U.S. Department of Transportation
Federal Highway Administration

1990 NPTS

NATIONWIDE PERSONAL TRANSPORTATION SURVEY

TRAVEL BEHAVIOR ISSUES IN THE 90's

1990 NPTS Publications Series:

- User's Guide for the Public Use Tape (for tape or diskette users)
- Summary of Travel Trends
- Travel Behavior Issues in the 90's
- 1990 NPTS Databook
- NPTS Urban Travel Patterns

Abbreviations used in this report:

- AHS — American Housing Survey
- MSA — metropolitan statistical area
- NPTS — Nationwide Personal Transportation Survey
- PMT — person miles of travel
- POV — personally operated vehicle
- VMT — vehicle miles of travel

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TRAVEL BEHAVIOR ISSUES IN THE 90'S

Based on Data from the
1990 Nationwide Personal Transportation Survey (NPTS)
and the
1985 and 1989 American Housing Surveys (AHS)

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FOREWORD

Travel Behavior Issues in the 90's presents a preliminary examination of the most recent personal travel data relating to key questions of interest to transportation planners and policymakers. Drawing on data from the 1990 Nationwide Personal Transportation Survey (NPTS) and the 1985 and 1989 American Housing Surveys (AHS), it provides a selective review of changes in the amount, purpose, and mode of personal travel, as related to various demographic and geographic factors.

This is a key historical moment in the relationship between the implementation of new surface transportation policy and real world travel behavior. There were significant changes in travel behavior during the past decade and there is every indication that the amount and nature of personal travel may continue to change. Many of the same social and demographic factors that were related to travel behavior change in the 1980's are still at work—the aging of the population, shrinking household size, increases in the percent of women holding driver's licenses, increases in vehicle ownership, and locational changes in where we live and work. While this report does not attempt to be an exhaustive analysis of these factors, it does provide a starting point for looking at personal travel as a reflection of the choices we have made in our social, economic, and cultural fabric.

There are more data available now to take a comprehensive look at travel behavior than there have been in at least a decade. In addition to the NPTS and AHS data sets used in this report, journey to work data from the 1990 Decennial Census and data from a number of major metropolitan planning organization (MPO) travel surveys are being made available now. This combination of data will allow further research in all of the issue areas discussed in this report, as well as other topics not yet addressed.

Alan Pisarski, a nationally acknowledged expert on transportation policy issues and interpretation of transportation trends, is the author of this report and we are gratified to have the benefit of his extensive experience and analytical capabilities. This report is part of a continuing effort by this office to share important information—even when preliminary—with the transportation community.

—*Stephen C. Lockwood*
Associate Administrator for Policy
Federal Highway Administration

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INTRODUCTION

The 1990 Nationwide Personal Transportation Survey (NPTS) provides a wealth of material for inspection and analysis. Taken together, the present study and the three previous studies are America's primary source of information on trends in national travel behavior over the last 20 years.

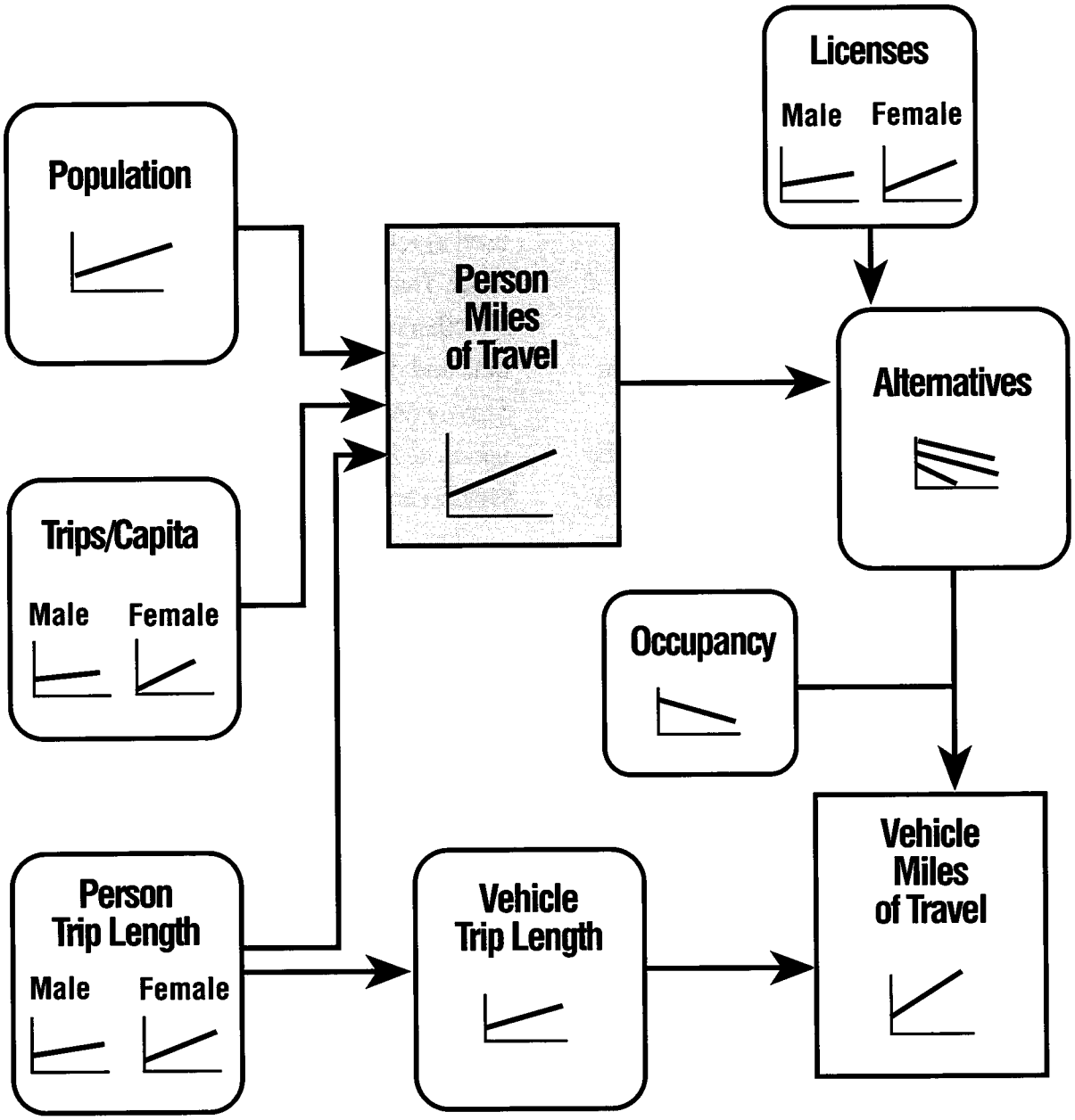
This report does not seek to summarize the results of the survey nor to summarize what is happening in American travel behavior. Other products underway are focused on these goals. Rather, this report has the pleasant task of addressing the questions that it is believed are the ones most people would most want to know about when a comprehensive data source on travel first becomes available. It seeks to anticipate the questions people will ask and attempts a first look at an answer—"What happened to women's travel?" " Why did vehicle miles of travel grow so much?" Most of the questions relate to important public policy concerns—"What is happening with transit?" "What are the trends in travel times?" All of the questions are aimed at the interests of those who seek a better understanding of the travel phenomenon.

Some of the material is preliminary at this stage in the processing of the data set. But, it seemed warranted to seek to get some material into the hands of a waiting research community, with an expression of warning about its preliminary character, rather than wait for definitive data to become available. For instance, no data were used involving geographic or temporal stratifications. That remains an exciting opportunity area for others to pursue. The report uses both NPTS data and data from the American Housing Survey (AHS) of the Bureau of the Census, sponsored by the Department of Housing and Urban Development.

This report certainly does not exhaust the number of policy and analytical questions that might be investigated with these data sets. There are many—"What are travel patterns of households without vehicles?" "How does household composition affect travel behavior?" "What changes in travel happened in areas that made major investments in transit or highways in the 80's?" There is a sense from these data that we are seeing the final democratization of travel, as young and old, low income populations, and women make immense strides in personal transportation. These and many more such questions should be pursued. It is hoped that this report will help stimulate the interest that will engage many others in the inspection and use of these data. There are many insights waiting to be discovered.

—Alan E. Pisarski

Factors in Growth of Personal Travel



CHAPTER ONE:
CHANGES IN PERSON MILES OF TRAVEL

Key Findings

- Growth in person miles of travel of about 19 percent between 1983 and 1990 has been the product of three factors in roughly equal proportions: population growth, increases in per capita tripmaking, and increases in average trip length.

- The geographic distribution of population is far more crucial than population growth in creating dramatic changes in travel in individual locations.

- Women led the growth in tripmaking with a major share of their increase in personal business trip purposes, while men led the growth in trip length. Changes in the proportion of the population with driver's licenses were a major factor in differences in tripmaking rates and average trip lengths.

Changes in person miles of travel (PMT) are a product of change in the size of the population, change in the number of trips made per capita, and change in average trip length. Between 1983 and 1990, total national PMT increased by 19 percent according to the NPTS. This is a very substantial increase for such a short period of time. This review will examine the three components of change to determine their relative contributions to PMT growth in the last decade.

Figure 1 shows the growth rates of the components of PMT in the 1983-1990 period. The figure, in effect, depicts a formula for PMT—population multiplied by trips per capita equals total trips; multiplied by average trip length equals total PMT. As indicated in the figure, population increase of those over 5 years of age was the least important factor at 4.3 percent; trips per capita increased 7.0 percent; and trip length shows a similar increase at 6.9 percent. This effect is further emphasized in Figure 2, which displays the relative contribution of each of the factors on total PMT. As can be seen from the figure, each contributed to the 19 percent growth in PMT in the period.

One point that this emphasizes is that population increase by itself is just one factor to consider. Had there been no population increase in the period, there still would have been an increase in PMT on the order of 14 to 15 percent. Thus, efforts to limit growth or penalize its arrival are dealing with only a segment of the travel growth picture. What, then, are the underlying factors that cause change in trips per capita and in trip length?

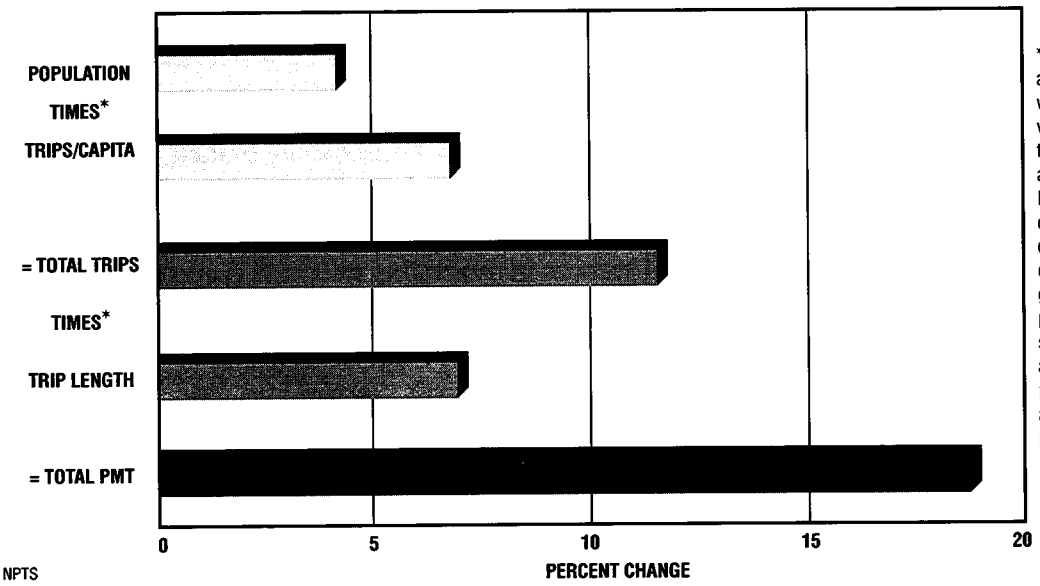
Population

Population change contributed less than 5 percent growth to PMT from 1983 to 1990. Excluding internal migration swings, overall population

Population increase by itself is just one factor to consider. Had there been no population increase in the period, there still would have been an increase in PMT on the order of 14 to 15 percent. Thus, efforts to limit growth or penalize its arrival are dealing with only a segment of the travel growth picture.

FIGURE 1

Factors Affecting Person Travel
Percent Change
1983 – 1990



*The formula shown at the left is correct when the actual values for population, trips per capita, etc. are being used. However, percent change is used in this chart in order to display the data graphically. When percent change is substituted for the actual values, the percent changes are added together instead of multiplied.

Source: NPTS

increase should be a relatively minor factor in PMT growth in the future, with annual growth rates, including immigration, estimated at less than 1 percent per annum through the decade.

Obviously, that growth varied dramatically from place to place in America. Some places, most particularly the metropolitan areas of the South and West, incurred prodigious growth in the eighties. Of the 50 fastest growing metropolitan areas in the decade, 37 were in Florida, Texas, and California. The area among the 50 with the lowest growth for the decade was above 25 percent. Areas such as Dallas, Atlanta, and San Diego, all around 2.5 million in population in 1990, had growth rates in the 30 to 35 percent range for the decade. Phoenix, Arizona, an area of over 2 million in population, grew 40 percent in the decade and has doubled since 1970. Despite signs that the strength of these shifts is ebbing, internal migration will be an important PMT factor.

Trips per Capita

Of the three factors of interest affecting PMT, trips per capita grew 6.96 percent in the 1983-1990 period. Many factors can contribute to an increase in

tripmaking behavior in the population. Increased tripmaking per capita can be called a true mobility increase. Historically, increased tripmaking has been associated with variations over time in demographic structure, such as age variations, geographic location, and stage in the life cycle; it is also associated with long-term improvements in the society's condition, such as rising incomes and improvements in minority well being. Sex differences can also be a factor. In modal terms, all person trip increases were the product of vehicle trip increases.

In modal terms, all person trip increases were the product of vehicle trip increases.

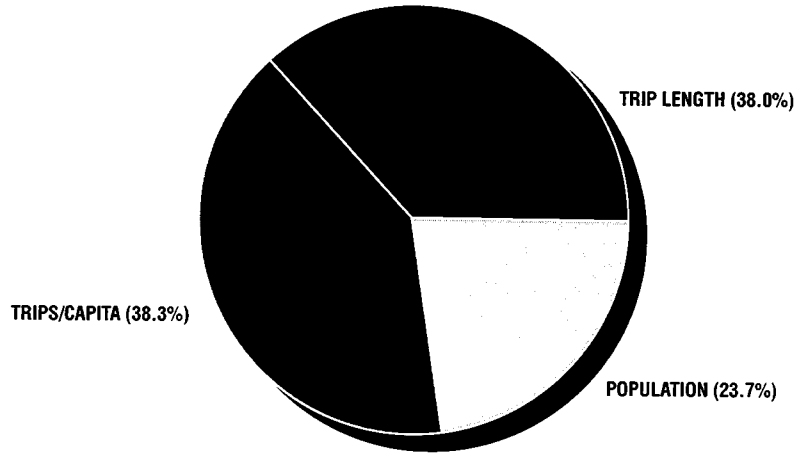
In 1983, males and females over age 5 had the same rate of tripmaking per day, but with significant differences in both mode and purpose. In 1990, male trip rates had grown to 3.04 daily trips per person, while female trip rates had grown to 3.13 trips per person—a 3 percent higher trip rate for women contrasted to that for men. Because weekend trip rates for men and women are the same, the differences between them are all a product of weekday travel patterns. This subject is treated more extensively in the section on women's travel trends.

In this decade, there have been significant shifts in age in the population, with substantial percentage decreases in the young adult age groups, and corresponding increases in those in their middle working years and in the elderly. This is a likely source of tripmaking change because the age-specific variations in tripmaking rates are well known. However, age cohort analyses indicate that the age shift from 1983 to 1990 actually contributed to a slight decrease in tripmaking per capita in that the population was shifting into higher age groups with lower typical trip rates.

One factor to consider is that the change in tripmaking from 1983 to 1990 is an effect of longer-term economic trends. There is some basis for this. The decline in overall tripmaking rates and trip lengths between 1977 and 1983 as measured in NPTS surveys in those years could have been a

FIGURE 2

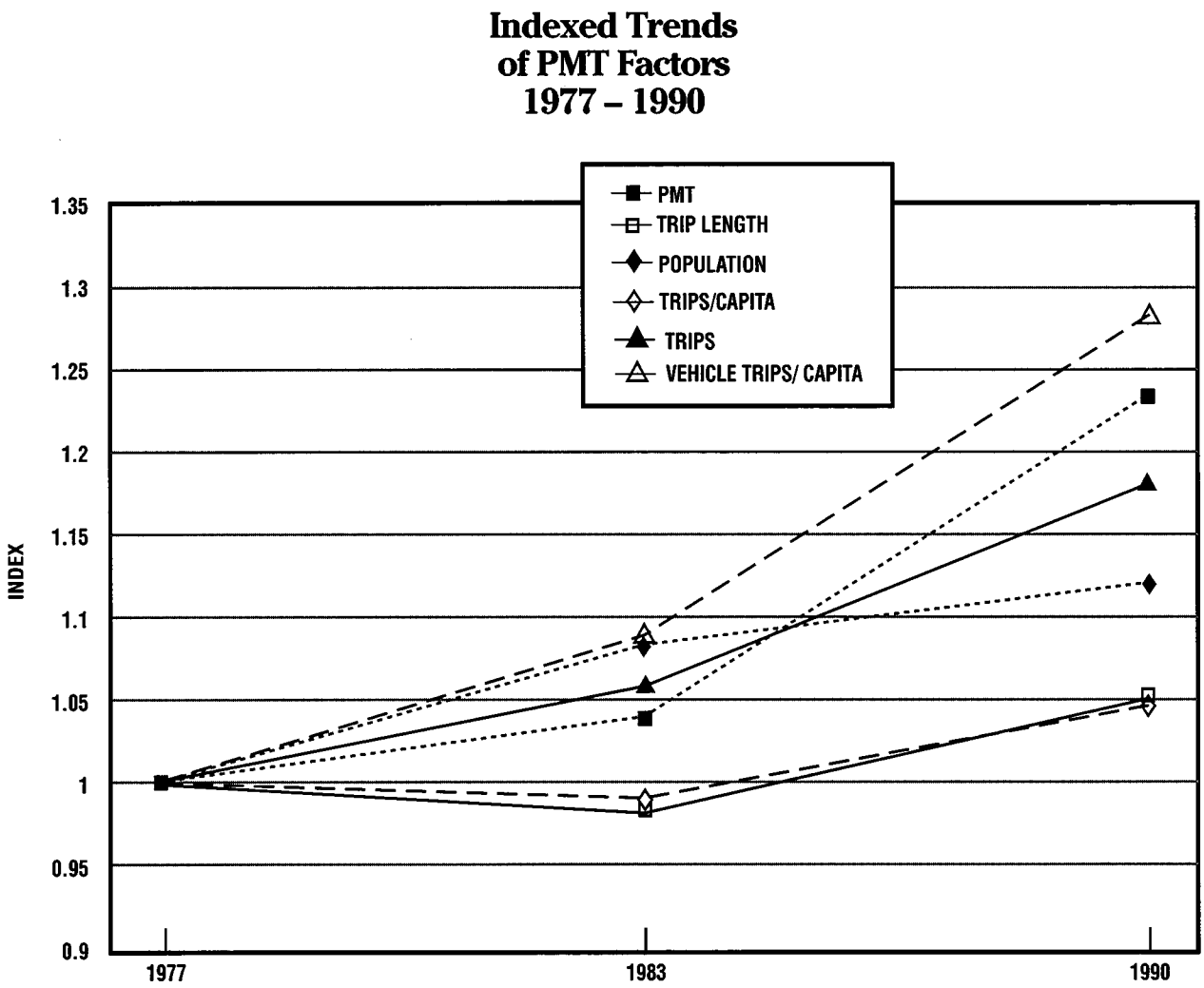
Person Miles of Travel
Factors of Increase
1983 – 1990



Source: NPTS

Stage in the life cycle can be an important factor in tripmaking because so many trips are determined by serving younger members of the household, or caring for the household itself. Thus, how the population of 243 million persons distributes itself in various groupings can have tremendous effect on trip rates.

FIGURE 3



Source: NPTS

product of the recession in the 1981-1983 period. These factors are depicted in Figure 3.

Other factors that affect trip rates per capita are household size and availability of driver's licenses. Related to these factors, stage in the life cycle can be an important factor in tripmaking because so many trips are determined by serving younger members of the household, or caring for the household itself. Thus, how the population of 243 million persons distributes itself in various groupings can have tremendous effect on trip rates. The NPTS data for 1983 show person trip rates can double between a single adult with child under age 6 and a household with two adults and no children. Average household size is a major factor to consider. The average household size has declined steadily over the last several decades, from 3.16 in 1969, to 2.83 in 1977, 2.69 in 1983, down to 2.56 in 1990. Thus the population of today forms into 4 million more households than that same population would have with 1983 average persons per household rates. To the extent that tripmaking is household-based rather than person-based, this would have had a differential effect on average trip rates.

The two most significant factors in trip length growth are population shifts to very large metropolitan areas, and to the suburbs of those areas, and the increase in driver's licenses, particularly among women.

Trip Length

Increases in average trip length contributed 6.9 percent to PMT growth between 1983 and 1990. The detailed factors affecting trip length changes are treated in a separate section specific to that factor, but can be briefly summarized here.

The two most significant factors in trip length growth are population shifts to very large metropolitan areas, and to the suburbs of those areas, and the increases in driver's licenses, particularly among women. For example, work trips by women with driver's licenses are 50 percent longer than work trips by women without driver's licenses. Driver's licenses do not cause longer trips, but the license is a component of a life style structure that signals certain kinds of needs and behaviors, of which longer trips are a part. It may signal a greater tendency for women to seek more substantial job opportunities from a broader geographic environment for which a longer trip is required in trade for higher incomes and professional rewards, and which a driver's license makes feasible.

The greater availability of personal vehicles, linked to licenses, has supported the tendency to greater trip lengths. The central question for review will be to examine the expanded opportunities available to those incurring the longer trip lengths.

With respect to the first point, it is known that work trip lengths increase in distance with metropolitan area size, as do some other trip purposes, and tend to be significantly longer for suburban residents than central city residents. Suburban work trip lengths were unchanged from 1985 to 1989, but a person with a central city job and a central city residence shifting to a suburban residence could add almost 50 percent to his work trip length. Thus, as the population had shifted to the suburbs of the Nation's large metropolitan areas, work trip lengths to the center increased. The effect of job locations shifting to the suburbs may have tended to bring jobs closer to suburban workers. The potential for persons with suburban jobs to shift their residences well beyond the suburban fringe, starting a new wave of suburban development, will be a factor to watch. The NPTS data also indicate that large increases in trip length occurred for central city residents, suggesting that work destinations are shifting to suburban locations or to adjacent metropolitan areas.

A third factor that needs further research is that some trip purposes have been growing in trip length, e.g., work and personal business, while others, like shopping, have been more stable. If the trips that are growing in length are also the trips that are growing relative to other trip purposes, the trip length average

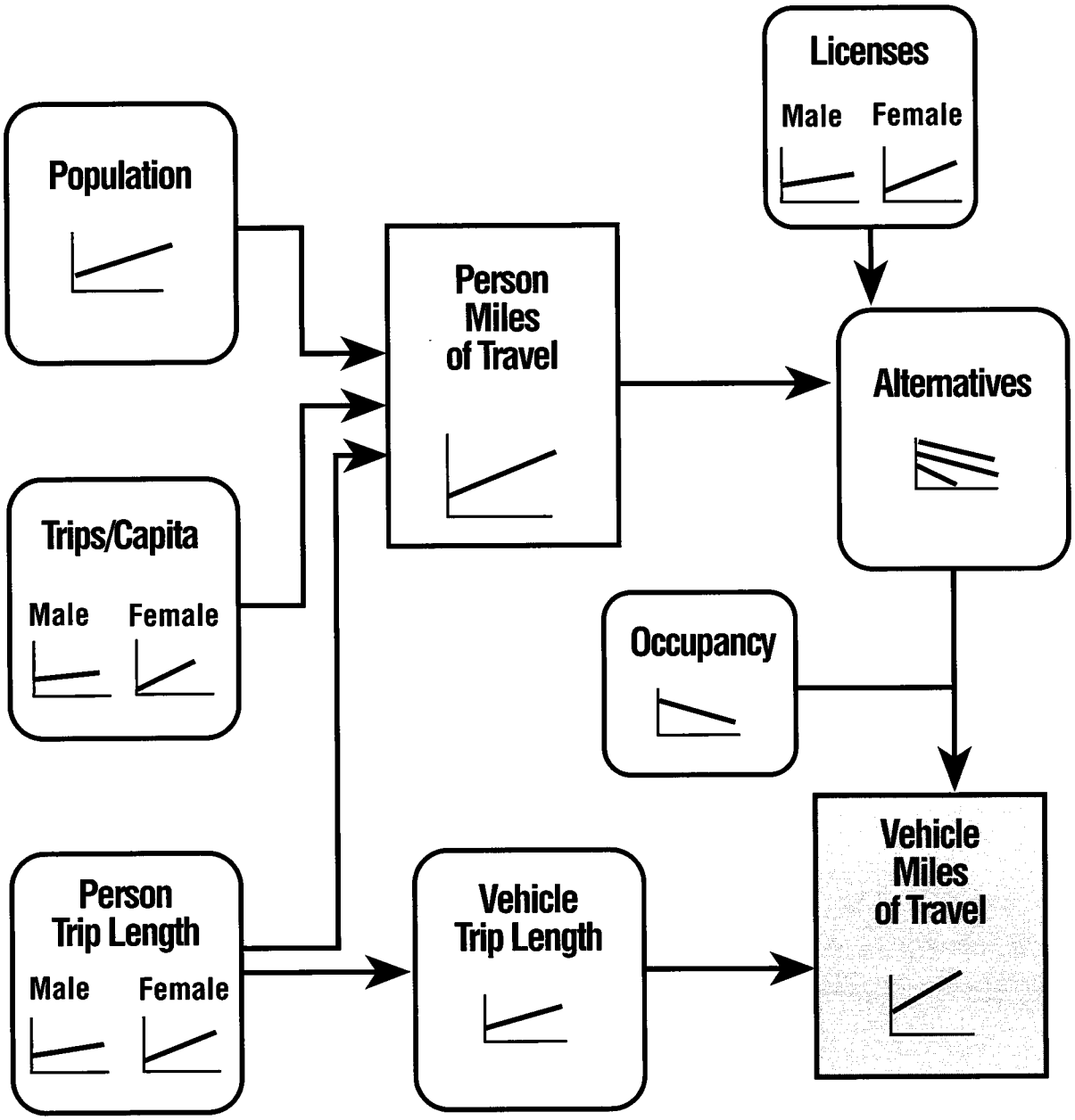
would be affected. Preliminary data review suggests that this is the case. Personal business trips, which increased their share of total vehicle travel from 16 percent in 1983 to 20 percent in 1990, also grew 7 percent in vehicle trip length. School/church trips grew 36 percent in length and work trips grew by almost 30 percent in the period from 1983 to 1990, as measured by vehicle trip lengths.

Overall growth in trip lengths has occurred differentially between men and women. Men's average trip lengths were considerably longer than women's in 1983, roughly 20 percent longer. Men's trip lengths have grown faster as well, about a 10 percent increase from 1983 to 1990 contrasted to about a 6 percent increase for women's trip lengths, so that by 1990, men's average trip length exceeded women's by 25 percent. Analyses indicate that this is typical across almost all age groups with the exception of the childhood years and post-65 age group.

Further Work

The three components of personal miles of travel growth need to be carefully monitored in the future. Population growth is the least significant and perhaps the easiest to measure. The important aspects of the population question for subnational analyses are: interregional migration, size of metropolitan area, metropolitan area physical distributions and density variations in population, jobs, and commercial activities. Understanding tripmaking and trip length trends and patterns and, particularly, their links to household structure and women's changing roles, will be critical to evaluating the values and costs of changes in these elements of travel behavior.

Factors in Growth of Personal Travel



CHAPTER TWO:
CHANGES IN VEHICLE MILES OF TRAVEL

Key Findings

- Vehicle trip growth and vehicle miles of travel growth substantially exceeded growth in person trips and person miles of travel. Vehicle rates of growth were approximately double the person rates. Total person trip growth between 1983 and 1990 was a product of vehicle trip growth.

- The decline in all alternatives to the private vehicle was a major factor, as was the decline in average vehicle occupancies.

- Vehicle trip lengths grew faster than person trip lengths, adding further to total vehicle travel growth.

As noted earlier, person miles of travel grew substantially in the 1983-1990 period. But this growth was rather dramatically exceeded by growth in personally operated vehicle (POV) trips and personally operated vehicle miles of travel (VMT). Overall, vehicle trips grew by 25 percent between 1983 and 1990 and vehicle miles of travel grew by 40 percent—both more than doubling the person travel trend.

The factors that affected person trips and person miles of travel obviously also affected vehicle trips and vehicle miles of travel. Several additional factors influenced the growth in personally operated vehicle activity:

1. Changes in choice of mode, particularly shifts to POV from transit and walking.
2. Changes within POV activity, specifically shifts in vehicle occupancy as passengers become drivers of their own vehicles.
3. Particularized changes in the PMT factors, such as specific population changes related to vehicles, vehicle-specific trip length changes, and vehicle-specific trip rate changes.

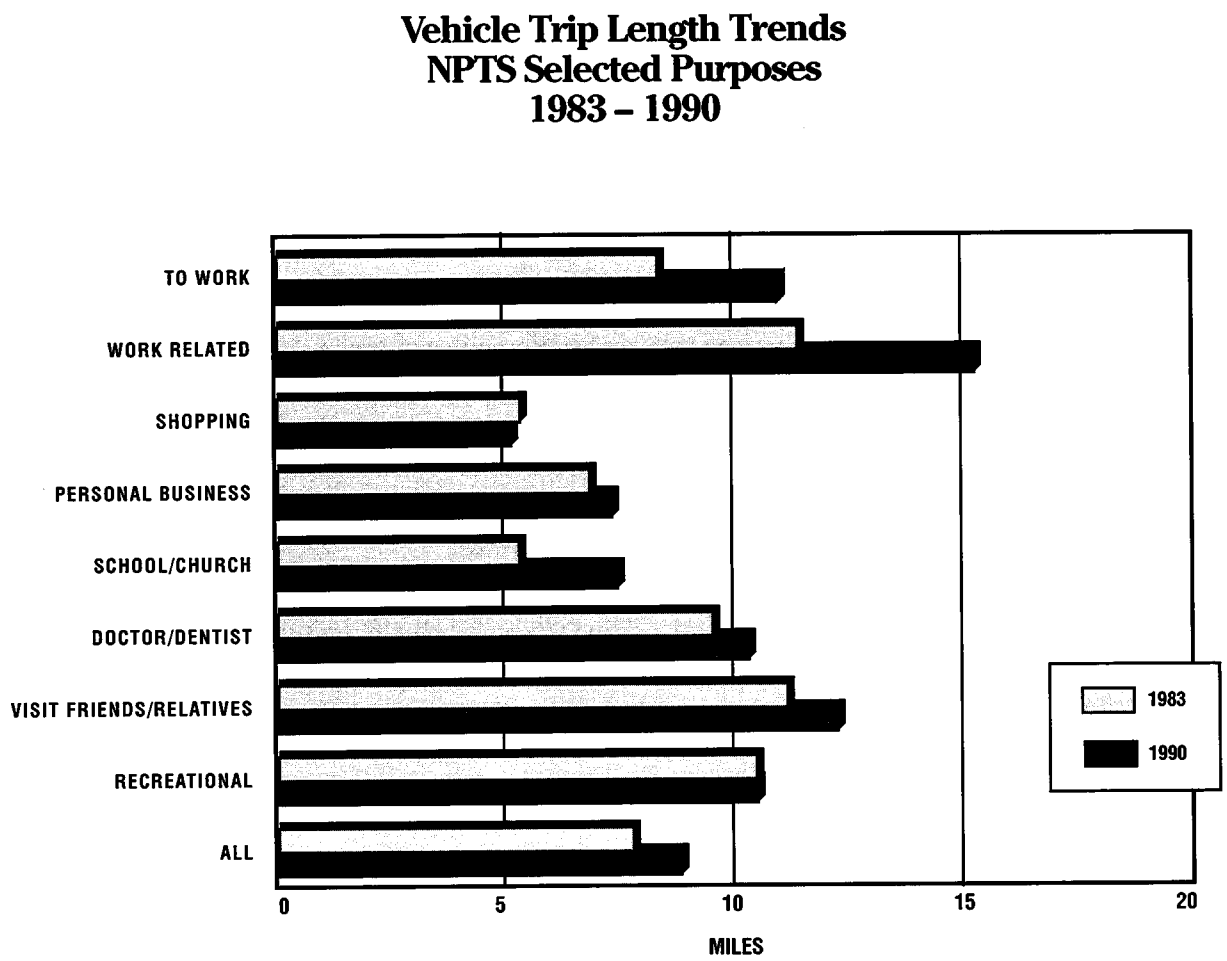
Overall, vehicle trips grew by 25 percent between 1983 and 1990 and vehicle miles of travel grew by 40 percent—both more than doubling the person travel trend.

These factors will be briefly examined here to help localize the nature of the growth trends affecting private vehicles.

Mode Choice

Although the nature of modal shares can vary depending upon definitions used, at the broadest level POV use accounted for 82 percent of all travel in 1983, rising by 5 percentage points to 87 percent in 1990. As noted in other sections, this was the product of declines in all alternatives to the private vehicle—transit, walking, and working at home. Major factors in these declines were shifts in trip patterns poorly

FIGURE 4



Source: NPTS

served by alternatives and increased vehicle availability, especially to rural and low income populations. A review of total trip activity changes reveals that all trip increases between 1983 and 1990 were accounted for by vehicle trip increases. The total vehicle trip increase of over 30 million trips exceeded the total increase in person trips by more than 5 million trips.

Vehicle Occupancy

Average vehicle occupancies for all trips declined from 1.9 in 1977 to 1.7 in 1983 and to 1.6 in 1990. A separate section describes and explains the causes of these trends. Primarily, they are a product of decreasing family size and increasing vehicle availability. The decline in vehicle occupancy between 1983 and 1990 means that an increase in vehicles of about 6 percent is required to serve the same set of riders.

Vehicle Trip Length

As noted in the section on person miles of travel, person trip lengths rose by almost 9 percent. However, vehicle trip lengths grew by considerably more than that—12.3 percent. Conjecture on why vehicle trip lengths had such substantial growth is possible. Figure 4 indicates that the increase in trip length is pervasive across all purposes—only shopping trips declined slightly in length. In terms of rates of growth, as in person

trip length changes, there is a group of relatively stable purposes and a group that grew substantially.

Those purposes with under 10 percent growth were shopping, doctor/dentist, and visits to friends and relatives. Those with growth over 25 percent were work, work-related, and school/church trips. Some confusion on the part of respondents about the distinctions between the definitions of work trips and work-related trips may have affected the large increase of 29 percent in work trip lengths, but that would have had only limited effect. Refer to the Glossary for definitions of work trip and work-related trip.

Components of VMT Growth

Using a parallel formula to the person trip formula of population times vehicle trips per capita times average vehicle trip length, shown in Figure 5, yields the following:

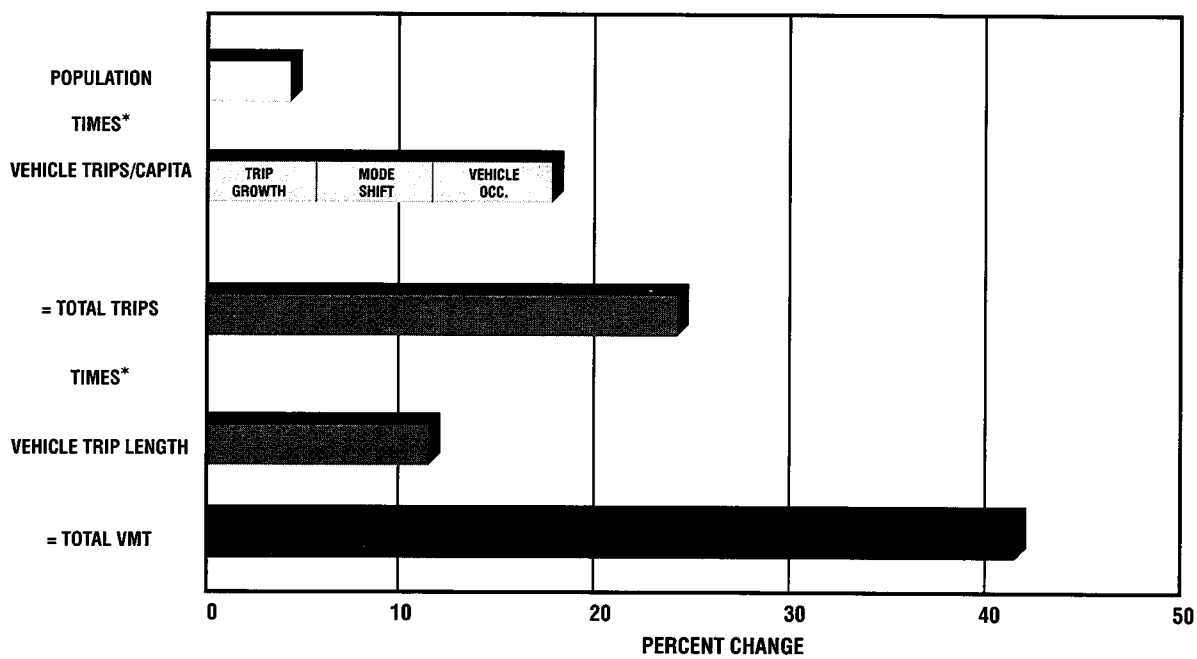
The first three changes—7 percent due to growth in person trips per person, 5 percent due to shifts in modal choice, and 6 percent due to vehicle occupancy changes, and the cumulative effects of these three factors on each other, indicate a 20 percent increase in vehicle trips per capita. The increase in trips per capita, coupled with the 4 percent increase in population, explains the 25 percent increase in vehicle trips. The dramatic increase in vehicle trip lengths of about 12 percent, added to the 25 percent increase in vehicle trips, falls just short of explaining fully the 40 percent increase in vehicle miles of travel. Figure 6 displays these elements as percents of total VMT growth.

Further Work

The VMT trends and the relationship of VMT to issues of congestion, air quality, and the amount of time we are spending in our cars raise

FIGURE 5

Factors Affecting Vehicle Travel
Percent Change
1983 – 1990



Source: NPTS

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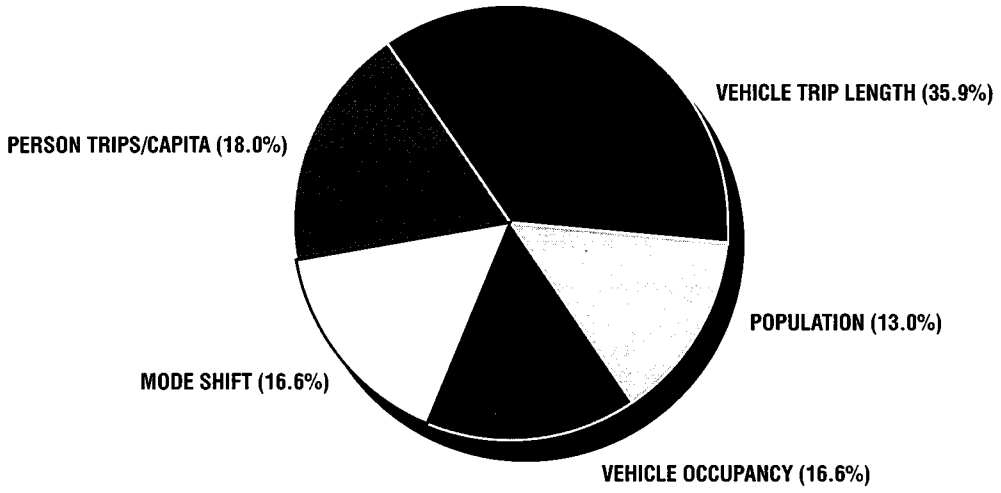
The decline in vehicle occupancy between 1983 and 1990 means that an increase in vehicles of about 6 percent is required to serve the same set of riders.

FIGURE 6

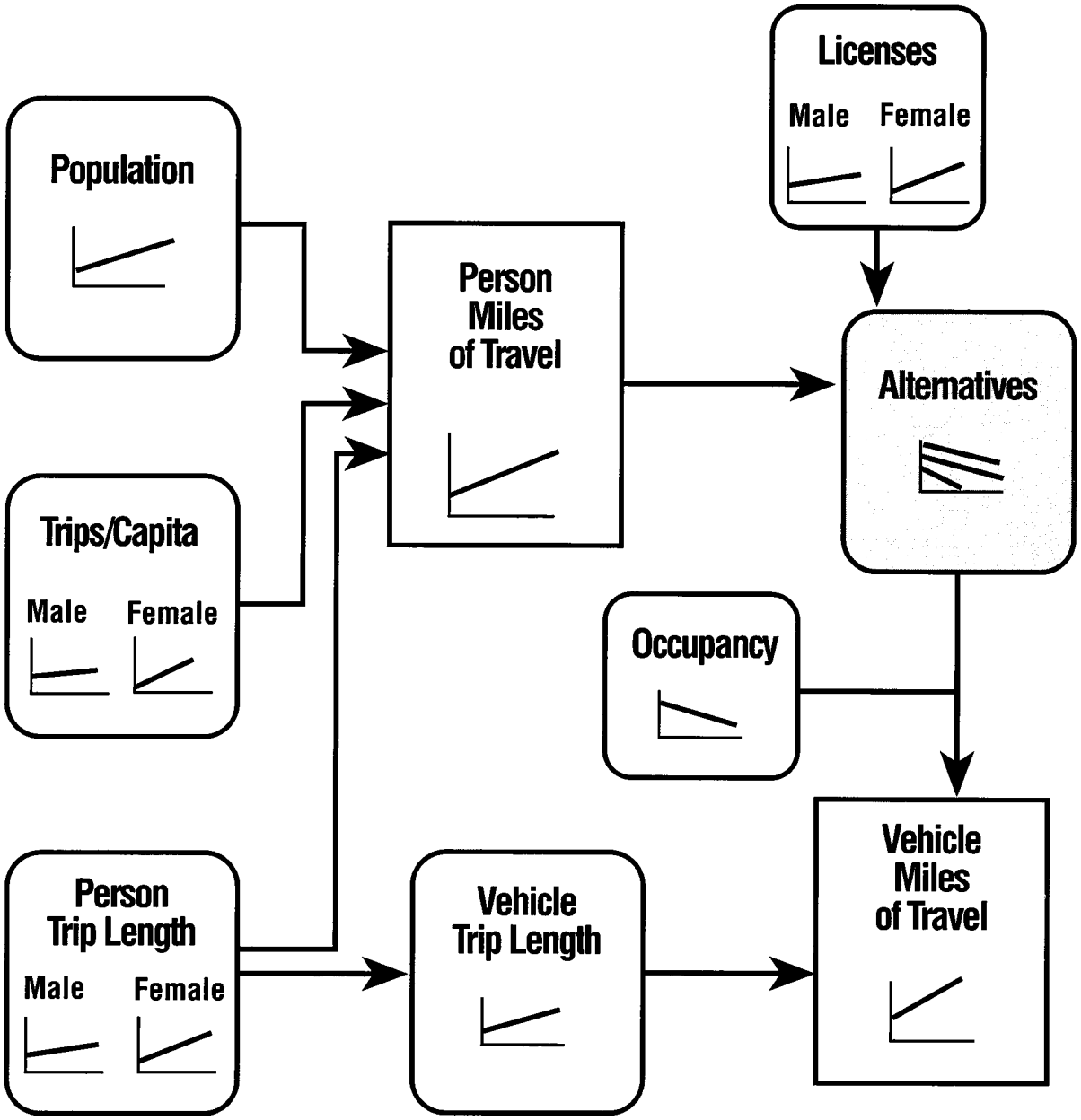
Vehicle Miles of Travel
Factors of Increase
1983 – 1990



Source: NPTS

numerous questions that require further research. The link between the demographics of our society and VMT changes needs extensive investigation. Driving by women, young people, and senior citizens is currently on the rise. Will this trend continue? Changes in trip length were a significant factor in VMT increases over time. How do changes in land use patterns affect trip lengths? How do locational decisions of housing, jobs, and services affect other aspects of travel behavior? Research is also needed in the phenomenon of trip linking and the potential for increases in this behavior in the future.

Factors in Growth of Personal Travel



CHAPTER THREE:
WHAT HAS HAPPENED WITH TRANSIT?

Key Findings

- Transit's share of all national travel has declined to about 2 percent. However, in the general context of decline of all alternatives to the auto, transit has fared better than other alternatives.

- A review of the sources of decline indicates that the downward trend seems uniform across all the traditional users of transit: women, all age groups, especially younger and older travelers, geographic area types, and demographic groups. Losses have been greatest in the Northeast which is the area that exceeds total transit use in the rest of the country.

- Strong declines in transit use among women reflect a reduction in the traditional tendency of women to use transit more than men.

- Low income populations have shifted away from transit to the extent that single occupant private vehicle use by the poverty population has reached 60 percent for trips to work.

Analyses of mass transit tend to focus mainly on urban work trips, where transit has its biggest role. But it is useful, at least at the outset, to review transit in a broader context in which all areas and purposes are incorporated. When person trips of all purposes and lengths for the entire country are considered, transit (including bus, street car or trolley, subway, elevated, commuter rail, and Amtrak commuter services) accounts for about 2 percent of all trips, according to the 1990 NPTS. The bus mode identified here includes intercity scheduled bus service as well. When measured on a passenger mile basis, the transit share changes only slightly to 2.5 percent.

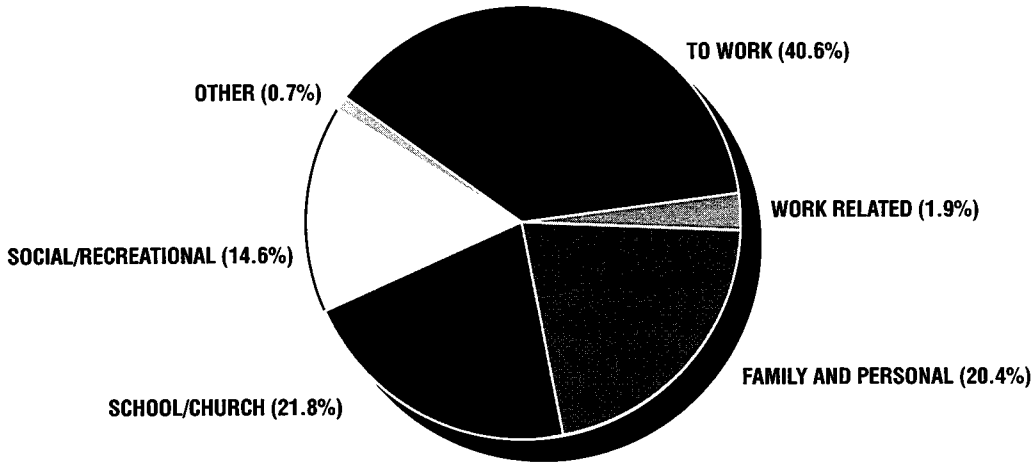
In the general context of decline of all alternatives to the auto, transit has fared better than other alternatives.

This depiction of transit might be considered inappropriate in the sense that it includes geographic areas and activities where transit does not provide service. At a more relevant transit-oriented scale, if only those trips (a) made in urbanized areas of 1 million or more with a subway system, (b) made on weekdays, and (c) with a trip length under 75 miles are considered, transit's share increases to about 3.63 percent of trips.

Seen in terms of trends, the pattern has been one of overall decline in transit shares. The 1977 NPTS showed a transit share of 2.4 percent of person trips, declining to 2.2 percent in 1983 and finally to 2.0 percent in 1990. To understand the nature of this decline, the elements of transit-oriented

FIGURE 7

Share of Transit Activity by Trip Purpose 1990



Source: NPTS

travel need to be considered and the broad national trends affecting all travel as well as transit need to be taken into account.

Transit Patterns

Although transit tends to play a minor role in most travel purpose categories outside of work travel, these purposes represent a significant part of transit patronage. Figure 7 shows the shares of all transit travel accounted for by different trip purposes. As expected, travel associated with commuting to work is the single most important market for transit, with almost 41 percent of transit use for the journey to work. But school and church attendance, with stronger emphasis on the school portion, is a major factor in transit, accounting for almost 22 percent of transit use. This purpose category is important because transit use is a significant share of total activity, accounting for almost 3.8 percent of trips with a school/church purpose. Obviously, school bus and walking account for the dominant share of activity in that purpose category.

Figure 8 presents the trend from 1983 to 1990 in share of trips served by transit in each of the same purpose categories employed in Figure 7. It is clear that transit decline has occurred in all purpose categories with the exception of the category called "other." Referring back to Figure 7 helps explain the importance to transit markets of the changes in various purposes. The category "other," with less than one percent of transit activity, is a very minor component of transit travel.

Any analysis of recent trends in mass transit activity based on survey data must begin within the general context of the decline of all alternatives to the single occupant vehicle. A discussion of the decline of all alternatives to the private vehicle, primarily focused on the work trip, is presented elsewhere in this study. Briefly summarized, all increased trips from 1983 to 1990 were the product of personal vehicle travel.

The same trend data that showed transit decline in shares from 2.4 percent to 2.0 percent from 1977 to 1990 also showed all other alternatives to the single occupant vehicle declining as well. For example, the increase in the total number of workers

using a single occupant vehicle from 1985 to 1989 exceeded the increase in the total number of workers for the same period, based on data from the AHS.

To further quantify the trend, the AHS indicates that tripmaking for work purposes increased by about 7 percent from 1985 to 1989, while the single occupant vehicle portion of that travel increased by more than 12 percent. In that context, transit use declined by somewhat more than 4 percent. While this is certainly a negative finding with regard to transit, transit's decline was less precipitous than the other alternatives: in the same period carpooling and walking declined by almost 10 percent, and working at home declined by more than 7 percent. Only the mode category "other" (made up of an assortment of minor modes) had a slight absolute increase and almost held its market share.

While there is a tendency to see a decline in walking to work trips as a "negative" based on urban concerns for air quality, it would be inappropriate to assume that this trend is a "problem to be solved." A large part of the shift away from walking is occurring in rural areas where people for the first time have the means to own a vehicle and substitute its use for walking. As such, it can represent a real mobility increase by expanding access to jobs and other opportunities to the otherwise isolated rural population.

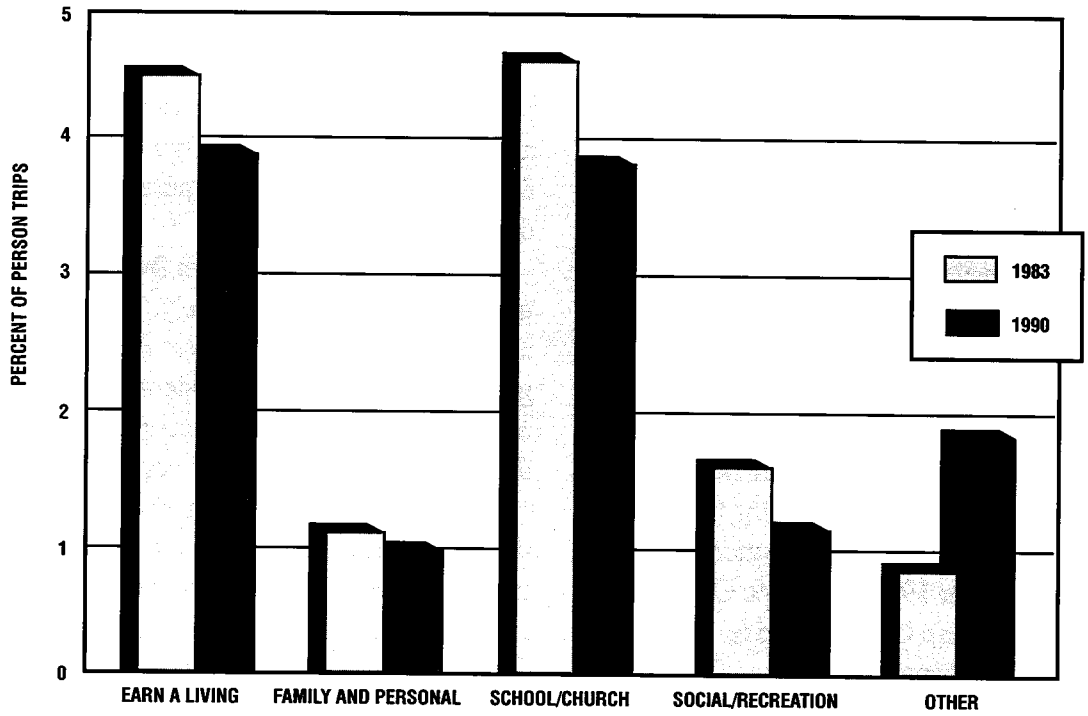
Outside of work travel, all other trip purposes, with the exception of school and church purposes where transit and school buses are factors, are almost exclusively made by private vehicle.

Sources of Decline

To examine fully the causes of how and why transit shares of travel have declined would require

FIGURE 8

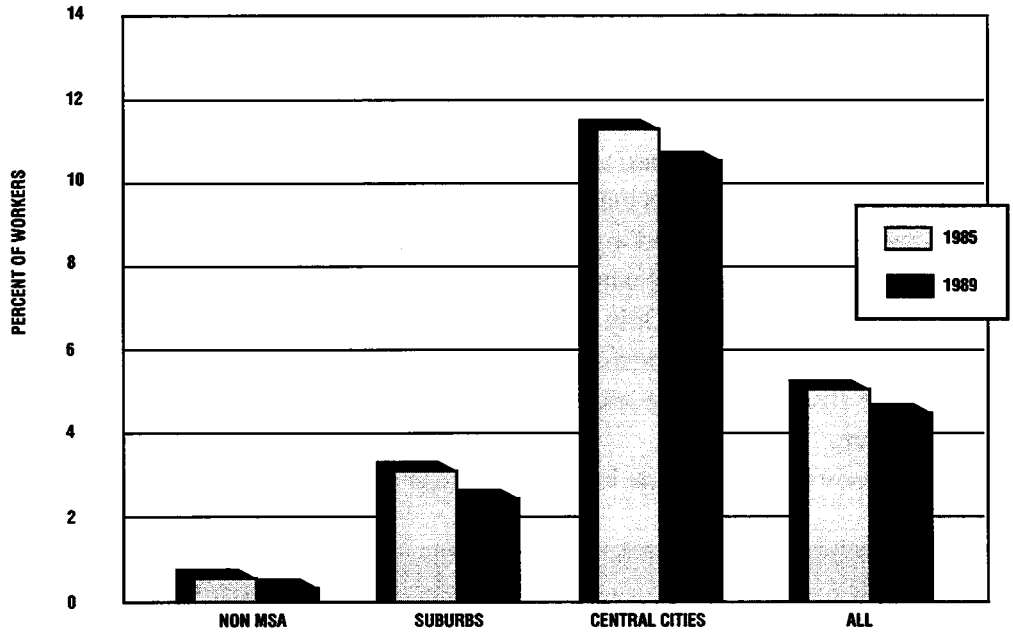
Transit Shares of All Travel by Purpose Category 1983 & 1990



Source: NPTS

FIGURE 9

Transit Shares of Work Travel by Place of Residence 1985 & 1989



Source: AHS

a far more extensive analysis than is possible here, but the outlines of the changes that have occurred, where they have occurred, and the extent to which they have contributed to the decline, can be developed from the survey sources available. The two major sources available are the AHS, conducted by the Bureau of the Census, which only treats work travel, and the NPTS, conducted by the U.S. Department of Transportation (DOT). The data used here from the two surveys cover relatively similar time periods, 1985-1989 for AHS and 1983-1990 for NPTS.

Geographic Factors

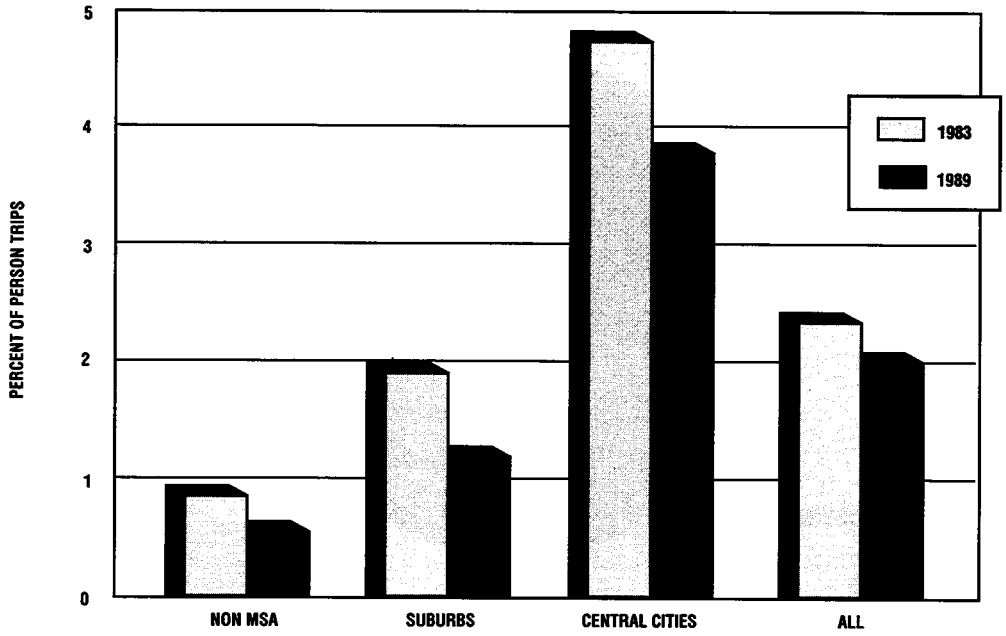
The AHS is a detailed treatment of the commuting to work portion of transit use. It can help to localize the nature of the trends affecting transit. Figure 9 shows the geographic distribution of transit use for trips to work for 1985 and 1989. One clear point made by this figure is that, based on the residence location of the tripmaker, the transit decline is not limited to one area or residential grouping, but is apparent in central cities, suburbs, and nonmetropolitan statistical areas (non-MSAs).

The NPTS data, covering the time period 1983 to 1990, shown in Figure 10, show parallel patterns for all purpose categories. The only apparent significant distinction between the work pattern and the pattern for all purposes from two different surveys and two time periods is that non-MSA transit usage for work purposes, already quite small, has not declined appreciably.

Figures 11 and 12, drawn from the AHS, examine these patterns more closely. The pie chart in Figure 11 shows the shares of transit trips to work by geographic area. Figure 12 identifies where the reductions in transit travel occurred. A key point is that suburbs, where national population growth is centered, representing 29.2 percent of transit trips, accounted for over 41 percent of the decline in travel by transit. Central cities, with almost 69 percent of transit travel, only accounted for 56 percent of the decline. Thus, center city transit use, the main market for transit services, is not eroding as rapidly as are suburban markets.

FIGURE 10

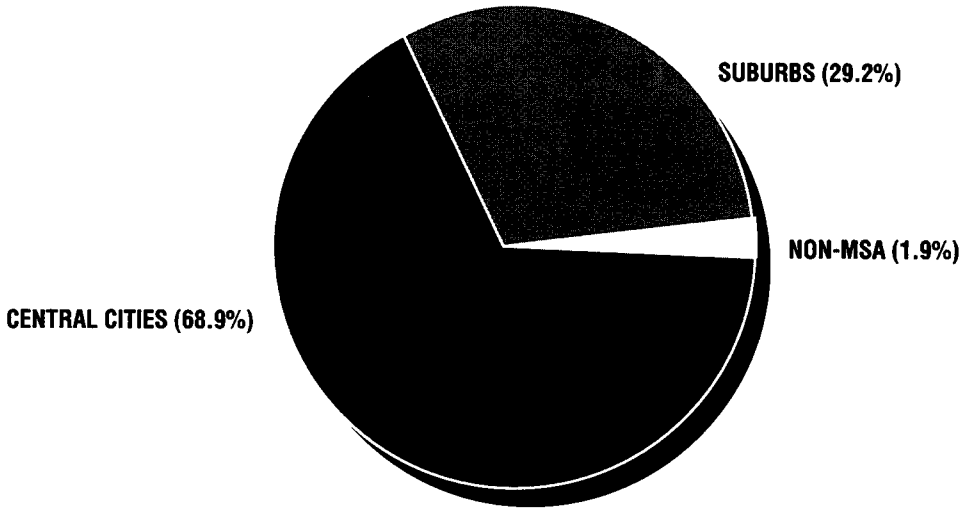
Transit Shares of All Travel by Place of Residence 1983 & 1990



Source: NPTS

FIGURE 11

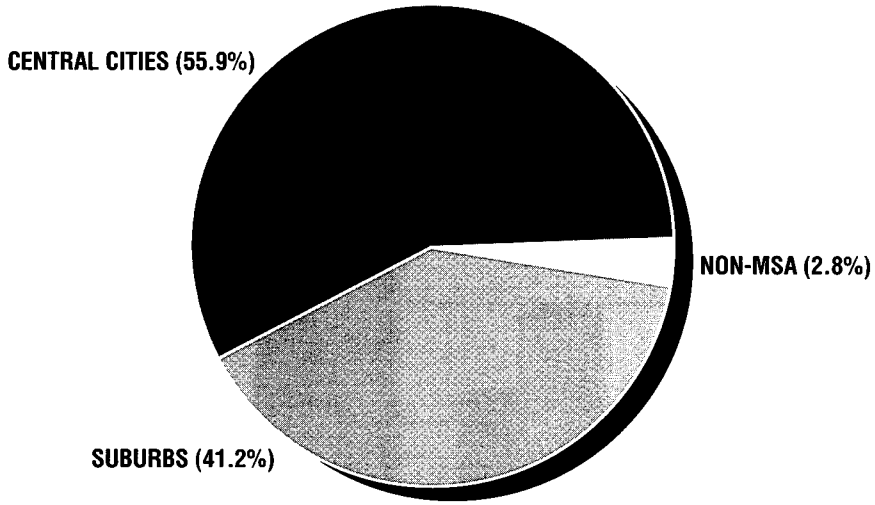
Source of Transit Trips to Work by Place of Residence 1985



Source: AHS

FIGURE 12

Source of Decline in Transit Work Trips by Place of Residence 1985 – 1989



Source: AHS

The AHS provides another area of insight into transit use. It identifies areas where transit service is available and relates them to transit use. Figure 13 shows the findings for all areas and for central cities and suburbs, based on the residence of the traveler. For each area, transit use is divided into categories that reflect frequent, infrequent, and never used transit. These data are for 1985. More recent data, when available, will provide insight into the effect of transit availability on transit use. Preliminary data from the 1990 NPTS indicate that transit use is 2.0 percent nationally, but this rises to 3.1 percent where transit is available and reaches 4.1 percent where transit is within a quarter mile of the household.

The AHS also collects information rating transit service as part of its assessment of neighborhood quality. In almost all cases where households use transit weekly, or less than weekly, the satisfactory ratings for transit services were very high—on the order of 90 percent.

Work Travel Trends

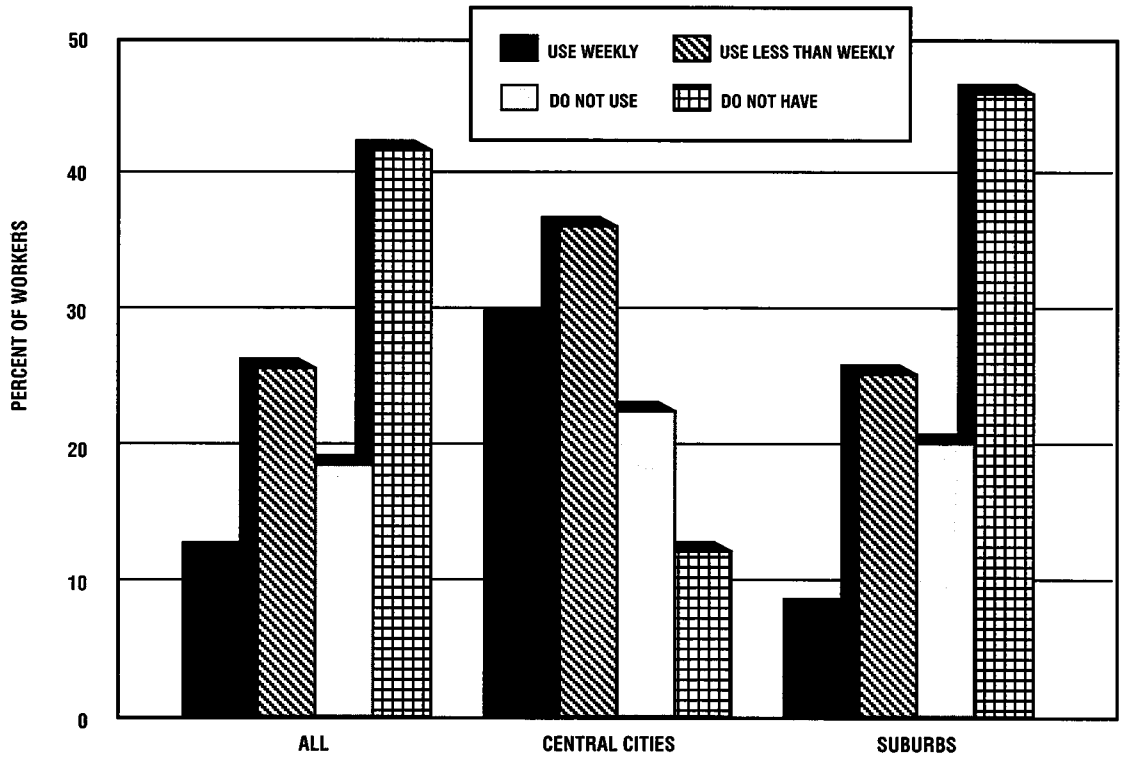
Further segmentation of transit work travel from the AHS, shown in Figure 14, provides additional insight into the sources of transit decline. The most important observation from this figure is that declining transit shares for work travel seem pervasive across almost all housing, demographic, and geographic groups. Notably, those over age 65, and both African Americans and Hispanics report declining shares, as do renters and homeowners. The positive side was represented by small towns, those who moved within the last year, and those in new housing within the last 4 years—all of which showed small share increases. These patterns of increase need to be analyzed further.

Regional Trends

A different geographic stratification of work-related transit use in 1985 and 1989 from the AHS reveals an important national trend pattern.

FIGURE 13

Transit Use by Area Type by Transit Available 1985



Source: AHS

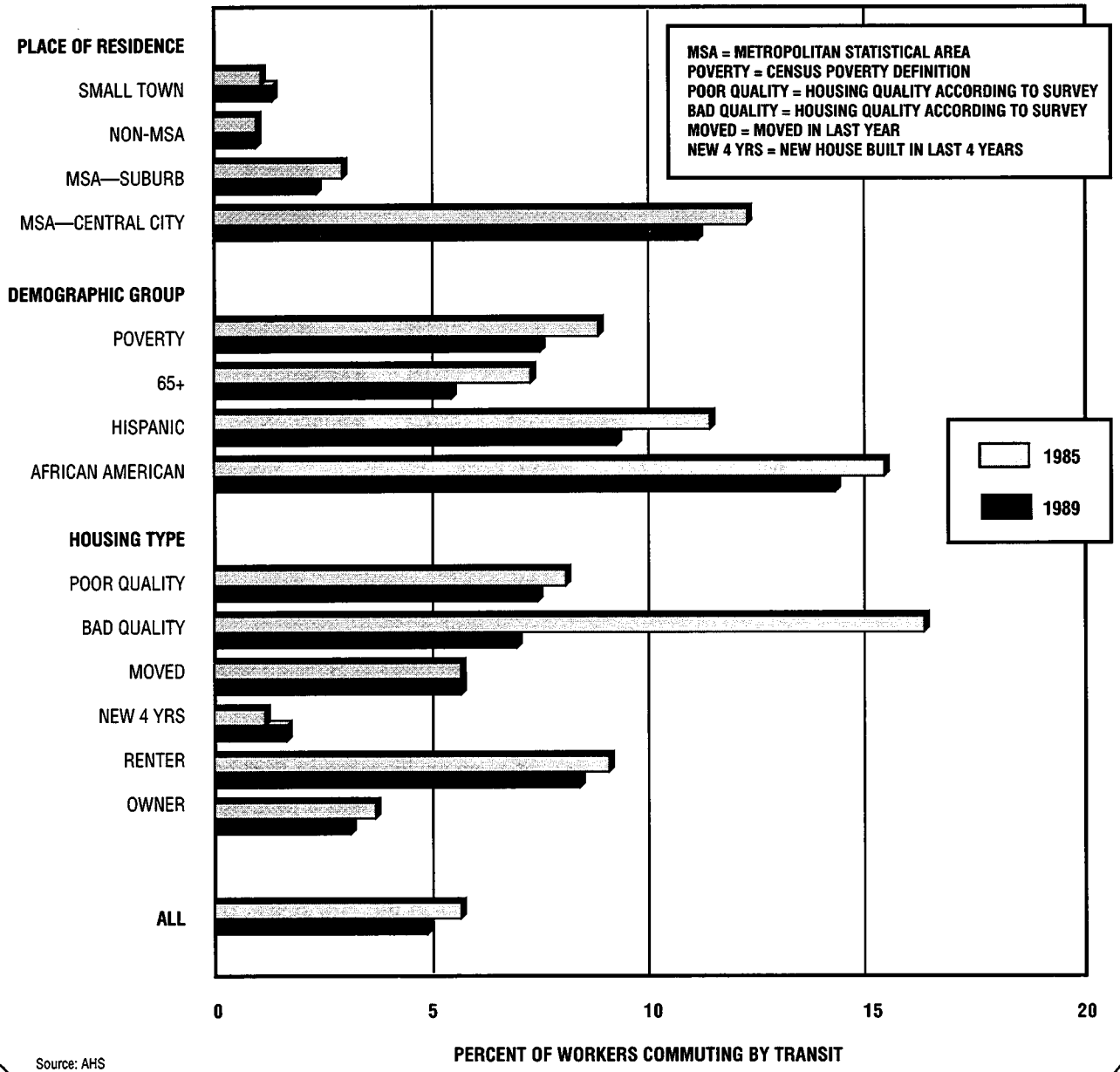
When the country is divided into the traditional four quadrants, it becomes clear that the Northeast, the dominant source of transit use, was also the dominant source of transit decline, as shown in Figure 15. In 1985, transit use in the Northeast exceeded transit use in the other three regions of the country combined. Its losses were similarly dramatic—the decline in transit use was well over 9 percent in the Northeast. The South also sustained significant losses on the order of 8 percent. The West actually had growth sufficient to obtain a small increase in share. The Midwest did show absolute increases but not enough to maintain market share. Thus, transit's ridership problems are apparently centered in the Northeast and the South. These trends were not the product of worker decrease in these areas. Total workers increased by 5 and 8 percent, respectively, in these two regions between 1985 and 1989.

Pursuing the question of the marked decline of transit in the Northeast, transit trends were assembled from the NPTS data by metropolitan area size for all trip purposes. The main feature of this analysis is the heavy decline in the largest areas, particularly areas over 3 million, which are heavily represented in the Northeast.

Declining transit shares for work travel seem pervasive across almost all housing, demographic, and geographic groups. Notably, those over age 65, and both African Americans and Hispanics report declining shares, as do renters and homeowners.

FIGURE 14

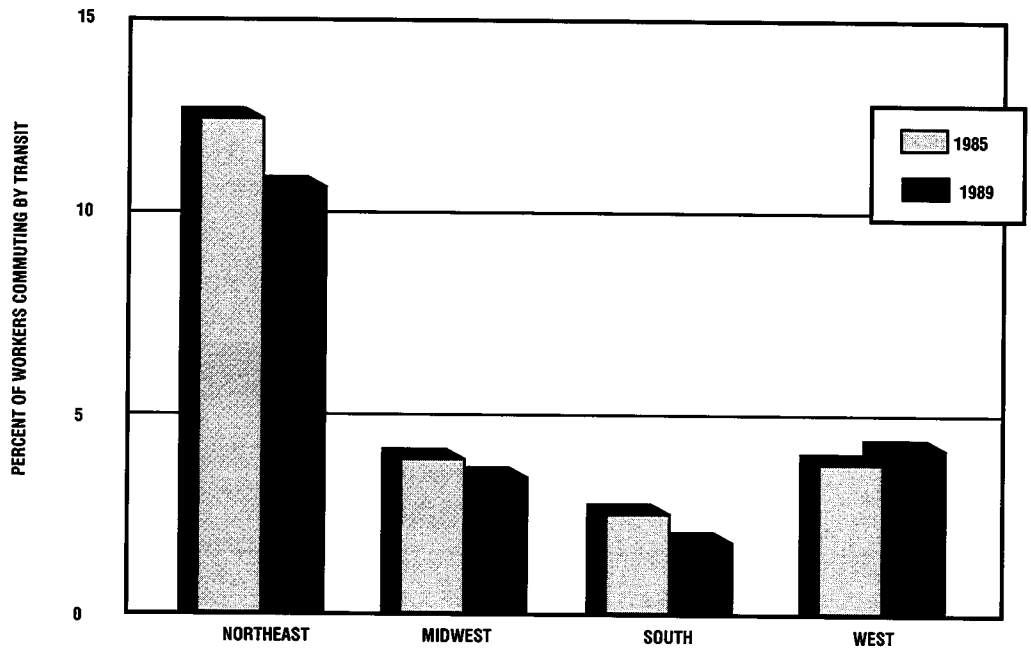
Trends in Transit Use for Work Trips
Selected Groups
1985 & 1989



Source: AHS

FIGURE 15

Transit Use Trends by Region
1985 & 1989



Source: AHS

Age Structure

A factor to be considered is the changing age structure of the society and its impact on transit usage. Figure 16 shows that, with one exception, transit decline was not significantly age related and declined in share of travel across all age groups. The exception was growth in share of travel in the age group from 20 to 29, an interesting and important potential trend.

Other variants on the main trend were the fact that the age groups over 50 seemed to show the greatest decline in share, reflecting the increasing incomes and driving ability of the older population. This will be the dominant age group in the population in the near-term future. The young age group from 5 to 15, a major transit using age group, also showed exceptional declines. Thus, losses in share were most substantial among the traditionally major markets of transit—the young, the old, and women. This discussion has been oriented to changes in share rather than changes in absolute levels of usage. As total trip rates increase and the size of different age cohorts varies over time, actual usage levels will reflect those changes. For example, the 20- to 29-year-old age cohort will decline in size in the nineties, balancing the increase in transit share of travel per person in that age group, so that total transit use by that age group will change little.

Women's Transit Use

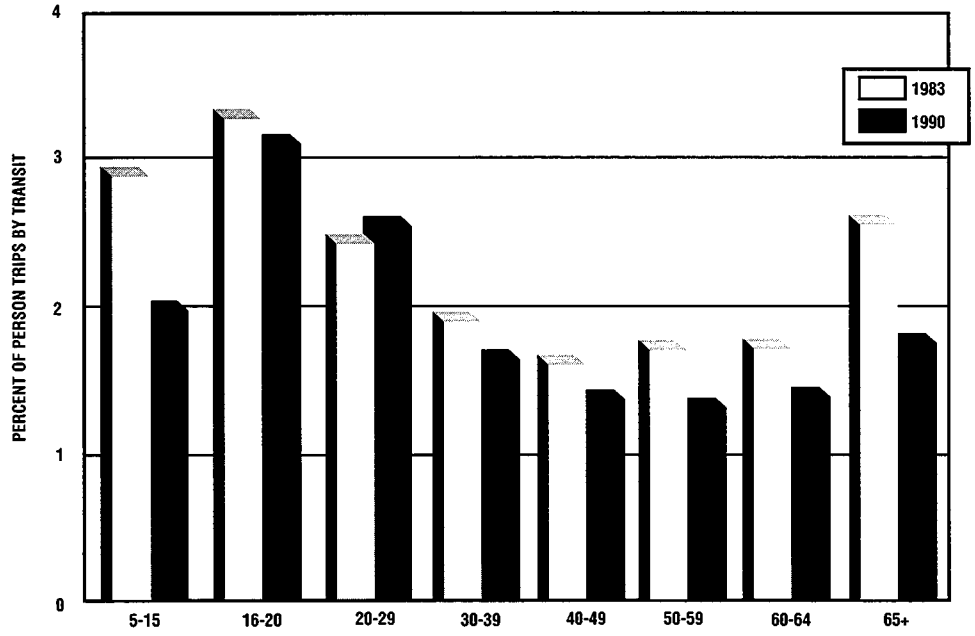
Changes in women's travel behavior, job activity, and access to automobiles, among other changes, have affected their transit use. Women have traditionally been more oriented to transit than men, but that disparity is rapidly diminishing. Figure 17 traces the trends in women's and men's shares of travel oriented to transit from 1977 to 1990, based on trips of all travel purposes from the NPTS.

Two important trends are apparent. First, the

Thus, losses in share were most substantial among the traditionally major markets of transit—the young, the old, and women.

FIGURE 16

Transit Shares of All Travel by Age Group 1983 & 1990

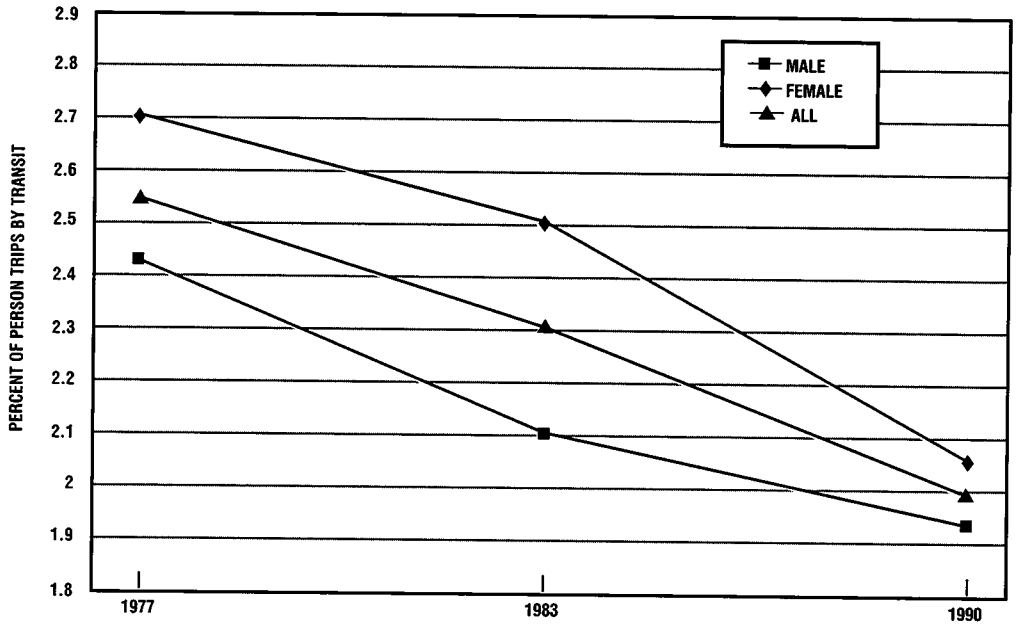


Source: NPTS

trend is clearly downward for both women and men. Second, the disparity between men's and women's transit use is narrowing such that the dispersion around the value for all users is less. This is the result of women's share of transit use declining faster than that of men. The transit share of men's travel declined by less than 10 percent, while the share decline for women was over 20 percent. It is important to recognize that the discussion is about changes in share rather than actual transit use. With the number of women, their trips per capita and average trip lengths increasing, actual transit activity would not be as adversely affected as these trends

FIGURE 17

Male/Female Transit Use Trends
1977, 1983 & 1990



Source: NPTS

would indicate. The actual decline in total trips on transit for women, as measured by the NPTS, was about 8 percent.

Transit and Low Income Populations

The most surprising trend is the substantial shift away from transit for work purposes by the poverty population and those in poor or very poor housing. These populations, of course, probably overlap. According to the AHS actual transit use declined by 26 percent in the poverty population, not quite as radical an event as it might appear because the *number of workers* in the poverty population itself declined by 7 percent in the period. Figure 18 portrays the modal shares for trips to work by those in the poverty classification of the Census. Poverty was defined in 1989 as a family of four with an annual income of less than $12,674. The figure shows a pattern remarkably similar to the overall national pattern, and most notably shows about a 5 percentage point increase in trips by single occupant vehicles among the poverty population, reaching approximately 60 percent by that means. This clearly suggests the increasing affordability of POV travel and increasing access to private vehicles by the poverty population. Although this trend is negative for transit, it may have more positive overtones in the broader society.

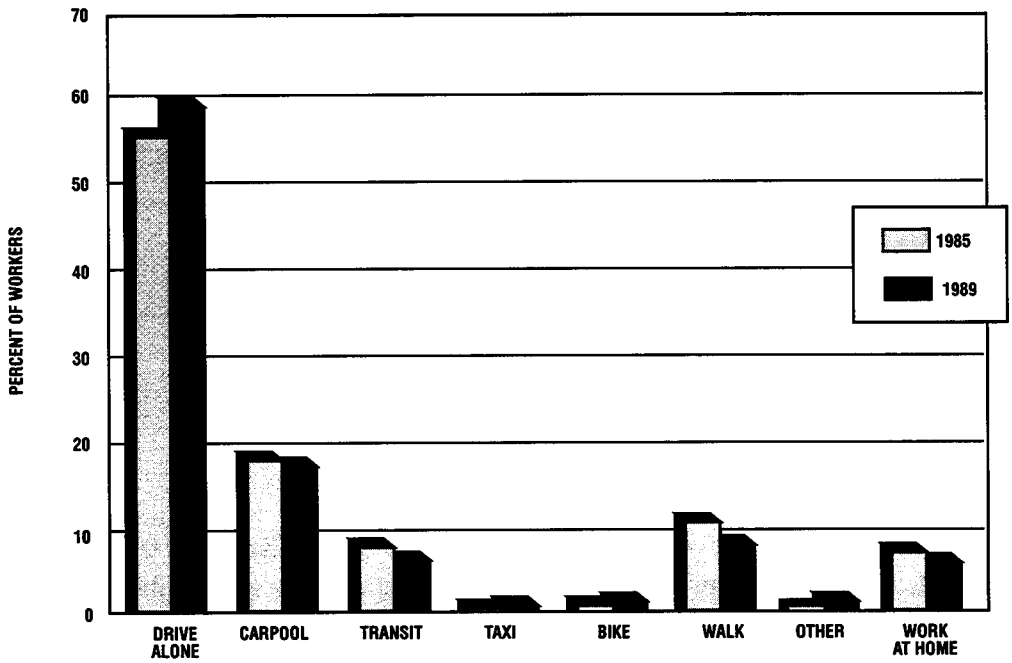
Further Work

It is clear that the surface has only been scratched on transit analysis. The key point is that all the traditional sources of transit use are declining. Each group needs further research, especially women's travel, low income travel, and travel by younger and older age groups.

This clearly suggests the increasing affordability of POV travel and increasing access to private vehicles by the poverty population. Although this trend is negative for transit, it may have more positive overtones in the broader society.

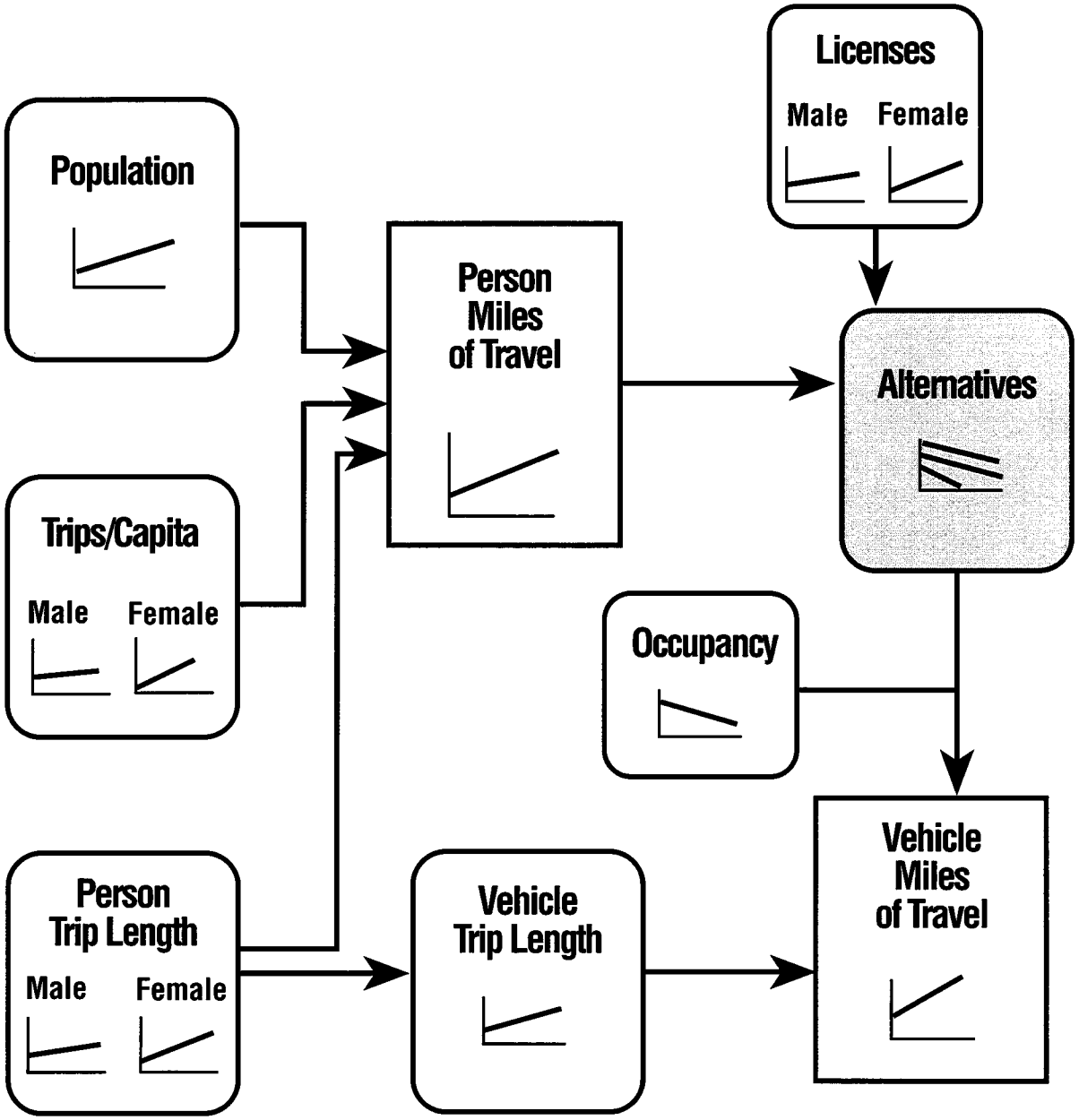
FIGURE 18

Mode Choice of the Poverty Population for Work Trips 1985 & 1989



Source: AHS

Factors in Growth of Personal Travel



CHAPTER FOUR:
TRENDS IN VEHICLE ALTERNATIVES TO WORK

Key Findings

- Together, walking to work and working at home exceed transit use as a share of work trips. Like transit use, both have shown relative decline in share of total work travel.
- Walking to work has two main components: a central city and a rural component. Walkers are differentially poor, from lower quality housing.
- Working at home has a similar contrasting pair of components: rural workers and suburban homeowners.
- In metropolitan areas, walking to work and working at home seem to be complements, with walking a central city phenomenon and working at home more characteristic of suburban neighborhoods.

The dominant trend in modes of transportation used for trips to work has been the decline in share of all alternatives to the personally operated vehicle (POV). Figure 19 shows this across the board decline for the years 1985 to 1989. The changes in vehicle occupancy and the patterns in mass transit use are treated separately elsewhere. The remaining significant alternatives—walking and working at home—are discussed here.

Walking as a mode of travel to work has been in decline for a very long time as transit and the automobile have become more pervasive. Working at home has been affected more by the decline in farming than by competition from other modes of travel. Figures 20 and 21 show the walk share of the journey to work in recent years along with the share that work at home, stratified by the geographic area of the worker's residence. In 1985, about 7 percent of workers either walked to work or worked at home. This share declined to about 6 percent by 1989. Together they exceeded mass transit in share of workers. In terms of miles of travel, they are far less significant. Preliminary data from the 1990 NPTS indicate that almost three-fourths of walk trips to work are less than one-half mile in length. Further review of the geographic detail in Figure 20 shows that the decline was relatively uniform across all residential areas including central cities, suburbs, and nonmetropolitan areas.

These two alternatives are attractive to planners because they employ no vehicles and consume few resources, making little or no infrastructure demands on the society. But to better understand why these options have declined requires a more careful examination of their characteristics.

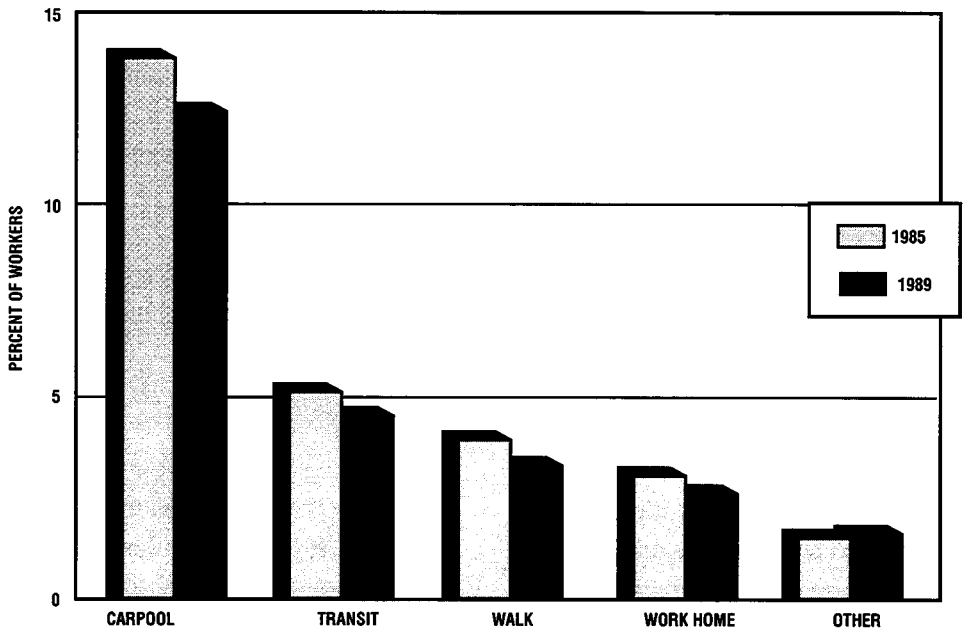
Walk to Work

The 1985 AHS identified roughly 4 million walkers out of the 100 million workers in the Nation. By 1989, walkers had declined to

Together, walk to work and work at home exceed mass transit in share of workers.

FIGURE 19

Trends in Alternatives to the Single Occupant Vehicle for Work Trips 1985 & 1989



Source: AHS

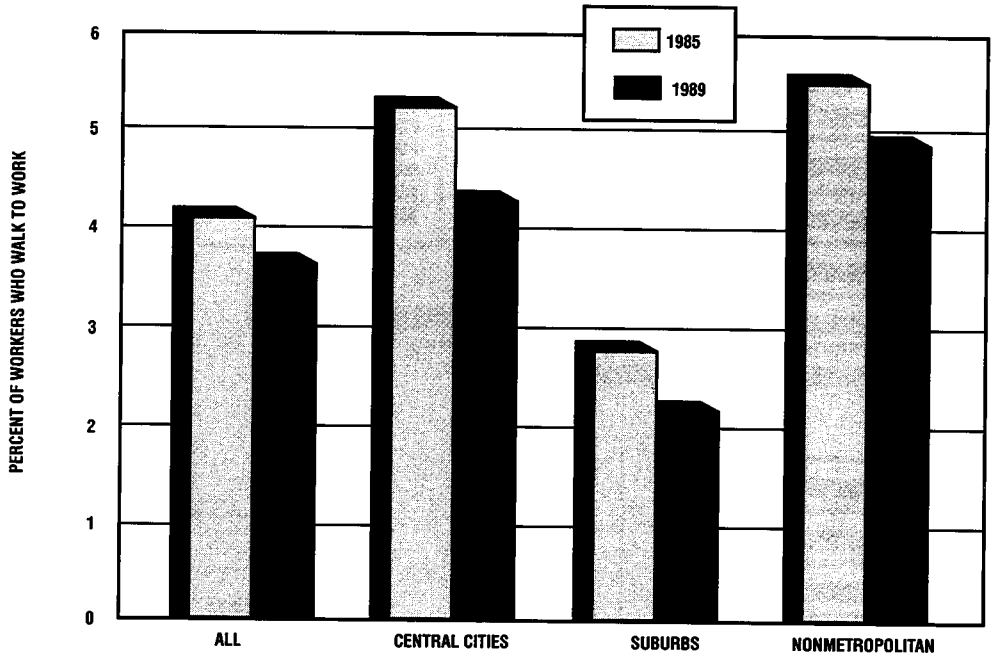
3.6 million of the 106 million workers. These walkers can be separated into various groups according to the survey data. The first stratification is by place of residence. Figure 22 shows, among other things, how walk to work trips are distributed by place of residence categories, contrasted to the distribution of all work trips by the same categories. From this it seems that walking is a characteristic of small towns and large cities. Central cities, with 30 percent of the worker population, have 38 percent of the walkers, and nonmetropolitan areas with 20 percent of the workers have 28 percent of walkers. Within nonmetropolitan areas, small towns, with only 7 percent of the national population, have 11 percent of walkers.

Preliminary data from the 1990 NPTS indicate that, within metropolitan areas, walking to work increases with area size and with increased availability of transit. The NPTS also indicates that walkers tend to have work trips of less than half a mile.

Walkers are almost evenly divided between homeowners and renters, although renters represent only 32 percent of the population. Walkers are dramatically disproportionately poor, living in poor or bad quality housing, but not dramatically disproportionately African American or Hispanic.

FIGURE 20

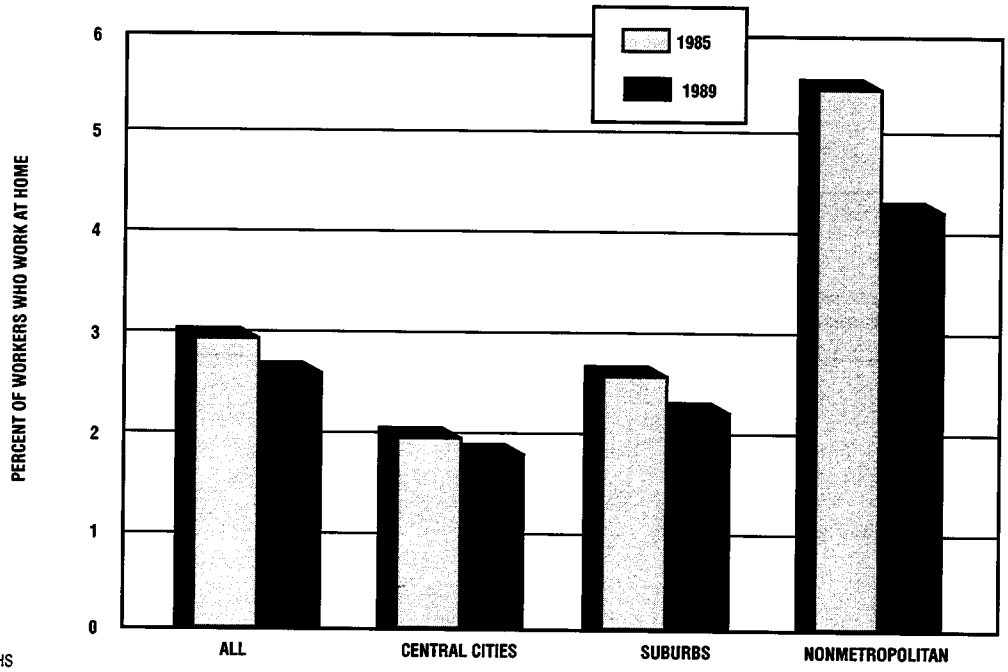
Walk to Work Trends
1985 & 1989



Source: AHS

FIGURE 21

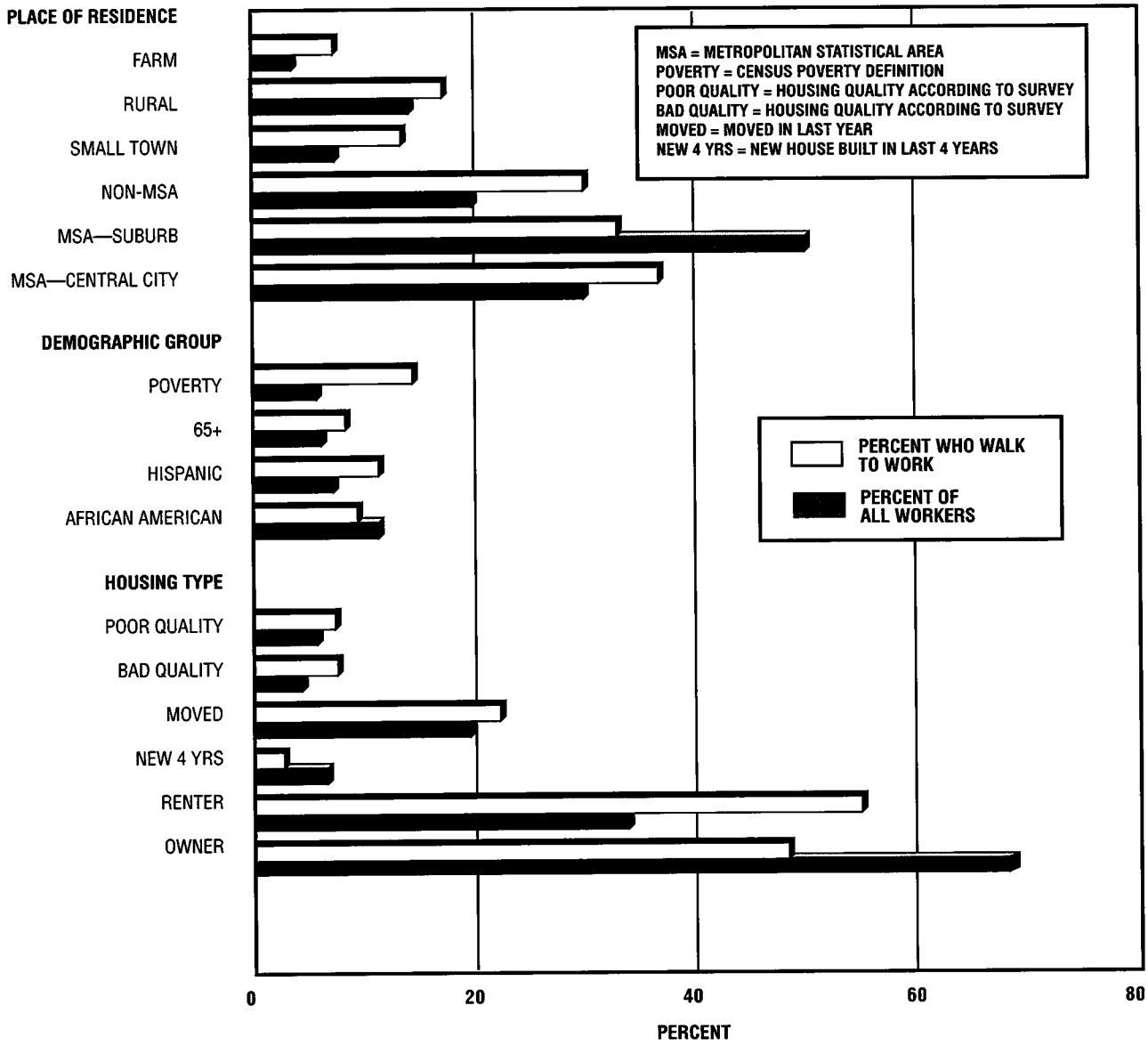
Work at Home Trends
1985 &1989



Source: AHS

FIGURE 22

Walk to Work Shares Compared to All Workers' Shares*
1989



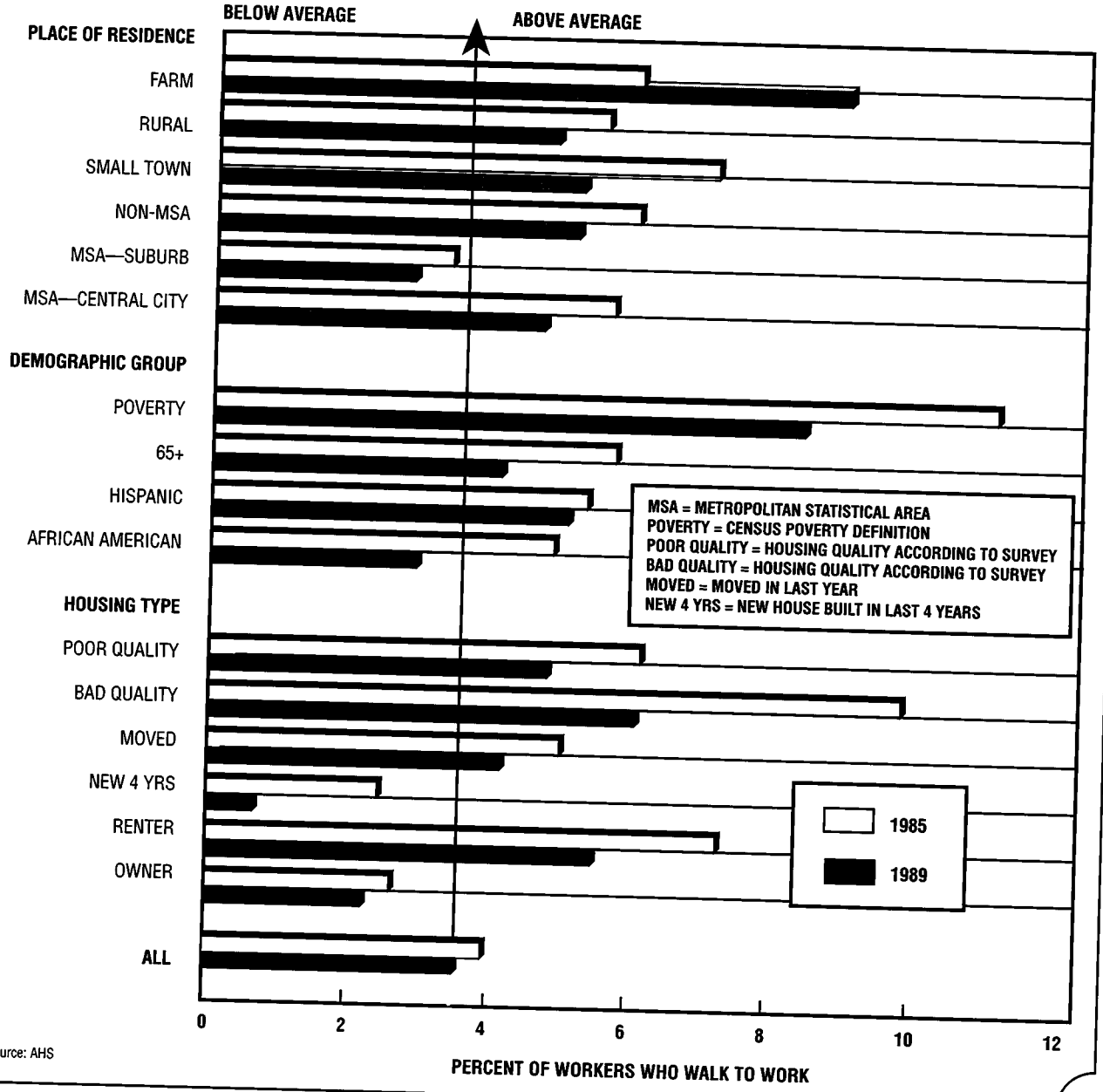
Source: AHS

*Using workers who live in suburbs as an example, this graph shows that 33% of workers who walk to work live in suburbs, yet 50% of all workers live in suburbs. Therefore, suburban workers are underrepresented in considering which groups tend to walk to work.

As the population becomes increasingly suburban and less poor, walking will decline. Interestingly, and perhaps unexpectedly, the aging of the population does not seem to have a negative effect on walking.

FIGURE 23

Walk to Work Trends
Selected Housing Categories
1985 & 1989



Source: AHS

The share of walking to all work travel is shown in Figure 23 for these and other groups. Among the clear conclusions to be drawn from these patterns is that, as the population becomes increasingly suburban and less poor, walking will decline. Interestingly, and perhaps unexpectedly, the aging of the population does not seem to have a negative effect on walking. As Figure 23 shows, those who are over 65 and work do walk to work in higher proportion than the national average.

While there is a tendency to see a decline in walking to work as a "negative," based on urban concerns for air quality, it is inappropriate to assume that this trend is a "problem to be solved." A large part of the shift away from walking is occurring in rural areas where people for the first time have the means to own a household vehicle and substitute its use for walking. As such, it can represent a real mobility increase, expanding access to jobs and other opportunities to the otherwise isolated rural population.

Work At Home

In some respects, the pattern among the 2.7 million people who work at home is the reverse of the walk to work pattern. Walking is underrepresented among homeowners, while working at home is heavily oriented to homeowners. Working at home is lower in central cities and higher in suburbs compared to walking. African Americans and Hispanics are notably underrepresented among those who work at home.

There are probably three main patterns that characterize working at home. One pattern involves a suburban professional who is technically oriented, representing the so-called, and long-awaited, technical revolution. The second pattern involves a metropolitan area resident who is working at a job that is home-based by definition, such as a family day care provider. The third pattern involves a rural person, probably poor and engaged in agriculture. Those engaged in farming, with less than 2 percent of the population, constitute almost 17 percent of those who work at home. Nonmetropolitan areas account for almost a third of all those who work at home. Figure 24 provides a picture of shares of workers working at home vs. shares of all workers for significant demographic and housing variables drawn from the AHS.

Clearly, trends in working at home have been negatively affected by the decline in the farm population in this century. It is questionable whether the growth in the technical professional component of the economy will ever reach a scale where working at home increases as a share of commuting. However, the key point is that the share of national travel represented by working at home can decline, yet still make a significant contribution to commuting efficiency, as long as the metropolitan component of work at home continues to expand. Figure 25 supports the previous discussion showing that the rates of working at home are well above the national average for low income and rural populations.

Further Work

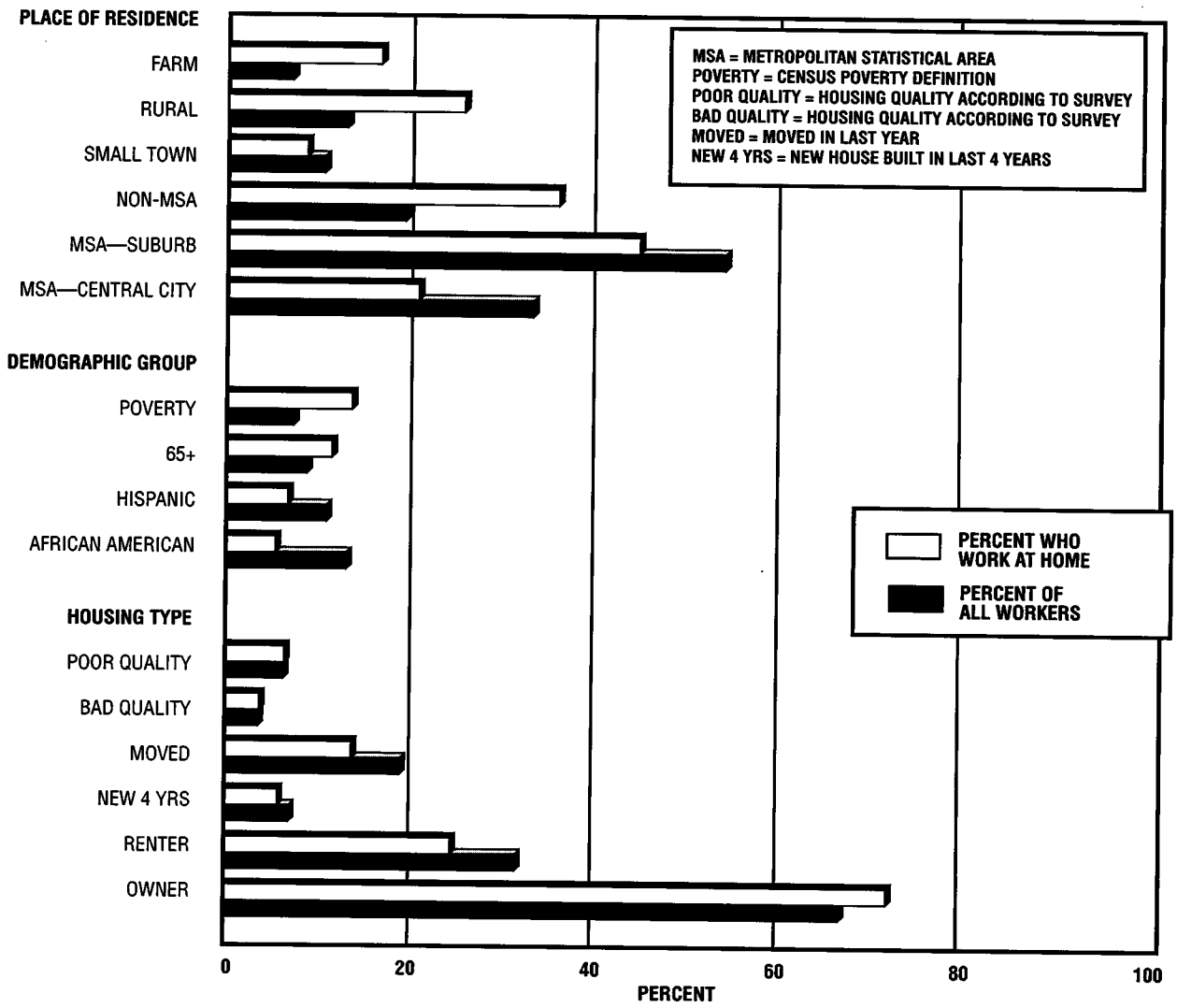
The walk to work mode needs to be looked at geographically and demographically. Of particular interest is the identification of cities with higher than typical walk to work shares. Density and area size are obvious factors. The correlation of walking with transit deserves further analysis. Indications that short trips shift from walk to personal vehicle rather than transit suggest that transit and walking are not substitutes because of long transit wait times.

The work at home phenomenon needs further research. The typical work-at-homer should be characterized demographically and geographically. Detailed data from the Decennial Census will provide very fertile ground for further research when the full journey to work statistics become available.

The share of national travel represented by working at home can decline, yet still make a significant contribution to commuting efficiency, as long as the metropolitan component of work at home continues to expand.

FIGURE 24

Work at Home Shares Compared to All Workers' Shares* 1989

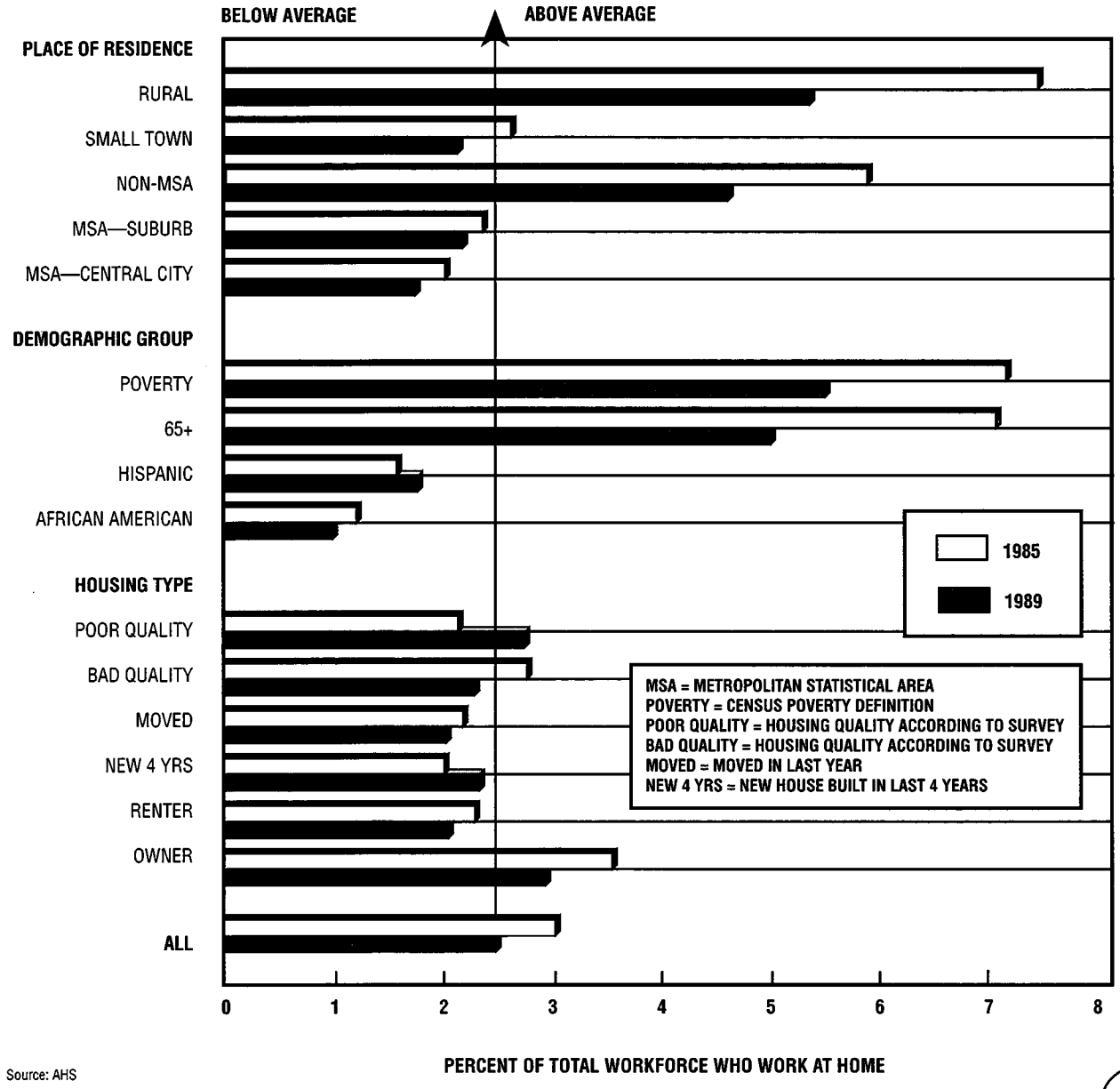


*Using workers who live in suburbs as an example, this graph shows that 47% of all workers who work at home live in suburbs, and 50% of all workers live in suburbs. Suburban workers are only very slightly underrepresented in looking at which groups work at home.

Source: AHS

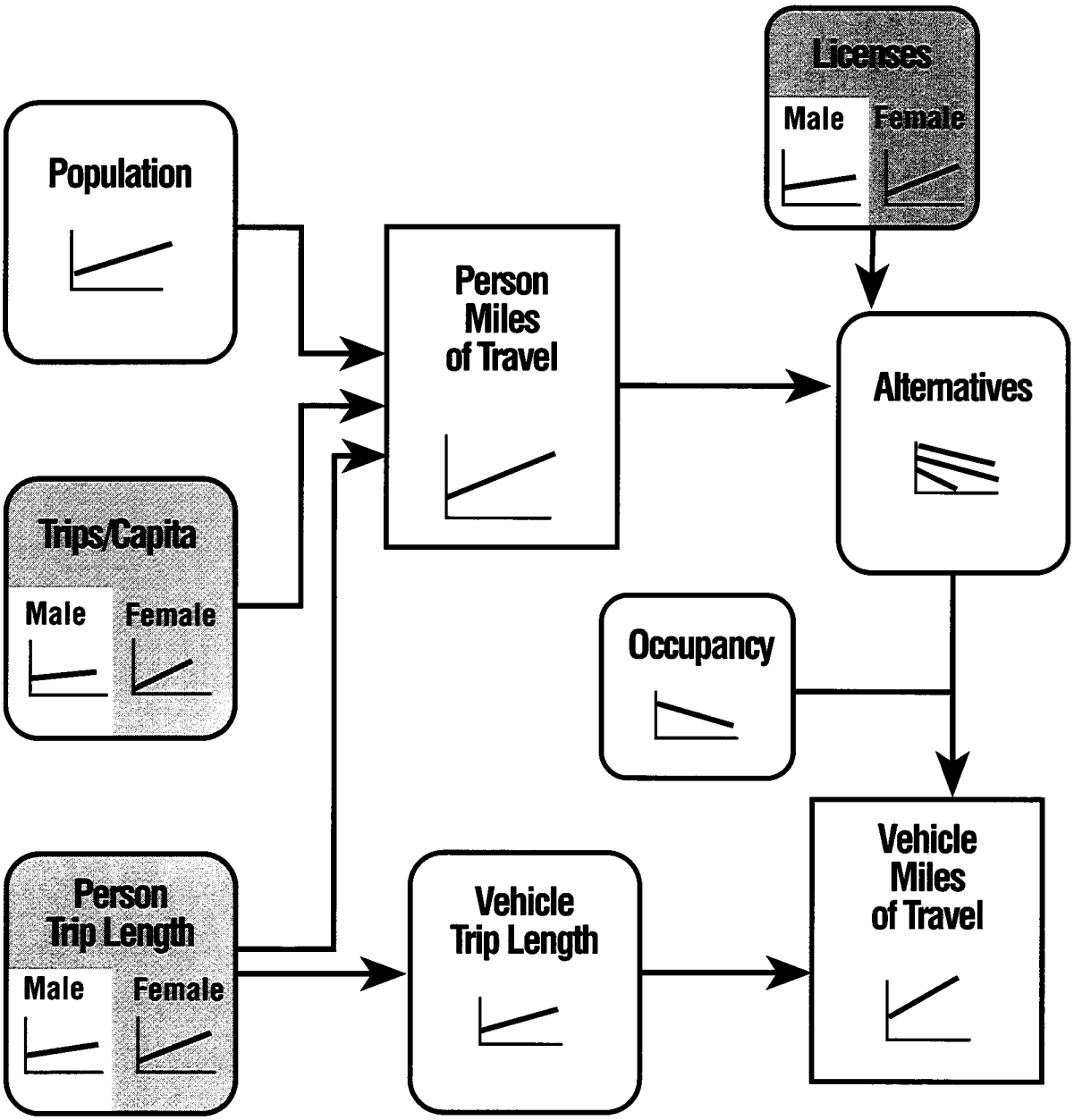
FIGURE 25

Work at Home Trends
Selected Housing Categories
1985 & 1989



Source: AHS

Factors in Growth of Personal Travel



CHAPTER FIVE:
DESCRIBING WOMEN'S TRAVEL BEHAVIOR

Key Findings

- Women's daily rate of tripmaking has increased faster than men's. From 1983 women's rate increased 9 percent vs. a 5 percent increase for men.
- Men's trip rate increase was more evenly distributed over age groups, whereas women's show significant shifts among age groups with greatest growth in the 30- to 39-year-old age group.
- Because men's average trip lengths in all purpose categories still substantially exceed women's, men's average miles of travel still exceed women's.
- Purpose shifts also were significant. The big jump in the share of trips for personal business purposes was most pronounced among women, with that purpose rising to about 23 percent of all women's trips contrasted to men's rate of about 20 percent. Almost all of the increase in women's trip rate can be attributed to the increase in this activity.
- Increases in women's access to vehicles and possession of driver's licenses have increased their use of private vehicles and reduced their use of all alternatives.

The changing behavior and roles of women in society have had important impacts on travel and transportation. These changes have manifested themselves in the level of travel activity, purposes of trips, and choices of mode of travel and trip length, among others.

Some of the societal changes occurring cause women's travel behavior to be more like that of men, but other changes create disparities or increase existing differences between men and women's travel characteristics.

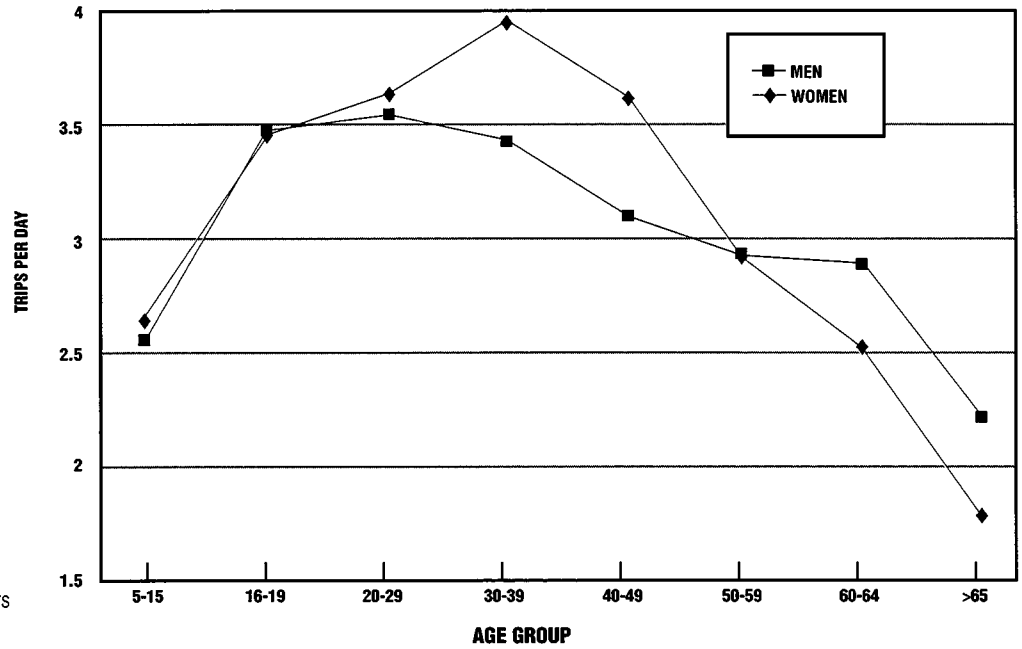
In 1983, men and women had approximately the same per capita trip rate of 2.88 trips per day for persons over 5 years of age. In 1990, the new trip rate for men was 3.04 trips per day and the rate for women was 3.13, a 9 percent increase from 1983 for women versus a 5 percent increase for men.

Changing Trip Rates

Among the significant changes that mark an interesting departure point between men and women's travel behavior are the increases in tripmaking per capita. In 1983, men and women had approximately the same per capita trip rate of 2.88 trips per day for persons over 5 years of age. That rate increased for both groups between 1983 and 1990, but increased considerably more rapidly for women. In 1990, the new trip rate for men was 3.04 trips per day and the rate for women was 3.13, a 9 percent increase from 1983 for women

FIGURE 26

Women's Trips per Day Contrasted to Men's by Age Group 1990



Source: NPTS

versus a 5 percent increase for men. Certain aspects of the pattern of these changes are pertinent.

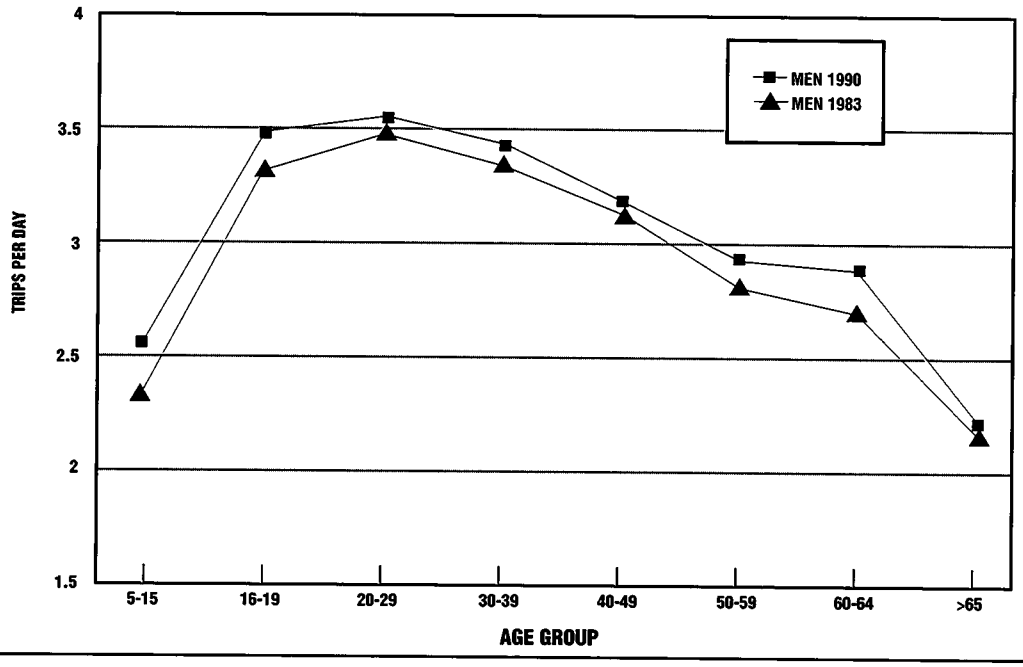
The first of these is that the trip pattern for women varies from men's in a number of ways. Figure 26 shows the 1990 patterns for tripmaking by age group for men and women. Of note is that, in the early age groups, young people's trip rates do not vary by gender. In the twenties' age group, women's tripmaking tendency increases faster than men's, is greater than men's throughout the middle years, but returns to the same rate as men's in the 50 to 59 age group. In the later years, men's trip rates exceed women's although both are very low. One can conjecture about these patterns, relating them to child-rearing duties and household activities.

Further insight can be gained by looking at the individual trends from 1983 to 1990 for men and women. The pattern of men's trip rate increase by age group, shown in Figure 27, is remarkably uniform. The overall increase in tripmaking for men is uniformly distributed among all age groups. The trend pattern for women, by contrast, shown in Figure 28, is much more dramatic and more interesting. There are big increases among the younger and older populations in trip rates, but the most significant factor is the increase in tripmaking by women 30 to 49 years old. The 30- to 39-year-olds increased their tripmaking by 8 percent per person, and women in their 40's increased by 14 percent per person. Again, conjecture might suggest work and child-related changes in behavior patterns.

Finally, and perhaps most pertinently, stratification by possession of a driver's license demonstrates the substantial impact of the availability of a driver's license on trip rates. Comparison of 1983 and 1990 daily trip rates for females, differentiating those with licenses from those without, indicates that the trip rates within the groups have, in fact, changed little. From the data in Table 1, it appears that the changes in overall tripmaking were the product of the change in the

FIGURE 27

Trends in Men's Trips per Day by Age Group 1983 & 1990



Source: NPTS

proportion of females with licenses as a share of the total female population. This is in substantial contrast to male rates, which grew significantly from 1.7 to 2.2 trips per day for the no license group and from 3.1 to 3.4 for the license holders. Thus, men's overall trip rate was much more a product of changing trip rates than of changing proportions of men with licenses.

If women's trip rates are stratified by driver's license availability, an important revelation occurs. According to the NPTS, there was virtually no change in women's trip rates between 1983 and 1990 when corrected for license availability. Women without licenses made 1.7 trips per day in 1983 and in 1990. Women with driver's licenses made 3.5 trips per day in 1990 compared to 3.4 per day in 1983.

Note that the rates shown here for those with no license have been modified to exclude those under driving age. Thus, the differences are not attributable to different age categories included in the surveyed groups.

Trip Purpose Trends

Looking at women's trip purpose pattern is further revealing of differences in behavior. Figure 29 shows the pattern of trip purposes by age group. The importance of work and work-related travel is evident with its signature pattern, but the importance of personal business trips is also striking. Personal business trips are strongly evident and seem to reach their peak in the 30 to 39 age group. Personal business trips include visits to doctors, dentists, banks, cleaners, and other service establishments, as well as trips to give others a ride to a destination (i.e., serve passenger trips). The personal business category changed dramatically from 1983 to 1990, rising from 17 percent to over 23 percent of women's travel. Men's personal business travel also grew, but not quite as rapidly as women's, from 15 percent of travel to about 20 percent. Women's work trips as a purpose grew slightly as a share of travel and actually declined in share for men. All other purpose categories, particularly visits to friends and relatives

For women, changes in overall tripmaking were the product of the change in the proportion of females with licenses as a share of the total female population. In contrast, men's overall trip rate was much more a product of changing trip rates than of changing proportions of men with licenses.

TABLE 1

Women's Daily Trip Rates by Availability of a Driver's License (trips per day)

	Trip Rate Without License	Trip Rate With License	Percent Licensed
1983	1.71	3.44	76.2%
1990	1.70	3.49	84.6%

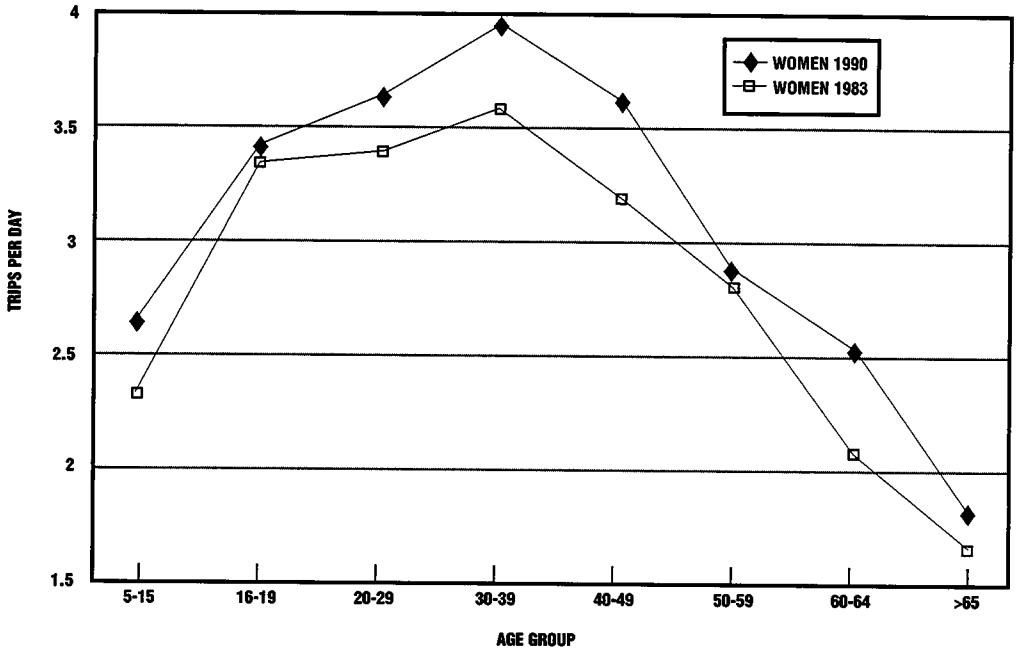
and recreational travel, declined or barely remained stable. These, of course, are relative changes in shares against a backdrop of increasing overall tripmaking.

When the trip purpose stratification is reviewed by trip rate per day, the significance of the personal business factor is overwhelming. Women without licenses had almost identical trip rates when 1990 is compared to 1983, exhibiting extraordinary stability, as shown in Table 2.

With respect to the pattern for license holders (Table 3), the change is in the trip rate for

FIGURE 28

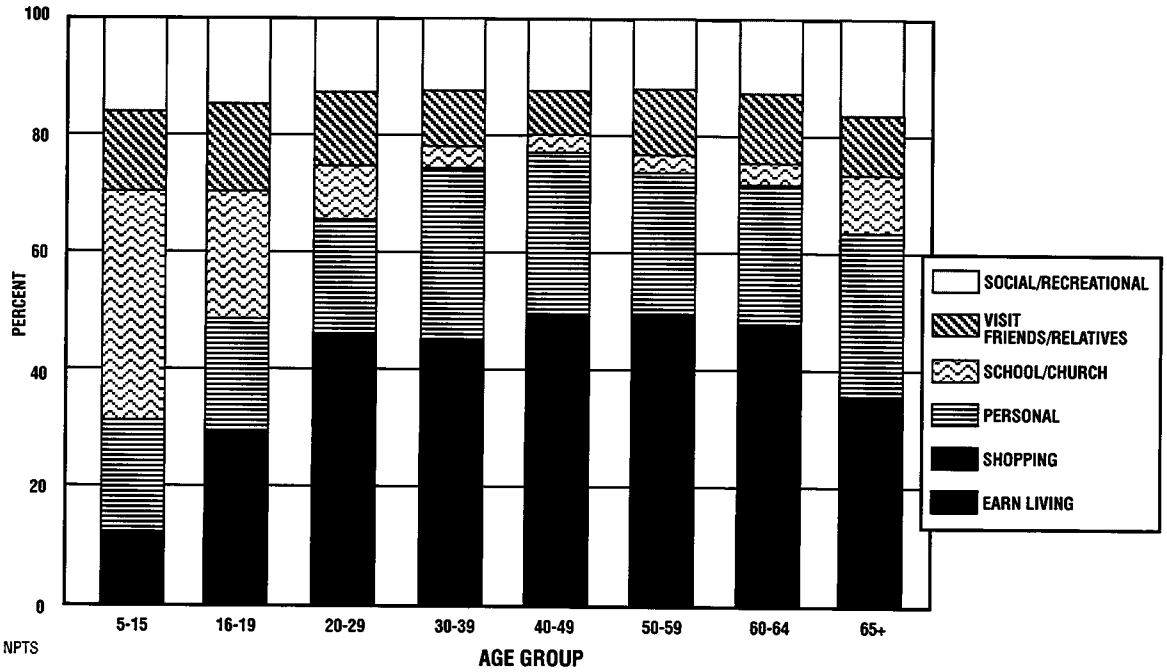
Trends in Women's Trips per Day by Age Group 1983 & 1990



Source: NPTS

FIGURE 29

Women's Trips by Purpose by Age Group 1990

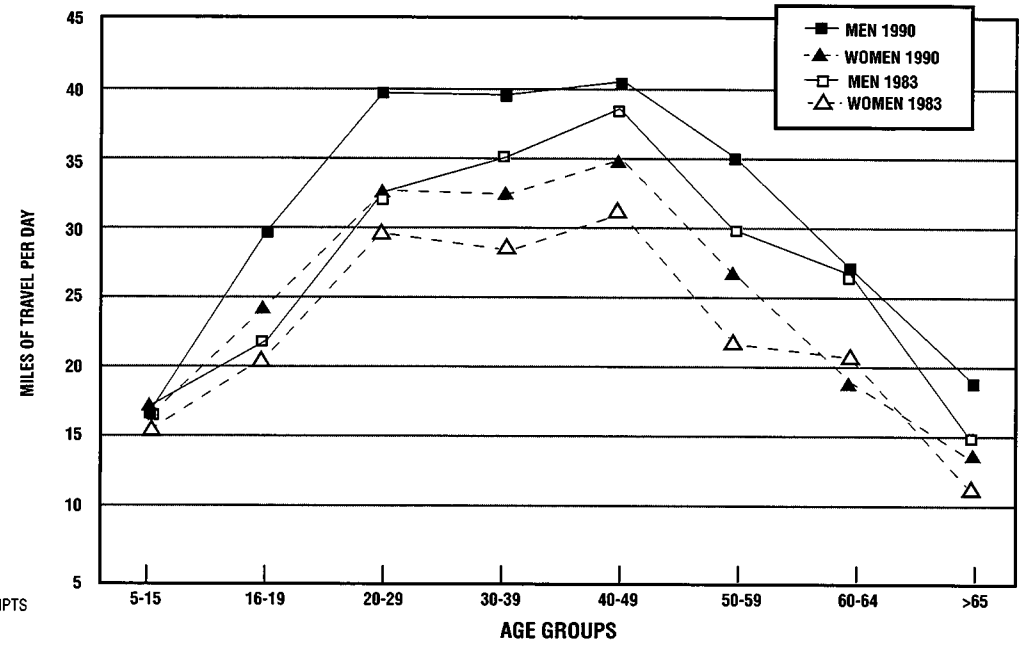


Source: NPTS

Of the 13 million new license holders arriving on the scene since 1983, more than 8 million, 61 percent, were women.

FIGURE 30

Travel per Day Broken Down by Age and Sex 1983 & 1990



Source: NPTS

personal business; all other purposes were either stable or declining. Men's patterns are almost identical to women's in this respect, with effectively all the increase in trip rate resulting from growth in personal business rates.

Trip Lengths

An important major distinction between women's and men's travel is a product of the overall length of their trips. Depicted in Figure 30 is the fact that men's miles of travel each day exceed women's in almost all age groups except the childhood years. As can be seen in the figure, even men's 1983 travel exceeds women's current travel. This results from the large differences in average trip lengths between the groups, overcoming the fact that women's tripmaking rates exceed men's. Part of this certainly is a product of the differences in travel purposes identified earlier. There is no consistent pattern of reduction in the disparity between men's and women's trip lengths. Specifically, however, in regard to work trips, the growth in women's trip lengths has tended to close the gap with men's.

Driving and Transit Use

A major element in the changing character of women's travel behavior that is treated under other topics deserves mention here. It involves a whole

TABLE 2

Women With No License
Trip Rate Trend by Purpose
(trips per day)

Purposes	1983	1990
Earn a Living	.23	.27
Family and Personal Business	.69	.69
Civic, Education, Religious	.26	.23
Social/Recreational	.50	.41
Other	.03	.10
All	1.71	1.70

TABLE 3

Women With License
Trip Rate Trend by Purpose
(trips per day)

Purposes	1983	1990
Earn a Living	.75	.74
Family and Personal Business	1.43	1.69
Civic, Education, Religious	.27	.24
Social/Recreational	.93	.80
Other	.06	.02
All	3.44	3.49

complex of activities characterized by increased use of driver's licenses among women, increasing availability of private vehicles to women, and their consequent reduced use of mass transit and other alternatives to private vehicles. Since 1965, the number of women with driver's licenses has doubled, and the availability of a license is now about 85 percent for women, contrasted to 77 percent in 1983. This number is still less than the number of licenses available to men—roughly 92 percent of men were licensed in both time periods. Of the 13 million new license holders arriving on the scene since 1983, more than 8 million, 61 percent, were women.

The key point is that dramatic changes accompany the presence of a driver's license among women. As noted earlier, effectively all of the increase in the overall trip rate must be attributed to the increasing percentage of women with a license to drive. Tripmaking is more than twice as frequent for women drivers compared to the women of driving age without licenses, and average trip lengths jump substantially. As a result, women with licenses average three times the daily miles of travel of women over 16 without licenses. Thus, for every 1 percent shift from nondriver to driver in the female population, total travel jumps almost 10 billion miles per year. As expected, transit use drops significantly—women with licenses use transit for about 1 percent of their trips, while the transit share of trips for women without licenses is over 13 percent.

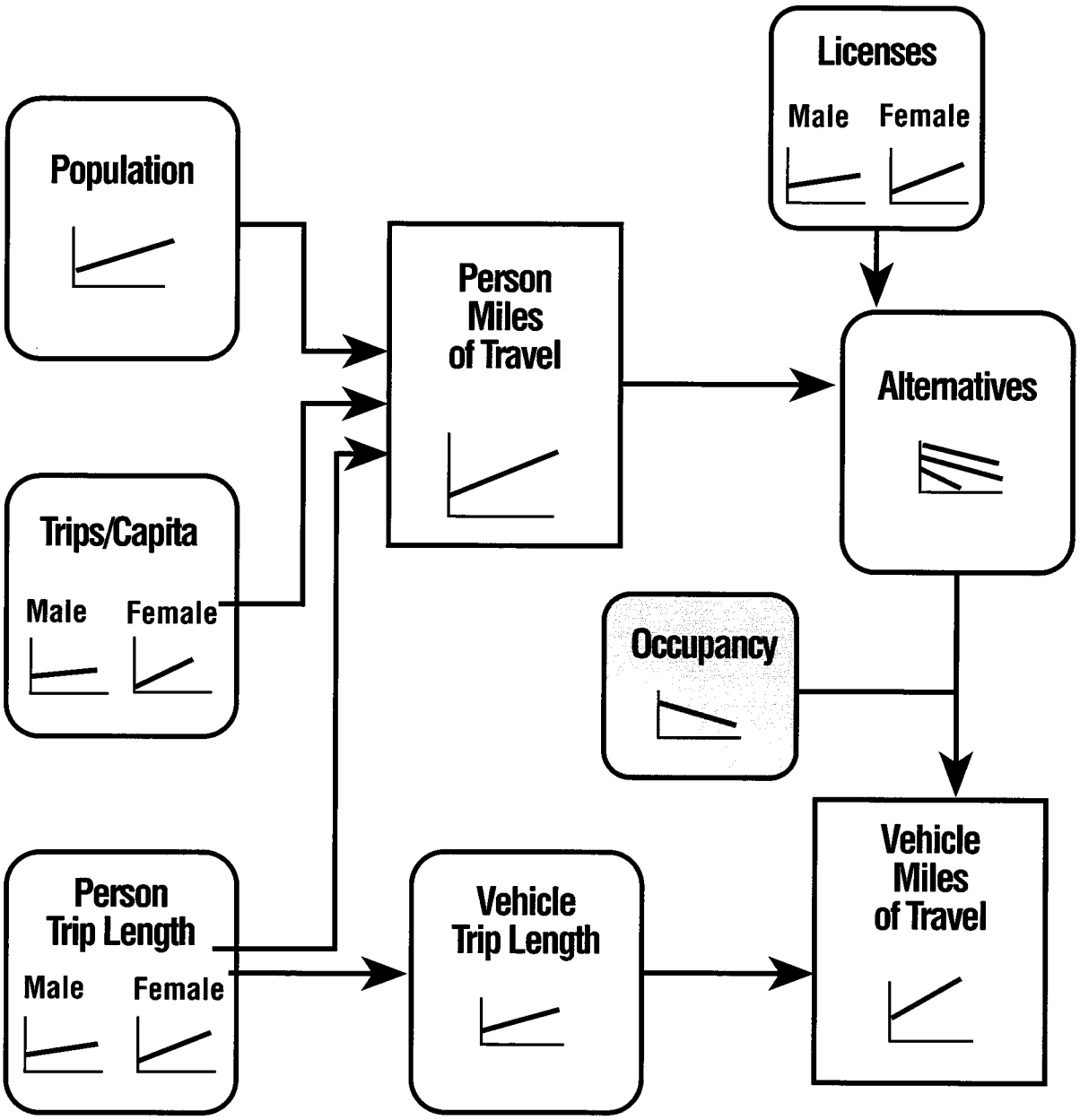
Thus, for every 1 percent shift from nondriver to driver in the female population, total travel jumps almost 10 billion miles per year.

The data indicate that men's travel behavior with respect to mode has perhaps reached a relatively stable condition while women's is still evolving. Men's use of walking and bicycling remained stable from 1983 to 1990, declining somewhat in the case of walking; women's use of these alternatives, however, changed substantially. In the case of bicycles, women's shares had been half of men's in 1983, but dropped to a third of men's by 1990. Walking, where the share of women's travel was over 9 percent compared to under 8 percent for men, shifted to almost identical levels of around 7.2 percent.

Further Work

This discussion of women's travel behavior just begins the analysis of this critical area. There are important and exciting areas for further work. The interactions between licenses and tripmaking are very crucial as are their effects on choice of mode. The whole area of personal business trips needs careful treatment. Stratification of these trips by persons in the vehicle, by age, would be very revealing. Trip length trends also need careful consideration in substantial detail. Variations in trends of tripmaking behavior and other characteristics of travel by age will be very useful as well. Is the boom in women's travel coming from women of working age caring for families, for example, or from young women of school age driving for the first time?

Factors in Growth of Personal Travel



CHAPTER SIX:
VEHICLE OCCUPANCY TRENDS AND PATTERNS

Key Findings

- Average vehicle occupancy, measured as person miles per vehicle mile, continues to decline in all travel purpose categories, and notably in work travel. The overall average has descended from 1.9 in 1977 to 1.7 in 1983 and to 1.6 in 1990.

- The key factors in this decline seem to be declining family size and increasing vehicle availability. Along with other factors, these trends have shrunk the pool of those available to carpool or use transit.

- A separate factor of significance is that vehicle occupancy tends to increase with increasing length of trips, improving the energy efficiency and the costs of long distance travel.

The overall increase in share of travel by personally operated vehicles was not that substantive in the 1980's—the share increasing from 82 percent in 1983 to roughly 87 percent in 1990. However, the numbers of vehicles on the road increased more substantially because of the declining number of persons per vehicle, i.e., average vehicle occupancy. Vehicle occupancy patterns are important attributes of travel because they indicate a great deal about the relative efficiency of personal vehicle travel and the prospective congestion generated by vehicle use.

Two aspects of current vehicle occupancy trends are particularly significant. The first is that vehicle passengers tend to look very much like transit users in demographic terms. In many respects, they are competing for the same pool of travelers, a market that is declining in overall size. The competition for this shrinking market, particularly in work travel, says a great deal about opportunities for increases in transit use and improvements in average occupancy.

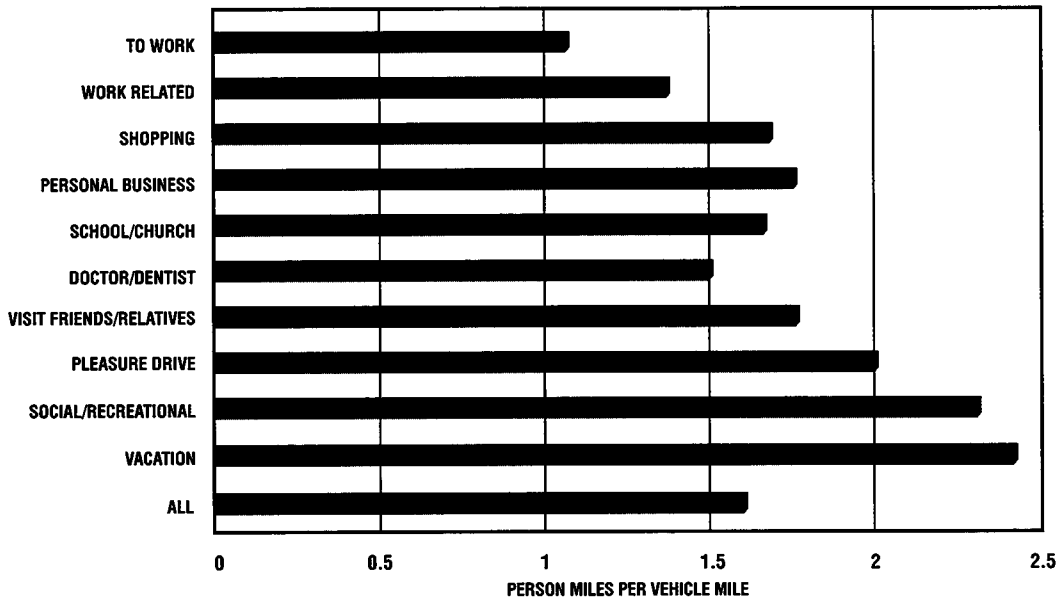
Vehicle passengers tend to look very much like transit users in demographic terms. In many respects, they are competing for the same pool of travelers, a market that is declining in overall size.

The second aspect of the issue is that the number of passengers riding in a vehicle significantly changes the costs per user. While this has an important impact in commuting, it is even more significant in intercity travel where the competitive costs in air, bus, or rail are person-based, not vehicle-based. Thus, average occupancies for long trips are important determinants of the perceived costs to travelers in personal vehicles contrasted to travel by common carrier.

Figure 31 shows the average occupancy by trip purpose, as found in the 1990 NPTS, calculated as the number of passenger miles divided by the

FIGURE 31

Average Vehicle Occupancy by Trip Purpose
1990
(Person Miles per Vehicle Mile)



Source: NPTS

number of vehicle miles traveled. Thus, these statistics represent occupancies that reflect the distances traveled in that the occupancies observed in long trips are given more weight than short trips. This is important because trip length tends to have a significant impact on the average value of vehicle occupancies. All trip purposes tend to have occupancy rates that are comprised of short trips where occupancy tends to be lower than average and long trips where occupancy tends to be higher than average. For trips that are usually very short, such as shopping or personal business travel, this is not very significant, but for trips that have a long distance component, such as pleasure driving, vacation travel, and visits to friends and relatives, it can have a major impact. For instance, while the average for all trips is 1.6 person miles per vehicle mile, the average for trips with a length greater than 40 miles is almost 1.9. Thus, the longer the vehicle trip, the more fuel efficient and less expensive it is per unit of travel.

Consistent with historical patterns, work purposes tend to have lower occupancy levels than other trip purposes. This is to be expected given that other purposes often involve family activities or involve a driver serving the needs of a passenger, as in a parent taking a child to a dentist. Current levels for work trips are about 1.14 person miles per vehicle mile, down from about 1.3 in the past. Work trip occupancies are seen as crucial to congestion management because they directly affect the number of vehicles on the road in peak travel periods. Figure 32 displays work trip vehicle occupancy on the basis of persons per vehicle trip, so that the differences by trip length can be shown better. Interestingly, work trips show a bimodal distribution with respect to distance, as shown in the figure. Vehicle occupancies are high for very short trips, decline to a minimum at about 5 miles, and then rise again to about 1.2 for long work trips. These long trips are often the source of large car or van pools designed to overcome the costs and tedium of long distance work trips. These long distance carpools have a tremendous impact on reducing overall vehicle miles of travel.

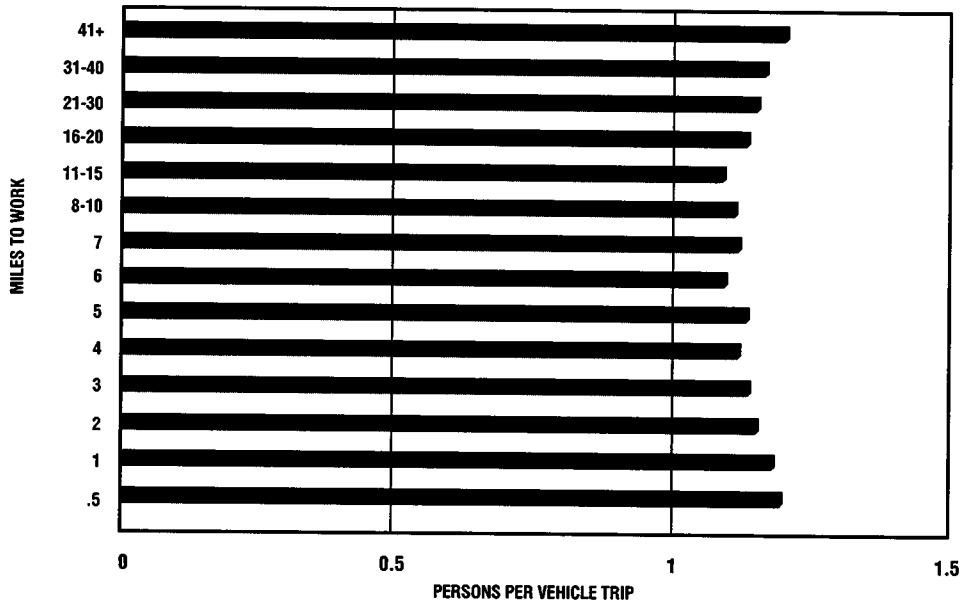
A further source of concern is the shifting

Thus, the longer the vehicle trip, the more fuel efficient and less expensive it is per unit of travel.

FIGURE 32

Work Trip Vehicle Occupancy by Trip Length 1990

(Persons per Vehicle Trip)



Source: NPTS

distribution of vehicle occupancies as indicated in work trip data from the AHS for 1985 and 1989. The sharpest decline was in four-person carpools, which declined 26 percent, while three-person pools declined 14 percent and two-person pools declined only 6 percent. Two-person pools now constitute over 76 percent of all carpoolers. These trends diminished overall carpool efficiency by reducing average occupancies from 1.10 to 1.07, as measured in that survey.

The overall trend in vehicle occupancies continues to decline. For 1990, the average occupancy for all travel purposes was 1.6 person miles per vehicle mile, contrasted to a rate of 1.7 in 1983 and 1.9 in 1977, observed in previous NPTS surveys. These trends are depicted in Figure 33, which shows the long-term declining trend in the average for all trips and in representative purpose categories.

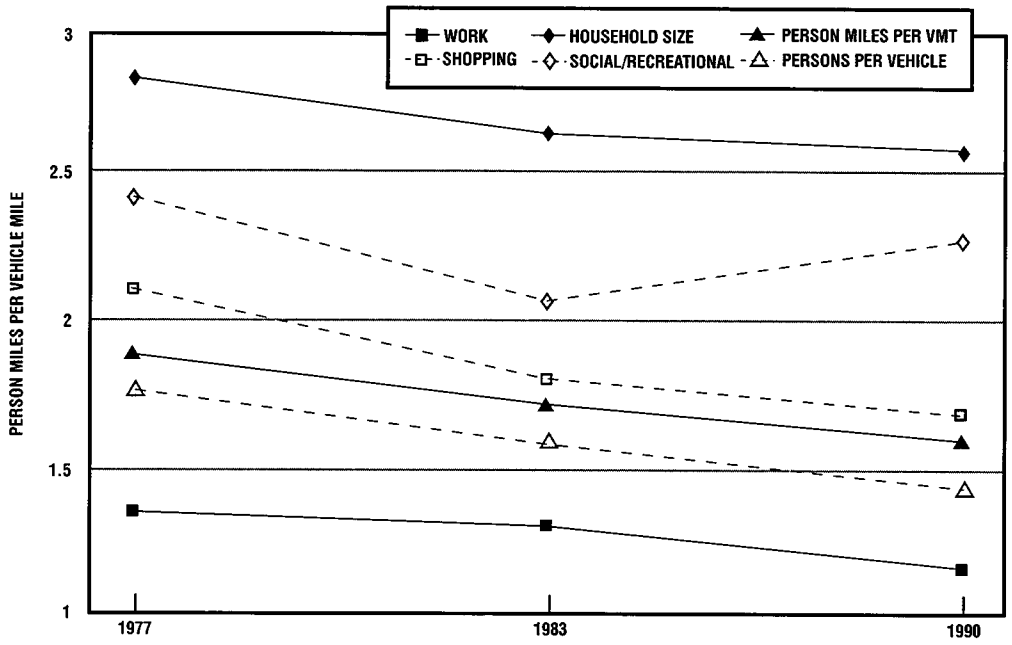
Figure 33 provides further insight into the "why" of declining average vehicle occupancies. Two factors that affect occupancies are also shown in the figure. The first is the trend in average household size, as measured in the NPTS, showing a parallel declining pattern. Clearly the decline in household members has affected occupancies in household related kinds of tripmaking, such as social, recreational, and

This suggests that the decline in the number of persons without vehicles and the increased general availability of vehicles have affected the occupancy trend, as would be expected. In effect, both these trends result in fewer people available to be passengers. These two factors, along with the increased dispersion of work destinations, seem to portend a continuation of low levels of vehicle occupancy.

FIGURE 33

Average Vehicle Occupancy by Trip Purpose 1977, 1983 & 1990

(Person Miles per Vehicle Mile)



Source: NPTS

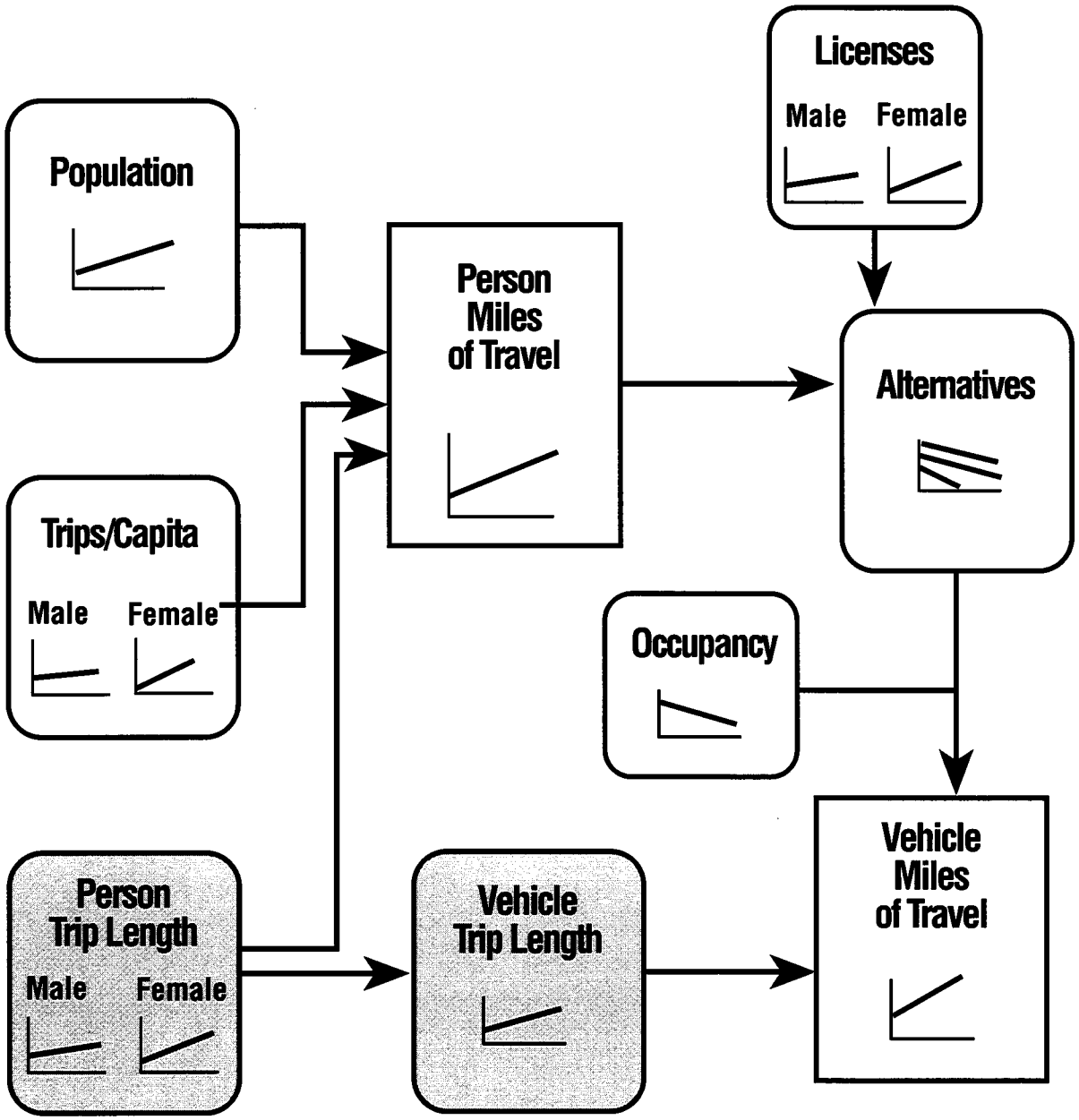
vacation trips. The second factor shown is persons per vehicle, which, as household vehicles have increased faster than persons in the population, has also exhibited a declining trend. This suggests that the decline in the number of persons without vehicles and the increased general availability of vehicles have affected the occupancy trend, as would be expected. In effect, both these trends result in fewer people available to be passengers. These two factors, along with the increased dispersion of work destinations, seem to portend a continuation of low levels of vehicle occupancy.

Further Work

There is a great deal of useful further work to be done. A question remains regarding whether transit competition with private vehicle passengers has affected vehicle occupancy and vice versa. The scale of the overall vehicle passenger/transit market needs to be quantified and its trend patterns analyzed. The importance of long distance carpools to overall work trip VMT reduction needs quantification.

A review of vehicle occupancy by purpose to assess the relative components of change would not seem to be worth it. The volatility of occupancies by trip length due to sample size is a statistical problem that needs consideration. If increasing average trip lengths increase occupancy rates and average lengths are increasing, this should be a mitigating factor in the long-term trend of decline.

Factors in Growth of Personal Travel



CHAPTER SEVEN:
CHANGES IN TRIP LENGTH

Key Findings

- Average trip lengths have increased as a result of the mix of certain trip purposes increasing in average length, while other purposes remained relatively stable. An increase in tripmaking of trips that are also increasing in length, notably personal business trips, has added to the increase.

- Behavioral patterns associated with rising incomes, possession of vehicles and driver's licenses, and the increase in persons living in large metropolitan areas have boosted trip lengths.

- Work trip lengths have increased in almost all areas and demographic groups. Short work trips have actually declined in number, while trips over 30 miles in length have grown substantially.

Changes in trip length can have unexpected impacts on total travel volumes. For example, changes in average trip length between 1983 and 1990 had greater impact on total travel demand than population growth.

One of the key factors in changes in travel demand is the very different trip length characteristics of various trip purposes. These purposes have exhibited varying levels of trip length growth in recent years. Figures 34 and 35 identify the trip length growth trends of the major trip purposes as used in the NPTS surveys of 1977, 1983, and 1990. The trip lengths shown are for vehicle trips. The trends indicate an erratic pattern. The group of purposes in Figure 34 shows a tendency toward increasing trip lengths, particularly for work and work-related purposes. Figure 35 contains the categories that have exhibited greater stability in trip length, particularly shopping trips, trips to visit friends and relatives, and visits to doctors and dentists.

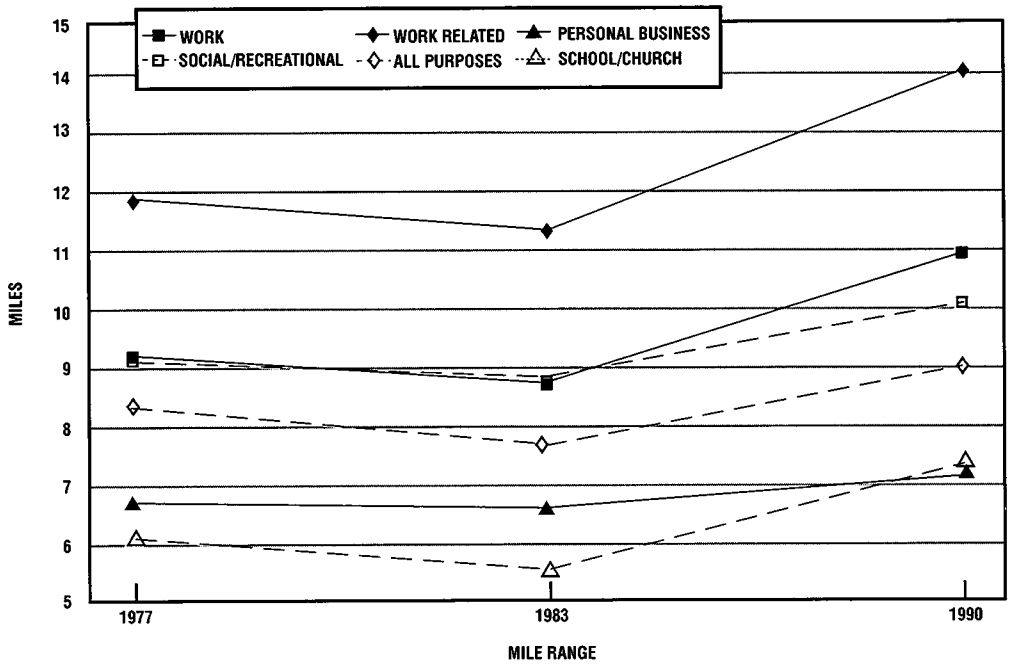
Behavioral patterns associated with rising incomes, possession of vehicles and driver's licenses, and the increase in persons living in large metropolitan areas have boosted trip lengths.

A common characteristic of many of the more stable trip purposes is that they are made to nearby destinations. Supermarkets, convenience stores, doctors, and dentists are continually striving to minimize their distance from consumers. Surprisingly, other trip purposes that would seem to share that characteristic, notably trips to school and church and personal business trips, have shown increases in average length.

Changes in the overall average trip length are affected by the shifts in length in the component trip purposes that make up the average. The average trip length can also be affected by shifts

FIGURE 34

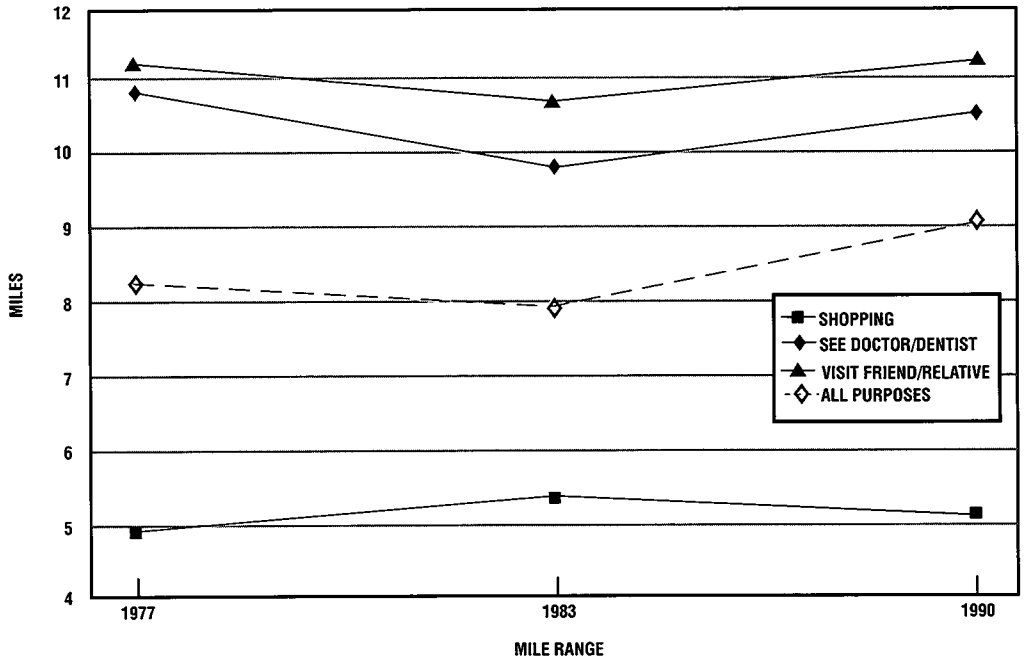
Vehicle Trip Length Trends by Purposes with Increasing Lengths 1977, 1983 & 1990



Source: NPTS

FIGURE 35

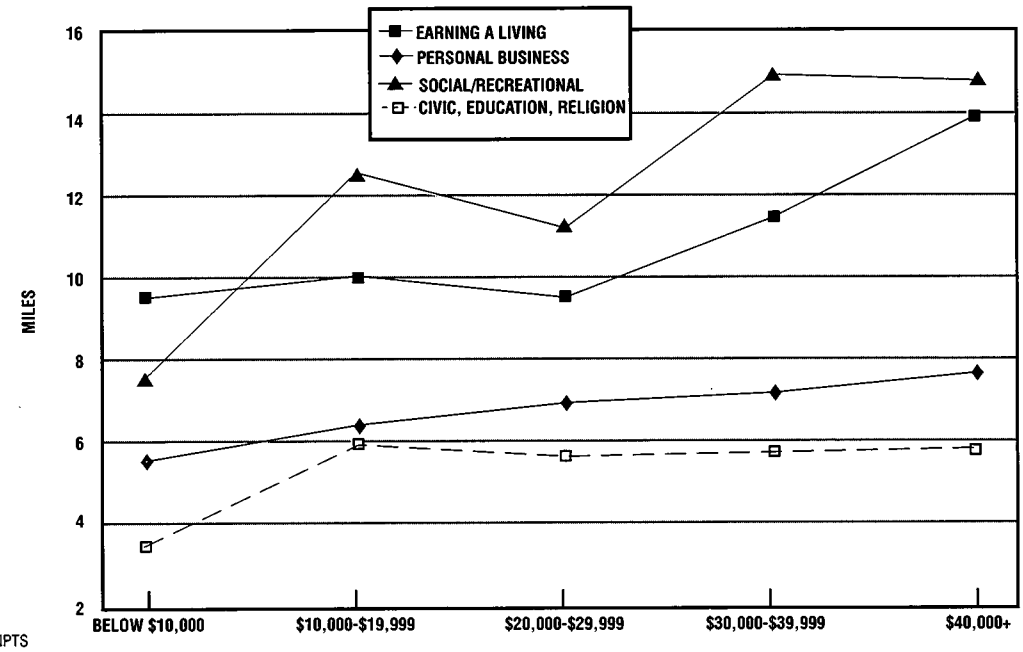
Vehicle Trip Length Trends by Purposes with Stable Lengths 1977, 1983 & 1990



Source: NPTS

FIGURE 36

Trip Length Trends by Income by Trip Purpose 1990



Source: NPTS

in the relative proportions of the mix of trips by purpose. The main shift in the overall trip mix between 1983 and 1990 is the relative increase in trips for personal business purposes. This is also a trip purpose that incurred increases in trip length.

Socio-Economic Factors in Trip Length

A number of factors can affect trip lengths, including, among others, income levels, area size, and location. A number of these have been reviewed from the NPTS and the AHS data sets and examined for their potential contribution to travel demand. To better examine these factors, person trips by all modes will be used for the remainder of this chapter.

Men tend to have greater person trip lengths than women in almost every purpose category, even when the data are controlled for availability of a driver's license. Significantly, women's average trip length in each purpose category is considerably greater for women with driver's licenses. In work trips, women with licenses travel an average of 9.4 miles to work contrasted to 6.1 miles for women without licenses—a 50 percent increase. Similarly, civic, educational, and religious trips exhibit more than a 50 percent increase. Clearly, the rapid growth in the number of women with driver's licenses has affected the trip length average for all women and the overall growth in passenger miles of travel. Since 1983, women with driver's licenses have increased by almost 11 percent, while the number of men with driver's licenses increased only 6 percent.

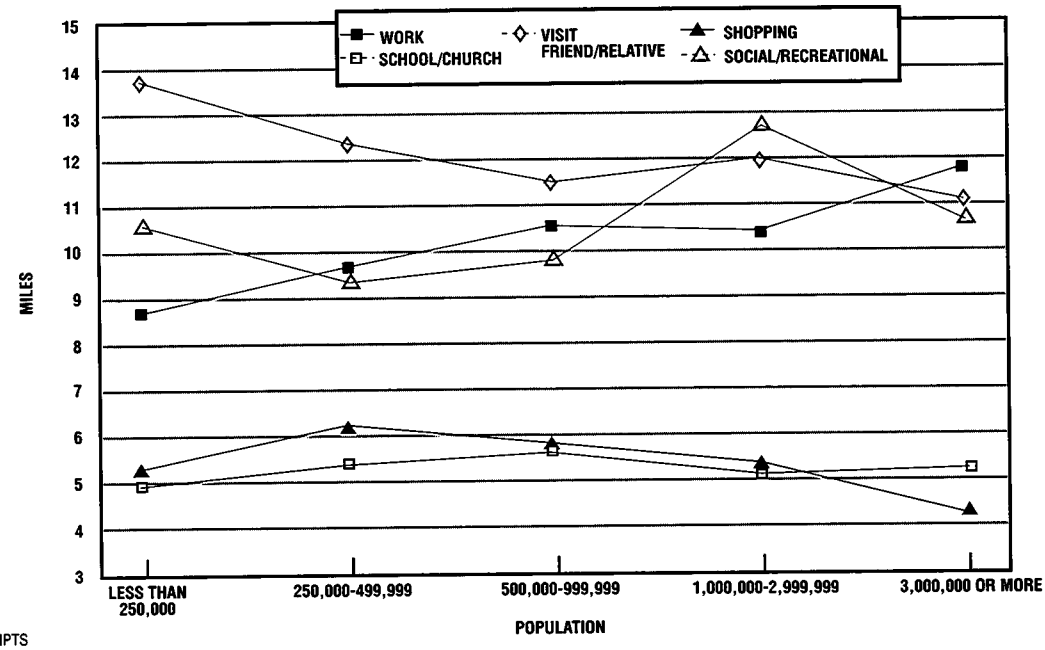
In all purpose categories, average trip lengths rise with increased incomes of households. Other factors associated with income, such as age, residence location, home ownership, and car ownership, could be significant agents of change. All modes have shown roughly similar percentage increases in average length of trips. Figure 36 shows the increases in trip length with increasing household incomes for selected trip purposes. All categories show substantial increases with increasing incomes, with the exception of trips to school and church.

Examination of the effect of area size indicates varying impacts on trip length for most trip purposes, as shown in Figure 37. Shopping, visiting friends and relatives, and social and recreational

Work trips are the major exception—increasing significantly with area size, such that shifts of the population to larger areas might become an important factor in determining work trip length trends.

FIGURE 37

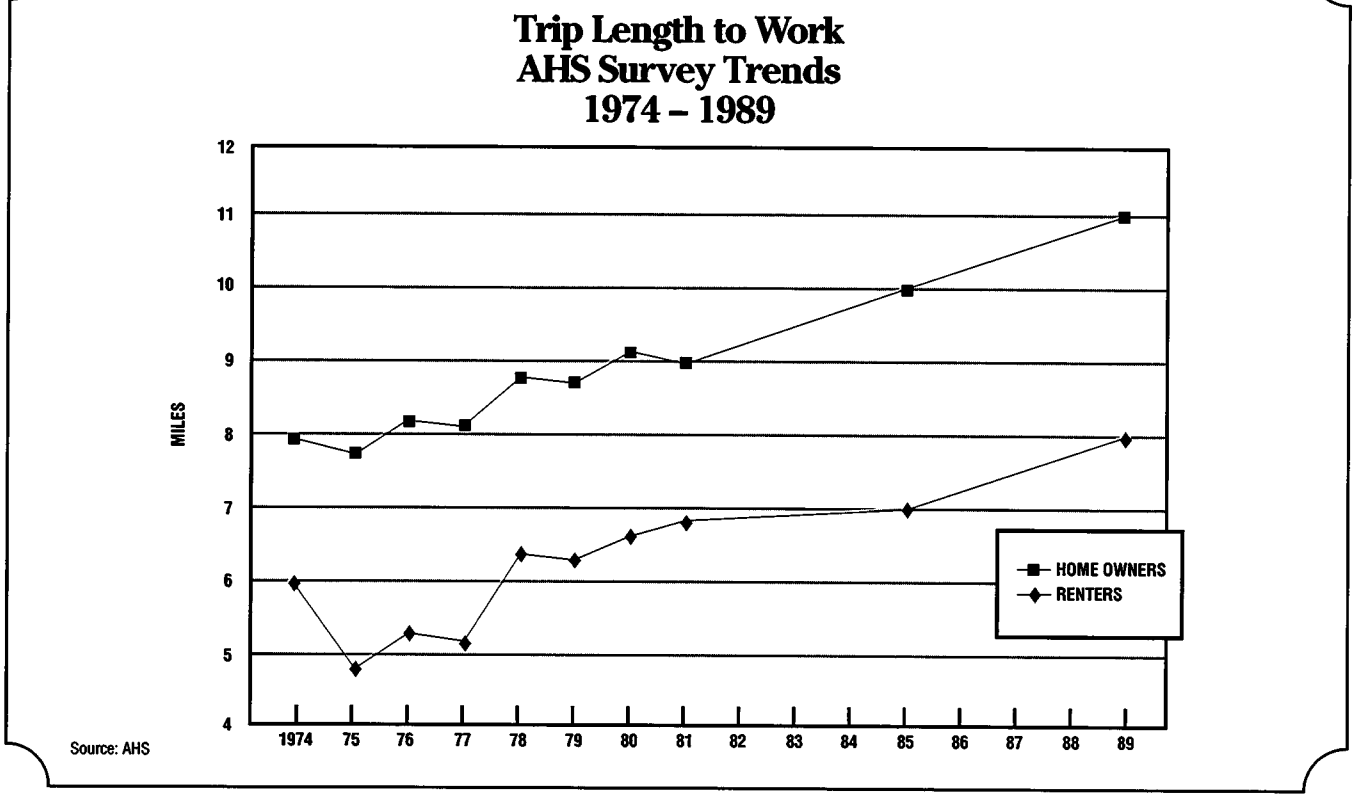
Trip Length Trends by Population of Place of Residence
NPTS Selected Purposes
1990



Source: NPTS

travel show little effect. In some cases, for instance shopping, trip lengths actually decrease with increasing area size. Work trips are the major exception—increasing significantly with area size, such that shifts of the population to larger areas might become an important factor in determining work trip length trends. One factor that may be significant for further consideration is that average trip lengths seem to be shorter in the metropolitan areas over 1 million population with rail transit systems. Again, work trips are the exception to this pattern.

FIGURE 38



Work Trip Lengths

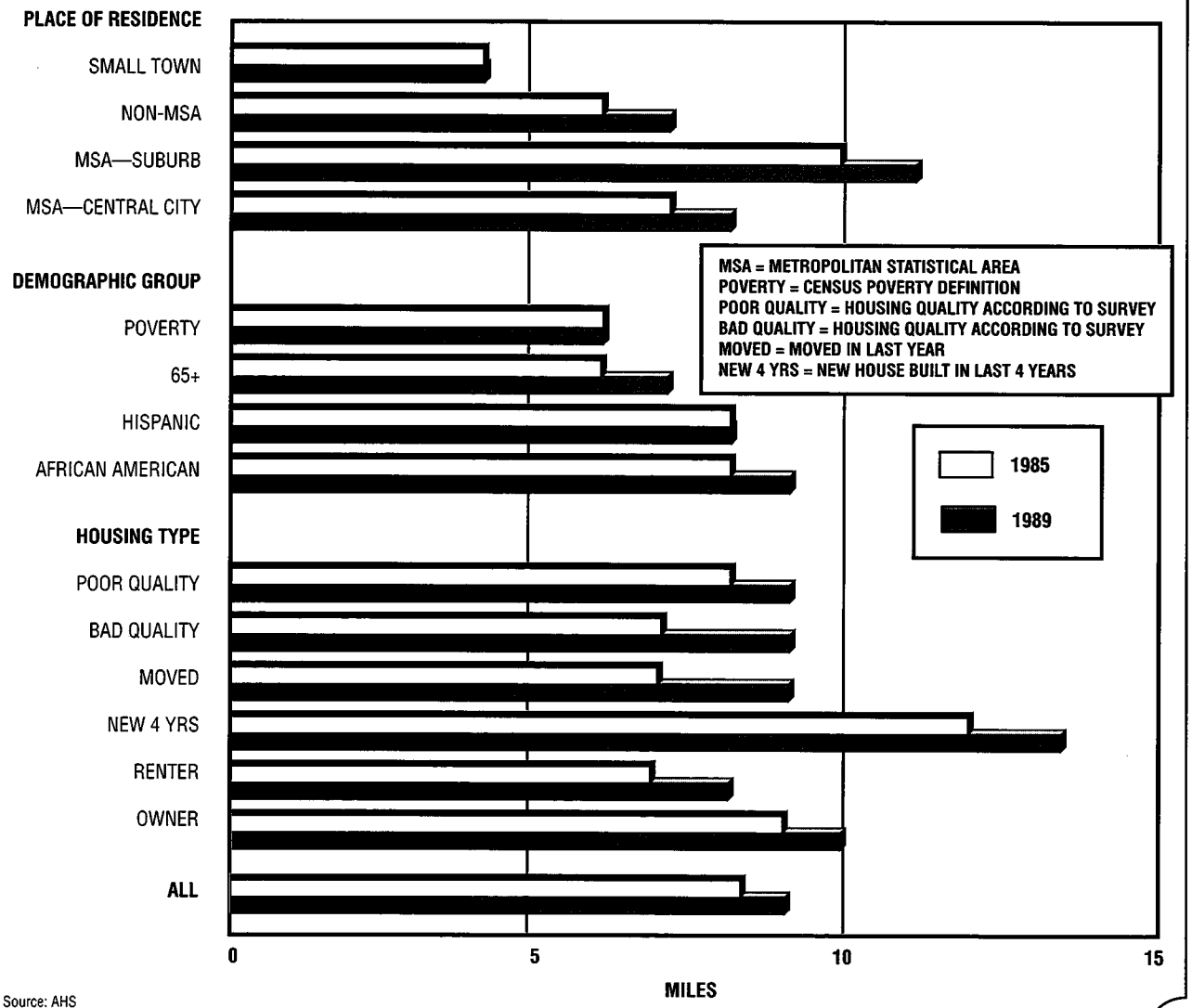
The most significant trip length growth has been in work trips and work-related business activity. Figure 38, drawn from the AHS, shows median trip length growth trends over the last 15 years separately for home owners and renters. Although growth rates can be misinterpreted from this figure because of lack of precision in the data, long-term overall growth in work trip lengths in the period is clear. A number of causal factors involved in these trends are examined here.

As previously noted, work trip lengths increase with increasing household incomes, with increasing area size, and with possession of a driver's license. Figure 39 shows the median trip lengths for 1985 and 1989 from the AHS for selected demographic and housing groups. To be noted are almost uniform increases across all groups with few exceptions observed, notably small towns, the poor, and Hispanics. The use of the median, the central item in the distribution, will produce shorter trip lengths than the mean, the arithmetic average. The 1985 AHS gave a median work trip of 8 miles and had a mean (average) of 10.8 miles. Note that NPTS trip lengths are usually expressed as the mean.

Review of more detailed trip length distributions suggests that both central city and suburban trip lengths have shifted toward longer trips. Figure 40, first of all, shows the distribution for work trips by central city and suburban residents in 1989 from the AHS survey. It is clear that suburban work trip lengths are considerably longer than

FIGURE 39

Median Work Trip Length Trends
Selected Demographic Groups
1985 & 1989

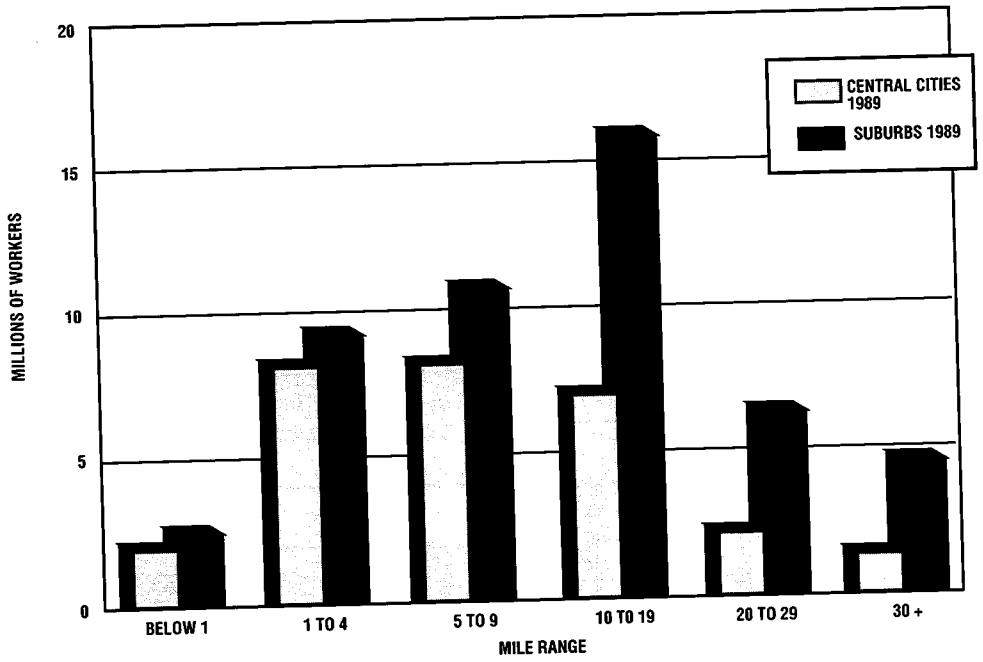


Source: AHS

Suburban trip length growth may suggest that householders are going farther out from the center to obtain lower cost housing and are commuting longer distances to central city or suburban job destinations.

FIGURE 40

Trip Length Distribution
Central Cities and Suburbs
1989



Source: AHS

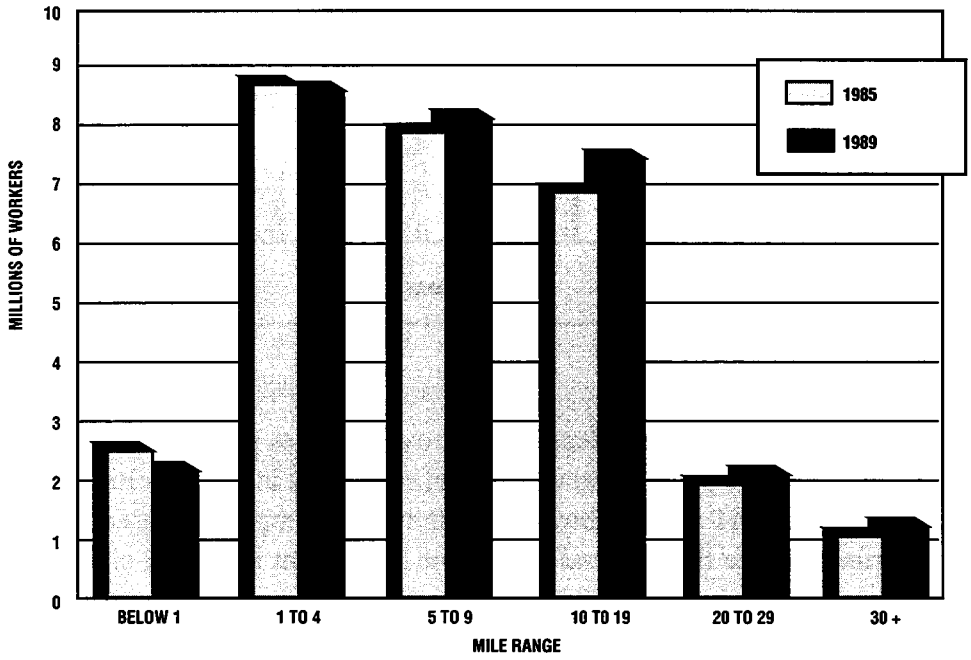
central city trips. Note that these trips are identified by their origins only, i.e., the place of residence of the tripmaker. Figures 41 and 42 show the change in the distributions for both central city and suburban origin work trips from 1985 to 1989. A remarkable amount of change is apparent in these charts for such a short period. In both the central city and suburban cases, trips of 1 to 4 miles in length actually declined in number, trips in the category from 5 to 9 miles grew slightly, and trips of 10 miles or more grew substantially. Trips in the 20 to 30 mile range and above 30 miles grew in all areas and remarkably so, especially in central cities. Trips over 30 miles in length increased by 16 percent overall and 21 percent in central cities.

The data for central cities seem to suggest a shift in travel orientation away from the city itself. Few cities have boundaries that permit trips of such length entirely within their borders. These must be trips bound for suburban job opportunities or to other adjacent metropolitan areas. Suburban trip length growth may suggest that householders are going farther out from the center to

The ultimate effect of land use planning on transportation is trip length.

FIGURE 41

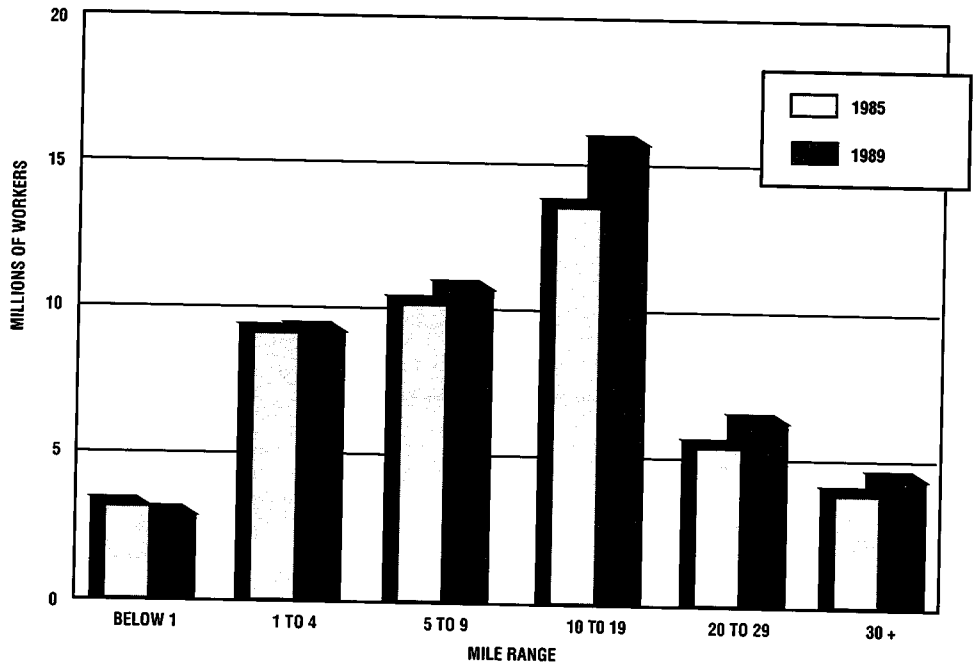
Trip Length Distribution
Central Cities
1985 & 1989



Source: AHS

FIGURE 42

Trip Length Distribution
Suburbs
1985 & 1989



Source: AHS

obtain lower cost housing and are commuting longer distances to central city or suburban job destinations. Further speculation on the reasons for these increases must await further data development on more detailed trip patterns from NPTS and the Decennial Census.

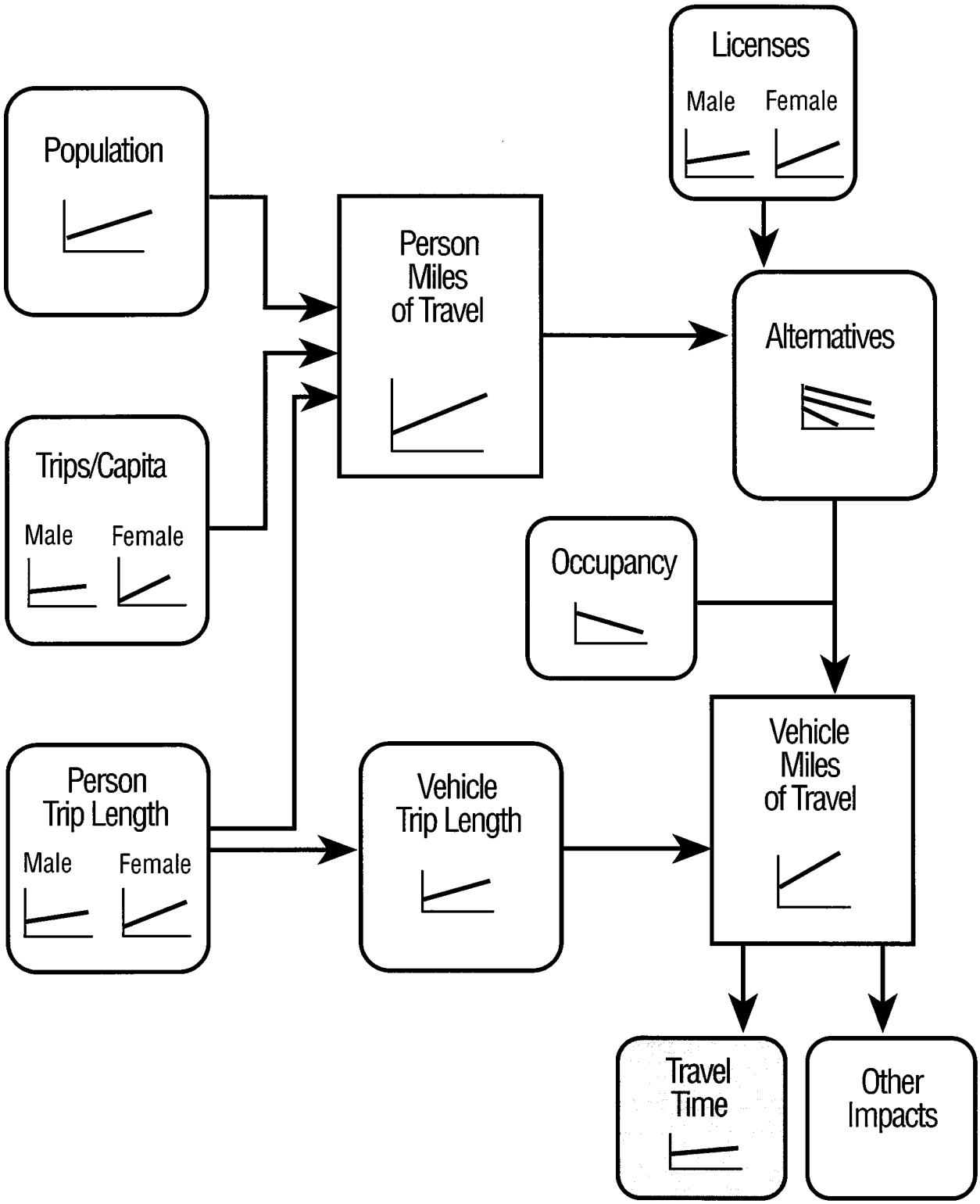
What is clear is that these data reflect the shifts over recent years of large shares of our jobs and population to the Nation's very large metropolitan areas. In 1990, more than 75 million people lived in areas of 3 million or more as compared to 60 million in 1980, an increase of 25 percent.

Further Work

The subject of trip length will be a major concern in the 1990's. The source material provided by the NPTS must be exhaustively mined to obtain a deeper understanding of trends.

Additional work can assess the effects of larger metropolitan areas, particularly on work and work-related trip lengths. The stability of nonwork trips in regard to length, as a function of destinations adjusting their locations to maintain relatively constant market areas, needs to be further evaluated. The ultimate effect of land use planning on transportation is trip length.

Factors in Growth of Personal Travel



CHAPTER EIGHT:
WORK TRIP TRAVEL TIMES

Key Findings

- Travel surveys place the average travel time for all workers at varying values, but roughly in the range of 20 minutes, with approximately 70 percent of workers taking less than half an hour.

- The NPTS shows improvement in travel times in all geographic sectors: central city, suburban, and nonmetropolitan, despite increasing average trip lengths. Improvements are a product of improved personal vehicle times as transit travel times got longer.

- There are some indications that workers are departing for work earlier in order to circumvent the peak of traffic problems.

One of the critical measures of transportation, along with safety, cost, and reliability, is travel time. Work trips, in particular, are closely watched for changes in travel times or speeds. Travel times are variously measured as either average or median, the middle item in a distribution. The median is used to avoid the distorting effects that a few very long trips would have on the average. It would be expected that the average will exceed the median.

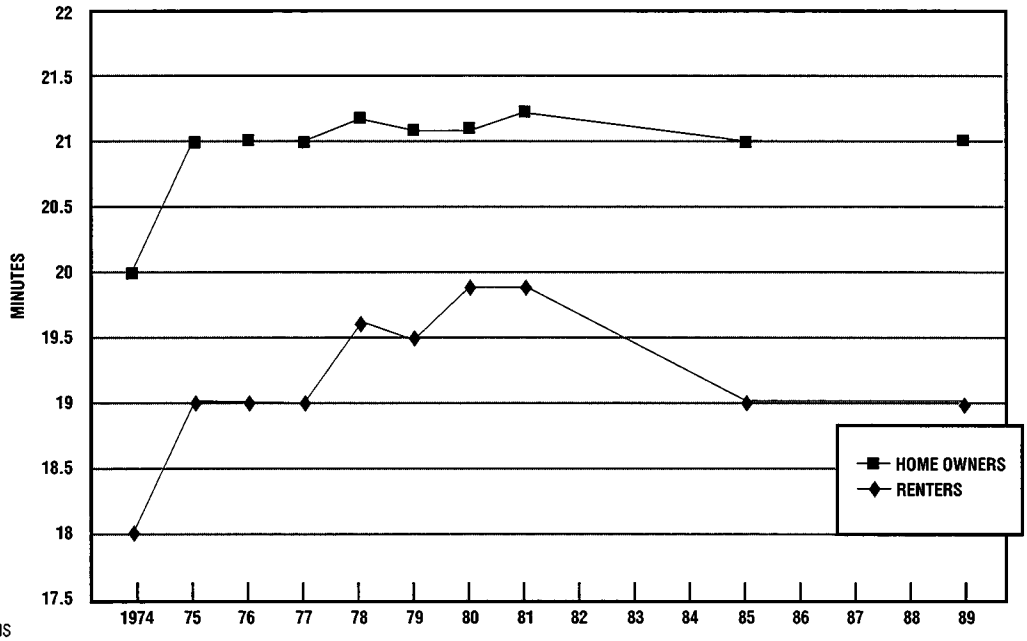
The AHS measured work travel times as having a median of 19 minutes in 1985 (with a corresponding *average* of 20.9 minutes) and a median of 20 minutes in 1989. The NPTS data for 1990 indicate an *average* travel time of 19.7 minutes, down from 20.4 in 1983. In 1980, the *average* travel time to work was observed by the Decennial Census to be 21.7 minutes. Early results of the 1990 Decennial Census show a slight increase in *average* travel times to 22.4 minutes, with indications that some areas have increased and others have declined.

Another factor in improved travel times is the shift of travel from the city centers to the suburbs, where typical speeds tend to be higher. Given greater average work trip lengths, even stable travel times suggest an improvement in average speeds.

The AHS does provide a long-term trend pattern from a consistently defined source. The survey travel time observations are presented in Figure 43 for homeowners and renters for the period from 1974 to 1989. The trends in the figure would suggest that average travel times have improved in recent years, which appears to contradict a lot of individual personal experience. It is entirely possible that the statistics and the personal experiences could both be correct. Travel times would improve as shifts documented elsewhere took place from slower to faster modes. The period identified in Figure 43 was one in which major shifts occurred from walking and transit to personal vehicle-based

FIGURE 43

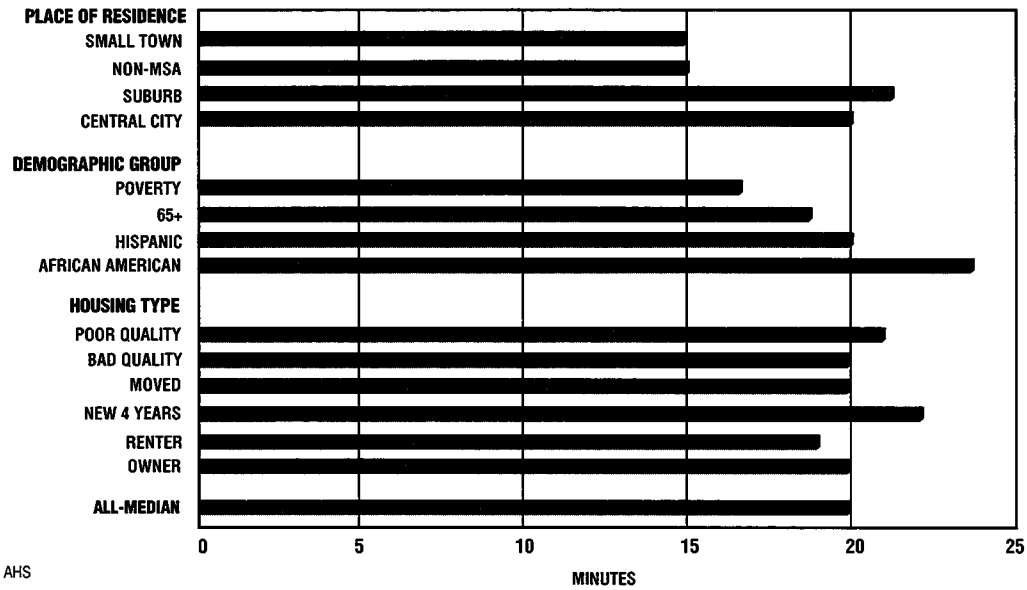
Travel Time to Work
AHS Survey Trends



Source: AHS

FIGURE 44

Travel Time to Work
Selected Demographic Groups
1989



Source: AHS

The increase in average work trip speed does not necessarily mean that highway speeds have improved, but rather reflects the improvement in individual speeds obtained by shifts to the single occupant vehicle from carpooling, mass transit, and walking.

TABLE 4

Work Trip Travel Time, Length, and Speed by Household Location

	Central Cities	Suburbs	Non-MSA	All
Work Travel Time (minutes):				
1983	20.5	21.5	18.4	20.4
1990	19.2	21.4	17.2	19.7
Work Trip Length (miles):				
1983	8.0	11.1	10.6	9.9
1990	8.9	11.9	10.9	10.7
Calculated Speed (mph):				
1983	23.4	31.0	34.6	29.1
1990	24.8	33.4	38.0	32.3

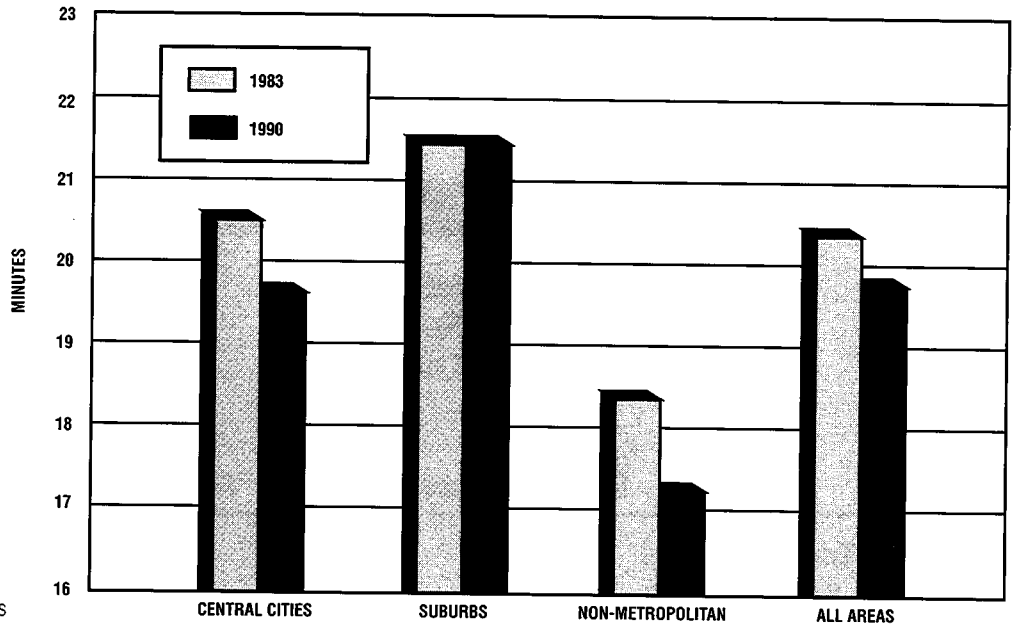
modes. Another factor in improved travel times, discussed later, is the shift of travel from the city centers to the suburbs, where typical speeds tend to be higher. Given greater average work trip lengths, even stable travel times suggest an improvement in average speeds.

The AHS also provides insight into the variation in travel times by area, housing type, and demographic group. Figure 44 shows the median travel times for selected groups as measured in 1985 by the AHS. The AHS preliminary data for 1989 show little notable change. Effective interpretation of these data depends on examining a number of factors. First, understanding the comparable travel distances involved sheds light on the speeds observed. For example, while suburban workers have slightly longer travel times than central city workers, their travel distances are far greater, indicating that their travel speeds are superior. Workers in small towns enjoy short travel times primarily because of short distances to work rather than because of high speed services. Small town workers also walk more, thereby lowering their average speeds.

Travel time data from the NPTS suggest a similar picture, with a slight decrease in work trip travel times from 20.4 minutes in 1983 to 19.7 minutes in

FIGURE 45

Travel Time to Work by Place of Residence 1983 & 1990



Source: NPTS

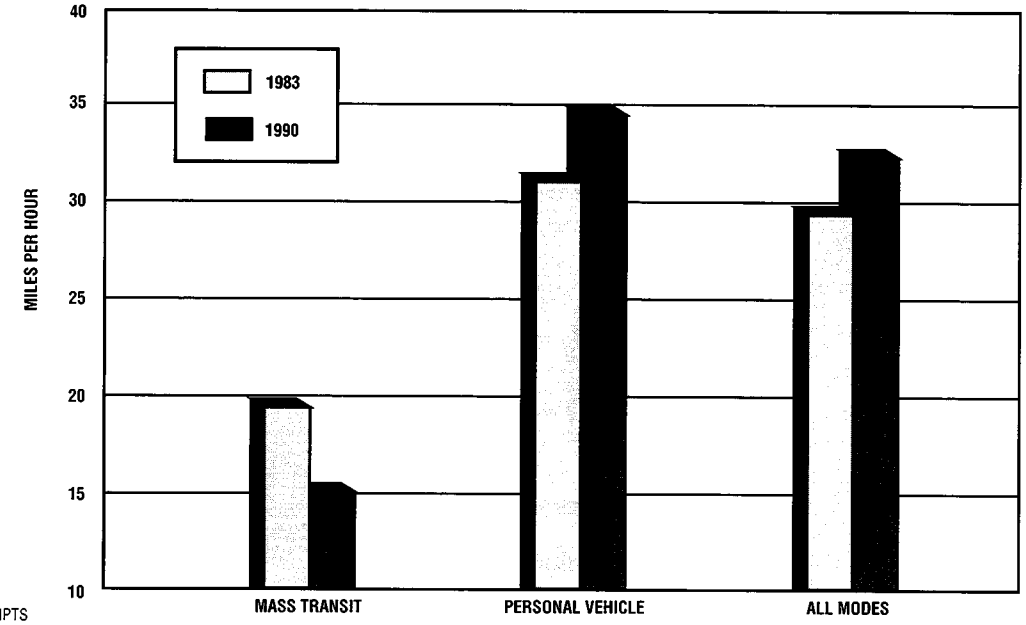
TABLE 5

Work Trip Travel Time, Length, and Speed by Mode

	POV	Transit	Walk	All
Work Travel Times (minutes):				
1983	19.3	46.1	8.9	20.4
1990	19.0	49.9	9.6	19.7
Work Trip Lengths (miles):				
1983	10.2	15.1	0.4	9.9
1990	11.0	12.6	0.5	10.7
Calculated Speed (mph):				
1983	31.7	19.7	2.7	29.1
1990	34.7	15.2	3.1	32.3

FIGURE 46

Travel Speeds to Work by Mode 1983 & 1990



Source: NPTS

1990, depicted in Figure 45. The new NPTS data indicate an improvement in average travel times in central cities, suburbs, and nonmetropolitan areas. Table 4 shows these values along with the changes in average trip length observed in the survey. Given the increases observed in trip length, the data suggest average speed increases across all geographic areas. As noted earlier, this does not necessarily mean that highway speeds have improved, but rather reflects the improvement in individual speeds obtained by shifts to the single occupant vehicle from carpooling, mass transit, and walking.

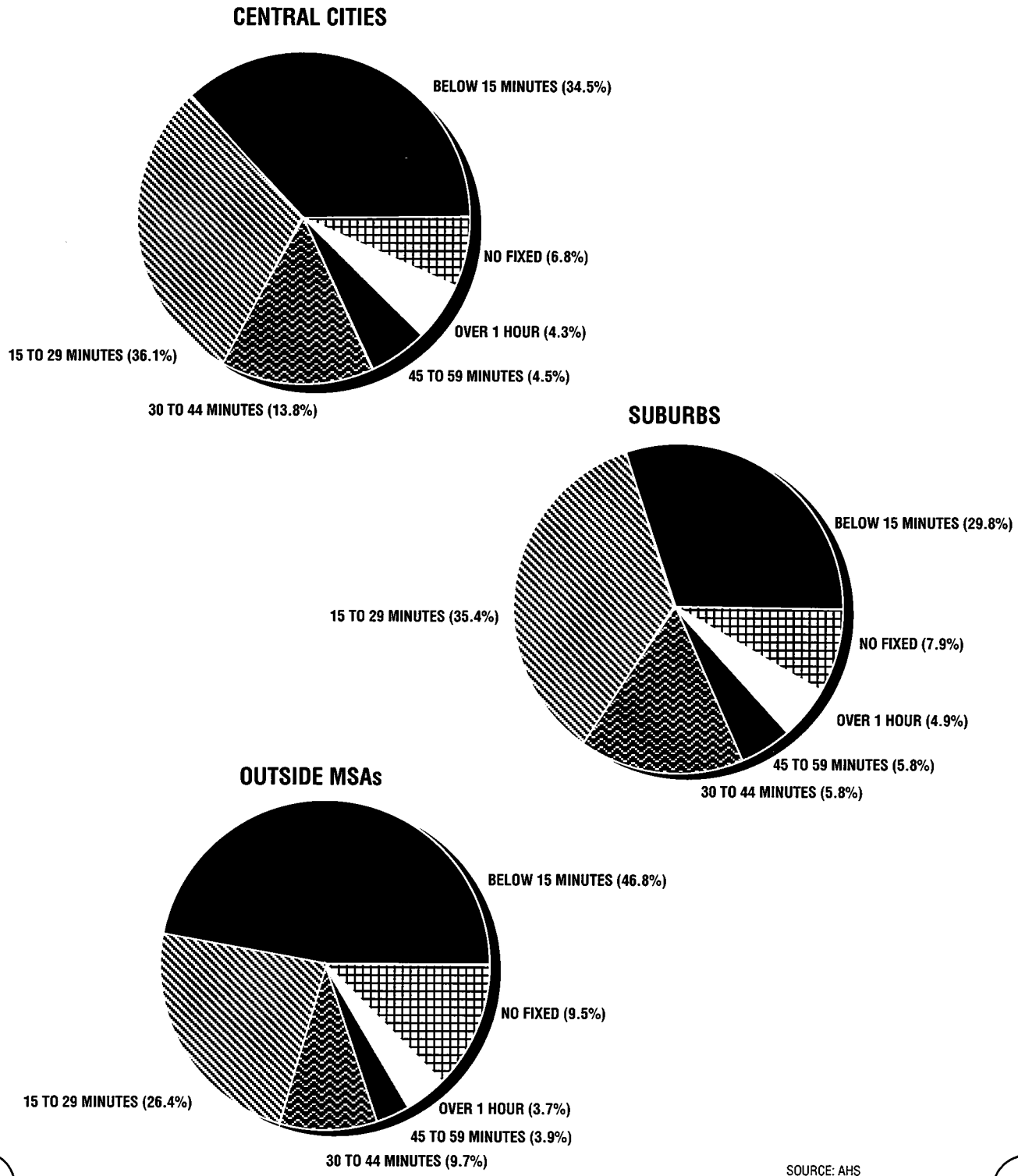
Table 5 shows the changes in trip length and travel time by mode observed in the NPTS. Personally operated vehicles improved slightly in average travel time even though average trip lengths increased considerably. Mass transit travel times, already more than double private vehicle travel times, got longer even though average trip lengths decreased in transit work trips. These values are converted to speeds in Figure 46.

The three pie charts in Figure 47 show the shares of commuters by travel time group for central city, suburban, and nonmetropolitan areas, so that travel times can be measured on a cumulative basis. For instance, in 1989 about 69 percent of all workers got to work in less than 30 minutes, as shown in Figure 48. That percentage had dropped by one percentage point from 1985. Evaluation of 1989 data indicates that in percentage terms the distribution of work trips by travel time group changed little since 1985. The most notable change was a small decline in those arriving at work within 15 minutes. There were significant declines in those who worked at home and significant increases in those with no fixed place of work, such as construction workers.

Another factor to be considered in evaluating work trip travel times is the start time of the trip. A number of considerations affect start times. Increasing congestion in the peak hour has the effect of pushing traffic off onto the shoulder periods, either before or after the peak. Changing job patterns, particularly the shift to services, have tended to move work trips away from traditional peak

FIGURE 47

Travel Time to Work
1989 AHS

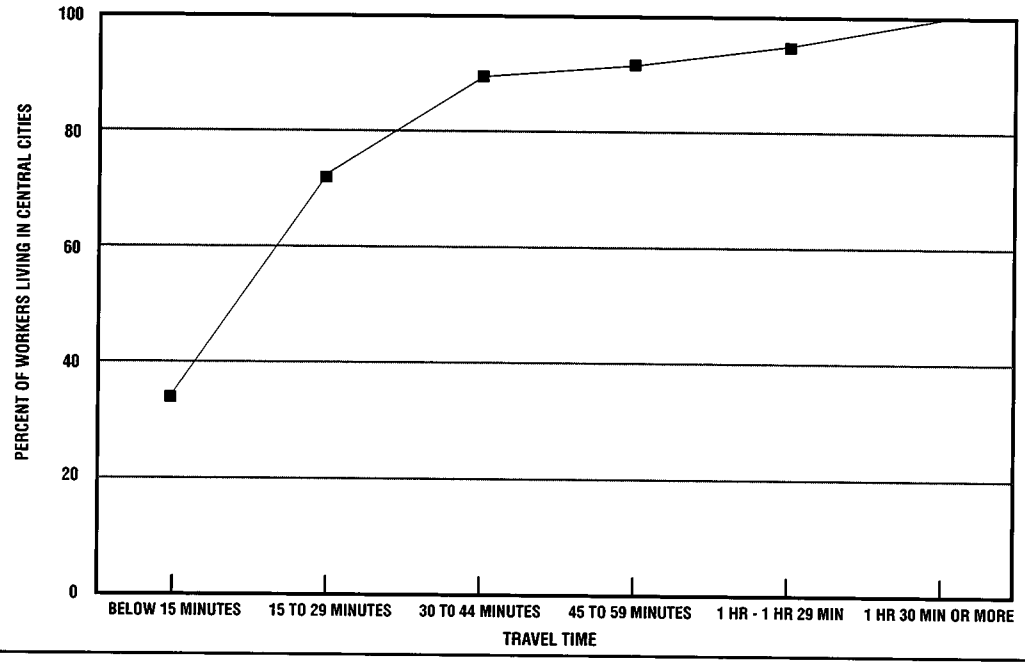


SOURCE: AHS

Changing job patterns, particularly the shift to services, have tended to move work trips away from traditional peak periods.

FIGURE 48

Cumulative Travel Time to Work
Central Cities
1989



Source: AHS

periods. All of this has the effect of improving speeds. Figure 49 shows the numbers of workers by the start time of their commute trip in 1985 and 1989. Of the 4 million additional workers reporting in 1989, 1.3 million departed for work before 6 a.m., 1.1 million started in the 6 a.m. to 7 a.m. range, and another 1.1 million started in the 7 a.m. to 8 a.m. range, with only small increases spread throughout the rest of the day. The percentage distribution of traffic showed little change other than a small 1 percentage point increase in the midnight to 6 a.m. category. There is in these data at least some reinforcement of the prediction of a tendency toward peak hour traffic shifting to the shoulder periods.

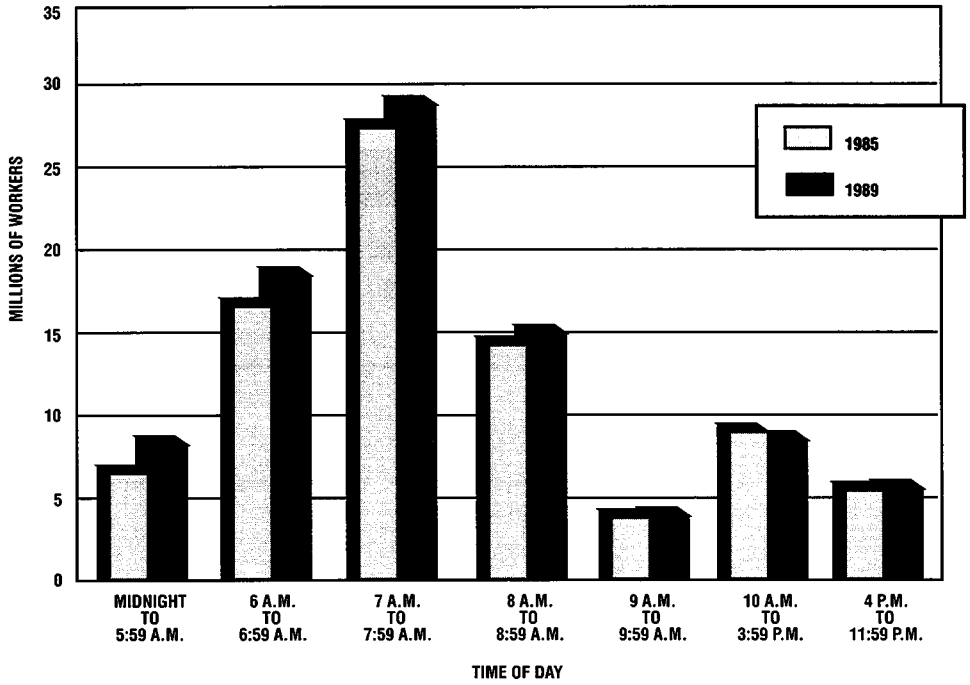
Further Work

The NPTS survey will permit analysis of the travel times of trips for nonwork purposes. This could provide valuable new insight into emerging patterns and trends.

In the work trip sector, the availability of the 1990 Decennial Census data, along with more detailed NPTS data, will open up opportunities for more serious treatment of work trip travel time analysis by highly refined geographic stratifications. Of particular importance will be the analysis of suburb to suburb travel time trends and examination of exurban-suburban travel patterns.

FIGURE 49

Time of Departure for Work
1985 & 1989



Source: AHS

Outline of Glossary – Travel Behavior Issues in the 90's

- Adult
- Household
- Household Income
- Household Vehicle
- Housing Condition
  - Bad Housing
  - Poor Housing
- Journey- to -Work
- Means of Transportation
  - Private Vehicle
    - Automobile
    - Van
    - Pickup Truck
    - Other Truck
    - RV or Motor Home
    - Motorcycle
  - Public Transportation
    - Bus
    - Commuter Train
    - Streetcar/Trolley
    - Elevated Rail/Subway
  - Other Modes
    - Airplane
    - Taxi
    - Bicycle
    - Amtrak
    - Walk
    - School Bus
    - Moped (Motorized Bicycle)
    - Other
- Metropolitan Statistical Area (MSA)
  - MSA
    - Central City
    - Suburb
  - Non-MSA
- Occupancy (Vehicle)
- Person Miles of Travel (PMT)
- Person Trip
- Poverty
- Region (Census Drawn)
- Travel Day
- Travel Day Trip
- Trip Purpose
  - Earning a Living
    - To or From Work
    - Work-Related Business
  - Family and Personal Business
    - Shopping
    - Doctor or Dentist
    - Other Family or Personal Business
  - School or Church
  - Social and Recreational
    - Vacation
    - Visit Friends and Relatives
    - Pleasure Driving
    - Other Social and Recreational
- Urban and Rural Residence
  - Urban and Rural Residence
  - Urbanized Area
  - Small Town
  - Farm-Nonfarm Residence
- Vehicle
- Vehicle Miles of Travel (VMT)
- Vehicle Trip

GLOSSARY

ADULT

A person 16 years and older.

HOUSEHOLD

A group of persons whose usual place of residence is a specific housing unit. These persons may or may not be related to each other. The total of all U.S. households represents the total civilian, non-institutionalized population. This category does not include group quarters (i.e., 10 or more persons living together, none of whom are related).

HOUSEHOLD INCOME

The statistics on income in the Nationwide Personal Transportation Survey and the American Housing Survey are based on the respondent's reply to questions on income for the 12 months prior to the interview and are the sum of the amounts reported for wage and salary income, self-employment income, interest or dividends, Social Security or railroad retirement income, public assistance or welfare payments, alimony or child support, and all other money income. The figure represents the amount of income received before deductions for personal income taxes, Social Security, union dues, bond purchases, health insurance premiums, Medicare deductions, etc.

HOUSEHOLD VEHICLE

A motorized vehicle that is owned, leased, rented, company-owned, or available under some other arrangement, such as borrowed. The vehicle must be available to be used regularly by household members during the travel period. Also included are vehicles used solely for business purposes or business-owned vehicles if kept at home and used for the home-to-work trip, (e.g., taxicabs, police cars, etc.) which may be owned by, or assigned to, household members for their regular use. Vehicles that were owned or available for use by members of the household during the travel period even though a vehicle may have been sold before the interview are also included. Excluded from this category are vehicles that were not working and not expected to be working within 60 days, and vehicles that were purchased or received after the designated travel day.

HOUSING CONDITION

Bad Housing

A housing unit is classified as "bad housing" if it has any of the following five problems:

- **Plumbing**

  Lacking hot or cold piped water or a flush toilet, or lacking both bathtub and shower, all inside the structure for the exclusive use of the unit.

- **Heating**

  Having been uncomfortably cold last winter for 24 hours or more because the heating equipment broke down, and it broke down at least three times last winter for at least 6 hours each time.

- **Electric**

  Having no electricity, or all of the following three electric problems: exposed wiring; a room with no working wall outlet; and three blown fuses or tripped circuit breakers in the last 90 days.

- **Upkeep**

  Having any five of the following six maintenance problems: water leaks from the outside, such as from the roof, basement, or around windows and doors; leaks from inside structure such as pipes or plumbing fixtures; holes in the floors; holes or open cracks in the walls or ceilings; more than 8 inches by 11 inches of peeling paint or broken plaster; or signs of rats or mice in the last 90 days.

- **Hallways**

  Having all of the following four problems in public areas; no working light fixtures; loose or missing steps; loose or missing railings; and no elevator.

Poor Housing

A unit is considered to be "poor housing" if it has any of the following five problems, but none of the problems listed under "bad housing":

- **Plumbing**

  On at least three occasions during the last 3 months or while the household was living in the unit if less than 3 months, all the flush toilets were broken down at the same time for 6 hours or more.

- **Heating**

  Having unvented gas, oil, or kerosene heaters as the primary heating equipment.

- **Upkeep**

  Having any three of the overall list of six upkeep problems mentioned above under "bad housing."

- **Hallways**

  Having any three of the four hallway problems mentioned above under severe physical problems.

- **Kitchen**

  Lacking a sink, refrigerator, or either burners or oven all inside the structure for the exclusive use of the unit.

Journey-to-Work

Includes travel to or from a place where one reports for work. Does not include any other work-related travel.

Means of Transportation

A mode used for going from one place (origin) to another (destination). Included are private and public modes, as well as walking. For all travel day trips, each change of mode constitutes a separate trip. The following transportation modes, grouped by major mode, are included:

Private Vehicle

- **Automobile**

  A licensed motorized vehicle, including cars, jeeps, and station wagons.

- **Van**

  Vans and minivans designed to carry passengers or to haul cargo.

- **Pickup Truck**

  A motorized vehicle with an enclosed cab that usually accommodates two to three passengers and an open cargo area in the rear. Pickup trucks usually have about the same wheelbase as a full-sized station wagon.

- **Other Truck**

  All trucks other than pickups (such as dump trucks and trailer trucks).

- **RV or Motor Home**

  Includes self-powered recreational vehicles that are operated as a unit without being towed by another vehicle.

- **Motorcycle**

  Includes large, medium, and small motorcycles. Does not include minibikes, which cannot be licensed for highway use.

Public Transportation

- **Bus**

  Includes intercity buses, mass transit systems, buses, and shuttle buses that are available to the general public. Also included are Dial-A-Bus and Senior Citizen buses that are available to the public. Excluded from this category are (1) shuttle buses operated by a government agency or private industry for the convenience of employees or (2) contracted or chartered buses or school buses.

- **Commuter Train**

  Includes local and commuter train service other than elevated rail and subway.

Intercity service by Amtrak is excluded.

- **Streetcar/Trolley**

  Includes trolleys, streetcars, and cable cars.

- **Elevated Rail/Subway**

  Includes elevated rail and subway trains.

Other Modes

- **Airplane**

  Includes commercial airplanes and smaller planes that are available for use by the general public in exchange for a fare. Private planes and helicopters are included under "other."

- **Taxi**

  The use of a taxicab by a passenger for a fare. Also included are airport limousines.

- **Bicycle**

  Includes bicycles of all speeds and sizes that do not have a motor.

- **Amtrak**

  The U.S. national passenger railroad service providing intercity train service.

- **Walk**

  Includes walking to a destination. Excluded is walking for exercise where the trip origin and destination are the same.

- **School Bus**

  Includes county school buses, private school buses, and buses chartered from private companies for the express purposes of carrying students to or from school and/or school-related activities.

- **Moped (Motorized Bicycle)**

  Includes motorized bicycles equipped with a small engine, typically 2-horsepower or less. Also included are minibikes such as dirt bikes and trail bikes. Note that a motorized bicycle may or may not be licensed for highway use.

- **Other**

  Includes any type of transportation not listed above.

Metropolitan Statistical Area (MSA)

Metropolitan statistical areas are defined by the Office of Management and Budget. By current standards, an area qualifies for recognition as an MSA in one of two ways: if there is a city of at least 50,000 population, or a Census Bureau defined urbanized area of at least 100,000 (75,000 in New England). Except in the New England States, an MSA is defined in terms of entire counties. In New England, MSA's are composed of cities and towns. In addition to the county containing the main city, additional counties are included in an MSA if they are socially and economically integrated with the central county. An MSA may contain more than one city of 50,000 population and may cross State lines.

MSA

- **Central City**

  Every metropolitan statistical area (MSA) has at least one central city, which is usually its largest city. Smaller cities are also identified as central cities if they have at least 25,000 population and meet the following two commuting requirements. First, the city must have at least 75 jobs for every 100 residents who are employed. Second, no more than 60 percent of the city's resident workers may commute to jobs outside the city limits. In addition, any city with at least 250,000 population or at least 100,000 persons working within its corporate limits qualifies as a central city even if it fails to meet the above two commuting requirements. Finally, in certain smaller metropolitan statistical areas, there are places with between 15,000 and 25,000 population that also qualify as central cities, because they are at least one-third the size of the metropolitan statistical area's largest city and meet the two commuting requirements.

- **Suburb**

  An area located within an MSA but outside the central city (cities) of that MSA.

Non-MSA

Any area not included in an MSA. In most of the United States, MSA's are defined along county lines. In New England, MSA's are made up of cities and towns.

Occupancy (Vehicle)

The number of persons, including driver and passenger(s), in a vehicle. NPTS occupancy rates are generally calculated as person miles divided by vehicle miles.

Person Miles of Travel (PMT)

A measure of person travel. When one person travels one mile, one person mile of travel results. When one person travels five miles, five person miles of travel results. When four persons travel five miles in the same vehicle, 20 person miles of travel result.

Person Trip

A person trip is a trip by one person in any mode of transportation. If more than one person is on the trip, each person is considered as making one person trip. For example, four persons traveling together in one auto account for four person trips.

Poverty

Families and unrelated individuals are classified as being above or below poverty level using the poverty index originated at the Social Security Administration in 1964 and revised by the Federal Interagency Committees in 1969 and 1980. The poverty index is based solely on money income and does not reflect the fact that many low-income persons receive noncash benefits such as food stamps, Medicaid, and public housing. The index is based on the Department of Agriculture's 1961 Economy Food Plan and reflects the different consumption requirements of families based on their size and composition. The poverty thresholds are updated every year to reflect changes in the Consumer Price Index (CPI).

Region (Census Drawn)

Regions are large groups of States that form the first-order subdivisions of the United States for census purposes. The four regions are the Northeast, Midwest, South, and West. See map on page G-9.

Travel Day

A 24-hour period from 4:00 a.m. to 3:59 a.m. of the following day designated as the reference period for studying trips and travel of a particular household.

Travel Day Trip

A travel day trip is defined as any one-way travel from one place (address) to another by any means of transportation (e.g., private vehicle, public transportation, bicycle, walking). When travel is to more than one destination, a separate trip exists each time the following criteria are satisfied: the travel time between two destinations exceeds 5 minutes, and/or the purpose for travel to one destination is different from the purpose for travel to another.

The one exception is travel within a shopping center or mall. It is to be considered travel to one destination regardless of the number of stores visited.

Trip Purpose

The main reason that motivates the trip. For purposes of this survey, there are 11 reasons for trips. For travel day trips, if there is more than one reason for the trip, and the reasons do not involve different destinations, then only the main reason is chosen, If there are two or more reasons, and they each involved different destinations, then each reason is classified as a separate trip. For travel period trips, if there was more than one reason, the primary reason was collected. The 11 trip reasons (grouped into the

four major purposes) are defined as follows:

Earning a Living

- **To or From Work**

  Includes travel to a place where one reports for work. Does not include any other work-related travel.

- **Work-Related Business**

  Trips related to business activities except travel to the place of work, e.g., a plumber drives to a wholesale dealer to purchase supplies for his business.

Family and Personal Business

- **Shopping**

  Includes purchases of commodities such as groceries, furniture, clothing, etc., for use or consumption elsewhere.

- **Doctor or Dentist**

  Trips made for medical, dental, or psychiatric treatment or other related professional services.

- **Other Family or Personal Business**

  Includes purchase of services such as cleaning garments, haircuts, and car repair and maintenance. Also includes trips to take someone else somewhere, i.e., "serve passenger" trips.

School or Church

- **School/Church**

  Trips to school, college, or university for class(es), PTA meetings, seminars, etc., to church services or to participate in other religious activities. Social activities that take place at a church or school are classified as social and recreational.

Social and Recreational

- **Vacation**

  Trips reported by the respondent as "vacation."

- **Visit Friends or Relatives**

  Trips made to visit friends or relatives.

- **Pleasure Driving**

  Includes trips made with no other purpose listed but to "go for a drive" with no destination in mind.

- **Other Social and Recreational**

  Any purpose for a trip that does not fit into one of the above categories. For example, going to dinner with friends, attending movies/theater, etc.

Urban and Rural Residence

Urban and Rural Residence

Urban housing comprises all housing units in urbanized areas and in places of 2,500 or more inhabitants outside urbanized areas. More specifically, urban housing consists of all housing units in (a) places of 2,500 or more inhabitants incorporated as cities, villages, boroughs (except in Alaska and New York), and towns (except in the New England States, New York, and Wisconsin), but excluding those housing units in the rural portions of extended cities; (b) census designated places of 2,500 or more inhabitants; and (c) other territory, incorporated or unincorporated, included in urbanized areas. Housing units not classified as urban constitutes rural housing.

Urbanized Area

The major objective in delineating urbanized areas is to provide a better separation of urban and rural housing in the vicinity of large cities. An urbanized area is comprised of an incorporated area and an adjacent densely settled surrounding area that together have a minimum population of 50,000.

Small Town

Defined in this report as urban housing located outside an urbanized area. These are places in areas between 2,500 and 50,000 population, excluding those places considered to be in an

urbanized area. See definition of "Urban and Rural Residence" and "Urbanized Area."

Farm-Nonfarm Residence

In rural areas, occupied housing units are subdivided into rural-farm housing, which comprises all rural units on farms and rural-nonfarm housing, which comprises the remaining rural units. Occupied housing units are classified as farm units if the sales of agricultural products amounted to at least $1,000 during the 12-month period prior to the interview. Occupied units in rural territory which do not meet the definition for farm housing are classified as nonfarm.

VEHICLE

In the 1969 survey, "vehicle" refers to autos and passenger vans owned or available to the household. In the 1977, 1983, and 1990 surveys, the term "vehicle" was expanded to include pickups and other light trucks, RV's, motorcycles and mopeds owned or available to the household. Estimates show that in 1969 there were an additional 7.5 million pickups and other light trucks that are not reflected in the 1969 NPTS data.

VEHICLE MILES OF TRAVEL (VMT)

A unit to measure vehicle travel made by a private vehicle, such as an automobile, van, pickup truck, or motorcycle. Each mile traveled is counted as one vehicle mile regardless of the number of persons in the vehicle.

VEHICLE TRIP

A trip by a single vehicle regardless of the number of persons in the vehicle.

CENSUS REGIONS AND DIVISIONS OF THE UNITED STATES

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