This is illustrated in Figure 14 which shows the transit mode share at 11.4% within a jurisdiction and 23.6% when jurisdictional lines are crossed. As with the first study, the responses to this question imply that Metrorail accessibility opens up a substantial labor pool that might not otherwise be available.

Figure 15 shows the location of residence for Bell Atlantic employees, examination of these pie charts illustrates how employees are distributed throughout the metropolitan region. This widespread distribution of employees' residences throughout the metropolitan area is typical of most buildings surveyed.

Table 3. Mode by Location of Residence Trip to and from Work by Percents

Location	Mode	D.C.	Fairfax County	Arl.	Alex.	Va. Other	P.G. County	Montg. County	Md. Other	Other	Subtotal	Percent Auto	Percent Transit
1701 Penn	Auto	38.0%	61.3%	43.8%	23.5%	100.0%	60.9%	34.0%	60.0%	100.0%	44.6%		
	Transit	48.0	38.7	50.0	70.6	0.0	39.1	66.0	20.0	0.0	50.0		
	Other	14.0	0.0	6.3	5.9	0.0	0.0	0.0	20.0	0.0	5.4		
	Total	24.5	15.2	7.8	8.3	1.0	11.3	26.0	4.9	1.0	100.0	44.6%	50.0%
Silver Spring Metro Center	Auto	39.4	77.8	72.7	—	—	66.7	65.9	85.7	100.0	63.8		
	Transit	51.5	22.2	27.3	—	—	22.2	9.8	0.0	0.0	24.6		
	Other	9.1	0.0	0.0	—	—	11.1	24.4	14.3	0.0	11.5		
	Total	25.4	20.8	8.5	0.0	0.0	6.9	31.5	5.4	1.5	100.0	63.8	24.6
Ballston One	Auto	81.8	89.8	63.0	93.3	70.3	64.9	87.5	100.0	66.7	78.5		
	Transit	18.2	6.5	14.8	6.7	0.0	35.1	12.5	0.0	0.0	13.2		
	Other	0.0	3.7	22.2	0.0	29.7	0.0	0.0	0.0	33.3	8.3		
	Total	9.5	30.9	15.5	4.3	10.6	16.3	9.2	2.0	1.7	100.0	78.5	13.2
Bell Atlantic	Auto	66.7	83.1	78.9	94.7	82.9	92.3	93.2	100.0	100.0	85.2		
	Transit	26.7	14.8	11.3	5.3	4.9	7.7	6.8	0.0	0.0	11.4		
	Other	6.7	2.1	9.9	0.0	12.2	0.0	0.0	0.0	0.0	3.4		
	Total	5.4	43.4	12.7	3.4	7.3	11.6	10.5	5.2	0.5	100.0	85.2	11.4
East West Towers	Auto	66.7	100.0	—	—	—	100.0	77.8	100.0	—	83.3		
	Transit	0.0	0.0	—	—	—	0.0	22.2	0.0	—	13.3		
	Other	33.3	0.0	—	—	—	0.0	0.0	0.0	—	3.3		
	Total	10.0	6.7	0.0	0.0	0.0	10.0	60.0	13.3	0.0	100.0	83.3	13.3

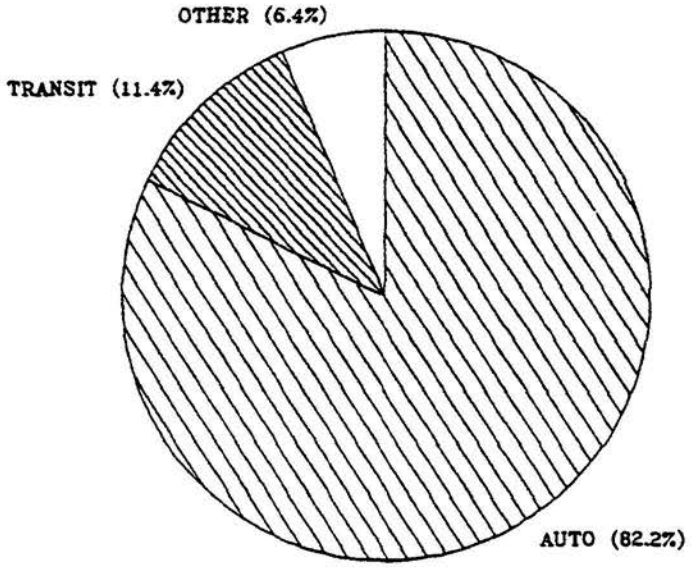
Table 3. Mode by Location of Residence Trip to and from Work by Percents (Continued)

Location	Mode	D.C.	Fairfax County	Arl.	Alex.	Va. Other	P.G. County	Montg. County	Md. Other	Other	Subtotal	Percent Auto	Percent Transit
Bethesda	Auto	70.6	88.9	100.0	100.0	100.0	70.4	84.4	81.0	33.3	82.3		
Metro Center	Transit	29.4	11.1	0.0	0.0	0.0	29.6	12.3	4.8	66.7	14.6		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	3.2	14.3	0.0	3.1		
	Total	6.7	7.1	2.4	2.0	1.2	10.6	60.6	8.3	1.2	100.0	82.3	14.6
Twinbrook	Auto	40.0	100.0	88.9	100.0	100.0	95.7	90.8	100.0	50.0	90.1		
	Transit	60.0	0.0	0.0	0.0	0.0	4.3	9.2	0.0	50.0	9.3		
	Other	0.0	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5		
	Total	5.5	9.3	4.9	2.2	3.3	12.6	53.8	7.1	1.1	100.0	90.1	9.3
Parklawn	Auto	68.4	97.4	83.3	100.0	87.5	94.0	87.3	88.3	50.0	87.2		
	Transit	21.1	2.6	16.7	0.0	12.5	6.0	7.7	5.2	0.0	7.8		
	Other	10.5	0.0	0.0	0.0	0.0	0.0	4.9	6.5	50.0	4.9		
	Total	5.5	5.7	0.9	0.3	1.2	7.2	67.5	11.2	0.6	100.0	87.2	7.8
Crystal	Auto	100.0	73.4	37.5	77.3	94.6	94.1	68.2	88.2	---	75.8		
Square 2	Transit	0.0	21.5	37.5	13.6	0.0	5.9	31.8	11.8	---	17.8		
	Other	0.0	5.1	25.0	9.1	5.4	0.0	0.0	0.0	---	6.4		
	Total	0.5	36.1	11.0	10.0	16.9	7.8	10.0	7.8	0.0	100.0	75.8	17.8
Bethesda	Auto	56.3	100.0	66.7	50.0	---	87.5	79.7	77.8	---	79.3		
Office Center	Transit	43.8	0.0	33.3	50.0	---	12.5	12.2	0.0	---	14.3		
	Other	0.0	0.0	0.0	0.0	---	0.0	8.1	22.2	---	6.5		
	Total	7.4	8.3	2.8	1.8	0.0	7.4	68.2	4.1	0.0	100.0	79.3	14.3

Note: This table presents the mode share by jurisdiction for each office building and the distribution of employee residences by jurisdiction. For each jurisdiction, the percentage of trips by mode are indicated in the rows labeled "Auto," "transit," and "other." These three totaled vertically for each building equal 100%. For each office location, the row labeled "total" indicates the percentage of trips from each jurisdiction. Totaled horizontal this row equals 100%.

OFFICE COMMUTE BY JURISDICTION

TRIPS WITHIN JURISDICTION



OFFICE COMMUTE BY JURISDICTION

TRIPS BETWEEN JURISDICTIONS

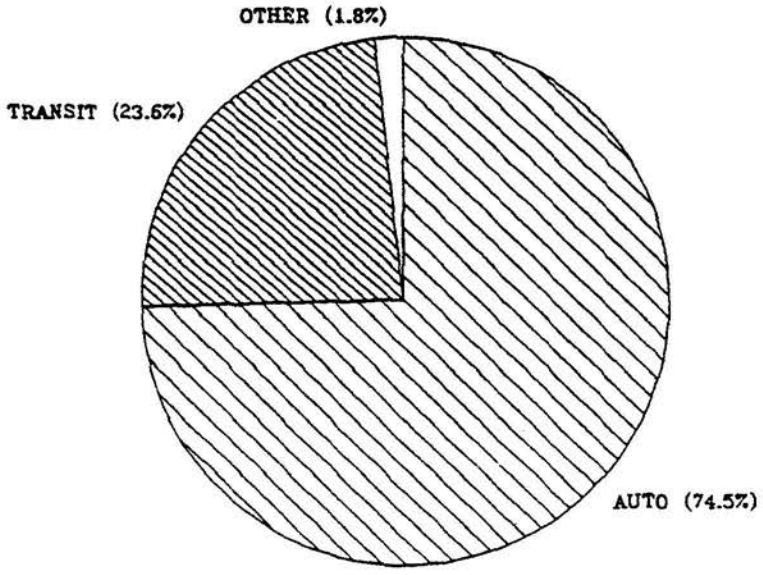
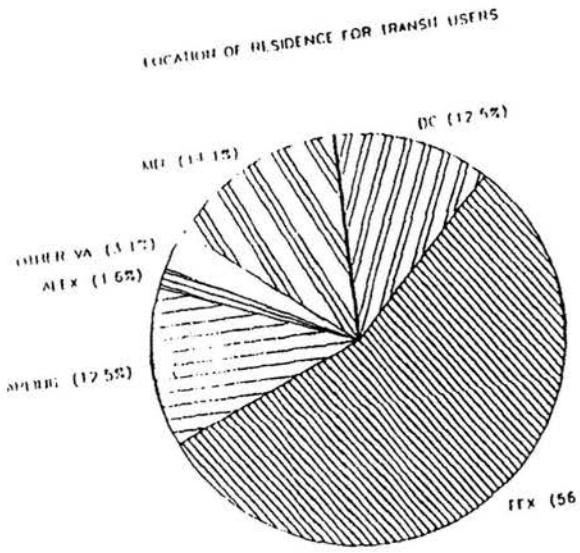
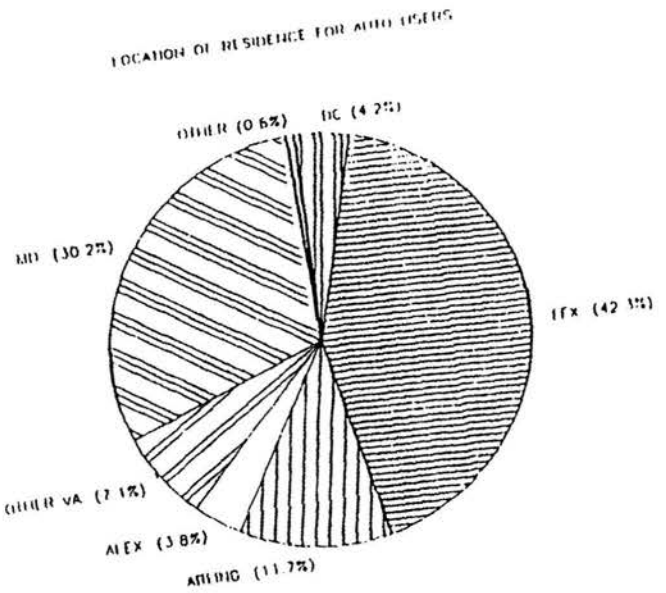


Figure 14.


LOCATION OF RESIDENCE FOR TRANSIT USERS
DC (12.6%)
MD (11.1%)
OTHER VA (3.1%)
ALEX (1.6%)
ARLING (12.5%)
FFX (56.3%)


LOCATION OF RESIDENCE FOR AUTO USERS
OTHER (0.6%)
DC (4.2%)
MD (30.2%)
FFX (42.3%)
OTHER VA (7.1%)
ALEX (3.8%)
ARLING (11.7%)

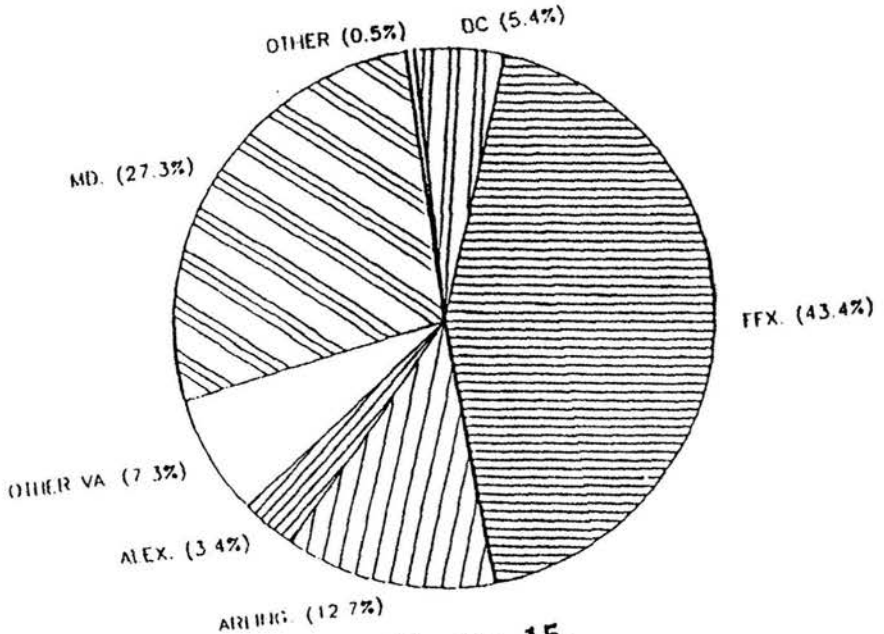

LOCATION OF RESIDENCE FOR ALL EMPLOYEES
OTHER (0.5%)
DC (5.4%)
MD. (27.3%)
FFX. (43.4%)
OTHER VA (7.3%)
ALEX. (3.4%)
ARLING. (12.7%)

Figure 15.

Based on the responses to question 4 the auto ownership per household is 2.05. This is above the regional average of 1.93. Auto availability by building and mode of travel is shown in Table 4. The results confirm that auto users generally have more cars available.

Figure 16 summarizes the responses by gender. The result indicates that there is almost no difference in mode share by gender. This is in contrast to some previous studies which have indicated that women are more likely to use transit than men (studies in other cities have indicated that this is changing). The response rate to the survey by females was higher compared to males with approximately 57% of all replies made by women. The results of this analysis indicates the higher response by females does not bias the overall findings of this survey.

Examining the mode share by age indicates that transit usage declines with age from 27% by people in their twenties to approximately 15% for people in their forties and fifties (Table 5). This is probably a reflection of several factors: older people generally hold positions that require a greater use of their auto during the day; they perhaps have more disposable income and can afford more cars per household; parking provided by employers tends to be by rank thus more people in the older age groups have parking provided; and people in older age brackets developed their commuting practices before Metrorail was in place and old habits die hard.

While this relationship will probably hold true for some time to come, it does indicate that WMATA should consider strategies to expand the 35 and up market. This could become increasingly important as the average age of the work force increases.

The impact of occupation on mode share appears to be insignificant with the exception of clerical jobs which report greater transit usage. However, it should be kept in mind that the data base for this study is limited to primarily white collar office buildings and occupations are classified based on respondents information.

Based on the responses, the peak hour for the AM is between 7:30 and 8:30 and the PM is between 4:30 and 5:30. Examination of the data also reveals that in most cases the number of people arriving in the peak hour is not significantly greater than the hour immediately before and after. Instead there is a peak period that lasts for about 2 1/2 hours. This is true for all buildings, perhaps indicating that employees are taking advantage of flexible work hours allowed by their employers to avoid the peak hours. Over 50% of respondents reported that their employers allowed flexible working hours.

The mode share (auto vs transit) for the commute trip to each office building is given in Table 6 and illustrated in Figure 17. The cordon count conducted at each

Table 4. Workplace Surveys

Number of Vehicles Available by Mode to Work

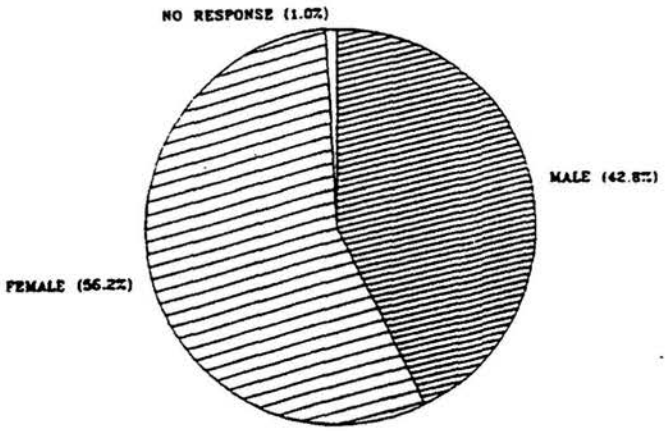
Average Number of Vehicles Per Household

Building	MODE				All Modes	Transit Mode Shares
	Auto	Transit	Walk	Other		
Olmstead Building	2.04	1.51	0.80	NA	1.67	50.0%
Silver Spring Metro Center	2.01	1.53	1.00	1.78	1.83	24.6
Ballston One	2.11	1.18	1.50	2.17	1.95	13.2
Bell Atlantic	2.21	1.82	1.00	2.00	2.13	11.4
East West Towers	1.90	2.00	1.00	NA	1.88	16.7
Bethesda Metro Center	2.20	1.71	3.00	1.67	2.14	14.6
Twinbrook	2.18	0.92	NA	1.00	2.09	9.3
Parklawn	2.23	1.45	1.79	1.67	2.14	7.8
Crystal Square II	2.35	2.03	1.00	1.50	2.21	17.8
Bethesda Office Center	2.11	1.10	2.63	0.00	1.95	14.3
Averages	2.18	1.54	1.61	1.70	2.05	17.6

Note: This table shows the auto availability by building and by mode of travel. For example, at the Bell Atlantic building, the average number of vehicles per household among transit users is 1.82.

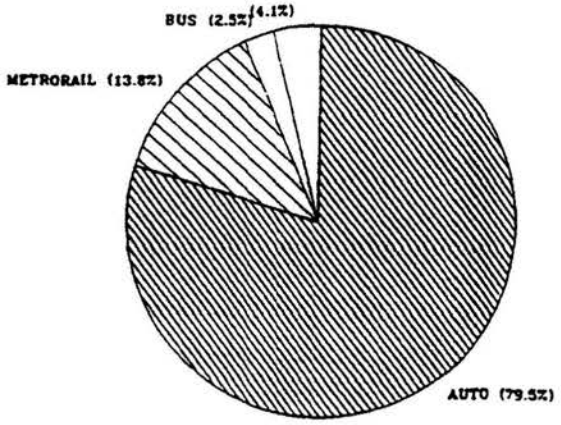
GENDER OF SURVEY RESPONDENTS

OFFICE BUILDINGS



MODE SPLIT FOR OFFICE BUILDINGS

MALE EMPLOYEES



MODE SPLIT FOR OFFICE BUILDINGS

FEMALE EMPLOYEES

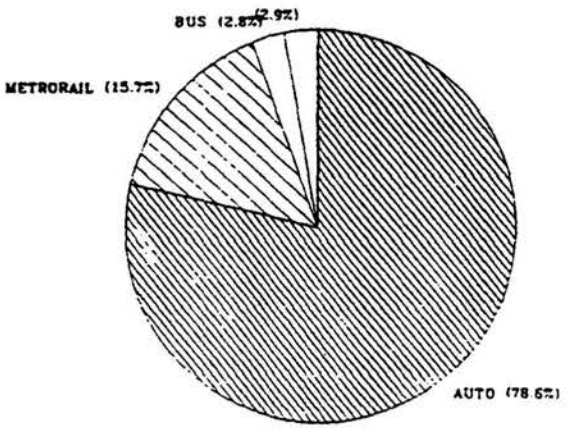


Figure 16.

Table 5. Workplace Surveys

Age By Mode By Office

Sites 1 - 10: All Surveyed Offices

	Auto	Transit	Walk	Other	Total
<18	5	3	0	0	8
19 - 24	158	65	5	2	230
25 - 34	498	134	20	7	659
35 - 44	563	91	12	11	677
45 - 54	404	84	9	4	501
55 - 64	158	25	4	3	190
>65	24	3	1	0	28
Missing Values	19	3	0	1	23
Totals	1829	408	51	28	2316

Note: "Missing Values" refer to people who answered the question but did not specify their mode of travel.

Table 6. Mode Share for Trips to and from Work

Location	Mode					Summary	
	Auto	Rail	Bus	Walk	Other	Subtotal	% Auto	% Transit
Olmstead Building	44.0%	43.5%	7.2%	3.9%	1.4%	100.0%	44.0%	50.7%
Silver Spring Metro Center	64.4	19.7	4.5	5.3	6.1	100.0	64.4	24.2
Ballston One	78.6	12.0	1.1	3.1	5.1	100.0	78.6	13.1
Bell Atlantic	85.1	11.0	0.5	1.9	1.4	100.0	85.1	11.5
East Wet Towers	83.3	13.3	3.3	0.0	0.0	100.0	83.3	16.7
Bethesda Metro Center	82.4	14.5	0.0	1.6	1.6	100.0	82.4	14.5
Twinbrook	90.3	7.6	1.1	0.5	0.5	100.0	90.3	8.6
Parklawn	87.4	4.7	3.0	3.4	1.4	100.0	87.4	7.8
Crystal Square II	75.8	16.4	1.4	2.7	3.7	100.0	75.8	17.8
Bethesda Office Center	79.5	10.0	4.1	5.0	1.4	100.0	79.5	14.2

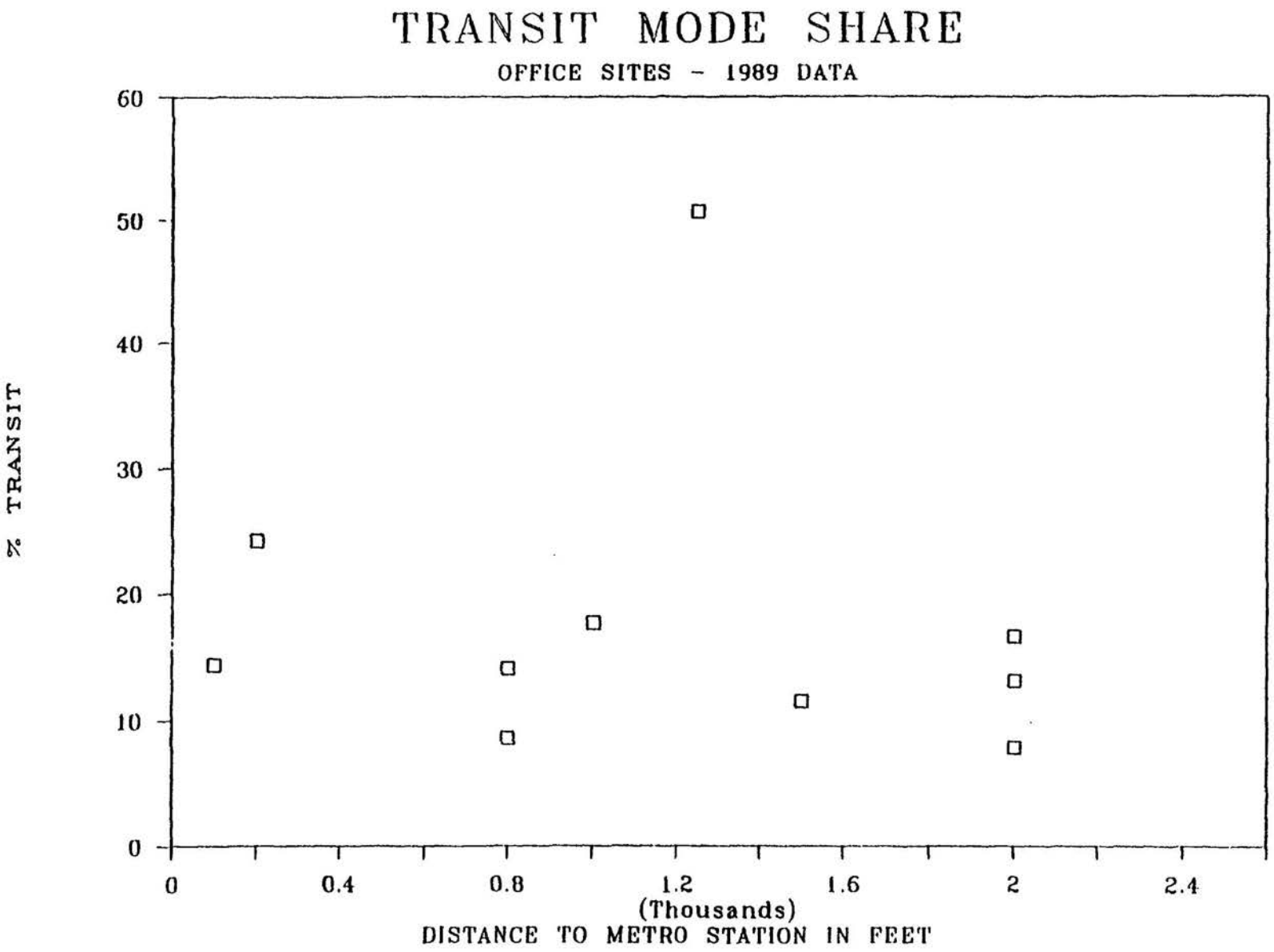

TRANSIT MODE SHARE
OFFICE SITES - 1989 DATA
% TRANSIT
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
(Thousands)
DISTANCE TO METRO STATION IN FEET

Figure 17.

building allowed the actual trip generation rate to be determined, this was then compared to predicted trip generation rates estimated from the survey responses. This comparison helped to determine and adjust for the presence of bias in the survey responses. At five of the buildings it was possible to conduct occupancy counts at the entrance(s) as the parking for the building was restricted to the building as opposed to shared parking for two or more buildings. At these sites then the mode share as determined by the survey responses could be compared for reasonableness to the mode share for the site.

As was the case with the first study, distance from a Metrorail station portal is one of the main dependent variables for determining the mode share for transit. In general, the data confirmed the findings of the first study, namely that the offices closer to the Metrorail station portals exhibit a higher percent of transit users than those located further from the station portals and that the percent of transit users is a function of the location within the metropolitan area. For instance, sites located outside the Beltway exhibit different trends than those inside the Beltway. Table 7 summarizes the findings of this study. These relationships are examined in more detail in Chapter 3.

Transit users can be classified as either "captive" or "choice" users. A choice user, as the term implies, is one who actively chooses to use public transit rather than other modes that are available to him or her. The typical choice rider lives in the suburbs, works in the central business district (CBD) and, faced with peak period congestion on the roads, limited and expensive parking and relatively high levels of transit service to the downtown, chooses to leave his or her auto at home and use public transit.

Conversely, a captive rider is one who effectively has no alternative mode of travel. Typically he or she does not have the use of an automobile available. The majority of transit trips throughout the day in many urban areas is typically made by captive riders and this provides the core ridership. Additional ridership is developed by attracting choice users, particularly from the segment of work related commute trips. In this study 67.6% of Metrorail riders and 60.3% of transit riders in general reported that they did have a car available. This is illustrated in Figure 18 and summarized by building in Table 8. Captive vs choice user is a measure of a systems perceived competitiveness vs other modes within a region. Thus, the results indicate that transit is perceived as being competitive by more people in the Washington metropolitan area than in many urban areas. The higher the percent of choice users, the better in terms of achieving a reduction in auto traffic. Expansion of ridership, for the most part, must

Table 7. Summary of Transit Mode Share - Office

	Number of Sites	Percent Transit Range	Percent Transit Average
CBD Locations	1	50.0%	50.0%
Suburban Locations Inside Beltway	7	11.4% - 24.6%	15.6%
Suburban Locations Outside Beltway	2	7.8% - 9.3%	8.5%
All Office Locations	10	7.8% - 50.0%	17.6%

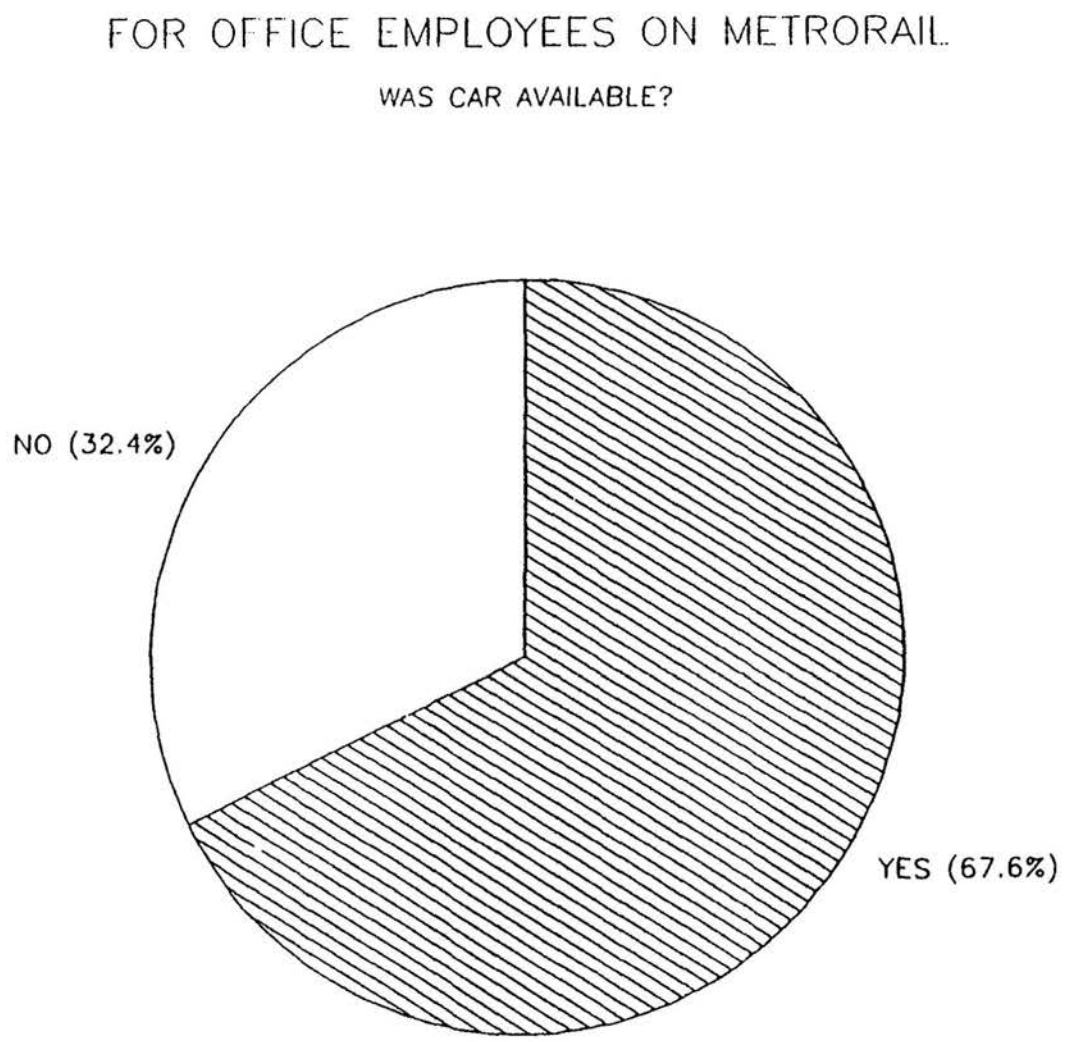

FOR OFFICE EMPLOYEES ON METRORAIL
WAS CAR AVAILABLE?
NO (32.4%)
YES (67.6%)

Figure 18.

Table 8. Workplace Surveys
Auto Availability

If you took transit, was a car available?

Building	Yes	No	Not Answered	Total	Percent Available
1701 Pennsylvania	62	17	4	83	74.7%
Silver Spring Metro Center	22	14	2	38	57.9
Ballston One	16	25	5	46	34.8
Bell Atlantic	53	18	3	74	71.6
East West Towers	2	4	1	7	28.5
Bethesda Metro Center	19	8	3	30	63.3
Twinbrook	7	7	0	14	50.0
Parklawn	28	25	3	56	50.0
Crystal Square II	20	11	0	31	64.5
Bethesda Office Center	17	10	2	29	58.6
TOTALS	246	139	23	408	60.3

come from segments of the population who would be classified as choice users. Despite the fact that a large percentage of patrons are choice users, only 11.8% of all respondents who have a car available use transit. Another statistic generated from the data, is that transit is perceived as a viable option by approximately 48% of employees at the sites surveyed. If transit mode share is expressed as a percent of those who have acceptable connections it rises from 17.6% to 36.7% -- more than double. This implies that lack of access is perceived as a major obstacle by a large segment of potential choice users.

Another factor that influences transit ridership is the cost of travel. Parking costs varied somewhat for each site, however at most sites there was significant off-site parking available. No relationship to parking cost could be determined.

Travel times for both auto and transit users are summarized in Table 9. Transit mode share tends to increase for longer distance trips. This is to be expected as it is difficult for transit to be competitive on shorter trips as waiting times account for a bigger percentage of an individual's trip resulting in a poor travel time relative to auto travel. On longer trips this is overcome. For instance, a short trip may take 10 minutes by car and 15 to 20 minutes by transit including wait time while a 30 minute trip by car could be accomplished in 35 to 40 minutes by transit.

Table 10 summarizes the responses to the attitudinal questions. As expected transit users have a better perception of transit than auto users. The most significant difference is in opinions concerning the availability of schedule information. Approximately 48% of auto users believe that schedule information is readily available while approximately 63% of transit users believe schedule information is readily available. Of the total respondents only 49.4% believe schedule information is readily available. This suggests that a marketing strategy that distributes information to employees may be beneficial. Targeted information could be distributed to offices within each station area.

The final set of questions pertained to trip making characteristics for all trips throughout the day. Respondents were asked the purpose, mode and destination for all trips to and from their office building for the day in question. Also, information concerning stop overs was collected for each trip.

Table 11 summarizes the mode share by location of employees' residences for the commute trips to and from work. Figure 19 illustrates the percent of linked trips that are made for each time period during the day; linked trips are most prevalent during the mid-day period. Table 12 summarizes mid-day trips by trip purpose and mode share.

Table 9. Average Travel Times

Auto Users	(Minutes)
Drive from home to office parking	31.6
Walk from office parking to office	3.2
Total trip time, home to office	36.2
Transit Users	
Trip from home to transit	9.6
Time on transit vehicle(s)	31.3
Trip from last transit vehicle to office	7.0
Total trip time, home to office	43.9

Table 10. Workplace Surveys
Respondents Opinions By Mode of Travel

Q12A: People should be encouraged to use transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	1385	(75.8%)	331	(81.1%)	42	(82.4%)	23	(82.1%)	1781	(76.9%)	28	(66.7%)	1809	(76.7%)
Disagree	112	(6.1)	17	(4.2)	2	(3.9)	0	(0.0)	131	(5.7)	3	(7.2)	134	(5.7)
No Opinion	297	(16.2)	46	(11.3)	7	(13.7)	5	(17.9)	355	(15.3)	8	(19.0)	363	(15.4)
Not Answered	35	(1.9)	14	(3.4)	0	(0.0)	0	(0.0)	49	(2.1)	3	(7.2)	52	(2.2)
Total	1829	(100.0)	408	(100.0)	51	(100.0)	28	(100.0)	2316	(100.0)	42	(100.0)	2358	(100.0)

Q12B: Schedule information for transit is readily available.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	874	(47.8%)	257	(63.0%)	22	(43.1%)	12	(42.9%)	1165	(50.3%)	16	(38.1%)	1181	(50.1%)
Disagree	576	(31.5)	99	(24.3)	21	(41.2)	7	(25.0)	703	(30.4)	8	(19.0)	711	(30.2)
No Opinion	348	(19.0)	37	(9.1)	8	(15.7)	7	(25.0)	400	(17.3)	14	(33.3)	414	(17.6)
Not Answered	31	(1.7)	15	(3.7)	0	(0.0)	2	(7.1)	48	(2.1)	4	(9.5)	52	(2.2)
Total	1829	(100.0)	408	(100.0)	51	(100.0)	28	(100.0)	2316	(100.0)	42	(100.0)	2358	(100.0)

Table 10. Workplace Surveys
Respondents Opinions By Mode of Travel
(Continued)

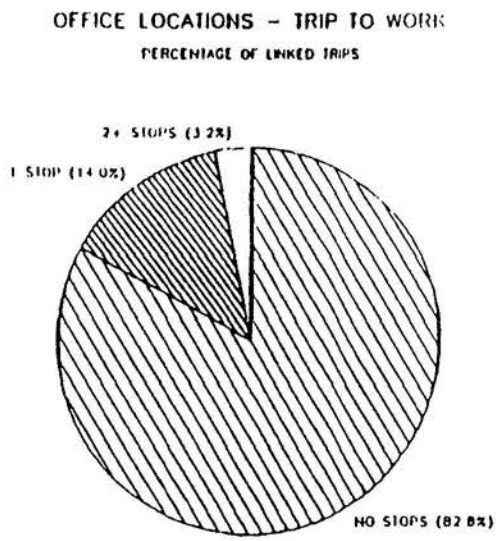
Q12C: Metrorail is clean and reliable.

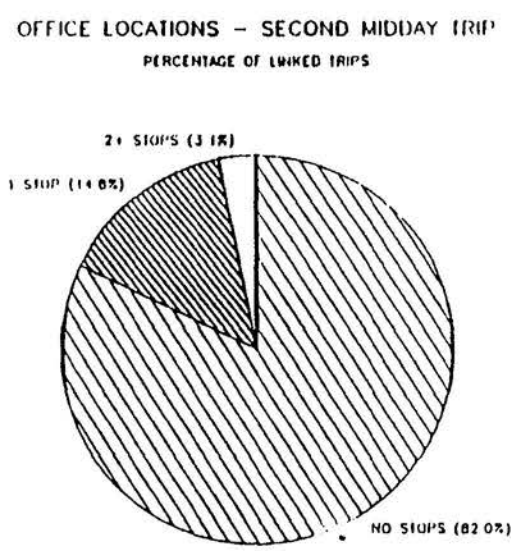
	Mode of Travel															
Question	Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	1543	(84.4%)	379	(92.9%)	51	(100.0%)	23	(82.1%)	1996	(86.2%)	30	(71.4%)	2026	(85.9%)
Disagree	58	(3.2)	9	(2.2)	0	(0.0)	1	(3.6)	68	(2.9)	3	(7.1)	71	(3.0)
No Opinion	202	(11.0)	6	(1.5)	0	(0.0)	1	(3.6)	209	(9.0)	6	(14.3)	215	(9.1)
Not Answered	26	(1.4)	14	(3.4)	0	(0.0)	3	(10.7)	43	(1.9)	3	(7.1)	46	(2.0)
Total	1829	(100.0)	408	(100.0)	51	(100.0)	28	(100.0)	2316	(100.0)	42	(100.0)	2358	(100.0)

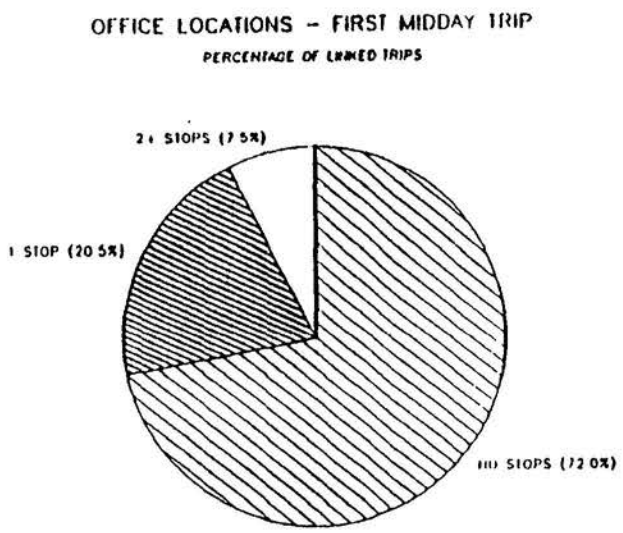
Q12D: Metrobus is clean and reliable.

	Mode of Travel															
Question	Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	521	(28.5%)	142	(34.8%)	15	(29.4%)	3	(10.7%)	681	(29.4%)	10	(23.8%)	691	(29.3%)
Disagree	358	(19.6)	93	(22.8)	9	(17.6)	11	(39.3)	471	(20.3)	7	(16.7)	478	(20.3)
No Opinion	917	(50.1)	154	(37.7)	27	(52.9)	11	(39.3)	1109	(47.9)	22	(52.4)	1131	(48.0)
Not Answered	33	(1.8)	19	(4.7)	0	(0.0)	3	(10.7)	55	(2.4)	3	(7.1)	58	(2.5)
Total	1829	(100.0)	408	(100.0)	51	(100.0)	28	(100.0)	2316	(100.0)	42	(100.0)	2358	(100.0)

Note: Not answered refers to people who specified their mode of travel but do not answer the question. Missing values refer to people who answered the question but did not specify their mode of travel.


OFFICE LOCATIONS – TRIP TO WORK
PERCENTAGE OF LINKED TRIPS
2+ STOPS (3.2%)
1 STOP (14.0%)
NO STOPS (82.8%)


OFFICE LOCATIONS – SECOND MIDDAY TRIP
PERCENTAGE OF LINKED TRIPS
2+ STOPS (3.1%)
1 STOP (14.8%)
NO STOPS (82.0%)


OFFICE LOCATIONS – FIRST MIDDAY TRIP
PERCENTAGE OF LINKED TRIPS
2+ STOPS (7.5%)
1 STOP (20.5%)
NO STOPS (72.0%)

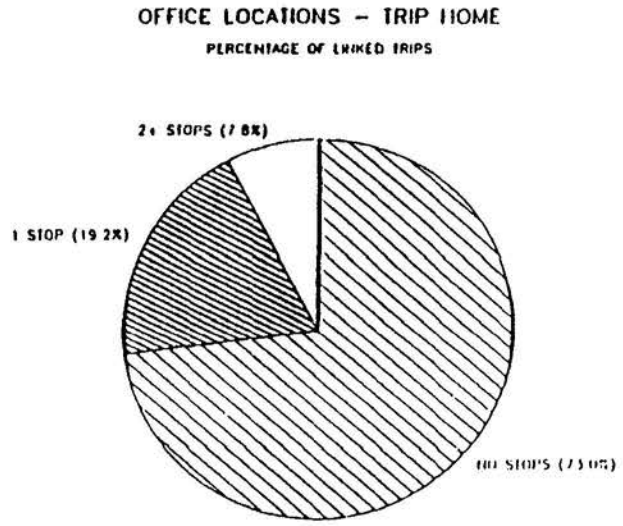

OFFICE LOCATIONS – TRIP HOME
PERCENTAGE OF LINKED TRIPS
2+ STOPS (7.8%)
1 STOP (19.2%)

Figure 19.

Table 11. Mode by Location of Residence Trip to and from Work by Percent

Location	Mode	D.C.	Fairfax County	Arl.	Alex.	Va. Other	P.G. County	Montg. County	Md. Other	Other	Subtotal	Percent Auto	Percent Transit
1701 Penn	Auto	38.0%	61.3%	43.8%	23.5%	100.0%	60.9%	34.0%	60.0%	100.0%	44.6%		
	Transit	48.0	38.7	50.0	70.6	0.0	39.1	66.0	20.0	0.0	50.0		
	Other	14.0	0.0	6.3	5.9	0.0	0.0	0.0	20.0	0.0	5.4		
	Total	24.5	15.2	7.8	8.3	1.0	11.3	26.0	4.9	1.0	100.0	44.6%	50.0%
Silver Spring	Auto	39.4	77.8	72.7	—	—	66.7	65.9	85.7	100.0	63.8		
Metro Center	Transit	51.5	22.2	27.3	—	—	22.2	9.8	0.0	0.0	24.6		
	Other	9.1	0.0	0.0	—	—	11.1	24.4	14.3	0.0	11.5		
	Total	25.4	20.8	8.5	0.0	0.0	6.9	31.5	5.4	1.5	100.0	63.8	24.6
Ballston One	Auto	81.8	89.8	63.0	93.3	70.3	64.9	87.5	100.0	66.7	78.5		
	Transit	18.2	6.5	14.8	6.7	0.0	35.1	12.5	0.0	0.0	13.2		
	Other	0.0	3.7	22.2	0.0	29.7	0.0	0.0	0.0	33.3	8.3		
	Total	9.5	30.9	15.5	4.3	10.6	16.3	9.2	2.0	1.7	100.0	78.5	13.2
Bell Atlantic	Auto	66.7	83.1	78.9	94.7	82.9	92.3	93.2	100.0	100.0	85.2		
	Transit	26.7	14.8	11.3	5.3	4.9	7.7	6.8	0.0	0.0	11.4		
	Other	6.7	2.1	9.9	0.0	12.2	0.0	0.0	0.0	0.0	3.4		
	Total	5.4	43.4	12.7	3.4	7.3	11.6	10.5	5.2	0.5	100.0	85.2	11.4
East West	Auto	66.7	100.0	—	—	—	100.0	77.8	100.0	—	83.3		
Towers	Transit	0.0	0.0	—	—	—	0.0	22.2	0.0	—	13.3		
	Other	33.3	0.0	—	—	—	0.0	0.0	0.0	—	3.3		
	Total	10.0	6.7	0.0	0.0	0.0	10.0	60.0	13.3	0.0	100.0	83.3	13.3

Note: This table presents the mode share by jurisdiction for each office building and the distribution of employee residences by jurisdiction. For each jurisdiction, the percentage of trips by mode are indicated in the rows labeled "Auto," "transit," and "other." These three totaled vertically for, each building equal 100%. For each office location, the row labeled "total" indicates the percentage of trips from each jurisdiction. Totaled horizontal this row equals 100%.

Table 11. Mode by Location of Residence Trip to and from Work by Percent (Continued)

Location	Mode	D.C.	Fairfax County	Arl.	Alex.	Va. Other	P.G. County	Montg. County	Md. Other	Other	Subtotal	Percent Auto	Percent Transit
Bethesda	Auto	70.6	88.9	100.0	100.0	100.0	70.4	84.4	81.0	33.3	82.3		
Metro Center	Transit	29.4	11.1	0.0	0.0	0.0	29.6	12.3	4.8	66.7	14.6		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	3.2	14.3	0.0	3.1		
	Total	6.7	7.1	2.4	2.0	1.2	10.6	60.6	8.3	1.2	100.0	82.3	14.6
Twinbrook	Auto	40.0	100.0	88.9	100.0	100.0	95.7	90.8	100.0	50.0	90.1		
	Transit	60.0	0.0	0.0	0.0	0.0	4.3	9.2	0.0	50.0	9.3		
	Other	0.0	0.0	11.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5		
	Total	5.5	9.8	4.9	2.2	3.3	12.6	53.8	7.1	1.1	100.0	90.1	9.3
Parklawn	Auto	68.4	97.4	83.3	100.0	87.5	94.0	87.3	88.3	50.0	87.2		
	Transit	21.1	2.6	16.7	0.0	12.5	6.0	7.7	5.2	0.0	7.8		
	Other	10.5	0.0	0.0	0.0	0.0	0.0	4.9	6.5	50.0	4.9		
	Total	5.5	5.7	0.9	0.3	1.2	7.2	67.5	11.2	0.6	100.0	87.2	7.8
Crystal	Auto	100.0	73.4	37.5	77.3	94.6	94.1	68.2	88.2	—	75.8		
Square 2	Transit	0.0	21.5	37.5	13.6	0.0	5.9	31.8	11.8	—	17.8		
	Other	0.0	5.1	25.0	9.1	5.4	0.0	0.0	0.0	—	6.4		
	Total	0.5	36.1	11.0	10.0	16.9	7.8	10.0	7.8	0.0	100.0	75.8	17.8
Bethesda	Auto	56.3	100.0	66.7	50.0	—	87.5	79.7	77.8	—	79.3		
Office Center	Transit	43.8	0.0	33.3	50.0	—	12.5	12.2	0.0	—	14.3		
	Other	0.0	0.0	0.0	0.0	—	0.0	8.1	22.2	—	6.5		
	Total	7.4	8.3	2.8	1.8	0.0	7.4	68.2	4.1	0.0	100.0	79.3	14.3

Note: This table presents the mode share by jurisdiction for each office building and the distribution of employee residences by jurisdiction. For each jurisdiction, the percentage of trips by mode are indicated in the rows labeled "Auto," "transit," and "other." These three totaled vertically for each building equal 100%. For each office location, the row labeled "total" indicates the percentage of trips from each jurisdiction. Totaled horizontal this row equals 100%.

Table 12. Mode Share for Midday Trips by Purpose

Location	Mode	Work Related	Personal Business	Meal/ Snack	Shopping	Educa- tional	Recrea- tional	Other	Total	Summary Percent Auto	Summary Percent Transit
1701	Auto	22.2%	0.0%	0.0%	0.0%	—%	33.3%	—%	8.6%		
Penn	Transit	11.1	20.0	0.0	25.0	---	33.3	---	14.3		
	Other	66.7	80.0	100.0	75.0	---	33.3	---	77.1		
	Total	25.7	28.6	25.7	11.4	0.0	8.6	0.0	100.0	8.6%	14.3%
Silver	Auto	45.5	33.3	44.4	100.0	---	---	---	44.4		
Spring	Transit	54.5	0.0	0.0	0.0	---	---	---	22.2		
Metro	Other	0.0	66.7	55.6	0.0	---	---	---	33.3		
Center	Total	40.7	22.2	33.3	3.7	0.0	0.0	0.0	100.0	44.4	22.2
Ballston	Auto	81.3	90.0	78.3	85.7	100.0	100.0	0.0	81.7		
One	Transit	12.5	10.0	0.0	0.0	0.0	0.0	0.0	5.0		
	Other	6.3	0.0	21.7	14.3	0.0	0.0	100.0	13.3		
	Total	26.7	16.7	38.3	11.7	1.7	3.3	1.7	100.0	81.7	5.0
Bell	Auto	73.1	78.3	64.4	83.3	50.0	40.0	83.3	71.9		
Atlantic	Transit	15.4	4.3	5.1	3.3	33.3	0.0	0.0	6.7		
	Other	11.5	17.4	30.5	13.3	16.7	60.0	16.7	21.3		
	Total	14.6	25.8	33.1	16.9	3.4	2.8	3.4	100.0	71.9	6.7
East	Auto	25.0	0.0	---	---	---	---	---	20.0		
West	Transit	50.0	100.0	---	---	---	---	---	60.0		
Towers	Other	25.0	0.0	---	---	---	---	---	20.0		
	Total	80.0	20.0	0.0	0.0	0.0	0.0	0.0	100.0	20.0	60.0

Note: For each purpose, the percentage of trips by mode are indicated in the rows labeled "auto", "transit", and "other". These vertically total to 100% for each purpose. For each office location the row labeled "total" indicates the percentages of trips by purpose. This row totals horizontally to 100%.

Table 12. Mode Share for Midday Trips by Purpose
(Continued)

Location	Mode	Work Related	Personal Business	Meal/ Snack	Shopping	Educa- tional	Recrea- tional	Other	Total	Summary: Percent Auto	Summary: Percent Transit
Bethesda	Auto	76.7	63.0	61.5	100.0	---	50.0	---	71.3		
Metro	Transit	20.0	7.4	0.0	0.0	---	0.0	---	10.0		
Center	Other	3.3	29.6	38.5	0.0	---	50.0	---	18.8		
	Total	37.5	33.8	16.3	10.0	0.0	2.5	0.0	100.0	71.3	10.0
Twinbrook	Auto	92.9	92.9	62.5	85.7	100.0	0.0	100.0	81.8		
	Transit	7.1	7.1	0.0	0.0	0.0	0.0	0.0	3.6		
	Other	0.0	0.0	37.5	14.3	0.0	100.0	0.0	14.5		
	Total	25.5	25.5	29.1	12.7	3.6	1.8	1.8	100.0	81.8	3.6
Parklawn	Auto	62.1	91.8	85.0	97.2	100.0	75.0	85.7	86.2		
	Transit	34.5	4.1	0.0	0.0	0.0	0.0	0.0	5.6		
	Other	3.4	4.1	15.0	2.8	0.0	25.0	14.3	8.2		
	Total	12.5	31.5	34.5	15.5	1.3	1.7	3.0	100.0	86.2	5.6
Crystal	Auto	66.7	76.2	40.0	—	0.0	—	100.0	63.9		
Square 2	Transit	33.3	14.3	6.7	—	100.0	—	0.0	22.2		
	Other	0.0	9.5	53.5	—	0.0	—	0.0	13.9		
	Total	45.8	29.2	20.8	0.0	1.4	0.0	2.8	100.0	63.9	22.2
Bethesda	Auto	77.8	53.3	18.2	66.7	—	33.3	—	54.7		
Office	Transit	5.6	13.3	0.0	16.7	—	33.3	---	9.4		
Center	Other	16.7	33.3	81.8	16.7	—	33.3	—	35.8		
	Total	34.0	28.3	20.8	11.3	0.0	5.7	0.0	100.0	54.7	9.4

Note: For each purpose, the percentage of trips by mode are indicated in the rows labeled "auto", "transit", and "other". These vertically total to 100% for each purpose. For each office location the row labeled "total" indicates the percentages of trips by purpose. This row totals horizontally to 100%.

The results for this study were very similar to the first study. Approximately two thirds of the mid-day trips were made for job-related business or for a meal or snack. Job-related business accounted for approximately one third of the total mid-day trips. The actual percentages varied considerably. The Parklawn Building was at the low end with 12.5% reporting a mid-day trip, while East-West Towers was at the high end with 80% of respondents reporting a mid-day trip.

In contrast to the first study, office buildings were located in areas with varying density. For the meal or snack category, transit ridership was low. Transit ridership ranged from 0 to 6.7% and the percentage for auto usage ranged from 0 to 85%, with the higher auto use at the Parklawn Building (see Table 12). Transit mode share for non-walk mid-day trips by purpose is shown in Table 13.

The job-related business trip percentage increases when walk trips are removed from the data base while the percent of meal snack decreases significantly. One implication is that work related business is the least likely to be by transit. It should be noted that the sample sizes for the non-walk mid-day trips become very small in some cases and may not be representative of what actually happens.

Table 14 contains information on the percent of mid-day trips to each destination by office building and the mode share for each destination. Table 15 was prepared utilizing only non-walk mid-day trips. Eliminating these walk trips essentially removed the short localized trips. For example, a large percentage of the trips from 1701 Pennsylvania Avenue were walk trips. Removing the walk trips dramatically increased the percentage of trips to Virginia or Maryland. Generally trips from the offices outside the CBD to other offices in Maryland or Virginia exhibit a very low transit mode share. However, trips to or from the District of Columbia, where Metrorail access is the greatest, are expected to exhibit a larger transit ridership percentage. It is interesting to note that Silver Spring Metro Center and Crystal Square 2 both have a significant transit mode share. The implication is that a high percentage of mid-day office to office trips will take place on Metrorail as long as rail access is good at both ends. Locating office buildings at suburban stations should have the effect of increasing mid-day transit ridership through job-related interchange between that location and other Metrorail stations. An indirect effect of making mid-day job-related trips accessible by transit is the greater possibility of suburban employees commuting to their offices by transit, since their car would be needed less frequently for mid-day travel.

Table 13. Mode Share for Midday Trips by Purpose
Only Non-Walk Trips Included

Location	Mode	Work Related	Personal Business	Meal/ Snack	Shopping	Educational	Recreational	Other	Total	Summary: Percent Auto	Summary: Percent Transit
1701	Auto	33.3	0.0	---	0.0	---	50.0	---	27.3		
Penn	Transit	16.7	100.0	---	100.0	---	50.0	---	45.5		
	Other	50.0	0.0	---	0.0	---	0.0	---	27.3		
	Total	54.5	18.2	0.0	9.1	0.0	18.2	0.0	100.0	27.3	45.5
Silver	Auto	45.5	100.0	100.0	100.0	---	---	---	66.7		
Spring	Transit	54.5	0.0	0.0	0.0	---	---	---	33.3		
Metro	Other	0.0	0.0	0.0	0.0	---	---	---	0.0		
Center	Total	61.1	11.1	22.2	5.6	0.0	0.0	0.0	100.0	66.7	33.3
Ballston	Auto	86.7	90.0	100.0	100.0	100.0	100.0	---	94.2		
One	Transit	13.3	10.0	0.0	0.0	0.0	0.0	---	5.8		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	---	0.0		
	Total	28.8	19.2	34.6	11.5	1.9	3.8	0.0	100.0	94.2	5.8
Bell	Auto	79.2	94.7	92.7	96.2	60.0	100.0	100.0	90.8		
Atlantic	Transit	16.7	5.3	7.3	3.8	40.0	0.0	0.0	8.5		
	Other	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.7		
	Total	17.0	27.0	29.1	18.4	3.5	1.4	3.5	100.0	90.8	8.5
East	Auto	33.3	0.0	---	---	---	---	---	25.0		
West	Transit	66.7	100.0	---	---	---	---	---	75.0		
Towers	Other	0.0	0.0	---	---	---	---	---	0.0		
	Total	75.0	25.0	0.0	0.0	0.0	0.0	0.0	100.0	25.0	75.0

Table 13. Mode Share for Midday Trips by Purpose
Only Non-Walk Trips Included
(Continued)

Location	Mode	Work Related	Personal Business	Meal/ Snack	Shopping	Educa- tional	Recrea- tional	Other	Total	Summary Percent Auto	Summary Percent Transit
Bethesda	Auto	79.3	89.5	100.0	100.0	—	100.0	—	87.7		
Metro	Transit	20.7	10.5	0.0	0.0	—	0.0	—	12.3		
Center	Other	0.0	0.0	0.0	0.0	—	0.0	—	0.0		
	Total	44.6	29.2	12.3	12.3	0.0	1.5	0.0	100.0	87.7	12.3
Twinbrook	Auto	92.9	92.9	100.0	100.0	100.0	—	100.0	95.7		
	Transit	7.1	7.1	0.0	0.0	0.0	—	0.0	4.3		
	Other	0.0	0.0	0.0	0.0	0.0	—	0.0	0.0		
	Total	29.8	29.8	21.3	12.8	4.3	0.0	2.1	100.0	95.7	4.3
Parklawn	Auto	64.3	95.7	100.0	100.0	100.0	100.0	100.0	93.9		
	Transit	35.7	4.3	0.0	0.0	0.0	0.0	0.0	6.1		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	Total	13.1	32.9	31.9	16.4	1.4	1.4	2.8	100.0	93.9	6.1
Crystal	Auto	66.7	84.2	85.7	—	0.0	—	100.0	74.2		
Square 2	Transit	33.3	15.8	14.3	—	100.0	—	0.0	25.8		
	Other	0.0	0.0	0.0	—	0.0	—	0.0	0.0		
	Total	53.2	30.6	11.3	0.0	1.6	0.0	3.2	100.0	74.2	25.8
Bethesda	Auto	93.3	80.0	100.0	80.0	—	50.0	—	85.3		
Office	Transit	6.7	20.0	0.0	20.0	—	50.0	—	14.7		
Center	Other	0.0	0.0	0.0	0.0	—	0.0	—	0.0		
	Total	44.1	29.4	5.9	14.7	0.0	5.9	0.0	100.0	85.3	14.7

Note: For each purpose, the percentage of trips by mode are indicated in the rows labeled "auto", "transit", and "other". These vertically total to 100% for each purpose. For each office location the row labeled "total" indicates the percentages of trips by purpose. This row totals horizontally to 100%.

Table 14. Mode Share for Midday Trips by Destination

Location	Mode	Within 1/2 mi	D.C.	Ffx. County	Arl.	Alex.	Va Other	P.G. County	Mont. County	Md Other	Other	Subtotal	Summary Percent Auto	Summary Percent Transit
1701	Auto	0.0%	0.0%	---%	0.0%	0.0%	---%	---%	---%	---%	---%	0.0		
Penn	Transit	0.0	46.7	—	100.0	0.0	---	—	---	—	—	22.9		
	Other	100.0	53.3	—	0.0	100.0	---	—	---	---	—	77.1		
	Total	51.4	42.9	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	22.9
Silver	Auto	0.0	42.9	—	—	—	—	—	52.9	—	—	44.4		
Spring	Transit	0.0	57.1	—	—	—	—	—	11.8	—	—	22.2		
Metro	Other	100.0	0.0	—	—	—	—	—	35.3	—	—	33.3		
Center	Total	11.1	25.9	0.0	0.0	0.0	0.0	0.0	63.0	0.0	0.0	100.0	44.4	22.2
Ballston	Auto	25.0	80.0	90.9	84.6	100.0	100.0	—	100.0	100.0	100.0	80.0		
One	Transit	0.0	20.0	9.1	7.7	0.0	0.0	—	0.0	0.0	0.0	6.7		
	Other	75.0	0.0	0.0	7.7	0.0	0.0	—	0.0	0.0	0.0	13.3		
	Total	13.3	8.3	18.3	43.3	5.0	5.0	0.0	3.3	1.7	1.7	100.0	80.0	6.7
Bell	Auto	18.2	61.9	100.0	75.0	100.0	---	100.0	100.0	---	100.0	72.4		
Atlantic	Transit	0.0	33.3	0.0	5.7	0.0	---	0.0	0.0	---	0.0	6.9		
	Other	81.8	4.8	0.0	19.3	0.0	---	0.0	0.0	---	0.0	20.7		
	Total	12.6	12.1	14.4	50.6	5.2	0.0	1.1	3.4	0.0	0.6	100.0	72.4	6.9
East	Auto	0.0	—	—	—	—	—	—	33.3	—	—	20.0		
West	Transit	0.0	—	—	—	—	—	—	33.3	—	—	60.0		
Towers	Other	0.0	—	—	---	---	---	---	33.3	---	—	20.0		
	Total	40.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	0.0	100.0	20.0	60.0

Table 14. Mode Share for Midday Trips by Destination
(Continued)

Location	Mode	Within 1/2 mi	D.C.	Ffx. County	Arl.	Alex.	Va Other	P.G. County	Mont. County	Md Other	Other	Subtotal	Summary: Percent Auto	Summary: Percent Transit
Bethesda	Auto	38.5	44.4	100.0	50.0	—	—	100.0	77.5	100.0	100.0	70.1		
Metro	Transit	0.0	55.6	0.0	50.0	—	—	0.0	5.0	0.0	0.0	10.4		
Center	Other	61.5	0.0	0.0	0.0	—	—	0.0	17.5	0.0	0.0	19.5		
	Total	16.9	11.7	6.5	2.6	0.0	0.0	3.9	51.9	5.2	1.3	100.0	70.1	10.4
Twinbrook	Auto	72.7	100.0	—	—	100.0	—	100.0	78.1	100.0	100.0	81.8		
	Transit	0.0	0.0	—	—	0.0	—	0.0	6.3	0.0	0.0	3.6		
	Other	27.3	0.0	—	—	0.0	—	0.0	15.6	0.0	0.0	14.5		
	Total	20.0	9.1	0.0	0.0	3.6	0.0	3.6	58.2	3.6	1.8	100.0	81.8	3.6
Parklawn	Auto	61.5	50.0	100.0	100.0	—	—	100.0	91.8	100.0	—	86.0		
	Transit	0.0	50.0	0.0	0.0	—	—	0.0	3.3	0.0	—	5.7		
	Other	38.5	0.0	0.0	0.0	—	—	0.0	4.9	0.0	—	8.3		
	Total	11.4	6.1	0.4	0.4	0.0	0.0	0.9	79.5	1.3	0.0	100.0	86.0	5.7
Crystal	Auto	0.0	35.7	93.3	71.4	100.0	100.0	100.0	—	100.0	100.0	63.9		
Square 2	Transit	20.0	64.3	6.7	19.0	0.0	0.0	0.0	—	0.0	0.0	22.2		
	Other	80.0	0.0	0.0	9.5	0.0	0.0	0.0	—	0.0	0.0	13.9		
	Total	13.9	19.4	20.8	29.2	2.8	2.8	5.6	0.0	4.2	1.4	100.0	63.9	22.2
Bethesda	Auto	9.1	50.0	100.0	—	—	100.0	100.0	65.5	100.0	—	54.7		
Office	Transit	0.0	50.0	0.0	—	—	0.0	0.0	3.4	0.0	—	9.4		
Center	Other	90.9	0.0	0.0	—	—	0.0	0.0	31.0	0.0	—	35.8		
	Total	20.8	15.1	1.9	0.0	0.0	3.8	1.9	54.7	1.9	0.0	100.0	54.7	9.4

Note: For each destination, the percentage of trips of trips by mode are indicated in the rows labeled "auto", "transit", and "other". These total vertically to 100%. For office location, the row labeled "total" indicates the percentage of trips made to each destination. This row totals horizontally to 100%.

Table 15. Mode Share for Midday Trips by Destination
Only Non-Walk Trips Included

Location	Mode	Within 1/2 mi	D.C.	Ffx. County	Arl.	Alex.	Va Other	P.G. County	Mont. County	Md Other	Other	Subtotal	Summary Percent Auto	Summary Percent Transit
1701	Auto	---%	0.0%	---%	0.0%	0.0%	---%	---%	---%	---%	---%	0.0%		
Penn	Transit	---	77.8	---	100.0	0.0	---	---	---	---	---	72.7		
	Other	---	22.2	---	0.0	100.0	---	---	---	---	---	27.3		
	Total	0.0	81.8	0.0	9.1	9.1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	72.7
Silver	Auto	---	42.9	---	---	---	---	---	81.8	---	---	66.7		
Spring	Transit	---	57.1	---	---	---	---	---	18.2	---	---	33.3		
Metro	Other	---	0.0	---	---	---	---	---	0.0	---	---	0.0		
Center	Total	0.0	38.9	0.0	0.0	0.0	0.0	0.0	61.1	0.0	0.0	100.0	66.7	33.3
Ballston	Auto	100.0	80.0	90.9	91.7	100.0	100.0	---	100.0	100.0	100.0	92.3		
One	Transit	0.0	20.0	9.1	8.3	0.0	0.0	---	0.0	0.0	0.0	7.7		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	---	0.0	0.0	0.0	0.0		
	Total	3.8	9.6	21.2	46.2	5.8	5.8	0.0	3.8	1.9	1.9	100.0	92.3	7.7
Bell	Auto	100.0	61.9	100.0	93.0	100.0	---	100.0	100.0	---	100.0	90.6		
Atlantic	Transit	0.0	33.3	0.0	7.0	0.0	---	0.0	0.0	---	0.0	8.6		
	Other	0.0	4.8	0.0	0.0	0.0	---	0.0	0.0	---	0.0	0.7		
	Total	2.9	15.1	18.0	51.1	6.5	0.0	1.4	4.3	0.0	0.7	100.0	90.6	8.6
East	Auto	0.0	---	---	---	---	---	---	50.0	---	---	25.0		
West	Transit	100.0	---	---	---	---	---	---	50.0	---	---	75.0		
Towers	Other	0.0	---	---	---	---	---	---	0.0	---	---	0.0		
	Total	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	100.0	25.0	75.0

Table 15. Mode Share for Midday Trips by Destination
Only Non-Walk Trips Included
(Continued)

Location	Mode	Within 1/2 mi	D.C.	Ffx. County	Arl.	Alex.	Va Other	P.G. County	Mont. County	Md Other	Other	Subtotal	Summary Percent Auto	Summary Percent Transit
Bethesda	Auto	100.0	44.4	100.0	50.0	—	—	100.0	93.9	100.0	100.0	87.1		
Metro	Transit	0.0	55.6	0.0	50.0	—	—	0.0	6.1	0.0	0.0	12.9		
Center	Other	0.0	0.0	0.0	0.0	—	—	0.0	0.0	0.0	0.0	0.0		
	Total	8.1	14.5	8.1	3.2	0.0	0.0	4.8	53.2	6.5	1.6	100.0	87.1	12.9
Twinbrook	Auto	100.0	100.0	—	—	100.0	—	100.0	92.6	100.0	100.0	95.7		
	Transit	0.0	0.0	—	—	0.0	—	0.0	7.4	0.0	0.0	4.3		
	Other	0.0	0.0	—	—	0.0	—	0.0	0.0	0.0	0.0	0.0		
	Total	17.0	10.6	0.0	0.0	4.3	0.0	4.3	57.4	4.3	2.1	100.0	95.7	4.3
Parklawn	Auto	100.0	50.0	100.0	100.0	—	—	100.0	96.5	100.0	—	93.8		
	Transit	0.0	50.0	0.0	0.0	—	—	0.0	3.5	0.0	—	6.2		
	Other	0.0	0.0	0.0	0.0	—	—	0.0	0.0	0.0	—	0.0		
	Total	7.6	6.7	0.5	0.5	0.0	0.0	1.0	82.4	1.4	0.0	100.0	93.8	6.2
Crystal	Auto	0.0	35.7	93.3	78.9	100.0	100.0	100.0	—	100.0	100.0	74.2		
Square 2	Transit	100.0	64.3	6.7	21.1	0.0	0.0	0.0	—	0.0	0.0	25.8		
	Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	—	0.0	0.0	0.0		
	Total	3.2	22.6	24.2	30.6	3.2	3.2	6.5	0.0	4.8	1.6	100.0	74.2	25.8
Bethesda	Auto	100.0	50.0	100.0	—	—	100.0	100.0	95.0	100.0	—	85.3		
Office	Transit	0.0	50.0	0.0	—	—	0.0	0.0	5.0	0.0	—	14.7		
Center	Other	0.0	0.0	0.0	—	—	0.0	0.0	0.0	0.0	—	0.0		
	Total	2.9	23.5	2.9	0.0	0.0	5.9	2.9	58.8	2.9	0.0	100.0	85.3	14.7

Note: For each destination, the percentage of trips of trips by mode are indicated in the rows labeled "auto", "transit", and "other". These total vertically to 100%. For office location, the row labeled "total" indicates the percentage of trips made to each destination. This row totals horizontally to 100%.

Office Visitors

Office visitors were interviewed rather than given a self administered survey. This resulted in a higher response rate than was achieved in the first study. When conducting the interviews each person approached was asked if they were a visitor or an employee. If they were an employee, no further questions were asked; if they were a visitor the questions concerning their trip were asked. The number of each (employee or visitor) approached was recorded by time period. This allowed the percent of visitors to be determined at each office by time of day. For the most part visitors accounted for about 10% to 15% of all persons entering an office. The mode share for visitors is shown in Table 16. No relationship to distance from the station could be determined. Most buildings averaged about a 10% transit mode share. This agrees with the findings of the office surveys in relation to the mid-day trip information.

RESIDENTIAL

Ten residential sites were chosen for study. Data was collected via a self-administered mail-back survey forms and by conducting cordon counts at each site for selected hours during the day. The primary objective was to determine the trip making characteristics for residential developments in close proximity of a Metrorail station. A variety of housing types were chosen that included both rental accommodations and owner occupied units. Site characteristics of each building are contained in Table 17. The average response rate for the home-based surveys was 12.6%.

Data Collection

The primary objective of the home-based survey was to obtain information on the trip making characteristics of residents. A sample home-based survey is contained in the appendix. The primary changes to the survey as compared to the first study were an attempt to gather information concerning linked trips and the addition of questions to determine residents' attitude towards transit. Mail-back surveys were mailed to each unit of a building on a Monday or Tuesday in an attempt to have residents receive the survey on a Tuesday, Wednesday, or Thursday.

In addition to the surveys, cordon counts were conducted at all ten sites and in most cases occupancy counts were conducted for vehicles leaving the buildings during the peak periods.

Table 16. Mode Share of Office Visitors

Office Site	Mode						Summary	
	Auto	Rail	Bus	Walk	Taxi	Other	Subtotal	% Auto	% Transit
1701 Penn	61.0%	11.0%	0.0%	19.5%	0.0%	8.5%	100.0%	61.0%	11.0%
Silver Spring Metro Center	79.3	13.8	0.0	6.9	0.0	0.0	100.0	79.3	13.8
Ballston One	61.2	5.0	0.0	24.0	0.0	9.9	100.0	61.2	5.0
Bell Atlantic	52.8	10.4	0.0	29.6	4.8	2.4	100.0	52.8	10.4
East West Towers	83.8	10.3	0.0	5.9	0.0	0.0	100.0	83.8	10.3
Bethesda Metro Center	34.0	33.3	4.1	27.9	0.0	0.7	100.0	34.0	37.4
Twinbrook	84.6	7.7	0.0	7.7	0.0	0.0	100.0	84.6	7.7
Parklawn	75.5	9.1	2.1	11.2	1.4	0.7	100.0	75.5	11.2
Crystal Square II	11.1	8.9	1.6	78.4	0.0	0.0	100.0	11.1	10.5
Bethesda Office Center	80.0	6.3	0.0	13.8	0.0	0.0	100.0	80.0	6.3

Table 17. Site Characteristics of Residential Developments

	Residential	Distance to Station (ft)	No. Units	Effi-ciencies	One Bdrm.	Two Bdrm.	Three Bdrm.	Percent Occupied	Number Parking Spaces	Parking Cost per Month	Year Constructed
Crystal City	Crystal Square Apts. (12)[1]	500	378	58	247	58	15	99	(*)	1 space included in rent, additional space $45	1976
	Crystal Plaza Apts. (13)	1500	540	94	184	214	48	100	570[3]	1 space included in rent, additional space $45	1966
	Crystal Park Condos (14)	2000	180	--	--	--	--	--	--	--	--
Silver Spring	Twin Towers (16)	900	315	--	--	--	--	99	320[4]	$50	1965
	Georgian Towers (15)	1400	656	--	--	--	--	99	550	$55 reserved $40 unreserved	1969
Ballston	Randolph Towers (23)	500	507	--	--	--	--	--	--	--	--
Twinbrook	Bethany House (39)	2400	276	--	--	--	--	100	69	$12	1968
Grosvenor	Grosvenor House Apts. (33)	2300	404	--	--	--	--	--	--	--	--
	Grosvenor Park I (34)	1850	399	--	--	--	--	--	--	--	--
	Stoneybrook (35)	2000	109	--	--	--	--	--	--	N/A	--

[1] Numbers in parentheses refer to location maps in Figures 2 to 13.

[2] Shared parking with entire Crystal Square complex, tenants are guaranteed one space/dwelling unit, no waiting list at present time.

[3] Approximately 218 spaces rented out to area workers on a monthly basis, these employees must be out of garage by 5:30-6:00 PM.

[4] Includes parking for 50 hotel rooms.

Analysis

Residential surveys were designed to obtain socioeconomic, demographic, and trip making characteristics. As with previous studies the response rate was not as good as with the workplace surveys, therefore caution must be exercised when interpreting the data at buildings with a small sample size. The data structure is included in the appendix. Crosstabs are also included in the appendix.

Similar to the office surveys, summary tables were produced based on the analysis. Mid-day trip information was found to be unreliable as a significant number of respondents reported on all trips they made during the day rather than just trips that began or ended at their building.

Results

Table 18 summarizes the socioeconomic and demographic data collected for each site. As with the office surveys more respondents were female and they tended to be older. Based on observation during site selection and while conducting the counts, it is felt that the average age as determined by the survey tends to be high although we are unable to verify this. Based on the cordon counts it appears that there is an under reporting of commute trips. This could be partially explained by the number of older retired respondents. Examining the counts (contained in the technical appendix) it appears that the transit mode share may be slightly higher than determined by the survey. The data suggests that the typical resident falls into three categories: single person households, couples without children and older people. Families tend to live in areas further away from the Metro station in lower density neighborhoods. The implication is that while families tend to generate more trips per household, the likelihood of this group increasing their transit usage cannot be influenced to a great degree by the nature of the development in the area of Metrorail stations. Increasing transit patronage by this segment of the population is influenced by access to the Metrorail station either by car or by feeder bus.

Table 19 presents mode share of each building by destination for the commute trips and a summary is presented in Table 20. Transit mode share ranges from 30.2% at Grosvenor Park I to 73.7% at Twin Towers with an overall average 46.2% Bethany House was excluded from the data base due to the small sample size. The trip generation from Bethany House was low as would be expected at a retirement home.

Table 18. Demographic Data for Residential Developments

Location	Mean Age	Mean Number of Vehicles per DU	Mean Number of Residents per DU
Crystal Plaza	52.0	0.98	1.53
Crystal Park	44.9	1.20	1.57
Crystal Square West	48.1	1.05	1.63
Georgian Towers	39.4	0.76	1.27
Randolph Towers	43.0	0.97	1.58
Grosvenor House	41.1	1.19	1.44
Stoneybrook	43.7	1.56	2.06
Bethany House	72.7	0.25	1.09
Twin Towers	43.3	0.50	1.30
Grosvenor Park I	59.3	1.24	1.35
Averages	**47.8**	**1.01**	**1.49**

Table 19. Mode Share by Destination of Trip

Location	Mode	Within Half Mile	D.C.	Fairfax County	Arling. County	Alex.	Other Va.	Mont. County	P.G. County	Other Md.	Elsewhere	Total
Crystal	Auto	40.0	20.0	100.0	27.3	0.0	100.0	75.0	100.0	—	—	33.3%
Plaza	Transit	0.0	80.0	0.0	50.0	100.0	0.0	25.0	0.0	—	—	57.5
	Other	60.0	0.0	0.0	22.7	0.0	0.0	0.0	0.0	—	—	9.2
	Total	5.7	51.7	5.7	25.3	2.3	2.3	4.6	2.3	0.0	0.0	100.0
Crystal Park	Auto	0.0	9.1	100.0	14.3	50.0	—	50.0	100.0	—	—	24.2
	Transit	14.3	90.9	0.0	42.9	50.0	—	50.0	0.0	—	—	48.5
	Other	85.7	0.0	0.0	42.9	0.0	—	0.0	0.0	—	—	27.3
	Total	21.2	33.3	9.1	21.2	6.1	0.0	6.1	3.0	0.0	0.0	100.0
Crystal	Auto	0.0	8.2	66.7	25.0	83.3	—	0.0	0.0	—	—	15.6
Square West	Transit	16.7	91.8	33.3	41.7	16.7	—	100.0	0.0	—	—	62.2
	Other	83.3	0.0	0.0	33.3	0.0	—	0.0	100.0	—	—	22.2
	Total	20.0	54.4	3.3	13.3	6.7	0.0	1.1	1.1	0.0	0.0	100.0
Georg'n	Auto	33.3	30.0	66.7	0.0	33.3	100.0	52.6	75.0	66.7	100.0	42.3
Towers	Transit	33.3	70.0	33.3	100.0	66.7	0.0	31.6	25.0	33.3	0.0	52.6
	Other	33.3	0.0	0.0	0.0	0.0	0.0	15.8	0.0	0.0	0.0	5.1
	Total	3.8	51.3	3.8	1.3	3.8	1.3	24.4	5.1	3.8	1.3	100.0
Rand'ph	Auto	0.0	9.8	50.0	9.1	100.0	100.0	80.0	—	—	—	20.6
Towers	Transit	66.7	87.8	33.3	54.5	0.0	0.0	20.0	—	—	—	69.1
	Other	33.3	2.4	16.7	36.4	0.0	0.0	0.0	—	—	—	10.3
	Total	4.4	60.3	8.8	16.2	1.5	1.5	7.4	0.0	0.0	0.0	100.0

Note: For each jurisdiction, the percentage of trips by mode are indicated in the rows labeled "auto", "transit", and "other". The overall mode share for each location is given in the column labeled "total". For each residential location, the row labeled "total" indicates the percentage of trips from each jurisdiction.

Table 19. Mode Share by Destination of Trip
(Continued)

Location	Mode	Within Half Mile	D.C.	Fairfax County	Arling. County	Alex.	Other Va.	Mont. County	P.G. County	Other Md.	Elsewhere	Total
Grosv'r	Auto	0.0	25.0	—	33.3	100.0	0.0	88.9	100.0	0.0	—	60.0%
House	Transit	0.0	75.0	—	33.3	0.0	100.0	11.1	0.0	100.0	—	35.0
	Other	100.0	0.0	—	33.3	0.0	0.0	0.0	0.0	0.0	—	5.0
	Total	2.5	30.0	0.0	7.5	2.5	2.5	45.0	7.5	2.5	0.0	100.0
Stoneybrook	Auto	—	30.0	100.0	0.0	—	0.0	66.7	100.0	100.0	—	57.6
	Transit	—	60.0	0.0	100.0	—	100.0	20.0	0.0	0.0	—	33.3
	Other	—	10.0	0.0	0.0	—	0.0	13.3	0.0	0.0	—	9.1
	Total	0.0	30.3	9.1	3.0	0.0	3.0	45.5	3.0	6.1	0.0	100.0
Beth'y	Auto	—	—	—	—	—	—	0.0	—	—	—	0.0
House	Transit	—	—	—	—	—	—	100.0	—	—	—	100.0
	Other	—	—	—	—	—	—	0.0	—	—	—	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Twin Towers	Auto	—	8.3	—	—	—	—	20.0	0.0	—	—	10.5
	Transit	—	91.7	—	—	—	—	40.0	50.0	—	—	73.7
	Other	—	0.0	—	—	—	—	40.0	50.0	—	—	15.8
	Total	0.0	63.2	0.0	0.0	0.0	0.0	26.3	10.5	0.0	0.0	100.0
Grosv'r	Auto	100.0	15.4	100.0	—	—	—	87.0	100.0	100.0	—	67.4
Park I	Transit	0.0	84.6	0.0	—	—	—	8.7	0.0	0.0	—	30.2
	Other	0.0	0.0	0.0	—	—	—	4.3	0.0	0.0	—	2.3
	Total	4.7	30.2	7.0	0.0	0.0	0.0	53.5	2.3	2.3	0.0	100.0

Note: For each jurisdiction, the percentage of trips by mode are indicated in the rows labeled "auto", "transit", and "other". The overall mode share for each location is given in the column labeled "total". For each residential location, the row labeled "total" indicates the percentage of trips from each jurisdiction.

Table 20. Summary of Transit Mode Share - Residential

	Number of Sites	Percent Transit Range	Percent Transit Average
CBD Locations	—	—	—
Suburban Locations Inside Beltway	6	48.5% - 73.7%	60.0%
Suburban Locations Outside Beltway	3	30.2% - 35.0%	32.8%
All Residential Locations	9	30.2% - 73.7%	46.2%

Note: Bethany House excluded from table because sample size = 1.

The transit mode share vs distance is plotted in Figure 20. The results were generally consistent, with higher transit ridership typically occurring at residential buildings closer to a rail station. Stoneybrook, an expensive ($250,000.00 per unit) town-home development near the Grosvenor station had a transit mode share of 33% indicating that even though higher income developments are more likely to have more autos available per household, substantial transit mode shares will be realized if convenient access to a rail station is available.

Average auto ownership for all residential sites was 1.01 per unit, less than half the average reported by respondents to the workplace survey which could be taken to represent the general population. It can be debated as to whether households without cars seek to locate near a rail station or whether their location influences their decision to buy a second or third car. In order to get some feel for this, the average auto ownership for areas with similar mid to high density development were examined. While auto ownership was found to be substantially lower, approximately 1.6 cars per household vs about 2.2 for single family neighborhoods, for mid to high density areas the building sites studied are well below comparable sites away from rail stations. The implication here is that locating residential developments near Metrorail stations has significant impact in terms of reducing auto ownership and hence vehicle trips. This has a greater impact than just replacing vehicle work trips with transit work trips. Second and third cars, once purchased, are usually used for more than just commuting, so if the proximity to a rail station tips the decision to buy or not to buy a car against buying, it reduces the auto availability for other trips as well, indirectly reducing the overall trip generation rate.

Table 21 presents the results of the attitudinal questions for the residential data base. In general the findings are similar to those for the office surveys. The most significant finding is the number of respondents who feel that adequate schedule information is not available for transit. This is further illustrated by Figure 21 which shows the results for Crystal Plaza apartments, where over 40% of respondents feel that they do not have adequate information. As mentioned earlier, this suggests that market strategies for station areas should be developed that provide residents, patrons, or office workers information concerning the transit options available.

The attempt to collect information on linked trips was not particularly successful as many respondents were confused and responded with information about all trips, whether or not they began or ended at the building.

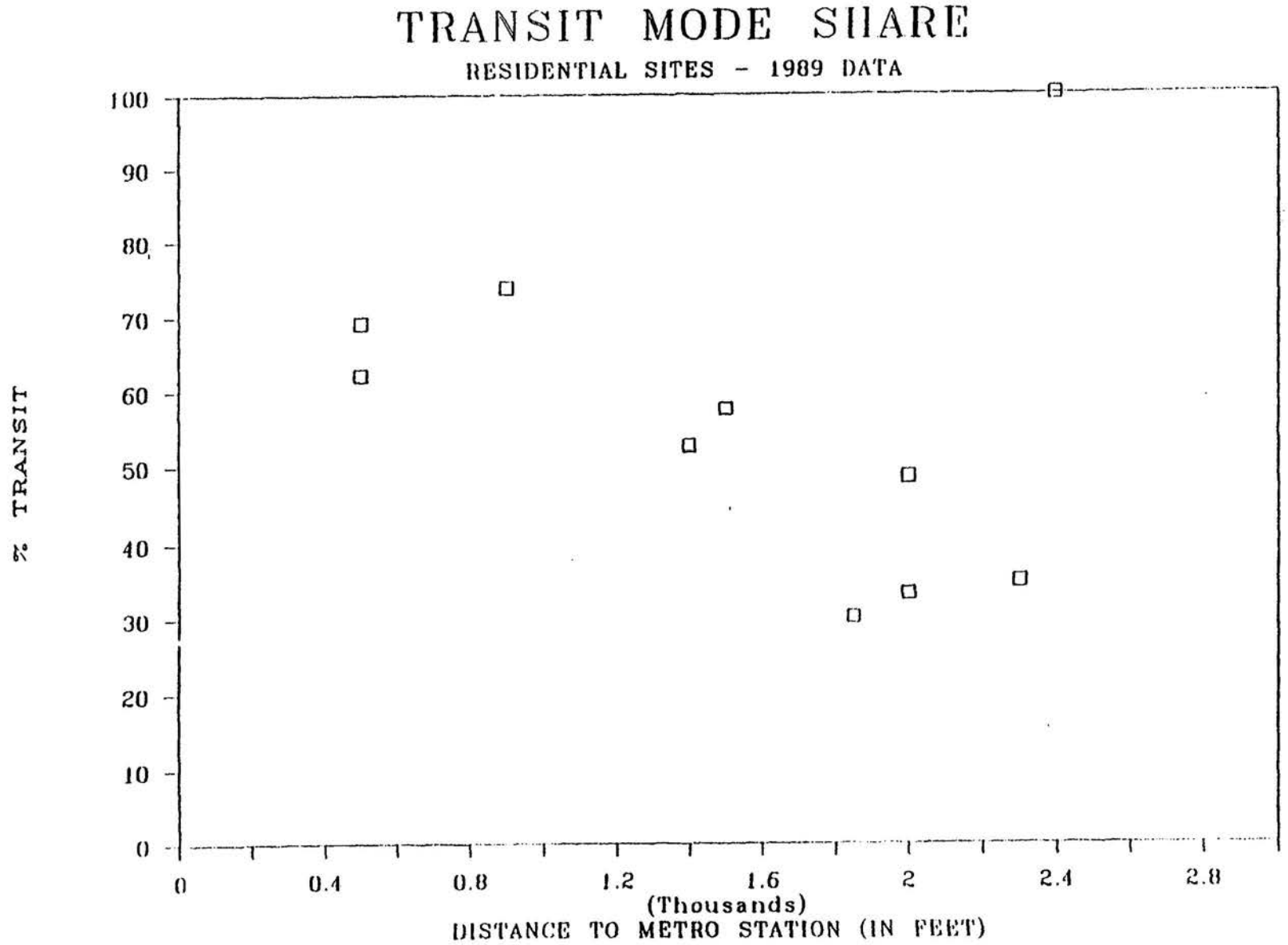

TRANSIT MODE SHARE
RESIDENTIAL SITES - 1989 DATA
% TRANSIT
100
90
80
70
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
(Thousands)
DISTANCE TO METRO STATION (IN FEET)

Figure 20.

Table 21. Residential Surveys
Respondents Opinions By Mode of Travel

Q8A: People should be encouraged to use transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	164	(88.6%)	274	(94.6%)	44	(84.6%)	2	(100.0%)	457	(91.4%)	158	(87.3%)	615	(90.3%)
Disagree	5	(2.7)	1	(0.4)	1	(1.9)	0	(0.0)	7	(1.4)	4	(2.2)	11	(1.6)
No Opinion	11	(5.9)	9	(3.4)	5	(9.6)	0	(0.0)	25	(5.0)	11	(6.1)	36	(5.3)
Not Answered	5	(2.7)	4	(1.5)	2	(3.8)	0	(0.0)	11	(2.2)	8	(4.4)	19	(2.8)
Total	185	(100.0)	261	(100.0)	52	(100.0)	2	(100.0)	500	(100.0)	181	(100.0)	681	(100.0)

Q8B: Schedule information for transit is readily available.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	88	(47.6%)	171	(65.5%)	31	(59.6%)	1	(50.0%)	291	(58.2%)	94	(51.9%)	385	(56.5%)
Disagree	75	(40.5)	66	(25.3)	13	(25.0)	0	(0.0)	154	(30.8)	49	(27.1)	203	(29.8)
No Opinion	18	(9.7)	21	(8.0)	6	(11.5)	1	(50.0)	46	(9.2)	26	(14.4)	72	(10.6)
Not Answered	4	(2.2)	3	(1.1)	2	(3.8)	0	(0.0)	9	(1.8)	12	(6.6)	21	(3.1)
Total	185	(100.0)	261	(100.0)	52	(100.0)	2	(100.0)	500	(100.0)	181	(100.0)	681	(100.0)

Table 21. Residential Surveys
Respondents Opinions By Mode of Travel
(Continued)

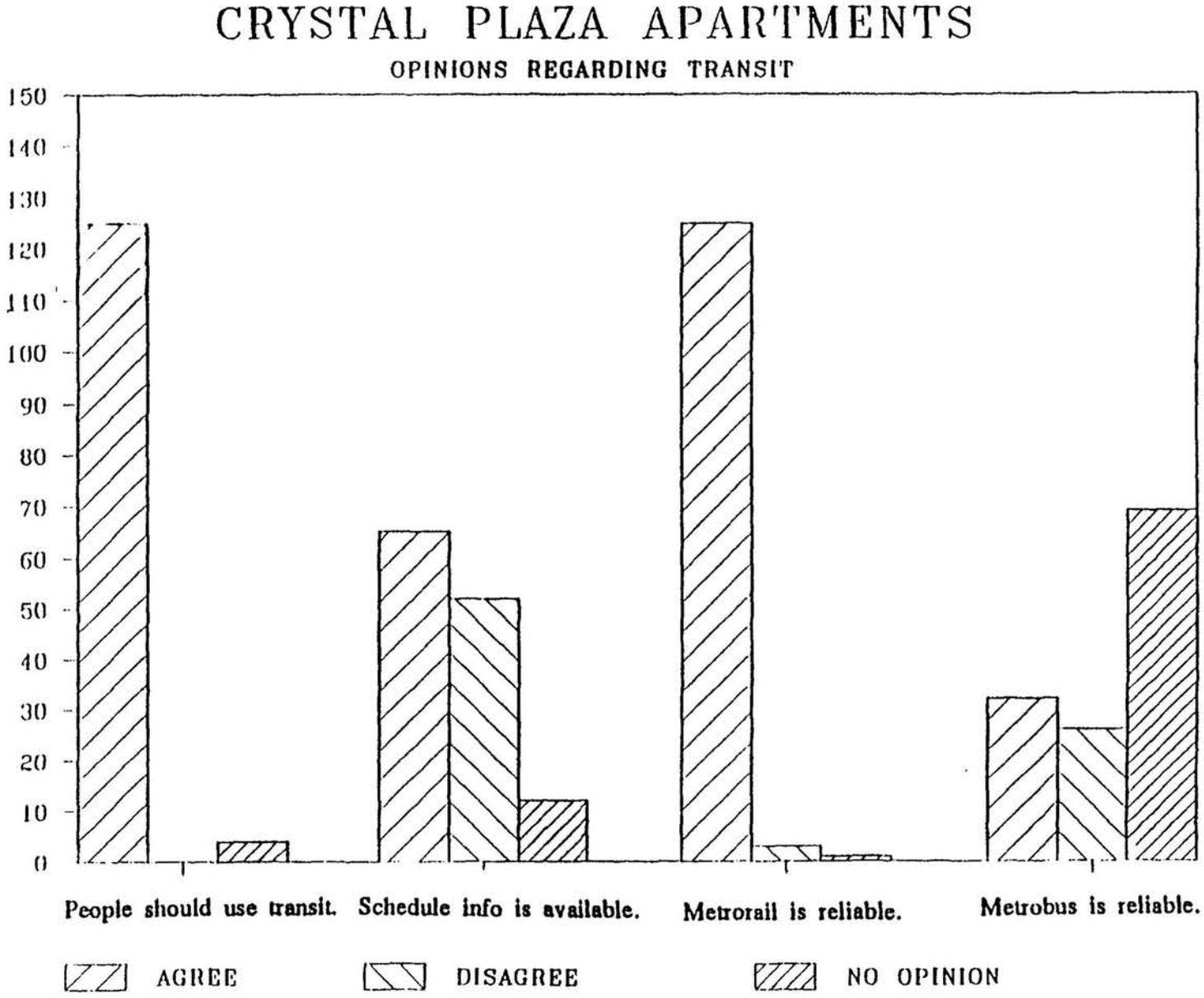
Q8C: Metrorail is clean and reliable.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	177	(95.7%)	257	(98.5%)	49	(94.2%)	2	(100.0%)	485	(97.0%)	160	(88.4%)	645	(94.7%)
Disagree	3	(1.6)	0	(0.0)	1	(1.9)	0	(0.0)	4	(0.8)	3	(1.7)	7	(1.0)
No Opinion	1	(0.5)	1	(0.4)	0	(0.0)	0	(0.0)	2	(0.4)	9	(5.0)	11	(1.6)
Not Answered	4	(2.2)	3	(1.1)	2	(3.8)	0	(0.0)	9	(1.8)	9	(5.0)	18	(2.6)
Total	185	(100.0)	261	(100.0)	52	(100.0)	2	(100.0)	500	(100.0)	181	(100.0)	681	(100.0)

Q8D: Metrobus is clean and reliable.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	42	(22.7%)	62	(23.8%)	17	(32.7%)	1	(50.0%)	122	(24.4%)	68	(37.6%)	190	(27.9%)
Disagree	35	(18.9)	51	(19.5)	4	(7.7)	0	(0.0)	90	(18.0)	20	(11.0)	110	(16.2)
No Opinion	104	(56.2)	140	(53.6)	29	(55.8)	0	(0.0)	273	(54.6)	80	(44.2)	353	(51.8)
Not Answered	4	(2.2)	8	(3.1)	2	(3.8)	1	(50.0)	15	(3.0)	13	(7.2)	28	(4.1)
Total	185	(100.0)	261	(100.0)	52	(100.0)	2	(100.0)	500	(100.0)	181	(100.0)	681	(100.0)

Note: Not answered refers to people who specified their mode of travel but do not answer the question. Missing values refer to people who answered the question but did not specify their mode of travel.


CRYSTAL PLAZA APARTMENTS
OPINIONS REGARDING TRANSIT
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
People should use transit.
Schedule info is available.
Metrorail is reliable.
Metrobus is reliable.
AGREE
DISAGREE
NO OPINION

Figur· 21.

RETAIL

Eight retail sites were surveyed. Site characteristics are summarized in Table 22. These sites varied in the types of tenants, as well as in size, from 200,000 to 550,000 gross square feet (GSF) of floor area. For example, the Underground and Crystal Plaza in Crystal City both with direct access to the Metro station, cater primarily to the occupants of the office buildings adjacent to the retail centers. These locations are convenient for those who walk through the building to get to the Metrorail station, residence or parked car. Neither establishment has an anchor tenant. The second type of establishment surveyed was the single tenant building. This site, Hecht's at Metro Center was a repeat from the first survey. Ballston Common shopping mall, also a repeat site, has two large anchor tenants and Union Station represents a multi-mode transfer point, a shopping area, and a tourist attraction.

Data Collection

The pedestrian-based survey was designed to gather information on particular trip characteristics, such as trip purpose, trip mode, and trip origin-destination. A sample retail patron interview form is contained in the appendix. The interview was conducted in person by reading the questions from left to right and marking the answers in a single row for each respondent.

For most sites interviews were conducted at random throughout the common areas. At Hecht's Metro Center, The Shoppes and Mazza Gallerie, interviews were conducted at the entrances. Pedestrian counts were also conducted at these locations, as well as determining person trip generation. These counts also allowed for any bias to be detected and weighting factors to be developed for those sites where interviews were conducted at the entrances. For instance if a higher percentage of persons were interviewed at an entrance that is utilized by transit users, the results would be biased in favor of transit.

The interviews were conducted from the time the establishments opened until six o'clock PM on a Tuesday, Wednesday or Thursday. At Ballston Common and Mazza Gallerie interviews were conducted until nine o'clock PM.

Table 22. Site Characteristics of Retail Establishments

Metrorail Station	Retail Establishment	Distance to Station	Gross Square Feet (1000)	Selling Square Feet (1000)	No. Parking Spaces	Year Constructed
Metro Center	The Hecht Company (1)[1]	100	270	204	none	Oct. '85
	The Shops (41)	450	125			1984
Crystal City	The Underground (8)	100	150		200[2]	1979
	Crystal Plaza Shops (9)	2000	150			1985
Ballston Common	Ballston Common (21)	1000	530	530	2,900[3]	Oct.'86
Friendship Heights	Mazza Gallerie (25)	50	--	--	--	--
Bethesda	Bethesda Metro Center (31)	100	60	--	1400[4]	1985
Union Station	Union Station (42)	50	Total 750 Retail 210			Sept.'88

[1] Numbers in parentheses refer to location maps in Figures 2 to 13.

[2] 200 commercial parking spaces (at any one time not more than 50 percent are used by The Underground.

[3] Arlington County owns the parking structure.

[4] Total parking for project.

Analysis

As with office and residential sites, summary tables and figures were prepared including: mode share by retail establishment, transit/auto mode share by trip purpose, and transit/auto mode share by the location of the last stop for the retail patron. Due to the unique character of Union Station a more detailed analysis was undertaken and is presented here.

Results

Mode share for each of the retail establishments by location of the last stop is presented in Table 23. Table 24 summarizes transit mode share for retail sites. These are graphed on Figure 22. Transit mode share ranged from approximately 34% to 55%. This is significantly better than was found when the first study was conducted. Also, it is important to note that transit accounts for the biggest share at most sites ahead of auto. As expected the lower mode shares are found at the suburban sites. However, impressive mode shares were reported at these sites.

Several sites were repeated from the first study allowing a direct comparison with the two studies. In the first study The Underground at Crystal City had a disappointing transit mode share (13.6%), in this survey the transit mode share was found to be just over 40%. The transit mode share at Ballston Common increased from approximately 12% to 27%, although it is important to note that transit mode share varies considerably by the time of day from a peak of over 50% midday to approximately 20% in the evening. At Hecht's Metro Center transit mode share increased slightly from 40.8% to 44.4%.

An increase in the transit mode share at one particular location could be dismissed as just another data point due to the fact that mode shares are likely to vary more from day to day than for office sites based on a number of factors such as the weather, time of year, and hours surveyed. However, given the substantial mode share at all sites and the increases at all three sites that were repeated it can be concluded that Metrorail is becoming an accepted transportation mode for retail sites that are conveniently located near a Metrorail station.

Another important finding is that the retail sites appear to be attracting higher transit mode shares than office sites at the same Metrorail station. This is different than in the first study which found that transit mode share was consistent within a station area. This possibly indicates that it takes longer for retail sites to mature than

Table 23. Mode Share by Location of Last Stop

Retail Location	Mode	D.C.	Fairfax County	Arling. County	Alex.	Other Virginia	P.G. County	Mont. County	Other Maryland	Other	Totals
The	Auto	37.0%	45.5%	19.6%	62.5%	42.9%	57.1%	25.0%	58.8%	38.5%	33.7%
Under-	Transit	59.3	54.5	33.6	37.5	28.6	28.6	66.7	35.3	30.8	42.4
Ground	Other	3.7	0.0	46.7	0.0	28.6	14.3	8.3	5.9	30.8	23.9
	Total	21.2	8.6	42.0	6.3	2.7	2.7	4.7	6.7	5.1	100.0
Crystal	Auto	29.3	84.6	32.1	87.5	71.4	100.0	36.4	56.3	62.5	47.7
Plaza	Transit	65.9	15.4	32.1	50.0	14.3	0.0	63.6	43.8	33.3	42.5
Shops	Other	4.9	0.0	35.7	12.5	14.3	0.0	0.0	0.0	4.2	9.8
	Total	26.8	8.5	18.3	5.2	4.6	3.3	7.2	10.5	15.7	100.0
Ballston	Auto	32.1	68.8	57.6	68.8	56.8	75.0	66.7	53.3	71.4	53.3
Common	Transit	64.1	18.8	31.2	25.0	18.9	25.0	33.3	46.7	14.3	36.6
	Other	3.8	12.5	11.2	6.3	24.3	0.0	0.0	0.0	14.3	10.1
	Total	24.6	10.1	39.4	5.0	11.7	1.3	0.9	4.7	2.2	100.0
Bethesda	Auto	27.5	100.0	16.7	100.0	100.0	33.3	41.4	48.0	12.5	38.6
Metro	Transit	70.6	0.0	50.0	0.0	0.0	66.7	25.7	44.0	37.5	42.7
Center	Other	2.0	0.0	33.3	0.0	0.0	0.0	32.9	8.0	50.0	18.7
	Total	29.8	1.2	3.5	1.2	2.3	1.8	40.9	14.6	4.7	100.0
Mazza	Auto	31.9	100.0	25.0	100.0	100.0	100.0	44.4	34.5	56.3	39.6
Gallerie	Transit	61.1	0.0	75.0	0.0	0.0	0.0	55.6	37.9	12.5	48.7
	Other	6.9	0.0	0.0	0.0	0.0	0.0	0.0	27.6	31.3	11.7
	Total	46.8	1.3	2.6	0.6	1.3	0.6	17.5	18.8	10.4	100.0

Table 23. Mode Share by Location of Last Stop
(Continued)

Retail Location	Mode	D.C.	Fairfax County	Arling. County	Alex.	Other Virginia	P.G. County	Mont. County	Other Maryland	Other	Totals
Hecht's	Auto	12.2	0.0	0.0	33.3	100.0	100.0	0.0	37.5	0.0	13.3
Metro	Transit	45.9	100.0	100.0	66.7	0.0	0.0	100.0	62.5	66.7	49.5
Center	Other	42.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	37.1
	Total	86.2	1.0	1.9	1.4	0.5	0.5	1.9	3.8	2.9	100.0
Union	Auto	19.7	55.6	12.5	50.0	54.5	100.0	22.7	26.5	16.7	23.4
Station	Transit	48.6	44.4	50.0	25.0	45.5	0.0	68.2	58.8	73.3	53.5
	Other	31.7	0.0	37.5	25.0	0.0	0.0	9.1	14.7	10.0	23.0
	Total	52.8	3.3	5.9	1.5	4.1	0.4	8.2	12.6	11.2	100.0
The Shops	Auto	12.7	50.0	0.0	—	50.0	0.0	0.0	25.0	20.0	14.4
	Transit	45.3	0.0	87.5	—	50.0	100.0	100.0	75.0	70.0	50.3
	Other	42.0	50.0	12.5	—	0.0	0.0	0.0	0.0	10.0	35.3
	Total	80.2	1.1	4.3	0.0	4.3	0.5	2.1	2.1	5.3	100.0

Note: For each jurisdiction, the percentage of trips by mode share is indicated in the rows labeled "auto," "transit," and "other." These total vertically to 100%. The overall mode for each retail location is shown in the columns labeled "total." For each retail location, the row labeled "total" indicates the percentage of trips from each jurisdiction. This row totals horizontally.

Table 24. Summary of Transit Mode Share - Retail

	Number of Sites	Percent Transit Range	Percent Transit Average
CBD Locations	4	45.3% - 55.8%	49.5%
Suburban Locations Inside Beltway	4	34.4% - 40.7%	38.9%
Suburban Locations Outside Beltway	0	—	—
All Retail Locations	8	34.4% - 55.8%	44.2%

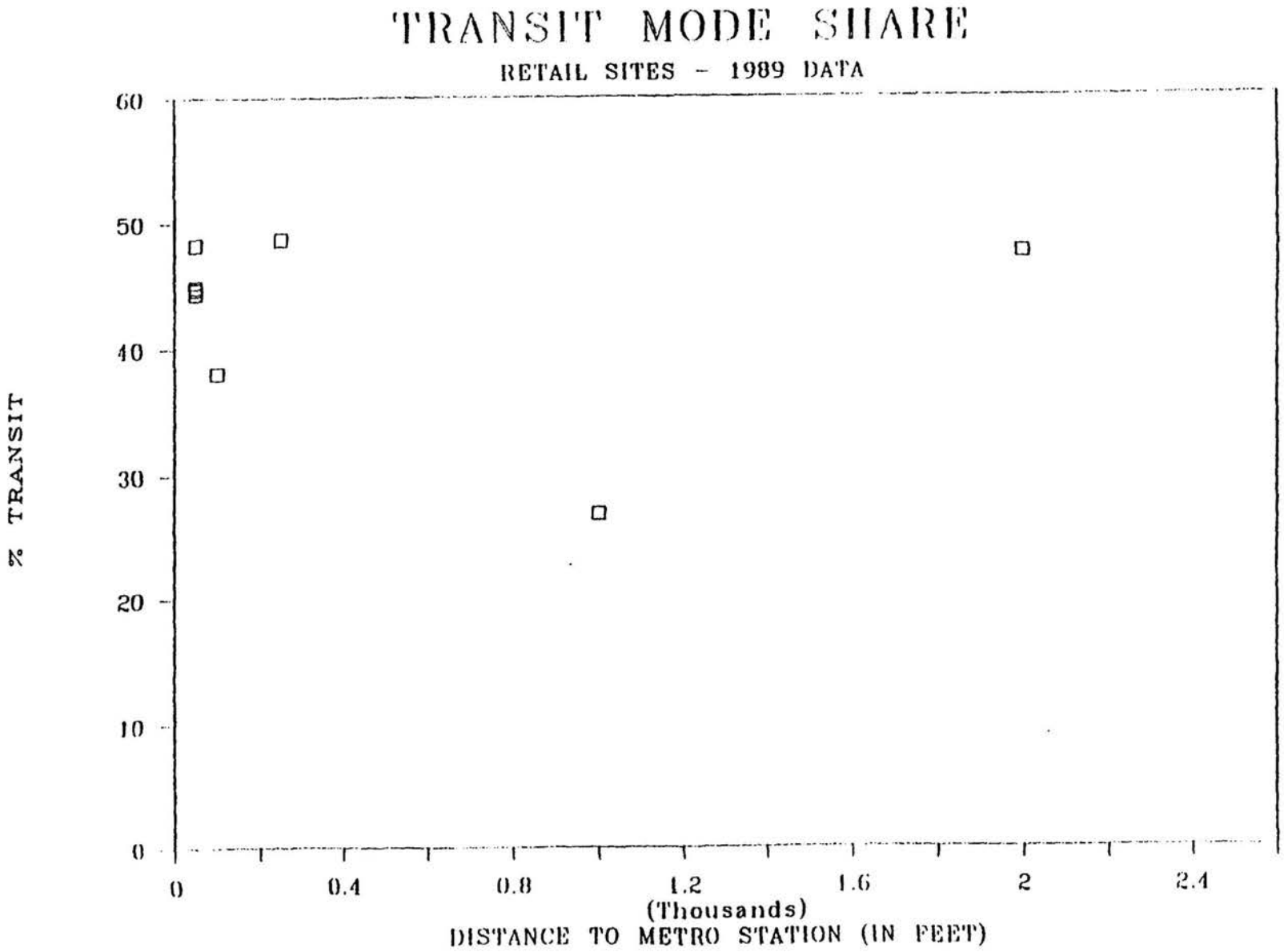

TRANSIT MODE SHARE
RETAIL SITES - 1989 DATA
% TRANSIT
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
(Thousands)
DISTANCE TO METRO STATION (IN FEET)

Figure 22.

Table 25. Mode Share by Purpose for Trips to and from Retail Sites

Retail Site	Purpose	Auto	Rail	Bus	Walk	Taxi	Amtrak	Other Mode	Total	Summary % Auto	Summary % Transit
The	Shopper	27.9%	37.2%	7.6%	22.1%	1.2%	0.0%	4.1%	100.0%	27.9%	44.8%
Under-	Employee	44.2	35.1	5.8	14.3	0.0	0.0	0.6	100.0	44.2	40.9
Ground	Restaurant	30.8	46.2	7.7	15.4	0.0	0.0	0.0	100.0	30.8	53.8
	Other	32.9	27.1	5.8	27.7	2.6	0.0	3.9	100.0	32.9	32.9
Crystal	Shopper	33.3	47.6	0.0	16.7	0.0	0.0	2.4	100.0	33.3	47.6
Plaza	Employee	47.5	39.4	6.9	6.3	0.0	0.0	0.0	100.0	47.5	46.3
Shops	Restaurant	54.5	27.3	0.0	18.2	0.0	0.0	0.0	100.0	54.5	27.3
Center	Other	42.4	30.5	0.0	23.7	0.0	0.0	3.4	100.0	42.4	30.5
Ballston	Shopper	64.4	21.7	5.3	8.0	0.6	0.0	0.0	100.0	64.4	26.9
Common	Employee	47.1	33.7	4.8	10.6	0.0	0.0	3.8	100.0	47.1	38.5
	Restaurant	50.0	18.4	3.9	27.6	0.0	0.0	0.0	100.0	50.0	22.4
	Other	34.4	56.3	0.8	7.0	0.0	0.0	1.6	100.0	34.4	57.0
Bethesda	Shopper	61.9	35.7	2.4	0.0	0.0	0.0	0.0	100.0	61.9	38.1
Metro	Employee	59.1	31.8	4.5	4.5	0.0	0.0	0.0	100.0	59.1	36.4
Center	Restaurant	29.6	29.1	8.4	31.8	0.0	0.0	1.1	100.0	29.6	37.4
	Other	32.9	42.1	7.9	13.2	3.9	0.0	0.0	100.0	32.9	50.0
Mazza	Shopper	43.9	40.4	4.7	11.1	0.0	0.0	0.0	100.0	43.9	45.0
Gallerie	Employee	30.0	56.7	10.0	0.0	3.3	0.0	0.0	100.0	30.0	66.7
	Restaurant	18.8	43.8	18.8	28.8	0.0	0.0	0.0	100.0	18.8	62.5
	Other	37.5	37.5	2.8	19.4	0.0	0.0	2.8	100.0	37.5	40.3

Table 25. Mode Share by Purpose for Trips to and from Retail Sites (Continued)

Retail Site	Purpose	Auto	Rail	Bus	Walk	Taxi	Amtrak	Other Mode	Total	Summary % Auto	Summary % Transit
Hecht's	Shopper	12.5	25.9	18.5	40.7	2.3	0.0	0.0	100.0	12.5	44.4
Metro	Employee	20.0	60.0	20.0	0.0	0.0	0.0	0.0	100.0	20.0	80.0
Center	Restaurant	12.5	87.5	0.0	0.0	0.0	0.0	0.0	100.0	12.5	87.5
	Other	4.0	26.0	12.0	54.0	2.0	0.0	2.0	100.0	4.0	38.0
Union	Shopper	24.6	39.8	5.9	18.6	5.1	2.5	3.4	100.0	24.6	48.3
Station	Employee	31.3	31.3	25.0	6.3	0.0	6.3	0.0	100.0	31.3	62.5
	Restaurant	32.1	22.6	17.9	25.0	0.0	2.4	0.0	100.0	32.1	42.9
	Other	18.5	23.5	18.1	12.1	5.0	20.1	2.7	100.0	18.5	61.7
The Shops	Shopper	20.9	34.8	13.9	24.1	4.4	0.0	1.9	100.0	20.9	48.7
	Employee	13.2	55.3	28.9	0.0	2.6	0.0	0.0	100.0	13.2	84.2
	Restaurant	0.0	21.2	6.1	69.7	3.0	0.0	0.0	100.0	0.0	27.3
	Other	8.3	22.0	27.5	34.9	6.4	0.0	0.9	100.0	8.3	49.5

Note: For each retail location, the mode split is given for each trip purpose. In the columns labeled "summary," transit includes rail, bus, and Amtrak.

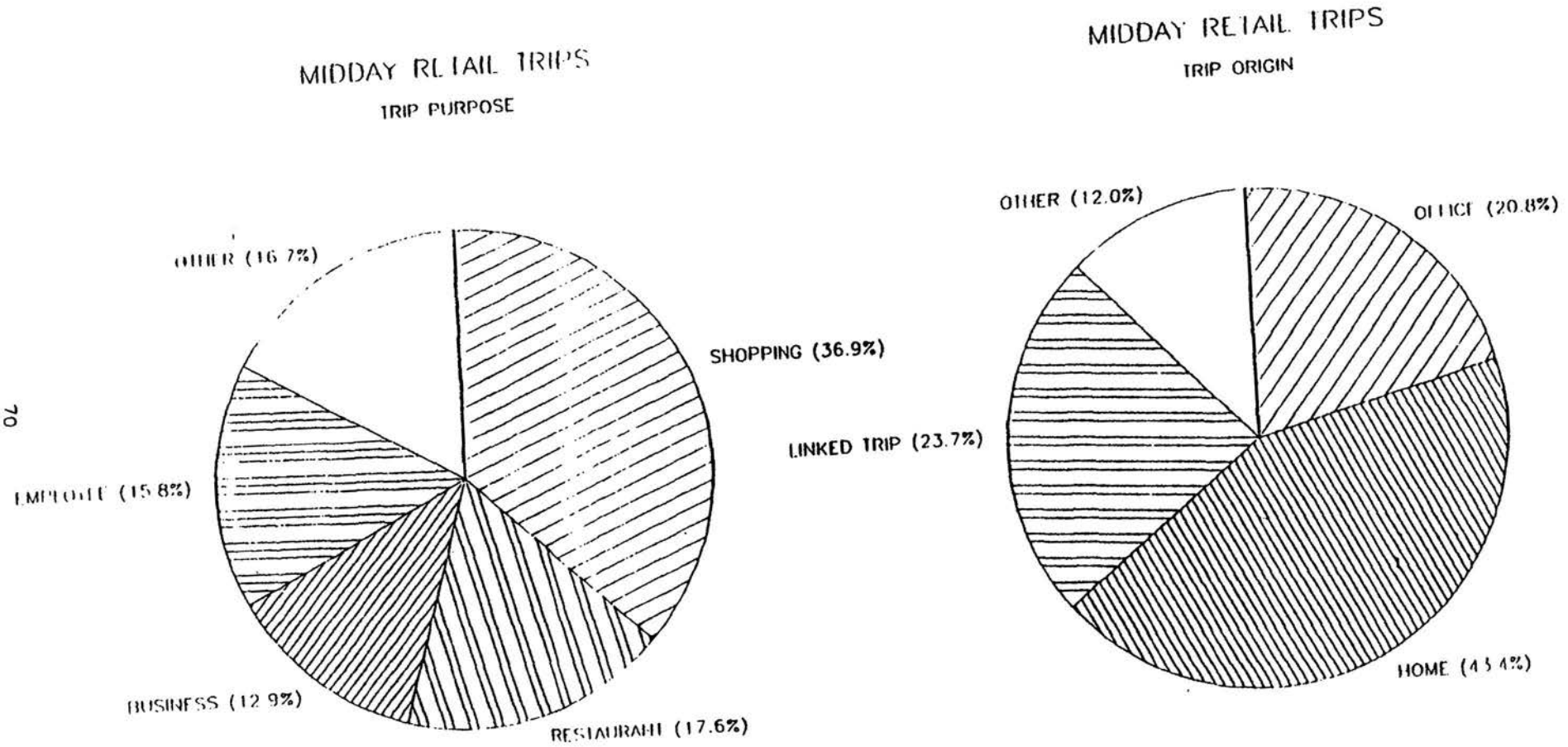

MIDDAY RETAIL TRIPS
TRIP PURPOSE
OTHER (16.7%)
SHOPPING (36.9%)
EMPLOYEE (15.8%)
BUSINESS (12.9%)
RESTAURANT (17.6%)
MIDDAY RETAIL TRIPS
TRIP ORIGIN
OTHER (12.0%)
OFFICE (20.8%)
LINKED TRIP (23.7%)
HOME (43.4%)

Figure 23.

Table 26. Retail Surveys
Respondents Opinions by Mode of Travel

Q15: People should be encouraged to use transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	544	(88.9%)	702	(92.9%)	265	(90.4%)	26	(92.9%)	1537	(91.0%)	24	(88.9%)	1561	(91.0%)
Disagree	30	(4.9)	15	(2.0)	9	(3.1)	0	(0.0)	54	(3.2)	1	(3.7)	55	(3.2)
No Opinion	36	(5.9)	35	(4.6)	18	(6.1)	2	(7.1)	91	(5.4)	1	(3.7)	92	(5.4)
Not Answered	2	(0.3)	4	(0.5)	1	(0.3)	0	(0.0)	7	(0.4)	1	(3.7)	8	(0.5)
Total	612	(100.0)	756	(100.0)	293	(100.0)	28	(100.0)	1689	(100.0)	27	(100.0)	1716	(100.0)

Q16: Schedule information is readily available for transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	425	(69.4%)	601	(79.5%)	209	(71.3%)	22	(78.6%)	1257	(74.4%)	23	(85.2%)	1280	(74.6%)
Disagree	113	(18.5)	117	(15.5)	59	(20.1)	2	(7.1)	291	(17.2)	1	(3.7)	292	(17.0)
No Opinion	70	(11.4)	35	(4.6)	24	(8.2)	4	(14.3)	133	(7.9)	2	(7.4)	135	(7.9)
Not Answered	4	(0.7)	3	(0.4)	1	(0.3)	0	(0.0)	8	(0.5)	1	(3.7)	9	(0.5)
Total	612	(100.0)	756	(100.0)	293	(100.0)	28	(100.0)	1689	(100.0)	27	(100.0)	1716	(100.0)

Table 26. Retail Surveys
Respondents Opinions by Mode of Travel
(Continued)

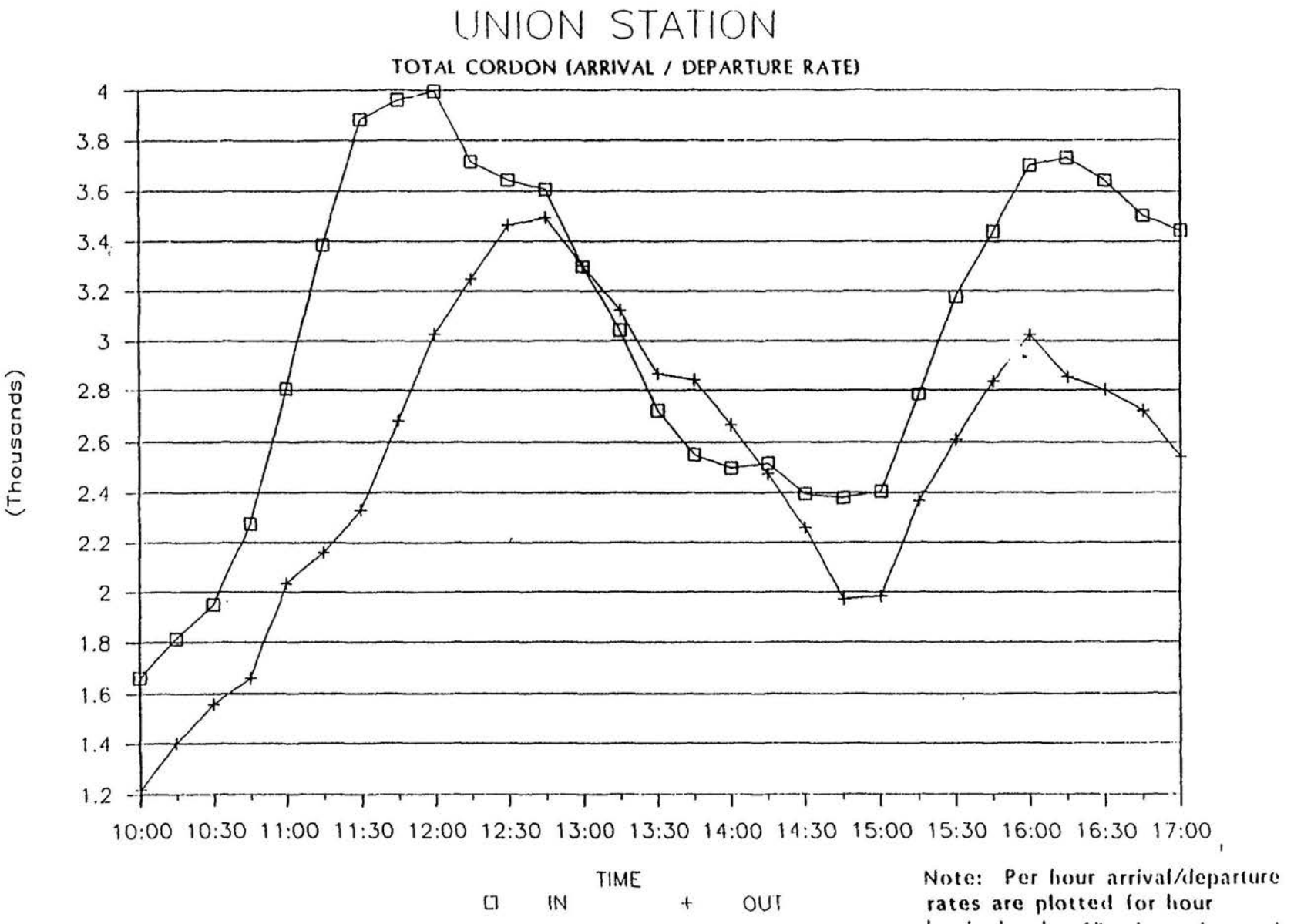
Q17: Metrorail is clean and reliable.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	544	(88.9%)	701	(92.7%)	268	(91.5%)	22	(78.6%)	1535	(90.9%)	21	(77.8%)	1556	(90.7%)
Disagree	18	(2.9)	13	(1.7)	7	(2.4)	0	(0.0)	38	(2.2)	0	(0.0)	38	(2.2)
No Opinion	47	(7.7)	39	(5.2)	16	(5.5)	6	(21.4)	108	(6.4)	5	(18.5)	113	(6.6)
Not Answered	3	(0.5)	3	(0.4)	2	(0.7)	0	(0.0)	8	(0.5)	1	(3.7)	9	(0.5)
Total	612	(100.0)	756	(100.0)	293	(100.0)	28	(100.0)	1689	(100.0)	27	(100.0)	1716	(100.0)

Q18: Metrobus is clean and reliable.

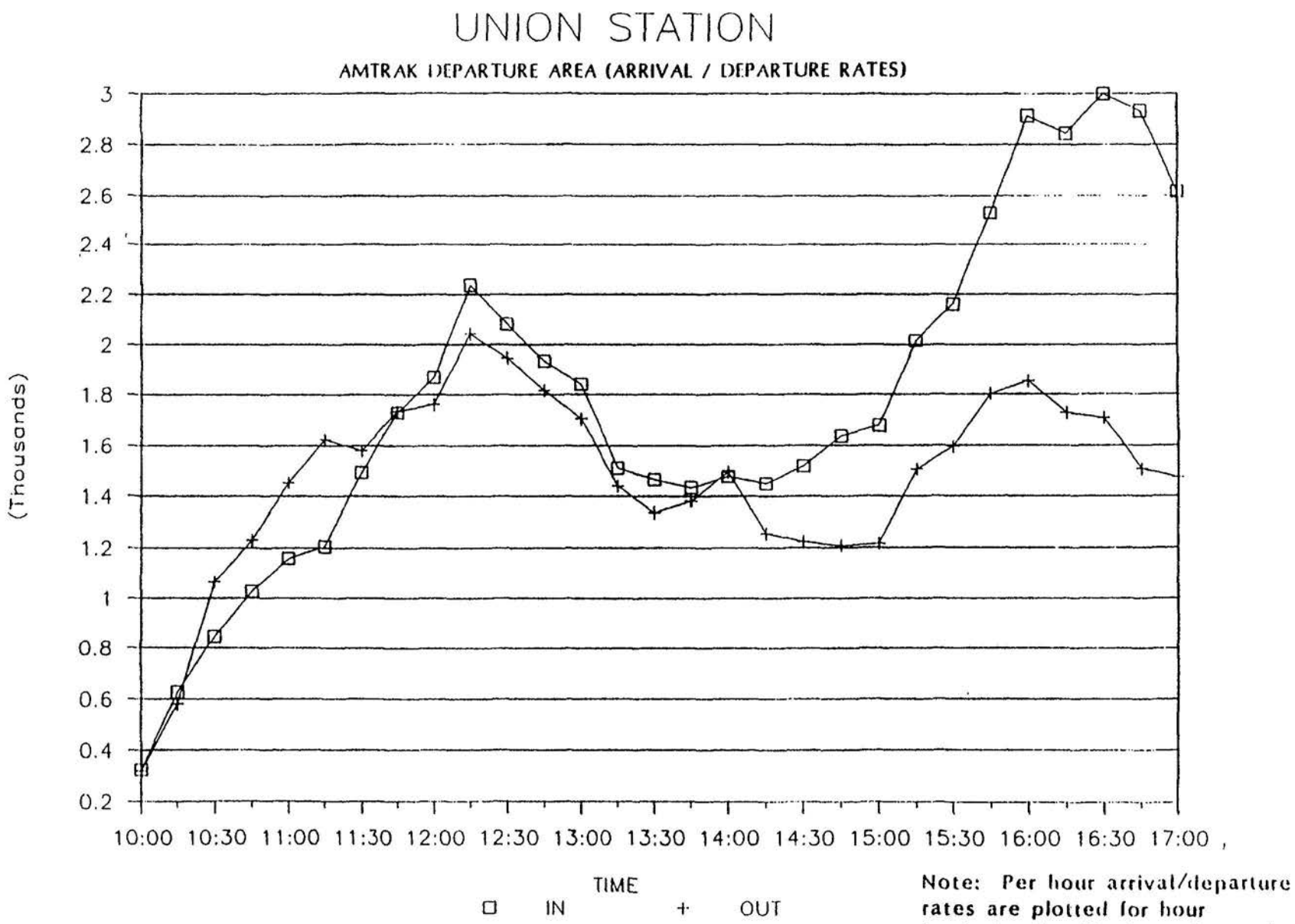
Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	251	(41.0%)	325	(43.0%)	122	(41.6%)	10	(35.7%)	708	(41.9%)	9	(33.3%)	717	(41.8%)
Disagree	115	(18.8)	210	(27.8)	72	(24.6)	3	(10.7)	400	(23.7)	0	(0.0)	400	(23.3)
No Opinion	242	(39.5)	218	(28.8)	99	(33.8)	15	(53.6)	574	(34.0)	17	(63.0)	591	(34.4)
Not Answered	4	(0.7)	3	(0.4)	0	(0.0)	0	(0.0)	7	(0.4)	1	(3.7)	8	(0.5)
Total	612	(100.0)	756	(100.0)	293	(100.0)	28	(100.0)	1689	(100.0)	27	(100.0)	1716	(100.0)

Note: Not answered refers to people who specified their mode of travel but do not answer the question. Missing values refer to people who answered the question but did not specify their mode of travel.



Note: Per hour arrival/departure rates are plotted for hour beginning by 15 minute intervals

Figure 24.



Note: Per hour arrival/departure rates are plotted for hour beginning by 15 minute intervals

Figure 25.

office sites. As more studies are completed in the future, trend analysis may define this relationship better.

Mode share is presented by purpose in Table 25. The transit mode share for employees is higher than the transit mode share found at the office sites in the corresponding station area. A similar geographic distribution of patrons was found as compared to the office sites. This suggests that people chose their shopping location in areas they are familiar with based on their daily work trips.

Figure 23 illustrates the purpose of mid-day transit trips to the retail areas as well as the origin of trips based on the last stop reported. It is interesting to note that only a little over a third of trips are for the purpose of shopping. This is considerably lower than in the evenings or on a weekend. Less than half the reported trips originate at the patrons home with 23.7% reported as linked trips. This is about the same magnitude of linked trips as found among auto users which is somewhat contradictory to the excuse given by many auto users for not using transit. That is, if they use transit they cannot stop off or make multi-purpose trips.

Responses to the attitudinal questions were similar to those for office and residential sites and are presented in Table 26.

Union Station

One of the retail sites chosen was the retail area at Union Station. This site is unique in the metropolitan area acting as a multi-modal transfer point for trips up and down the east coast via Amtrak, commuter rail (MARC), a Metrorail station, a retail area with 210,000 square feet of shops, 100,000 square feet of office, and a tourist attraction. There were three components to the data collection at Union Station. First, the entire building was cordoned off and pedestrians entering and exiting the building were counted by 15 minute intervals for each entrance. Second, a secondary cordon recorded pedestrians entering or exiting the Amtrak arrival/ departure lounge area. Finally interviews were conducted for the full counting period of 10:00 AM to 6:00 PM. The tables and figures in this section highlight mode share, trip generation, trip purpose and other trip characteristics for trips made to and from Union Station.

Over the eight hour count period approximately 43,600 persons were seen to enter or exit Union Station, the hourly arrival and departure rates by 15 minute increments is shown in Figure 24. Figure 25 shows the arrival and departure rates for the Amtrak arrival/departure area. Approximately 57% of all persons entering Union Station enter

the Amtrak arrival departure area, or putting it the other way around, 43% are visitors, for reasons such as shopping, lunch, or just plain sight seeing.

The Union Station Metrorail stop had approximately 26,000 patrons for the same time period. Of these it is estimated that approximately one-half entered Union Station. The arrival and departure rates for the Metrorail station are shown in Figure 26. The Metrorail station was considered outside of Union Station, therefore, it was counted separately. Of the 26,000 patrons it is estimated that approximately 8,000 enter or exit Union Station.

Figure 27 shows the jurisdiction of origin by mode. Just over half of all trips to Union Station originated in DC. Figure 28 shows mode share by trip purpose. It is interesting to note that arrival by car accounts for less than one third of all trips to or from Union Station.

Figure 29 illustrates the expenditures by patrons at Union Station. The average or mean expenditure is $22.00 and the median expenditure is $6.00. Finally Table 27 summarizes some of the information discussed above.

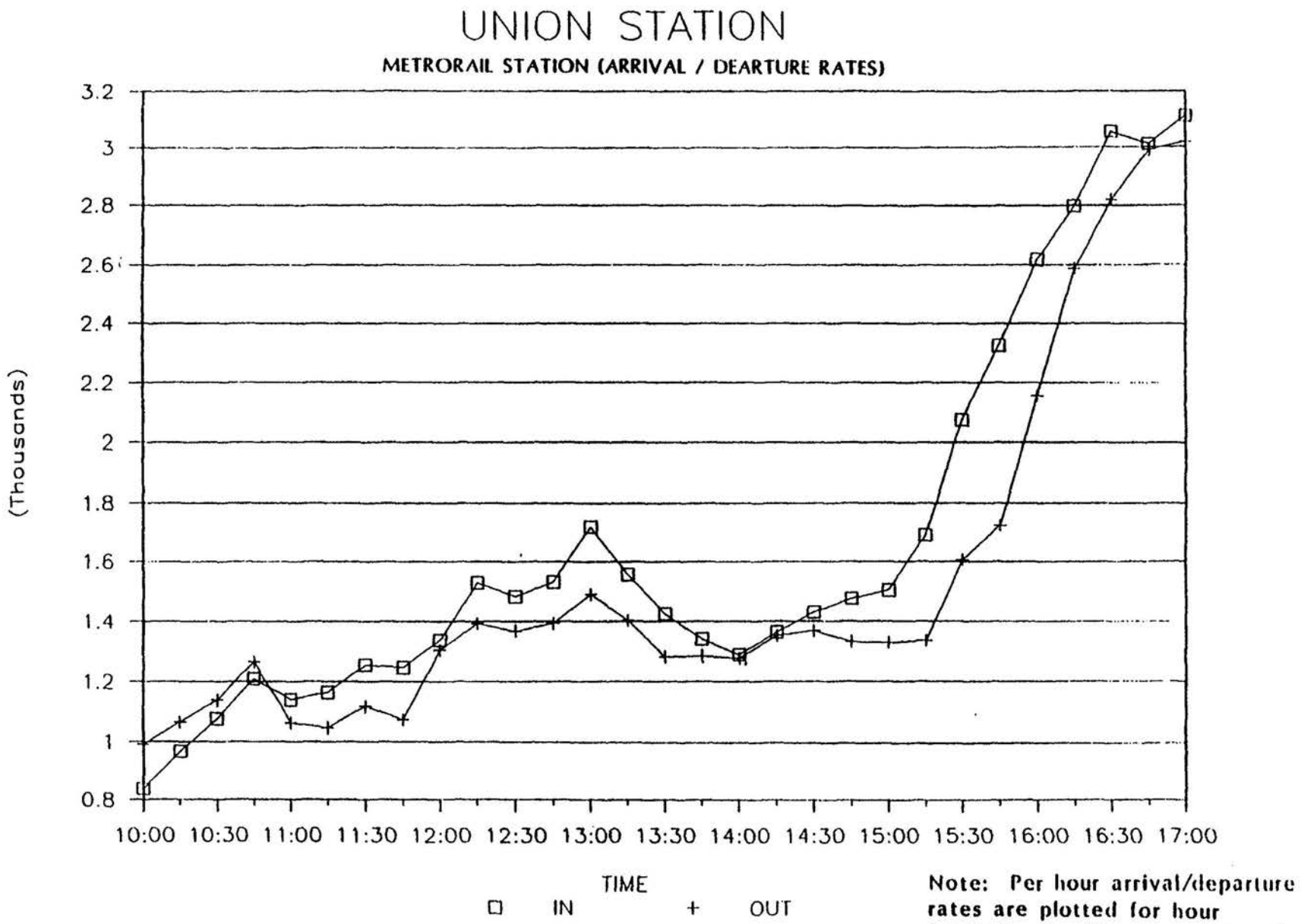
In summary Union Station generates over 4000 trips per hour for most of the day, with the absolute peak occurring at noon hour. The majority of trips to and from Union Station are made by transit or on foot. Union Station generates considerable revenue for WMATA throughout the day, not just the peak periods and represents a mixed use development that appears to encourage transit ridership to a greater extent than these uses would, located on their own.

HOTEL

The ten hotels chosen for study were full service hotels ranging in size from 88 to 907 guest rooms. The characteristics for each hotel were given in Table 28. Conference/meeting space varied from 10,000 to 50,000 gross square feet. A wide range of distances from Metrorail stations was studied. As well, four of the five hotels surveyed in the first study were repeated in this study.

Data Collection

Data were collected at hotel sites using a pedestrian-based survey to gather information from patrons and cordon counts were conducted to determine actual trip generation rates. The format and procedures employed were very similar to those used for retail sites. The objectives were:

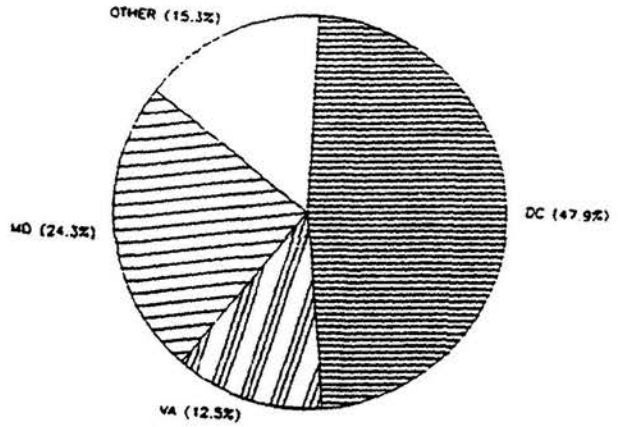


Note: Per hour arrival/departure rates are plotted for hour beginning by 15 minute intervals

Figure 26.

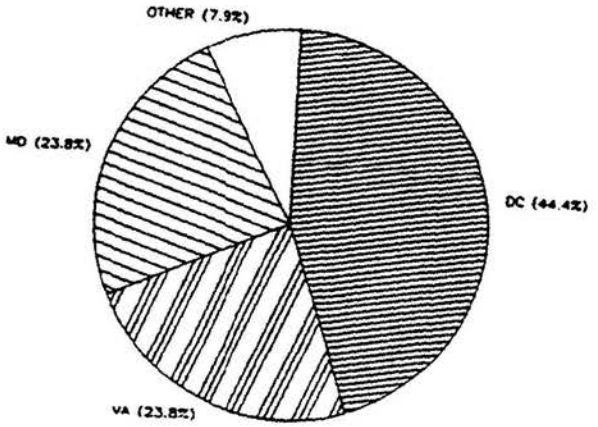
UNION STATION

LOCATION OF LAST STOP FOR TRANSIT USERS



UNION STATION

LOCATION OF LAST STOP FOR AUTO USERS



UNION STATION

LOCATION OF LAST STOP FOR ALL PERSONS

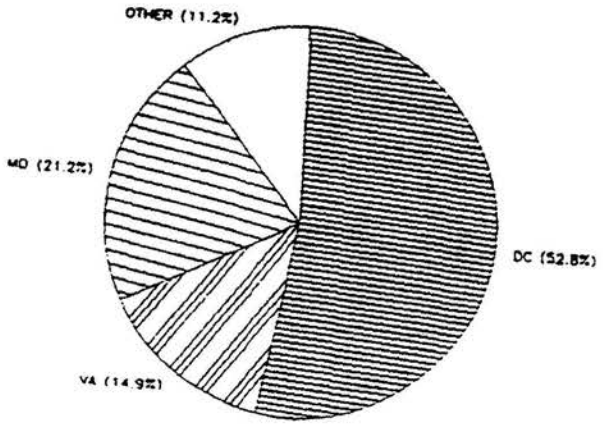
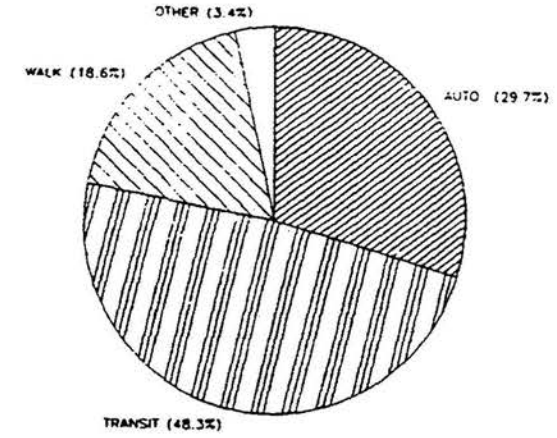


Figure 27. 78

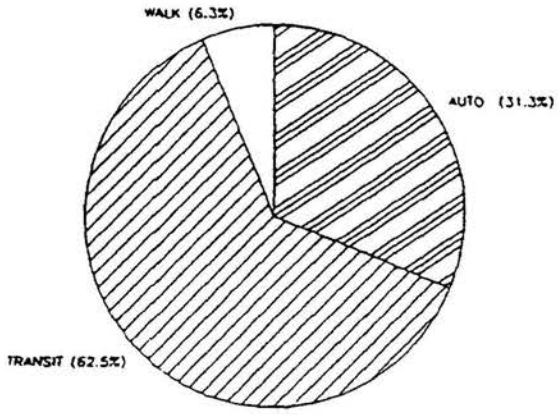
UNION STATION

MODE SPLIT FOR SHOPPERS



UNION STATION

MODE SPLIT FOR EMPLOYEES



UNION STATION

MODE SPLIT FOR RESTAURANT PATRONS

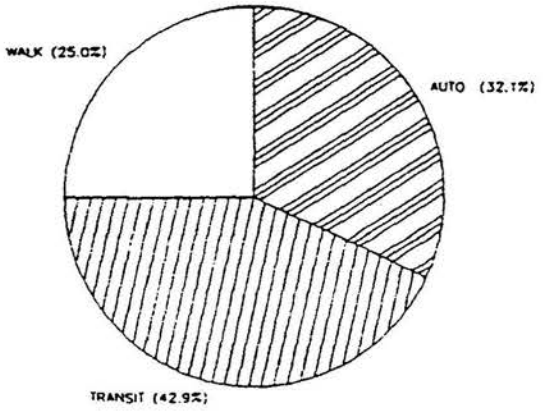


Figure 28.

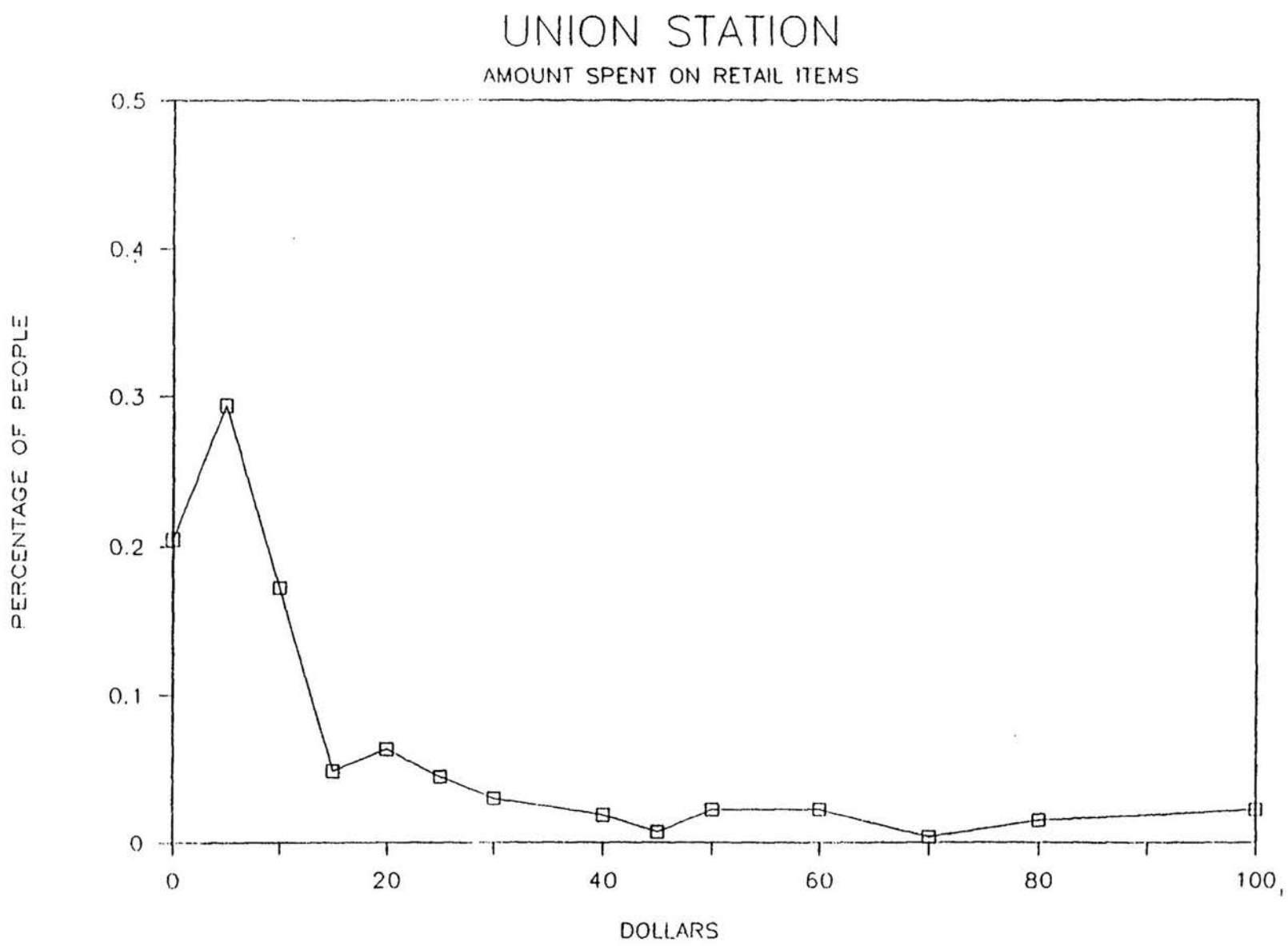

UNION STATION
AMOUNT SPENT ON RETAIL ITEMS
PERCENTAGE OF PEOPLE
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
DOLLARS

Figure 29.

Table 27. Union Station

Counting Period:	10:00 AM - 6:00 PM
Peak Hour:	12:30 PM - 1:30 PM (Metrorail: 4:30 PM - 5:30 PM)

Total Number of Persons:

	IN	OUT
Counting Period		
Union Station	23,817	19,799
Amtrak	13,876	11,279
Metrorail	13,561	12,634

- Approximately 9% of visitors park in the parking structure
- Approximately 57% of visitors enter the Amtrak arrival/departure area

Average (mean) Expenditure:	$22.00	
Parking Costs:	$1.50/hour	$7.50/day

Table 28. Site Characteristics of Hotels

Metrorail Station	Hotel	Distance to Station (ft.)	No. Guest Rooms	GSF Conf. Space	Rest./ Lounge Seats	No. Parking Spaces	Parking Costs	Year Constructed
Metro Center	JW Marriott (2)[1]	1300	773	28,360	450			1983
	Hyatt Grand (3)	500	907	50,000				1987
Rosslyn	Hyatt Arlington (45)	300	303	6,020	330	290	guests free conf. varies	1976
Crystal City	Crystal Gateway (10)	100	702	14,800	350	320	guest/conf. pay for parking	1982
	Crystal Hyatt (11)	3800	685	31,900	594	330	guest $7.50/day rest. validates weekend guests free	1982
Woodley Park/Zoo	Omni Shoreham (46)	1050	770					
Bethesda	Hyatt Regency (32)	300	380			1400[2]		
Twinbrook	Holiday Inn-- Crowne Plaza (38)	400	315	850[3]				
Union Station	Phoenix Park (43)	900	88	150[3]				
Silver Spring	Holiday Inn (19)	2500	227					

[1] Numbers in parentheses refer to location maps in Figures 2 to 13.

[2] Total parking for project.

[3] Capacity of conference area.

- to determine the purpose of the trip to the hotel
- to determine mode of travel used to get to or from the hotel on the survey day.
- to determine where the trips originated
- to determine trip generation rates

The pedestrian surveys contained in the Appendix were conducted at the entrances of the hotel or in the lobby area. Interviews were conducted for a minimum of 6 hours at each site covering both peak periods and portions of the mid-day. Cordon counts were conducted throughout this time and in the suburban locations auto occupancy counts were conducted.

Analysis

As with the other land use categories the responses to each question were tabulated and the person trips by 15 minute period tabulated. Summary tables presenting mode share by site and trip purpose are presented in this section.

Results

As with the retail sites transit mode share (Table 29) was found to be considerably higher than that found in the first study with all four repeat sites showing increase in transit mode share. The highest transit mode share was 37.7% at the Holiday Inn Crowne Plaza near the Twinbrook station, while the lowest was found at the Phoenix Park Hotel near Union Station. Of all the land uses surveyed, hotels can be expected to have the greatest variability in transit mode share.

The expansion of the mode share table to include trip purpose is shown in Table 30. Figure 30 graphs the relationship between transit mode share and distance for hotel sites. The table reveals that as was the case in the first study, overnight guests consistently had a lower transit ridership than meeting/conference attendees. Many factors influence transit ridership. For instance, lack of familiarity with the system may result in fewer overnight guests or out of town conference attendees choosing to take transit. Also, the reason the overnight guest is in town may influence their mode choice. For instance, an overnight guest visiting the area for pleasure rather than

Table 29. Summary of Transit Mode Share - Hotel

	Number of Sites	Percent Transit Range	Percent Transit Average
CBD Locations	4	10.8% - 35.9%	25.0%
Suburban Locations Inside Beltway	5	12.4% - 29.8%	19.3%
Suburban Locations Outside Beltway	1	37.7%	37.7%
All Hotel Locations	10	10.8% - 35.9%	25.2%

Table 30. Mode Share by Purpose for Trips to and from Hotel Sites

Hotel	Purpose	Auto	Rail	Bus	Walk	Taxi/Limo	Shuttle	Total	Summary % Auto	Summary % Transit
Hyatt	Overnight Guest	48.7%	33.3%	2.6%	5.1%	10.3%	0.0%	100.0%	48.7%	35.9%
Regency	Meeting/Conf.	48.4	29.0	0.0	9.7	9.7	3.2	100.0	48.4	29.0
Bethesda.	Restaurant	28.6	14.3	7.1	21.4	21.4	7.1	100.0	28.6	21.4
	Other	50.0	20.0	0.0	20.0	0.0	10.0	100.0	50.0	20.0
Holiday	Overnight Guest	54.2	16.7	4.2	20.8	4.2	0.0	100.0	54.2	20.8
Inn	Meeting/Conf.	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0
Silver	Restaurant	---	---	---	---	---	---	---	---	---
Spring	Other	---	---	---	---	---	---	---	---	---
Hyatt	Overnight Guest	23.1	30.8	1.9	23.1	21.2	0.0	100.0	23.1	32.7
Grand	Meeting/Conf.	14.3	39.3	0.0	14.3	28.6	3.6	100.0	14.3	39.3
	Restaurant	36.4	9.1	0.0	54.5	0.0	0.0	100.0	36.4	9.1
	Other	19.2	38.5	7.7	26.9	7.7	0.0	100.0	19.2	46.2
Holiday	Overnight Guest	61.7	33.3	0.0	1.7	3.3	0.0	100.0	61.7	33.3
Inn	Meeting/Conf.	26.8	56.1	9.8	0.0	7.3	0.0	100.0	26.8	65.9
Crowne	Restaurant	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Plaza	Other	83.3	16.7	0.0	0.0	0.0	0.0	100.0	83.3	16.7
J.W.	Overnight Guest	34.4	18.5	2.1	12.8	30.3	2.1	100.0	34.4	20.5
Marriott	Meeting/Conf.	26.7	20.0	20.0	20.0	13.3	0.0	100.0	26.7	40.0
	Restaurant	61.9	23.8	0.0	0.0	14.3	0.0	100.0	61.9	23.8
	Other	41.7	23.3	6.7	13.3	15.0	0.0	100.0	41.7	30.0

Note: For each hotel location, the mode split is given for each trip purpose. In the columns labeled "summary," transit includes rail and bus.

Table 30. Mode Share by Purpose for Trips to and from Hotel Sites
(Continued)

Hotel	Purpose	Auto	Rail	Bus	Walk	Taxi/Limo	Shuttle	Total	Summary % Auto	Summary % Transit
Crystal	Overnight Guest	33.6	28.0	0.9	14.0	11.2	12.1	100.0	33.6	29.0
Gateway	Meeting/Conf.	53.8	19.2	0.0	7.7	15.4	3.8	100.0	53.8	19.2
Marriott	Restaurant	0.0	50.0	0.0	50.0	0.0	0.0	100.0	0.0	50.0
	Other	45.8	16.7	2.1	29.2	0.0	6.3	100.0	45.8	18.8
Hyatt	Overnight Guest	23.0	28.0	2.0	21.0	19.0	7.0	100.0	[illegible].0	30.0
Arlington	Meeting/Conf.	30.4	52.2	0.0	13.0	4.3	0.0	100.0	30.4	52.2
	Restaurant	78.6	7.1	0.0	7.1	7.1	0.0	100.0	78.6	7.1
	Other	66.7	7.7	2.6	23.1	0.0	0.0	100.0	66.7	10.3
Phoenix	Overnight Guest	17.4	8.7	0.0	21.7	52.2	0.0	100.0	17.4	8.7
Park	Meeting/Conf.	33.3	0.0	0.0	16.7	50.0	0.0	100.0	33.3	0.0
Hotel	Restaurant	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
	Other	16.7	16.7	16.7	33.3	16.7	0.0	100.0	16.7	33.3
Hyatt	Overnight Guest	23.3	4.1	1.4	8.2	8.2	54.8	100.0	23.3	5.5
Regency	Meeting/Conf.	10.8	27.0	0.0	0.0	37.8	24.3	100.0	10.8	27.0
Crystal	Restaurant	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
City	Other	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Omni	Overnight Guest	15.7	25.1	0.5	7.9	46.6	4.2	100.0	15.7	25.7
Shoreham	Meeting/Conf.	43.5	36.5	1.2	8.2	10.6	0.0	100.0	43.5	37.6
	Restaurant	100.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
	Other	45.0	20.0	15.0	10.0	10.0	0.0	100.0	45.0	35.0

Note: For each hotel location, the mode split is given for each trip purpose. In the columns labeled "summary," transit includes rail and bus.

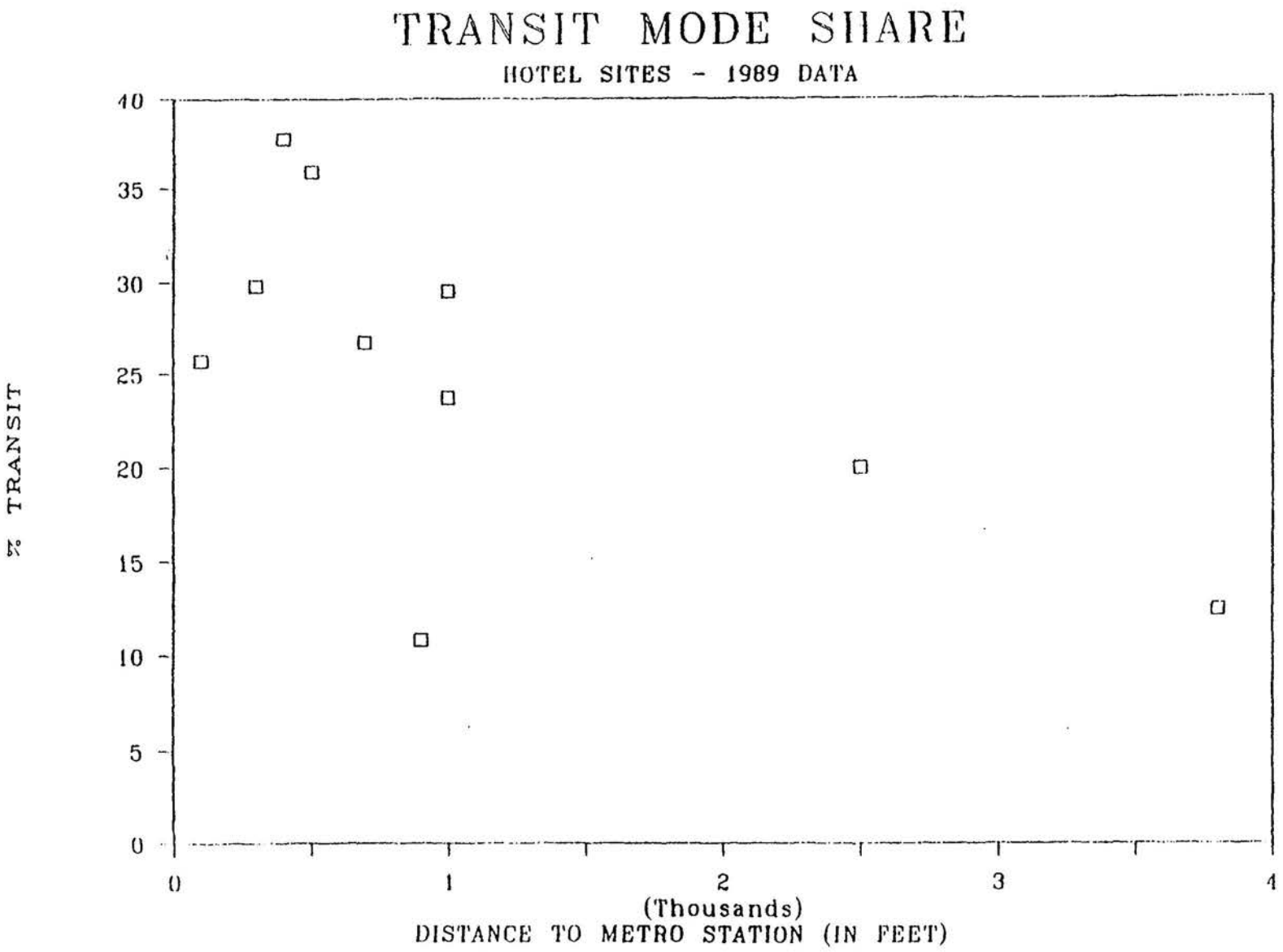

TRANSIT MODE SHARE
HOTEL SITES - 1989 DATA
% TRANSIT
40
35
30
25
20
15
10
5
0
0
1
2
3
4
(Thousands)
DISTANCE TO METRO STATION (IN FEET)

Figure 30.

business may choose transit more often than the business person on a travel expense account. During the interviews common observations from overnight guests from out of town were that they did not know that Washington had a rail system or that it took them 2 or 3 days to discover the system. While this is admittedly a subjective statement, it again suggests that a marketing strategy targeted at individual station areas may be appropriate. Responses to the attitudinal questions from the hotel surveys are presented in Table 31.

DATA FROM OTHER SOURCES

There are several other sources of data, similar to that collected in this study, that provide insight into travel behavior at sites near Metrorail stations. The first study which has been referred to throughout this report provided data on 34 sites. Another study completed by JHK & Associates for the Maryland-National Capital Park and Planning Commission involved the collection of mode split and trip generation data at sites along the Metrorail Red Line in Montgomery County. The Council of Governments (COG) has also conducted studies at several sites in the downtown and at the Van Ness-UDC station. Mode share and trip generation data has been collected over the past year and half at the NRC Building near the White Flint station.

Data from a number of other sites in these studies has been included in the appendix B of this report. This data can be used for comparative purposes or for additional points of reference at rail stations other than those included in this study. In general, the data from the several studies support one another. Data from the downtown sites, collected by COG suggest a high transit mode share, as would be expected. Several tables of data from these studies are provided in Appendix B.

Table 31. Hotel Surveys
Respondents Opinions by Mode of Travel

Q12: People should be encouraged to use transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	308	(89.8%)	149	(93.7%)	49	(92.5%)	78	(94.0%)	584	(91.5%)	520	(87.5%)	1104	(89.6%)
Disagree	9	(2.6)	2	(1.3)	1	(1.9)	1	(1.2)	13	(2.0)	12	(2.0)	25	(2.0)
No Opinion	23	(6.7)	6	(3.8)	3	(5.7)	4	(4.8)	36	(5.6)	59	(9.9)	95	(7.7)
Not Answered	3	(0.9)	2	(1.3)	0	(0.0)	0	(0.0)	5	(0.8)	3	(0.5)	8	(0.6)
Total	343	(100.0)	159	(100.0)	53	(100.0)	83	(100.0)	638	(100.0)	594	(100.0)	1232	(100.0)

Q13: Schedule information is readily available for transit.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	219	(63.8%)	123	(77.4%)	40	(75.5%)	64	(77.1%)	446	(69.9%)	354	(59.6%)	800	(64.9%)
Disagree	61	(17.8)	21	(13.2)	10	(18.9)	11	(13.3)	103	(16.1)	118	(19.9)	221	(17.9)
No Opinion	60	(17.5)	13	(8.2)	3	(5.7)	8	(9.6)	84	(13.2)	120	(20.2)	204	(16.6)
Not Answered	3	(0.9)	2	(1.3)	0	(0.0)	0	(0.0)	5	(0.8)	2	(0.3)	7	(0.6)
Total	343	(100.0)	159	(100.0)	53	(100.0)	83	(100.0)	683	(100.0)	594	(100.0)	1232	(100.0)

Table 31. Hotel Surveys
Respondents Opinions by Mode of Travel
(Continued)

Q14: Metrorail is clean and reliable.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	264	(77.0%)	144	(90.6%)	47	(88.7%)	65	(78.3%)	520	(81.5%)	424	(71.4%)	944	(76.6%)
Disagree	3	(0.9)	3	(1.9)	1	(1.9)	2	(2.4)	9	(1.4)	2	(0.3)	11	(0.9)
No Opinion	74	(21.6)	10	(6.3)	5	(9.4)	16	(19.3)	105	(16.5)	166	(27.9)	271	(22.0)
Not Answered	2	(0.6)	2	(1.3)	0	(0.0)	0	(0.0)	4	(0.6)	2	(0.3)	6	(0.5)
Total	343	(100.0)	159	(100.0)	53	(100.0)	83	(100.0)	683	(100.0)	594	(100.0)	1232	(100.0)

Q15: Metrobus is clean and reliable.

Question	Mode of Travel: Auto		Transit		Walk		Other		Subtotal		Missing Values		Total	
Agree	128	(37.3%)	61	(38.4%)	19	(35.8%)	26	(31.3%)	234	(36.7%)	188	(31.6%)	422	(34.3%)
Disagree	26	(7.6)	16	(10.1)	6	(11.3)	3	(3.6)	51	(8.0)	23	(3.9)	74	(6.0)
No Opinion	181	(52.8)	77	(48.4)	28	(52.8)	53	(63.9)	339	(53.1)	380	(64.0)	719	(58.4)
Not Answered	8	(2.3)	5	(3.1)	0	(0.0)	1	(1.2)	14	(2.2)	3	(0.5)	17	(1.4)
Total	343	(100.0)	159	(100.0)	53	(100.0)	83	(100.0)	683	(100.0)	594	(100.0)	1232	(100.0)

Note: Not answered refers to people who specified their mode of travel but do not answer the question. Missing values refer to people who answered the question but did not specify their mode of travel.

ANALYSIS OF TRENDS AND RELATIONSHIPS

This chapter discusses the development of mathematical relationships between transit ridership and the characteristics of building sites, and provides peak hour generation rates for the buildings based on cordon counts and/or estimates made based on the survey results. Data from the previous study has been included in this analysis and the differences are highlighted. The primary objective of these analyses was to refine and if possible, expand the tools developed in the first study for use in land use and transportation planning in the vicinity of Metrorail stations. The development of mathematical relationships is presented first, followed by summaries of trip generation rates.

MATHEMATICAL RELATIONSHIPS BETWEEN TRANSIT RIDERSHIP AND SITE CHARACTERISTICS

- What type of development is most appropriate?
- What percent of employees, residents, or patrons will come by transit?
- How many vehicle trips will be generated?
- How can vehicle trips be minimized while transit ridership is encouraged?

The answer to these questions and others has implications on the roadway facilities required, on the amount of parking needed, and on the utilization of the transit system.

There is no foolproof method of predicting what transit mode share will be. Each building and its occupants are unique, in terms of the travel habits and O/D characteristics of its employees, the cost and supply of parking, age, sex, income etc. For example, a building that houses primarily real estate and insurance personnel will be different than for a building that houses primarily medical professionals. However, trends and typical relationships between transit ridership and certain site factors can be developed. In this study and the previous WMATA study the technique applied was multiple regression analysis. Regression analysis enables the development of mathematical equations that best explain the variation in a dependent variable (transit mode share in this case) on the basis of one or more independent variables such as distance to a metrorail station, number of employees, size of building etc. The resulting equations provide a reliable estimate of the transit mode share. It must be understood, however, that these are not perfect predictors but only tools to be used for general

planning purposes. Individual sites may have transit ridership characteristics that vary widely from the norm. This study has focused on site characteristics that influence transit ridership. However, characteristics of the transit system and the road network also influence transit ridership along with land use characteristics of the general area. Other studies have developed tools based on these and other characteristics. The tools developed in this study must be used in conjunction with the other planning tools available.

The data collection for this study was designed to collect data related to site characteristics, however some of the data collected relates to characteristics of the system and the region as a whole. The implications of these data are discussed where possible. However, to gain the full benefit of the data it must used to supplement other data sources such as demographic and socioeconomic data provided by COG.

The analysis of the data was undertaken in three steps. The first step was to tabulate the data and perform a comparison between this study and the first WMATA study. The data from this survey was in general very similar to that of the first study with the exceptions noted previously. The first study undertook a stepwise regression and produced correlation matrices between pairs of dependent and independent variables. The second step verified correlations between selected variables developed in the first WMATA study based on the survey results and then equations were developed that were practical for planning purposes. The final step involved the merging of the results from the two studies and other data sources where possible to produce a composite set of equations based on the total data available. While some variables that are highly correlated are not practical for inclusion in the equations, their possible implications are discussed.

The candidate dependent and independent variables considered throughout the two studies are discussed below. Suggested planning equations are presented, and the equations are portrayed graphically.

Office

The following candidate dependent and independent variables were identified in the office regression analysis:

Candidate dependent variables

- percent of work trips by auto

- percent of work trips by transit
- percent of work trips by walking
- percent of all mid-day trips by auto
- percent of all mid-day trips by transit
- percent of all mid-day trips by walking
- percent of non-walk mid-day trips by auto
- percent of non-walk mid-day trips by transit
- average auto occupancy

Candidate independent variables

- auto availability
- distance from the DC core, measured in airline miles between the Metrorail station and the closet edge of the DC core area. This distance was considered to be 0 for Farragut West, Metro Center, and Union stations.
- development setting: downtown DC, inside the Beltway, outside the Beltway
- employer type: multiple tenant, single tenant, private sector, government
- number of employees
- employees per 1000 square feet
- GSF gross square feet of building floor area
- percent of those residing in the same state as they work
- distance of the building from the station portal
- percent of drivers with free parking
- cost of parking
- parking spaces per 1000 GSF
- cost for transit users (dollars per day for round trip)
- household size

The philosophy in developing the candidate variables was to include all possible factors that could explain variations in travel characteristics and for which data were available. There are very fine differences between some of the variables (e.g., those

related to cost). Others, such as the auto and transit variables, are complements of one another. Emphasis was placed primarily on developing equations to explain the variations in transit mode share, both for work trips and mid-day trips. Experimenting was also done with several of the other candidate dependent variables.

Factors were only included in an equation if they added significantly to the explanatory power of the equation as a whole. The explanatory power is summarized in the R-squared statistic and is the proportion of the variance in the dependent variable that can be "explained" by the independent variables. If all the variance could be explained, the R-squared value would be 1.0. Several other tests also need to be conducted to determine the extent to which the given equation is valid. Several observations from the regression analysis are discussed below:

When all sites from both studies are included in the data set, the development type is the most correlated with the percent of work trips by transit. This is because of the dramatic difference between the transit mode share for downtown and suburban sites.

When broken into groups by location within the metropolitan area, the most important variable is the distance from the building to the Metrorail station portal.

Including other variables such as auto availability, transit costs, parking, costs, etc. does not significantly increase the R-squared value and are not as easily used in planning applications.

Considered on their own several other non-site factors (household size, auto availability, transit availability) do exhibit mathematical relationships which can be used if information is available to confirm predictions based on site factors.

The expanded data set was used to refine the two sets of equations developed in the first study, one for downtown sites and another for suburban sites. Equations were developed to predict transit mode share for commute trips and for non walk midday trips.

Equations for Downtown Offices

Only one building was surveyed in downtown Washington for this study. The addition of this site to the data base resulted in only a slight change to the suggested equation. The suggested equation is:

$$T = 61.37 - 0.76 * (M)$$

(T = Transit Mode Share)
(M = distance from Metro)

The R-squared value for this equation is a moderate .57, only a slight improvement over the original equation. The equation is graphed in Figure 31. The equation indicates that the transit mode share for a building directly adjacent to a station portal would be slightly over 60 percent. This would decrease by 0.76 percent for each 100 feet distance from the station portal. Intuitively one would not expect the relationship between transit mode share and Metro to be linear. It is more likely that the transit mode share would stay fairly level up until a certain distance is from Metro and then begin to fall off more dramatically as the distance from the station is increased and then leveling off again at the farthest distances. Testing of a non linear relationship with the current data resulted in a curve that dropped off quicker near the station portal and than leveled off similar to the relationship found in two Canadian cities as illustrated in Figure 32. The R^2 of a non-linear equation was slightly better, however, it was felt that without more data the linear relationship was the most appropriate and would suffice as an approximate planning tool producing similar results for distances between 200 and 2,000 feet. Based on the available data from these studies and similar studies elsewhere the proposed equation probably underestimates transit mode share for building sites near a rail station and overestimates transit mode share at more distant sites. This equation should not be considered to be the final answer, but should be modified as the system and the land around it develops. More data is required to better define the equation and improve its validity.

The following equation is suggested to explain the transit mode share for mid-day non-walk trips:

$$T = 62.76 - 1.12 * (M)$$

(T = Transit Mode Share)
(M = distance from Metro)

The R-squared for this equation is 0.33 which is relatively poor. The fact the addition of one site reduced the R-squared from 0.52 to 0.33 illustrates the need for a larger database to improve validity.

The mid-day equation is shown in Figure 33. It is important to note that the equations should not be extended beyond the limits of the available data without more data collection.

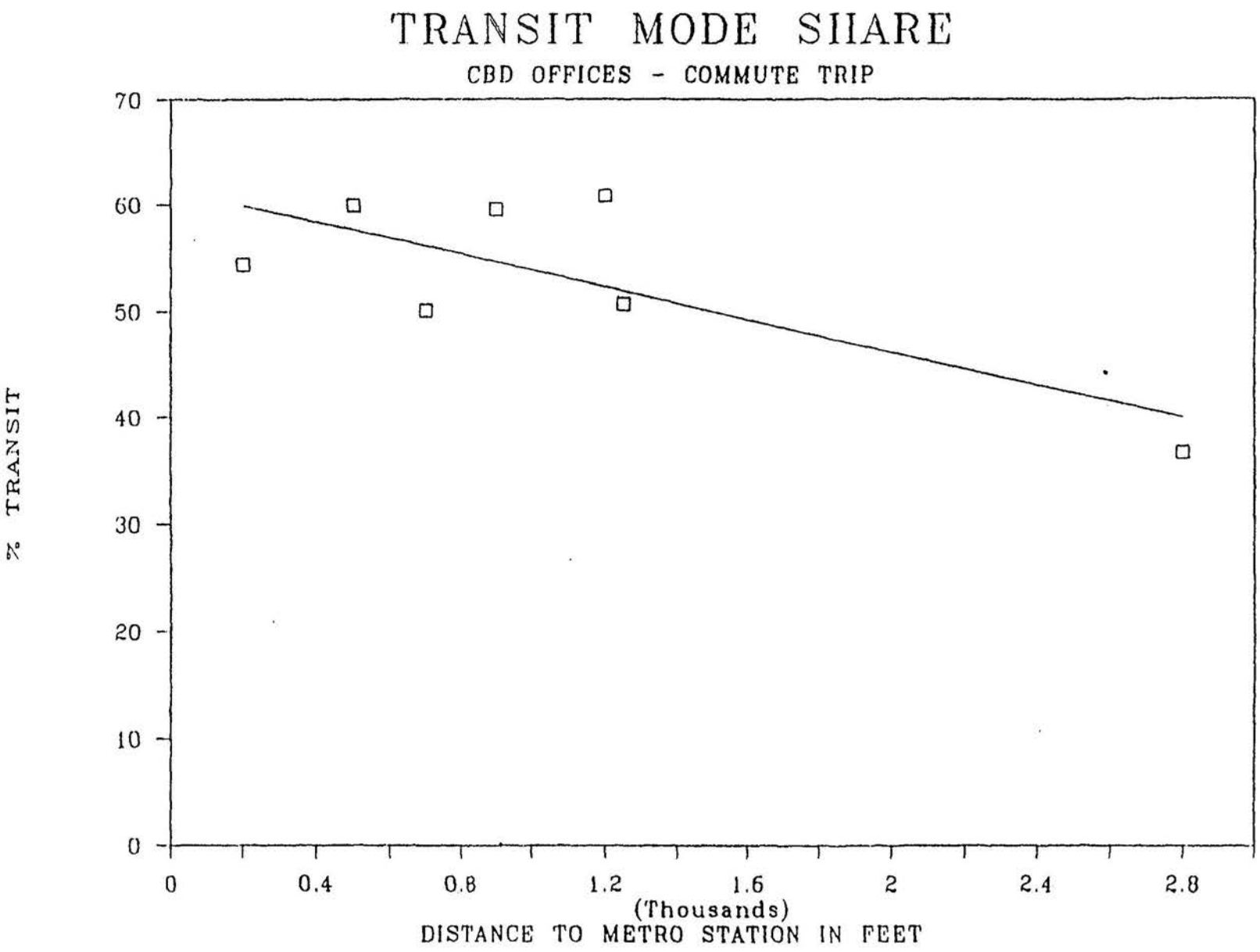
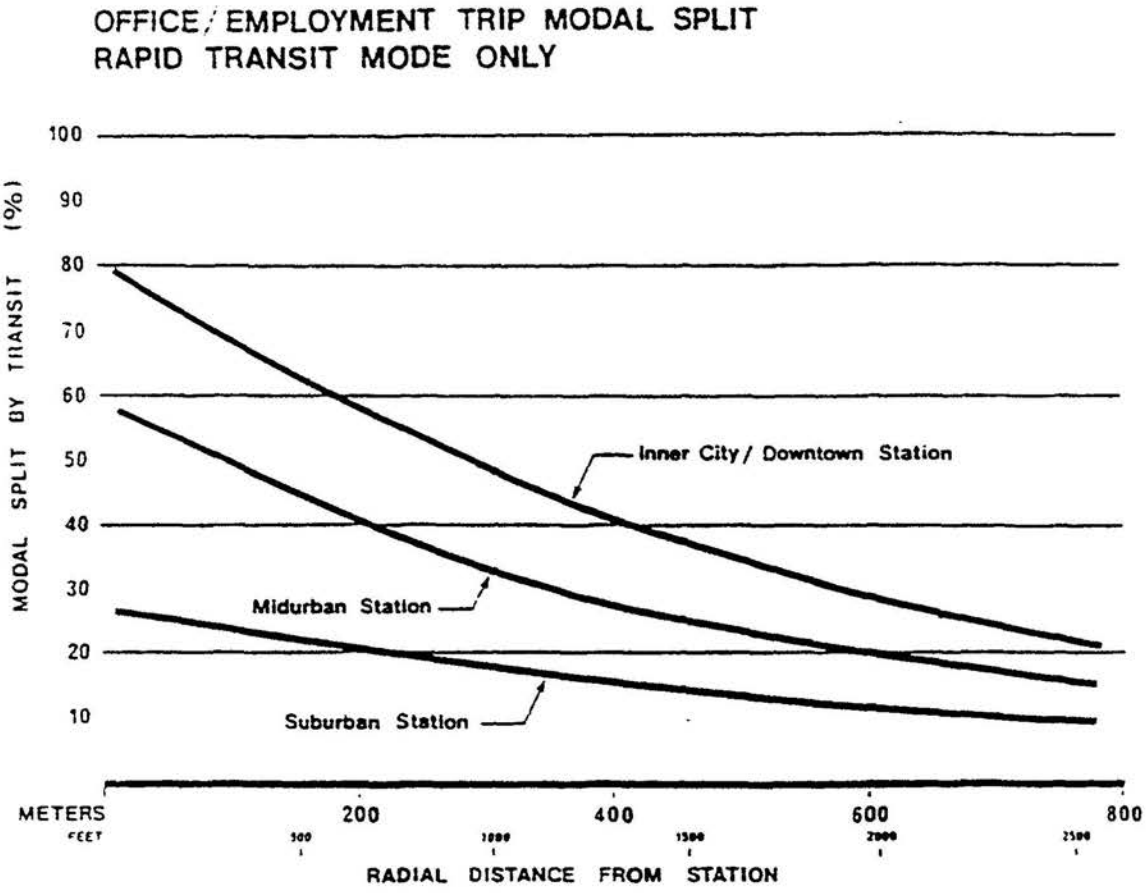

TRANSIT MODE SHARE
CBD OFFICES - COMMUTE TRIP
% TRANSIT
70
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
(Thousands)
DISTANCE TO METRO STATION IN FEET

Figure 31

RAPID TRANSIT MODE SPLIT FOR OFFICE WORK TRIPS
VERSUS WALK DISTANCE TO STATION



Source: Stringham 1983

Figure 32.

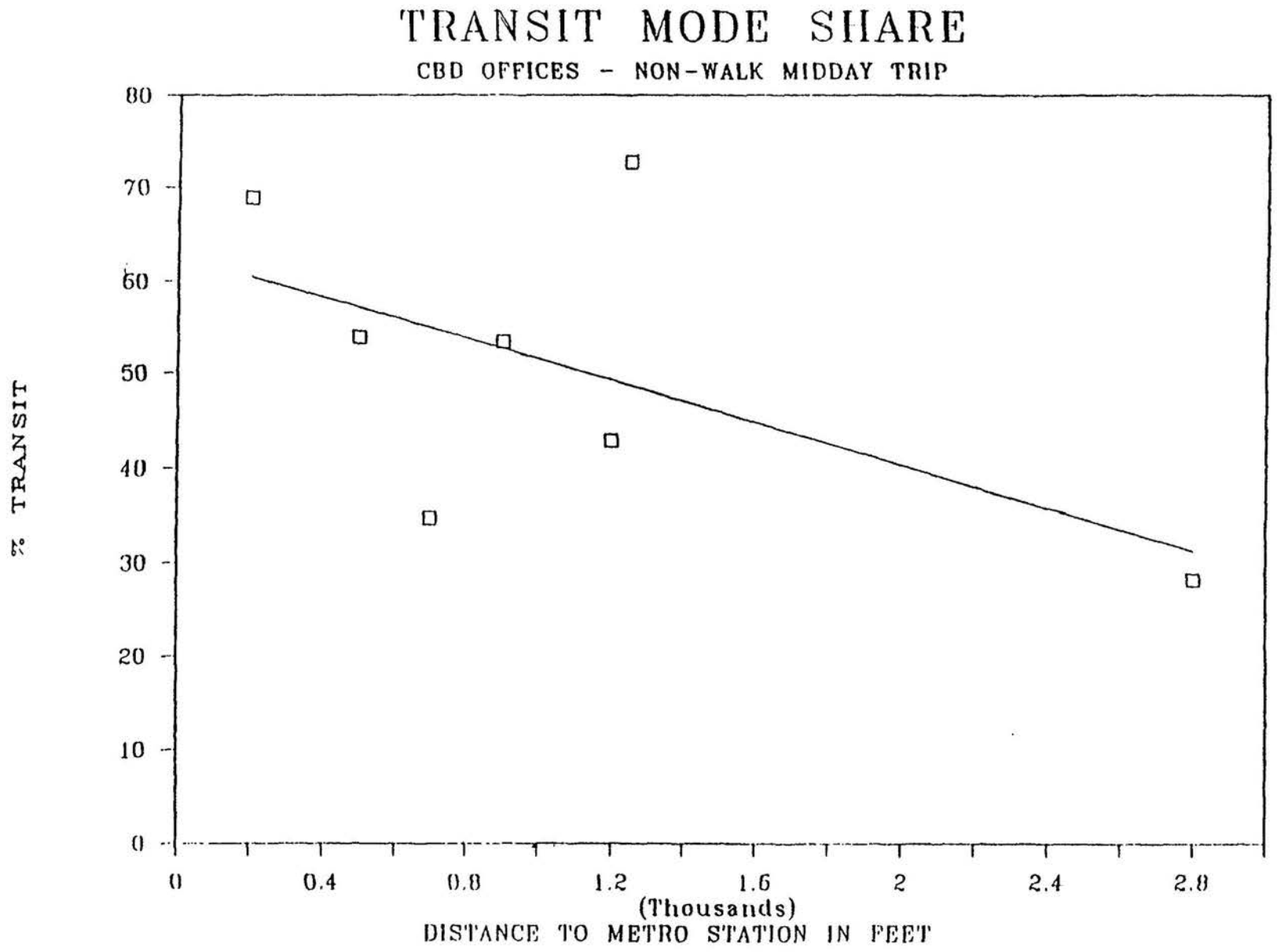

TRANSIT MODE SHARE
CBD OFFICES - NON-WALK MIDDAY TRIP
% TRANSIT
80
70
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
(Thousands)
DISTANCE TO METRO STATION IN FEET

Figure 33

Equations for Suburban Offices

For suburban offices, the following equations are suggested incorporating two independent variables - distance from the DC core, and distance from Metro. Equations that incorporate all applicable data from the first study, the Red Line study and this study are recommended. The equation for the commute trip is:

$$T = 27.16 - 0.61(M) - 0.84(D)$$

(T = Transit Mode Share)
(M = distance from Metro)
(D = distance to downtown)

The R-squared is 0.57. The equation for mid-day non-walk trip is:

$$T = 33.31 - 0.86(M) - 1.63(D)$$

The R-squared for this equation is 0.47.

These equations are considered to be more valid as they include 40 sites for the commute trip and 18 sites for the mid-day trips. This is considerably more than in the first study. As well there are buildings covering the full range of distances. As indicated by the R-squared values there is a better relationship for the commute trip. The two equations are graphed on Figures 34 and 35 respectively.

Residential

The candidate variables for residential sites were as follows:

Candidate dependent variables

- percentage of all trips by auto
- percentage of work trips by auto
- percentage of all trips by transit
- percentage of work trips by walking

Candidate independent variables

- average age of residents
- distance from the DC core

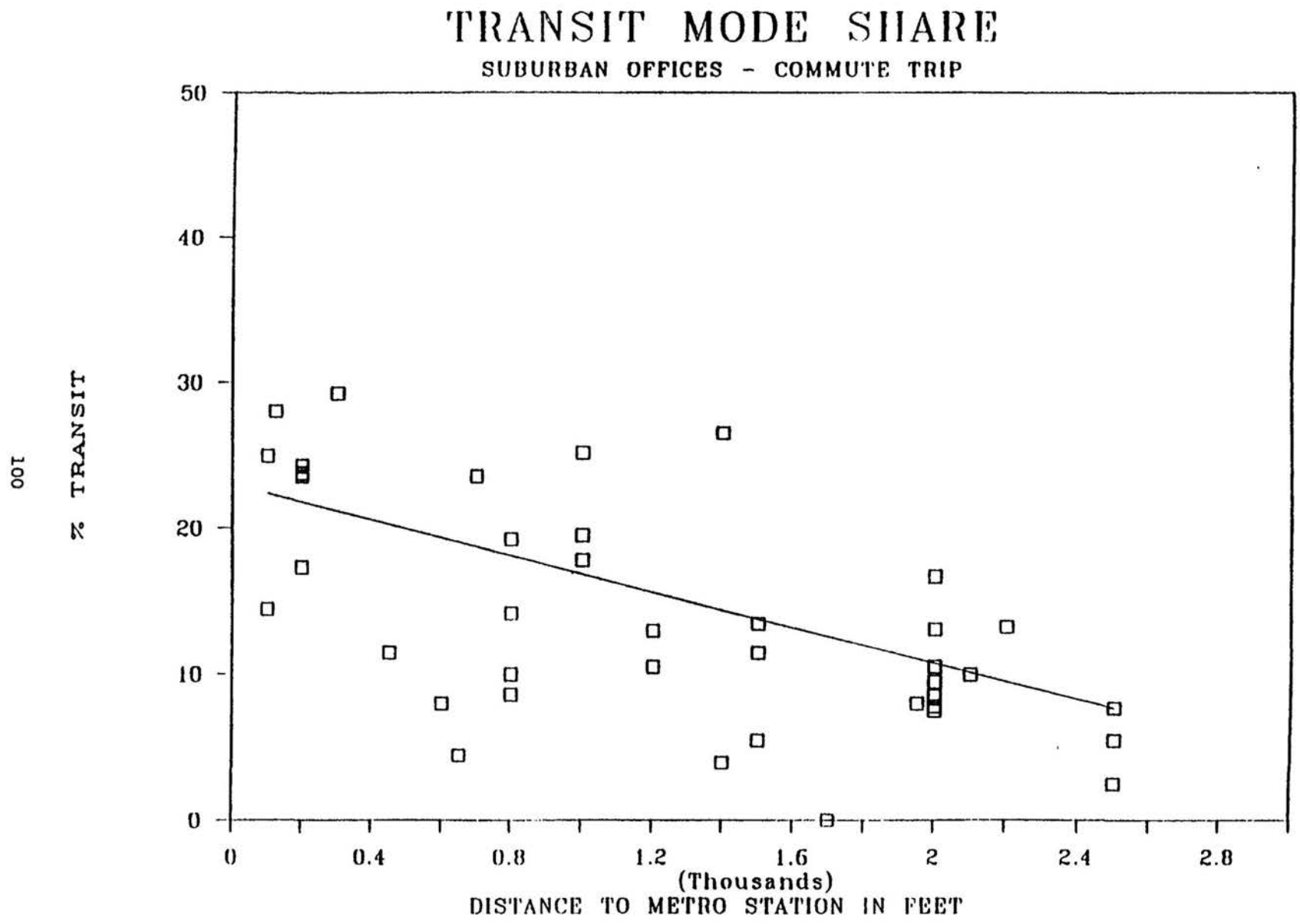

TRANSIT MODE SHARE
SUBURBAN OFFICES - COMMUTE TRIP
% TRANSIT
100
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
(Thousands)
DISTANCE TO METRO STATION IN FEET

Figure 34.