




A New Direction

Our Changing Relationship with Driving and the Implications for America's Future

RIPIRG Education Fund

FRONTIER GROUP

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Executive Summary

The Driving Boom—a six decade-long period of steady increases in per-capita driving in the United States—is over.

Americans drive fewer total miles today than we did eight years ago, and fewer per person than we did at the end of Bill Clinton's first term. The unique combination of conditions that fueled the Driving Boom—from cheap gas prices to the rapid expansion of the workforce during the Baby Boom generation—no longer exists. Meanwhile, a new generation—the Millennials—is demanding a new American Dream less dependent on driving.

Transportation policy in the United States, however, remains stuck in the past. Official forecasts of future vehicle travel continue to assume steady increases in driving, despite the experience of the past decade. Those forecasts are used to justify spending vast sums on new and expanded highways, even as existing roads and bridges are neglected. Elements of a more balanced transportation system—from transit systems to bike lanes—lack crucial investment as powerful interests battle to maintain their piece of a shrinking transportation funding pie.

The time has come for America to hit the "reset" button on transportation policy—replacing the policy infrastructure of the Driving Boom years with a more efficient, flexible and nimble system that is better able to meet the transportation needs of the 21st century.

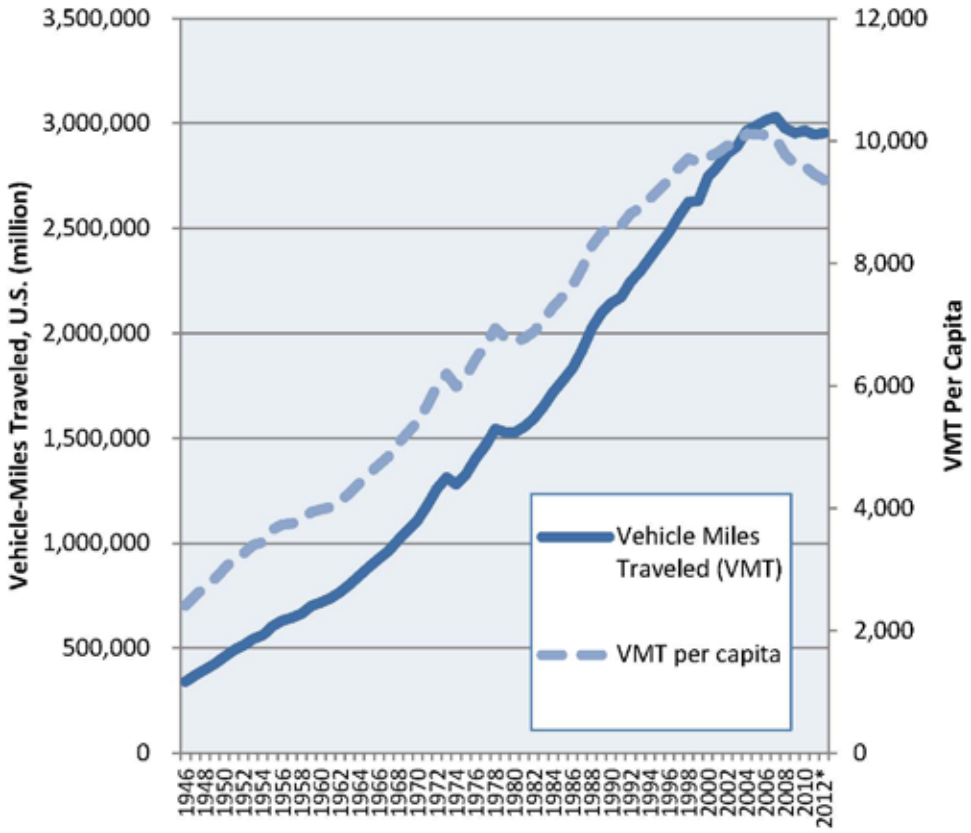
The Driving Boom is over.

- Americans drove more miles nearly every year between the end of World War II and 2004. (See Figure ES-1, next page.) By the end of this period of rapid increases in per-capita driving—which we call the "Driving Boom"—the average American was driving 85 percent more miles each year than in 1970.

- Americans drive no more miles in total today than we did in 2004 and no more per person than we did in 1996.

- On the other hand, Americans took nearly 10 percent more trips via public transportation in 2011 than we did in 2005. The nation also saw increases in commuting by bike and on foot.

Figure ES-1. Total and Per-Capita Vehicle-Miles Traveled, U.S.



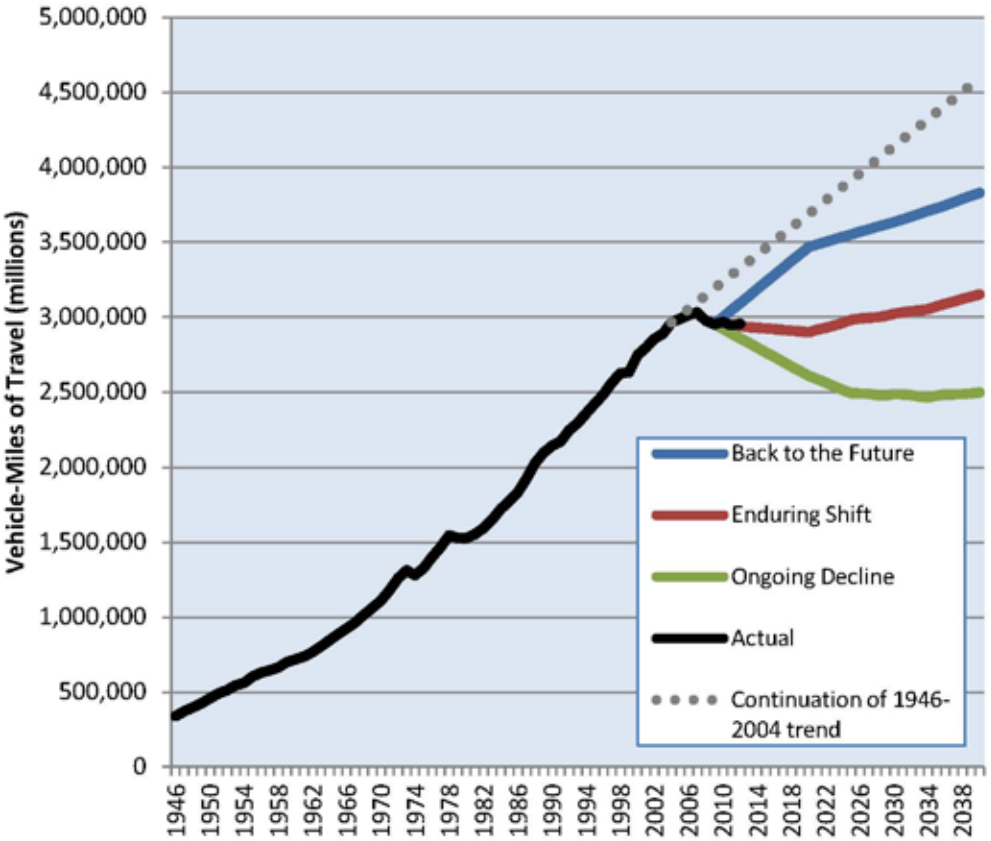
* 2012 data from U.S. Department of Transportation's (U.S. DOT) *Traffic Volume Trends* series of reports; data from previous years from U.S. DOT's *Highway Statistics* series of reports.

- A return to the steady growth in per-capita driving that characterized the Driving Boom years is unlikely given the aging of the Baby Boom generation, the projected continuation of high gas prices, anticipated reductions in the percentage of Americans in the labor force, and the peaking of demand for vehicles and driver's licenses and the amount of time Americans are willing to spend in travel.

The Millennial generation has led the recent change in transportation trends—driving significantly less than previous generations of young Americans. Millennials are already the largest generation in the United States and their choices will play a crucial role in determining future transportation infrastructure needs.

- The Millennials (people born between 1983 and 2000) are now the largest generation in the United States. By 2030, Millennials will be far and away the largest group in the peak driving age 35-to-54 year old demographic, and will continue as such through 2040.

Figure ES-2. Aggregate Vehicle-Miles Traveled in the United States under Several Scenarios of Future Travel Growth, 1946-2040



- Young people aged 16 to 34 drove 23 percent fewer miles on average in 2009 than they did in 2001—a greater decline in driving than any other age group. The severe economic recession was likely responsible for some of the decline, but not all.

- Millennials are more likely to want to live in urban and walkable neighborhoods and are more open to non-driving forms of transportation than older Americans. They are also the first generation to fully embrace mobile Internet-connected technologies, which are rapidly spawning new transportation options and shifting the way young Americans relate to one another, creating new avenues for living connected, vibrant lives that are less reliant on driving.

- If the Millennial-led decline in per-capita driving continues for another dozen years, even at half the annual rate of the 2001-2009 period (illustrated by the *Ongoing Decline* scenario in Figure ES-2 above), total vehicle travel in the United States could remain well below its 2007 peak through at least 2040—despite a 21 percent increase in population. If

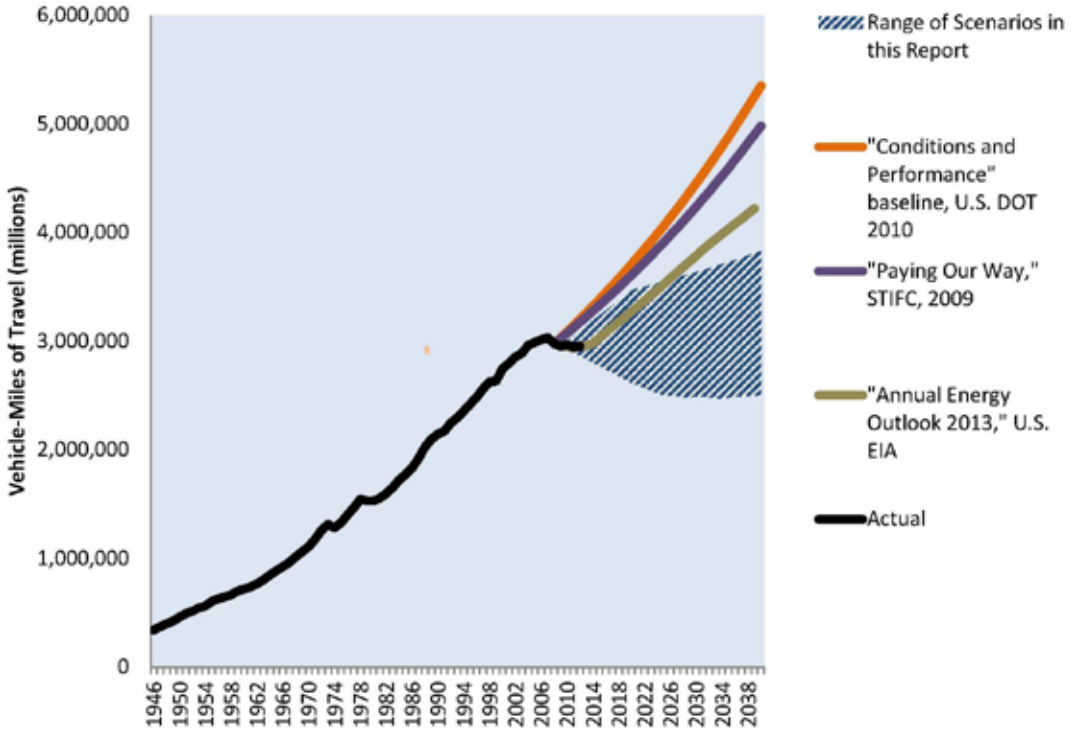
Millennials retain their current propensity to drive less as they age and future generations follow (*Enduring Shift*), driving could increase by only 7 percent by 2040. If, unexpectedly, Millennials were to revert to the driving patterns of previous generations (*Back to the Future*), total driving could grow by as much as 24 percent by 2040.

- All three of these scenarios yield far less driving than if the Driving Boom had continued past 2004. Driving declines more dramatic than any of these scenarios would result if future per-capita driving were to fall at a rate near that of recent years or if annual per-capita reductions continue through 2040.

- Regardless of which scenario proves true, the amount of driving in the United States in 2040 is likely to be lower than is assumed in recent government forecasts. This raises the question of whether changing trends in driving are being adequately factored into public policy. (See Figure ES-3.)

The recent reduction in driving has already delivered important benefits for

Figure ES-3. Recent Official Forecasts of Vehicle Travel Compared to Range of Scenarios, 1946-2040



U.S. DOT = U.S. Department of Transportation
STIFC = Surface Transportation Infrastructure Financing Commission
U.S. EIA = U.S. Energy Information Administration

the nation, while raising new challenges. Future driving trends will have major implications for transportation policy and other aspects of American life.

- **Traffic congestion has fallen.** According to data from the Texas Transportation Institute, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in 2005. Further reductions in driving could lead to additional easing of congestion without massive investments in new highway capacity, as long as roads are maintained in a state of good repair.

- **America is less dependent on oil.** In 2011, gasoline consumption for transportation hit a 10-year low. Further reductions in driving consistent with the *Ongoing Decline* scenario—coupled with expected vehicle fuel economy improvements—could result in the nation using half as much gasoline or other fuels in our cars and trucks by 2040 as we use today.

- **Our roads are getting less use … but the gas tax is bringing in less income.** Reduced vehicle travel (particularly in large trucks) reduces the wear and tear on our nation's roads, reducing maintenance needs. Reduced driving, however, also reduces the amount of revenue brought in by the already-strained gasoline tax.

The recent reduction in driving and embrace of less auto-dependent ways of living by Millennials and others creates a golden opportunity for America to adopt transportation policies that use resources more efficiently, preserve our existing infrastructure, and provide support for Americans seeking alternatives to car travel.

A new vision for transportation policy should:

- **Plan for uncertainty.** With future driving patterns uncertain, federal, state and local transportation officials should evaluate the costs and benefits of all transportation projects based on several scenarios of future demand for driving. Decision-makers should also prioritize those projects that are most likely to deliver benefits under a range of future circumstances.

- **Support the Millennials and other Americans in their desire to drive less.** Federal, state and local policies should help create the conditions under which Americans can fulfill their desire to drive less. Increasing investments in public transportation, bicycling and pedestrian infrastructure and intercity rail—especially when coupled with regulatory changes to enable the development of walkable neighborhoods—can help provide more Americans with a broader range of transportation options.

- **Revisit plans for new or expanded highways.** Many highway projects currently awaiting funding were initially conceived of decades ago and proposed based on traffic projections made before the recent decline in driving. Local, state and federal governments should revisit the need for these "legacy projects" and ensure that proposals for new or expanded highways are still a priority in light of recent travel trends.

- **Refocus the federal role.** The federal government should adopt a more strategic role in transportation policy, focusing resources on key priorities (such as repair and maintenance of existing infrastructure and the expansion of transportation options) and evaluating projects competitively on the basis of their benefits to society.

- **Use transportation revenue where it makes the most sense.** Transportation spending decisions should be based on overall priorities and a rigorous evaluation of project costs and benefits—not on the source of the revenue.

- **Do our homework.** Federal and state governments should invest in research to evaluate the accuracy and usefulness of transportation models and better understand changing transportation trends in the post-Driving Boom era.

Introduction

No region of the United States is as closely associated with "car culture" as Southern California. So much of what Americans associate with the car—from hot rodding to drive-ins and from smog to traffic congestion—either began or reached its fullest expression in the region. As early as the mid-1930s, according to one analyst, Los Angeles had become "America's first thoroughly motorized metropolis."[1]

Like the rest of America, California experienced rapid growth in driving from World War II through the turn of the 21st century. The number of miles driven in the state doubled between 1981 and 2002—an average rate of growth of more than 3 percent per year.[2]

With all signs in the 1980s pointing to continued increases in the demand for driving, officials in Southern California began looking for ways to expand their clogged freeway network. In Orange County, officials launched a plan to build a series of toll roads to ease existing and anticipated congestion.[3] When the first of the toll roads opened in 1993, a state senator confidently stated that the roads would be a success because, "People around here will do anything to avoid gridlock."[4] Several other toll roads—some built and operated by private corporations—opened in the region between the early 1990s and late 2000s.

Far from meeting the initial predictions of success, however, Southern California's toll roads have served as a cautionary tale of what can happen when millions of dollars are spent on expanded highways … and the cars don't show up.

Traffic on Orange County's San Joaquin Hills toll road fell short of projections almost immediately after opening—by 2010, traffic on the road was less than half of what had been anticipated.[5] Another Orange County project, the Foothill/Eastern toll road, met expectations until 2008, when traffic slumped.[6] In San Diego County, the privately built South Bay Expressway, which opened in 2007, fell so far short of its traffic projections that the private enterprise that built and operated the road was forced into a form of bankruptcy.[7]

These failed predictions have serious consequences. In Orange County, tolls on the highways have been raised to among the highest in the nation in a grab for revenue. The bonds issued by one of the toll

road authorities have been downgraded to junk bond status,[8] and an investigation was launched in late 2012 of the finances of the local government agencies responsible for building and operating the Orange County highways.[9]

Southern California toll roads aren't the only highways getting less traffic these days, either in California or across the country. After decades of relentless growth in vehicle travel, Californians are driving about as much today as they did a decade ago, mirroring nationwide trends.[10]

After roughly a decade of stagnation in driving, it is becoming clear that the rapid increases in per-capita driving that took place in California and across the nation between 1946 and the early 2000s—a period we call the "Driving Boom"—are over. Yet, transportation policy in the United States has failed to catch up with the times, leaving the nation at risk of over-investing in transportation infrastructure that we don't need while under-investing in the repair of our existing transportation network and the broader range of transportation choices Americans increasingly seek in the 21st century.

The nation needs a new transportation policy—one that embraces the recent change in driving patterns and seeks to maximize their benefits. That new transportation policy would accept the fact that future transportation demands are uncertain and prioritize investments that would deliver benefits under a broad range of potential futures. It would create a coherent and refocused role for the federal government in ensuring that our transportation infrastructure is well-maintained and in partnering with cities and states that seek to provide new transportation options to their people. And it would reevaluate whether previous plans for major highway expansion projects still make sense in light of changing trends in driving.

With the fate of tens of billions of dollars in transportation investments at stake, the time has come for policymakers and the public to understand the seismic implications of changing driving trends on transportation policy, and to build a new transportation policy that reflects the needs of 21st century America.

The End of the Driving Boom

The Driving Boom—a six decade-long period of steady increases in per-capita driving—is now over. Americans drove no more per person in 2012 than we did at the end of Bill Clinton's first term as president. Many long-term economic and demographic trends suggest that the period of prolonged stagnation in vehicle travel may just be beginning.

The recent change in driving trends—led by young Americans—has huge implications for transportation policy. To understand those implications, it is important to answer a few basic questions: Why did the Driving Boom happen? Why did it end? And why is it unlikely to return?

The Rise in Driving from 1946-2004

Throughout the 20th century—with short interruptions for crises such as wars or energy shocks—the number of miles Americans drove each year marched steadily upward. By 2004, the total number of miles driven annually on America's roads was approaching 3 trillion—more than double the amount of just three decades earlier.[11] Between 1970 and 2004, the number of miles driven per capita skyrocketed by 85 percent—from 5,400 miles per year to just over 10,000.[12]

Rapid increases in driving were so commonplace during this period—which we call the "Driving Boom"—as to be considered inevitable. Rising traffic congestion (or the threat of it), along with the perceived importance of highways to economic growth, spurred government officials to invest hundreds of billions of dollars in expanded highway capacity. Between 1980 and 2010, the nation expanded its freeway capacity (measured in lane-miles) by 35 percent, the equivalent of building a new lane of freeway stretching from New York to Los Angeles every single year.[13]

Table 1. Average Annual Change in Vehicle Travel, Driving Boom and Post-Driving Boom[14]

	1946-2004	2004-2012
Total miles	3.8%	0.0%
Miles per capita	2.5%	-1.0%

New highways, in turn, spurred additional driving. New off-ramps in previously rural communities fueled sprawling real estate development in distant suburbs and exurbs consisting largely of housing subdivisions, office parks and shopping centers, many of them designed so as to be accessible only by automobile. The percentage of Americans living in suburbs increased from 23 percent in 1950 to 50 percent in 2000.[15]

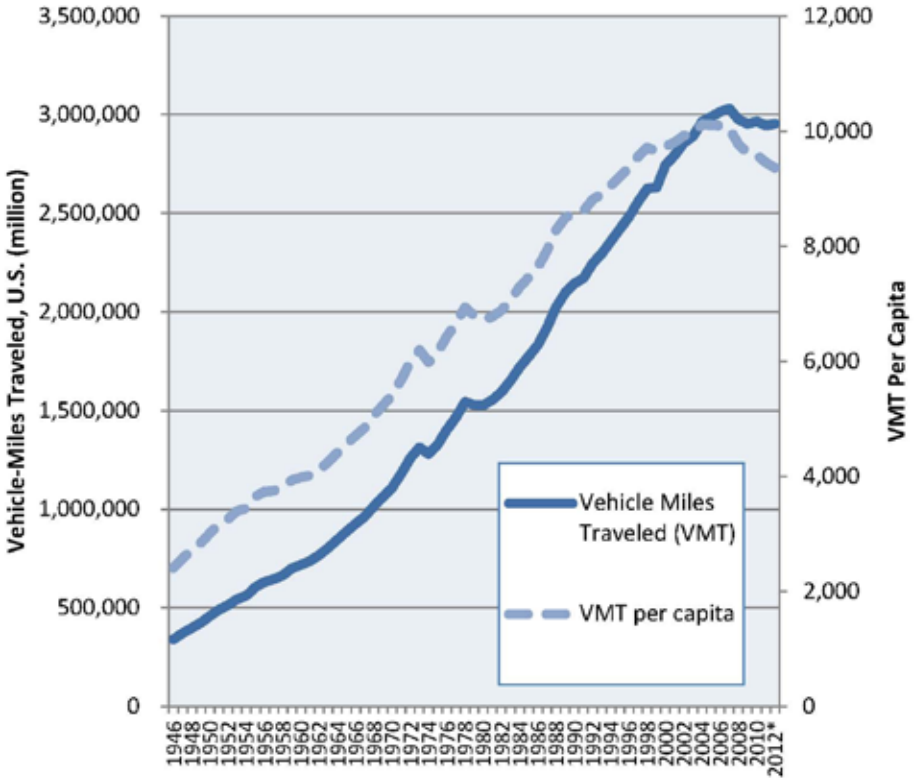
As longer commutes and the need to use a car for virtually every daily task led to more driving, revenues from the gasoline tax increased steadily. Between 1970 and 2000, the real value of highway "user fees"—gasoline taxes, vehicle registration fees and other taxes and fees paid by drivers—collected by all levels of government increased by 34 percent.[16]

Because federal and state governments devoted most (and in some cases, all[17]) revenues from drivers to highways—and because most of the nation's existing highways were still relatively new and did not yet require major reconstruction—vast amounts of revenue were available to add new highway capacity. In 2000, for example, even after more than four decades of rapid highway construction, 46 percent of federal highway funding was still being spent on new roads and expansion of capacity on existing roads.[18]

This self-reinforcing cycle—new roads fed new development that led to more driving, which created more revenue, which made possible more roads—continued for decades.

Then, around the turn of the 21st century, it stopped.

Figure 1. Total and Per-Capita Vehicle-Miles Traveled, U.S.[19]



* 2012 data based on U.S. Department of Transportation's (U.S. DOT) *Traffic Volume Trends* report. Previous years based on U.S. DOT *Highway Statistics* series of reports.

The Crest of the Wave: Driving Trends in the 21st Century

By the late 1990s, the rapid rise in vehicle travel that characterized the Driving Boom began to slow, then stop, and ultimately reverse. Americans now drive no more in total than they did in 2004 and no more on average than they did at the end of Bill Clinton's first term as president. (See Figure 1.)

The recent reduction in vehicle travel is nearly unprecedented in American history.[20] The longest previous drop in vehicle travel was during World War II—a period of gasoline rationing and extraordinary societal disruption. It took five years and the conclusion of the war for 1941 levels of driving to be surpassed again in 1946. The United States has now gone more than five years since its last peak in vehicle travel.[21]

Why the Driving Boom Is Over … and Why it's not Coming Back

There are many reasons to believe that driving per-capita has peaked, at least for the foreseeable future, signaling the end of the Driving Boom. While the *total* number of miles driven on American roads may inch upwards over time with population growth, the pace of that increase in vehicle travel—if it occurs at all—will be far slower than during the Driving Boom years.

Saturated with Driving

In the decades after World War II, rising incomes put automobile ownership within reach of an increasing number of Americans. The construction of new highways and development of new low-density suburbs created a new—and to many, appealing—automobile-oriented lifestyle. The increased participation of women in the workforce, particularly from the 1960s onward, put millions of new commuters on the roads and changed travel patterns in fundamental ways. Meanwhile, dramatic improvements in vehicles and the opening of shiny new highways enabled Americans to increase the number of miles they drove without sacrificing time for work or leisure.

Each of these changes led more Americans to take to the roads, helping to fuel the dramatic increase in the number of miles driven between World War II and 2004. By the turn of the 21st century, however, these trends had largely played themselves out, and some had shown signs of beginning to reverse. (See Figure 2, next page.)

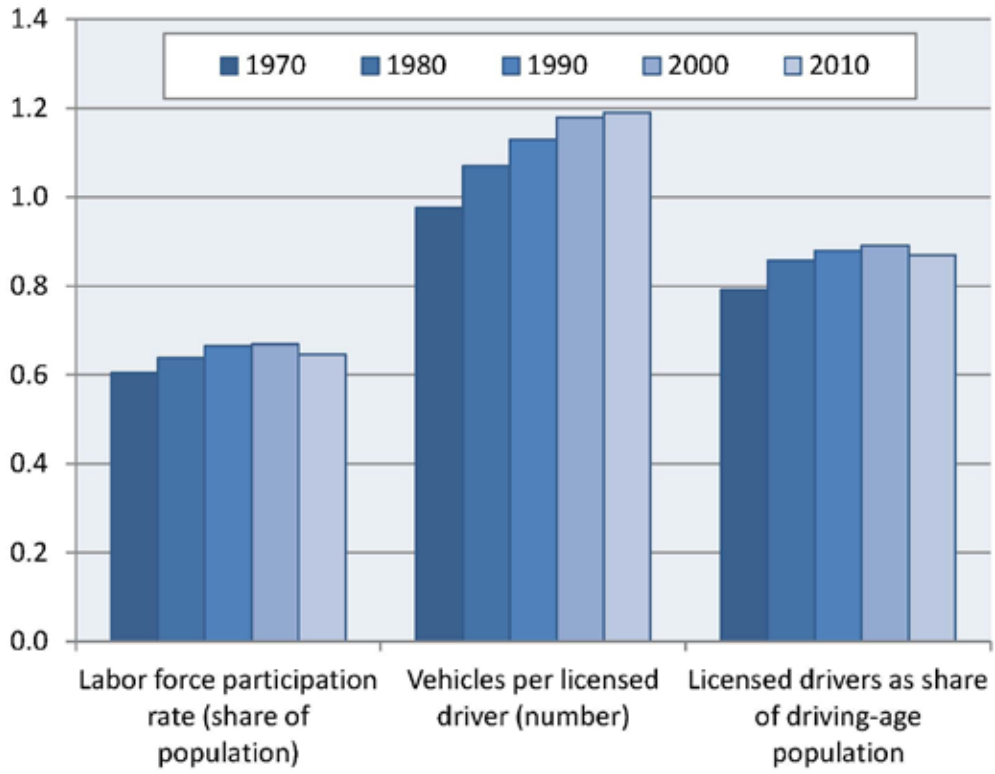
Labor Force Participation

Workers tend to drive more miles than non-workers, and the Driving Boom years saw a dramatic expansion in the share of the American population taking part in the labor force. Between 1970 and 2000, the share of Americans in the labor force increased from just over 60 percent to a peak of 67.3 percent.[23] Since 2000, however, the share of Americans in the labor force has dropped to 63.6 percent, a level roughly equal to that of 1979.[24] The drop in labor force participation began well before the current recession and is expected to continue well beyond it, largely due to the aging of the Baby Boom generation. A 2011 Congressional Budget Office report projected that the participation rate would drop to 63 percent by 2021.[25]

Vehicle Ownership

People who have greater access to a vehicle could be expected to drive more frequently than those with less access—even in situations where they might otherwise walk, take transit, or not travel at all. During the Driving Boom, the number of Americans who owned cars increased dramatically. In

Figure 2. Trends in Driver's Licensing, Vehicle Ownership and Labor Force Participation Rate[22]



1972, the number of vehicles registered in the United States exceeded the number of people licensed to drive them for the first time.[26] Over the next three decades, the ratio of vehicles to licensed drivers continued to increase, reaching a peak of 1.24 vehicles per driver in 2006. Since 2006, however, vehicle ownership per licensed driver has declined by 4 percent, suggesting that Americans may have reached a limit in the number of vehicles they can beneficially use.

Driver's Licensing

Increasing vehicle ownership was matched in the Driving Boom years by an increasing share of the population holding a license to drive. By 1992, 90 percent of the driving-age population of the United States was licensed to drive—an all-time high with little room for further increase. Since then, however, the percentage of driving-age (16 and older) Americans holding driver's licenses has stagnated and then declined—by 2011, 86 percent of driving-age Americans held driver's licenses, the lowest percentage in 30 years.[27]

Time Spent in Travel

Highway expansion and vehicle improvements during the Driving Boom years meant that Americans could go farther, faster, and in greater comfort than ever before. Improvements in average highway travel speeds continued right up through the 1980s, making it possible for Americans to live or work in ever-more distant suburbs or exurbs without losing precious work or family time. Since the early 1990s, however, travel speeds (at least for commute

trips) have slowed.[28] Barring major technological advances, there are few prospects for a repeat of the quantum leap in travel speeds that occurred during the Driving Boom.[29]

This finding is important because some transportation theorists believe that there are inherent—if difficult to define—boundaries to the average amount of time each day that people are willing to spend in travel.[30] This limit is thought to be in the range of 1.1 to 1.3 hours per day.[31] In 2011, Americans spent an average of 1.17 hours a day in travel, slightly less time than they had spent in travel in 2005.[32]

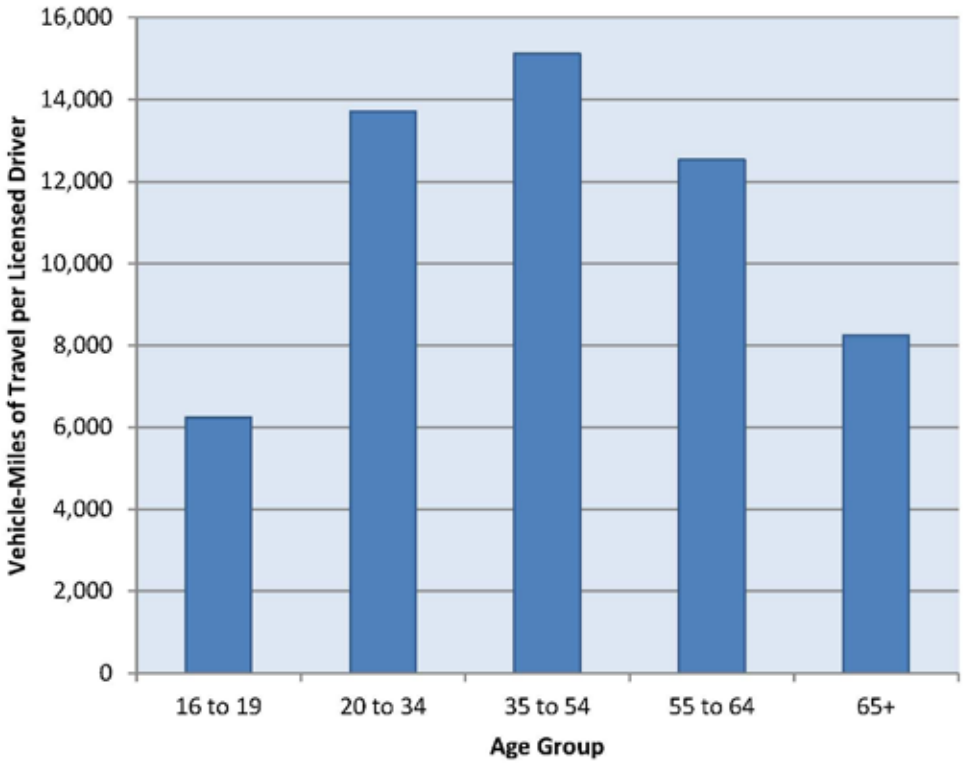
In short, Americans may be hitting the limit of the amount of time they are willing to spend in their cars each day—meaning that, unless travel speeds increase, they may be hitting the limit of the number of miles they are willing to drive each day as well.

Demographics: The Graying of America

The Driving Boom coincided, in large measure, with the lives of those born in the Baby Boom—the massive demographic bubble consisting of those born between 1946 and 1964. The passage of the Baby Boomers through their peak working and child-rearing years turbocharged the trend toward increased driving—especially between the 1980s and 2000s.

Driving is an activity that is highly dependent on one's stage of life. People in their prime earning and child-rearing years tend to drive the most, as they commute to jobs, shuttle children to activities, and often opt to live in more spacious suburban communities that are also more auto-dependent. Younger people and older people, on the other hand, are less likely to drive. (See Figure 3.)

Figure 3. Vehicle Miles Traveled per Licensed Driver by Age, 2009[33]



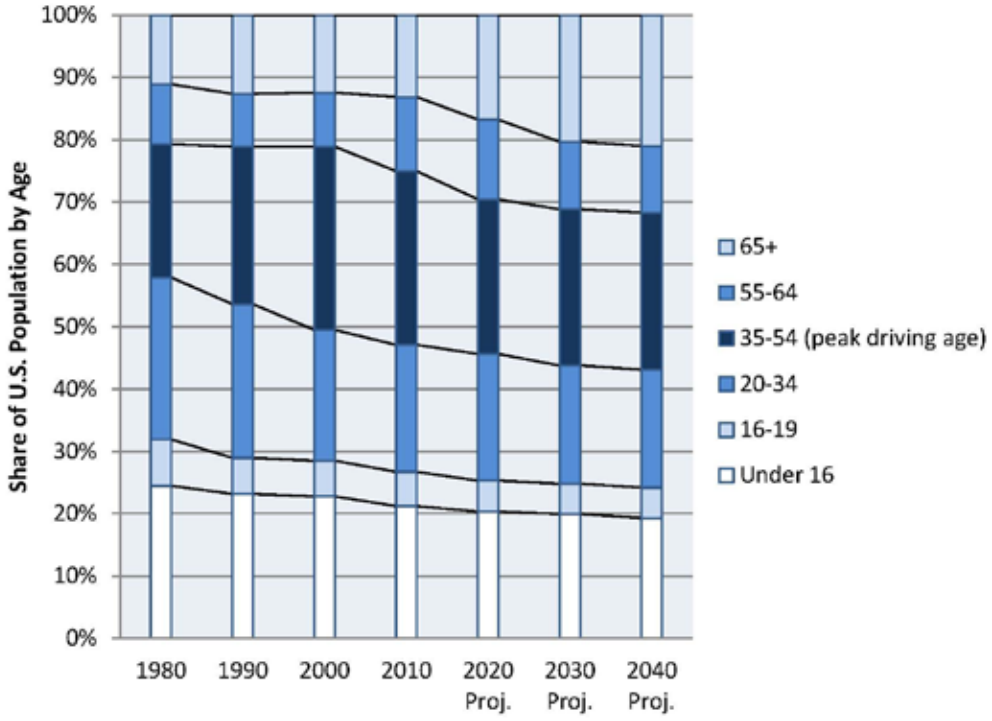
Regardless of other trends, therefore, the greater the share of Americans in the peak driving-age 35-to-54 age group, the more one can expect per-capita vehicle travel, as averaged across the entire population, to increase. In the latter years of the Driving Boom, the percentage of Americans in the peak driving-age demographic increased rapidly. By 2000, 35 to 54 year-olds accounted for 29.5 percent of the U.S. population, up from 25.3 percent of the population in 1990 and 21.4 percent of the population in 1980. (See Figure 4.)

The Baby Boom generation is now passing through the prime driving years and heading toward retirement. By 2010, the share of Americans in the 35 to 54 year-old age bracket fell to 27.9 percent and by 2020 it is projected to fall further to 24.8 percent. In fact, despite overall population growth, there are projected to be fewer 35 to 54 year-olds *in total* in 2020 than there were in either 2010 or 2000.

At the same time, the share of population in the 65 and older age bracket is projected to increase dramatically between now and 2040. In 1980, seniors 65 and older made up 11 percent of the population; by 2040, their share of the population is expected to roughly double to 21 percent.[35]

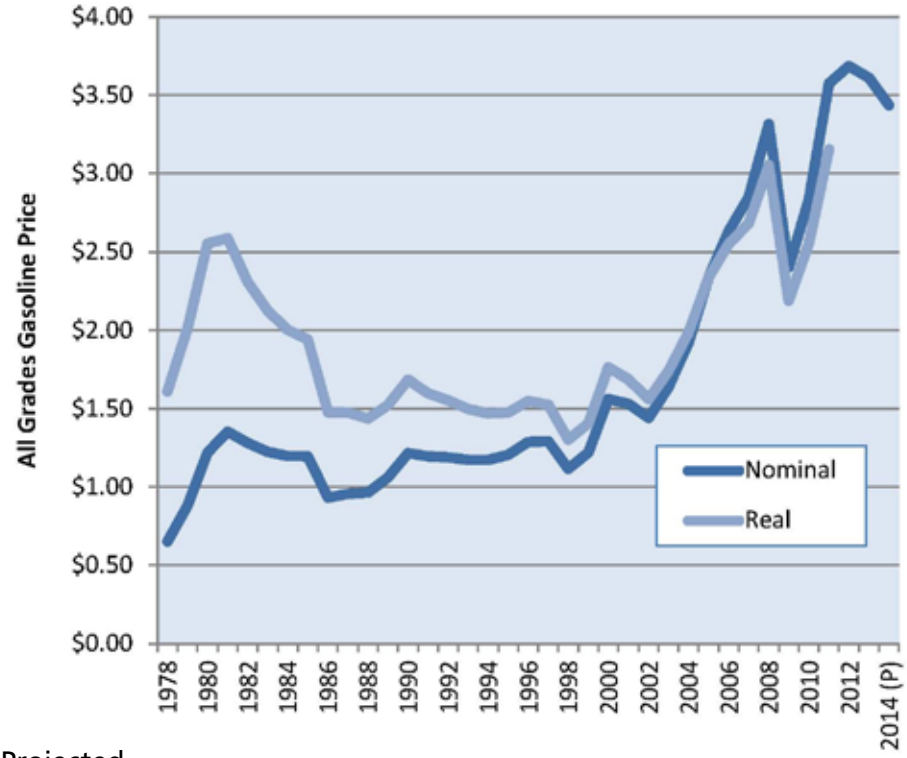
A greater share of Americans, therefore, will soon be in age groups that have historically driven fewer miles. This demographic shift can be expected to reduce the number of miles driven per capita when averaged across the entire population.

Figure 4. Shares of U.S. Population by Age Group[34]



The share of Americans in their peak driving years (age 35-54) is shown in dark blue. Between 1980 and 2000, the share of Americans in the peak driving demographic ballooned from 21.4 percent of the population to 29.5 percent, as the Baby Boomers reached peak driving age. With the Baby Boom generation now headed toward retirement, the share of Americans in the peak driving age group is projected to decline to 24.8 percent by 2020.

Figure 5. Average Annual Regular Grade Gasoline Prices, United States, Nominal and Real (Adjusted for Inflation)[38]



(P)=Projected

Economics: The Sustained Rise in Gasoline Prices

The cost of driving has gone up dramatically in the last decade. Between 2002 and 2011, the average inflation-adjusted price of a gallon of gasoline doubled.[36]

The cost of gasoline has both short- and long-term impacts on the amount people drive. In the short term, people may pass up the opportunity to take certain trips due to high prices. The perception of higher gasoline prices in the long-term, meanwhile, can cause people to reorient their lives to avoid the expense of fuel—for example, by moving closer to their work or purchasing a more fuel-efficient car.[37]

U.S. government forecasters project that gasoline prices will remain well above historical levels, which would tend to depress vehicle travel. However, trends in gasoline prices may become less important over time as vehicle fuel economy improves and alternative fuel vehicles become more common on American roads.

Rising Use of Transit and Other Transportation Modes

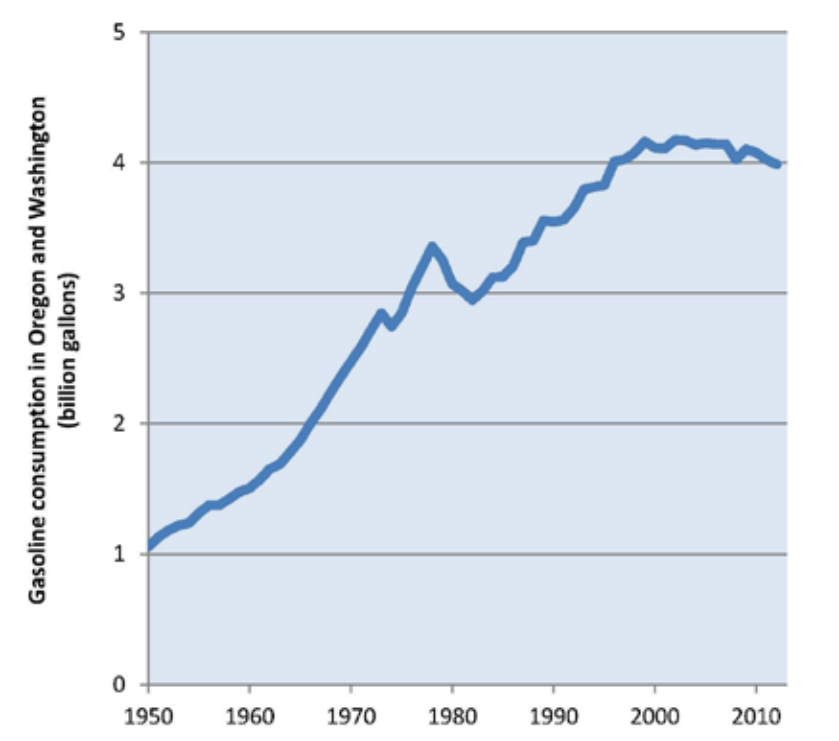
Another contributing factor to the recent decline in driving has been the increasing eagerness of many Americans to choose other modes of transportation—light rail, buses, trains, bicycles or walking—for trips they might once have taken by car. Indeed, while driving has been stagnant or declining in recent years, the use of nearly all of these other modes of transportation has increased. (continued, page 18)

Implications of Changing Driving Trends: The View from the Pacific Northwest

By **Clark Williams-Derry, Sightline Institute**

The Pacific Northwest was well ahead of the curve in the national trend toward reduced driving and fuel consumption. Out here in the land of mist and mountains, gasoline consumption plateaued way back in 1999.[43] (See Figure 6.) Total vehicle travel on Washington and Oregon's state highways flattened out in 2002.[44] And, after factoring in population growth, gas consumption per resident in the two states has now fallen to its lowest level since 1964—a dramatic decline, though one that has received surprisingly little attention from the region's policy-makers.[45]

Figure 6. Gasoline Consumption in Oregon and Washington[46]



Because driving slumped here before it did in the rest of the nation, we're among the first to confront the fiscal fallout of stagnating gas tax revenues.

Like many states across the country, Washington and Oregon financed highway expansion by floating bonds, intending to pay for highway construction by tapping

into ever-growing fuel tax collections anticipated in the future. But flat-lining gas tax receipts have driven the region's transportation officials into a panic. Oregon recently announced that flat or declining revenue from the gasoline tax, coupled with rising debt payments, decreased federal funding, and increasing construction costs, could force deep cuts in the state's transportation budget in the next several years.[47]

Washington is in even worse shape. After years of denial, the state recently slashed long-term revenue forecasts by billions of dollars.[48] But since the state back-loaded interest payments on many of its highway bonds, its debt obligations will rise even if fuel tax receipts dip. Within just a few years, more than 70 percent of the state's gas tax receipts will go to pay off debts on projects that have *already* been completed—leaving precious little gas tax revenue for maintenance of existing roads, let alone new construction.[49]

Both Oregon and Washington have flirted with tolling to finance new highways—gambling that drivers who are reluctant to pay for expensive gas will prove willing to pay costly tolls instead. Washington took a foray into toll-financed construction on the Tacoma Narrows Bridge. But the fiscal outlook for the project is grim. Traffic across the new span has fallen,[50] rather than growing as anticipated,[51] leaving a widening gap between toll collections and the rising payments for construction debt. At the same time, a high-occupancy toll (HOT) lane pilot project southeast of Seattle has generated far less revenue than hoped.[52] And the state has been forced to slash its projected toll revenue from a tunnel project under downtown Seattle; the state now expects to raise at most $200 million in tolls[53] towards a $4 billion project.[54]

In short, Washington's and Oregon's transportation agencies are speeding towards a fiscal cliff of their own making. If anything, they're stepping on the accelerator by continuing to move forward with costly megaprojects—wider highways, bigger bridges and a budget-busting tunnel—that the states don't need and can't afford.

One obvious solution to the Northwest's transportation finance crisis is to cancel, or at least downsize, some of these megaprojects. (Who needs bigger highways if traffic isn't growing?) Yet so far, transportation officials see flat-lining traffic simply as the cause of a funding shortfall, rather than an opportunity to rethink the region's road construction priorities.

It took the Northwest states nearly a decade to accept that a sea change in car travel trends had sown the seeds of a transportation revenue crisis. Let's hope it doesn't take another decade to accept that the best solution to that crisis is to scale back our highway-building ambitions, so that they match both our financial means and our newly restrained driving habits.

Sightline Institute is an independent, nonprofit research and communications center based in Seattle, dedicated to making the Pacific Northwest a global model of sustainability—strong communities, a green economy and a healthy environment.

Table 2. Factors that Influence Driving: Past, Present and Future[55] (Green = Indicates Higher Per-Capita Driving, Yellow=Neutral, Stable or Unknown, Red=Indicates Lower Per-Capita Driving)

	Driving Boom	Recent	Future
Labor Force Participation Rate	Rapid increases due to increased participation of women, demographic bubble	Declining	Declining due to Baby Boomer retirements
Speed of Automobile Travel	Increasing due to highway and vehicle improvements	Stable or declining	Unlikely to improve in the absence of major technological changes
Share of Population of Peak Driving Age (35-54)	Steadily increasing due to Baby Boom	Declining	Declining in short term, increasing slowly thereafter, but not above previous Baby Boom peak
Cost of Gasoline	Mostly stable and low	Increasing, followed by relative stability at higher level	Projected to remain high
Vehicle Ownership	Increasing to near-universal vehicle ownership	Stable or declining	Unknown, but potential for further growth above historic, near-saturation highs is limited
Driver's Licensing	Increasing to near-universal licensure	Declining	Unknown, but unlikely to exceed previous peak
Use of Non-Driving Modes	Dramatically decreasing, then stagnant	Increasing	Unknown, though demand for transit among younger and older Americans could be expected to increase

In 2011, Americans took nearly 10 percent—or 900 million—more trips via public transportation than they had in 2005.[39] That growth in transit use continued through 2012, despite reductions in service and increases in fares in many cities in the wake of the Great Recession.[40] A 2011 American Public Transportation Association survey of transit agencies found that more than half had either increased fares or cut service since the beginning of 2010, while more than 20 percent of the agencies had both raised fares *and* cut service.[41]

Public transportation isn't the only non-automobile mode to experience an increase in recent years. For example, the

number of workers commuting to work by bike increased by 39 percent between 2005 and 2011, while the number of people commuting on foot increased by 20 percent between 2005 and 2009.[42]

In addition, in recent years, advances in mobile technology have enabled a range of new transportation options—from bike sharing to car sharing to ride sharing—to take root in an increasing number of cities. (See page 26.) It is too soon to determine how these new options might change transportation behaviors over the long term, but they create the potential for further changes in transportation habits that could affect overall demand for driving in the years to come.

Summary

The Driving Boom of the second half of the 20th century coincided with rapid economic, cultural and demographic changes in the United States. Those changes largely pointed in the same direction: toward a more automobile-oriented society.

Many of those trends, however, have either reached their natural limits or have reversed direction. (See Table 2.) A review of those trends points to the conclusion that the trajectory toward increased per-capita driving that prevailed during the Driving Boom has likely reached its end, and that the levels of per-capita driving achieved in the early 2000s are unlikely to be surpassed in the foreseeable future.

What Comes Next? How the Millennials Will Determine the Future of Transportation

Transportation infrastructure lasts for decades. The investments we make in transportation infrastructure, therefore, must be based on anticipated future needs at least as much as the needs of today.

For decades, transportation planners have assumed that economic and population growth would create continuous increases in demand for driving, necessitating new and ever-wider highways to alleviate the crippling congestion that was sure to follow. Over the last decade, though, those anticipated increases in driving have failed to materialize.

The degree to which driving will increase in the future depends crucially on the Millennial generation—otherwise known as "Generation Y"—those born between 1983 and 2000. In 2010, the Millennials surpassed the Baby Boomers as the largest generation in the United States, with the more than 77 million members of the Millennial generation accounting for nearly one in four Americans.[56]

By the end of this decade, Millennials will begin moving into what has traditionally been the peak driving age (35 to 54 year-old) demographic, and by 2030 they will represent the vast majority of the members of that age group. As a result, the evolving driving behaviors of the Millennials will be a key determinant of whether the trend toward stagnating vehicle travel will continue, reverse or even accelerate in the years to come.

Defining the Generations

There is no standard definition of generational boundaries. In this report, generations are defined as follows:

- **Baby Boomers:** those born between 1946 and 1964
- **Generation X:** those born between 1965 and 1982
- **Millennials (Generation Y):** those born between 1983 and 2000
- **Generation Z:** those born after 2000.

The New Transportation Habits of the Millennials

No age group has experienced a greater change in its driving habits than young Americans.

According to the National Household Travel Survey, from 2001 and 2009, the annual number of vehicle-miles traveled by 16 to 34 year-olds (a group that included a mix of Millennials and younger members of Generation X) decreased from 10,300 miles to 7,900 miles per capita—a drop of 23 percent.[57] (See "Generation X Has Also Reduced its Driving," next page.)

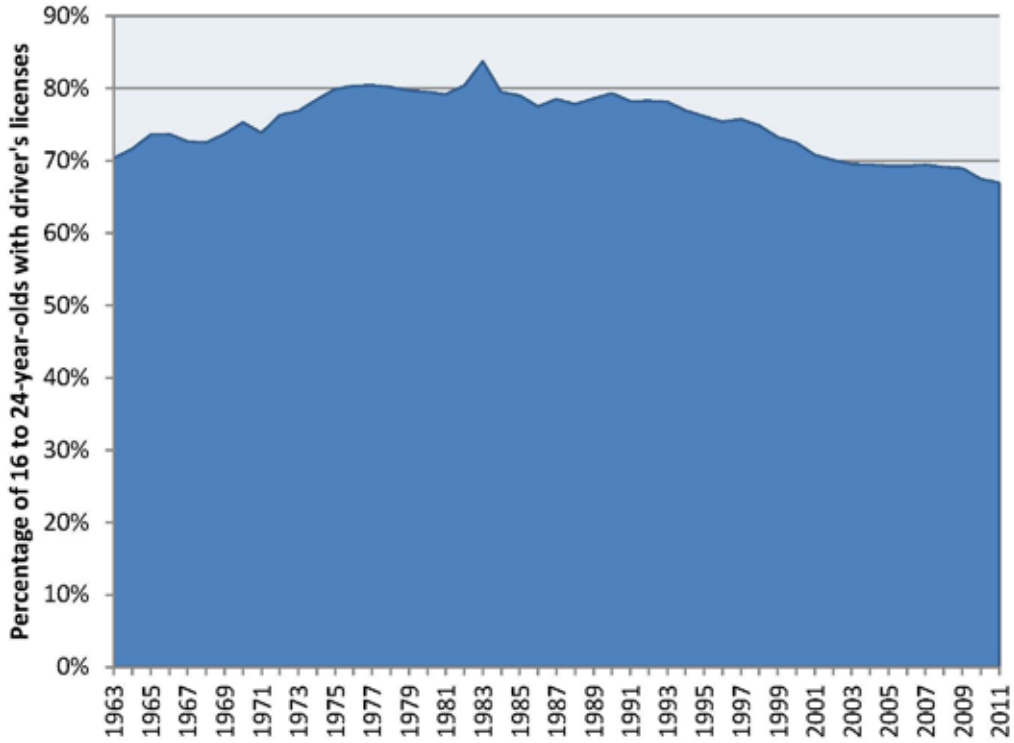
The percentage of young people with a driver's license has been dropping for years. In 2011, the percentage of 16 to 24 year-olds with driver's licenses dipped to 67 percent—the lowest percentage since at least 1963.[58]

While young Americans are driving less than they did at the beginning of the 2000s, they have increased their use of other forms of transportation. In 2009, 16 to 34 year-olds as a whole took 24 percent more total bike trips than they took in 2001, despite the age group actually shrinking in size by 2 percent. From 2001 to 2009, the number of passenger-miles traveled per capita by 16 to 34 year-olds on public transit increased by 40 percent.[59]

Why are Millennials driving less? The economy is likely one factor. The recession has been particularly difficult for young Americans—reducing job prospects, curtailing disposable income, and causing many young people to delay forming new households.

However, there are a number of compelling reasons to believe that the economy is not the only factor at play:

Figure 7. Percentage of 16 to 24-Year-Olds with Driver's Licenses[58]



Generation X Has Also Reduced its Driving

Recent changes in transportation behavior among members of the Millennial generation have attracted great notice, and for good reason—the changes in driving patterns in the United States have been most dramatic among the Millennials, and as America's largest generation, the preferences and habits of the Millennials have the greatest implications for the future.

However, Millennials were not the only Americans to reduce the number of miles they drove during the 2000s. Members of Generation X (those born between 1965 and 1982) also experienced declines in per-capita driving. Among younger "Gen X'ers" between 30 and 34 years of age in 2009, per-capita driving fell by 17 percent relative to drivers of a similar age in 2001, with a similar decline among those 35 to 39 years of age. The oldest members of Generation X—those between 40 and 44 years of age in 2009—experienced only a slight 3 percent decline in per-capita driving relative to 2001.[60]

- **Driving started to decline before the start of the recession:** The trend toward reduced per-capita VMT began long before the recent recession. Per-capita vehicle travel peaked in 2004, while the recent recession did not begin until the fall of 2007.

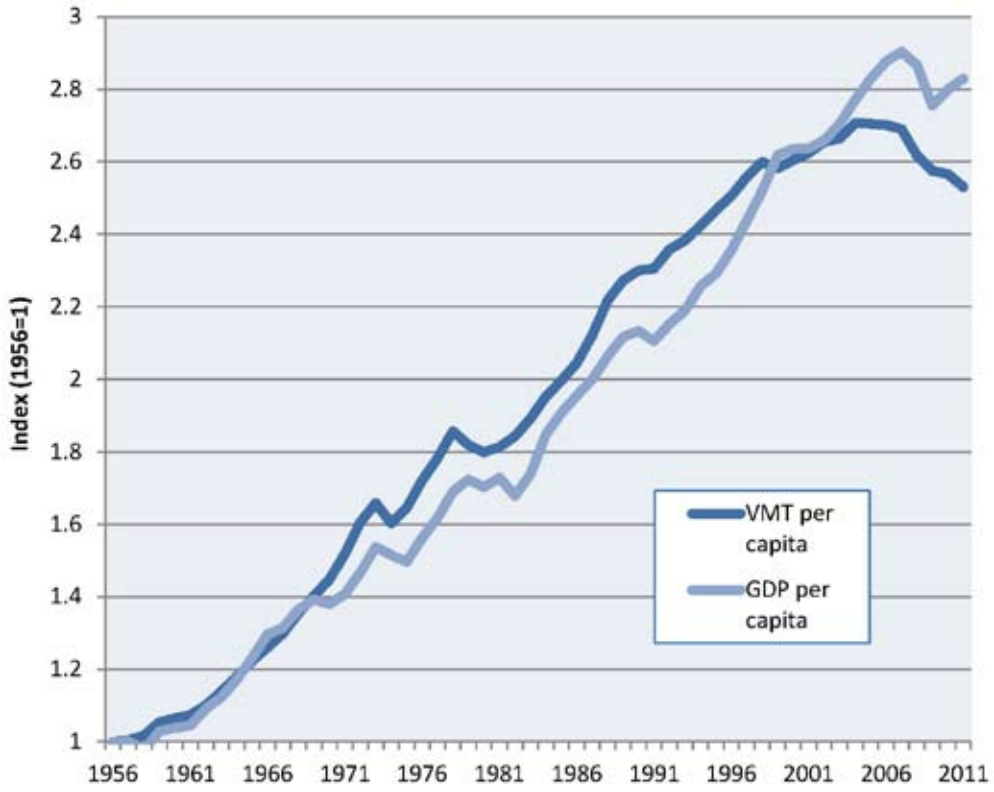
- **Driving has fallen among those with jobs:** Among young people, per-capita driving declined among both those with jobs and those without them between 2001 and 2009. Among 16 to 34 year-olds with jobs, per-capita vehicle travel declined by 16 percent during that time span.[61]

- **Driving and economic growth have diverged:** After moving in lockstep for decades, trends in economic growth and growth in vehicle travel have diverged in recent years, with per-capita GDP generally growing faster than per-capita vehicle travel since the late 1990s, suggesting that economic growth and vehicle travel are no longer as closely correlated as they once seems to be. (See Figure 8.)

- **New limits have been imposed on young drivers:** Between 1996 and 2006, every state one but one enacted a Graduated Driver's Licensing law.[62] These laws impose restrictions on young drivers, limiting the conditions under which new drivers may operate a vehicle and imposing additional costs, thereby discouraging driving.

The recent recession no doubt reduced the number of miles young Americans drove, but the economy is clearly not the only factor at play. Members of the Millennial generation have expressed a greater willingness to pursue less auto-oriented lifestyles than previous generations, and have been the first to grow up with access to the mobile Internet-connected technologies that are reshaping society and how people connect with one another. These changes could be playing a role in the dramatic reduction in driving among young Americans.

Figure 8. Trends in Per-Capita Vehicle-Miles Traveled and Real Gross Domestic Product [63]



For decades, economic growth and vehicle travel were closely correlated. Since the beginning of the 21st century, however, economic growth and vehicle travel have diverged, suggesting a weakening link between the state of the economy and the number of miles Americans drive.

Transportation and Lifestyle Preferences of the Millennials

In survey after survey, Millennials express preferences for housing and transportation that differ—sometimes markedly—with those of older generations.

Walkable Neighborhoods

Millennials are twice as likely as Baby Boomers and Generation X'ers to express a desire to live in a city.[68] According to a survey by the National Association for Realtors, conducted in March 2011, 62 percent of people ages 18-29 said they would prefer to live in an area described as having a mix of single family houses, apartments and condominiums, with stores, restaurants, libraries, schools and access to public transportation nearby, than in a sprawl-style neighborhood. The percentage of young people who preferred to live in mixed-use, walkable neighborhoods was between four and 11 points higher than that of all other age groups.[69] Nearly two-thirds of Millennials surveyed for an Urban Land Institute report in 2011 said

Implications of Changing Driving Trends: The View from Wisconsin

By **Bruce Speight, WISPIRG Foundation**

Wisconsin continues to spend heavily on new road capacity and highway expansion, despite the fact that Wisconsinites are driving less.

The average Wisconsinite drove nearly 500 fewer miles in 2010 than in 2004, when total and per-capita VMT peaked. Yet, Wisconsin's transportation spending plans and recent state budgets have been tone deaf to these emerging trends. A January 2013 WISPIRG Foundation report found that Wisconsin has committed a disproportionately large amount of its planned spending to building new and wider highways. Wisconsin ranked 11th among the 50 states in the percentage of funds it is committing to new road capacity, with 30 percent of its State Transportation Improvement Plan (STIP) designated for new capacity, compared to a national average of 20 percent.[64] Those investment choices appear strange, not only because of the recent reductions in driving but also because Wisconsin's population is expected to grow much more slowly than the U.S. population over the next several decades.[65]

The trends hardly justify diverting limited transportation resources from other transit and repair needs to major highway expansion projects. But that is exactly what state leaders have done. In the 2011-2013 biennial budget, state leaders increased the major highway budget by nearly 10 percent, while decreasing state funding for transit systems by 10 percent, as well as cutting funding for local road repair.

Major components of Wisconsin's transportation system are crumbling and in some cases inadequate. According to a 2008 report, 43 percent of Wisconsin's roads were rated as being in "less than good" condition, and 1,142 structurally deficient bridges in Wisconsin stood in need of repair in 2010. Drivers in Wisconsin pay an average of an extra $281 per year in vehicle operating costs due to the poor condition of our roads and bridges.[66]

Shrinking transit systems, meanwhile, are leaving Wisconsinites with fewer options for travel. With state budget cuts to transit agencies, local transit systems are increasingly cutting service, raising fares, or both. A University of Wisconsin Milwaukee study found that in Milwaukee, bus service miles have been reduced by nearly 20 percent since 2001. As a result, tens of thousands of jobs have become inaccessible to Milwaukee residents, making economic recovery more difficult for both the city and the state.[67]

The time has come to reevaluate the state's transportation planning process to ensure that transportation investments reflect population, demographic and transportation trends.

WISPIRG Foundation is a non-profit organization that works to protect consumers and promote good government.

that walkability was essential (14 percent) or preferable (50 percent) in their housing choices.[70]

Changing Values and Preferences

According to a recent survey by KRC Research and Zipcar, 44 percent of young people (18-34 years old) polled said they have consciously made an effort to replace driving with other transportation options—this is compared with 33 percent of those aged 35 to 44 and 26 percent of those 55 years old and up.[71] A survey conducted by RCLCO in 20 major metropolitan areas found that 20 percent of Millennials would consider giving up a car as an unjustified expense, a far higher percentage than other generations.[72]

Fading Car Culture

Mobile communications and computers have supplanted cars as the most important technology in the lives of Millennials. According to a survey conducted for Zipcar, 35 percent of those aged 18 to 34 believe that losing their computer would have the greatest negative impact on them, with 30 percent saying that loss of their mobile phone would be most negative. Only 28 percent said the same thing about their car. Baby Boomers ranked these choices in the opposite order, with nearly half of those aged 55 and up reporting that losing their car would have the greatest negative impact on their life, while 31 percent said the same thing about their computer and only 7 percent said their mobile phone.[73] Nearly two out of three college students responding to a 2011 survey by computer networking company Cisco said that they would choose an Internet connection over access to a car.[74]

Millennials are also less likely to express an interest in automobiles as a hobby or cultural phenomenon: less than 15 percent of Millennials describe themselves as "car enthusiasts" as opposed to 30 percent of Baby Boomers.[75]

The Mobile Technology Revolution, Millennials and Transportation

The use of mobile, Internet-connected technology has increased at almost incomprehensible speed. As recently as October 2010, according to the Nielsen market research firm, only 29 percent of all mobile phones in the United States were smartphones.[76] Less than two years later, that figure had nearly doubled to 55.5 percent.[77]

No generation has adopted high-tech lifestyles as quickly or as enthusiastically as the Millennials. Internet use is near universal among Millennials, with 95 percent of 18 to 29 year-olds using the Internet compared to 52 percent of those 65 years old and up.[78] Two-thirds of young adults (18 to 29) own smartphones, compared with 45 percent of the population overall.[79] Cell phone owners between the ages of 18 and 24 exchange more than 100 text messages *per day* on average, compared with 41 for the population as a whole.[80]

Technology has created revolutionary changes in Millennials' social and economic lives. Three-quarters of 18 to 24 year-olds were using social networking by December 2008, a time when less than one-third of Americans over the age of 35 were using the technology.[137] A survey by computer networking equipment maker Cisco in 2012 found that two-thirds of college students and young professionals spend at least as much time with friends online as they do in person.[81] Young people report being more likely to purchase items online rather than traveling to a store, and more likely to choose to spend time with friends online than driving to see them.[82]

The spread of mobile, Internet-connected technology has the potential to change transportation just as it has changed other aspects of society. Specifically:

- **Mobile technology makes non-driving travel options more appealing.** Mobile technology can remove many of the day-to-day barriers that dissuade people—especially casual users—from using public transportation. New mobile apps allow transit riders to obtain real-time information on arrivals and departures, gain assistance with route and schedule planning, and even pay fares by smartphone. Because these tools are relatively new, there is little research on their impact on transit utilization, though a recent study found that the launch of real-time bus information in Chicago had led to a modest increase in bus ridership.[83]

  Mobile technology also allows transit riders to engage in recreational or job-related activities while riding—something that is difficult and dangerous to do while driving—and provides pedestrians and bicyclists with access to navigational information, including the location of nearby stores, transit stops and other amenities.

- **Mobile technologies enable new transportation options.** The past several years have seen an explosion of new transportation alternatives that rely on the Internet or mobile technologies. Several varieties of car sharing, bike sharing, taxi-booking services, and real-time ride sharing have come onto the scene. Again, with the exception of traditional car sharing (which has become mainstream and has been shown to reduce vehicle travel[84]) it is too early to tell if any of these new transportation options will gain broad acceptance or make a significant impact on vehicle travel. Each of them, however, create new options that travelers can use to reduce the need to own a personal vehicle.

- **Mobile technologies can substitute directly for driving.** Telework, e-shopping, social networking, teleconferencing and distance education all have the potential to substitute for trips that might once have been made by car. Research on the impact of activities such as telework and e-shopping on vehicle travel has been mixed, though most studies suggest that telework leads to a reduction in VMT.[85]

Unsurprisingly, Millennials have been the most likely to report having used these new, technology-enabled alternatives. According to the recent Zipcar survey cited above, 25 percent of those aged 18 to 34 reported that mobile transportation apps (such as taxi apps, real-time transit information and car sharing) had reduced their driving frequency, compared with only 9 percent of those 55 years of age and older.[86] People who use these apps quickly come to rely on them—when a popular bus-tracking application in Washington, D.C., ceased functioning in December 2012, the company's in-box was quickly flooded with more than 7,000 angry e-mails from customers.[87]

Summary

Millennials are demonstrating significantly different lifestyle and transportation preferences than older generations. They drive less on average than previous generations of young people. More of them say they wish to live in cities and walkable neighborhoods. And more of them are drawn to forms of transportation other than driving. Moreover, the Millennials are the first generation whose lifestyles are shaped by the availability of mobile, Internet-connected technologies, social media, and the innovative forms of social connection, commerce

and mobility that those technologies are spawning.

There is a chance that the differences in transportation and lifestyle habits currently demonstrated by Millennials may fade as they age. But it is also possible that cultural changes and advances in mobile technology will continue or even accelerate Millennials' transition away from driving—with massive implications for transportation policy.

How could the changing driving behaviors of the Millennials and subsequent generations affect overall demand for driving? And what implications would those changes have on transportation policy? The next two sections address those questions.

Americans Will Drive Less than Was Predicted a Few Years Ago. How Much Less Is Uncertain.

The maturing Millennials play a profound role in determining America's future transportation needs. It is too soon to tell whether their desire for less auto-intensive lifestyles will persist or even grow over time. It is increasingly clear, however, that Americans will likely drive far fewer miles in the future than government agencies forecast even a few years ago. That conclusion has powerful ramifications for transportation policy in the years to come.

Three Scenarios of Future Driving

One way to understand the potential implications of changing driving trends is through the use of **scenario analysis**. According to one definition, "A scenario is a tool for ordering one's perceptions about alternative future environments in which today's decisions might be played out."[88] Scenario analysis enables the public and policy makers to assess the likely implications of various "what ifs" of future trends. Scenarios are *not* predictions of the future, but rather visions of possible futures that may unfold.[89]

In this report, we present three simplified scenarios of future trends in driving up to 2040 as a means to consider the possible implications for transportation policy of various pathways. All three scenarios are built on a common set of population projections and demographic assumptions from the Census Bureau. (See "Methodology" for the full details on how the scenarios were constructed.)

In comparison to recent trends in vehicle-miles traveled per capita, the three scenarios are all quite conservative. None portray the possibility that per-capita driving might continue to decline at the annual pace it did for specific age cohorts between 2001 and 2009, much less accelerate. Nor does any scenario portray a future in which per-capita driving continues to fall for any age cohort after 2025. The amount of vehicle travel under scenarios with more aggressive or persistent reductions would fall far below any of those represented here, with far more dramatic consequences.

Back to the Future

The **Back to the Future** scenario assumes that the decline in driving in the United States since 2004 is a temporary "blip," not a lasting trend. It is consistent with a worldview that attributes the recent decline in driving largely to economic factors (such as slower economic growth and higher gas prices) and assumes that those conditions will fully reverse. The *Back to the Future* scenario is consistent with a world in which the housing and transportation preferences of Millennials increasingly come to mimic those of previous generations, economic growth returns to its brisk pace of the late 20th century, and the net effect of mobile, Internet-connected technology on demand for driving is minimal to non-existent. We represent the *Back to the Future* scenario by assuming that driving among members of a particular age group and sex will return to that group's per-capita driving levels of 2004 by 2020 and continue at those levels thereafter.

Enduring Shift

The **Enduring Shift** scenario assumes that the shift in driving behaviors that has occurred over the last decade is real and lasting. It is consistent with a worldview in which the shift in housing preferences toward walkable neighborhoods and embrace of a broader range of transportation choices by Millennials and others persists as they age and is adopted by future generations as they reach driving age. The *Enduring Shift* scenario represents a world in which the cost of gasoline continues to remain high, a revival of economic growth does not result in a proportional increase in vehicle travel, and changes due to advances in mobile, Internet-connected technology continue to alter patterns of vehicle ownership and reduce per-capita driving, but only to the degree they have already done so.

We represent the *Enduring Shift* scenario by assuming that drivers in each age and sex cohort retain the same relative size of their reduction in driving as they age that they experienced relative to the previous cohort of drivers their age between 2001 and 2009. For example, if 20 year-old males in 2009 drove 20 percent less than 20 year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than 31-year-old males did in 2001. Similarly, it is assumed that in 2030 this same cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16-to-24-year-olds did between 2001 and 2009. Thus, a 20year-old male in 2020 or 2030 will drive approximately the same amount as a member of this cohort did in 2009.

Ongoing Decline

The **Ongoing Decline** scenario assumes that the decline in driving that has taken place over the last decade is the beginning of a deeper change in transportation patterns. The *Ongoing Decline* scenario is consistent with a worldview in which the recent change in driving patterns among young people is but the start of a broader shift—driven by changes in technology and consumer preferences—that makes driving a less necessary or desirable task for daily living than it has been in the recent past. The *Ongoing Decline* scenario may also represent a world in which external factors—such as dramatically higher gasoline prices, increased concern about the environment, or prolonged economic malaise—will increase the level of urgency for individuals to find alternatives to auto-oriented lifestyles. This scenario does not suggest that driving will become obsolete for Americans, but rather that it will stabilize at a much lower level per-capita after a period of additional change.

We represent the *Ongoing Decline* scenario by assuming that the percentage reduction in driving behavior experienced by each cohort during the eight years between

2001 and 2009 will be replicated over the 16 years between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009.

Implications of Possible Futures

The three scenarios do not represent predictions of the future. Rather, they are intended to illustrate a range of plausible outcomes.

As can be seen in Figure 9, the *Back to the Future* scenario would result in a rapid return to overall VMT growth, though, due to demographic shifts, driving would still increase at a slower rate than in the past. Ultimately, VMT would increase by 24 percent by 2040. In the *Enduring Shift* scenario, overall VMT remains roughly at today's levels through the mid-2020s before rising again (though at a slower rate than in previous decades) as Millennials hit peak driving age, resulting in an 7 percent increase in VMT in 2040. That 7 percent increase in VMT compares with a 21 percent increase in population over the same time span. In the *Ongoing Decline* scenario, total VMT declines steadily through the mid-2020s—bottoming out at a level roughly 19 percent below the peak VMT of 2007. VMT remains roughly stable thereafter and fails to ever regain its 2007 peak by the end of the study period in 2040.

These three scenarios represent dra-

Figure 9. Vehicle-Miles Traveled under the Three Scenarios, 1946-2040

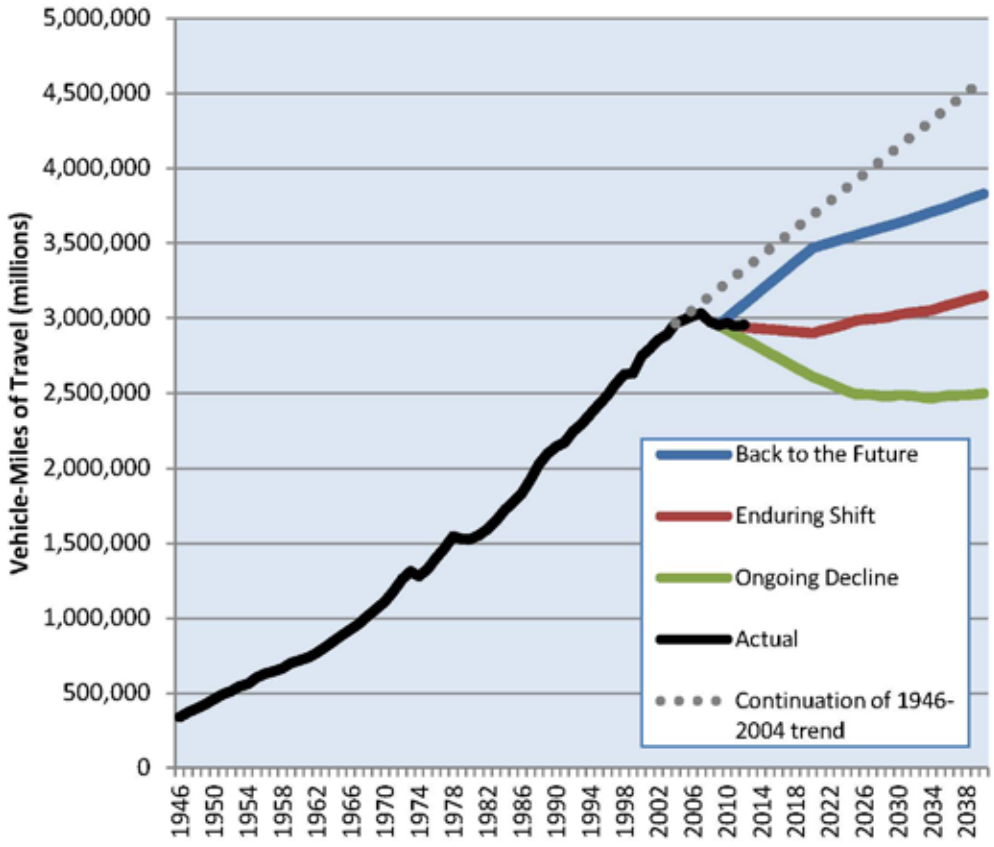
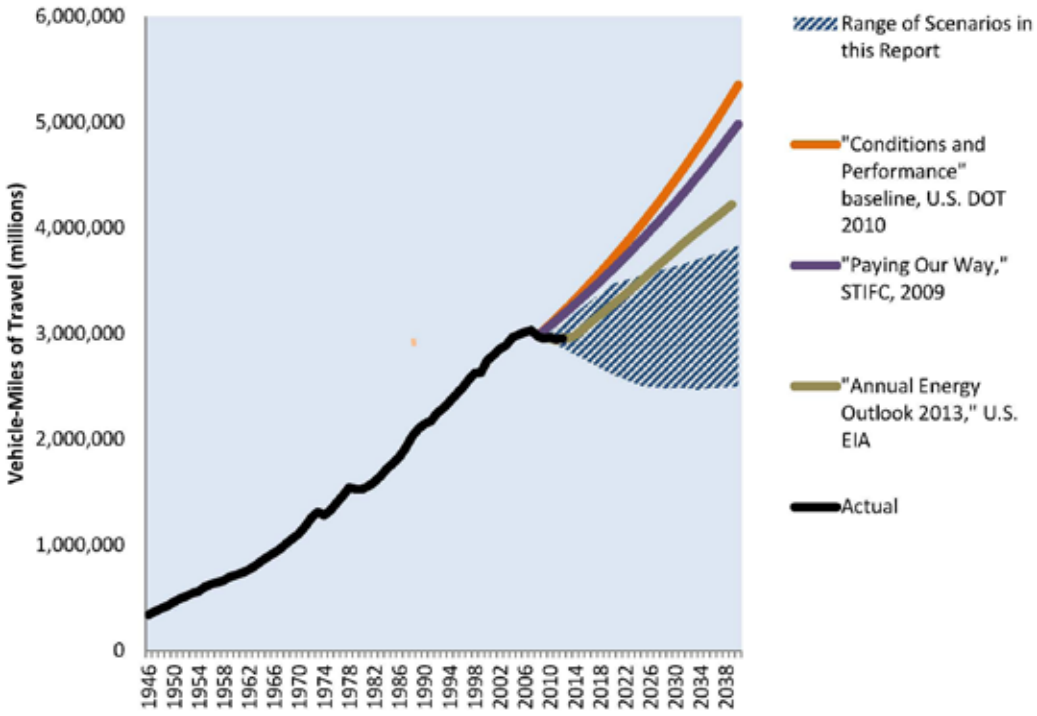


Figure 10. Recent Government Forecasts Compared with the Three Scenarios of VMT, 1946-2040



U.S. DOT = U.S. Department of Transportation
STIFC = Surface Transportation Infrastructure Financing Commission
U.S. EIA = U.S. Energy Information Administration

matically different visions of the future. By 2040, the difference in VMT among the three scenarios reaches nearly 1.3 trillion miles. All three scenarios, however, represent a break from the trend in driving during the Driving Boom era. Had those trends continued without change, Americans could have been expected to drive more than 4.5 trillion miles by 2040.

The "starting point" for each of the three scenarios is 2009—the last year for which data on vehicle travel by age are available from the National Household Travel Survey.[90] Actual aggregate VMT data from 2010, 2011 and 2012 have so far tracked nearly exactly with the *Enduring Shift* scenario. This does not necessarily mean that the *Enduring Shift* scenario is most likely to represent future driving trends. It does mean that neither the rapid return to previous levels of driving assumed by the *Back to the Future* scenario nor the deeper trend away from driving described by the *Ongoing Decline* scenario appear to have yet begun.

While the three scenarios differ greatly with one another, *all three scenarios* would represent a departure from recent government forecasts of future driving. Figure 10 above compares the range of VMT from the three scenarios above with three recent government documents that forecast future VMT growth rates:

- *Paying Our Way*, the 2009 report of the National Surface Transportation Infrastructure Financing Commission (STIFC), a blue-ribbon panel created by Congress to evaluate the nation's transportation funding needs.[91]

- The U.S. Department of Transportation's (U.S. DOT) *2010 Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance ("Conditions and Performance")* report, the latest in a series of biennial reports to Congress on the status of the nation's transportation system.[92]

- The U.S. Energy Information Administration's (U.S. EIA), *Annual Energy Outlook 2013: Early Release*, the latest in a series of annual forecasts of energy use in the United States.[93]

Only the most recent of these projections—published by the EIA—is near the boundaries of the three scenarios evaluated here. (Although previous EIA forecasts have failed to foresee the recent decline in driving, see page 41.) Indeed, actual levels of vehicle travel have already diverged from the government forecasts made a few years ago, which were issued after the start of the recession and after several years of declining per-capita travel.

While we cannot be certain about the magnitude of future changes in driving trends, it is increasingly clear that Americans will drive significantly fewer miles in the future than was forecast even a few years ago. And if Millennials and others continue to reduce their driving relative to previous generations of Americans, it is possible that future driving behaviors will diverge from those predictions even more dramatically.

Changing driving trends have many important implications for transportation policy and various aspects of American life. The following section explores these implications in detail.

The Implications of Changing Driving Trends: Opportunities and Challenges

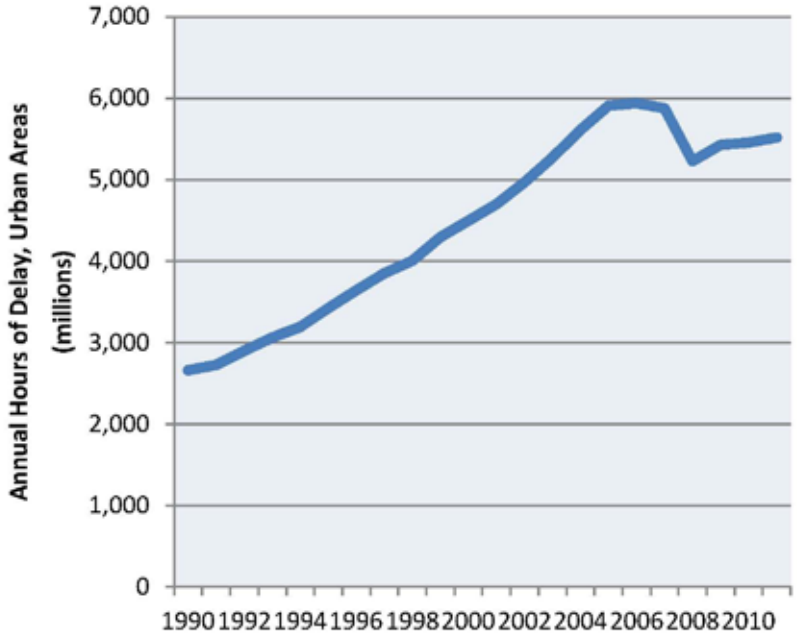
Changing trends in driving both create great opportunities and pose significant challenges to the United States. Flagging demand for driving curbs the threat of traffic congestion, reduces oil consumption and its resulting pollution, curtails the potential need for expensive new investments in highway expansion, and reduces the wear and tear on our roadways. However, reduction in the rate of growth in driving also threatens the stability of the nation's transportation funding system, which is already failing to meet its obligations.

Less Congestion

As driving has fallen in recent years, so has traffic congestion. According to data from the Texas Transportation Institute's (TTI) Urban Mobility Report, Americans spent 421 million fewer hours stuck in traffic in 2011 than they did in the peak congestion year of 2005.[94] After decades of increasing road congestion, Americans now spend less total time stuck in traffic than they did in 2004, according to the TTI analysis—despite an 8.5 percent increase in urban population over that span of time.[95] Congestion continued to fall in 2012, according to the travel monitoring company, INRIX, which estimated that congestion fell by a whopping 22 percent in 2012 before ticking up again in the opening months of 2013.[96]

Congestion levels do not necessarily track with total VMT. If vehicle travel is rising in urban areas and declining in rural areas, or if individuals are shifting travel to more-congested highways or times of day in which congestion is more likely, it is quite possible for congestion to increase even amid stagnating VMT. It is likely, however, that a rapid rise in VMT such as that posited in the *Back to the Future* scenario would cause a rise in congestion, while the *Enduring Shift* scenario would result in congestion remaining at roughly today's levels for at least another decade, and the *Ongoing Decline* scenario resulting in further reductions in congestion. None of these scenarios would result in congestion

Figure 11. Hours Lost to Traffic Delay Annually, 1990-2011[97]



levels that would be predicted by models that assumed the steady increases in VMT common during the Driving Boom.

Thus, transportation investment can safely focus less on preventing massive increases in traffic congestion and more on other priorities.

Reduced Fossil Fuel Consumption and Air Pollution

Gasoline consumption for transportation—which accounts for 45 percent of America's consumption of oil—contributes to a litany of problems.[98] It leaves America dependent on foreign regimes for oil (contributing to national security challenges and the trade deficit), it contributes to global warming and to dangerous air pollution in our cities, and it leaves Americans' pocketbooks vulnerable to volatile swings in world oil prices.

The recent reduction in driving in the United States has helped reduce our dependence on oil. In 2011, U.S. gasoline consumption for transportation hit a 10-year low, due in part to both stagnant driving and improved vehicle fuel economy.[99] The decline in transportation oil consumption was one of several factors contributing to a reduction in petroleum imports to their lowest level since 1995.[100] Emissions of carbon dioxide, the leading global warming pollutant, from transportation were the lowest since 1999.[101]

Consumption of energy for light-duty vehicles is expected to decline in the next several decades as a result of improved fuel economy. However, fuel consumption would decline even more under scenarios with greater reductions in vehicle travel. By 2040, for example, the *Enduring Shift* scenario would result in the United States

using the equivalent of 16 billion fewer gallons of gasoline per year for our cars and light-duty trucks than in the *Back to the Future* scenario—the rough equivalent of all the gasoline currently consumed each year in California. The *Ongoing Decline* scenario, meanwhile, would result in the nation using roughly half as much gasoline or alternative fuels in our cars and light trucks by 2040 as we use today. Proportional reductions in health-threatening air pollution and pollution that contributes to global warming could also be expected.

In sum, a future in which vehicle travel resembles the *Enduring Shift* or *Ongoing Decline* scenarios represents a great opportunity to reduce the nation's persistent problems with oil dependence, as well as the environmental and public health costs associated with our reliance on fossil fuels.

Reduced Expenditures for Highway Expansion and Maintenance

Reduced VMT growth can have a major impact on assumptions of future transportation investment needs. Reduced vehicle travel reduces congestion—undermining the cost-benefit rationale for many highway expansion projects—and reduces wear and tear, reducing the need for maintenance expenditures in the long run.

Two recent estimates of highway investment needs illustrate the dramatic savings that are possible by reducing vehicle travel. The U.S. Department of Transportation's 2010 *Conditions and Performance* report evaluated two scenarios for highway investment needs: one that reflected states' projections that VMT would increase by an annual rate of 1.85 percent per year, and another that reflected a more modest 1.23 percent per year increase. At the higher VMT projection, the department estimated that there was more than $105 billion in "cost-beneficial" spending that could occur each year, as opposed to $80 billion in the lower VMT scenario.[102]

Similarly, the American Association of State Highway and Transportation Officials' (AASHTO) 2009 *Bottom Line* report mapped out alternative transportation investment scenarios assuming 1.4 percent and 1.0 percent annual VMT growth going forward, with the 1.0 percent scenario costing 20 percent less than the one reflecting steeper growth.[103]

Maintenance needs are affected not just by the amount of traffic, but also by the types of vehicles traveling on roads and bridges. Heavy-duty trucks impose far greater damage on roads than light-duty vehicles.[104] As a result, a future in which there are fewer miles driven overall, but more of them in heavy trucks, could result in similar or greater wear and tear on highways. However, the number of miles driven in the heaviest trucks has actually declined *faster* than overall vehicle travel in recent years, falling by 11 percent between 2007 and 2011.[105] There is little evidence thus far for the proposition that reductions in household driving must coincide with an increase in heavy-duty truck traffic.

The *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios, therefore, can be expected to have dramatically different implications for future highway maintenance and construction needs, with the investments required under the *Back to the Future* scenario resembling those described by recent evaluations of transportation investment needs by AASHTO, the U.S. DOT and others. The *Enduring Shift* and *Ongoing Decline* scenarios, however, hold out the possibility that those needs might not be quite so great.

These scenarios speak to future maintenance needs, not the pressing need to

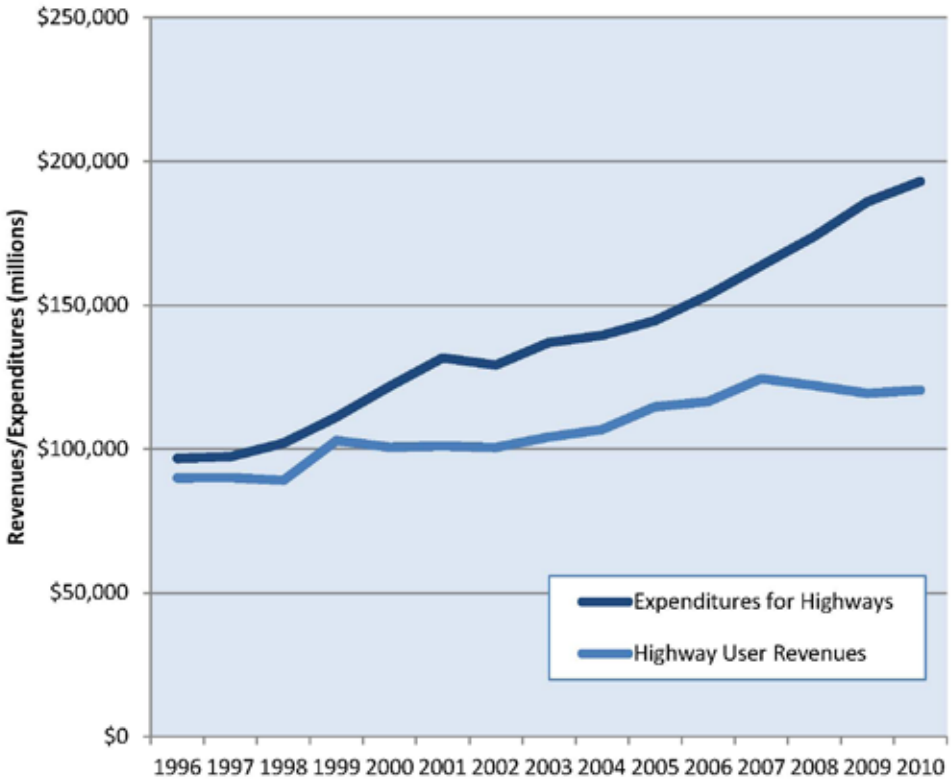
address the significant and mounting backlog of infrastructure repair projects in the United States at present. Shifting funds from highway expansion projects that may not be necessary in the future to repair and maintenance projects would be a reasonable response to any of the three scenarios.

Reduced Revenue from the Gasoline Tax

While reduced driving lessens the need for new highways and repairs of old ones, it also diminishes the amount of money available to fund transportation improvements by eroding the chief source of transportation revenue: the gas tax.

There remains a common misconception that "roads pay for themselves"—that is, that revenues from the gasoline tax are sufficient to cover the costs of highways and driving.[106] By 2010, revenue brought in from gas taxes and other user fees (not all of which is dedicated to highways[107]) equaled only 62 percent of highway spending by all levels of government.[108] In other words, for every two dollars of highway improvements paid for by drivers, general taxpayers chipped in a third dollar—a subsidy of $73 billion in 2010 alone. While projects paid for by the American Recovery and Reinvestment Act helped fuel the continued increase in road spending in 2009 and 2010—widening the gap between revenues and expenditures—the long-term trajectory has been toward increased dependence on general taxpayers for transportation funding, both at the federal level and in many states.[109]

Figure 12. Highway User Revenues versus Expenditures for Highways[110]



In 2009, the National Surface Transportation Infrastructure Financing Commission (STIFC) concluded that the nation faced a "crisis" in transportation finance. The commission concluded that making up the gap between anticipated revenues and the cost of investments needed to maintain the system would require an increase in state and federal gasoline taxes of 53 to 58 cents per gallon, or a per-mile fee on driving (VMT fee) of 3.2 to 3.5 cents per mile.[138]

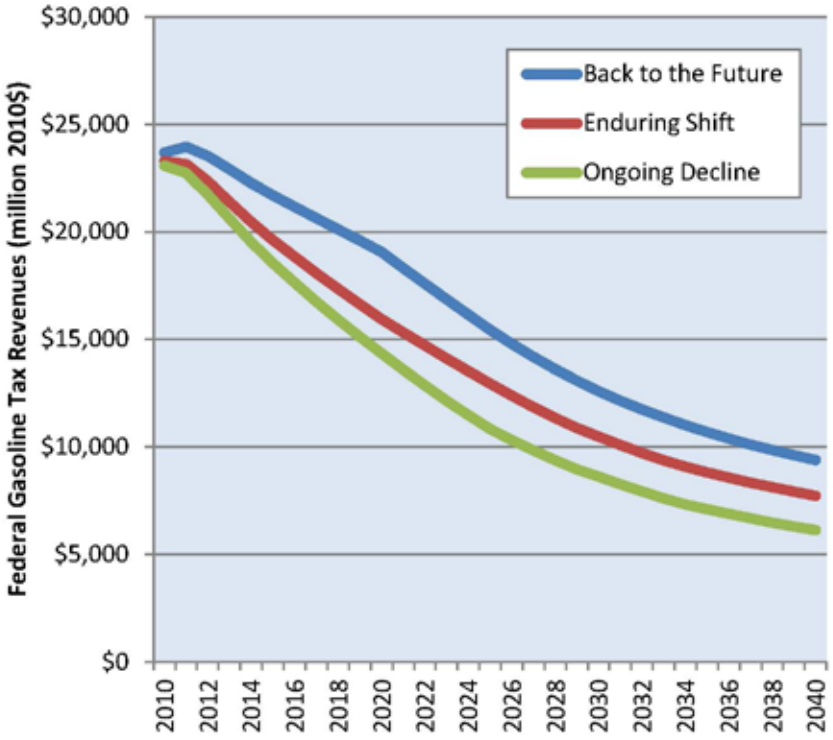
The recent trend toward reduced driving—coupled with continued moves to improve vehicle fuel economy—makes the commission's bleak revenue projections look positively rosy.

To estimate the impact of the various scenarios on federal gasoline tax revenue, we multiplied the light-duty portion of VMT under each of the three scenarios presented in this report[111] by the current federal gasoline tax rate of 18.4 cents per gallon and divided that figure by the fleet average real-world vehicle fuel economy (in miles per gallon) projected by the EIA in its *2013 Annual Energy Outlook*.[112]

All three scenarios would result in significantly lower real revenues in future years due to the effects of inflation and improvements in vehicle fuel economy, but the size of the reduction depends greatly on trends in vehicle travel. Under the *Back to the Future* scenario, gasoline tax revenue would decline by 60 percent by 2040 when corrected for inflation, relative to 2011 levels. Under the *Enduring Shift* scenario, the decline is a more significant 67 percent, while under the *Ongoing Decline* scenario it is 74 percent.

Since most states also fail to index their gasoline taxes to inflation, the decline in

Figure 13. Inflation-Adjusted Federal Gasoline Tax Revenue under the Three Scenarios (2010$)



the real value of the gasoline tax will be magnified.[113] The 36 states with flat rate (i.e., non-indexed) gasoline and diesel taxes have already seen a 29 percent erosion in the value of their fuel taxes since the last time those taxes were raised, contributing to a $10 billion decline in real state gas tax revenue.[114] Stagnation in driving, coupled with improving fuel economy and the effects of inflation, would compound the erosion of transportation funding at the state level as well.

Changes in VMT trends would also affect the sustainability of funding from VMT-based fees, a commonly proposed alternative to the gasoline tax. VMT fees would need to become significantly higher over time in order to generate the same amount of revenue.

Increased Risk for Public-Private Partnerships

As gasoline tax revenues have dried up, federal and state transportation officials have sometimes looked toward public-private partnerships (PPPs) as a potential alternative. There are many possible ways for government to partner with the private sector, including traditional forms of financing and procurement that raise private money through the municipal bond market and hire private contractors to provide materials and labor. But most of the attention given to PPPs involves the potential for a private entity to agree to build and/or maintain a highway for a given period of time in exchange for revenue—in many cases, from vehicle tolls.

Uncertainty regarding VMT trends reduces the attractiveness of toll revenue as a payout to private investors. Fewer investors will be willing to invest the massive amounts of capital required to build and maintain a toll road if the number of paying customers is not likely to rise over time. In 2005 and 2006, foreign toll road operators financed by large financial companies made large bets on future traffic volume by purchasing a 99-year lease in Chicago and a 75-year lease in Indiana for major toll roads. In each of these deals and many smaller ones, the private investors acted as concessionaires, collecting tolls for their own bottom line. Many people thought these toll concessions were the wave of the future.

Several toll concessions have produced less revenue than expected. Some have needed to be bailed out by the government. Others—such as a brand-new billion-dollar toll road in Texas that sought to attract traffic by posting the nation's fastest speed limit, 85 miles per hour—have faced the threat of a credit downgrade as a result of flagging traffic.[115] These shortfalls in privately collected tolls do not necessarily mean that the government received a "good deal," since more expensive private capital costs and other potential compensation must also be covered.[116]

More recently, the trend toward toll concessions has been replaced with an alternative form of long-term PPP arrangement in which private investors are paid a pre-established rate by the government for making toll lanes available.[117] A downside of using these so-called "availability payment" arrangements is that they merely shift the risk of lower-than-expected toll revenue from reduced travel from private enterprise to taxpayers, eliminating one of the important potential benefits claimed for PPPs.

The trend away from toll concessions and toward availability payments can be seen as an implicit bet by Wall Street and other investors against the idea that vehicle travel will return to the sustained growth of the Driving Boom years, and an indication that investors are seeking a hedge against VMT trends similar to those

in the *Enduring Shift* and *Ongoing Decline* scenarios.

Emergence of trends similar to those of the *Back to the Future* scenario would likely set off a resurgence of investor interest in toll road concessions, whereas the other scenarios would likely solidify the trend away from toll concessions. Another implication is that governments could doubly lose out if they invest in building and maintaining new toll lanes based on financing projections that assume the *Back to the Future* scenario. If the *Enduring Shift* or *Ongoing Decline* scenarios instead come about, then governments could find they have paid for new lanes that are both unneeded and fall far short of covering their expected costs.

Changing vehicle travel trends pose risks not just for private investors but for taxpayers as well—regardless of how the risks are distributed at the outset of a PPP arrangement.

Summary

Changing trends in driving bring with them tremendous opportunities, as well as significant challenges. Stagnant or declining VMT would significantly reduce many of the environmental and public health problems caused by driving, while reducing growth in congestion and alleviating the need for costly expenditures to maintain and rebuild highways. However, reduced driving has already contributed to the nation's transportation funding woes by eroding gasoline tax revenue, and it also poses major obstacles to potential funding sources that have been suggested as alternatives to the gas tax, including VMT charges and public-private partnerships.

Transportation policy in the United States should work to maximize the benefits of changing driving trends by supporting the desires of Millennials and others to reduce their driving, while also addressing the funding challenges posed by reductions in vehicle travel. The following section lays out a blueprint for how transportation policy could be revised to meet the needs of the 21st century.

A New Vision for Transportation Policy

The nation's current transportation policies were borne out of the needs of early to mid-20th century America. Those policies did an excellent job of raising money for and building new highway capacity. By the end of the 20th century, these policies had succeeded in completing the Interstate Highway System and largely financed the creation of a road network designed to encourage and accommodate the postwar Driving Boom.

The needs of 21st century America are different, but our transportation policies remain stuck in the past. We continue to spend vast sums on highway construction projects of dubious value, even as the highway infrastructure America built in the 20th century ages and deteriorates. Meanwhile, there is little recognition among policymakers that transportation trends have changed, or that the needs and desires of rising generations such as the Millennials may be different from those of previous generations of Americans.

America's current transportation policy framework is unproductive and unsustainable. The nation needs to hit the "reset" button on transportation policy to account for recent changes in driving habits and to create a transportation system that meets the needs of the 21st century.

A new vision for transportation policy in the United States begins with a few common-sense principles.

1. Plan (and invest) for uncertainty.

The evidence is clear that the Driving Boom—the 60-year period of regular, steady increases in per-capita driving—is now over. We don't yet know, however, what will replace it.

Are the changes that have occurred in driving behaviors—particularly among young Americans—temporary shifts that will be erased by renewed economic growth? Are they just the beginning of a more sustained shift away from auto-oriented lifestyles? Or is the reality somewhere in between?

The scenarios of future demand for driving presented in this report are *all* a sea change from the defining assumptions of the Driving Boom era, and

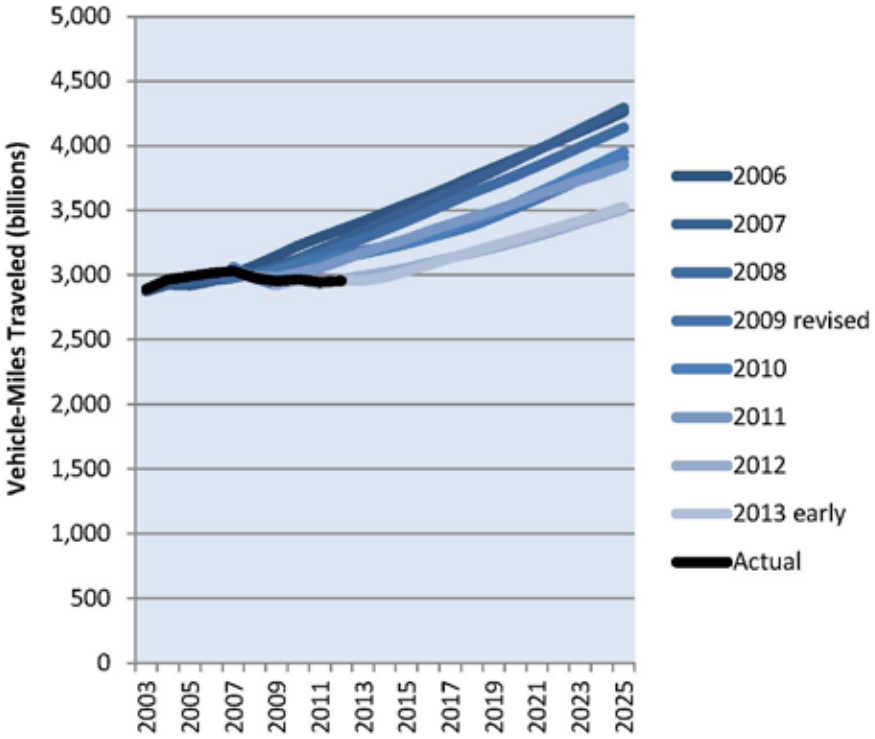
the investments suggested by any of these scenarios differ from those suggested by recent government forecasts that anticipated a return to rapid and sustained growth in vehicle travel. But differences in the three scenarios in this report illustrate a significant gulf between future possibilities. The investment decisions that would be required to accommodate the increase in driving in the *Back to the Future* scenario are vastly different than those that would be needed if the recent drop in driving is the beginning of a deeper decline. How can policymakers possibly make wise long-term investments in such an atmosphere of uncertainty?

The first step is for policymakers to stop pretending that future increases in driving are foreordained. Over the past decade, official forecasts have continued to predict steady, rapid increases in vehicle travel that have failed to materialize. For example, the U.S. Energy Information Administration (EIA)—which produces the official U.S. government forecasts of energy use—forecast in 2006 that Americans would be driving more than 3.3 trillion miles per year by 2012. Instead, Americans drove less than 3 trillion miles—10 percent fewer than had been predicted just six years earlier. Figure 14 shows how official forecasts have predicted a resumption of vehicle travel growth year after year, even as that growth has failed to materialize.

To the extent that these forecasts have influenced public policy, America likely finds itself today over-investing in highway capacity at the expense of other transportation and societal priorities.

Transportation planners and public officials must understand that there are important uncertainties in future demand for driving and that these uncertainties are unlikely to be properly accounted for

Figure 14. Recent Energy Information Administration Forecasts of Vehicle-Miles Traveled by Date of Forecast[118]



using assumptions developed during the Driving Boom.

The second step is for policymakers to incorporate uncertainty into transportation decision-making. Specifically, planners and policymakers should:

- Evaluate transportation proposals under a variety of scenarios of future driving. Regional transportation plans and individual project proposals should be tested against different scenarios for economic growth and gasoline prices, as well as changes in population, demographics and consumer preferences.

- Prioritize projects that are the most likely to deliver benefits under any scenario. Investments in transportation demand management, for example, may compare favorably with large highway expansion projects given that they deliver benefits under a variety of possible future conditions and may be lower in cost and risk.

- Incorporate uncertainty into cost-benefit equations and risk calculations for PPPs. Effective management of PPPs requires a sophisticated understanding of risk. To the degree that private sector entities involved in PPPs take on traffic-related risks in the construction of private toll roads or other infrastructure, the public must be able to understand the potential for and implications of possible default or bailouts. To the extent that the public takes on those risks by agreeing to make future "availability payments," decision-makers must clearly assess whether the benefits of the project are worth the costs under a variety of scenarios of possible future driving. Consideration of lower-VMT scenarios may be particularly important for selecting the recipients of the competitive federal "innovative financing" loans (under the Transportation Infrastructure Finance and Innovation Act, TIFIA), so as to avoid overstating the congestion-reducing merits and creditworthiness of highway PPPs.

2. Support the desire of Millennials and other Americans to drive less.

The Millennial generation is saying loud and clear that it is looking for alternatives to auto-oriented lifestyles. Reducing the growth in driving on American roads can bring great benefits to society—curbing the nation's dependence on oil, reducing congestion without the massive expense and disruption of expanding highways, and reducing emissions of air pollutants that threaten the environment and public health.

Considering that Millennials and subsequent generations will be the primary beneficiaries of the transportation infrastructure we build today (and the ones who will ultimately pay for it) why shouldn't the investments we make today reflect their needs, particularly if doing so would also deliver broad benefits to society?

At the local level, many city governments are beginning to respond to these new demands, with cities increasingly racing to add bike lanes, streetcars and other infrastructure that enables new transportation options. Development is also now booming in many urban centers. An EPA analysis found that "infill" development in already built-out portions of metropolitan areas attracted a greater share of new residential construction in the late 2000s than earlier in the decade

in nearly three-quarters of the metropolitan areas studied.[119] In 2011, the population of large cities grew faster than that of suburban areas for the first time in at least nine decades.[120] Some state governments are beginning to respond to these new demands as well.[121] But the bulk of America's transportation policy framework is still designed to make building highways easy and investing in other solutions difficult.

In the postwar years, when Americans expressed their desire for suburban housing and greater mobility, the full weight of federal and state governments swung into action, building the Interstate Highway System, enacting automobile-focused planning and zoning codes, and subsidizing new housing in the suburbs.

What might a transportation policy look like that did the same for the Millennials? At minimum, it would:

- Make the expansion of transportation choices to a broader range of Americans a national priority in the 21st century—much as the development of the Interstate Highway System was seen as a national priority in the 20th century.

- Encourage state and local governments to reassess automobile-oriented planning and zoning rules—prioritizing the development of streets and roads suitable for driving, bicycling and walking; revising zoning rules that stand in the way of compact, mixed-use development; and ensuring that transportation infrastructure investments are consistent with land-use plans.

- Refocus federal investment on transportation infrastructure projects that received less investment and attention during the Driving Boom, including investments in the nation's passenger rail network and in urban transit systems.

While the Millennials will play a critical role in determining future driving trends, transportation policymakers must obviously keep in mind the needs of *all* Americans. The aging members of the Baby Boom generation—largely concentrated in the suburbs—will soon find themselves with new transportation needs. Federal, state and local governments must also consider how the changing mobility needs of the Baby Boom generation will affect demand for public transportation and paratransit services in areas that are often poorly served by current transit systems and must devote resources toward serving those needs.

3. Revisit plans for new or expanded highways.

Short-term and long-term transportation plans are filled with highway projects that were planned under very different expectations of future travel growth. Many of these "legacy projects" were originally proposed decades ago, and approved based on assessments of future travel made a decade ago or more.[122] Meanwhile, state and federal governments continue to invest vast resources in further expansions of highway capacity, despite nearly a decade of zero growth in vehicle travel. Between 2004 and 2008, states continued to devote 57 percent of highway funding to expansion projects, versus only 43 percent to system preservation.[123]

The assumptions of future growth in vehicle travel that undergird Long-Range Transportation Plans and short-term Transportation Improvement Programs appear to have not yet been reviewed in any systematic way since the close of the Driving

Boom. For example, the 2010 version of U.S. Department of Transportation's (U.S. DOT) biannual *Conditions and Performance* report—which provides a comprehensive view of the investment needs of the nation's highway and transit systems—was published in March 2012, well after the trend toward stagnant vehicle travel had become apparent. However, the U.S. DOT's study was based on state-supplied VMT growth forecasts that amounted to a 1.8 percent average annual growth rate in VMT—a rate of year-over-year growth that has not been achieved in *any* single year since 2004, and is more than double the average rate of growth between 2000 and 2010.[124]

The period of no growth or slow growth in vehicle travel is likely to continue for at least the next several years, if not longer. Even the Energy Information Administration's 2013 forecast, which anticipates an eventual return to sustained growth in driving, does not anticipate total VMT returning to its peak 2007 level until 2016.[125] If future driving trends more closely resemble those of the *Enduring Shift* scenario, it will be more than another decade before total VMT returns to its 2007 level; if trends resemble those in the *Ongoing Decline* scenario, they may not return to that level until after 2040, if ever.

This interregnum in vehicle travel growth provides an excellent opportunity to rethink previous transportation investments and reconfigure our priorities. Specifically, federal, state and local governments should:

- Begin an immediate review of projects on state and regional Transportation Improvement Programs and Long-Range Transportation Plans in light of new understandings about trends in vehicle travel. Projects that cannot be justified based on lower levels of expected traffic volume should be delayed or scrapped.
- Refuse to devote additional resources to new highway expansion projects unless the projects have been demonstrated to deliver significantly greater societal benefits compared with other transportation alternatives under a range of possible scenarios of future vehicle travel growth.

4. Refocus the federal role.

The recent sharp decline in federal fuel tax revenues—which has forced the infusion of ever-larger amounts of cash from the general fund to keep the Highway Trust Fund afloat—has led to a new set of conversations about the proper role of the federal government in transportation policy.

The federal government clearly has a role to play in making investments that address strategic national priorities. The current system, however, distributes highway funds to states with little accountability for results and no clear connection to broader strategic objectives.

The United States should establish clear, relevant national priorities for transportation investment. We propose the following priorities:

- The nation should set a goal of bringing the highway and transit systems to a state of good repair as soon as is practical.
- The federal government should serve the changing transportation needs of Americans by supporting the development of communities with multiple transportation options.
- The federal government should expand efforts to promote innovation in the application of technology and small-scale solutions to transportation chal-

lenges. A collection of inexpensive, small-scale fixes can sometimes be just as effective as a major infrastructure expansion in reducing congestion.[126] The advent of mobile Internet-connected technology provides more opportunities for such small-scale innovations. The federal government can help states to gain access to new solutions and to share their expertise and experiences with those solutions with one another.

Absent from this list of national priorities is expansion of the existing highway system. State and regional governments would be free, under this new vision of federal priorities, to propose highway projects as solutions to transportation needs, but no longer would those investments be first in line for federal taxpayer resources or receive a favorable federal match compared with transit projects or other transportation alternatives.

Once the nation sets clear priorities, all significant transportation investments should be evaluated based on the degree to which projects meet those objectives. The two-year federal transportation law passed in July 2012 (Moving Ahead for Progress in the 21st Century, or MAP-21) mandates the creation of performance metrics for states and the federal government, but those state metrics need not be established until years after the law has expired and will yield little benefit if they are not attached to clear triggers that reallocate transportation resources to better meet those goals and reward success.[127] The current law places light penalties on states that do not develop risk-based asset management plans after 2014 and can impose some light penalties for neglect of federally financed assets after 2018. While these provisions are a first step toward ensuring that transportation spending is aligned with true priorities and that the projects that receive federal funds are those that can deliver the greatest "bang for the buck," much more must be done to ensure the effectiveness and accountability of federal transportation spending.

5. Use transportation revenue where it is most needed.

America's transportation investments continue to be shaped by policies adopted nearly a century ago when paved roads were uncommon and the automobile was a novelty. In those years, state governments began to adopt statutory or constitutional provisions dedicating revenue from the gasoline tax to roads and bridges.[128] Many of these provisions remain in effect today, while the assumption that all revenues obtained from drivers should be spent for their exclusive benefit continues to shape the transportation debate.

The needs of 21st century America demand that we spend transportation revenue in ways that maximize the benefits for future Americans. Local, state and federal governments should be free to invest in transportation projects that deliver the greatest benefits to society. Outmoded constitutional provisions that bar the use of gasoline tax revenue for public transportation or other transportation alternatives should be discarded, while current federal policies that require transit projects to undergo a more difficult review process than highways or receive a less generous federal match should be eliminated.

6. Do our homework.

The recent decline in driving has exposed the inadequacy and inaccuracy of the current models and planning tools used

to guide infrastructure investments in the United States. At both the national and local levels, transportation planners have continually overestimated traffic demand.

After roughly eight years of stagnation in vehicle travel, the time has come to revisit whether we know everything we need to know about Americans' travel preferences and choices as we plan for the future.

Federal, state and local officials should launch renewed research efforts to investigate changing transportation trends and to evaluate the impact of new technologies and new patterns of development on accessibility and mobility. Key travel surveys—especially the National Household Travel Survey—should be conducted more frequently (ideally annually[129]) to provide better, more up-to-date information on transportation behaviors. State and local governments should also take steps to consider the implications of changing travel trends in their own planning processes.

Conclusion

The end of the Driving Boom has brought uncertainty to U.S. transportation policy. But it has also brought opportunity. A future of stabilized demand for driving is one in which roads last longer and are cheaper to maintain, traffic congestion remains stable or declines, America is less dependent on oil, and our cars produce less pollution.

The changing transportation priorities of the Millennial generation, the advance of new technology, and other changes provide an opportunity for the United States to create a new transportation policy that meets the needs of the 21st century. To achieve that goal, however, the nation must integrate our growing understanding of recent changes in transportation trends into every aspect of transportation decision-making, from the ways in which we estimate future transportation funding needs to the ways in which we choose our investment priorities.

We may not know the exact shape of the future, but it is increasingly likely that it will look very different from the past. By retiring Driving Boom-era assumptions and policies that no longer serve the nation's needs, we can build a transportation system that is more affordable, more efficient and more sustainable for the long haul.

Methodology

The scenarios presented in this report are intended to illustrate various visions for how aggregate vehicle-miles traveled (VMT) could change in the future, so as to better understand the implications of those changes on transportation policy. These scenarios are based on historic trends in per-capita VMT by age and gender from the National Household Travel Survey (NHTS), and projections of future population from the U.S. Census Bureau.

The three scenarios evaluated in this report—the *Back to the Future*, *Enduring Shift* and *Ongoing Decline* scenarios—align conceptually with the alternative hypotheses of future trends in driving ("interrupted growth," "saturation" and "peak car") suggested by Phil Goodwin in *Peak Travel, Peak Car and the Future of Mobility: Evidence, Unresolved Issues, Policy Implications and a Research Agenda*, International Transport Forum, discussion paper prepared for the roundtable on long-run trends in travel demand, 29-30 November 2012.

Constructing a Profile of Per-Capita VMT by Age and Sex

The scenario analysis required creation of a year-by-year estimate of per-capita VMT by age and sex. The NHTS includes estimates of vehicle-miles traveled by age category and sex for years in which the survey took place (2001, 2009). Data on annual vehicle-miles traveled by age group and sex were downloaded using the NHTS data extraction tool (nhts.ornl.gov/det/Extraction2.aspx) for the 2001 and 2009 surveys, and were divided by the number of licensed drivers of each sex in each age category (obtained from the FHWA's *Highway Statistics* series of reports) to arrive at a figure for VMT per licensed driver for members of each age group and sex.

To arrive at an estimate of average per-capita VMT for each age and gender, VMT-per-licensed-driver was multiplied by the number of licensed drivers of that sex and age group[130] from U.S. Department of Transportation, Federal Highway Administration, *Highway Statistics* series of reports, and divided by population for that age and sex from the U.S. Census Bureau.[131]

Population Estimates and Projections

Population estimates for the 2001 through 2010 period, broken down by age and sex, were obtained from the U.S. Census Bureau (www.census.gov/popest/data/intercensal/index.html). Population estimates for 2010 and 2011 were also obtained from the Census Bureau. Updated population projections for 2012 through 2040 were obtained from the U.S. Census Bureau in December 2012 (www.census.gov/population/projections/data/national/2012.html).

Constructing the Scenarios

This report uses three scenarios—*Back to the Future*, *Enduring Shift*, and *Ongoing Decline*—to illustrate the implications of various potential trends in per-capita household vehicle travel on transportation policy.

All three scenarios are built on estimates of household VMT, from which estimates of total VMT are calculated as described in the "Factoring in Non-Household VMT" section below. All three scenarios share a base year of 2009, the last year for which age and gender-specific VMT data are available. Household vehicle-miles traveled for 2009 were calculated by multiplying age- and gender-specific estimates of per-capita VMT in 2009 (calculated based on the NHTS and FHWA sources described above) by age- and sex-specific population estimates from the Census Bureau.

Back to the Future

The *Back to the Future* scenario assumes that average per-capita VMT by age and sex will return to its 2004 level by 2020 and continue at those levels thereafter.

For those of driving age (16 and older) at the time of completion of the 2009 NHTS, the following formula was used to estimate per-capita VMT for each sex and year of age, using linear interpolation between 2001 and 2009 values for per-capita VMT by age and sex to estimate values in the peak per-capita driving year of 2004:

$$PCVMT = PCVMT_{2001a} + \frac{\{((PCVMT_{2009a} - PCVMT_{2001a}) + (PCVMT_{2009a} - PCVMT_{2001b})) * 3/8\}}{2}$$

Where:

$PCVMT_{2009a}$ = *Per capita VMT by year of age and sex in* 2009

$PCVMT_{2001a}$ = *Per capita VMT by year of age and sex in* 2001

$PCVMT_{2001b}$
= *Per capita VMT by year of age and sex in* 2001 *of those of a particular age in* 2009
(*e.g. a* 21 *year old in* 2001 *who is* 29 *years old in* 2009.).

For those not of driving age in 2009, the formula is as follows:

$$PCVMT = PCVMT_{2001a} + ((PCVMT_{2009a} - PCVMT_{2001a}) * \frac{3}{8})$$

VMT per capita by age and sex were multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Enduring Shift

The *Enduring Shift* scenario assumes that drivers in each age cohort reduce (or increase) their driving as they age by the same percentage by which they changed their driving compared with an older cohort in 2009. For example, if 20-year-old males in 2009 drove 20 percent less than 20-year-old males did in 2001, it is assumed that eleven years later in 2020 they will similarly drive 20 percent less than did 31-year-old males did in 2001. In 2030, this same age cohort will drive 20 percent less than 41-year old males did in 2001. New drivers are assumed to reduce their driving (relative to 2001 per-capita driving levels by age) by the same percentage as 16 to 24 year-olds did between 2001 and 2009. Thus, a 20-year old male in 2020 or 2030 will drive approximately the same amount as members of that age group did in 2009. For those of driving age at the time of the 2001 NHTS, the formula for per-capita VMT by year of age and sex is as follows.

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}}\right)$$

Where:

$PCVMT_{2009a}$ = Per capita VMT by age and sex in 2009

$PCVMT_{2009b}$
= Per capita VMT by age and sex in 2009 for the cohort being measured in year x
(e.g. VMT in 2009 at age 29 for people who are 40 years old in 2020)

$PCVMT_{2001c}$
= Per capita VMT by age and sex in 2001 for sex and age represented by $PCVMT_{2009b}$
(in the above example, 29 year olds in 2001)

For those who were not of driving age during the 2001 NHTS, the following formula applies:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\,2009}}{PCVMT_{16-24\,2001}}\right)$$

Where:

$\frac{PCVMT_{16-24\,2009}}{PCVMT_{16-24\,2001}}$
= the average per capita VMT of drivers 16 to 24 years old in 2009 divided by the average per capita VMT of drivers in that same age group in 2001, by sex.

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Ongoing Decline

The *Ongoing Decline* scenario assumes that the percentage change in driving behavior experienced by each age group between 2001 and 2009 will be replicated between 2009 and 2025, and that new drivers will drive even less than young drivers did in 2009. It assumes no change in driving behavior after 2025, but total and aggregate per-capita VMT still changes as a result of population growth and demographic shifts.

For those who were of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2009a} * \left(\frac{PCVMT_{2009b}}{PCVMT_{2001c}}\right)^{x}$$

Where:

$PCVMT_{2009a} = Per\ capita\ VMT\ by\ age\ and\ sex\ in\ 2009$

$PCVMT_{2009b}$
$= Per\ capita\ VMT\ by\ age\ and\ sex\ in\ 2009\ for\ the\ cohort\ being\ measured\ in\ year\ y$
$(e.g.\ VMT\ in\ 2009\ at\ age\ 29\ for\ people\ who\ are\ 40\ years\ old\ in\ 2020)$

$PCVMT_{2001c}$
$= Per\ capita\ VMT\ by\ age\ and\ sex\ in\ 2001\ for\ sex\ and\ age\ represented\ by\ PCVMT_{2009b}$
$(in\ the\ above\ example, 29\ year\ olds\ in\ 2001)$

$x = 2$ in 2025 and subsequent years, and an amount between 1.6875 and 2 in 2020 through 2024

For those not of driving age in 2001, the formula for per-capita VMT by year of age and sex in 2020 and subsequent years is as follows:

$$PCVMT = PCVMT_{2001a} * \left(\frac{PCVMT_{16-24\,2009}}{PCVMT_{16-24\,2001}}\right)^{x}$$

Where x=2 in 2025 and subsequent years, and an amount between 1.6875 and 2 from 2020 through 2024.[133]

VMT per capita by age and sex was multiplied by projected population by age and sex from the Census Bureau, and then aggregated across all age and sex categories for 2020 and subsequent years. Aggregate VMT for years between 2009 and 2020 were estimated based on a linear interpolation of 2009 and 2020 values.

Treatment of Non-Household VMT

The National Household Travel Survey only reflects vehicle travel made in households, which accounts for approximately three-quarters of all vehicle travel.[134] Non-household vehicle travel includes travel in everything from heavy-duty trucks to rental cars to delivery vehicles to pick-up trucks used for work purposes. Not all of these types of vehicle travel are tracked by existing data sources. Complicating matters further, even those portions of non-household VMT that are regularly tracked—such as travel in certain types of commercial trucks—are represented in data sets that have experienced significant methodological changes in recent years, making time-series comparisons difficult.[135]

In this paper, we assume that the proportion of household to non-household VMT—calculated by subtracting household VMT in 2009 (from NHTS data) from total VMT (as reported by the Federal Highway Administration's *Highway Statistics* series of reports)—remains constant through 2040. This approach has been used by other analysts seeking to establish a relationship between household and total VMT,[136] though the relationship between household VMT as estimated by the NHTS and total VMT as estimated in publications such as *Highway Statistics* has been inconsistent over time.

The relationship between household and non-household VMT is particularly challenging to forecast since some changes that might reduce household VMT (e.g., increased e-commerce) could increase non-household VMT (e.g., increasing miles traveled in delivery trucks). We hope that additional research and better data sets will enable a fuller exploration of future trends in aggregate non-household VMT.

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129 Australia, Germany, the Netherlands and Great Britain, for example, conduct travel surveys continuously or annually. Juan de Dios Ortuzar, et al., "Continuous Mobility Surveys: The State of Practice," *Transport Reviews*, 31(3): 293-312, doi: 10.1080/01441647.2010.510224, May 2011.

130 The number of licensed drivers was divided by the number of years in each age group to arrive at an estimated number of licensed drivers by year of age and gender.

131 The use of non-NHTS estimates of population and the number of licensed drivers means that the aggregate household VMT estimates that form the basis of these scenarios differ from the aggregate household VMT figures from the NHTS. We opted to use population and driver's licensing data from other sources in order to minimize the impact of sampling error in the NHTS. A comparison of NHTS estimates of population and licensed drivers by age group with Census Bureau and FHWA sources suggests that the 2001 NHTS sample was skewed toward males in the 18 to 24-year-old demographic, toward older age groups, and toward drivers. A similar comparison with the 2009 NHTS suggests that the sample may be skewed toward drivers and the young. The underrepresentation of younger Americans in the 2001 NHTS was acknowledged at the time of the data's release, and is discussed in greater detail in Hart Nadav Feuer, *Paradigm Inertia in the U.S. National Household Travel Survey (NHTS)*, 1 February 2006.

132 The exponent increases by 0.625 annually between 2020 and 2025.

133 Ibid.

134 Based on comparison of household VMT from the 2009 National Household Travel Survey and total VMT for 2009 from the Federal Highway

Administration, *Highway Statistics* series of reports.

135 For example, the Federal Highway Administration changed its methodology for calculating vehicle-miles traveled by vehicle type in 2007, making comparisons between pre-2007 and post-2007 reports invalid. As a result, 2007 is the earliest year for which accurate time-series comparisons for commercial vehicles can be made.

136 Frank Southworth, Tim Reuscher and Pat Hu, *Estimation and Short Range Forecasting of County Level Vehicle Miles of Travel and Motor Fuel Use for the United States (Through 2015)*, 26 March 2009.

137 Amanda Lenhard, Pew Internet & American Life Project, *Adults and Social Network Websites*, 14 January 2009.

138. See note 91.