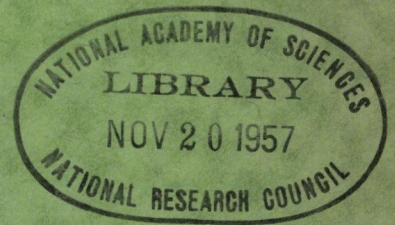


**HIGHWAY RESEARCH BOARD**  
**Bulletin 79**

***Travel to Commercial Centers***



**National Academy of Sciences—**  
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# Travel to Commercial Centers of the Washington Metropolitan Area

GORDON B. SHARPE, Highway Transport Research Engineer,  
Bureau of Public Roads

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

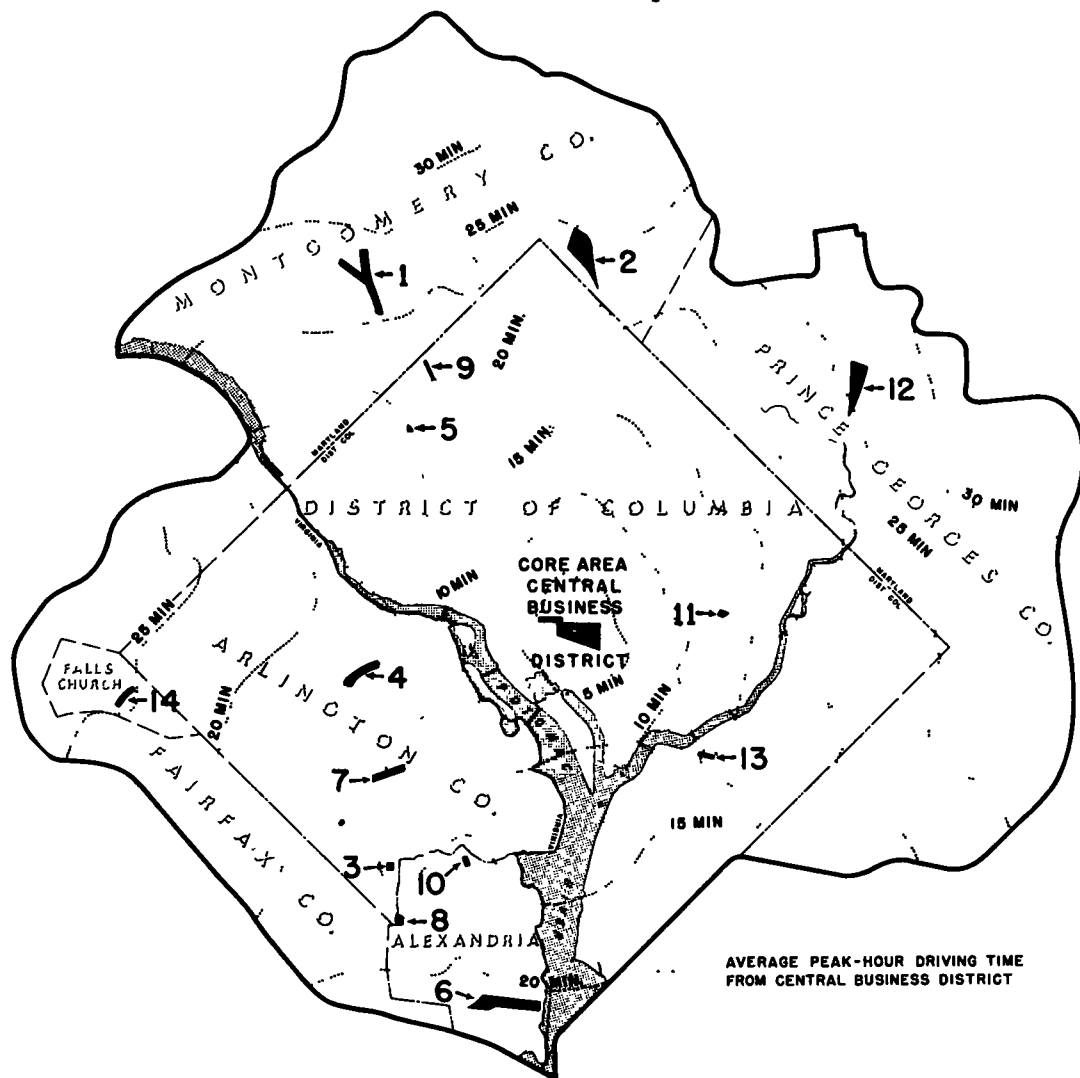


Figure 1. Location of selected suburban shopping centers and the central business district in the Washington, D. C., metropolitan area (1948).

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	18.3	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	2,283	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	483	1,670
	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

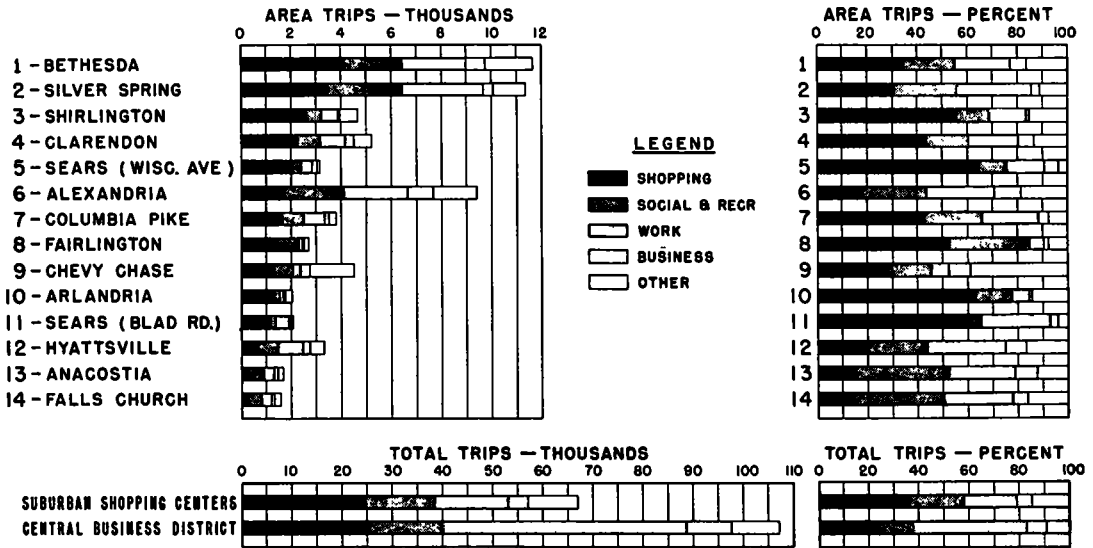


Figure 2. Comparison of trips to selected suburban shopping centers and to the central business district.

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

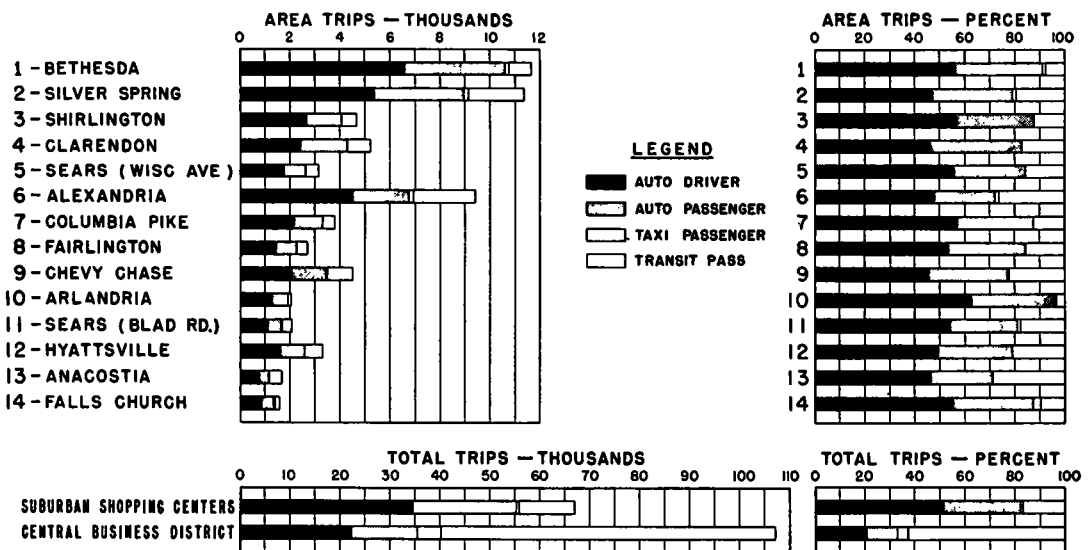


Figure 3. Comparison of trips to selected suburban shopping centers and to the central business district.

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	85.8	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	58.3	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		87.0	3.3	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

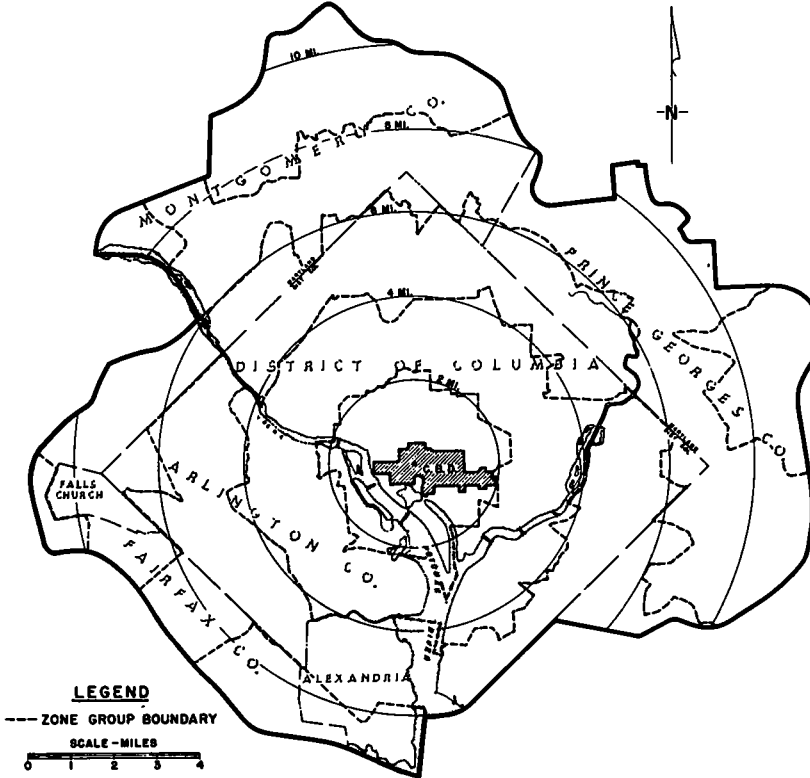


Figure 4. Zone groupings in accordance with distance from central business district.

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



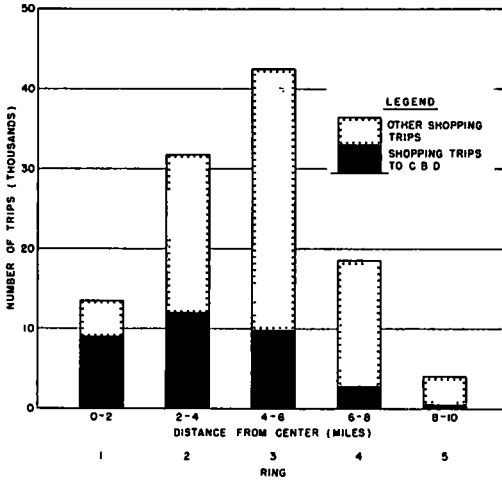


Figure 5. Distribution of total shopping trips versus shopping trips destined to central business district by residents of each ring for average weekday.

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

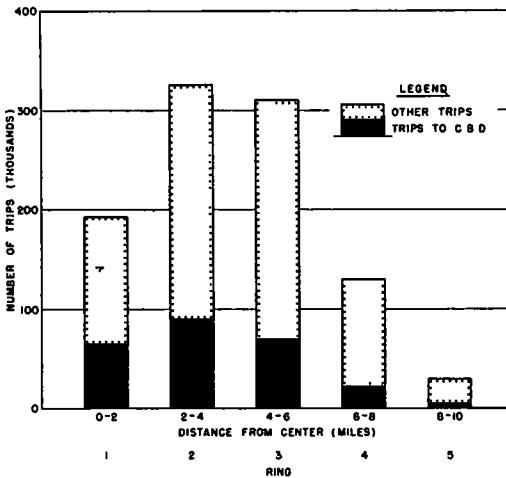


Figure 6. Distribution of all trips versus trips destined to central business district by residents of each ring.

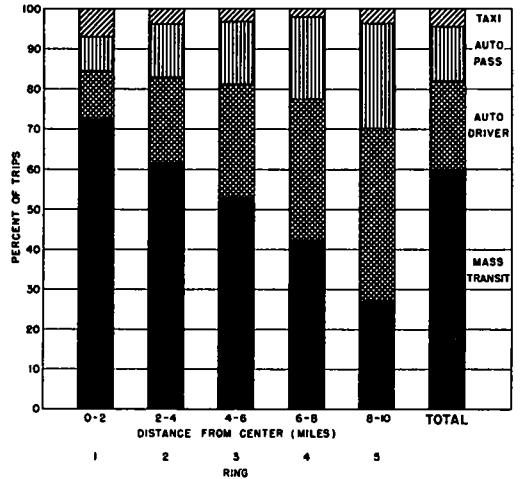


Figure 7. Mode of travel of trips to the central business district by residents of each ring.

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-

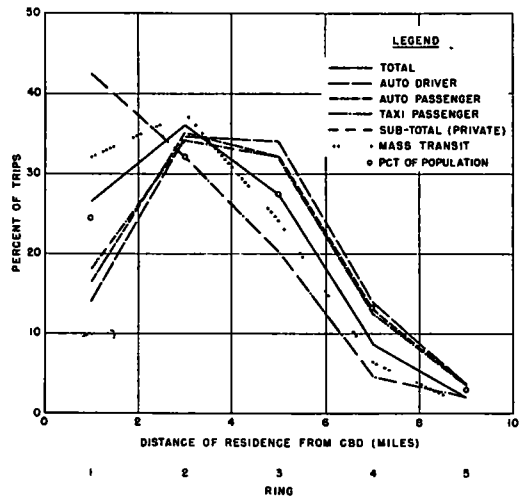


Figure 8. Proportion of all trips by each mode of travel to the central business district by residents of each ring.

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 percent 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.,

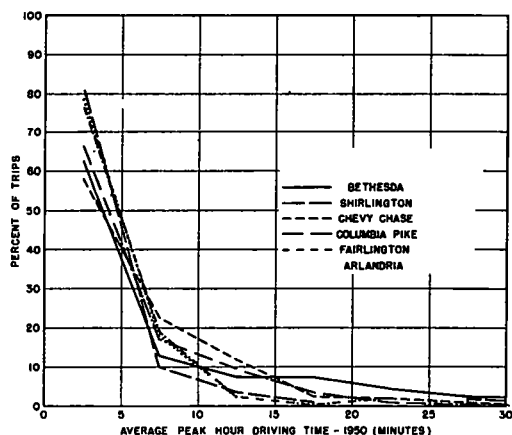


Figure 9. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

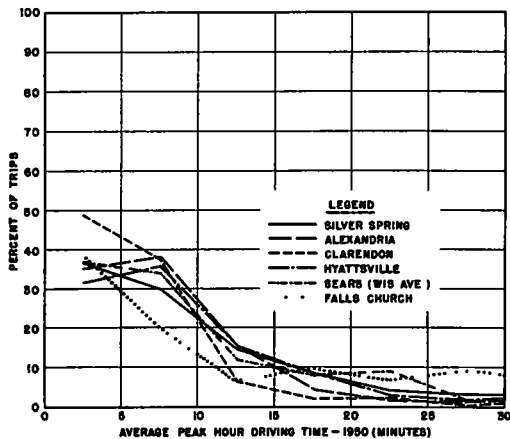


Figure 10. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

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

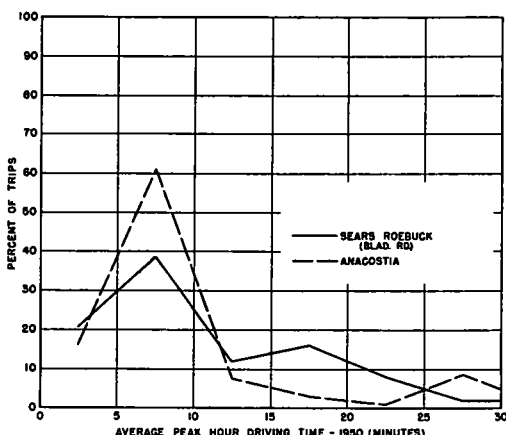


Figure 11. Distribution of all trips to selected shopping centers having similar curve characteristics by driving time from place of residence.

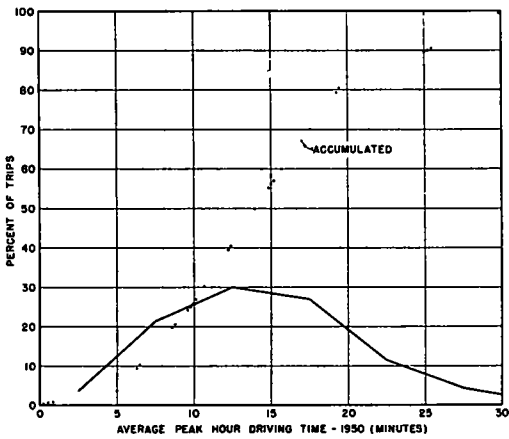


Figure 12. Distribution of all trips to the core area of the central business district by driving time from place of residence.

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

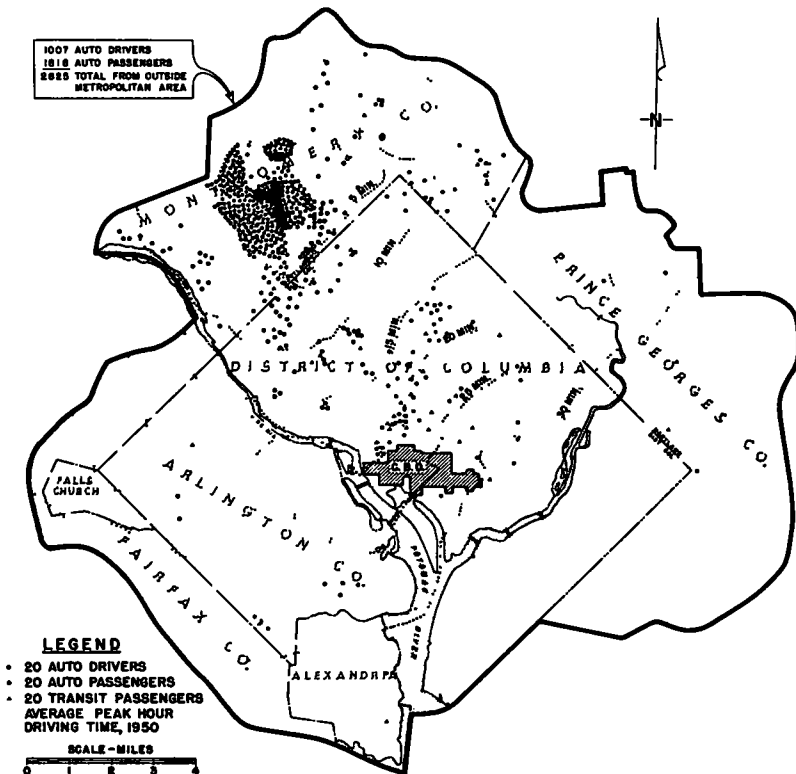


Figure 13. Place of residence and mode of travel of persons making trips to Bethesda shopping center.

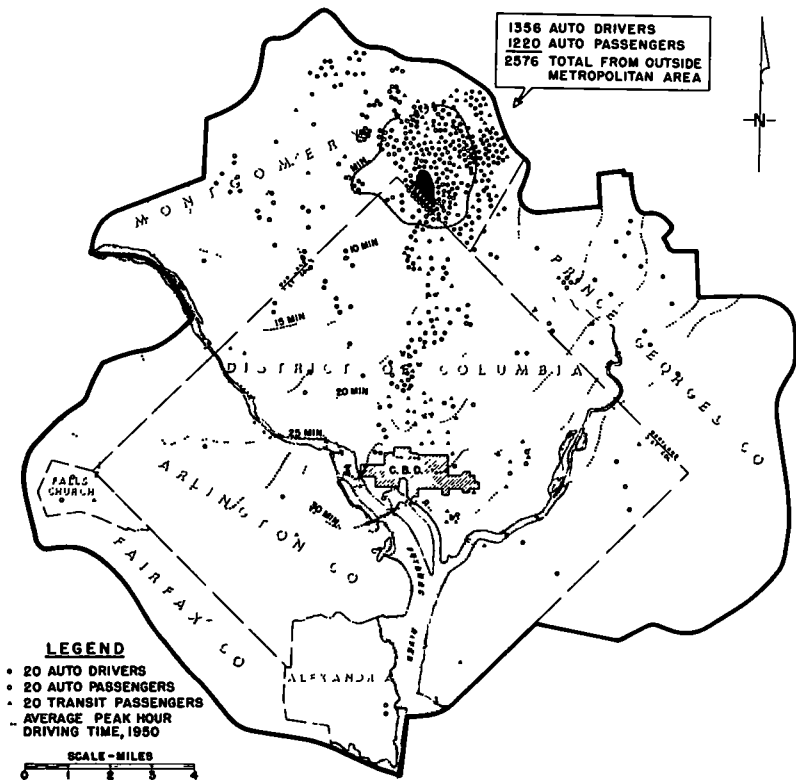


Figure 14. Place of residence and mode of travel of persons making trips to Silver Spring shopping center.

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

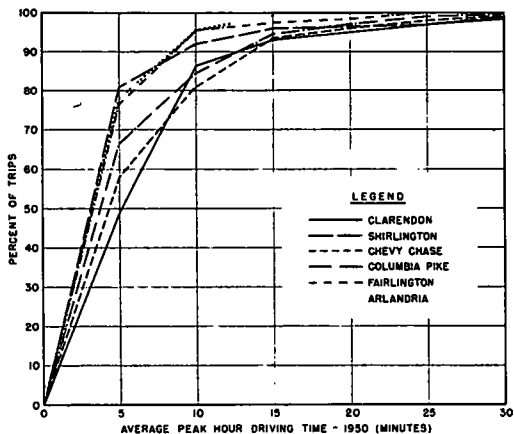


Figure 15. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.

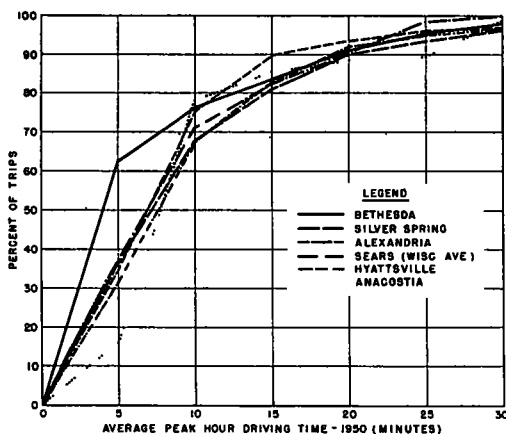


Figure 16. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.



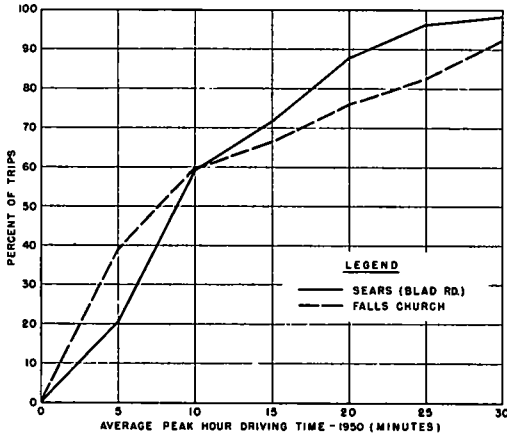


Figure 17. Accumulated distribution of all trips to selected shopping centers by driving time from place of residence.

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

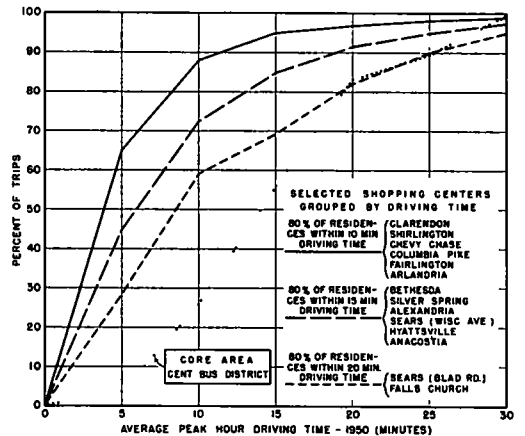


Figure 18. Accumulated distribution of all trips to shopping centers and core area of the central business district by driving time from place of residence.

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-

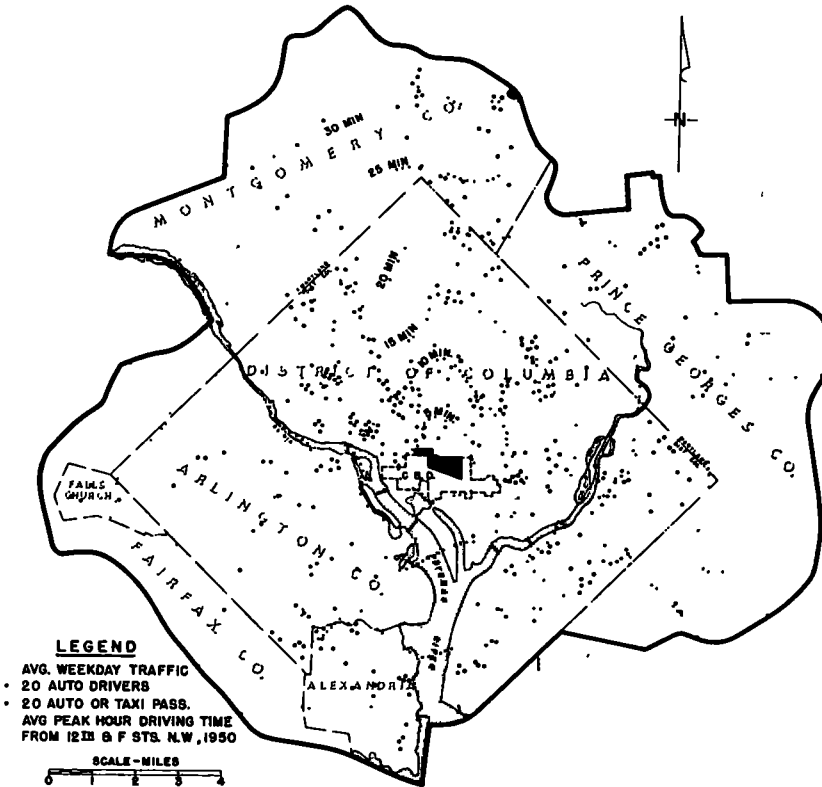


Figure 19. Place of residence of persons making shopping trips by automobiles to the core area of the central business district.

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.

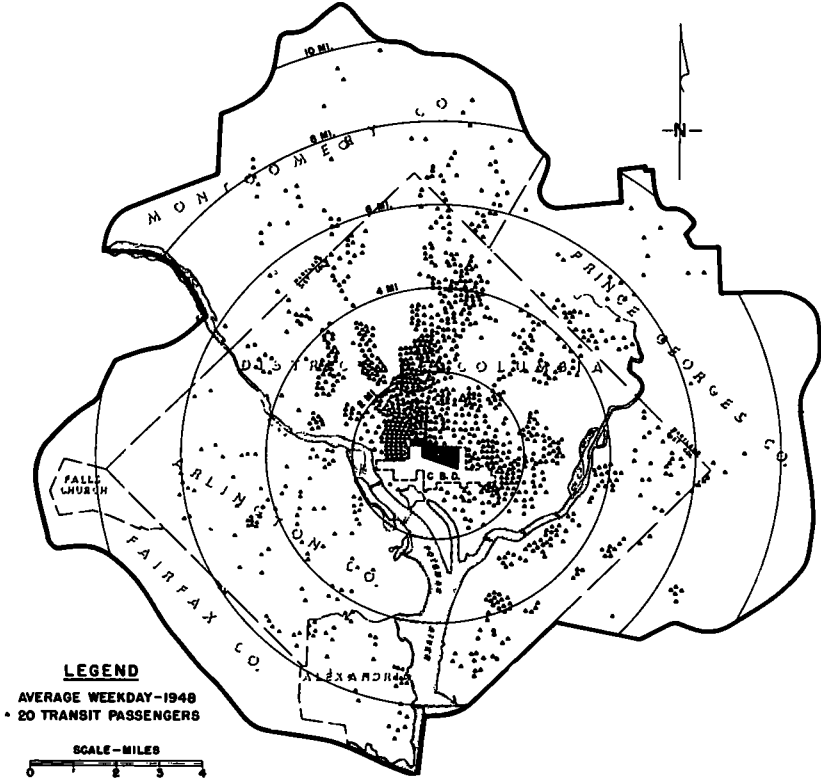


Figure 20. Place of residence of persons making shopping trips by mass transit to the core area of the central business district.

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.



# Factors in Planning Regional Shopping Centers

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● A MORE descriptive name, but too long, for this entirely new retail mechanism might be "suburban regional shopping-goods centers." They are a different animal than 98 percent of the many shopping centers being currently planned and/or constructed today.

The term "shopping goods" is important. It refers to seasonal, lifetime needs, and comprises two kinds, fashion and generally standardized, mass-produced products requiring servicing, such as automobiles and the like. However, the regional shopping-goods centers we are discussing deal with the fashion type of shopping goods primarily, both apparel and home furnishings. One or more department stores established in the area with their unbelievable pulling power are a necessity as a nucleus for the shopping-goods center.

Convenience goods, on the other hand, are daily and weekly needs, and the modern super market with its comparatively limited market area is the important nucleus of this kind of a center. Convenience-goods stores have comparatively minor seasonal peaks but have, in some cases, rather severe daily peaks, often producing over 60 percent of their weekly sales on Friday and Saturday.

On the other hand, fashion shopping-goods outlets must plan for seasonal peaks, especially in December, an important factor in the amount and type of parking areas required.

The region we are considering is primarily a segment of the periphery of our urbanized areas, towns, and the rural population, especially that they intercept, or can be reached easily within an hour or two by private automobile. These centers placed well out beyond the central city's limits and beyond the congestion not only pull from the city center, because often congestion decreases as you travel away from the center, but can extend the market considerably into the surrounding towns and rural areas. The pattern of a given region in this respect has a bearing on this

phase of the analysis. New England varies considerably from the Midwest, for example, as I will demonstrate later.

Our cities started with a small, compact, high-density area with walking and the horse and buggy the important means of transportation. They were in practically all cases a port, either seaboard or river. When we look back from the standpoint of tranquility this was rather a delightful era.

The second stage of growth depended upon the streetcar, whose fixed routes determined all of our major thoroughfares today with their many ribbon commercial developments and which, with their abutting interference, are impeding the flow of modern traffic.

The last stage, which has taken place mostly since 1920, is that of the virtual explosion of our cities about in direct proportion, not only to the registration of automobiles, but in proportion to their expanded use as urban transportation, because of the spread of family and individual incomes.

This migration to the suburbs is one not only of numbers but also of income. The average income in large central cities has been shown to be around \$3,200 as compared with \$4,200 in the suburbs. This is an important factor in merchandise planning for these new regional centers.

This low-density population in the suburbs can never be economically served by mass transportation, and it is accordingly quite dependent upon the private automobile, especially for the great majority of shopping trips. This fact is one of the basic reasons why all mass-transit companies in every city today are having economic pains.

By the same token, the central business district, which has heretofore had a monopoly on the presentation of shopping goods, can never be served by the private automobile. This large presentation of shopping goods is the key to the traffic generating power. Shoppers' World, Framingham, which was really the first proof of the

pudding as far as these large regional centers are concerned, has proven that a parking index of 15, i. e., 15 car spaces per thousand gross square feet of rentable area, is necessary to completely handle the December seasonal peak when the store area has reached its realistically maximum space productivity.

Incidentally, a great many reports are circulating to the effect that Shoppers' World has not been too successful. The usual mistakes that seem to be inevitable when you are constructively pioneering were made, many of which can and have been corrected, often at some expense. Even so, the development is definitely a success, and the business this current year is running 20 to 25 percent ahead of the previous year. There are some misfits, naturally, but on the whole the tenants are happy with their operation.

Assuming an average definition of a central business district, it is interesting to compare its parking facilities with Framingham's parking index of 15. It is impossible economically in any central district in a city of 200,000 and over to achieve a parking index of over 0.75 or 0.50, or in other words, over  $\frac{1}{20}$  to  $\frac{1}{30}$  of the proven parking demand in relation to structures that exist in Shoppers' World. Where possible to increase it materially, it would be impossible with all of the tricks of your gentlemen's trade to provide ample access.

In addition, the central district has to provide low-turnover parking space for the labor force that, by choice, insists upon using cars for transportation, and incidentally, many who can afford to pay fifty cents to a dollar per day for convenient parking spaces.

The former king of retailing, the department store, in the main has fought decentralization tooth and nail ever since the automobile became a problem in our urban areas. As a result, a number of things have happened to them. If they have made too great an investment in their plant in the central district or they have some unfavorable leases, they are in a difficult situation. As a whole, they have creaked to a halt and are going backwards. They as a group present a discouraging profit picture today.

The recent decade of inflation and the greater spread of incomes have saved many a department store. However, to-

day the great majority of merchants concede that it is not good business to continue to fight the natural current but to go with it and that branches of their operation in the suburbs are necessary, if only to maintain their prestige and render a greater needed service to the suburban communities.

As an indication of the considerable shift that has taken place in retail stores by type groups during the time of the increased use of the automobile, I would like to cite a few figures: comparing the year 1929 with the last quarter of 1951, all retail stores in that have succeeded in getting about 12 percent greater share of disposable income of individuals. This is an index in a way of the changed economic conditions primarily due to the greater spread of family income.

In the same period, using the Department of Commerce or Census definitions of store groups, the general merchandise group, which includes department stores, decreased 26 percent in relative share of the consumer's dollar. The apparel store group decreased about 14 percent but the men's stores, who have had their major presentation downtown and who are a part of this group, decreased about 37 percent in their dollar take. Furniture and furnishings stores have remained about the same because of the considerable home-building activity and the promotions of new merchandise, such as television.

We will refer to these three basic groups of kinds of stores hereafter as GAF.

On the other hand, the eating-out and drinking places have increased about 93 percent in relative business, and the super market, which in 1929 took in 8.9 percent of disposable income, now gets 13.5 percent, more than a 50 percent increase.

While the redistribution of incomes, the changing age groups, social habits (due mostly to the automobile), and other factors have been important causes in this shift in retail sales, it is not entirely coincidence that all the stores which have been congestion-bound in the central district and difficult to reach by modern transportation, are losing out in their share of the consumers' dollar, and those stores which have been able to disperse as the automobile has permitted the dispersion of people have had a material increase in relative sales.

It is even more serious when we realize that many department stores have built suburban branches within this period, and that many variety chains (part of the general merchandise group) have dispersed and have outlets in all outlying centers of any size. Further, every neighborhood center has its dress shop, hat shop, or men's haberdashery store.

I am not prophesizing the doom of the large, downtown department store by any means. It will continue to perform a necessary distributive function in any urban area. I do say, however, that (1) it cannot continue to expand in size to serve the modern urbanized area except by building comprehensive branches designed to serve this growth, (2) if it was overbuilt downtown it will never catch up to their full potential of productivity and at the same time make a profit, and (3) it can only maintain prestige and continue to render a needed service to a region by constructively decentralizing its operation.

Accordingly, the problem becomes how best to provide for the large department store and specialty shop branch. It is without any question in my opinion best to make them part of an integrated regional shopping center designed completely to serve the private car with safety, with a maximum amount of convenience, without congestion, and with the complete elimination of the many irritations and frustrations which are a part of trying to use the automobile in the congested central district.

In addition to the definite cumulative pull of many stores within walking distance of each other and stores that advertise (that is what has made downtown great during the street-car age) it is essential that there be many small stores and stores of a character which can competitively pay a higher rent per square foot to reduce the real-estate costs of the puller department store. This is necessary to reduce the one operating-expense ratio which increases today due to current building costs, plus the fact that it is expensive to provide the necessary parking which logically should be free parking. Present real-estate costs in shopping centers unfortunately are compared with those in the 20- or 30-yr.-old structures downtown, which have long since been charged off with the exception of lease-hold improvements.

To create the best retail mechanism

and the longest range investment in regional centers, certain basis factors are emerging as being definitely desirable to a maximum degree. First, they must be composed of a balanced group of shopping goods stores, preferably they should be branches of established shopping goods stores using a high degree of regional publicity, primarily newspaper space. They consist in the main of branches of one or more department stores, all kinds of apparel and specialty stores, at least one variety store, and the necessary convenience outlets, such as restaurants, package goods stores, drug stores and the like. There must also be a considerable number of necessary services (some of which can be given a monopoly) to create a so-called one-stop center. In reality, this new regional center becomes a branch of the shopping-goods part of the central business district.

The second factor, and one being neglected in the great majority of centers currently being built, is that it must have ample access, without congestion at the period and time that the local shopping habits demand. The congestion being created by many large centers has always been completely predeterminable and proper planning could have corrected it or the location was wrong to start with. In other words, proper access has a great deal to do with location.

Third, the site design must be based primarily on the organization of the traffic, private and public vehicles, trucking, and the organization of the pedestrian traffic in the center itself. It is possible to minimize the interference between vehicles and people and to provide the maximum pedestrian access to all stores creating all 98 to 100 percent locations.

As part of the site design we have the architectural concept. It must be architecture designed to sell merchandise and it must be today's and tomorrow's architecture, not yesterday's. This is essential to a long-range investment.

This entirely new, too-long-delayed environment for the selling of fashion shopping goods must break as sharply with tradition as the automobile has outmoded the horse drawn carriage. This is essential for its maximum success in not only making an exciting new experience in shopping possible but in naturally and inexpensively selling the maximum amount

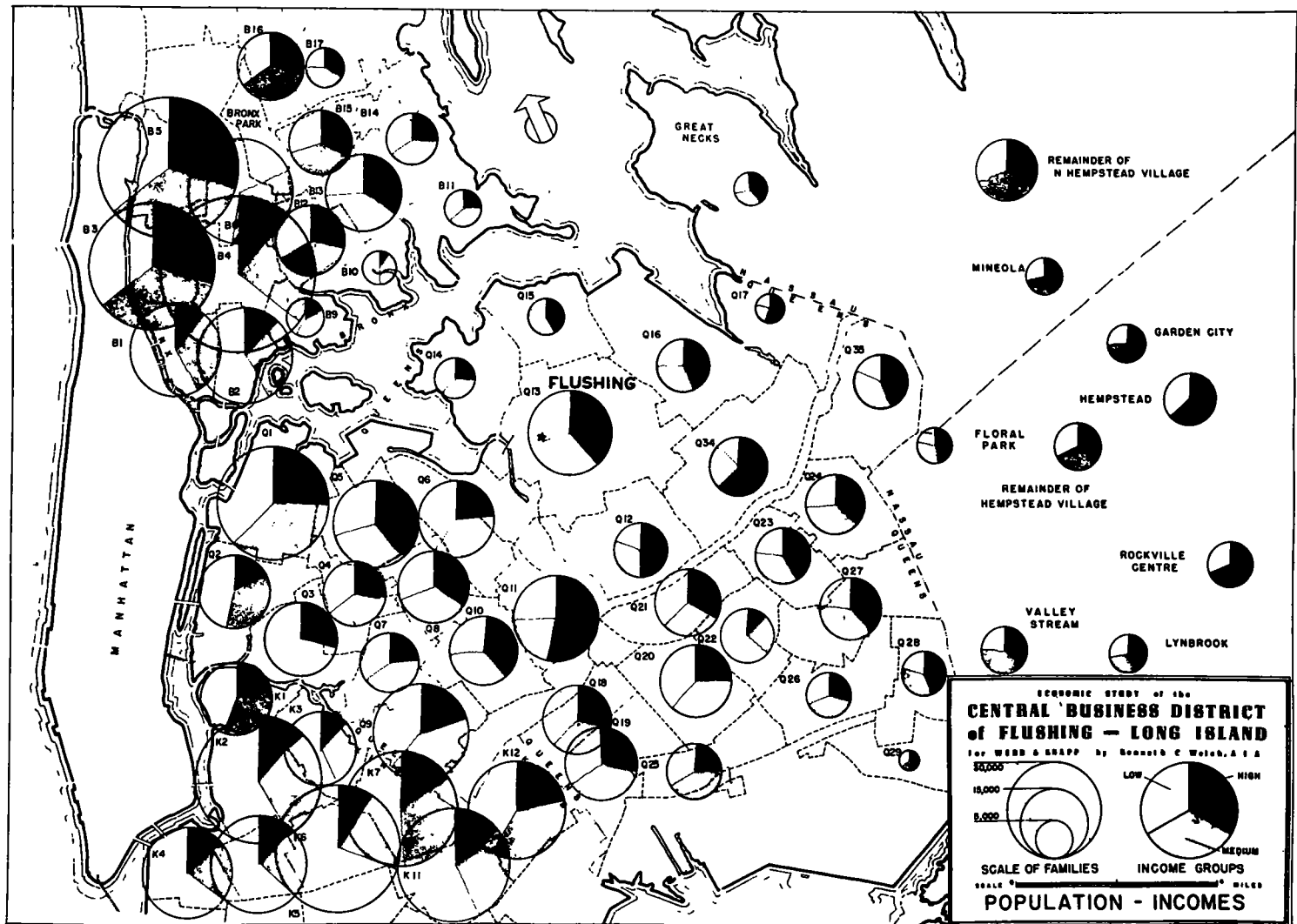


Figure 1.

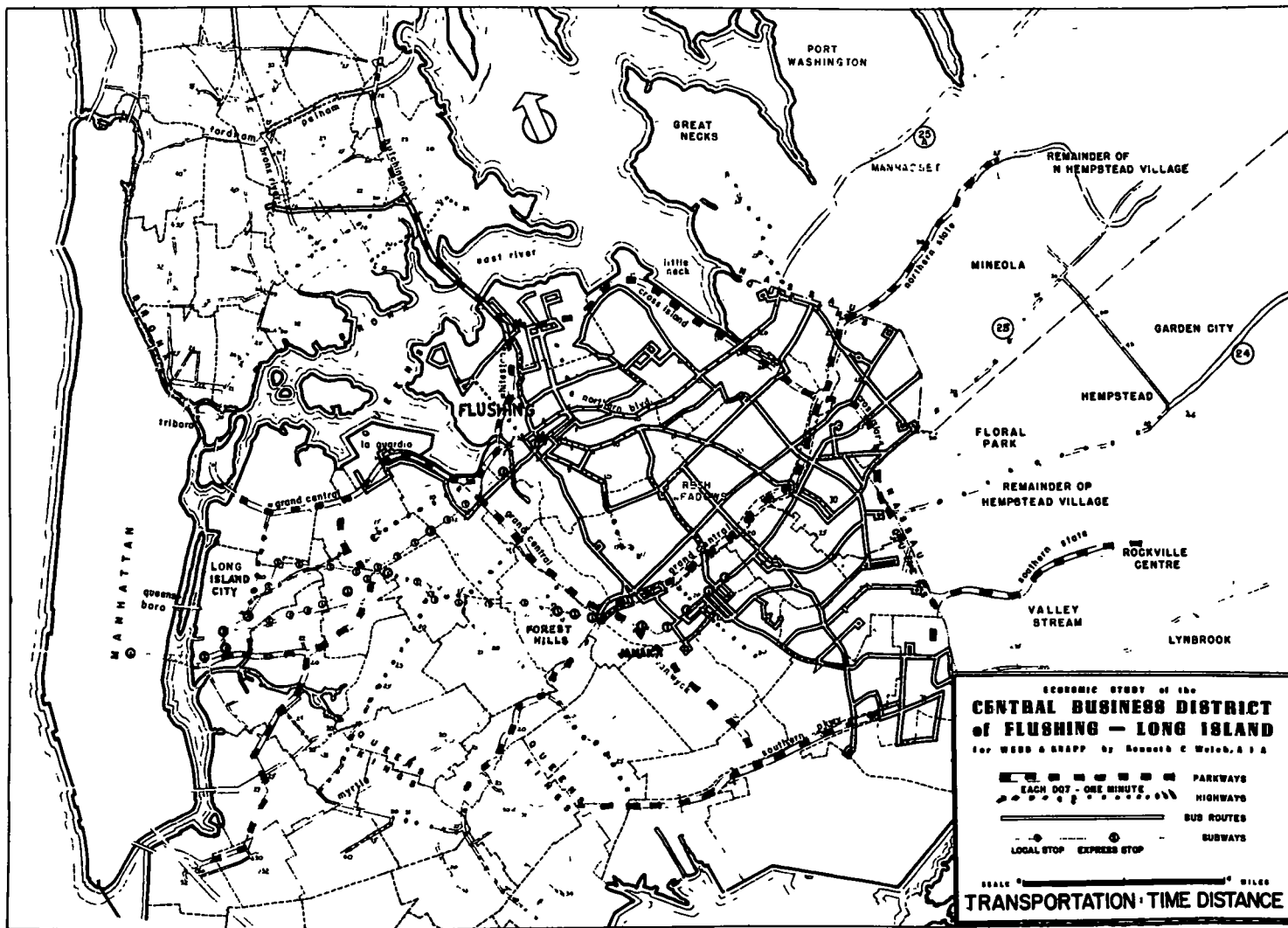


Figure 2

of impulse type of merchandise so important to maximum department-store and specialty-store profits.

This can be done to a high degree. It does not require any miracles, merely a complete application of the many proven design techniques now in use. They include such things as planned traffic flow within the center and within a given store, interrelation of merchandise and display, maximum facilities for suggestive selling, maximum flexibility for seasonal and other changes, minimum effort for sales personnel in completing a transaction, and other factors. Profits are helped too by planning minimum and easy movement of goods from truck to not only the point of sale but to the customer's parcel carrier that in the rear of her parked car. A logical concentration of merchandise that has difficult packing and unusually difficult delivery problems is possible when a store has room to spread laterally instead of vertically.

There are no visual barriers to displayed merchandise as, for example, reflections on show windows. All of this and more is possible only within the concept of a completely fresh architectural and planning approach, which is comparatively easy when you can plan an entire "downtown."

One other factor which should be mentioned in the traffic organization is the necessity of the concentration of pedestrian traffic and pedestrian purchasing power per front foot of display. Only pedestrians buy these kind of goods. Department stores have had to resort to too-much mail ordering and telephone ordering with their costly returns and lack of impulse sales. This concentration of pedestrian traffic is a basic factor in commercial land and structural economics. In central districts and, in fact, most commercial areas, too-much vehicular traffic can be detrimental.

One index of the success of this concentration of traffic in a given site plan is the ratio of the rentable area in a structure to the lineal feet of passageways leading from parking areas to a central point or to a puller. The so-called cluster plan that is the result of a single department store as the main generator often can produce less than 100 sq. ft. of rentable area per lineal foot of passageway or back street, and even the best of the cluster plans can produce as little as 300.

In the planning, for example, of Mondawmin (as reported in the March "Architectural Forum") we have been able to produce more than 650 sq. ft. of rentable area to lineal foot of passageway leading to the important concentrated frontage. Further studies are increasing this figure.

The fourth basic factor in the planning of regional centers is to provide the necessary protection for the surrounding community by voluntary zoning of buffer areas, which can be residential or industrial, to protect the planned highway capacity, to prevent the pirating of your superior parking facilities, and to protect the surrounding community from traffic and other inconveniences. In other words, it is an application of city planning at its best. In many cases when centers are put in built up areas as, Mondawmin, for example, the developer and tenants must be sure that the surrounding zoning and land uses are not politically manipulated to the detriment of the center.

Fifth, there should be an enlightened property management, primarily merchandise rather than real-estate minded. Percentage leases are an instrument for good in this connection.

Too-many good merchants are being sold space in projects that are primarily real-estate speculations. They unfortunately will have varying measures of success, primarily because of the efforts and the reputation in the area of the merchants. However, the great majority of these centers could have been materially improved to make this effort not only more profitable but more lasting.

Lastly, an economic survey and market analysis should be made to determine the potential sales and the types and characters of the stores for a given site and area.

A number of systems of market studies and economic analysis have been used. The growth of the chain stores, a product and accordingly designed for decentralization, but selling convenience goods primarily have a comparatively simple problem in this respect, because they need consider only the immediate surrounding area and market, — within 4 to 6 min. of time distance. However, the larger shopping-goods center pulls easily from 30 min. and further away, depending upon its size and its scope or presentation of shopping-goods merchandise. In the case of Shop-

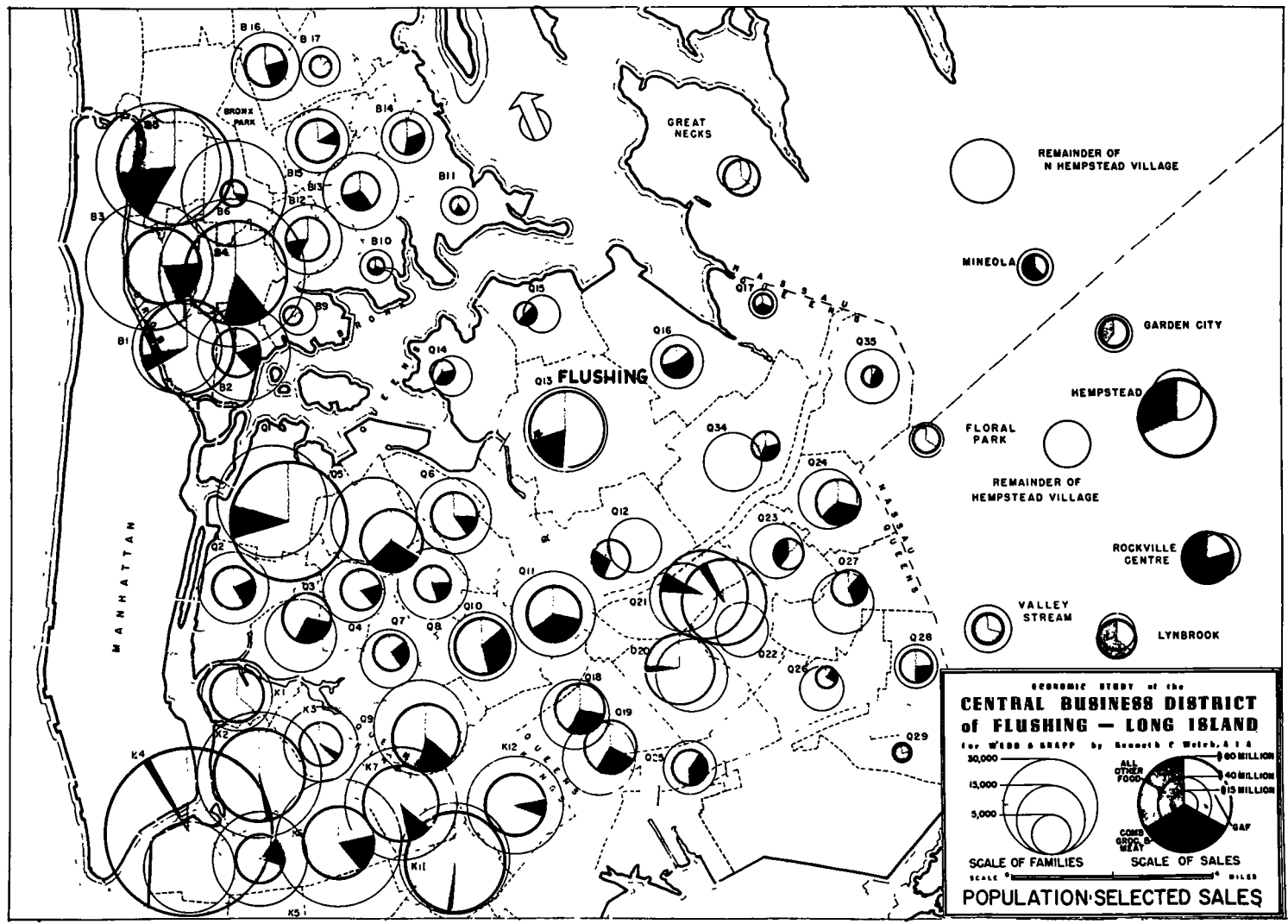


Figure 3.





pers' World, Framingham, subsequent checks have shown that over 30 percent of the number of customers are coming from beyond the original 30-min. time-distance market delimitation.

However, the most-logical method of analysis I feel is what could be called a refinement or modernization of Reilly's Law of Retail Gravitation. This law has been tested a great many times in a great many areas and has proven, when realistically applied, to produce satisfactory appraisal of relative markets and relative sales.

It was developed by William J. Reilly, of the University of Texas, in 1929. It said, "Two cities attract retail trade, primarily shopping goods, from an intermediate city or town in the vicinity of the breaking point, approximately in direct proportion to the populations of the two cities and in the inverse proportion to the square of the distance from these two cities to the intermediate town."

In the application of this law to a modern market analysis, we do the following things: Today the 1950 census breaks down unrelated individuals and families, which we will hereafter call expending units, into income groups by census tracts in cities and by small civil divisions, counties, and the like in the outer areas. This is done by a sampling technique and is not 100 percent accurate, but it is the best measure of purchasing power we have; when conservatively discounted to allow for any errors, it is a useful tool.

We group together a varying number of census tracts creating what we call economic areas of approximately the same number of expending units and, to a limited extent, with the same homogenous economic character. These areas or groups of census tracts become the intermediate town in Reilly's law.

Also, as the population of the cities varied with their presentation of shopping goods, we use today the amount of GAF sales in a given economic area or town as a measure of the direct attraction of retail trade.

Next, because limited access highways and even modern major thoroughfares with synchronized signals can be safely driven from 45 to 50 mph., whereas we are slowed down to 10 mph. or less in the congested districts, we substitute time distance for the distance that Reilly used.

While numbers of expending units in a given zone and the quantity of presentation of shopping goods and the time distance are primary factors, these forces are vitally influenced by the income status of purchasing power of a given group by the type of transportation facilities available and by the quality of the stores.

Admittedly, it is not an exact science and a considerable number of judgments are necessary. However, in a great many cases we make extensive field studies which together with our many conservative factors and discounts we feel gives an acceptable market potential for a given site and location.

In the large metropolitan areas, such as New York, Philadelphia, or Baltimore, the number of computations and the field work necessary to realistically apply this law are considerable. It is necessary to determine the amount of sales in any given area or concentration of sales in shopping goods. In some cities retail sales by types of stores have been broken down into census tracts, and when this is available it makes the problem much easier to solve. When we do not have this information, as for example in Toledo, we have to by examination on the ground and aerial photographs and maps and determining relative areas approximate the GAF sales in a given commercial development.

We use as a basis for shopping goods the GAF sales previously described. To arrive at total fashion shopping goods, or what might be called department-store-type merchandise, we add about 10 percent additional sales for such stores as jewelry, stationery, books, photographic supplies, luggage, and the like.

We feel that this constructive decentralization of this important retail function can help preserve the downtown area. With the suburban center's complete parking facilities it can take off much of the pressure of the suburbanite who insists on using his automobile for transportation making too many trips to the central district. In this way we can utilize the limited (economically) parking facilities available for the many other important functions of the central business district.

It is important, for example, to prevent the decentralization of office space and many other central-district functions that are equally if not more important to the





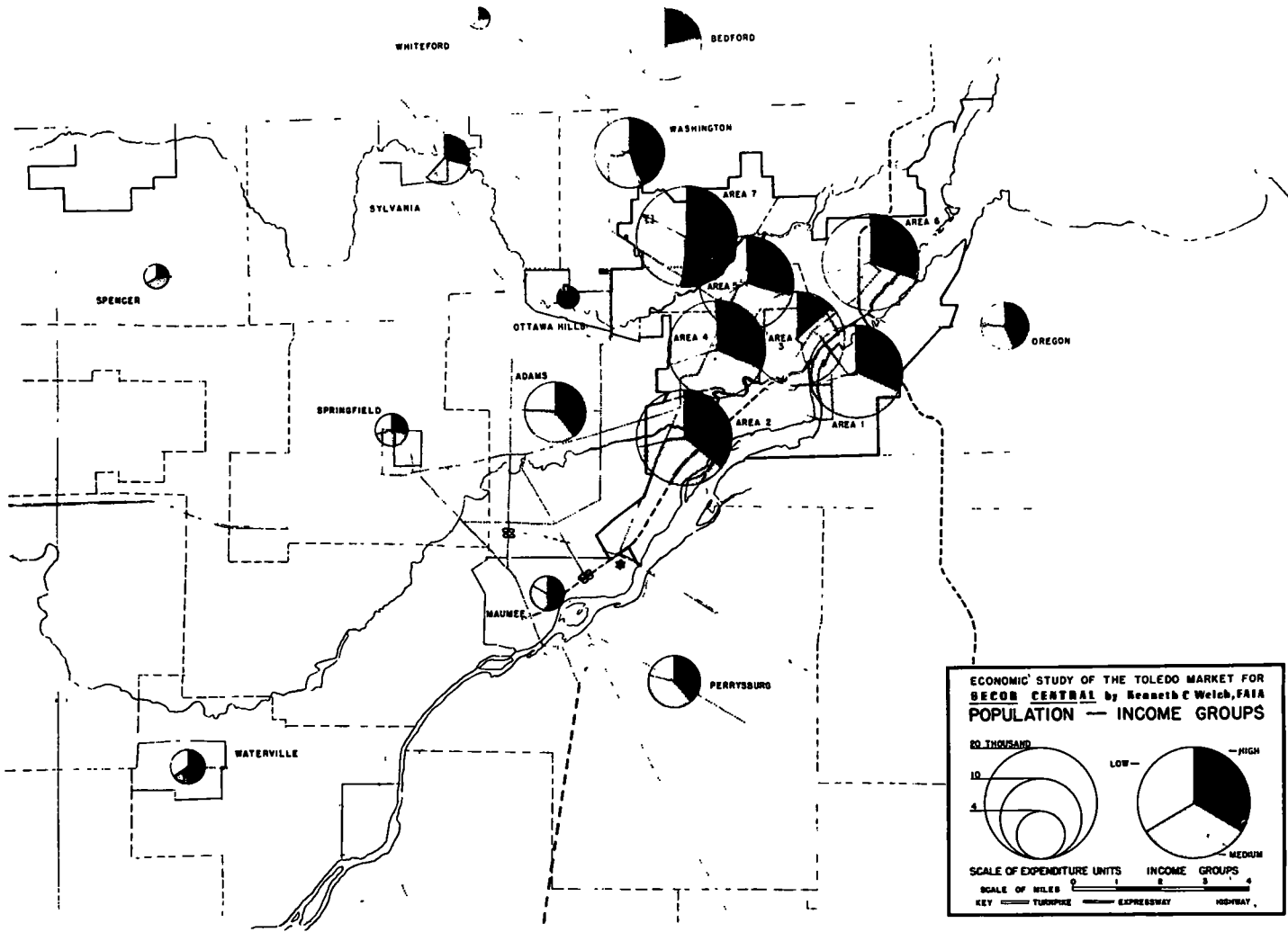


Figure 7.

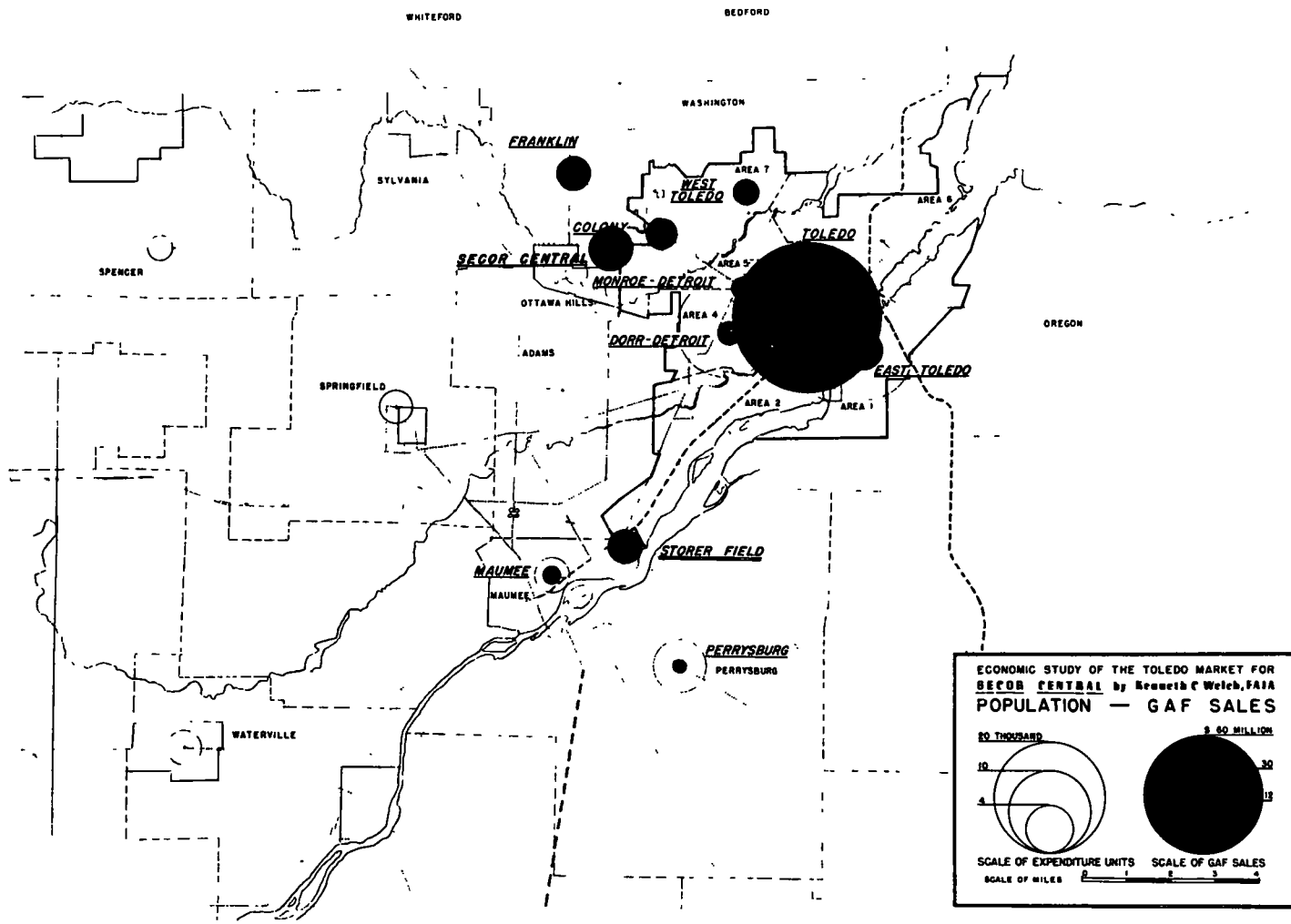


Figure 8.

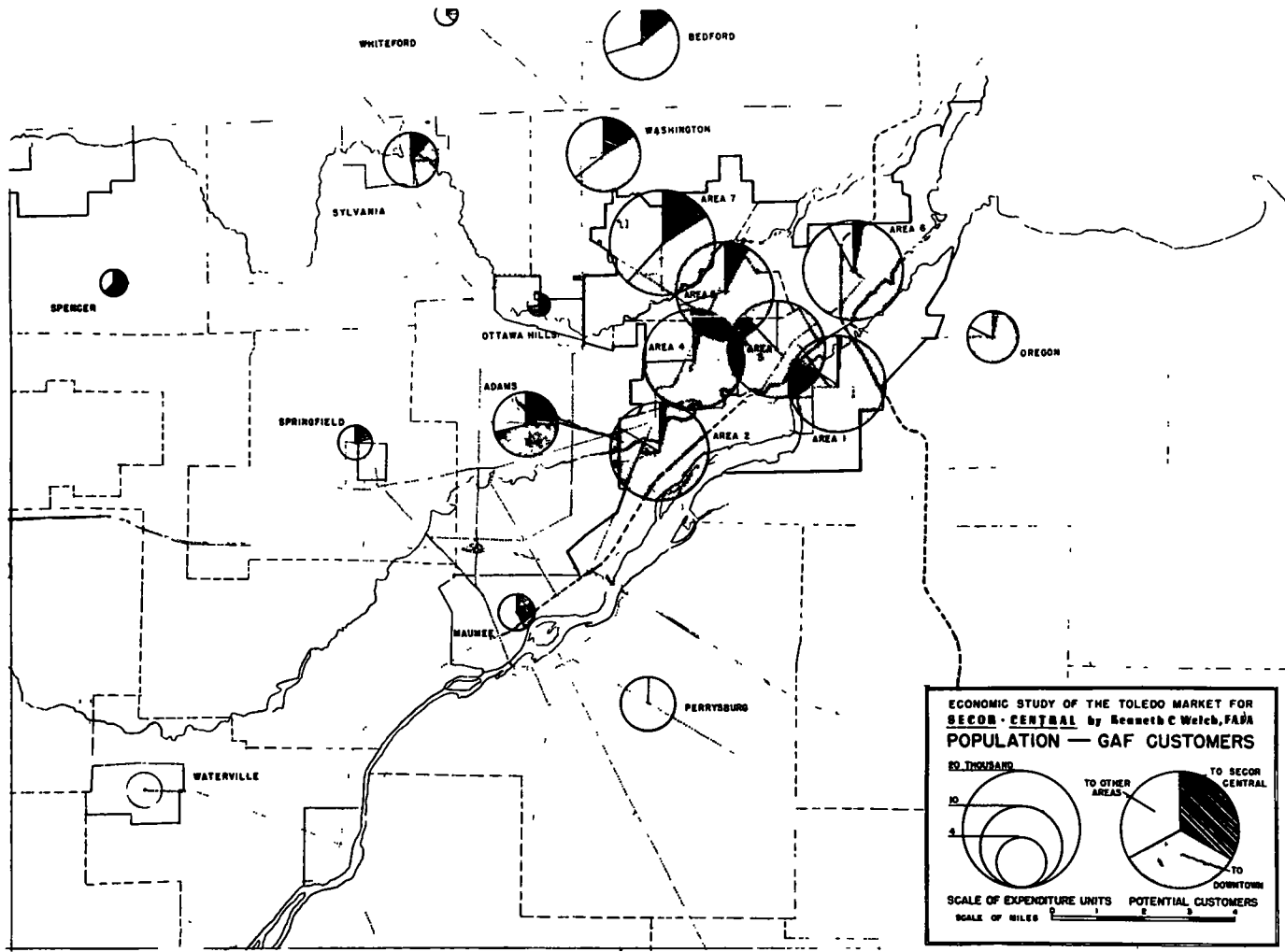


Figure 9.



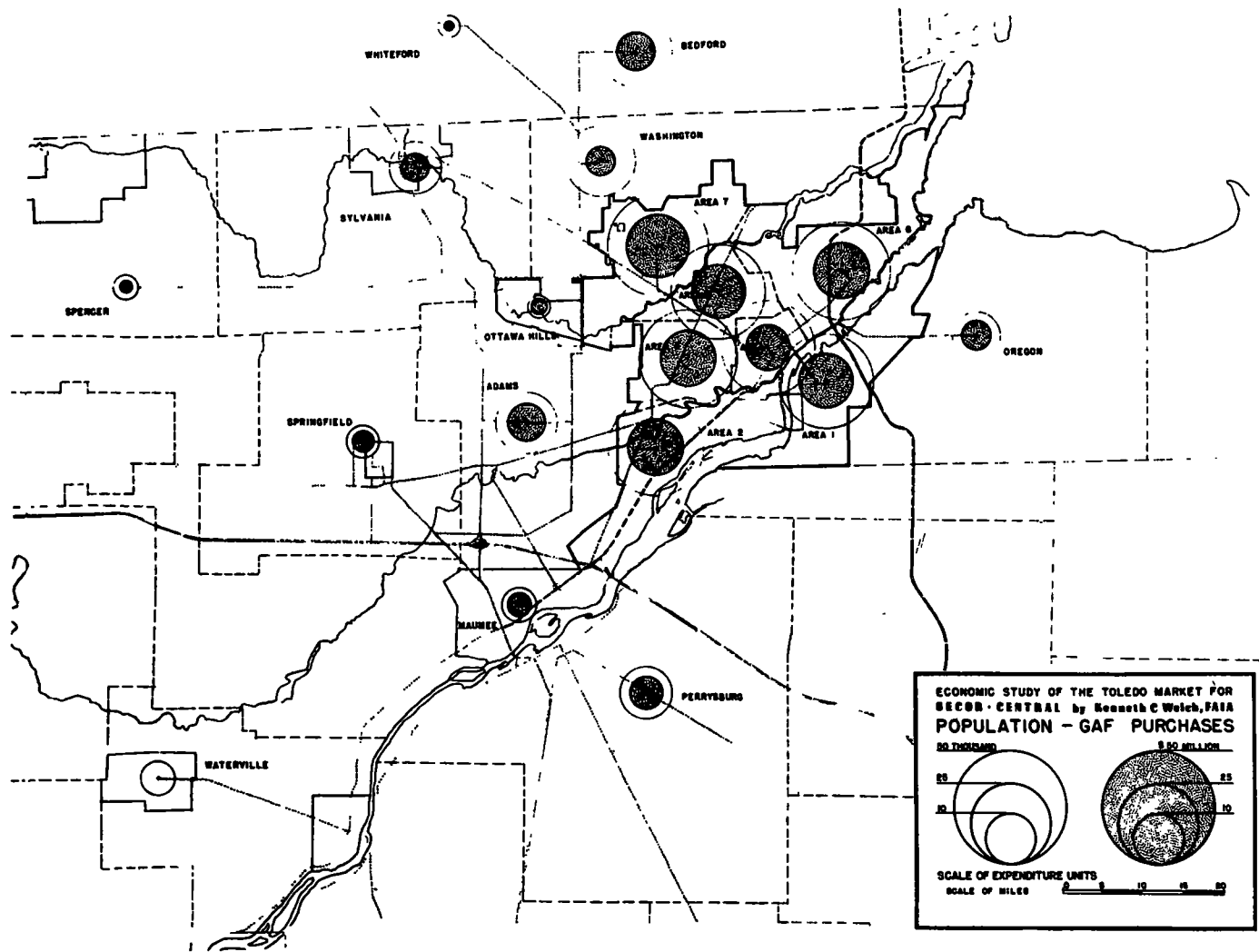


Figure 10.

community as a whole than the shopping section. The clerical force that works in the central district is one of the best markets for fashion apparel and accordingly should be preserved. On the other hand, there are many land uses and structural uses in the central district that would be better in some cases decentralized. This includes certain misplaced industrial operations.

#### CENTRAL BUSINESS DISTRICT STUDY, FLUSHING

Figure 1 shows by the area of the circle the expending units (EU's) broken down into three income groups: high, the dark tone; light gray, the medium income group; and white, the low income. In this case the lower third in Queens under \$3,000, the middle third \$3,000 to \$5,000, and the upper third over \$5,000. However, in the entire metropolitan area the upper third is only 25 percent of the EU's and the median 30 percent. As in all of these charts it is easy to pick out the high-income areas and the low-income areas. These are further merely graphical representations of the necessary tables and other data to apply Reilly's Law.

Figure 2 combines three basic transportation systems, bus lines and mass transit, subway and highways. All of these are important means of transportation to the center of Flushing. Instead of using the usual method of isochrons, we have shown by dots a minute driving time on the highways as we have to compute the time distance between the centers of all economic areas and centers or concentrations of shopping goods sales. These are established according to standards based on some field studies varying from 45 mph. on the parkways and expressways down to 10 mph. in congested areas. We also allow varying number of minutes to find parking spaces in a given kind of shopping center, varying from 2 to 5 min.

Figure 3. In this study are not only general merchandise, apparel, and furniture sales important but also food sales, separating the combination grocery and meat stores under which category fall the supermarkets. The latter are shown in black and all other food sales in gray and the GAF sales in white.

#### BRIDGEHAVEN CENTER

Figure 4 shows a typical distribution in New England of Expending Units. The study was made for a center half way between Bridgeport and New Haven. In this case the income groups were broken down into fifths with the upper fifth over \$5,000 and around to the lower fifth under \$1,500. It is interesting to compare the distribution of population and density with, for example, Long Island or Toledo.

Figure 5 shows the distribution of general merchandise, apparel, and furniture, home furnishing store sales. The upper quintan represents the G and clockwise the A sales and to the left the furniture home furnishing sales. In some instances it was not possible to break them down into the three stores groups as for example in the potential of the shopping center in which case they are shown in the solid tone.

Figure 6 shows a network of expressways in this part of Connecticut with a proposed new Route 1 and shows the isochrons of 10, 20, and 30 min. of distance.

If it were not for this excellent network of highways with which you are all familiar this 30-min. isochron would be contracted considerably and the market reduced accordingly.

#### TOLEDO AREA

Figure 7 shows again the expending units broken into income groups by thirds for the Toledo Metropolitan Area. It is interesting to compare this pattern and distribution of population which is comparatively compact with little in the outer peripheral areas with the wider distribution in New England and the dispersal of purchasing power on Long Island.

Figure 8 shows again the concentration of GAF sales and again note the importance of the central business district with its very high concentration.

Figure 9 shows the expending units and by the pies the GAF customers by numbers patronizing the shopping center, by the central district and by the white tone all other concentrations of shopping goods.

Figure 10 shows in gray circles the GAF purchases made by the various expending units. This can be compared with Figure 8 showing where these purchases are concentrated. Note the much-greater area of the circle in economic Area 7 as

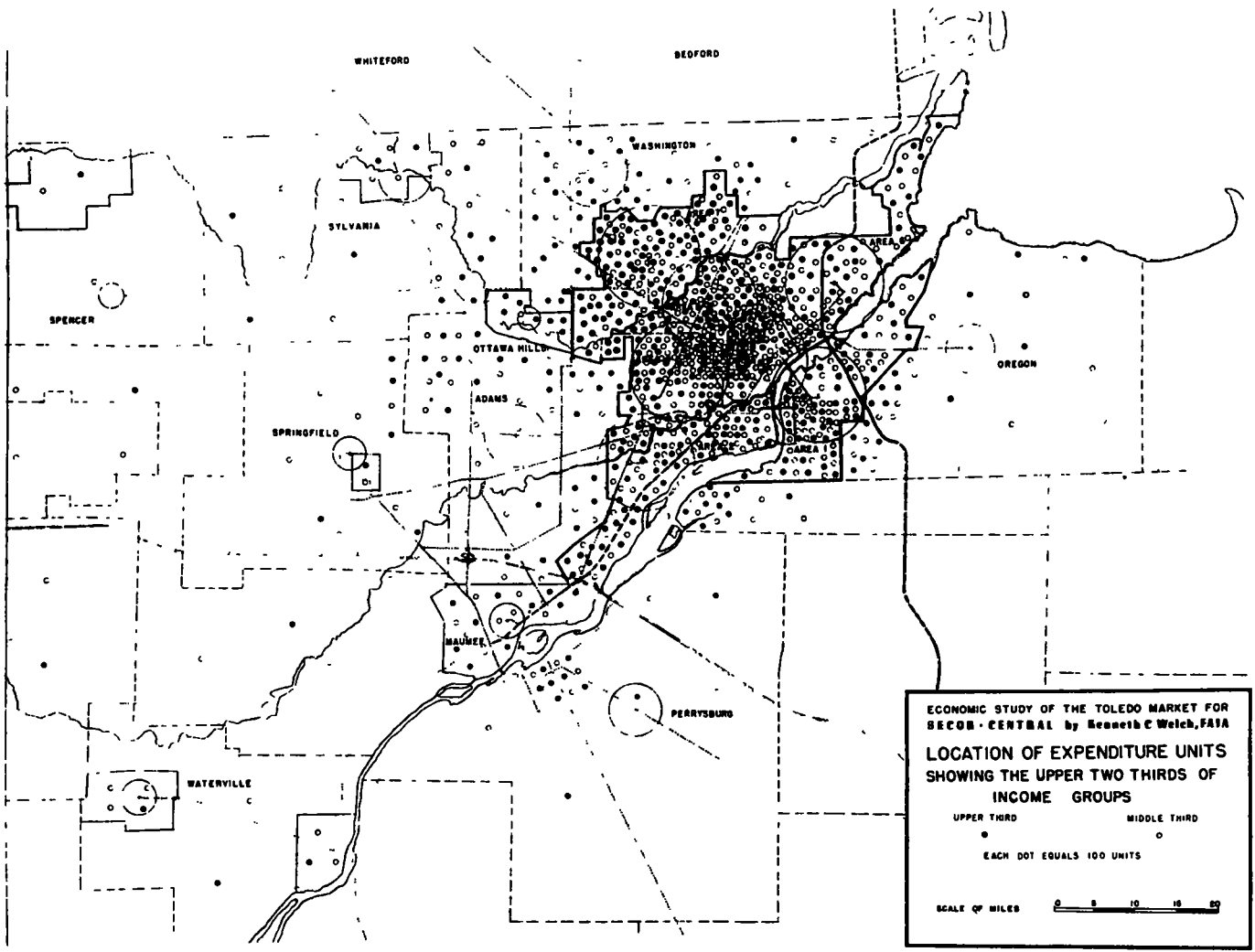


Figure 11.

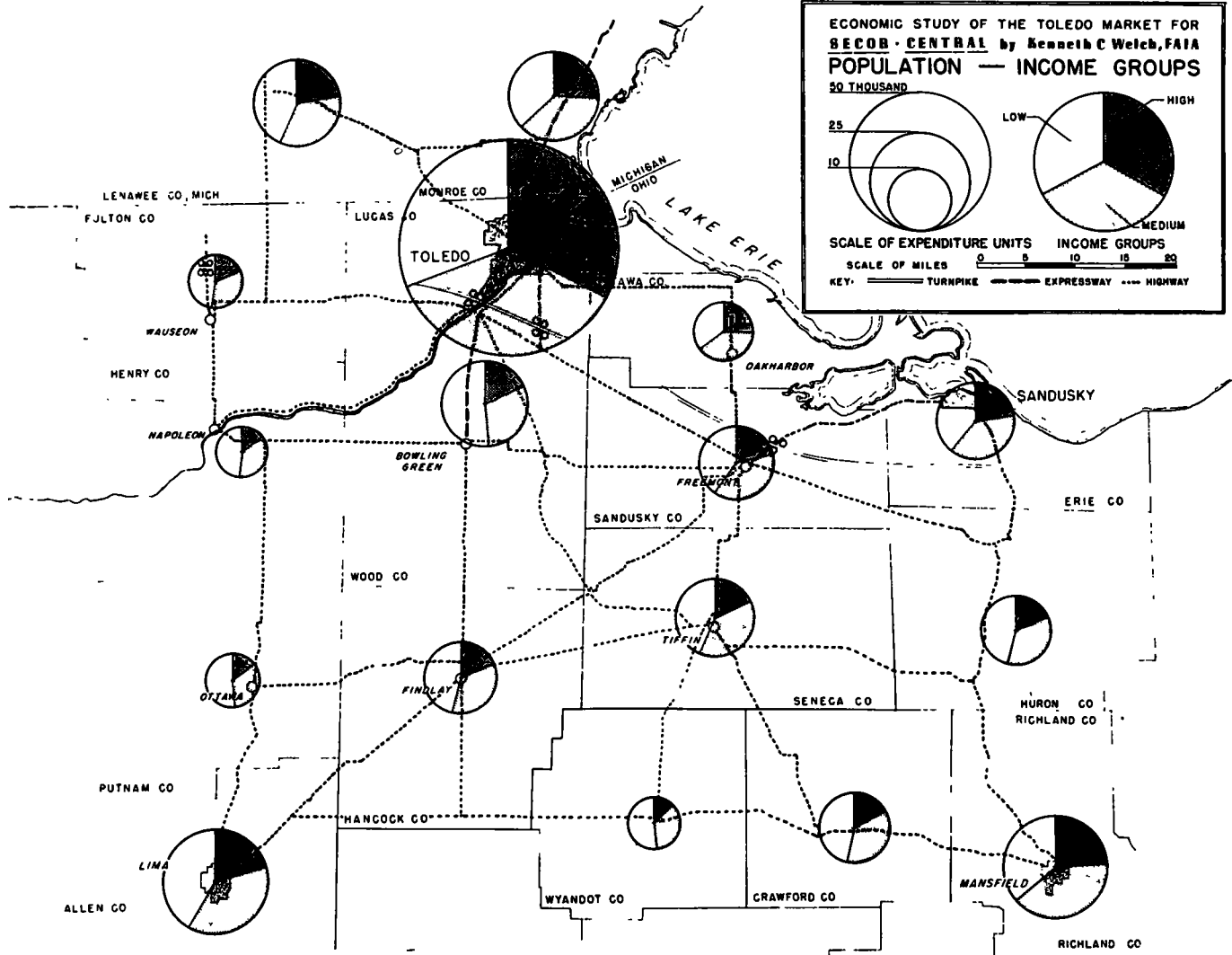


Figure 12.

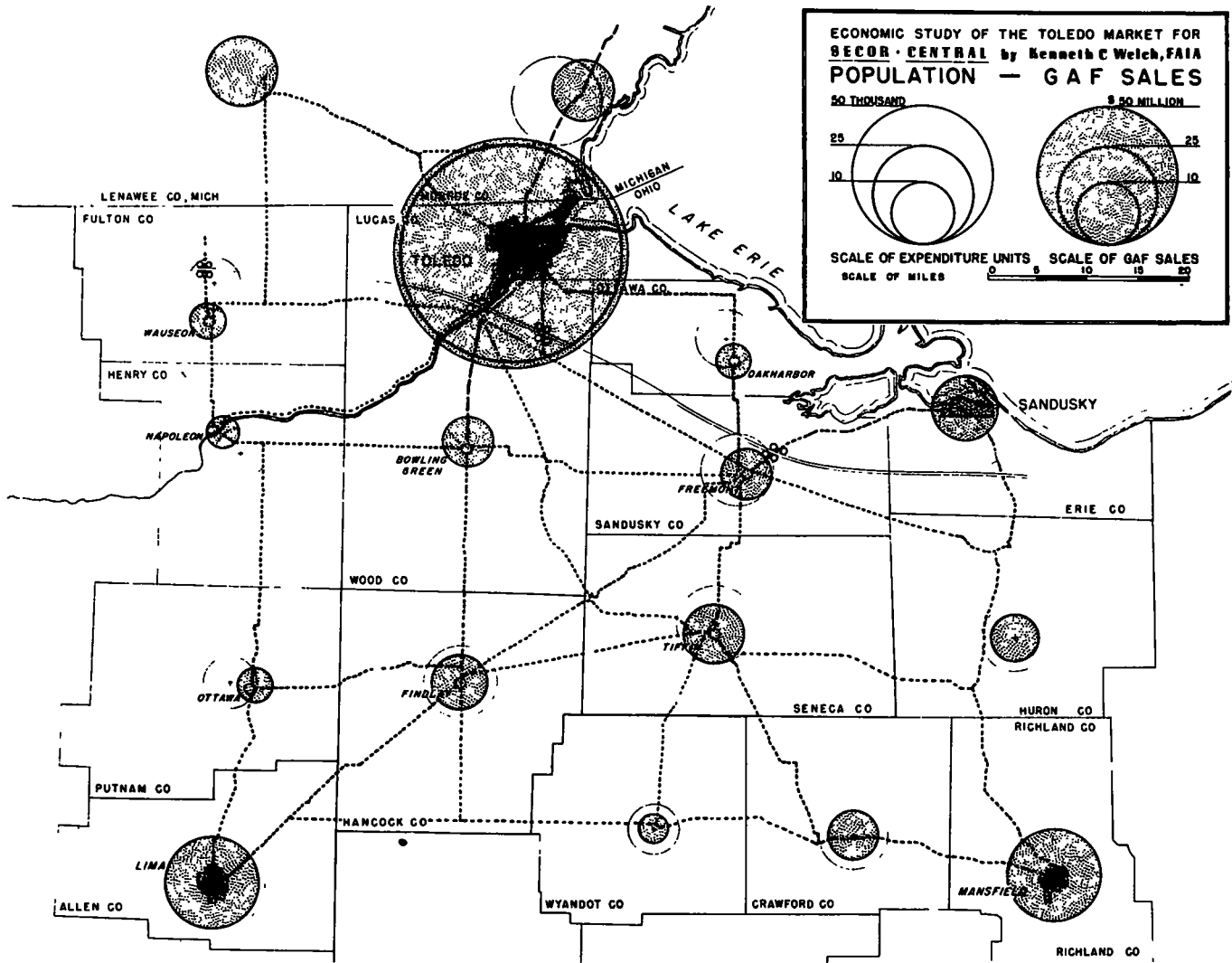


Figure 13.

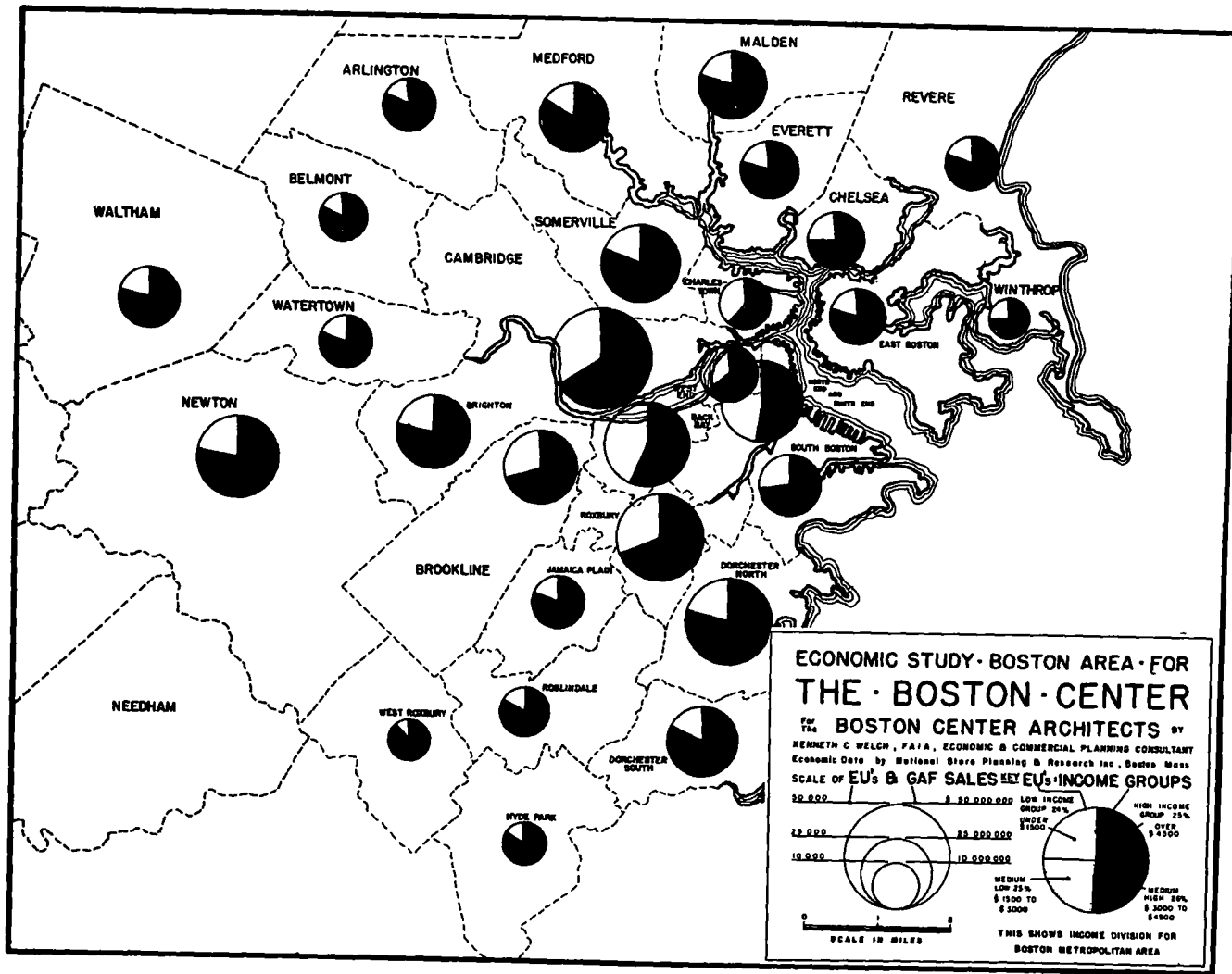


Figure 14.

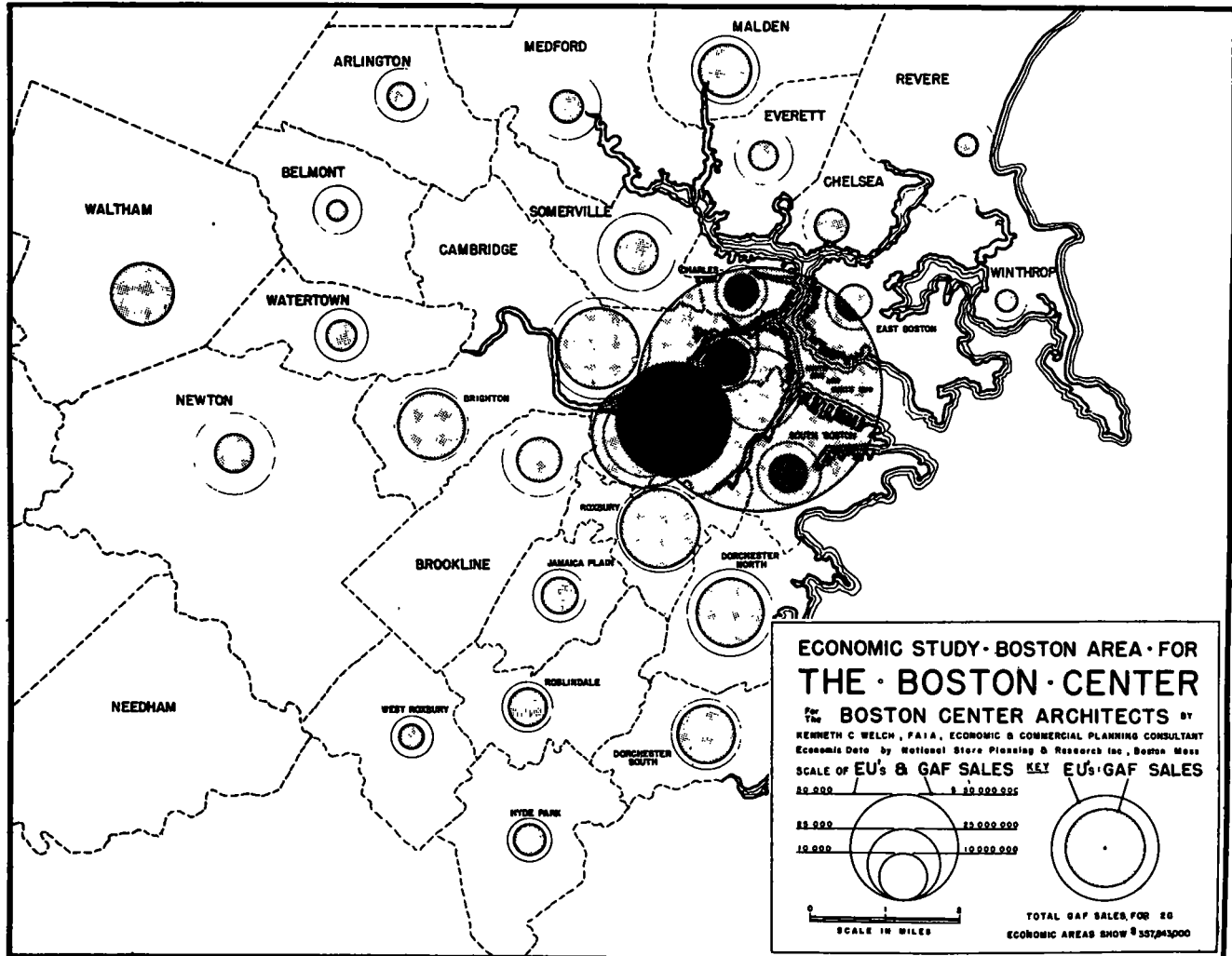


Figure 15.



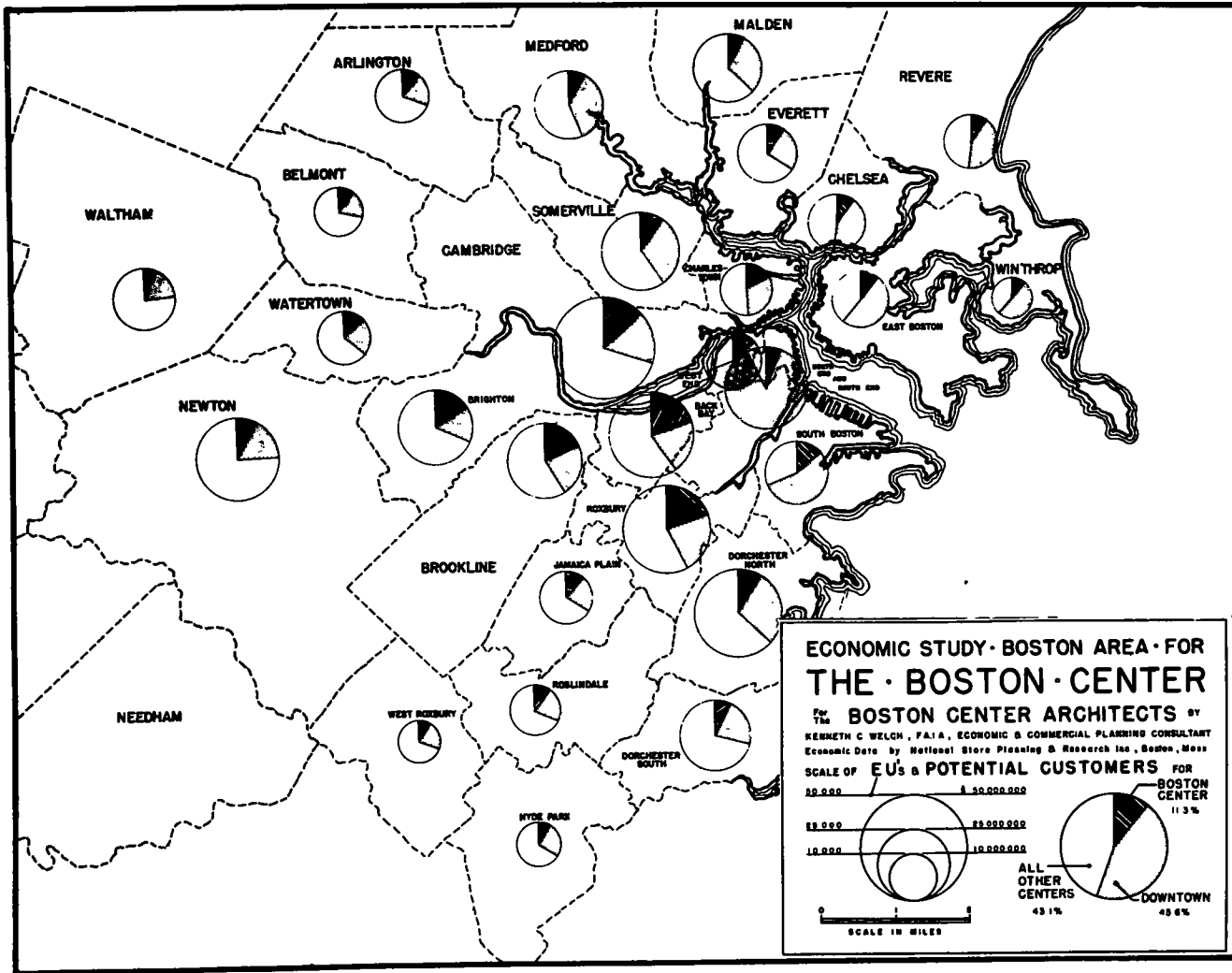


Figure 16.

compared with Area 3 adjacent to the central district, wherein are practically the same number of expending units in each.

Figure 11 is another method of showing income groups by location in a more detailed form. The dark dots represent 100 expending units in the upper third of the income groups and the light dots the middle third. In this case the lower third represents 30 percent of the population and purchase only 23 percent of shopping goods sold in the area.

Figure 12 shows the same expending units for an entire region comprising 17 counties and their breakdown into the same income groups. This study was extended to show the influence of the Ohio Turnpike in bringing additional GAF sales from counties with easy access to the turnpike to the Toledo area.

Figure 13 shows the existing GAF sales in the various counties as compared with Lucas County. Our study showed that some 14 to 15 percent additional GAF sales would come to the Toledo area from the 16 counties, the great majority coming by private automobile.

## THE BOSTON CENTER

This center is unusual in that it is just a little over a mile to the central business district. It is on two subway and elevated routes and on a considerable number of bus lines; it is also planned to have a station of the Boston-Albany railroad. It is in a triangle between Boylston, Huntington, and Massachusetts avenues. The matter of traffic access and the organization of the external and internal traffic is obviously one of the most important parts of the study. This is done in collaboration with Wilbur Smith and the economic analysis did a great deal to determine the direction from which the mass transit users would come as well as with the private vehicle traffic. Some 6,000 car spaces are being provided.

Figure 14 shows again the distribution of expending units with their income status and this time broken into fourths.

Figure 15 shows the concentration of GAF sales with the darker circle indicating the potential for the center.

Figure 16 shows again the potential customers for the new center as well as for the central district and all other centers.

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