

Commission Briefing Paper 4A-01

Analysis of Changing Relationships among Population Growth, Passenger Travel Growth, and Vehicle Miles Traveled Growth for Different Modes

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

The past 50 years has seen an unprecedented growth in travel due to several factors, one of which is demographic change. There are a myriad of unforeseeable influences that will shape the future of transportation planning and there are strong indications that the key factors (such as vehicle ownership) that have had a direct relationship on travel demand in the past may be less influential in the future. This paper uses current travel behavior to examine future potential travel demand based on demographic change alone and assumes all other factors are held constant.

The pattern of passenger travel in the United States is affected by a number of factors, including vehicle ownership, household characteristics, land use, the nation's economic health, and the availability and convenience of various modes for travel. This paper presents information on the changing relationship between growth and change in the population and travel demand.

Background and Key Findings

The movement of people constitutes the vast majority of travel across the Nation's transportation system. According to the estimates from the Highway Performance Monitoring System (HPMS) and the National Household Travel Survey (NHTS), 82 percent of the miles traveled in the United States are by private vehicles. Historically, population changes, both in demographics and geographic location, have had significant impacts on the size and distribution of travel demand. The growth of the suburbs, women entering the workforce, increases in auto ownership and licensure rates, and a surge in population growth over the past few decades are past examples of the impact that demographic shifts can have on travel demand. Currently, the U.S. is again in the midst of significant demographic change. Much of this change is occurring in six key areas:

1. An Aging Population
2. High Immigration Levels

3. Regional Migration in the U.S.
4. Changes in Urban and Rural Populations
5. Increases in Income – both personal and household income
6. Changes in Trip Purpose Distributions – specifically, the proportions of travel that are for work and non-work purposes.

The Demographics and Travel Demand section (Section IVA) provides a series of papers that address each of these six areas of change in detail. This paper provides an overview of total trends in population and travel demand. The data presented here rely heavily on data from the National Household Travel Survey (NHTS) and U.S. Census Bureau current and projected population data.

Key findings include:

- Over the last four decades, highway lane miles have increased by 6 percent while Vehicle Miles of Travel (VMT) has increased by 194 percent, placing a greater and greater demand on the highway system.
- VMT is projected to increase anywhere from 1.6 percent to 2.4 percent per year while population growth is estimated at 1 percent per year.
- Total VMT for 2050 is estimated at 4,834 billion miles, an increase of 46 percent from 2000 VMT (3,305 billion). For every one person, there will be roughly 11,513 vehicle miles generated.
- The population over the age of 65, comprising roughly 21 percent by 2050; double current population levels, will influence travel demand for all modes.
- Much of the increased congestion is a result of the growth in non-work travel intersecting with work travel, especially adding to the midday and pm peak.
- Daily patterns of travel shift with age, especially the miles, purpose, and time of day. By 2050, vehicle miles for shopping are expected to grow 56 percent, family and personal errands 50 percent, and social and recreational travel 110 percent.

Population and Travel Demand

Over the past 5 decades, travel demand has consistently outpaced population growth. Travel demand is measured in person miles of travel (PMT) which accounts for travel on all modes of transportation and VMT which accounts for travel by personal vehicles.

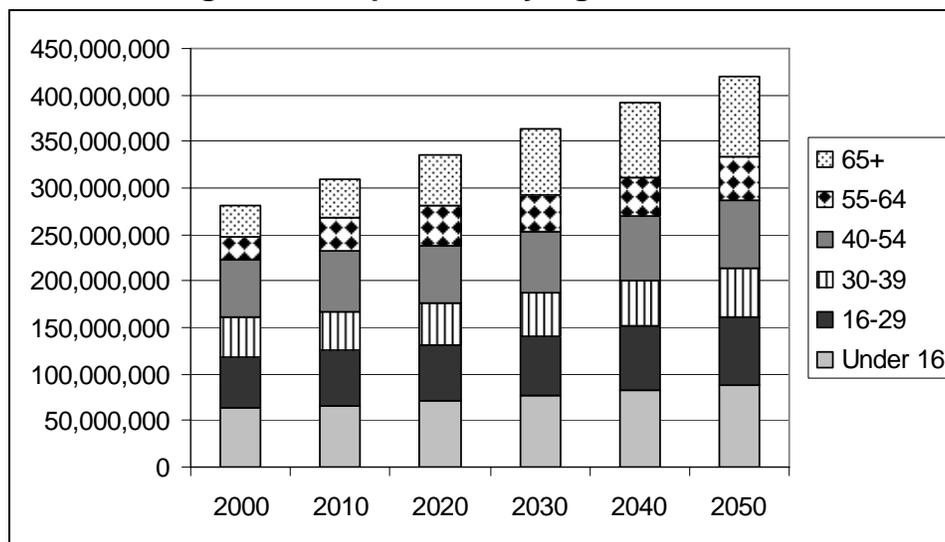
It is clear that a significant share of growth in travel demand is due to factors other than population growth. Since 1969, the population of the U.S. has grown by 32 percent; during the same time period PMT increased by 143 percent. Importantly, in the same period, the number of U.S. households grew by 58 percent, while household vehicle travel tripled (1).

Historically, factors that influence growth in travel beyond population growth include the age distribution of the population, auto ownership levels, licensure rates, household size, labor force participation, and real personal income per capita, immigration, and land use patterns (7). All of these factors heavily influence travel demand and its distribution across population groups and geographic areas.

Other papers in the Demographics and Travel Demand Module provide detailed information and projections for key areas of influence on future travel demand. These include Paper 2 on the Aging Population, Paper 3 on Immigration and Travel, Paper 4 on Trends in Urban and Rural Travel, Paper 5 on The Effects of Migration on Travel Demand, Paper 6 on Household Income, and Paper 7 on the Changing Distribution of Work and Non-Work Travel.

By 2050, for the first time in history, the population of the United States will have roughly equal numbers of people in every age group. This shift in the population may drastically change travel demand. Current projections show population growth at about 1 percent per year, slower than historic growth rates due to decreasing birth rates and an aging population (Figure 1).

Figure 1 – Population by Age, 2000 - 2050



Source: U.S. Census Bureau

Of significance is both the total population size, projected at 420 million, and the number of older Americans, rising from the current 12 percent to 21 percent of the population by 2050. Most researchers expect the baby boom generation to enjoy increased longevity and to drive more miles than today’s older adults.

The population is not only aging, but it is also becoming more diverse. In 1990, 24 percent of the U.S. Population was composed of people of color; 12 percent African American, 9 percent Hispanic, and 3 percent Asian. In 2006, the Hispanic population (of any race) had grown to 45 million, 15 percent of the total population. By 2050, 50 percent of the U.S. population is forecast to be people of color.

One important factor of population growth in the past decade is a larger than expected immigration to the U.S. The current number of immigrants (both legal and illegal) in the U.S. is 35.2 million, 12.1 percent of the population. Immigrants are overwhelmingly concentrated in working-age (16-45) and, until assimilation, have very different travel patterns than U.S.-born residents.

Labor Force Trends

The working-age population has doubled during the past fifty years. In 1960, about 36 of every 100 women participated in the labor force. By 2000, 58 of every 100 women were employed. The labor force participation of men declined from 80 percent in 1960 to 71 percent in 2000.

The growth in workers exceeded the growth in population for the period of 1970-1990, as shown in Table 1. In contrast, in the 1990s the population grew at a faster rate than the workforce. From 1990 to 2000, population has grown by 13.2 percent while workers have increased by 11.5 percent. Looking forward, the proportion of the population that is 16-64 continues to decrease as the population ages. Future labor force participation will have to expand to keep the labor force growing—expand through immigration, incorporating under-employed people, and enticing baby boomers to work past retirement.

Table 1 – U.S. Population, Workers, and Vehicles 1960 – 2000

	1960	1970	1980	1990	2000	Percent Change				
						1960-70	1970-80	1980-90	1990-2000	1960-2000
Total Population	179,323,175	203,211,926	226,545,805	248,709,873	281,421,906	13.30%	11.50%	9.80%	13.20%	56.90%
Total Workers	64,655,805	76,852,389	96,617,296	115,070,274	128,279,228	18.90%	25.70%	19.10%	11.50%	98.40%
Number of Households	53,022,121	63,444,750	80,389,673	91,993,582	105,539,122	19.70%	26.70%	14.40%	14.70%	99.00%
Persons per Household	3.33	3.11	2.75	2.63	2.59	-6.60%	-	-4.40%	-1.50%	-

Source: Journey to Work Trends in the United States and its Major Metropolitan Areas, 1960 – 2000

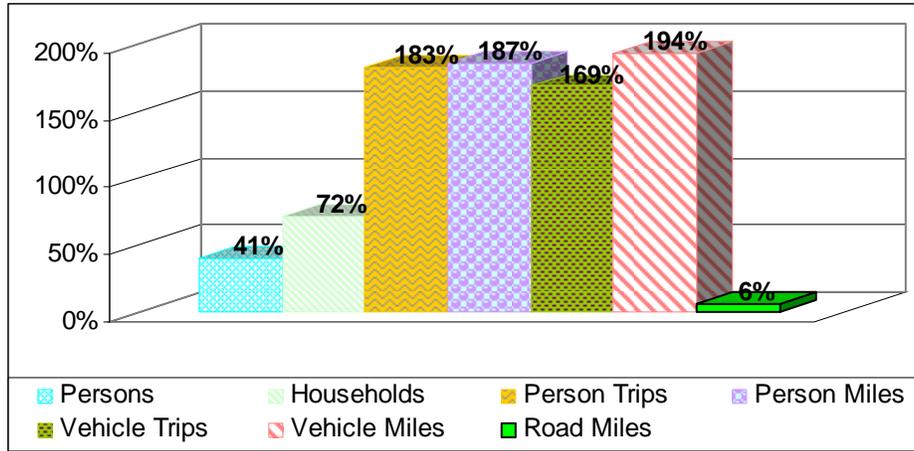
In 2000, the average number of persons per household was 2.6 compared to 3.3 person average household size in 1960. Table 1 shows a 99-percent increase in the number of households accompanied by a 22- percent decrease in household size from 1960 to 2000. Divorce rates and longevity of life play major roles in increasing the number of smaller households (6).

The growth of population, workers, households, and vehicles combined to fuel an immense growth in vehicle miles of travel, as shown in Figure 2.

Changing Household Structure (Households are Getting Smaller)

Historically, the number of households has increased much faster than the total population. While the overall population of the United States increased by 270 percent from 1900 to 2000, the total number of households grew from 16 million in 1900 to over 105 million in 2000, an increase of 561 percent. The major reason for this rapid household growth is changing household structure.

Figure 2 - Historical Trends Growth in Travel, 1969 - 2001



Source: National Household Travel Survey and Highway Performance and Monitoring System

In particular, married couples without children and single person households each outnumber traditional two-parent with children family households. At the same time, there is an increase in the number of larger households, made up of multiple workers and non-family members, perhaps fueled by the growing immigrant population and high housing costs, although the absolute numbers are relatively small. A separate paper in this series (4A-03) details the effect of immigration on future travel patterns. Table 2 provides detail on the number and percent of households by type for 1990 and 2000.

Table 2 – Households by Size, 1990 – 2000

	1990	2000	Difference 1990-2000	% Difference 1990-2000
Total:	91,947,410	105,480,101	13,532,691	14.72%
Family households:	64,517,947	71,787,347	7,269,400	11.27%
2-person household	25,655,016	29,264,081	3,609,065	14.07%
3-person household	15,297,566	16,617,344	1,319,778	8.63%
4-person household	13,607,139	14,657,823	1,050,684	7.72%
5-person household	6,115,401	6,834,963	719,562	11.77%
6-person household	2,269,856	2,595,658	325,802	14.35%
7-or-more person household	1,572,969	1,817,478	244,509	15.54%
Nonfamily households:	27,429,463	33,692,754	6,263,291	22.83%
1-person household	22,580,420	27,230,075	4,649,655	20.59%
2-person household	3,798,577	5,153,965	1,355,388	35.68%
3-person household	672,703	821,683	148,980	22.15%
4-person household	252,955	315,266	62,311	24.63%
5-person household	73,537	101,923	28,386	38.60%
6-person household	30,664	40,476	9,812	32.00%
7-or-more person household	20,607	29,366	8,759	42.50%

Source: U.S. Census

Vehicle Availability

Importantly, vehicle growth has far outpaced the growth in population, workers, and households, more than tripling in the last four decades, as these changes combined to fuel the immense growth in mobility. Table 3 shows that during this period the number of private vehicles nearly tripled to over 200 million and vehicle availability per household and per licensed driver has increased from 1.16 and 0.7 in 1969 to 1.89 and 1.06 in 2001.

This paper represents draft briefing material; any views expressed are those of the authors and do not represent the position of either the Section 1909 Commission or the U.S. Department of Transportation.

Table 3 – Vehicle Availability 1969 - 2001

	1969	1977	1983	1990	1995	2001
Total Vehicles (000)	72,500	120,098	143,714	165,221	176,067	202,586
Vehicles per household	1.16	1.59	1.68	1.77	1.78	1.89
Licensed drivers per household	1.65	1.69	1.72	1.75	1.78	1.77
Vehicles per licensed driver	0.70	0.94	0.98	1.01	1.00	1.06
Workers per household	1.21	1.23	1.21	1.27	1.33	1.35

Source: National Household Travel Survey Series (1969 -2001)

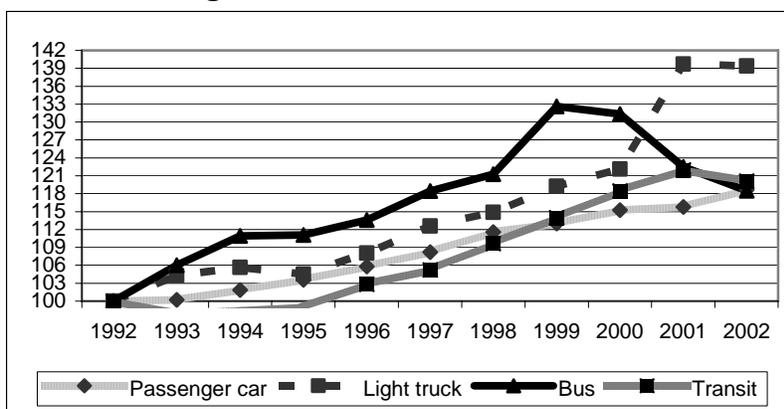
Note: The 1969 NHTS does not include pick-ups and other light trucks as household vehicles

The net effect is that vehicle availability and driver licensing no longer constrain auto travel. As such, these factors may not continue to be key determinants of future vehicle travel growth. Transportation planners and forecasters will need to look at other elements of demographics and travel behavior to accurately project future travel demand. This may constitute a critical shift in how we measure performance and plan for future system needs.

A Nation on the Move

On average, the typical American now travels about 14,500 miles annually including 4,900 miles on long-distance trips annually. The popularity of light-duty trucks such as SUVs during the 1990s attributed to the 39 percent growth in person miles of travel (PMT) by light trucks between 1992 and 2002, compared to just 19 percent growth for while passenger cars (Figure 3).

Figure 3 – Passenger Miles of Travel Trends – Indexed to 1992

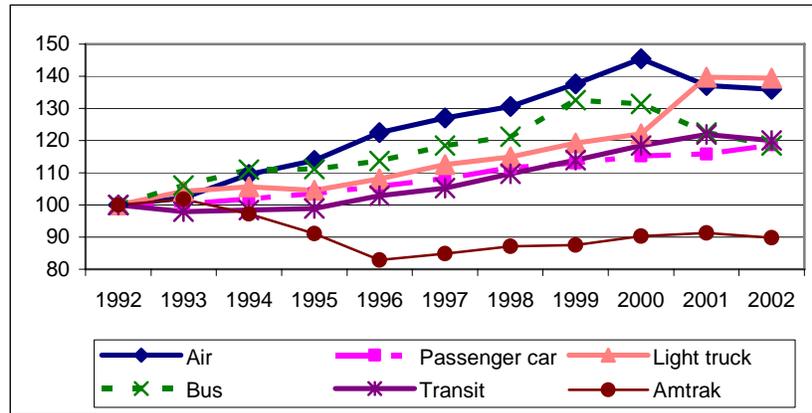


Source: Created using data from 2005 National Transportation Statistics, Bureau of Transportation Statistics. U.S. Department of Transportation

While most of travel is in private vehicles, other modes such as air, rail, and mass transit remain vital (1). For long distance travel, air travel makes up 41 percent of the trips (2). As shown in Figure 4, air carrier PMT grew by 36 percent since 1992. PMT by intercity train (Amtrak) declined overall, although there has been modest growth since 1996. Transit¹ PMT has grown since the mid-1990s.

¹ Transit includes travel by motor bus, heavy rail, commuter rail, light rail, ferry boat, trolley bus, demand response, and other transit vehicles.

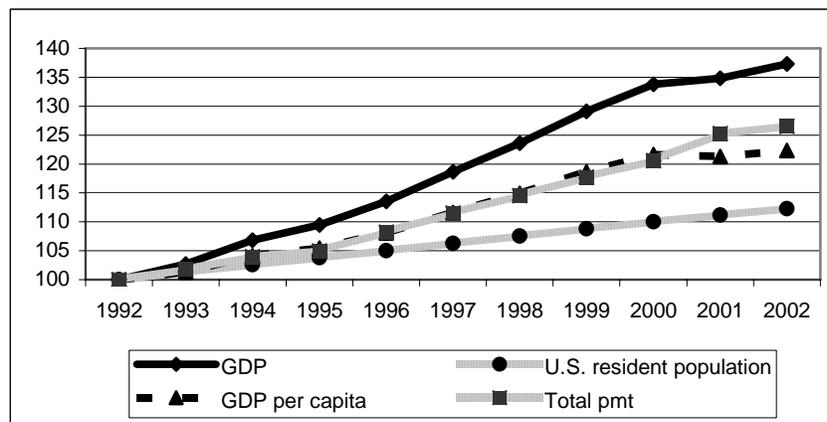
Figure 4 – Change in Person-Miles of Travel by Selected Mode: 1992–2002²



Source: Created using data from 2005 National Transportation Statistics, Bureau of Transportation Statistics. U.S. Department of Transportation

The nation’s healthy economy may be one of the contributing factors to the increase in vehicle-miles-traveled (VMT) at the household level over the past few decades. The economy grew faster than the population. While the U.S. resident population grew 12 percent, Gross Domestic Product (GDP) increased 37 percent and GDP per capita grew 22 percent between 1992 and 2002 (Figure 5). PMT increase paralleled the GDP growth.

Figure 5 – Growth Trend, Index 1992 – 2002



Source: Created using data from 2005 National Transportation Statistics, Bureau of Transportation Statistics. U.S. Department of Transportation

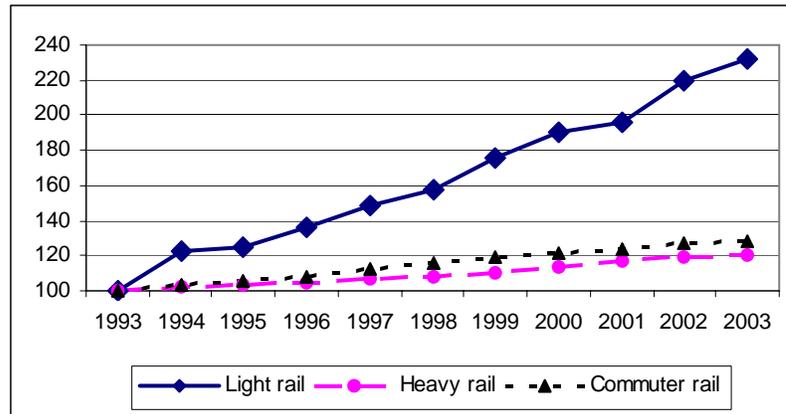
From 1977 to 2001, personal business travel rose by 114 percent, recreational travel rose by 65 percent, and school travel rose by 27 percent. For shopping trips, the last 20 years have seen a 12 percent increase in person trips and nearly a 20 percent increase in the number of miles traveled.

Transit passenger miles have also increased, from 17.9 billion in 1993 to 24.6 billion in 2000 (2). Most of this growth has occurred on light rail transit, which tends to serve a smaller geographic

² NOTES: To make it easier to compare data of differing magnitudes over time, the BTS divided the data for all years in each category (see table 1-2b) by the initial year value and multiplied the result by 100.

area than buses. PMT on rail increased at twice the 1.5 percent annual rate of non-rail modes (3). Figure 6 is a graphic presentation of non-highway vehicle miles of travel. Two of the major influences on transit use are service availability and population density. 80 percent of transit occurs in areas with over 4,000 persons per square mile (3).

Figure 6 - Change in Non-highway Vehicle Miles of Travel: 1993–2003



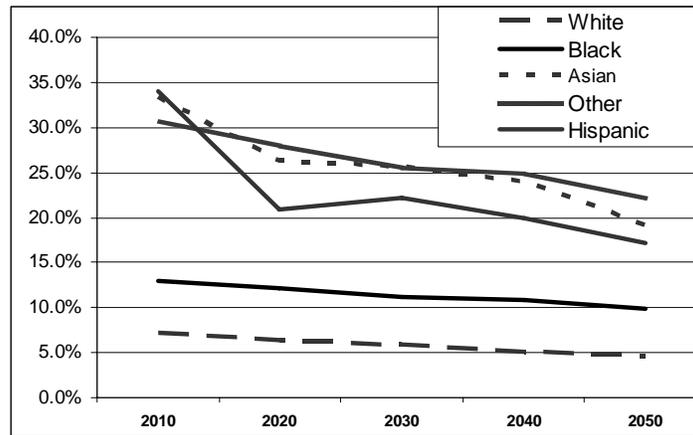
Source: Created using data from 2005 National Transportation Statistics, Bureau of Transportation Statistics. U.S. Department of Transportation

Daily peak period of travel over the last several decades has slowly increased from a one or two hour time period to four hours or more. Often non-work travel (shopping, recreational) intersects with peak travel, and the growth in non-work travel has added to lengthening peak periods and midday travel. A separate paper in this series (4A-07) describes the balance of work and non-work travel.

What the Future Holds

The bulk of the projected population growth will occur prior to 2030, and different races and ethnic groups will contribute to that growth (as shown in Figure 7). The number of Hispanic people (of any race) in the U.S. is expected to grow to 102.6 million, an increase of 188 percent. The Asian population will triple in size by 2050 with a projected growth rate of 213 percent. The black population (both Hispanic and non-Hispanic) is expected to grow to 61.4 million by 2050.

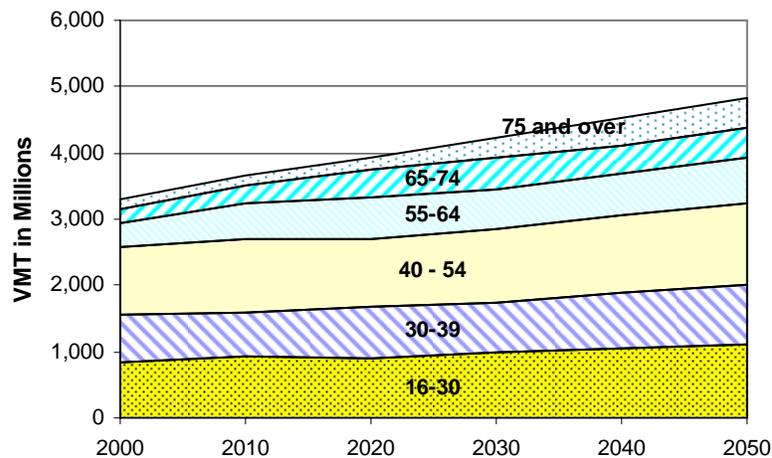
Figure 7 – Projected Percent Growth by Race and Ethnicity (2010 – 2050)



Source: U.S. Census Bureau

But importantly, daily patterns of travel shift with age, especially the miles, purpose, and time of day. Figure 8 presents the future trends using our current VMT and Census population projection. As evident in the chart, the VMT will continue to grow, though at a moderate pace.

Figure 8 – VMT by Age (2000-2050)



Source: Travel data is from the National Household Travel Survey. Population projections from the U.S. Census

The forecasted trends in the demographic and economic factors, along with the forecasts of continued growth in travel demand for both people and freight, will require a robust highway and intermodal transportation system. The Interstate Highway System is expected to remain the most important part of the nation’s transportation system (10).

Conclusions

The relationship among population growth, passenger travel and VMT has indeed undergone a dramatic change over the past 5 decades. As Pisarski noted in *Commuting in America III*, “Many of the major forces of change in the past have diminished: The explosive growth of drivers’ licenses and vehicle ownership, the rise of female participation in the workforce, the suburban boom, and the boom in baby boomer workers themselves are all behind us.” (6)

However, we are at a dramatic crossroads of demographic change again. The aging of the baby-boom cohort, high immigration, continuing economic growth, and changes in land-use and migration patterns will combine to transform travel in the future, placing more, and different, demands on the transportation system. For example, by 2050 VMT for non-commuting purposes will be a much greater portion of total VMT than today. As the population ages, the proportion of the population of working age will decline, requiring fuller labor participation of older people, immigrants, and under-employed sectors of the population, which will change commute patterns.

The challenge lies in the ability to forecast the potential relationships between changing demographics and the lifestyles of American households. With equal numbers of people in each age cohort in 2050, the population will be evenly spread across many life stages. There will be demands on the transportation system to serve these diverse markets equally well. In summary, the major factors affecting the future of the travel demand discussed here and in the related papers include:

- Potential changes in historical indicators of travel demand as vehicle availability reaches saturation levels,
- Disparate trends in travel behavior, with an aging and diversified traveling public,
- Increased travel demand in suburban areas, as the baby boomers that age in place cease to drive and as new immigrants make the suburbs their home.
- Transit and safe pedestrian facilities for new immigrants and older Americans,
- A potential focus on reliability over speed, and a market for reliable, high service options for commuters,
- Planning for increases in recreational travel, both local and long-distance, and
- Increases in local travel of all sorts not related to work, which impact congestion levels during peak and off-peak time periods.

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