

# Travel to Commercial Centers of the Washington Metropolitan Area

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THIS research demonstrates the further usefulness and adaptability of the home-interview type of metropolitan-area transportation studies to comprehensive urban planning.

The data obtained from the 1948 origin-and-destination study of traffic in the Washington, D. C. metropolitan area has been analyzed to determine the effects that distance of residence and length of driving time has upon trips made to the central business district and to 14 selected suburban shopping centers. Information as to mode of travel and trip purposes to these centers as related to residence locations of persons making the trips were also analyzed.

Methods of analyses also include the development of so-called areas of attraction of the selected study centers by determining the relative attraction of these centers as measured by the length of driving time from places of residence of persons making trips to the centers.

● THE primary purpose of this research is to demonstrate the further usefulness and adaptability of the home-interview type of metropolitan-area transportation studies to comprehensive urban planning.

For a number of years, particularly since the end of World War II, the Bureau of Public Roads has cooperated with the several state highway departments in conducting studies in about 100 metropolitan areas to determine the origin, destination, and characteristics of residents' daily trips in order to provide a more complete basis for the preparation of plans for urban highway improvements.

These comprehensive traffic studies have been eminently successful in acquiring a large volume of data pertinent to comprehensive planning, particularly as concerns the highway systems which form the skeletal patterns of our cities. Unfortunately a great deal of these data have not as yet been fully analyzed. By compiling the interchange of trips between origins and destinations along existing and proposed arterial routes, plans for many metropolitan highway systems have been developed, involving in many cases, the construction of freeway facilities providing for today's traffic, and we hope, tomorrow's. Such plans, however, have been based on a method of analysis which,

though valuable for immediate needs, has been limited to study of only an historical fact. In effect their results say, "The traffic began here and it went to there," and vice versa.

Our cities, however, have been and are in a period of phenomenal spatial expansion. The present period is one of transition from dependence upon a single centralized business center, for instance, to a series of centers including the dominant central business district; from dense population masses to suburban sprawl. This tendency has been materially aided by the widespread public recognition of the desirability of the private automobile as a means of convenient personal transportation. Changes, however, whether good or bad in theory, are inherent in cities and necessary for continued healthy existence. These changes in the character of the various parts of the city must be recognized as symbolic of the changing desires of the people. The highway engineer should have a better understanding of the causes of such population movements and desires if he is to prepare not only for the dynamic present but for the problematical future.

We need to dimension our problems; to establish factors or patterns of the public's travel behavior by which we can recognize

probable future changes in the composition of our metropolitan areas; to have a measure of the effects of such changes upon the traffic pattern of our highway systems, if we are to preserve and increase the efficiency of these systems.

travel time and distance as these factors affect a resident population whose living pattern has yearly become more mobile due to the widespread acceptance of the motor vehicle as almost a necessity of American life. Cannot indices be de-

Table 1

COMPARISON OF PURPOSES OF ALL TRIPS TO SELECTED SUBURBAN SHOPPING CENTERS AND TO THE CENTRAL BUSINESS DISTRICT OF THE WASHINGTON, D C METROPOLITAN AREA - 1948

Shopping centers		Work	Business	Social and recreation	Shopping	Other	Total	Major trip purposes
1 Bethesda, Maryland	Number	2,576	795	2,343	4,047	1,870	11,631	Shop.-work-soc rec
	Percent	22 1	6.8	20 1	34 8	16 2	100 0	
2 Silver Spring, Maryland	Number	3,254	407	2,940	3,466	1,273	11,340	Shop -work-soc. rec.
	Percent	28.7	3.6	25.9	30.6	11 2	100 0	
3 Shirlington, Virginia	Number	697	68	601	2,593	707	4,666	Shop -work-soc rec
	Percent	14 9	1.5	12.8	55 6	15 2	100 0	
4 Clarendon, Virginia	Number	1,036	333	879	2,254	703	5,205	Shop.-work-soc. rec.
	Percent	19.9	6 4	16.9	43 3	13 5	100 0	
5 Sears, Roebuck and Co. (Wisconsin Ave , N W )	Number	480	178	350	2,014	424	3,446	Shop.-work-soc rec
	Percent	13 9	5 2	10 2	58 4	12 3	100 0	
6. Alexandria, Virginia	Number	2,551	1,021	2,395	1,692	1,749	9,408	Work-soc. rec -shop
	Percent	27.1	10 8	25 5	18 0	18 6	100.0	
7 Columbia Pike, Virginia	Number	855	150	894	1,603	401	3,903	Shop.-soc rec -work
	Percent	21 9	3 8	22 9	41.1	10 3	100 0	
8 Fairlington, Virginia	Number	147	63	889	1,430	206	2,715	Shop -soc rec -other
	Percent	5 4	2 3	32.0	52 7	7.6	100.0	
9 Chevy Chase, D. C	Number	323	386	766	1,272	1,762	4,509	Other-shop -soc. rec
	Percent	7 2	8 6	17 0	28 2	39.0	100.0	
10 Arlandria, Virginia	Number	149	20	293	1,263	291	2,016	Shop -soc. rec -other
	Percent	7 4	1 0	14 5	62 7	14.4	100.0	
11 Sears, Roebuck and Co (Bladensburg Road, N E )	Number	573	64	165	1,171	83	2,056	Shop -work-soc. rec
	Percent	27.9	3 1	8.0	57 0	4 0	100.0	
12 Hyattsville, Maryland	Number	1,034	273	803	643	558	3,311	Work-soc rec. -shop
	Percent	31 2	8 2	24 3	19.4	16 9	100 0	
13. Anacostia, D C	Number	445	147	619	251	208	1,670	Soc rec -work-shop.
	Percent	26 6	8 8	37 1	15.0	12.5	100.0	
14. Falls Church, Virginia	Number	434	90	569	224	258	1,575	Soc. rec -work-shop.
	Percent	27.6	5.7	36.1	14 2	16.4	100 0	
Total - Suburban centers	Number	14,554	3,995	14,486	23,923	10,493	67,451	
	Percent	21 6	5.9	21.5	35 5	15.5	100 0	
Central business district "Core Area" (Trips with origin in C B D not included)	Number	48,881	8,811	14,753	25,123	9,584	107,152	Work-shop -soc rec.
	Percent	45 6	8 2	13 8	23 4	9 0	100.0	
Grand total - all trips	Number	63,435	12,806	29,239	49,046	20,077	174,803	
	Percent	36 3	7.3	16 8	28 1	11.5	100 0	

We need to understand more about the effects of different types of housing developments upon the adjacent highways, if we are to better provide for the next phase of suburban expansion. For the same reason do we not need to study the effects of dispersed industry upon the travel habits of its employees? Travel to work; to shop; and for social-recreational purposes. What about shopping centers? Where and when are they going to develop in our communities?

How and where does transit fit into the urban transport picture? We need to inquire further into the relationship between

veloped for cities of various population size, economic similarity, etc., to provide a yardstick by which those responsible for highway and traffic facilities can better determine where and when in spatial growth the attractiveness of the central business district will begin to decline and sub-centers develop to serve more conveniently the daily needs of the suburban public? The answer to these questions and many more lie within the developed statistics of the metropolitan area traffic study. They need to be further analyzed.

To determine the value of the origin-and-destination studies to answer these

and other questions, the Bureau of Public Roads began an analysis based on data produced by the Washington, D. C., Regional Highway Transportation Study of 1948.

The methodology was basically simple. We studied the quantity of trips, the mode of travel, and the purpose for which trips were made as related to time of travel from place of residence to 14 selected

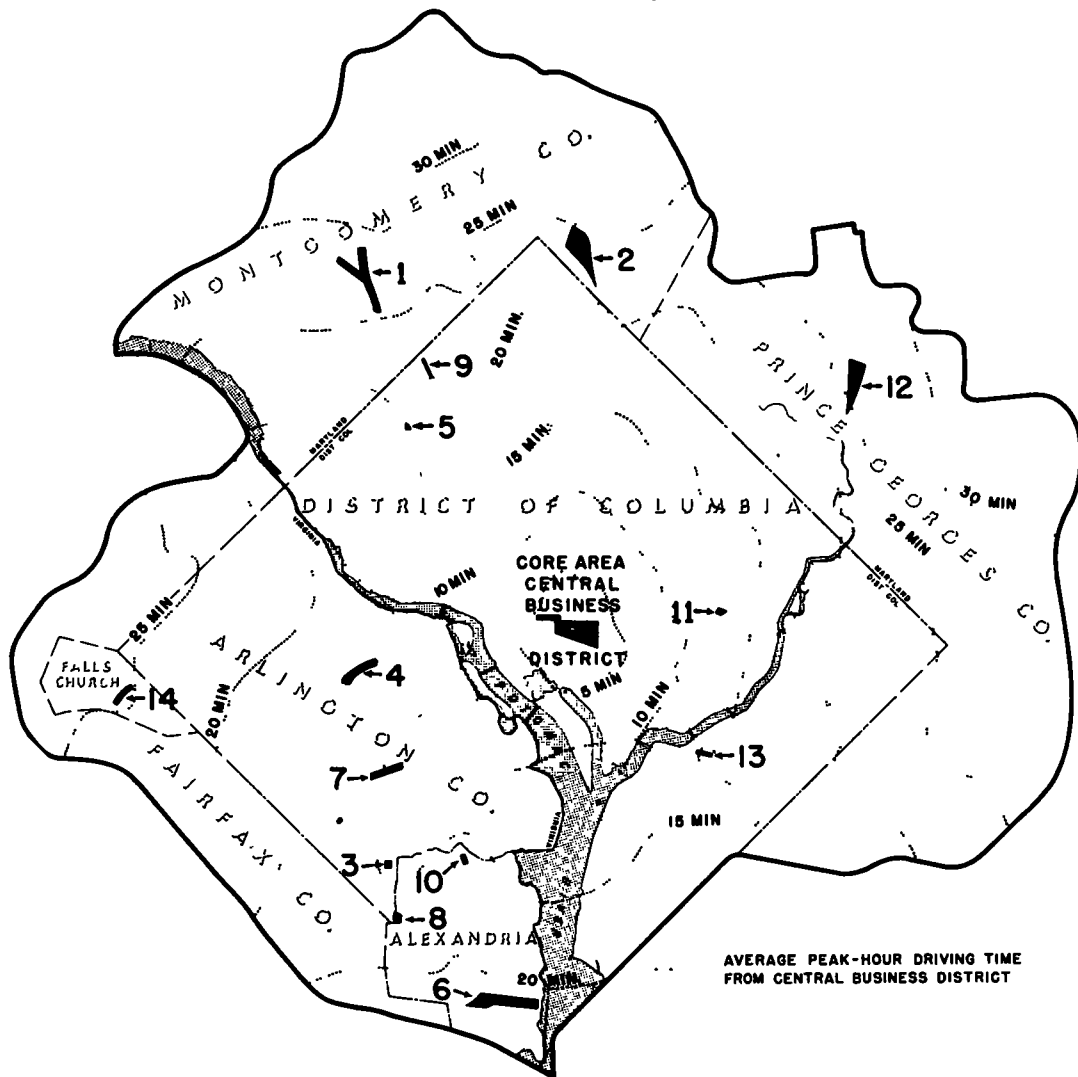


Figure 1. Location of selected suburban shopping centers and the central business district in the Washington, D. C., metropolitan area (1948).

As urban growth in Washington is currently synonymous with the often expressed phase "decentralization," it was logical to attempt the determination and measurement of the degree of such peripheral movement. This would be reflected by the trips made by residents of the metropolitan area to selected suburban shopping centers and to the central business district as related to their place of residence.

suburban shopping center destinations and to the central business district. The locations of these centers are shown in Figure 1. We also studied the effects that distance of residence had upon the volume, and character of trips made to the central business district. Trips from outside the metropolitan area were not included in the study as they would have prevented accurate correlation of the data. The

research is continuing, but quickening changes in our daily life require new understanding of their motivations. This, then, is in effect a progress report. It is not a manual of arithmetical proportions but rather the results of some in-

centers. Shopping trips to the core area represented almost a quarter of all shopping trips made by residents of the metropolitan area. More striking perhaps, is the fact that more than three times as many work trips were made to the core

Table 2  
COMPARISON OF MODES OF TRAVEL OF ALL TRIPS TO SELECTED SHOPPING CENTERS BY MODES OF TRAVEL BY RESIDENTS OF THE WASHINGTON, D. C. METROPOLITAN AREA - 1948

Shopping centers		Auto driver	Auto passenger	Taxi passenger	Total auto trips	Total transit trips	Total
1 Bethesda, Maryland	Number	6,586	4,034	131	10,751	880	11,631
	Percent	56.6	34.7	1.1	92.4	7.6	100.0
2. Silver Spring, Maryland	Number	5,368	3,612	170	9,150	2,190	11,340
	Percent	47.3	31.9	1.5	80.7	19.3	100.0
3 Shirlington, Virginia	Number	2,645	1,454		4,099	587	4,686
	Percent	56.7	31.1		87.8	12.2	100.0
4 Clarendon, Virginia	Number	2,406	1,907		4,313	892	5,205
	Percent	46.2	36.7		82.9	17.1	100.0
5. Sears, Roebuck and Co (Wisconsin Ave., N.W.)	Number	1,750	1,074		2,824	622	3,446
	Percent	50.8	31.2		82.0	18.0	100.0
6. Alexandria, Virginia	Number	4,526	2,263	156	6,945	2,463	9,408
	Percent	48.1	24.1	1.6	73.8	26.2	100.0
7. Columbia Pike, Virginia	Number	2,166	1,210		3,376	527	3,903
	Percent	55.5	31.0		86.5	13.5	100.0
8. Fairlington, Virginia	Number	1,447	849		2,296	419	2,715
	Percent	53.3	31.3		84.6	15.4	100.0
9 Chevy Chase, D.C.	Number	2,057	1,423	22	3,502	1,007	4,509
	Percent	45.6	31.6	0.5	77.7	22.3	100.0
10 Arlandria, Virginia	Number	1,263	691		1,954	62	2,016
	Percent	62.6	34.3		96.9	3.1	100.0
11. Sears, Roebuck and Co (Bladensburg Road, N.E.)	Number	1,112	559	21	1,692	364	2,056
	Percent	54.1	27.2	1.0	82.3	17.7	100.0
12 Hyattsville, Maryland	Number	1,626	994		2,620	691	3,311
	Percent	49.1	30.0		79.1	20.9	100.0
13 Anacostia, D.C.	Number	776	411		1,187	463	1,650
	Percent	46.5	24.6		71.1	28.9	100.0
14 Falls Church, Virginia	Number	874	503	46	1,423	152	1,575
	Percent	55.5	31.9	2.9	90.3	9.7	100.0
Total - suburban centers	Number	34,602	20,984	546	56,132	11,319	67,451
	Percent	51.3	31.1	0.8	83.2	16.8	100.0
Central business district "Core Area" (Trips with origin in C.B.D. not included)	Number	22,310	13,259	4,682	40,251	66,901	107,152
	Percent	20.8	12.4	4.4	37.6	62.4	100.0
Grand Total - all trips	Number	56,912	34,243	5,228	96,383	78,220	174,603
	Percent	32.6	19.6	3.0	55.2	44.8	100.0

quiries into the who, what, when where, and why of population movements in the Washington Metropolitan Area.

What are some of the results? By comparing trips to the fourteen selected shopping centers with trips to the core area, or retail business center of the central business district, we find the certain facts for an average weekday in 1948 (see Fig. 2).

Of particular interest, is the fact that approximately the same number of shopping trips, and also social-recreational trips, were made to the core area as were made to the combined 14 suburban

area than to all the other selected shopping centers combined.

The core area, attracting trips to business and professional establishments, is used for this comparison so that the results might be comparable to the business activities of the suburban centers as well as the central business district's of other cities. If the better than 100,000 work trips to the nearby downtown offices, largely governmental, are included, the ratio would be more than 10 to 1.

The importance of these work trips is emphasized because they represent potential shoppers, many of whom walk to

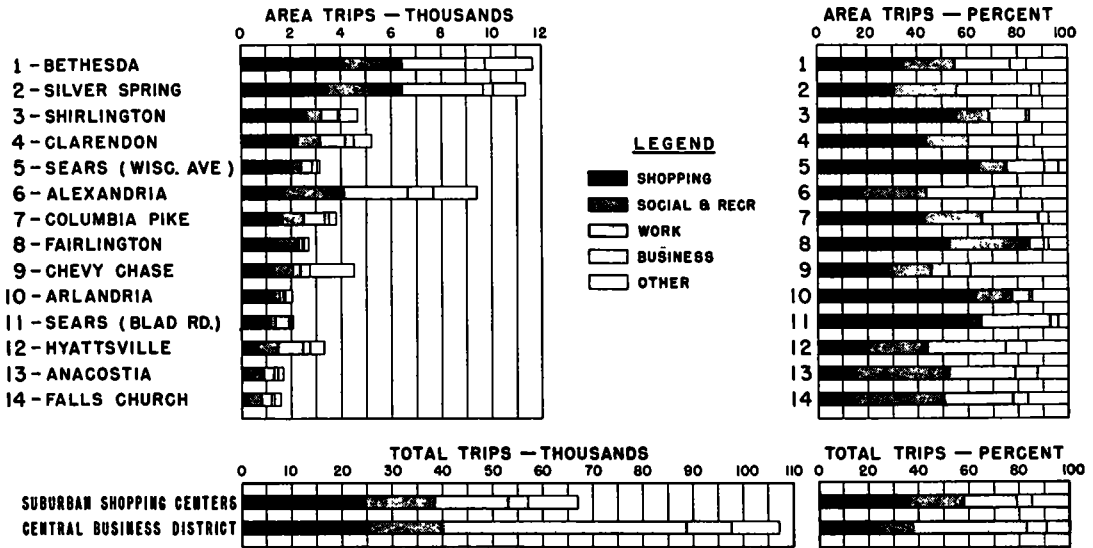


Figure 2. Comparison of trips to selected suburban shopping centers and to the central business district.

and from their place of employment to shop. This, of course, also would be true of the much-smaller number of workers in the suburban centers which serve primarily large residential concentrations.

Another illuminating item is that, of the total trips to the central business district regardless of purpose, two thirds were by transit (Fig. 3) and over 70 percent of the shopping trips to downtown Washington were also performed via mass transit (Table 3). By contrast, an average of 88 percent of all shopping trips

to the selected 14 suburban centers were by automobile. For the whole metropolitan area, 64 percent of the total shopping trips were made by automobile. Certainly it is obvious that the downtown merchants were greatly dependent on transit to bring shoppers to the central business district in 1948.

Knowing from reported figures that the core area of the central business district is by far the dominant retail market, the major purposes for which trips were made to this center were arranged in order of

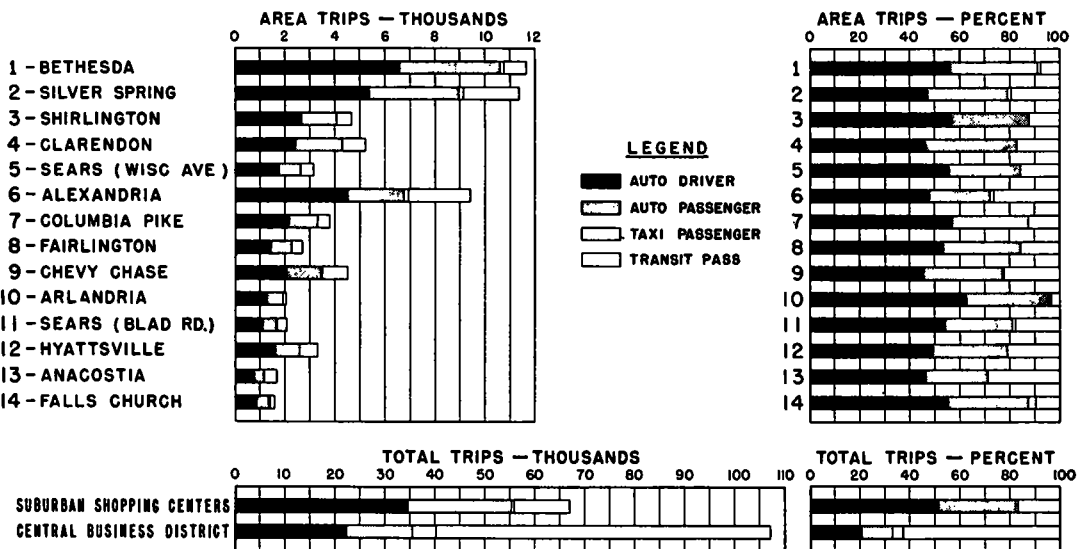


Figure 3. Comparison of trips to selected suburban shopping centers and to the central business district.

their frequency for use, perhaps, as a criterion by which other centers would be measured. The developed pattern of trip purposes to this area were in order: work, shopping, and social-recreational. The suburban centers, however, have a somewhat different pattern; ten having

in addition to the presently attracted shopping trips made by automobile or transit from surrounding residential areas. By providing a more-varied and better-balanced commercial composition, such centers would attract additional new business to locate their facilities within their

Table 3

COMPARISON OF MODES OF TRAVEL OF SHOPPING TRIPS TO SELECTED SHOPPING CENTERS AND TO THE CENTRAL BUSINESS DISTRICT OF THE WASHINGTON, D C METROPOLITAN AREA - 1948

Shopping centers		Auto driver	Auto passenger	Taxi passenger	Total auto trips	Total transit trips	Total	
1	Bethesda, Maryland	Number	2,664	1,227	22	3,913	134	4,047
		Percent	65.8	30.3	0.6	96.7	3.3	100.0
2	Silver Spring, Maryland	Number	1,950	1,002	85	3,037	429	3,466
		Percent	56.3	28.9	2.4	87.6	12.4	100.0
3	Shirlington, Virginia	Number	1,595	769		2,364	229	2,593
		Percent	61.5	29.7		91.2	8.8	100.0
4	Clarendon, Virginia	Number	945	797		1,742	512	2,254
		Percent	41.9	35.4		77.3	22.7	100.0
5	Sears, Roebuck and Co (Wisconsin Ave, N W)	Number	1,178	591		1,769	245	2,014
		Percent	58.5	29.3		87.8	12.2	100.0
6	Alexandria, Virginia	Number	901	355	41	1,297	395	1,692
		Percent	53.3	21.0	2.4	76.7	23.3	100.0
7	Columbia Pike, Virginia	Number	1,008	362		1,370	233	1,603
		Percent	62.9	22.6		85.5	14.5	100.0
8	Fairlington, Virginia	Number	1,014	270		1,284	146	1,430
		Percent	70.9	18.9		89.8	10.2	100.0
9	Chevy Chase, D. C	Number	749	322		1,071	201	1,272
		Percent	58.9	25.3		84.2	15.8	100.0
10	Arlandria, Virginia	Number	867	375		1,242	21	1,263
		Percent	68.6	29.7		98.3	1.7	100.0
11	Sears, Roebuck and Co (Bladensburg Road, N E)	Number	610	352	21	983	188	1,171
		Percent	52.1	30.0	1.8	83.9	16.1	100.0
12	Hyattsville, Maryland	Number	311	249		560	83	643
		Percent	48.4	38.7		87.1	12.9	100.0
13	Anacostia, D C	Number	147	21		168	83	251
		Percent	58.6	8.4		67.0	33.0	100.0
14	Falls Church, Virginia	Number	114	87		201	23	224
		Percent	50.9	38.8		89.7	10.3	100.0
Total - suburban centers		Number	14,053	6,779	169	21,001	2,922	23,923
		Percent	58.7	28.3	0.8	87.8	12.2	100.0
Central business district "Core Area" (Trips with origin in C B D not included)		Number	3,003	3,088	1,169	7,260	17,863	25,123
		Percent	12.0	12.3	4.6	28.9	71.1	100.0
Grand Total - all trips		Number	17,056	9,867	1,338	28,261	20,785	49,046
		Percent	34.8	20.1	2.7	57.6	42.4	100.0

shopping as the primary purpose, two having social-recreational trips, and the remaining two (which are older, independent cities) having work as the major purpose of trips. The four suburban centers having the greatest volume of shopping trips had only to increase their work opportunities to have the same purpose pattern as the central business district (Table 1).

By creating greater employment opportunities in their environs, currently successful shopping centers could develop a static or captive market for retail sales

boundaries, thus continuing the business-expansion cycle.

Such expansion would be reflected in part by increased traffic volumes from an expanding area of attraction.

What is this area of attraction? It is the area from which are attracted the predominant number of trips to the center. This area varies in size in accordance not only with the variety and quality of goods and services offered by the center, but also by the convenience of accessibility provided by transport.

To determine, if possible, the extent

of the central business district's area of attraction and to measure the effects that distance of residence from the center had upon person's travel, the metropolitan area was divided into concentric rings at 2-mi. intervals from the Zero Milestone, modified as necessary to fit boundaries of the zones used in the origin-and-destination survey (see Fig. 4). Trips by resi-

crease was 15 percent. Residents within the first 2 mi., or Ring 1, made 72.5 percent of their trips to the central business district by transit, while 72.5 percent of the trips by residents of the area beyond 8 mi. from the central business district were made by automobile (Fig. 7).

Figure 8 graphically illustrates the increasing effect distance of residence (or

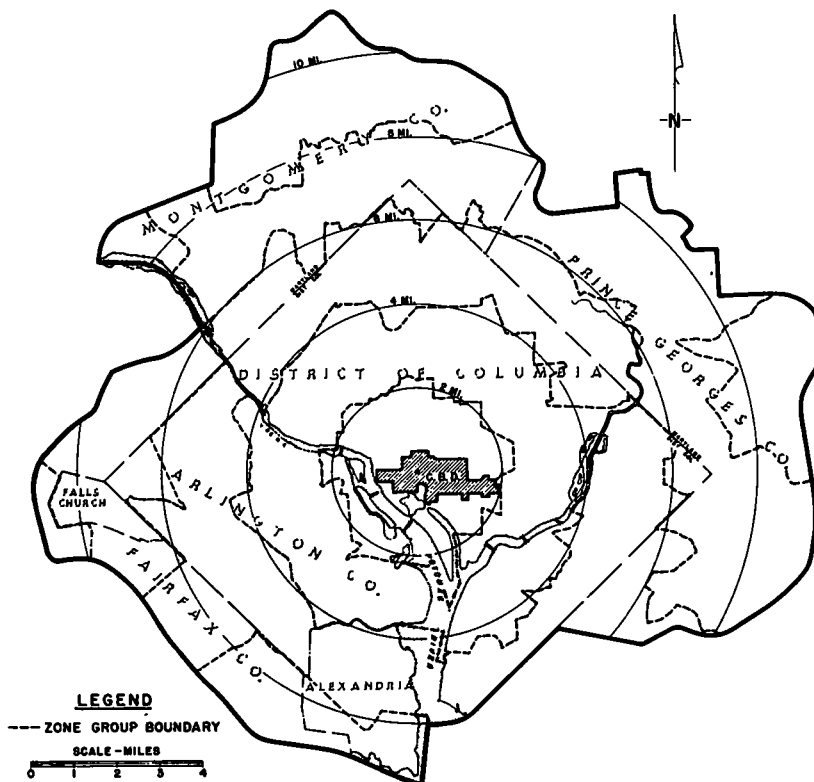


Figure 4. Zone groupings in accordance with distance from central business district.

dents of these rings to the central business district were then analyzed as to mode and purpose as related to their place of residence.

Here are some of the results:

1. As distance from the central business district increased beyond 2 mi., a consistently lower proportion of the total trips made by residents of each ring are made to the central business district. This applies to shopping as well as to total trips (Figs. 5 and 6).

2. Also, for each 2-mi. increment from the center, the percentage of trips made via transit decreased approximately 10 percent, except that from the 6-to-8-mi. zone to the 8-to-10-mi. zone the de-

crease was 15 percent. Residents within the first 2 mi., or Ring 1, made 72.5 percent of their trips to the Washington central business district. The percentage distribution of the resident population among the several rings also included on this chart, emphasizes the lessening attraction of the central business district and of transit, at distance increases, particularly beyond 6 mi. In 1948 almost 90 percent of all trips to the central business district came from the area within 6 mi. of distance, 93 percent of the transit trips, and 84 percent of the automobile trips. However, transit's predominant usage, or almost 70 percent, came from within 4 mi. of the central business district, while the predominant proportion of automobile usage extended to

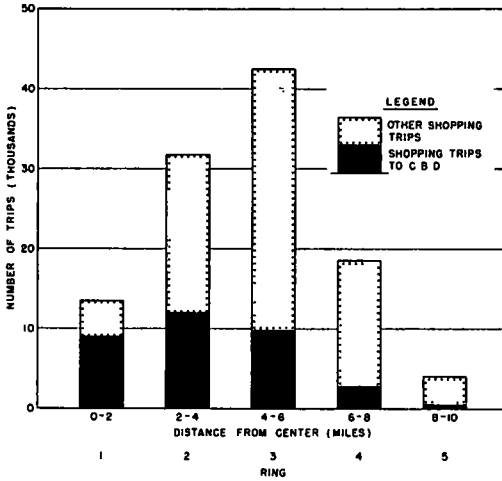


Figure 5. Distribution of total shopping trips versus shopping trips destined to central business district by residents of each ring for average weekday.

approximately 6 mi. This 6 mi. then was the outer limits of the primary area of attraction in 1948, as measured by distance.

In this same 6-mi. radius area about the central business district resided 84 percent of the total population, which incidentally was occupying only 56 percent of the total gross land area. To eliminate reasonable doubt as to the declining attraction of the central business district as distance of residence increased, comparisons were made between the percentage distribution of the population among the concentric rings with the percentage

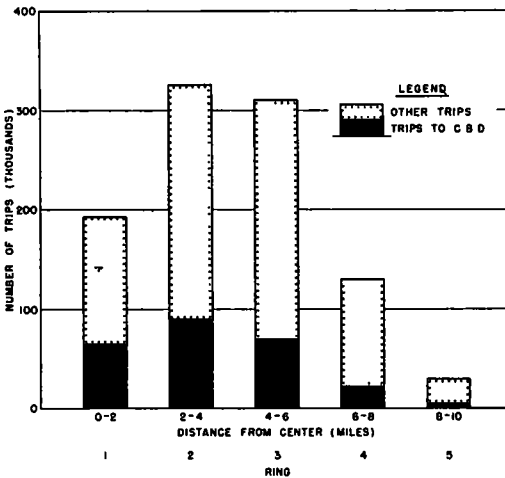


Figure 6. Distribution of all trips versus trips destined to central business district by residents of each ring.

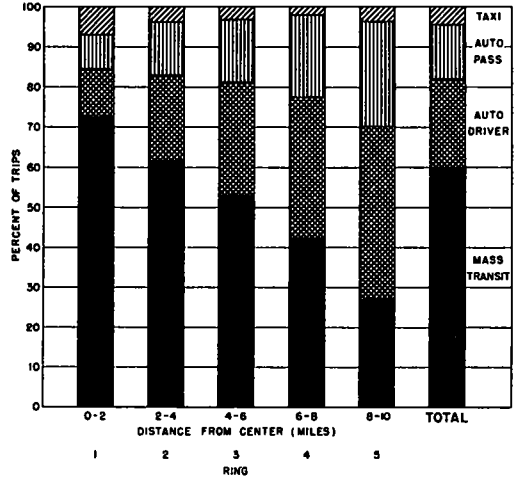


Figure 7. Mode of travel of trips to the central business district by residents of each ring.

distribution of trips to the central business district.

This resulted in a ratio of the percent of trips to the percent of population as shown in Table 4.

From this comparison table we see that the greatest proportion of trips in relation to population distribution came from the area within four miles of the central business district, and the trip percentage decreased to almost equal the population in the 4-to-6-mi. zone. Beyond 6 mi. the ratio of trips to population dropped precipitously.

This same relation exists when we con-

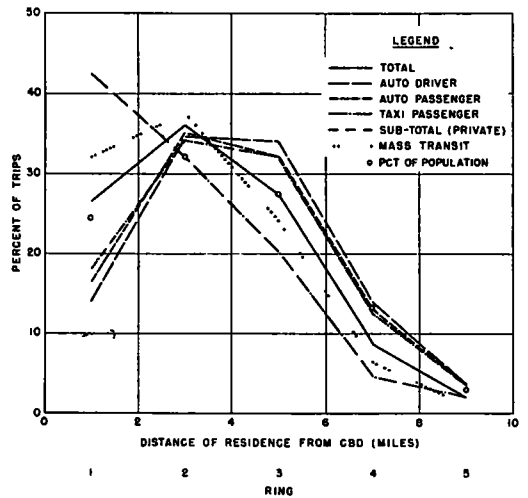


Figure 8. Proportion of all trips by each mode of travel to the central business district by residents of each ring.



sider the percentage distribution by trip purposes throughout the metropolitan area. For example, the greatest percentage of shopping trips to the central business district was made by residents of the ring 2

TABLE 4

COMPARISON OF THE PERCENTAGE DISTRIBUTION OF TRIPS MADE TO THE CENTRAL BUSINESS DISTRICT AND OF THE RESIDENT POPULATION OF CONCENTRIC RINGS OF THE WASHINGTON, D. C. METROPOLITAN AREA - 1948

Ring	Distance from central business district (miles)	Percent resident population	Percent of all trips to the central business district	Ratio of trips/population
1	0 - 2	24.5	28.2	1.07
2	2 - 4	32.0	35.9	1.12
3	4 - 6	27.5	27.2	0.99
4	6 - 8	13.1	8.8	0.67
5	8 - 10	2.9	1.9	0.66
		100.0	100.0	

to 4 mi. distant where the ratio of such percentage to the population percentage was 1.09, while beyond 6 mi. the ratio dropped to 0.65.

Somewhat surprisingly, the percentage distribution of trip purposes for the residents of the different rings were remarkably similar. For instance, approximately 13 percent of all trips made by the residents of each of the concentric areas to the central business district were for shopping. The exceptions were for business and for "other" purposes which declined near the periphery of the area.

In summary, as distance increased beyond 6 mi., the attraction of the central business district decreased rapidly, as measured by the percentage and purpose of trips in relation to the resident population percentage. Also, transit usage for trips to the central business district, though dominant within the first 4 mi.,

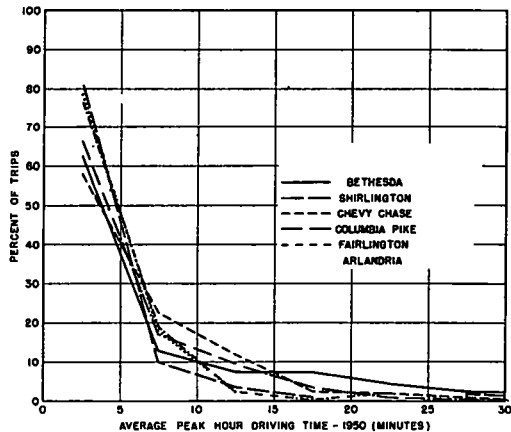


Figure 9. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

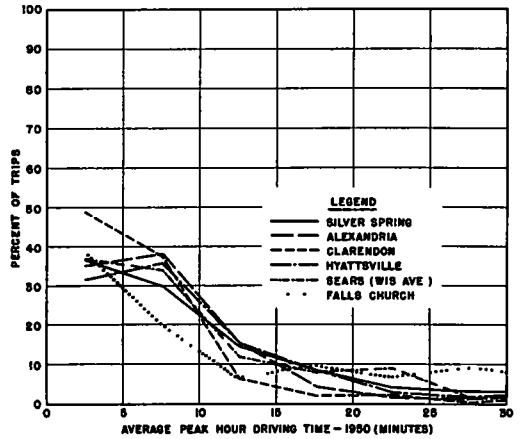


Figure 10. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

decline proportionately as distance increased, except for shopping trips. Beyond 6 mi. the automobile provided the major means of travel. Although not illustrated here, it is noted that for work and shopping trips to the central business district, transit carried the major load, while social-recreational trips to the same area were predominantly by automobile. For these same purposes almost two thirds of the trips made to other places in the metropolitan area utilized the automobile.

Having determined that the central business district has a definable area of attraction as measured by distance and the effect that distance has upon travel, it

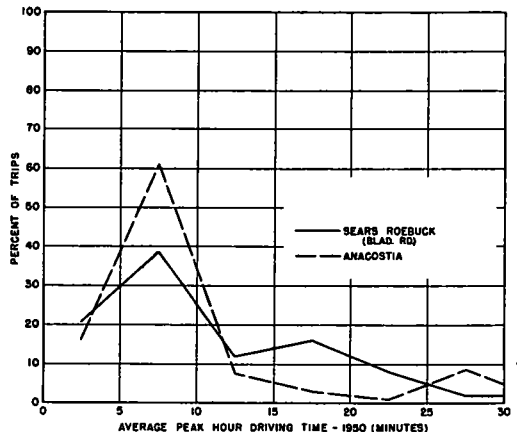


Figure 11. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

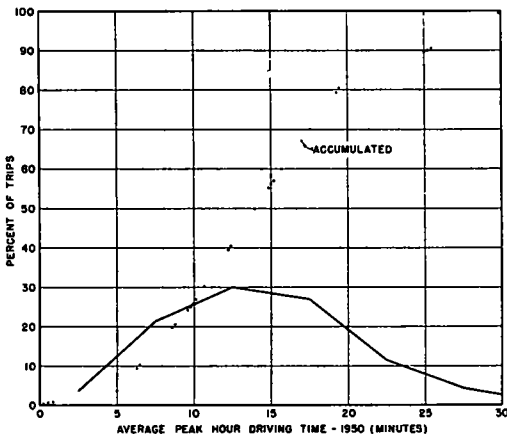


Figure 12. Distribution of all trips to the core area of the central business district by driving time from place of residence.

seemed likely that even more significant relationships could be established on the basis of time of travel. This factor was regarded as a better measure of the actual accessibility of the center to the residents of the different areas.

Residences of persons making trips

to each of the 15 selected study centers were therefore plotted on maps of the area and equal driving time zones of 5-min. intervals from each center were superimposed. Various pertinent data have been tabulated relating to trips per dwelling unit, trips per person, etc., but of initial interest are the results of the analysis pertaining to the area of attraction of these centers as measured by driving time from places of residence.

Early in this study, considerable differences in trip-frequency-distribution patterns became apparent. For the 15 selected shopping centers, four separate pattern groups finally evolved; one group, shown in Figure 9, is for six centers which had 60 to 80 percent of their total trips within 5 min. of driving time; another (Fig. 10) is for six having 30 to 50 percent of their trips within 5 min. of driving time; a third (Fig. 11) is for two with 16 to 20 percent within 5 min. of driving time; and the fourth is for the central business district, (Fig. 12) with only 4 percent of the trips within this initial time period. As is apparent, the developed

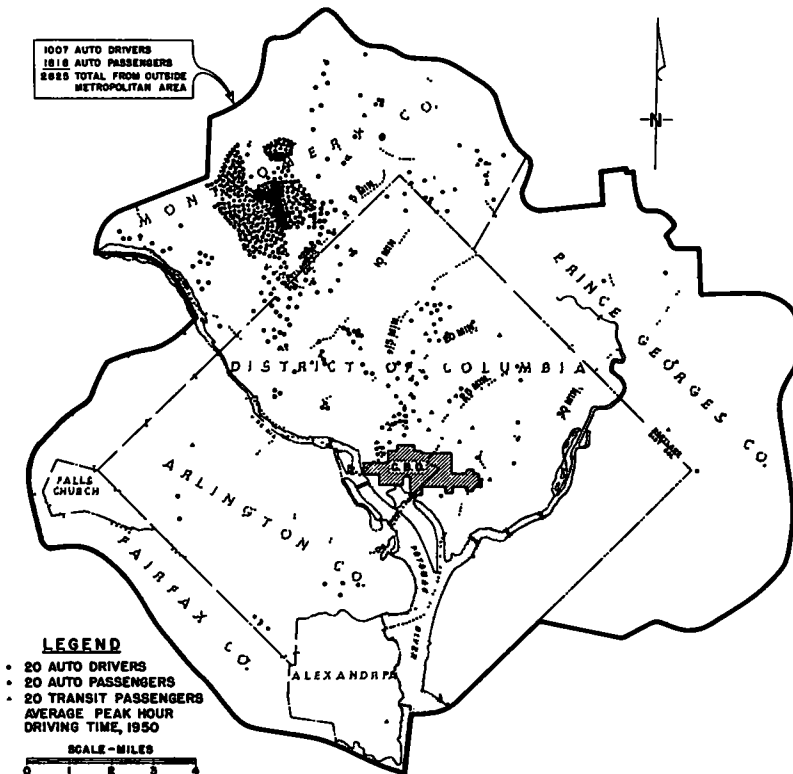


Figure 13. Place of residence and mode of travel of persons making trips to Bethesda shopping center.

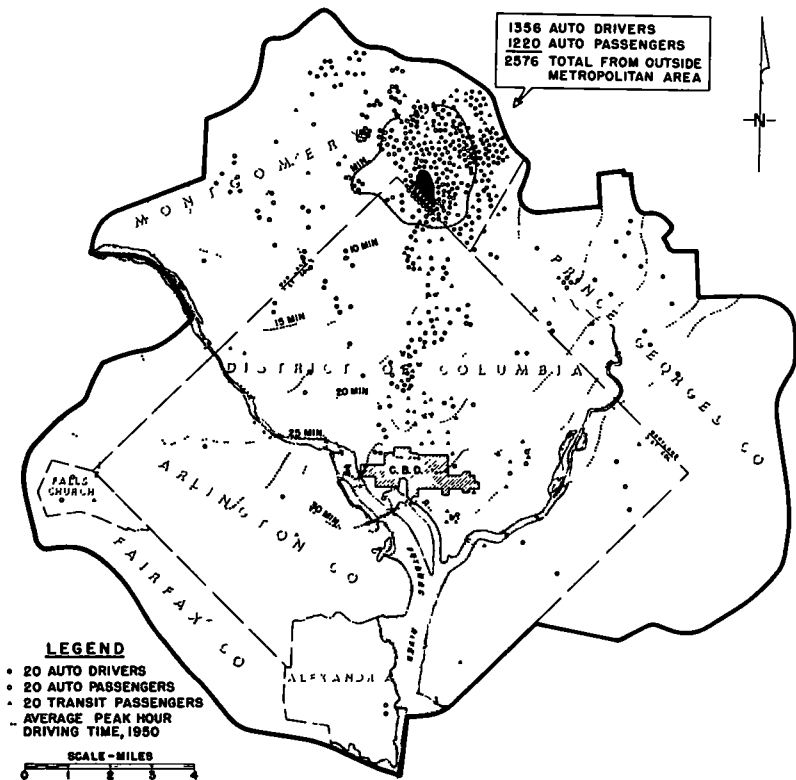


Figure 14. Place of residence and mode of travel of persons making trips to Silver Spring shopping center.

trip-frequency curves are quite different for the different groups. The curve for the central business district's core area is unique, with no more than 30 percent of the trips within any 5-min. driving time zone, and with its apex between 10 to 15 min. of driving time. This indicates that

its market area was of broader dimensions than that of the suburban centers, and that many persons within, say 5 min. of driving time, walked rather than rode from their residence to the central business district. Considering their entire length, the trip-frequency curves for the group of

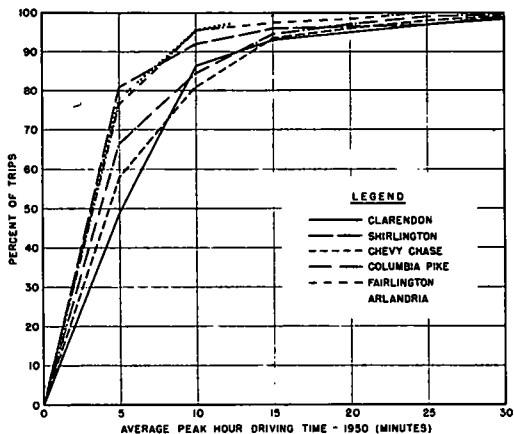


Figure 15. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.

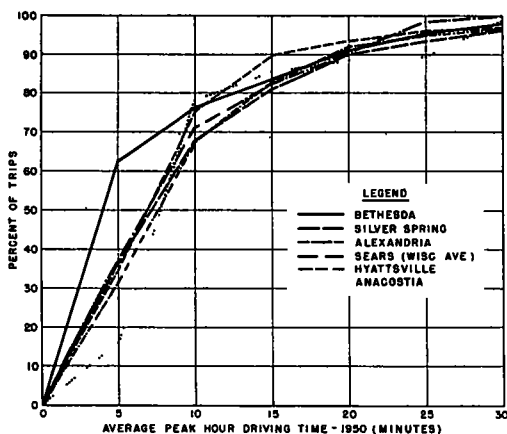


Figure 16. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.

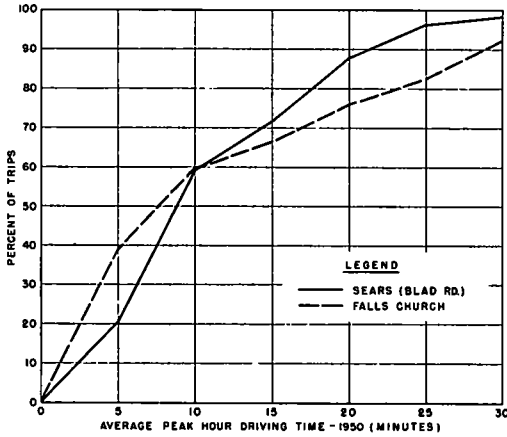


Figure 17. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.

suburban centers shown in Figure 9 had a somewhat similar pattern to that portion of the central business district curve beyond 15 min. of driving time.

Of interest to Washington area residents is the difference between trip-frequency patterns for Bethesda and Silver Spring, Maryland, shown previously in Figures 9 and 10, comparable and competitive adjacent communities to the north of the District of Columbia. The reasons for this difference can be seen by comparing the travel time map for Bethesda, (Fig. 13) with that for Silver Spring (Fig. 14). It is apparent that the majority of persons traveling to Bethesda (62.7 percent) reside within 5 min. of driving time of the center, compared to only 36.7 percent for Silver Spring; thus, Silver Spring has a more-open pattern of residence location of persons making trips, although it has almost the same total number of dwelling units within the 5-min. time zone as Bethesda. The areas of these 5-min. zones differ, however, being 12 sq. mi. for Bethesda and 8 sq. mi. for Silver Spring, which attracted almost an equal number of trips from the 10-min. zone as it did from the first 5-min. zone. Bethesda, on the other hand, attracted relatively few from this second zone. Although the accumulated gross area within this 10-min. driving time was about the same for both centers, faster travel within 5 min. of driving time could evidently be made on the highways radiating from Bethesda.

Although this grouping of shopping centers by similar trip-frequency patterns proved that there were measurable differ-

ences in attraction among the various centers, it was considered to be of greater use value to compute the accumulated trip patterns in order to delimit the areas of attraction for each center. If we could relate the various indicated types of centers to a uniform pattern of area of attraction (and also with other factors) for each type, then it would be possible to determine more accurately the needed highway improvements for existing and proposed centers. Instead of guessing that a projected center would attract traffic from "quite some distance," it would be possible to define such distance or area, as measured by time of travel, and estimate more accurately the probable volume of traffic attracted to the center.

Selecting 80 percent of total trips as an acceptable figure to denote dominant trip volume representative of the area of attraction, the accumulated trip-distribution curves for each of the selected centers were examined and then grouped according to similar driving-time areas, the results are illustrated in Figures 15, 16, and 17.

Some changes occurred from the previous trip-frequency groupings. For instance, on this basis Bethesda and Silver Spring, Maryland have the same size area of attraction, namely 15 min. (see Fig. 16).

It was also noted that Sears, Roebuck's Wisconsin Avenue store included in the 15-min. driving time area group shown in Figure 16 was the fifth largest attractor of shopping trips among the selected suburban centers, thus demonstrating the power of attraction of a single suburban business

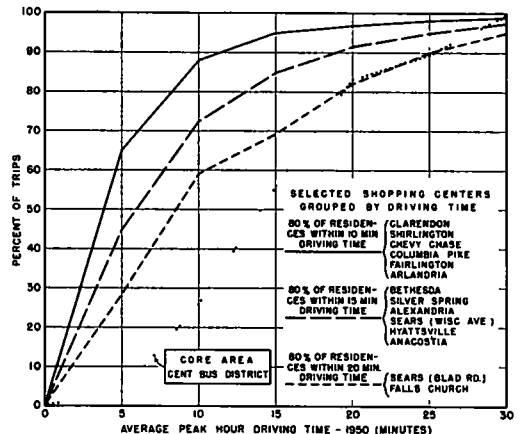


Figure 18. Accumulated distribution of all trips to shopping centers and core area of the central business district by driving time from place of residence.

enterprise, offering popular goods and services in conjunction with convenient free parking facilities.

By averaging the data developed for each group, weighted trip-accumulation curves were developed, as shown in Figure 18. All centers in the Washington area could now be classified as being in one of three area-of-attraction groups, namely those attracting residents of areas within

course, the static working population daily resident in its environs. These two exhibits also illustrate that residents making trips to centers are not uniformly distributed throughout stated areas of attraction. For example, the shopping attraction of the core area upon Virginia residents of the metropolitan area has evidently been reduced by the existence of the Potomac River barrier, and the consequent develop-

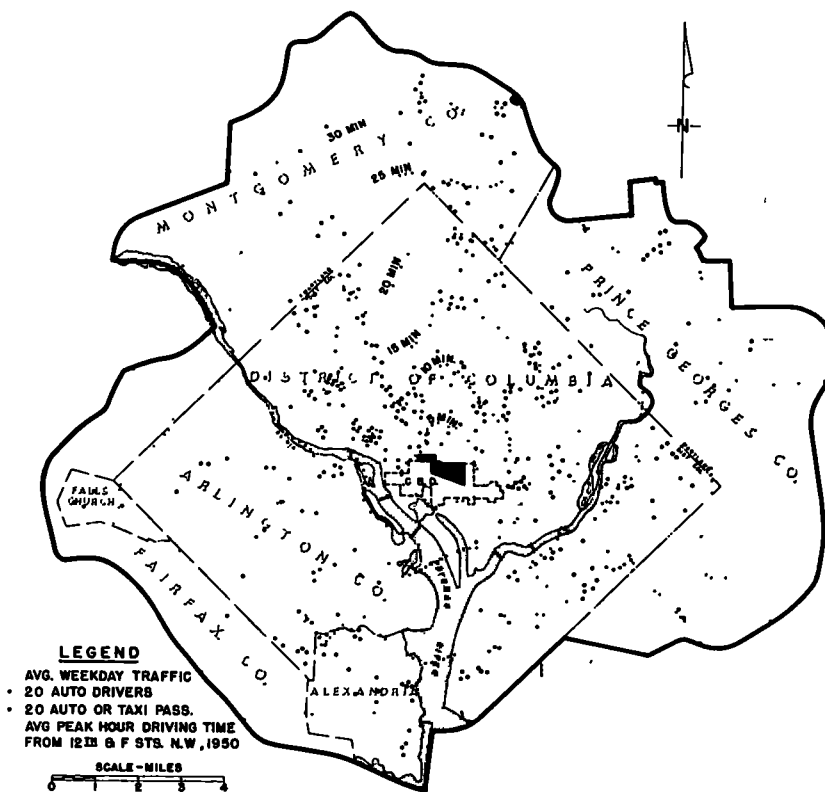


Figure 19. Place of residence of persons making shopping trips by automobiles to the core area of the central business district.

10, 15, and 20 min. of driving time. The core area of the central business district attracted 80 percent of its trips, automobile as well as transit, from residents of an area extending to about 20 min. away. This same area also accounts for over 80 percent of the shopping trips by all modes of travel. If only shopping trips by automobile are considered, the area would be extended to 25 min. of driving time. However, it is only necessary to examine the residence location maps for shopping trips to the core area (Figs. 19 and 20) to determine from what area and by what mode of transport the central business district is attracting its customers, excluding, of

ment of suburban centers in Virginia closer in than those on the northern, or District of Columbia, side of the river.

Although this report has only briefly touched upon some of the results of analysis of origin-and-destination statistics relative to travel to various kinds of business centers, there have also been undertaken, studies of travel to large governmental centers in relation to the residence locations of their employees and travel generated from residential subdivisions within the Metropolitan Area.

One result of such residential area study is the discovery of the large volume of trips made by residents of an attractive

multifamily subdivision, Parkfairfax - Fairlington, located in Virginia about 5 mi. from the central business district and divided by the relatively new Shirley Highway.

Here, from about 5,000 dwelling units, housing over 15,000 persons of all ages, and owning 3,800 automobiles, came over 36,000 trips per average weekday. Of

into the pattern of behavior evidenced by the urban residents required to travel, and they may be valuable in determining not only market areas, etc., but the probable vehicle volumes upon existing and projected highways in metropolitan areas, thus extending the usefulness of origin-and-destination studies, both as to time and place.

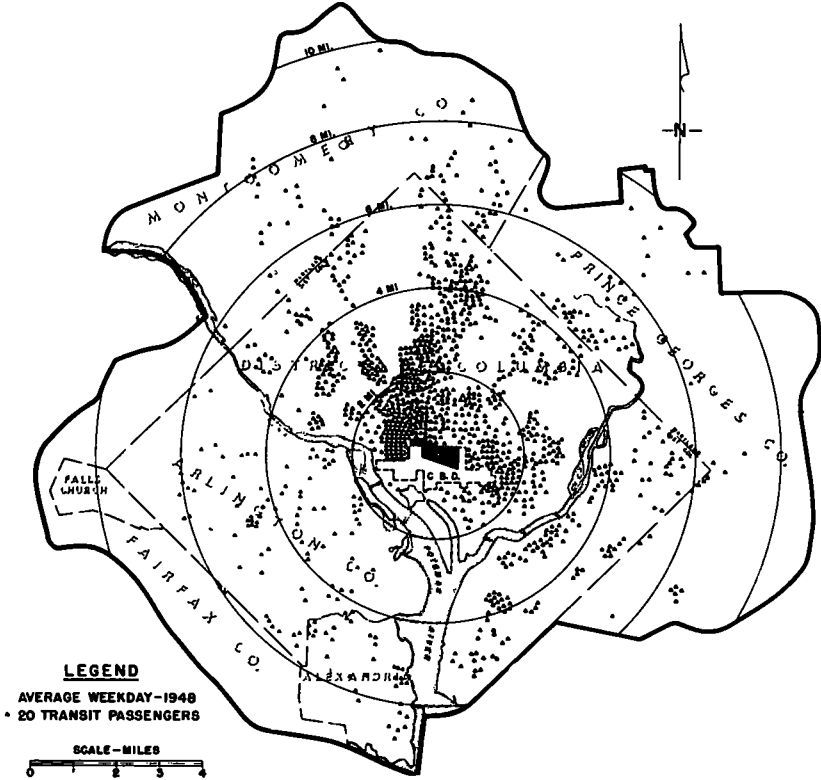


Figure 20. Place of residence of persons making shopping trips by mass transit to the core area of the central business district.

these, 28,000 were by automobile with over 17,000 representing automobile driver trips. Fifty-eight percent of the 4,100 trips made to the central business district were by automobile (only 331 which were for shopping). Residents made over 1,300 trips to the Pentagon and the nearby Navy Annex and, excluding to-home trips, over 4,000 trips within the residential area itself. Of these almost half were for shopping purposes at the Fairlington and Shirlington shopping centers located within the community. All this adds to an average of  $3\frac{3}{4}$  automobile driver trips and  $7\frac{1}{2}$  trips by all modes for each of the homes in the subdivisions.

Travel data relating to existing land use such as these provide greater insight

Everyone would probably like to spend a minimum amount of his daily activities in travel. This is evidenced by the fact that every business community studied, including the central business district, had a definable area of attraction, as measured by driving time.

Where you have a large market center for work or shopping, such as the central business district, the studies show that transit has a dominant role in transporting people, particularly from areas of high population densities. The reasons for this could be as evidenced in the research undertaken, that there is a definable point in distance and time of travel where in the spatial expansion of our cities the attraction of the central business district, as meas-

ured in volume and purpose of trips, become markedly reduced. Also there is an area within which transit is the preferable mode of travel, if all elements affecting such travel are considered.

Historical evidence indicates that the growth of the central business district and of transit have been closely related. The removal or failure of either of these business partners foredooms to failure the other, unless another equally attractive alliance can be formed, which of necessity, creates new problems. The successful economic future of any marketing operation, whether business center or public transport, depends not only on the continuing improvement in attraction of offered goods or services, but also by increasing the population densities both resident and

employee in the areas served. The re-development plans for central cities are important in this regard. If such improvements are made, the various centers are not limited as to their area of attraction until say 20 min. of driving time is reached. They can be further increased only by decreasing the existing time of travel. Lack of expressways and attractive, rapid, mass transportation hinders such expansion today.

Areas of attraction can be developed for any metropolitan area. This is important to those concerned with marketing goods and services, and it is likewise important to the planning engineer who must reduce his universe to understandable and workable components. He too, is marketing goods and services.