

Transportation: The Link Between People and Jobs

HAROLD KASSOFF, Bureau of Public Roads, Federal Highway Administration,
U. S. Department of Transportation; and
HAROLD D. DEUTSCHMAN, Newark College of Engineering

•THE CONCENTRATION of low-income households in the core areas of the nation's cities, coupled with a growing trend towards dispersion of employment opportunities, particularly in the unskilled and semiskilled categories, is resulting in a growing spatial mismatch of low-income residential areas and the location of available jobs. The problem is compounded by the general reliance of poverty-level households on public transportation systems that typically do not provide adequate access to outlying suburban areas. Although it is certainly clear that the improvement of living standards for more than 10 percent of the nation's population demands much more than improvements in accessibility to employment, evidence exists in some areas that the inability of workers to reach jobs as a result of transportation constraints can be a major factor in limiting their economic status. It is the purpose of this study to provide some insight and dimension to the nature of this people-job-transportation relationship in terms of its implications for poverty-level families.

The study was conducted for the New York metropolitan area using data available from the 1963 Tri-State Transportation Commission Home Interview Survey. The survey consisted of a 1 percent sample of households drawn from the 22 counties lying in those portions of New York, New Jersey, and Connecticut that comprise the Tri-State Study Area (Fig. 1). The data compiled reflect extensive socioeconomic as well as travel information for the residents of the study area.

For the purposes of this project, only those permanent-resident households with the head in the labor force were selected from the Home Interview file. This included employed heads of households as well as those who were unemployed but seeking employment when the survey was conducted. Not included were those heads of households classified as retired, students, or housewives; such persons are generally not affected significantly by the relative availability of employment opportunities. It must be emphasized that the labor force and employment statistics quoted in this report apply only to heads of households.

The research was structured into three major phases. The first was aimed at providing a descriptive profile of the social and travel characteristics of low-income households and an indication of the nature of the variation of some of these characteristics with household income. Such factors as age of head of household, family size, trip rates, occupation, industry, auto ownership, and residential and employment mobility are examined in terms of the financial status of the household.

The second phase of the study is concerned with the spatial distribution of low-income households in terms of places of residence and places of employment. As part of this analysis, graphic displays were prepared that show the concentrations of low-income homesites and worksites in the study area on a square-mile basis. Also shown is the geographical distribution of low-income unemployed heads of households. Statistics were compiled that reflect the percent distribution of households by income within counties both for places of residence and for employment. The availability of a private automobile was considered an important indicator of household travel potential and therefore was introduced as a classifying variable in some of the tabulations.

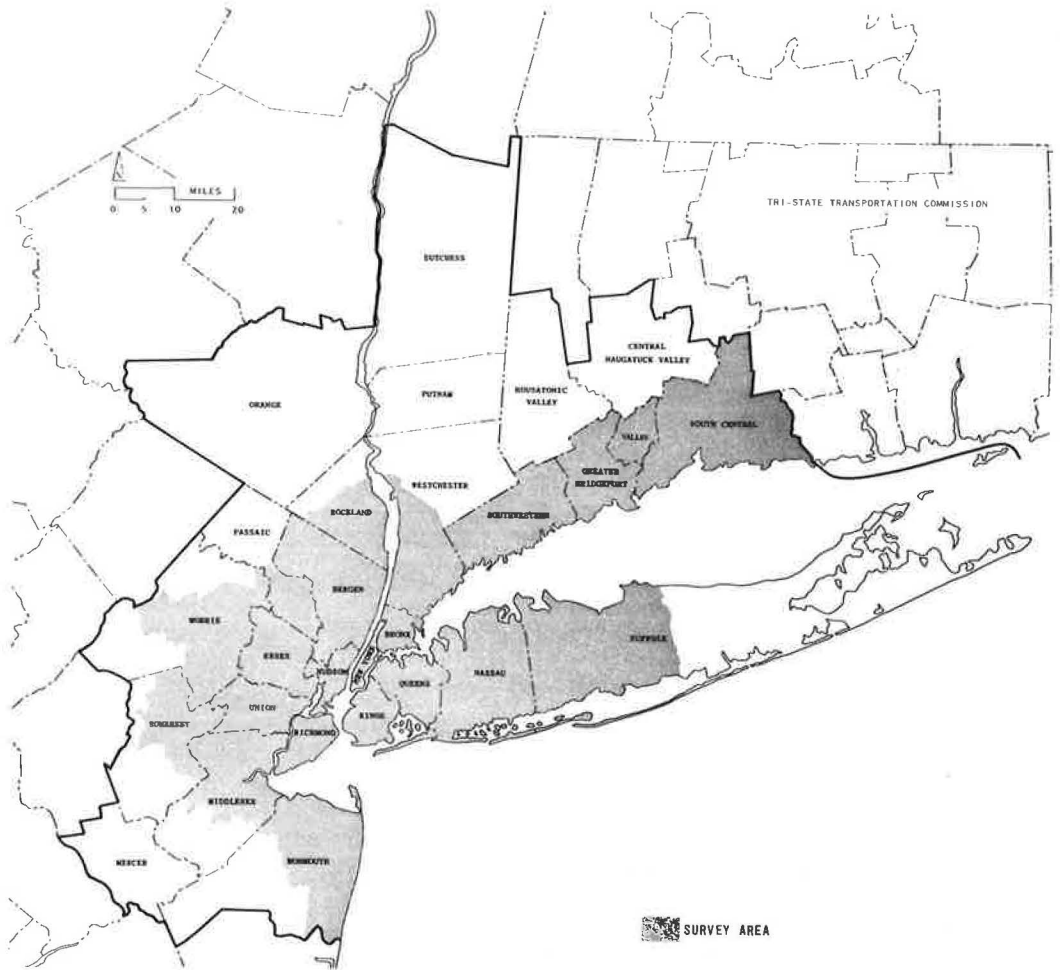


Figure 1. Tri-State Home Interview Survey area.

The final phase of the study consists of a profile of the journey-to-work characteristics of households according to income classification. Included are an analysis of trip length in terms of time as well as distance, percent transit usage, reverse commuting by residents of New York City, and percent of households living and working in the same county. Once again auto availability was used in many instances to further stratify households into groups of unique characteristics.

SOCIOECONOMIC PROFILE

There were approximately 16 million persons living in the 3,600-square-mile study area when the survey was conducted in 1963. About 4.25 million heads of households were in the labor force, 4 million of which were employed within the study area (Tables 1 and 2). A little more than 10 percent of these heads of households reported annual family incomes of under \$4,000 per year. In New York City this figure increased to about one out of every five, or 20 percent. Approximately three-quarters of the study area's low-income head-of-household labor force resided within New York City, whereas somewhat less than that fraction of total low-income employment was located there.

TABLE 1
PERCENT DISTRIBUTION OF LABOR FORCE BY HOUSEHOLD INCOME

Residential Location	Household Income Percentages			Total Labor Force (thousands)
	Under \$4,000	\$4,000- \$10,000	Over \$10,000	
New York City (excl. Richmond)	18.4	61.7	19.9	2,111
Outside New York City (incl. Richmond)	6.7	62.5	30.8	2,132
Study area	12.5	62.0	25.5	4,243

Note: Data include heads of households only, both employed and unemployed.

TABLE 2
PERCENT DISTRIBUTION OF EMPLOYMENT BY HOUSEHOLD INCOME

Employment Location	Household Income Percentages			Total Employment ^a (thousands)
	Under \$4,000	\$4,000- \$10,000	Over \$10,000	
New York City (excl. Richmond)	13.4	60.2	26.4	2,328
Outside New York City (incl. Richmond)	7.1	67.1	25.8	1,715
Study area	10.7	63.1	26.2	4,043

^aIncludes heads of households only.

The Tri-State study area contains a number of major urban centers besides New York City, including Newark, Jersey City, New Haven, and Bridgeport. In view of the relative dominance of New York City within the metropolitan region, however, most of the geographic stratification in this report is by location either within or outside New York. For analysis purposes the statistics in this report referring to New York City include only the four boroughs of Manhattan (New York County), Brooklyn (Kings County), Queens, and the Bronx. Richmond, because of its low density pattern of development, was considered as part of the rest of the study area outside of New York City. (The population of Richmond is only 3 percent of the total population of the city.) A number of tabulations were produced on a county basis (Tables 12-16) and these have been included in the Appendix.

Employment Characteristics

For low-income households with the head in the labor force, the key to improvement of economic well-being is the expansion of employment opportunities. In this respect, occupation becomes a key factor. It is not surprising to find that over 75 percent of low-income heads of households are either blue-collar workers or are unemployed, compared with about 55 percent of middle-income and 25 percent of high-income workers (Table 3). What is perhaps most startling is that almost one in every five heads of households in the low-income category (100,000 persons) is unemployed and actively seeking a job, whereas only slight fractions of middle- and high-income household heads are unemployed. (The definition of unemployed as used in the Home Interview Survey referred to individuals who were without jobs but actively seeking employment.) This situation arises in part as a consequence of shifting patterns in employment opportunities. The trend towards automation in many industries is resulting in both unemployment and a surplus of jobs. The problem in large part is that the talents of the unemployed do not generally match the requirements of the available

TABLE 3
OCCUPATIONAL DISTRIBUTION OF HEADS OF HOUSEHOLDS BY HOUSEHOLD INCOME

Household Income	Percent Distribution								Total Labor Force
	Managers	Clerical	Sales	Crafts-men	Opera-tives	Ser-vice	Labor-ers	Unem-ployed	
Under \$4,000	11.4	11.1	3.1	9.0	21.5	16.5	4.7	18.3	532,000
\$4,000 to \$10,000	24.5	13.0	6.1	21.5	18.9	9.2	4.2	2.2	2,634,000
Over \$10,000	60.5	5.6	10.0	12.1	6.7	3.3	1.2	0.6	1,078,000
All income classes	32.1	10.9	6.7	17.6	16.1	8.5	3.5	3.8	4,244,000

TABLE 4
INDUSTRY DISTRIBUTION OF HEADS OF HOUSEHOLDS BY HOUSEHOLD INCOME

Household Income	Percent Distribution								Total Employed
	Con-struction	Manufac-turing	Utilities, Commun., Transp.	Whole-sale	Retail	Finance Insur., Real Estate	Prof. and Service	Public Admin.	
Under \$4,000	3.4	30.2	4.7	2.6	15.2	7.8	31.9	4.2	434,000
\$4,000 to \$10,000	7.1	31.5	11.7	4.7	13.4	6.0	17.7	7.9	1,552,000
Over \$10,000	6.3	30.4	8.7	6.2	10.5	8.9	23.4	5.6	1,057,000
All income classes	6.5	31.1	10.2	4.8	12.8	6.9	20.7	7.0	4,043,000

jobs. The sharp differences between the occupational distribution of heads of low-income households and the rest of the labor force, coupled with the inordinately high unemployment rate in the former group, amplify the point.

A distribution of employment by industry type, for each income class, is given in Table 4. The manufacturing industry stands out as a major employer in all income categories. For low-income heads of households, the service industry accounts for a high percentage of employment compared with other income groups. Surprisingly, though, the relative percentages of heads of households employed in most of the industries do not vary sharply with income.

Family Characteristics

Household Size—Though the association of poverty with households is frequently not considered in terms of family size, it is clear that the number of persons in the family unit has a great bearing upon the standard of living attainable from a given income. In general, there seems to be a positive correlation between family size and income (Fig. 2). The degree of association varies somewhat by location; households residing outside New York City are generally larger than those within the city for a given income class. The tendency towards declining family size with decreasing income is preserved when households are stratified by age of head, as given in Table 5. For the under 35 age group, 31 percent of the low-income households consist of only one person whereas for middle- and high-income households the percents are only 9 and 4 respectively. Similar proportions apply to the over 35 age group. Thus, it appears that in the study area about one-third of the households with incomes under \$4,000 per year are single-person households for which the classification of "poverty" may be subject to some question.

Age of Head of Household—The relationship between income and age of head of household was examined by looking at the distribution of households by income class within each age group (Fig. 3). Although it is apparent that low-income households

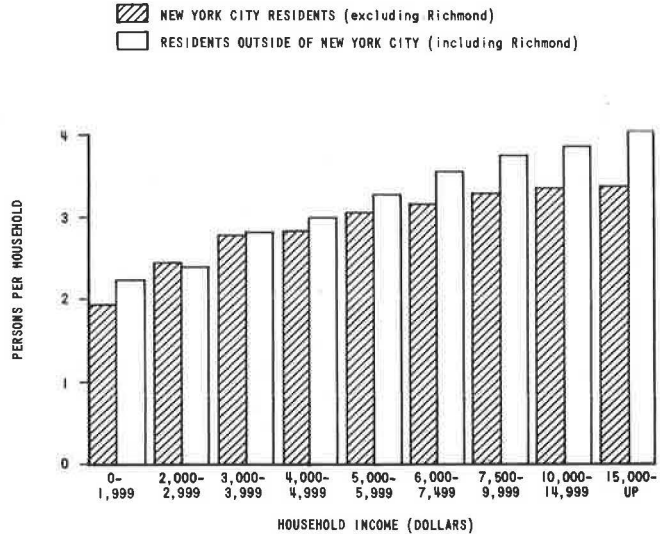


Figure 2. Persons per household by income and place of residence.

TABLE 5
PERCENT DISTRIBUTION OF PERSONS PER HOUSEHOLD
STRATIFIED BY INCOME AND AGE GROUP

Income	Percent Distribution of Persons per Household							
	Under 35 Age Group				Over 35 Age Group			
	1	2	3	4+	1	2	3	4+
Under \$4,000	31.3	17.1	18.6	33.0	37.2	28.9	12.4	21.5
\$4,000 to \$10,000	8.9	18.4	23.7	49.0	10.0	28.0	19.2	42.8
Over \$10,000	3.8	31.0	17.6	47.6	3.0	24.4	22.2	50.4
All income classes	11.9	20.1	21.9	46.1	10.9	27.0	19.4	42.7

TABLE 6
PERCENT DISTRIBUTION OF AGE OF HEAD OF HOUSEHOLD^a BY HOUSEHOLD INCOME

Income	Age Group						Total Households ^a
	Under 25	25-34	35-44	45-54	55-64	Over 65	
Under \$4,000	12.7	21.1	21.4	20.1	17.0	7.7	531,737
\$4,000 to \$10,000	4.1	22.3	29.1	25.2	15.9	3.4	2,634,607
Over \$10,000	1.1	13.3	28.0	33.3	20.2	4.1	1,077,577
All income classes	4.4	19.8	27.9	26.6	17.2	4.1	4,243,921

^aIncludes members of labor force only.

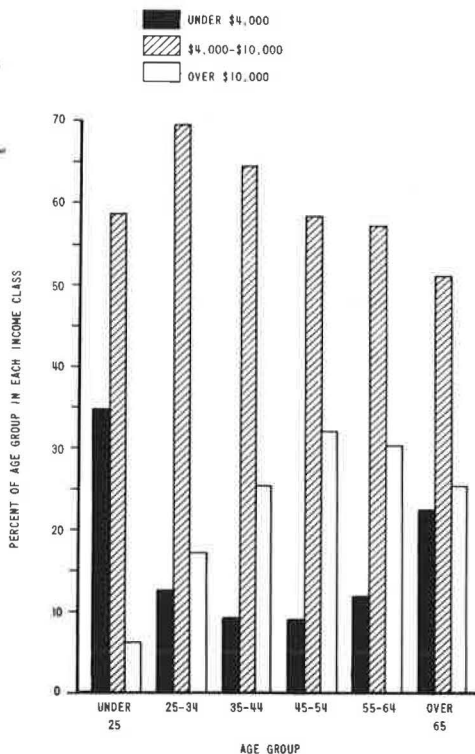


Figure 3. Percent distribution of household income by age of head of household.

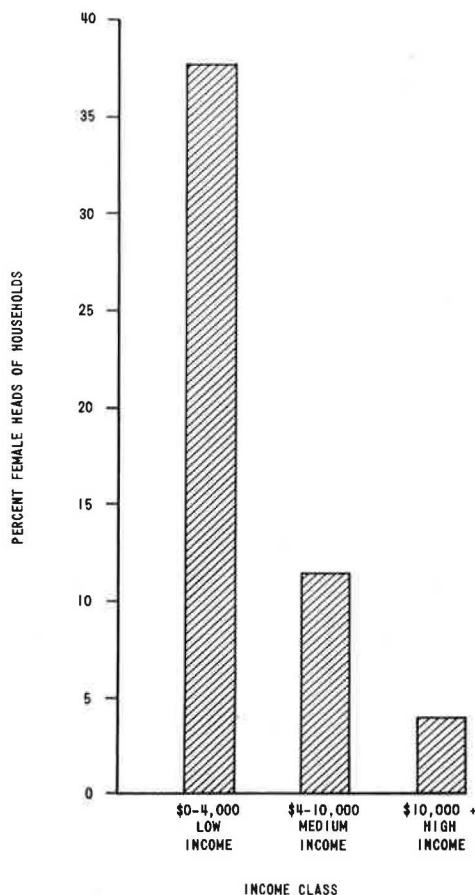


Figure 4. Percent of female heads of households in the labor force by income.

are in the minority in virtually every age group, the most interesting feature of the distributions are their relative shapes. The middle- and high-income households peak in terms of their relative presence in each age group in the 25 to 34 and 45 to 54 categories respectively, both trailing off somewhat in the youngest and oldest age categories. Low-income households are distributed quite differently, with their relative presence within each age group clearly peaking in the very young and very old age groups. In terms of percentage figures, low-income households comprise 35 percent of the under 25 group and almost 25 percent of the over 65 age group (note that retired heads of household are not included), whereas in the 35 to 44 and 45 to 54 age categories less than 10 percent are low-income households. Further analysis revealed that 20 percent of all low-income households fell into these two extreme age groups, whereas for middle- and high-income households these figures were 8 and 5 percent (Table 6).

It seems clear that compared to the rest of the population, a disproportionately large share of low-income households are clustered in the very young and very old age groups. This is not to minimize, however, the significance of the 80 percent of the low-income group that remains in the age 25 to 64 categories. The distribution does indicate, however, that a significant share of heads of households with annual incomes under \$4,000 are either near retirement or have just entered the labor force and have not developed to their full earning potential.

Sex of Head of Household—The distribution of sex of head of household by income class provides an interesting and significant insight into the composition of low-income

households. As shown in Figure 4, nearly 40 percent of the heads of low-income households in the labor force are females. This compares with 11 percent of middle-income and 4 percent of high-income heads of households who are female.

An analysis of unemployed low-income heads of households showed that 35 percent of those with incomes under \$4,000 per year who were out of work at the time of the survey were females. The unemployment rate among female low-income heads of households was virtually the same as for males, the former being 17 percent and the latter, 19 percent.

The high proportion of female heads of households in the low-income group is a consequence of social conditions that will not be discussed here. What is of major importance is how this relates to the notion of improving job opportunities for the poor. For example, a public works program that intended to increase the supply of jobs in the manufacturing and construction industries would have little effect upon four-tenths of the heads of households in the low-income labor force. There are transportation implications as well. Females are usually more reliant on transit and less willing or able to travel long distances to work (1). Such factors must be considered carefully in the development of programs to provide jobs or transportation to jobs for low-income households.

Residence and Employment Changes (1960-1963)

In analyzing the relationship between people, jobs, and transportation, it is useful to examine the dynamics of residential and employment mobility. The willingness of low-income households to change residence and to leave current low-paying jobs are factors to be considered in attempting to improve their accessibility to job opportunities. In this section, the frequency of residential and employment changes that occurred between the 1960 census and the 1963 Home Interview Survey is examined with respect to both income and age of head of household.

Residential Mobility—The relative residential mobility of households, stratified by income class as well as age of head, is given in Table 7 in terms of moves per thou-

TABLE 7
NUMBER OF RESIDENCE CHANGES (1960-63) PER THOUSAND HOUSEHOLDS BY INCOME AND AGE GROUP

Age of Head of Household	Under \$2,000	\$2,000 to \$2,999	\$3,000 to \$3,999	\$4,000 to \$4,999	\$5,000 to \$5,999	\$6,000 to \$7,499	\$7,500 to \$9,999	\$10,000 to \$14,999	\$15,000 and Over	All Income Classes
Under 25	1,261	1,518	1,127	1,276	1,154	1,264	1,281	1,517	1,562	1,269
25-34	1,140	1,013	807	744	749	772	782	848	832	798
35-44	924	635	497	426	358	333	312	360	413	375
45-55	476	434	394	327	237	210	202	207	258	245
55 and over	236	229	187	186	170	142	138	139	295	178
All age groups	758	665	536	479	424	408	367	360	363	421

TABLE 8
NUMBER OF JOB CHANGES (1960-63) PER THOUSAND HOUSEHOLDS BY INCOME AND AGE GROUP

Age of Head of Household	Under \$2,000	\$2,000 to \$2,999	\$3,000 to \$3,999	\$4,000 to \$4,999	\$5,000 to \$5,999	\$6,000 to \$7,499	\$7,500 to \$9,999	\$10,000 to \$14,999	\$15,000 and Over	All Income Classes
Under 25	270	741	498	615	622	686	603	539	688	572
25-34	403	463	433	406	414	434	437	464	430	432
35-44	424	365	246	252	253	228	241	298	291	261
45-54	271	236	213	160	149	156	172	192	176	175
55 and over	202	179	184	126	145	115	116	155	220	156
All age groups	292	353	293	262	263	263	247	264	243	263

sand households. The analysis indicates that frequency of moves tends to decline with increasing income in the older age groups. In the younger age groups, the middle-income households appear to be the most stable, whereas the low- and high-income households have a greater frequency of residential moves. Not surprisingly, the rate of residence changes declines with increasing age regardless of income group. In general, the analysis shows that low-income households have a greater tendency to change residence than the rest of the population.

Employment Changes—The pattern of employment changes per thousand households as a function of income and age of head of household is somewhat less distinct than the distribution of rates of residential changes. There seems to be no systematic variation in job changes by the head of household with household income. As was the case with shifts in residence, however, the rate of employment changes declines with increasing age in virtually all income classes (Table 8).

Travel Characteristics

Auto Availability—The availability of a private automobile is a key determinant of a household's travel behavior and is strongly influenced by income. Figure 5 shows the decrease in percent of households with no autos available as household income increases. Of New York City low-income households, less than one in five has a car available. This is contrasted with the highest income class residing outside New York City of which almost 99 percent own at least one automobile. The significantly higher percent of zero-auto households for New York City residents compared with the rest of the population, regardless of income class, is a reflection of both New York City's extensive transit system and the relative expense and inconvenience of maintaining a private auto within the city. The graph clearly indicates that reliance on modes of travel other than the automobile is highest among the lowest income groups within New York City.

A further analysis of auto availability within the low-income group by employment status shows that the percent of households with zero autos is significantly higher when

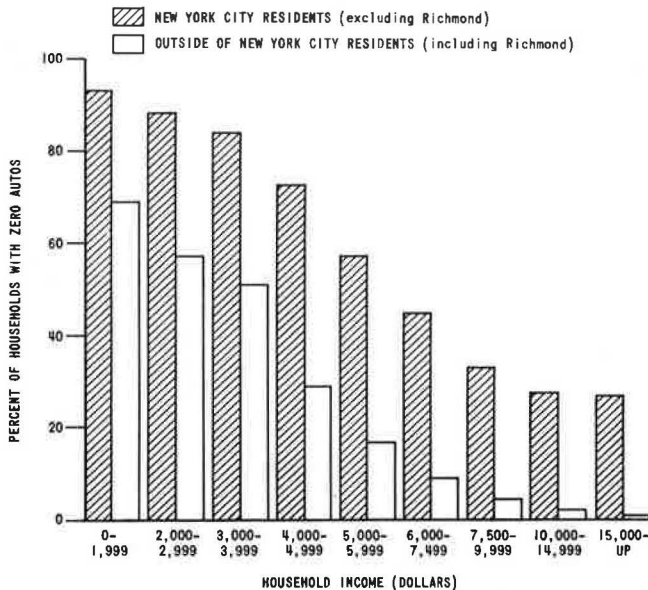


Figure 5. Percent of zero-auto households by income and place of residence.



the head is unemployed than when he holds a job (Table 9). The need for an automobile in areas of generally poor transit service is demonstrated by the fact that as much as 53 percent of the employed and 33 percent of the unemployed low-income households residing outside New York City have at least one private auto available.

Number of Trips—The relationship between household travel, in terms of number of trips and household income is shown in Figure 6. The graph demonstrates that households with higher incomes make more trips than those in the lower income groups, and that the trip rates for households residing outside New York City are progressively higher than for New York City residents as income increases. (Walking trips are not included.)

To account for the correlation between household size and household income, trips per person also were analyzed in relation to household income. The results shown in Figure 7 indicate that the positive relationship between travel and income is preserved, even on a per-person basis. The rate varies from a low of about one trip per person for households earning less than \$2,000 per year to a high of three trips in the \$15,000-and-over income category.

TABLE 9
PERCENT AUTO AVAILABILITY FOR LOW-INCOME HOUSEHOLDS BY EMPLOYMENT STATUS

Location	Employment Status	Autos Available	
		0	1+
New York City (excl. Richmond)	Employed	85.8	14.2
	Unemployed	92.4	7.6
Outside New York City (incl. Richmond)	Employed	53.3	46.7
	Unemployed	67.0	33.0

 NEW YORK CITY RESIDENTS (excluding Richmond)
 RESIDENTS OUTSIDE OF NEW YORK CITY (including Richmond)

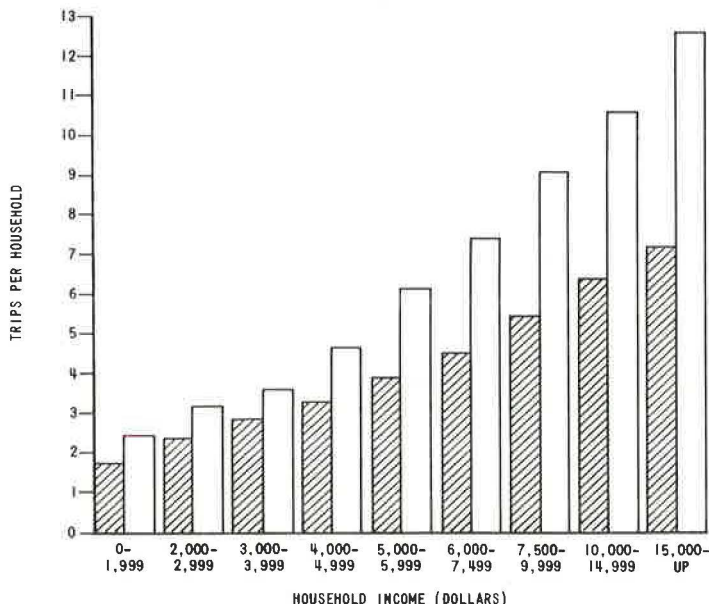


Figure 6. Trips per household by income and place of residence.

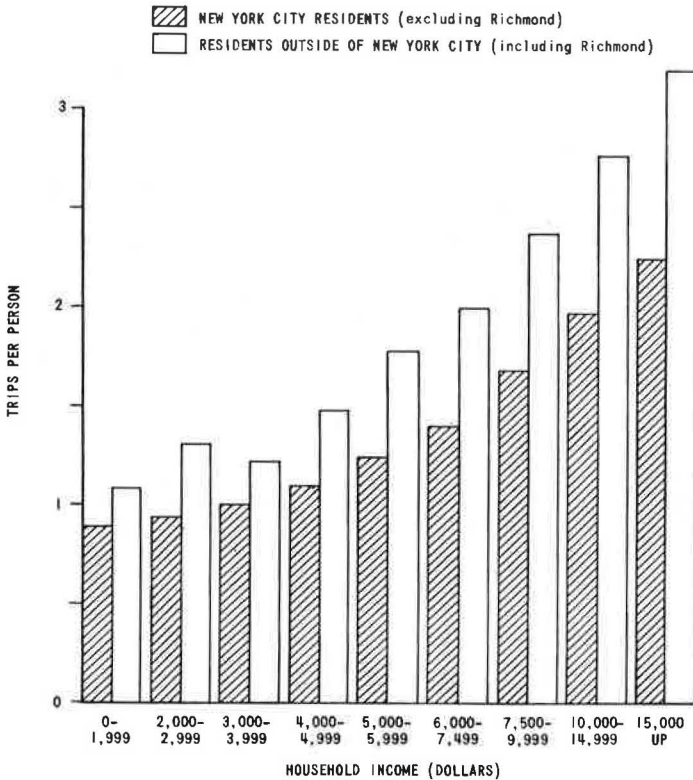


Figure 7. Trips per person by income and place of residence.

Thus, the travel mobility of low-income households, measured in terms of number of trips, is somewhat restricted in comparison with the wealthier segments of the population. Although travel per se is merely a means to an end, the implications are that the opportunity to engage in activities is more constrained for low-income households.

SPATIAL DISTRIBUTION

The spatial separation of place of residence from place of employment brings about the need for transportation to and from work. Although logic may dictate that this separation should be minimized, the pattern of growth in population and employment in most urban areas seems to defy this seemingly sound conclusion. In most major metropolitan areas the geographical distribution of middle- and upper-income households has been shifting to the suburbs while the populations of core areas increasingly are dominated by households with relatively low incomes. On the other hand, there is a trend toward a dispersion of major manufacturing employers who provide a large share of job opportunities for unskilled or semiskilled workers; whereas high-income, white-collar jobs tend to remain within centrally located areas.

This section examines the spatial distribution of homesites and worksites of the low-income labor force as it existed in the Tri-State area in 1963. Even though this analysis represents a single cross section in time, it should be considered in the context of the shifting pattern of urban development just described.

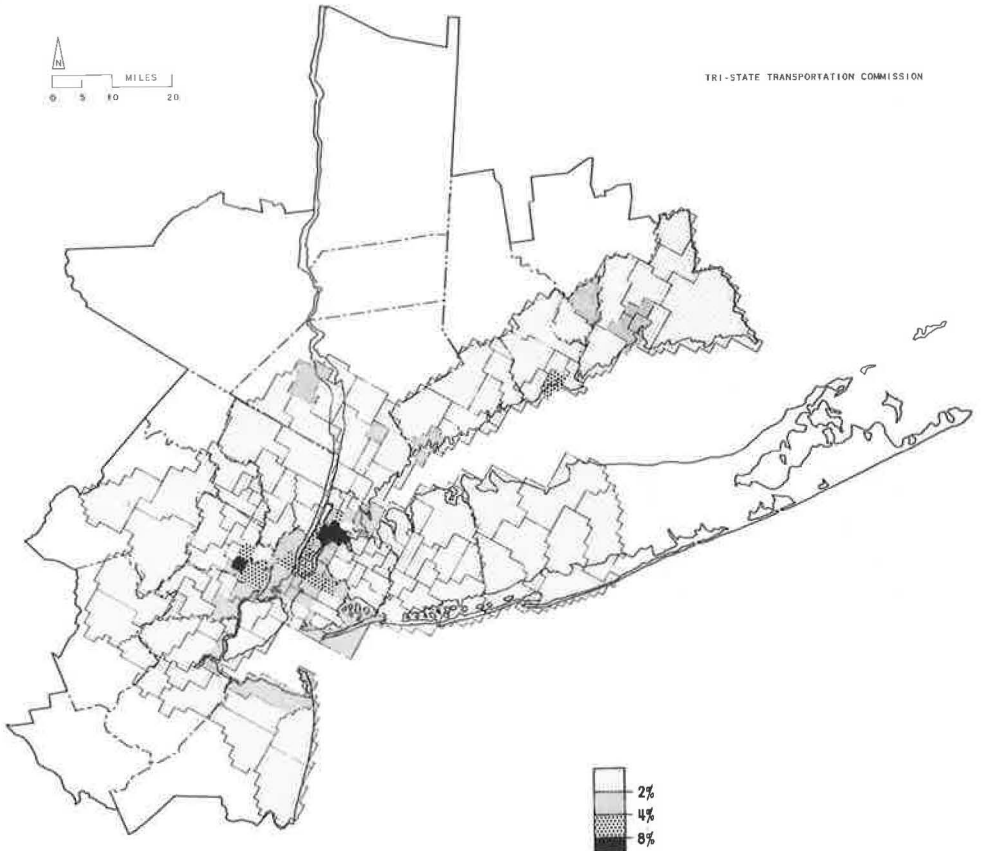


Figure 10. Percent of low-income unemployment by data aggregation district.

areas that are major centers of unemployment are in the Newark and New York City metropolitan areas, where, in the most severe cases, the rates (relative to the total labor force) range up to 8 and 13 percent respectively. Bridgeport is also a significant area of low-income unemployment.

Relative Distribution of Labor Force and Employment

The ratio of employment to resident labor force within a given area provides some indication of the amount of travel for the purpose of going to and from work required of the residents of that area. Such ratios were calculated for the Tri-State study area on a county basis (Table 14, Appendix). The results show that New York City has an overall deficit of low-income jobs for its resident labor force, whereas more employment opportunities are available in the middle- and upper-income ranges than there are residents. Within New York City, the borough of Manhattan (New York County) has the highest number of jobs in all income groups relative to its labor force, and for the most part the remaining boroughs have fewer jobs than resident workers (Table 15, Appendix). The same pattern is evident in Table 10 which gives the relative percentage of area-wide low-income labor force and employment for New York City and the rest of the study area.

TABLE 10
RELATIVE DISTRIBUTION OF LOW-INCOME LABOR FORCE AND LOW-INCOME EMPLOYMENT^a

Location	Percent of Labor Force (1)	Percent of Low-Income Labor Force (2)	Ratio (2):(1)	Percent of Employment (3)	Percent of Low-Income Employment (4)	Ratio (4):(3)
New York City (excl. Richmond)	49.8	73.2	1.47	57.6	71.9	1.25
Outside New York City (incl. Richmond)	50.2	26.8	0.53	42.4	28.1	0.66

^aIncludes heads of households only.

LINKING HOMESITES WITH WORKSITES

The spatial link between people and jobs is transportation. The increasing mobility afforded by the private automobile to most of the population has enabled many major employers to formulate locational decisions with a declining emphasis placed on the location of the potential labor force. For most of the population, access to employment is no longer a serious constraint. For a significant minority consisting of low-income households, however, over three-quarters of whom have no private vehicles available,

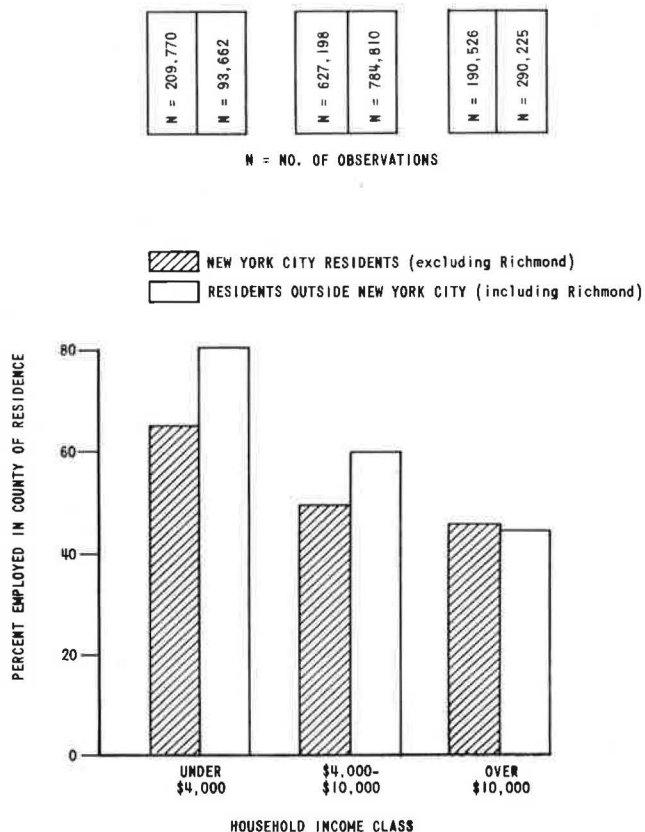


Figure 11. Percent of labor force employed in county of residence by income class.

transportation does represent a significant constraint. This section of the report examines the homesite-worksite linkage and the specific characteristics of the journey to work for low-income households in comparison with the remaining middle- and high-income population.

Percent of Labor Force Working in County of Residence

A rough measure of the work-trip mobility of the labor force is provided by examining the tendency of workers to hold jobs that are in proximity to their places of residence. In this regard, Figure 11 shows that low-income heads of households are less likely to travel outside their county of residence than those in the upper income categories. Although this relationship is preserved regardless of general residential location, it appears that low- and middle-income heads of households residing within New York City are more likely to travel outside their county of residence than those of the same groups living outside the city. This appears to be a result of both the superior transit coverage within the city and the concentration of job opportunities within Manhattan.

The combined effect of income and auto availability on the propensity to work outside the county of residence is given in Appendix Table 16. The results of this analysis show that across all income classes the availability of an automobile enhances the probability of working outside the residence county. A causal relationship is not truly demonstrated because there is no way of determining how many households forego the ownership of an automobile as a result of proximity of employment location. Given that many households do own one or more autos regardless of mode of travel to work, however, the data indicate that for low-income households with no autos available, the chance of employment outside the county of residence is relatively limited.

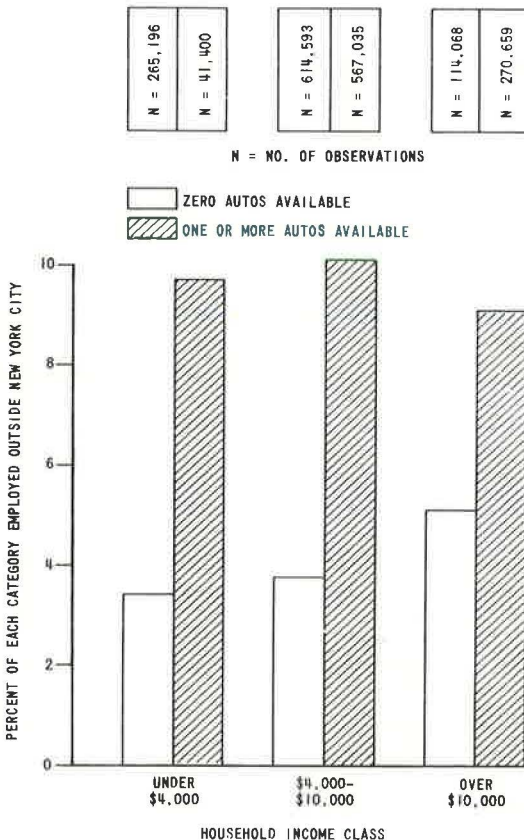


Figure 12. Percent of New York City resident labor force employed outside New York City as stratified by income and auto availability.

Reverse Commuting From New York City

The heavy concentration of low-income households residing within New York City coupled with the trend towards decentralization of employment opportunities suggested an analysis of reverse commuting from New York City. Figure 12 shows that the major factor discriminating between reverse commuters and those who remain within the city is the availability of an automobile. Regardless of income class, approximately 10 percent of all heads of households with at least one auto who reside in New York City are employed outside the city. For low-income households with zero autos this figure drops to less than 4 percent, whereas for the middle- and high-income households the absence of a private car is somewhat less of a constraint. Because the bulk of city-resident low-income households have no autos available, this group is generally

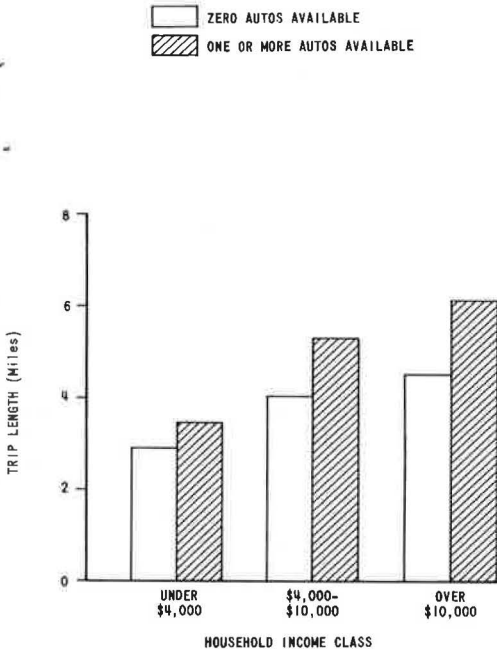


Figure 13. Average work-trip length for New York City residents.

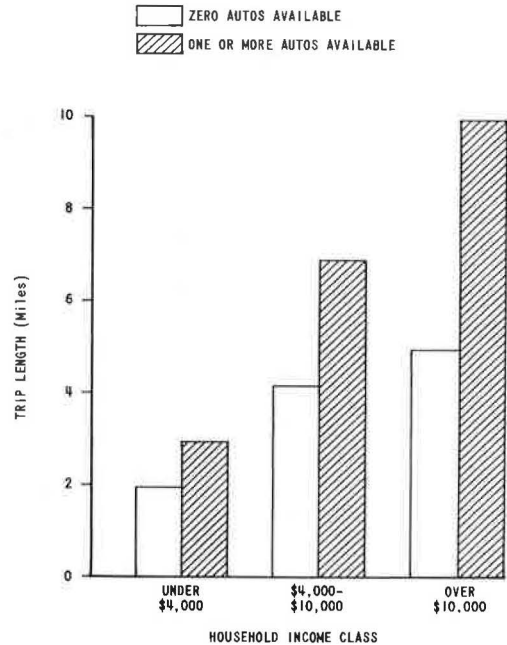


Figure 14. Average work-trip length for residents outside New York City.

much less likely to travel to work outside of New York City with the existing orientation of the transit system.

Work-Trip Length

The length of the journey to work, in terms of both distance and travel time, is a reflection of a multitude of interrelated factors. The geographical distribution of household residences with respect to centers of employment, the mode of travel used, the out-of-pocket costs incurred, and the particular occupation and industry all have a significant bearing on the time and space separation between homesites and worksites. The following discussion examines work-trip length in terms of income and auto availability and reduces the residential location bias by stratifying households according to place of residence with respect to New York City.

Distance—There is a clear correlation between distance to work and household income. Figure 13 shows that for residents of New York City the average trip length (in airline miles) for low-income heads of households is on the order of 3 miles, whereas for high-income households the average trip length is almost twice that figure. In addition, the figures for all income categories demonstrate that heads of households with one or more autos available travel longer distances between home and work than those without autos. Figure 14 shows work-trip distances for households residing outside New York City. Here, too, the shorter journey to work for low-income heads of households is substantiated; and again, those with private cars available travel greater distances.

Interestingly, the trip length for low-income households residing outside the city is shorter than for city residents whereas for high-income households the opposite is true. In the case of the former, the lack of good transit service outside New York City would tend to keep trip lengths to a minimum. For high-income households, the concentration of well-paying positions in the city, added to their ability to absorb high

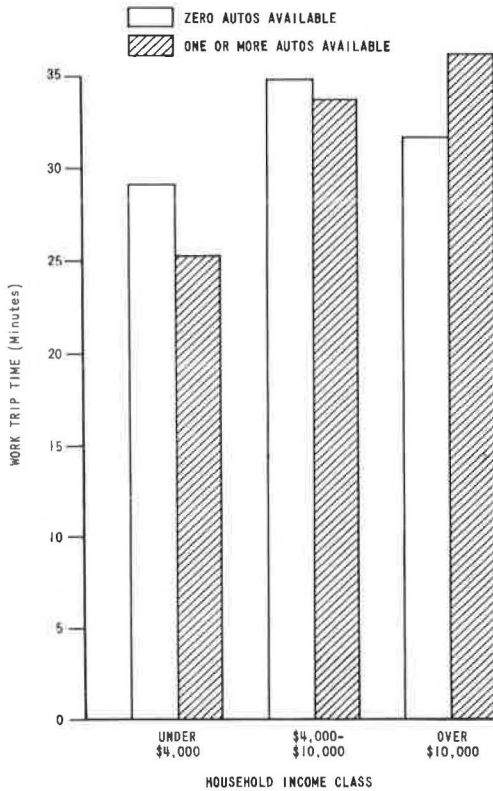


Figure 15. Average work-trip time for New York City residents.

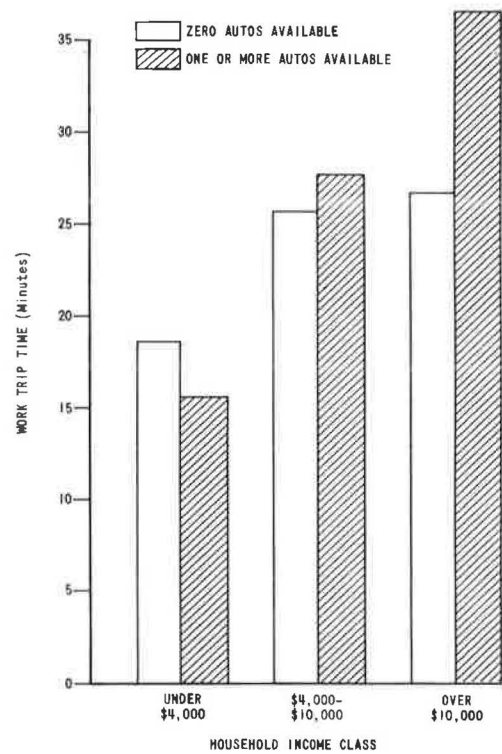


Figure 16. Average work-trip time for residents outside New York City.

travel costs, accounts for the longer journeys by nonresidents of the city.

Travel Time—Figures 15 and 16 demonstrate the relationship between income and time spent traveling to and from work for residents both inside and outside New York City. Low-income heads of households living in the city generally spend less time for their journey to work than middle- and high-income households. The addition of an auto tends to shorten the work-trip time, although as shown in the previous section, the distance traveled by those with autos is relatively longer. Regardless of auto availability, the average travel time for low-income heads of households is between 25 and 30 minutes. Middle- and high-income residents of New York City spend an average of close to 35 minutes traveling to and from work, and those in the high-income category with an auto available make longer trips in time than those with no autos.

For nonresidents of the city, the variation in work-trip time with household income is more marked than for city residents. Low-income heads of households in this subsample of the study area's population take an average of about 17 minutes to complete a journey to work whereas the mean travel time for middle-income heads is about 27 minutes and for the high-income group, well over 30 minutes. Low- and middle-income nonresidents of New York City seem to spend generally less time traveling to and from work than their city-resident counterparts. The effect of having an auto available for those living beyond the city limits varies by income class. As with city residents, low-income heads of households with a private car have a shorter work trip than those who have no private vehicle, whereas for middle- and high-income households those with autos available have a relatively longer work-trip travel time.

An indication of distance covered per 10 minutes of travel time stratified by household income, auto availability, and residential location is given in Table 11. The data indicate that low-income heads of households travel a shorter distance in a given span of time than middle- and high-income heads. Nonresidents of New York City seem to travel more swiftly than city dwellers, and the availability of an auto enhances the return on a minute's investment of travel time.

There are a number of interpretations possible from the analysis of work-trip length. The results showed that low-income heads of households generally travel less in terms of distance and time than those in the middle- and high-income groups. It is not entirely clear, however, to what extent this is a result of homesite-worksites locations and to what extent it is a reflection of the more limited travel capabilities of low-income households. The stratification of households by residence and nonresidence in New York City reduced the locational bias to a degree, but obviously did not eliminate it entirely. It is likely that a combination of factors, including limited employment opportunities, reliance on mass transit, high costs of long distance commuting, and clustering of poverty-level residential centers near the older centers of both large and small urban areas, contribute to the generally shorter work-trip lengths for low-income households.

Mode of Travel

The mode of travel used for the journey to work is an important indication of the degree to which access to employment opportunities represents a problem for low-income

TABLE 11
AVERAGE MILES COVERED PER 10 MINUTES OF
WORK-TRIP TRAVEL TIME

Residential Location	Autos Available	Mileage Stratified by Household Income		
		Under \$4,000	\$4,000-\$10,000	Over \$10,000
New York City (excl. Richmond)	0	1.0	1.2	1.4
	1+	1.4	1.6	1.7
Outside New York City (incl. Richmond)	0	1.0	1.6	1.9
	1+	1.9	2.5	3.1

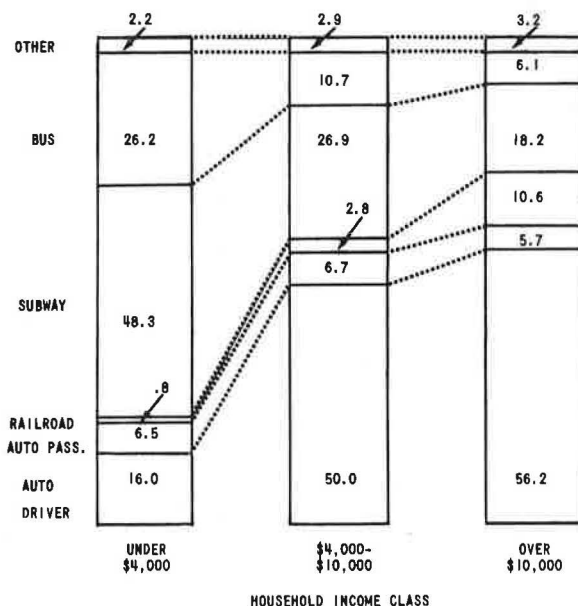


Figure 17. Percent distribution of mode for journey to work.

households. If the auto availability rate among low-income households were high, it is unlikely that transportation would be a major constraint in obtaining jobs. As shown earlier, however, relatively few low-income households have ready access to a private car. The reliance of these people upon public transportation thus is well established. The nature of the relationship between household income and the use of transit for the work trip is the subject of the following discussion.

Mode Distribution—The percent distribution of mode for the journey to work as stratified by household income is shown in Figure 17. The reliance of low-income heads of households upon mass transit modes is clearly demonstrated. About three of every four work trips made by low-income heads in the study area are via a transit mode (primarily subway and bus) whereas only slightly more than one in five are auto driver or auto passenger trips. The pattern shifts significantly in the middle- and upper-income categories where 57 and 62 percent respectively are auto driver or auto passenger trips. The growth in importance of commuter railroads as income increases is also illustrated, this being a reflection of both the outlying middle- and high-income residential areas and the ability of members of these income groups to sustain the relatively high costs associated with this travel mode.

Use of Mass Transit—In analyzing mass transit usage by the low-, middle-, and high-income groups, homesites and worksites were classified with respect to location within or outside New York City. For New York City residents there is a clear tendency toward declining transit patronage as household income increases, regardless of

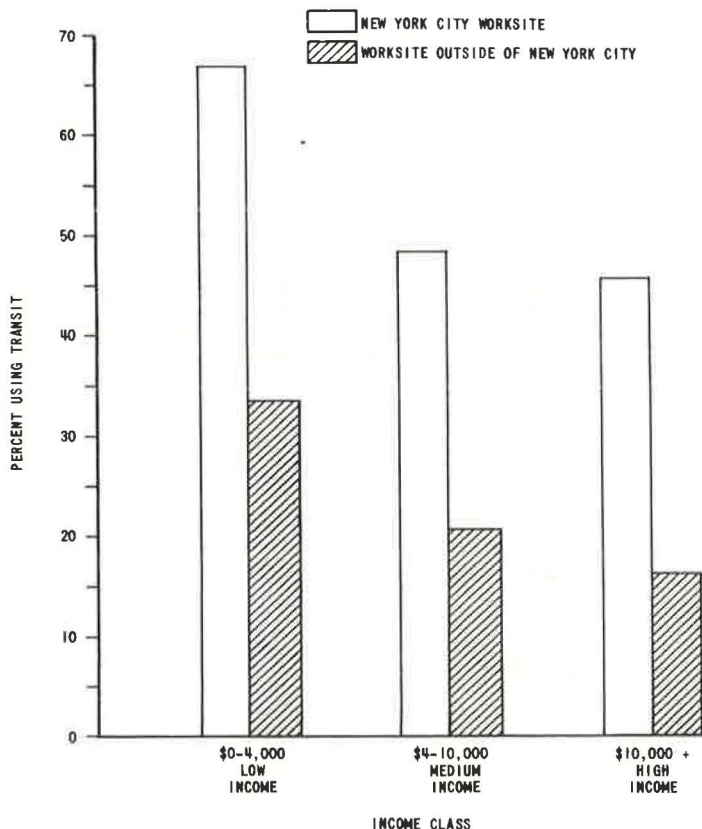


Figure 18. Use of mass transit for journey to work by New York City residents.

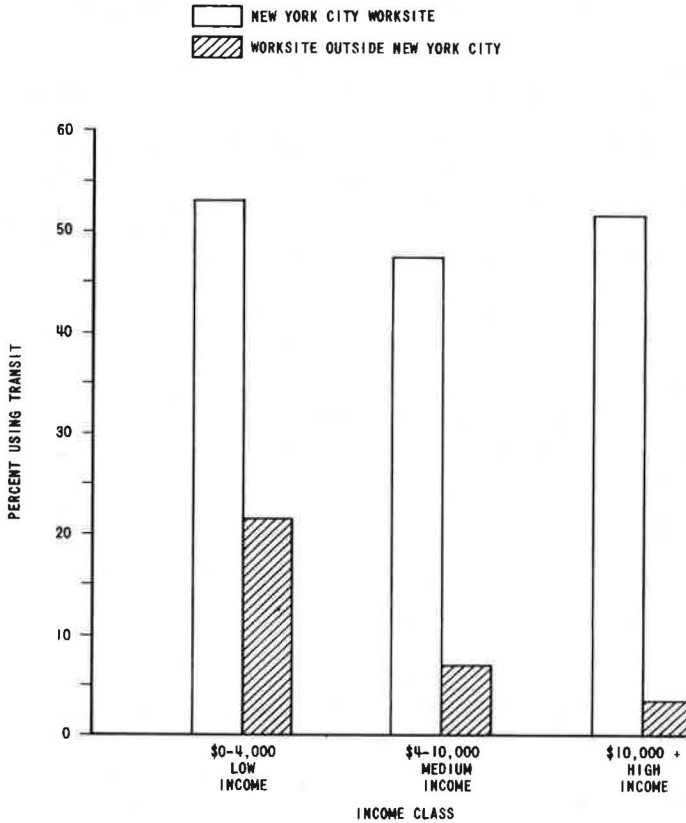


Figure 19. Use of mass transit for journey to work by residents outside New York City by income and worksite.

work location (Fig. 18). In addition, transit usage by residents employed within the city is about twice that for residents working outside the city regardless of income, reflecting in part the service, coverage, and orientation of the New York City transit system.

For residents outside New York City, the use of transit by those employed in New York City is fairly constant at around 50 percent. For those both residing and working outside the city, however, transit usage varies from 20 percent for the low-income group to under 5 percent for those in the highest income category (Fig. 19).

SUMMARY OF RESULTS

It was the purpose of this study to provide a profile of some of the major characteristics of low-income households that have some bearing on the relationship between transportation and employment opportunities in the Tri-State study area. The analyses performed were centered about factors that are related to the annual income of the family unit and that reflect to some extent the relative degree to which transportation remains a critical constraint to poverty-level heads of households in locating jobs. Some of the important findings contained within this report are listed below.

Major Findings

Socioeconomic Characteristics—Almost 20 percent of low-income heads of households in the labor force are out of work. This amounts of 100,000 men and women.

The majority of low-income heads of households are employed in the manufacturing and service industries.

Low-income households are generally smaller in size than those of higher income groups, signifying the importance of per-capita as well as per-household income measures.

A substantially higher proportion share of heads of low-income households are in the very young or very old age groups as compared with other income classes.

Almost 40 percent of low-income heads of households are females, compared with 10 percent in the middle-income groups and under 5 percent in the high-income groups.

Low-income households seem to change residence more frequently than higher-income families, even when age of head is accounted for. However, no clear relationship between frequency of employment shifts was noted within age groups. Within each income group, younger families change residence and employment more often than those in the older categories.

A much higher percentage of low-income households have no private vehicles available compared to higher income families. Across all income classes the percentage of zero-auto households is markedly higher for New York City residents than for the remaining populace.

Low-income households make fewer trips per household as well as per person than families in the middle- and high-income groups.

Spatial Distribution—Low-income residences tend to cluster in the core of the study area around and within New York City.

Employment locations of heads of low-income households are also concentrated in the center of the study area, but in New York City there are 100,000 fewer low-income worksites for heads of households in the study area than there are homesites.

The highest percentages of unemployed heads of low-income households occur in the core areas of the region's major urban centers.

Journey-to-Work Characteristics—Low-income heads of households are more likely to be employed within their county of residence than those in higher income families.

Of all heads of households residing in New York City and having no auto available, low-income households are the least likely to be employed outside of the city. Compared with these heads of households, those with one or more autos are at least twice as likely to reverse commute from New York City regardless of income.

Low-income heads of households work closer to home than the rest of the population. Regardless of income, those with an auto available make longer trips.

Low-income heads of households spend, on the average, less time traveling to or from work than those in the higher income groups.

The use of mass transit for the work trip is generally much more predominant among low-income heads of households than among those in the middle- and high-income groups.

Future Research

The research reported in this study is of a descriptive nature. It characterizes the composition of low-income households by means of demographic data and identifies their residential and worksite location and the transportation link between home and worksite. The effect of transportation on poverty may only be implied in this study through correlative measures associating auto ownership, transit usage, population, and employment density with job opportunities and employment status.

Future research should take a more concentrated analytical approach to the problems of poverty. This will come about only with an increased awareness and knowledge of the dimensions of the problem by all disciplines. In the field of transportation planning, sophisticated analytical tools are available to synthesize travel behavior, including the journey to work. Residential and employment growth have also been simulated in comprehensive computer modeling efforts. Efforts should be initiated to use these analytical models in testing the various effects of alternate approaches to the transportation problems of the poor.

In addition to analytically simulating the residence-employment relationship of low-income households, it is essential to have a much more enriched data source available to describe low-income households. The Tri-State Home Interview Survey permitted a multidimensional view of the household structure through specified cross-classifications. It was limited, however, because it was only a 1 percent sample of the entire population and was not designed specifically for this type of study.

One approach used to test methods of relieving the transportation problems of the poor is via mass transportation demonstration projects financed in large part by the federal government. These projects have the advantage of measuring the cause-effect relationships between transportation and poverty on a real-life dimension. Examples of such demonstration projects include the Watts Project and the Nassau-Suffolk study. In the Watts Project, the effect of improved transit service was analyzed by its impact on employment and other opportunities for the area's residents; and the Nassau-Suffolk study is testing whether an improved accessibility linkage between labor supply and demand in areas outside the central business district would increase employment opportunities among unskilled and semiskilled workers. Similar projects and studies are under way in several other major urban areas.

Perhaps the most effective means of understanding the link between transportation and poverty is the combined use of more meaningful data, analytical tools that can aid in testing alternate solutions, and demonstration projects that can apply these solutions under real-life circumstances.

REFERENCE

1. Fisher, R. J., and Sosslau, A. B. Census Data as a Source for Urban Transportation Planning. Highway Research Record 141, 1966, pp. 53-56.

Appendix

DATA STRATIFIED BY COUNTY OF RESIDENCE

Data pertaining to labor force, employment, income, and automobile availability are given in Tables 12, 13, 14, 15, and 16.

TABLE 12
PERCENT DISTRIBUTION OF LABOR FORCE^a WITHIN EACH COUNTY^b
BY INCOME AND AUTO AVAILABILITY

County	Unemployed (percent) (Under \$4,000)		Employed (percent)						Total Labor Force ^c
	0 Auto	1+ Auto	Under \$4,000		\$4,000-\$10,000		Over \$10,000		
			0 Auto	1+ Auto	0 Auto	1+ Auto	0 Auto	1+ Auto	
New York	5.3 ^d	0.3	21.0	1.7	39.4	11.1	10.7	8.6	577,400
Bronx	3.4	0.3	11.1	1.9	32.0	32.4	4.1	13.2	358,500
Kings	2.7	0.3	13.1	3.1	29.9	35.5	2.8	10.6	680,900
Queens	0.8	0.1	4.4	1.6	18.6	42.4	3.8	27.1	494,700
N. Y. C. (excl. Richmond)	3.0	0.3	13.0	2.2	30.3	29.8	5.5	14.3	2,111,500
Richmond	0.2	0.2	3.7	3.3	12.9	60.5	0.2	17.8	54,700
Nassau	0.3	0.2	0.9	1.3	2.9	50.2	0.6	42.5	323,700
Suffolk	0.1	0.1	0.7	1.4	2.5	62.6	0.4	30.4	147,000
Westchester	0.5	0.4	3.5	1.7	8.4	40.3	1.0	42.4	188,300
Rockland	0.6	0.3	1.8	1.5	1.2	64.5	0.0	28.8	36,800
Hudson	2.4	0.8	5.5	3.3	20.0	48.7	1.7	15.4	154,800
Essex	2.4	0.6	6.1	3.7	11.5	49.7	0.6	23.5	239,000
Bergen	0.2	0.3	1.2	1.9	3.2	52.6	1.0	38.3	210,100
Passaic	0.7	0.2	5.8	3.7	6.4	59.2	0.3	21.7	96,600
Morris	0.0	0.2	1.3	1.3	2.1	61.5	0.0	33.1	55,300
Union	0.9	0.6	1.8	1.4	5.0	58.8	0.2	30.6	134,200
Somerset	0.0	0.3	1.0	2.0	2.3	64.3	0.0	30.0	32,600
Middlesex	0.9	0.3	1.3	2.9	3.0	71.2	0.1	18.7	106,300
Monmouth	0.6	0.7	2.9	5.4	2.1	63.0	0.0	23.2	78,000
S. W. Conn.	0.4	0.9	3.2	2.3	3.5	44.0	0.7	44.0	78,900
Bridgeport	1.1	0.5	3.3	3.5	6.7	62.3	0.3	21.4	69,200
Ansonia Derby	1.8	0.0	2.5	4.3	4.9	62.6	0.0	22.7	16,500
South Central	0.6	0.6	2.6	3.2	5.0	67.2	0.4	19.6	110,100
Outside N. Y. C. (incl. Richmond)	0.8	0.4	2.9	2.5	6.5	54.8	0.6	30.1	2,132,100
Within Cordon	1.9	0.3	7.9	2.4	18.4	42.3	3.0	22.2	4,243,600

^aPercentages across do not total 100.0 because unemployed reporting over \$4,000/year are excluded from this tabulation.

^bFor counties divided by the Cordon, figures apply to portion lying within the Cordon.

^cIncludes heads of households only.

^dTable is read as follows: 5.3 percent of all heads of households in the labor force residing in New York County (Manhattan) are unemployed, are members of households reporting income under \$4,000/year, and have no private autos available.

TABLE 13
PERCENT DISTRIBUTION OF EMPLOYMENT^a WITHIN EACH COUNTY^b BY INCOME CLASSIFICATION

County	Employed (percent)			Total Employed	County	Employed (percent)			Total Employed
	Under \$4,000	\$4,000-\$10,000	Over \$10,000			Under \$4,000	\$4,000-\$10,000	Over \$10,000	
New York	13.0 ^c	57.0	30.0	1,370,600	Passaic	9.9	65.7	24.4	90,300
Bronx	13.9	64.6	21.5	172,400	Morris	4.9	65.8	29.3	45,500
Kings	16.7	64.8	18.5	456,000	Union	5.5	70.3	24.2	123,300
Queens	10.5	64.8	24.7	329,000	Somerset	5.5	72.9	21.6	25,300
N. Y. C. (excl. Richmond)	13.4	60.2	26.4	2,328,000	Middlesex	4.5	74.6	20.9	85,000
Richmond	9.6	70.3	20.1	31,700	Monmouth	12.5	67.5	20.0	53,600
Nassau	5.3	62.2	32.5	213,400	S. W. Conn.	7.8	63.2	29.0	63,200
Suffolk	3.1	67.1	29.8	95,200	Bridgeport	6.4	70.3	23.3	70,300
Westchester	8.8	59.6	31.6	134,700	Ansonia Derby	9.1	65.7	25.2	11,000
Rockland	6.3	68.8	24.9	23,500	South Central	6.7	74.9	18.4	97,300
Hudson	9.0	69.7	21.3	167,200	Outside N. Y. C. (incl. Richmond)	7.1	67.1	25.8	1,714,900
Essex	8.5	66.9	24.6	237,600	Total	10.7	63.1	26.2	4,042,900
Bergen	6.1	65.2	28.7	146,800					

^aIncludes heads of households only.

^bFor counties divided by the Cordon, figures apply to portion lying within the Cordon.

^cTable is read as follows: 13.0 percent of all heads of households employed in New York County (Manhattan) report household incomes under \$4,000/year.

TABLE 14
 COUNTY^a RATIOS OF EMPLOYMENT^b TO LABOR FORCE^b BY HOUSEHOLD INCOME CLASSIFICATION

County	Employed:Resident Labor Force			All Income Classes	County	Employed:Resident Labor Force			All Income Classes
	Under \$4,000	\$4,000- \$10,000	Over \$10,000			Under \$4,000	\$4,000- \$10,000	Over \$10,000	
New York	1.08 ^c	2.62	3.61	2.37	Passaic	0.87	0.91	1.03	0.94
Bronx	0.40	0.47	0.59	0.48	Morris	1.38	0.84	0.73	0.82
Kings	0.58	0.64	0.93	0.67	Union	1.04	1.01	0.72	0.92
Queens	1.02	0.69	0.53	0.67	Somerset	1.18	0.85	0.56	0.78
N. Y. C. (excl. Richmond)	0.81	1.07	1.46	1.10	Middlesex	0.65	0.79	0.88	0.80
Richmond	0.74	0.55	0.64	0.58	Monmouth	0.85	0.70	0.59	0.69
Nassau	1.28	0.76	0.50	0.66	S. W. Conn.	0.91	1.05	0.52	0.80
Suffolk	0.86	0.65	0.63	0.65	Bridgeport	0.76	1.02	1.09	1.02
Westchester	0.97	0.84	0.53	0.72	Ansonia Derby	0.71	0.64	0.74	0.67
Rockland	0.95	0.66	0.54	0.64	South Central	0.84	0.91	0.81	0.88
Hudson	0.80	1.07	1.33	1.08	Outside N. Y. C. (incl. Rich- mond)	0.85	0.83	0.67	0.80
Essex	0.63	1.05	1.05	0.99	Total	0.82	0.95	0.98	0.95
Bergen	1.19	0.53	0.51	0.70					

^aFor counties divided by the Cordon, figures apply to portion lying within the Cordon.

^bIncludes heads of households only.

^cTable is read as follows: The number of low-income heads of households employed in New York County exceeds the low-income resident labor force in New York County by 8 percent.

TABLE 15
 RELATIVE COUNTY PERCENTAGES OF LOW-INCOME LABOR FORCE AND EMPLOYMENT^a

County	Percent of Labor Force (1)	Percent of Low-Income Labor Force		Ratios		Percent of Employment (4)	Percent of Low-Income Employment (5)	Ratio (5):(4)
		Employed (2)	Unemployed (3)					
				(2):(1)	(3):(1)			
Manhattan	13.6	30.6	32.9	2.25	2.42	33.9	41.1	1.21
Bronx	8.4	10.6	13.7	1.26	1.63	4.3	5.5	1.28
Brooklyn	16.0	25.5	21.0	1.59	1.31	11.3	17.6	1.56
Queens	11.7	6.8	4.5	0.58	0.38	8.1	8.0	0.99
N. Y. C. (excl. Richmond)	49.7	73.5	72.1	1.48	1.45	57.6	72.2	1.25
Richmond	1.3	0.9	0.2	0.69	0.15	0.8	0.7	0.88
Nassau	7.6	1.6	1.8	0.21	0.24	5.3	2.6	0.49
Suffolk	3.5	0.7	0.3	0.20	0.09	2.4	0.2	0.08
Westchester	4.4	2.4	1.9	0.55	0.43	3.3	2.7	0.82
Rockland	0.9	0.3	0.3	0.33	0.33	0.6	0.3	0.50
Hudson	3.6	3.2	5.2	0.89	1.44	4.1	3.5	0.85
Essex	5.6	5.7	7.8	1.02	1.39	5.9	4.8	0.81
Bergen	5.0	1.5	0.9	0.30	0.18	3.6	2.1	0.58
Passaic	2.3	2.2	1.0	0.96	0.43	2.2	2.1	0.91
Morris	1.3	0.3	0.1	0.23	0.08	1.1	0.5	0.45
Union	3.2	1.0	2.1	0.31	0.66	3.1	1.7	0.55
Somerset	0.8	0.2	0.1	0.25	0.12	0.6	0.3	0.50
Middlesex	2.5	1.0	1.4	0.40	0.56	2.1	0.9	0.43
Monmouth	1.8	1.6	1.0	0.89	0.56	1.3	1.6	1.23
S. W. Conn.	1.9	1.0	1.1	0.3	0.58	1.6	1.1	0.69
Bridgeport	1.6	1.1	1.1	0.69	0.69	1.7	1.0	0.59
Ansonia Derby	0.4	0.3	0.3	0.75	0.75	0.3	0.2	0.67
South Central	2.6	1.5	1.3	0.58	0.50	2.4	1.5	0.63
Outside N. Y. C. (incl. Rich- mond)	50.3	26.5	27.9	0.53	0.55	42.4	27.8	0.66

^aIncludes heads of households only.

TABLE 16
 PERCENT OF LABOR FORCE^a IN EACH OF SIX INCOME-AUTO AVAILABILITY
 CATEGORIES EMPLOYED IN COUNTY^b OF RESIDENCE

County	Resident Labor Force (percent)						All Classes
	Under \$4,000		\$4,000- \$10,000		Over \$10,000		
	0 Auto	1+ Auto	0 Auto	1+ Auto	0 Auto	1+ Auto	
New York	84.7 ^c	70.7	83.2	73.7	86.1	80.9	82.3
Bronx	30.3	44.2	25.8	35.7	18.1	31.0	30.5
Kings	58.3	67.7	45.5	49.9	32.5	45.6	49.3
Queens	59.6	51.6	32.7	36.9	22.2	27.3	34.1
N. Y. C. (excl. Richmond)	66.2	62.1	53.5	45.3	58.0	41.0	51.2
Richmond	84.4	64.6	38.0	49.5	100.0	49.6	49.9
Nassau	89.1	74.4	59.2	47.2	65.5	33.5	42.5
Suffolk	70.1	68.7	74.1	50.2	48.6	44.4	49.4
Westchester	83.9	93.2	72.8	61.5	60.6	39.9	54.7
Rockland	83.6	100.0	74.8	54.1	—	34.7	50.0
Hudson	80.3	84.7	63.1	63.9	65.0	57.3	64.4
Essex	74.4	71.5	76.1	65.9	61.2	54.9	65.4
Bergen	91.1	63.1	36.8	48.5	30.3	36.3	44.0
Passaic	81.9	72.3	80.3	51.3	32.2	47.7	55.1
Morris	71.4	100.0	82.3	57.1	—	46.0	54.8
Union	81.7	78.7	77.6	53.4	100.0	42.6	52.3
Somerset	100.0	85.2	56.6	54.0	—	31.7	48.6
Middlesex	67.4	72.6	79.7	56.4	100.0	51.3	56.9
Monmouth	100.0	89.9	87.3	65.1	—	55.6	66.0
S. W. Conn.	96.1	88.5	96.2	86.1	80.0	43.9	67.8
Bridgeport	90.7	91.3	86.4	83.7	100.0	82.4	84.2
Ansonia Derby	100.0	71.3	86.5	51.9	—	45.7	54.2
South Central	96.2	94.2	98.1	85.1	100.0	76.1	84.7
Outside N. Y. C. (incl. Rich- mond)	82.7	79.2	69.7	59.0	59.9	44.1	56.3
Total	69.3	71.4	56.3	54.2	58.2	43.1	53.8

^aIncludes heads of households only.

^bFor counties divided by the Cordon, figures apply to portion lying within the Cordon.

^cTable is read as follows: 84.7 percent of all employed heads of households who reside in New York County (Manhattan), whose reported household income is under \$4,000/year, and who have no private vehicles available, are employed in New York County.