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The Road…Less Traveled: An Analysis of Vehicle Miles Traveled Trends in the U.S.

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"Continued declines in driving will have dramatic impacts in the realms of transportation finance, environmental emissions, and development patterns."

Findings

An analysis at the national, state, and metropolitan levels of changing driving patterns, measured by Vehicle Miles Traveled (VMT) primarily between 1991 and 2008, reveals that:

- **Driving, as measured by national VMT, began to plateau as far back as 2004 and dropped in 2007 for the first time since 1980.** Per capita driving followed a similar pattern, with flat-lining growth after 2000 and falling rates since 2005. These recent declines in driving predated the steady hikes in gas prices during 2007 and 2008. Moreover, the recent drops in VMT (90 billion miles) and VMT per capita (388 miles) are the largest annualized drops since World War II.

- **While total driving in both rural and urban areas grew between January 1991 and September 2008, rural and urban VMT have been declining since 2004 and 2007, respectively.** Amongst these collective driving declines, the nation shifted more of its VMT share to larger capacity, urban roadways.

- **While all vehicle types increased their total driving from 1991 to 2006, passenger vehicles—specifically cars and personal trucks—consistently dominate the national share.** This share dominance includes rural interstates, where combination trucks contribute a much larger share than they do elsewhere. Over time, however, passenger trucks produce a greater share of VMT due to their surge in registrations versus standard passenger cars.

- **Southeastern and Intermountain West states experienced the largest growth rates in driving between 1991 and 2006, while the Great Lakes, Northeastern, and Pacific states grew at a slower pace.** These varied, but positive, growth rates reversed after 2006, as 45 states produced less annualized VMT in September 2008. Similarly, per capita driving declined in 48 states since the end of 2006.

- **Total driving on principal arterials is concentrated in the 100 largest metropolitan areas, but the greatest driving per person occurs in low density Southeastern and Southwestern metros.** In addition, the 100 largest metros' urban driving share exceeds the national share, with 83 metros carrying over 70 percent of their principal arterial traffic on urban roadways.

Amid the current recession and declining gas prices, drops in driving should continue, creating dramatic impacts in the realms of transportation finance, environmental emissions, and development patterns. Government officials and policy makers at all levels must account for these potential long-term consequences.

I. Introduction

Like never before, Americans' travel habits have a special place in our national conversation. The combination of gas price fluctuations, economic stress, energy concerns, and public financing woes have transformed transportation issues from inside baseball to front page news and water cooler conversation.

A primary cause for this attention has been the major shifts in travel patterns. Americans have simply been driving less, when considering both historic growth rates and the most recent annualized measures of vehicle miles traveled (VMT).[1] At the same time driving has declined, transit use is at its highest level since the 1950s, and Amtrak ridership just set an annual ridership record in 2008.[2]

While all transportation modes have received their fair share of media attention, this report focuses on the VMT trends in detail. VMT is a pervasive measure used in transportation revenue, for both funding allocation formulas and planning and finance. With driving on the decline, the overall travel patterns will have profound impacts on how this nation pays for transportation and plans for future infrastructure needs. Furthermore, how much, where, and what we drive affects our energy consumption, carbon emissions, and land use patterns. Thus, VMT patterns inform the potential solutions to our national environmental and energy challenges.

This brief employs the latest federal data to construct a thorough picture of VMT patterns across the country, including roadway, vehicle, state, and metropolitan comparisons. It is intended to provide policymakers with a better understanding of American drivers' behavior—what roadways they use, what vehicles they use, and where they travel the most.

First, we assess national trends over time, considering both the total change over time and individual driving patterns. This national analysis is then reinforced by national trend analysis within specific roadway types and vehicle types. We then reduce our geographic scope to statewide and metropolitan trends, paying close attention to individual behavior and differences in land use characteristics. Finally, we synthesize VMT-related factors and our five findings into a series of implications.

II. Background: Why is VMT Important?

VMT, or vehicle miles traveled, literally measures the total travel on roadways. Federal and state governments produce VMT statistics by measuring how many total vehicles drive specific stretches of roadway. They do this by installing traffic counters, electronic devices that can determine how many vehicles pass a specific point. In turn, traffic counter data is multiplied by the distance measured to determine exactly how many miles each vehicle traveled. Finally, statisticians aggregate these localized traffic counts to create VMT totals based on various geographies, roadways, and vehicle types.

VMT has been a critical transportation indicator for years. Not only does it provide important data on the use of an individual piece of roadway, but aggregated up—to metropolitan, state, or national levels—it also shapes the transportation planning and programming of billions of public dollars. Large amounts of federal transportation dollars are distributed based solely on the amount of VMT driven.[3] Several states' formulas use a measure of VMT to parse out these dollars, as well.[4]

But most importantly, VMT has a direct correlation to gas tax receipts, the primary source of surface transportation funding.

Where the federal transportation program and most state transportation programs differ from other public programs is the reliance on a single revenue source for solvency. On the federal level, taxes on gasoline, diesel, and special fuels generated 85 percent of the receipts into the highway account in 2006. The sources vary more on the state level, but the largest share of state-generated funds also came from their motor fuel tax receipts. State gas tax funds plus federal gas tax funds represent about half of state spending on highways.[5]

In general, this reliance on gas tax receipts to fund transportation programs has been acceptable due to the consistent increases in vehicle registrations and driving. Total vehicle registrations increased 162 percent from 1966 to 2006, while Americans drove over 2 trillion more miles per year during that 40 year period.[6] Growth and development trends such as metropolitan decentralization, demographic trends related to population increase, and social trends such as women entering the workforce reinforced the increasing registrations and driving. As a result of these trends receipts into the federal Highway Trust Fund swelled with revenue, increasing steadily for decades and reached $38.6 billion in 2006.[7] State gas tax receipts reached $36.1 billion that same year.[8] However, adjusted for inflation, neither the federal or state gases taxes are generating much more revenue than they were in the mid-1990s. Plus, the cost of materials for building, repairing, and augmenting our nation's transportation infrastructure has increased, as well.

The recent drop in total VMT leaves federal and state governments shortchanged for current projects and potentially bankrupt for future ones. This situation will only get worse as these trends continue and as the demand for transportation dollars continues to rise. It also suggests that projections of revenue increases are off base, regardless of whether the primary revenue stream is the gas tax or other mileage-based systems.

Box 1. Recent Gas Price Volatility

There is, of course, a justifiable concern that the late 2008 deflation of gas prices will halt or reverse the nearly year-long drop in VMT. The historical record of VMT increases following the gas price spikes of the early and late 1970s only adds credence to such concerns. Just as importantly, initial anecdotal reports suggest that VMT may already be on the rise following the deflation.[9]

However, as our research indicates, the recent drop in VMT and VMT per capita began prior to the rapid rise in oil prices.[10] Similarly, downturns in economic activity also have the potential to reduce VMT even if gas prices remain at traditionally affordable levels; this was the case in the early 1980s and 1990s. The fall 2008 fiscal crisis and the looming possibility of an extended recession could easily offset any potential VMT increases from falling prices at the pump.

In addition, new federal policies have the potential to significantly affect VMT regardless of gas prices or economic growth. Based solely on recent proposals for government promotion of an environmentally-conscious and modally neutral federal transportation policy, driving may be held down regardless of gas prices. Similarly, the potential for a rise in federal fuel taxes to treat Highway Trust Fund (HTF) solvency issues could offset some of the drops in oil prices.

Overall, the uncertainty of future driving patterns on gas tax revenues will leave federal and state budget officials with an accounting tight-rope when it comes to projecting their upcoming fiscal year budgets.

The relationship, then, between the federal transportation program, the amount of driving, and the amount of gas consumed (and the amount of gas tax paid) is inextricable. This leaves the federal and state governments with a sensitive game of tug-of-war between driving patterns and programmatic spending.

Unfortunately, the political reality of the relationship between VMT and transportation funding puts it squarely at odds with environmental policies that seek to reduce VMT in an effort to curb greenhouse gas (GHG) emissions. While stabilization in VMT growth may help preserve and manage system capacity, it bodes ill for a system that relies on constantly increasing VMT to generate the fuel tax revenues needed to finance the system. This is a paradox as well as a public policy challenge.

Furthermore, VMT levels have a direct link to the pollution generated via transportation. While aircraft and large ships produce significantly more pollution per vehicle than automobiles, studies have proven that a majority of transportation pollution is generated from personal and commercial surface vehicles.[11] And while debates still rage as to the extent carbon emissions affect environmental conditions, there is no doubt that reducing VMT is a basic and effective method to reduce transportation emissions.

The entire transportation sector accounted for 33 percent of all U.S. CO_2 emissions in 2006—the single largest contributor to total emissions of all end-use sectors.[12] The lion's share of the sector's GHG emissions—82 percent—comes from passenger cars, sport utility vehicles, freight and light trucks.[13] And though emissions from other pollutants—such as volatile organic compounds (VOC) and nitrogen oxides (NO_x)—have fallen over time as a result of engine and fuel policies, emissions of CO_2 continue to rise almost lock-step with VMT.[14] Any change in VMT of such vehicles, therefore, corresponds almost directly with changes in GHG emissions.

Specifically, as VMT leveled off in recent years so did gasoline-related emissions from transportation. From 1990 to 1995 those emissions rose 7.7 percent, and from 1995 to 2000 they rose 12.4 percent. But from 2000 to 2005 the figure declines to 4.0 percent and in the last year, 2005 to 2006, there was actually a slight reduction of 0.7 percent.[15]

Of additional interest in the discussions about VMT are metropolitan growth and development trends. Where people live, work and shop affects driving patterns. Overall, cities are growing and downtowns have been improving in the past twenty years.[16] There are many factors driving this kind of development, but especially noteworthy is the revival of young adults seeking urban living. In turn, urban residents are more likely to use alternative modes of transportation than automobiles.[17]

But this type of downtown development is not consistent across the country as many metropolitan areas continue to decentralize.[18] Suburbs continue to produce sizable growth rates and many metropolitan areas continue to extend their geographic reach. In turn, employers have followed their workers to the suburbs and created decentralized job environments. One recent study of 13 large metropolitan areas found that small-scale, scattered commercial development—referred to as "Edgeless Cities"—account for about 40 percent of total national office space.[19] This is in comparison to traditional downtowns, which maintain 33 percent of office space. The end result is that expanding physical development, specifically sprawl, from housing and office development leads to more overall driving and higher rates of vehicle ownership.[20]

While these metropolitan areas were divergently developing the pricing bubble on the national housing market burst, leaving a rash of foreclosures and lost profits from Main Street to Wall Street. Highly volatile gas prices, and deep energy concerns, leave many commuters questioning the viability of their current residential locations.[21]

All of these developments, plus the many others currently transpiring and the future ones we can not yet imagine, will place new strains and opportunities on the nation's transportation system. The key is for policy makers to understand how these new developments will influence VMT—and, in turn, transportation finance, the environment, and general economic development.

III. Methodology

The data used in this report was entirely supplied from the Federal Highway Administration's (FHWA) Office of Highway Policy Information. Two different FHWA sources were used.

The Highway Performance Monitoring System (HPMS) is "a national level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways."[22] HPMS maintains administrative information and sectional lengths for all public roads. Travel data is a mix of complete data on all primary arterials roads (such as interstates and freeways) and sampled data for lower-level systems (such as local roads). The sampled data produces accurate data at the state and national level, but it precludes analysis of county-level travel data on minor arterial, collector, and local roads due to the calibration of the sampling system.[23] FHWA compiles finalized HPMS data into an annual publication, Highway Statistics, which contains a myriad of vital information regarding the nation's roadway network.

Traffic Volume Trends (TVT), is a monthly report "based on hourly traffic count data reported by the states."[24] Every year these numbers are adjusted to coordinate with HPMS data, making the current year's data preliminary prior to adjustment.[25] The only time we use TVT data is for total national VMT, the breakdown of VMT by road type, and statewide VMT for more recent periods. Because it is much more current than the HPMS, the TVT is updated through September 2008 while HPMS is only current through 2006. Therefore, the sub-state level data is only available through 2006.

Both data sources obtain their VMT data by using automatic and/or portable traffic recorders on public roadways. The state-managed traffic counters continuously monitor traffic and create a measure called Average Annual Daily Traffic (AADT). AADT, in essence, reports how many cars drive on a particular section of roadway each day. In turn, the AADT is then multiplied times the length of the roadway section, thereby producing the total vehicle miles traveled for that section on the average day. Multiplying the VMT amount times 365 (days) gives us the VMT for that particular roadway section for the entire year. Once the states have added all of these sectional statistics together to generate geographic totals of VMT they report their initial calculations to the federal government. The federal government conducts a final data quality review before publicly releasing the final statistics.[26]

The national roadway network is a complex and extensive system. In an effort to categorize this system and generate consistencies across state lines, the FHWA produces a series of guidelines that organizes these divergent elements into a series of subdivisions and specific types.

For one, roadway types are subdivided based on a rural/urban designation. The designations are determined by the U.S. Census' rural/urban boundaries—and since these boundaries change every ten years, each roadway's rural/urban classification is also subject to change. Once Census generates updated boundaries, FHWA will approve changes to urban boundaries based on those updates, modified to include major traffic-related development. States must then update their HPMS classification data to reflect the most current FHWA-approved boundaries and roadway designations.

However, it may take states years to update this data, generating a lag in the data.[27] It also means that some of the changes in rural and urban driving are due to a reclassification of roadways. Since our analysis is primarily concentrated in the period since 1990, the rural/urban designations were affected by the boundary changes in the 1990 and 2000 Censuses. These two categories enable us to determine if, in fact, the nation's conversion to a more metropolitan nation is being expressed in its driving patterns.

Based on the rural/urban designation, FHWA creates four distinct roadway categories under each designation: principal arterials, minor arterials, collectors, and local streets.[28] These roadway categories vary based on their connectivity characteristics and the roadway's relationship between mobility and land access. Connectivity characteristics include the expected distance of travel, what type of jurisdictions and population densities the roadway network services, and if the roadway network is continuous. Regarding the relationship between mobility and land access, mobility here is defined as the ease of movement between points while land access is defined as the access to specific property. While these are not mutually exclusive concepts, roadways tend to have an emphasis between the two.

Principal arterials are primarily designed with mobility in mind, not land access. They also enable travel over long distances, are continuous, and serve urban areas at some point in the network. In urban areas specifically, principal arterials carry the majority of traffic entering and leaving urban areas, travel looking to bypass the central city, and other major intra-area movements. Principal arterials include the entire federal interstate highway system and other urban freeways and expressways.

Minor arterials, both in rural and urban areas, are intended to interconnect with and augment the principal arterial network. In urban areas, they connect communities but do not intersect neighborhoods. Generally, minor arterials are still primarily geared towards mobility concerns but have a shifted emphasis towards land access versus that of principal arterials.

Collectors are the midpoint roads in the overall network. Their emphasis is essentially balanced between mobility and land access concerns. As the name suggests, these roads 'collect' vehicles from local roads and feed them to arterial routes for longer travels or other local roads if the total travel distance is relatively short. For rural areas, collectors will also service intercounty travels where an arterial roadway is not present.

Finally, local roads are primarily concerned with specific land access. For both rural and urban areas, local roads are also the roadways which do not fit into the previous three categories.

By splitting roadways based on their emphasis between mobility and land access, the data uncovers critical information regarding individuals' general travel patterns. If the country is characterized by sprawling development, have principal arterials expanded their share of VMT? Do states dominated by large, dense cities also drive the most on local urban streets? These specific categories help us answer those questions.

To conduct the analysis for metropolitan areas, we are forced to limit our roadways to only principal arterials because this is the only county-level data in HPMS. These roadways carried nearly 55 percent of all VMT in the nation in 2006; this is up from 52 percent in 1991. In addition, because these roads are predominantly part of the National Highway System or a state-managed roadway, these are the roads primarily supported by federal and states gas taxes. The remaining collector and local roads are primarily supported by local property taxes. Thus, this metro analysis covers the majority of total driving and the vast majority of driving on federal and state roads. When making comparisons between national totals and metropolitan totals, we only consider the Universal System road types. Regarding the metro areas, Brookings Metro Program determined the 100 largest metropolitan areas based on 2005 employment statistics.

Lastly, the FHWA also defines five distinct groups of vehicles that travel on these U.S. roads: passenger cars, buses, other passenger vehicles, single-unit trucks, and combination trucks.[29] "Other passenger vehicles," a unique category since 1966, includes a host of other passenger vehicles that meet the standard two-axle and four-tire criteria. The main vehicles falling under this category are vans, pickup trucks, and sport-utility vehicles. Single-unit trucks are single frame trucks that maintain at least two-axles and six-tires. These are different from combination trucks, which are the 'rigs' that move detachable freight cars. Since vehicle performance data is only published in the *Highway Statistics* series, the most current vehicle data is through 2006.

Vehicular travel patterns, both in terms of roadway usage and share of VMT, uncover what people are driving, where they are driving, and how public policies can help modify that behavior to achieve desired societal outcomes.

A final note on the term annualized VMT. Annualized VMT is the use of any consecutive twelve month period to construct VMT measures. Because TVT data is monthly and travel patterns vary by season, using an annualized measure of VMT accomplishes two goals. First, when using midyear data, it controls for seasonal variations. Second, it also permits us to compare VMT changes from the middle of the year to past 'January to December' yearly measures.

IV. Findings

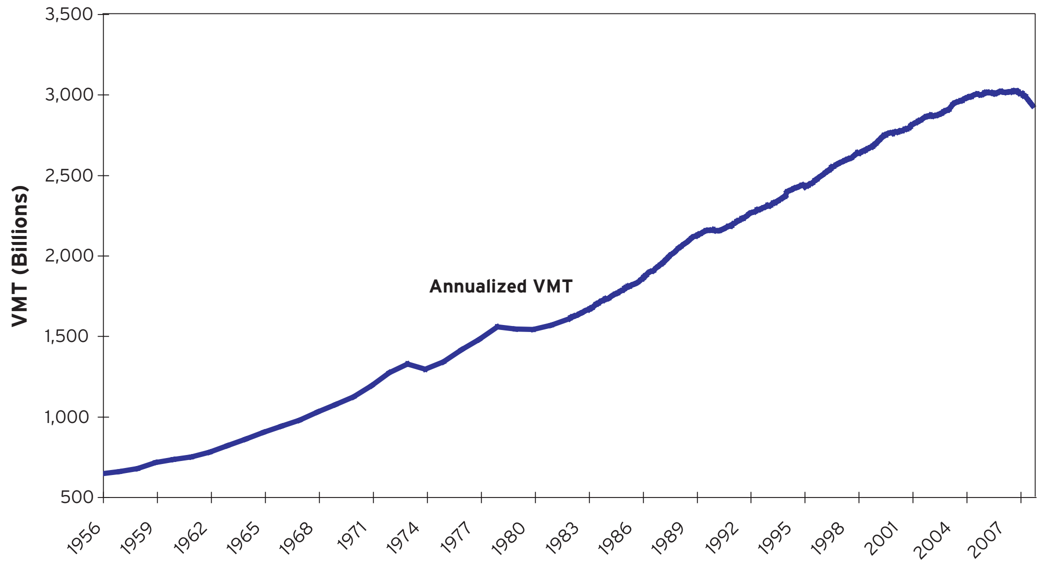
A. Total driving levels, as measured by national VMT, began to plateau as far back as 2004 and dropped in 2007 for the first time since 1980.

For nearly every year since statistics were collected, national VMT increased from one year to the next. As Figure 1 shows, VMT's trend line from 1956, the beginning of the interstate highway era, to 1991, the beginning of the current federal transportation era, is consistently positive. Even when accounting for the two dips based around the geopolitical events of the 1970s, it is clear that Americans continued to drive more and more over these thirty five years.[30] This trend continued after the passage of major federal transportation reform legislation in 1991: between January 1991 and December 2004 VMT grew by another 38.4 percent. This thirteen year period was composed of remarkably steady growth—the average annual rate was 2.4 percent and the median rate was 2.5 percent.

However, as Figure 1a shows, this consistent annual growth stopped in 2004. The next three annualized measures in December—2005, 2006, and 2007—show percent changes of 0.8, 0.6, and -0.3, respectively. The 2007 number is extremely significant. For the first time since 1980, and only the fourth time since the end of World War II, the annual change in national VMT was actually negative. Moreover, this annualized trend has continued into the nine reported months of 2008. Each of these months reported negative annualized VMT when compared to the previous twelve month periods.

A similar trend exists when examining VMT per capita for the nation. From 1991 through 2000, the amount of driving per capita steadily climbed upward. However, following the tech bubble burst in

Figure 1a. U.S. Vehicle Miles Traveled, Annualized, December 1956–September 2008

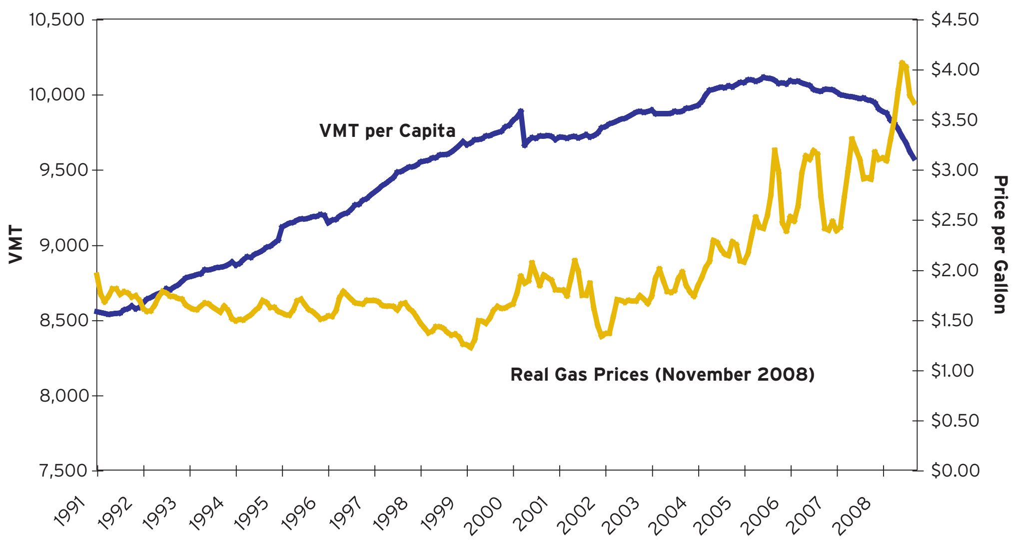


Source: 1956–1982: Highway Statistics, Table VM-201; 1983–September, 2008: Traffic Volume Trends

2000 the growth rate in VMT per capita began to plateau. Moreover, after 2005 the per capita rate actually began to slide. The per capita rate has continued to drop for over three straight years, to the point where the September 2008 VMT per capita rate (9,564 miles) is now less than what it was a decade ago (9,603 miles). What this means is that amid the total growth in VMT over this ten year period, the average American is still driving the same distances per year as they were in 1998. Interestingly, these years of plateau and decrease did not always coincide with gas price increases. As Figure 1b shows, inflationary-adjusted gas prices remained relatively stable between 2000 and 2005, followed by a period of volatility after 2006. Thus, only the most recent drop in per capita driving is coupled with gas price spikes.

While these national changes clearly indicate a significant decline in national driving, one of the primary stories regarding national VMT is how much it diverges across the country depending on the unit of analysis. The next four findings divide these numbers by road type, vehicle category, state, and metropolitan area, thereby helping to uncover the intricacies within our national driving patterns.

Figure 1b. U.S. Vehicle Miles Traveled Per Capita, Annualized and Real Gasoline Pump Prices, January 1991–September 2008



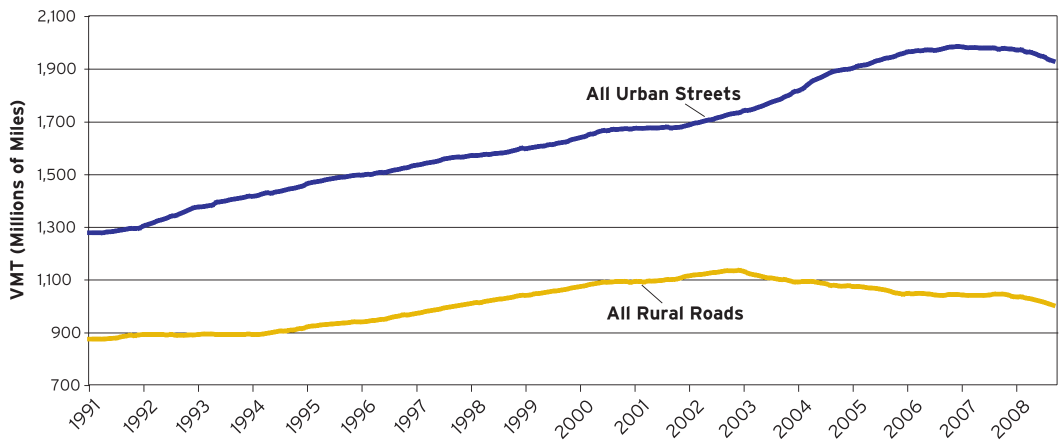
Source: Traffic Volume Trends and Energy Information Administration

B. While total driving in both rural and urban areas grew between January 1991 and September 2008, rural and urban VMT have been declining since 2004 and 2007, respectively.

The changes in VMT are not even across the spatial landscape of the U.S. Between January 1991 and September 2008, the VMT on all urban roadways jumped 51.3 percent in comparison to all rural roadways' increase of 14.9 percent. This means over the seventeen year period the growth in VMT from urban areas more than tripled its rural counterparts. However, this general comparison does not tell the whole story of the urban-rural split.

Prior to 2003, urban and rural VMT grew at a relatively equal rate. While total urban VMT is always significantly larger than total rural VMT, their growth rates were remarkably similar (see Figure 2). However, the total level of driving in rural and urban areas began to diverge in 2003. Rural VMT fell for the first time in 2003, and has proceeded to fall every year since.[31] The total decline in rural VMT from the beginning of 2003 to the end of 2006 was 7.7 percent. Urban roadways, conversely, continued to grow and added another 14.0 percent to their annualized VMT between January 2003 and the close of 2006.

Figure 2. Urban and Rural VMT, Annualized Total, January 1991-September 2008



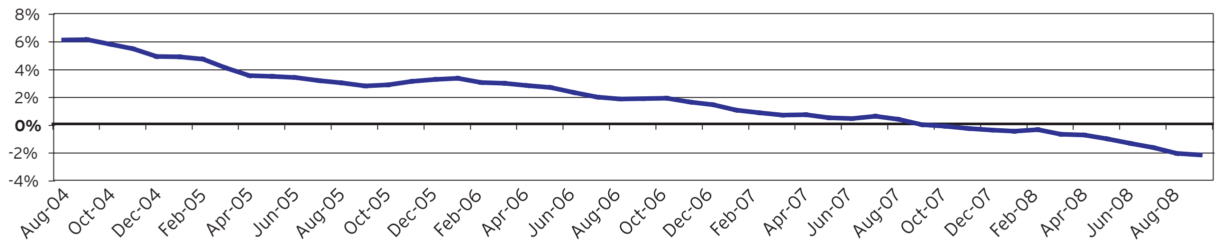
Source: TVT

Rural roadways continued their drop in annualized VMT throughout 2007 and the first nine months of 2008. Meanwhile, urban roadways displayed their first annualized drop in VMT at the close of October 2007. This negative growth rate was the culmination of shrinking annualized growth rates that began in August 2004 (see Figure 3).

Given the recent trends in rural and urban driving, there has been a significant shift in the 'share-splits' of total national VMT. At the close of 1991, rural roadways carried 40.7 percent of annualized VMT compared to urban roadways' 59.3 percent. By September 2008, these share-splits had shifted to 34.1 percent for rural roadways and 65.9 percent for urban roadways. Clearly, urban driving has continued to gain a larger majority of total driving in the U.S.

Table 1 shows where, by roadway type, the bulk of driving in rural and urban areas has taken place since 1991. Urban interstates, other principal arterials, and minor arterials carry by far the greatest share of annual national traffic.[32] These three urban road types combined to carry nearly 44 percent of national traffic in 2006, up from 40 percent in 1991. Of these three road types, urban interstates recently became the most driven type; up until 2002 other principal arterials was the leader. The other three urban road types also gained total share between 1991 and 2006.

Figure 3. Urban VMT, Annualized Growth, August 2004–September 2008



Source: TVT

Table 1. Rural and Urban Shares of National VMT by Roadway Type, 1991–2006

VMT: Share Splits				Change (% Points)	
	1991	2002	2006	1991-2002	2002-2006
Rural					
Interstate	9.4%	9.8%	8.6%	0.4	-1.2
Other Principal Arterial	8.3%	9.0%	7.7%	0.8	-1.3
Minor Arterial	7.2%	6.2%	5.4%	-1.0	-0.8
Major Collector	8.9%	7.5%	6.4%	-1.5	-1.1
Minor Collector	2.4%	2.2%	1.9%	-0.2	-0.2
Local	4.5%	4.9%	4.4%	0.4	-0.5
Total	40.7%	39.5%	34.4%	-1.2	-5.1
Urban					
Interstate	13.1%	14.3%	15.8%	1.2	1.5
Other Freeways and Expressways	5.9%	6.6%	7.2%	0.7	0.6
Other Principal Arterial	15.7%	14.3%	15.5%	-1.4	1.2
Minor Arterial	11.0%	11.9%	12.5%	0.9	0.6
Collector	4.9%	5.0%	5.7%	0.0	0.8
Local	8.7%	8.4%	8.8%	-0.3	0.4
Total	59.3%	60.5%	65.6%	1.2	5.1
National Total	100.0%	100.0%	100.0%	N/A	N/A

Source: Highway Statistics, 1991-2006, Table VM-2

What's especially interesting about this share analysis is the share of urban primary arterials such as interstates, freeways and expressways. As established in the Methodology section, those roadways are designed to move people longer distances and provide minimal access to specific properties. In other words, these limited-access roads offer few connections to land apart from those near the exit ramps. Due to their emphasis on movement between metropolitan areas or longer travels within the same metro, the increased shares of driving on these urban roadways reinforce the revival of traditional downtowns on one hand and continued peripheral "Edgeless City" growth on the other. This is the new reality of twentieth century development patterns—and this share data is another way to understand those pattern's effects on citizens' activities.

While these share-splits help explain where the total driving is occurring, another trend to consider is driving levels indexed to roadway capacity. Lane miles, rather than simple roadway length, is a measure of a roadway's width and length, thereby creating a more accurate measure of its capacity. For example, consider a fictitious eight-lane interstate running parallel to a two-lane local road for one mile. While each roadway's length would be only one mile, the interstate's lane mileage would be 8 miles versus the local road's length of 2 lane miles. Combining lane miles with VMT, then, allows us to get a better picture of the average traffic per lane on a roadway. Switching to this type of index creates more applicable comparisons between high-capacity and low-capacity roadways.

What one would expect to find—that higher capacity roadways would have higher ratios of VMT to lane miles—is in fact the case.[33] As Table 2 shows, the smallest ratios belong to the more local-serving roads: rural local roads, rural minor collector roads, rural major collector roads, and urban local roads. The largest ratios belong to the primary arterials, and especially urban interstates, expressways, and freeways. It is also apparent that VMT grew much faster than lane mileage from 1991 to 2002, leading to larger ratios for all twelve road types.

Conversely, the combination of falling VMT in rural areas and the expansion of lane mileage in urban areas led to falling ratios from 2002 to 2006. For rural areas—where both lane mileage and VMT fell over this five year period—VMT fell at a faster pace than the falling lane mileage. Urban roadways experienced the opposite as VMT continued to increase but the lane mileage expanded at a larger rate, leading to a decrease in the ratio.

Table 2. VMT per Lane Mile, 1991-2006

				Change	
VMT / Lane Mile Ratio (Thousands)	**1991**	**2002**	**2006**	**1991-2002**	**2002-2006**
Rural					
Interstate	1,502	2,080	2,074	38.5%	-0.3%
Other Principal Arterial	812	1,005	935	23.9%	-7.0%
Minor Arterial	524	612	577	16.9%	-5.8%
Major Collector	220	246	229	11.7%	-6.8%
Minor Collector	88	114	110	29.2%	-2.7%
Local	23	33	33	44.8%	-1.8%
Total	138	179	170	30.0%	-5.4%
Urban					
Interstate	4,542	5,440	5,427	19.8%	-0.2%
Other Freeways and Expressways	3,691	4,386	4,351	18.8%	-0.8%
Other Principal Arterial	1,926	2,176	2,118	13.0%	-2.7%
Minor Arterial	1,253	1,463	1,432	16.8%	-2.1%
Collector	649	743	747	14.5%	0.5%
Local	179	188	183	4.8%	-2.5%
Total	766	861	856	12.4%	-0.5%

Source: Highway Statistics, 1991-2006, Tables VM-2 and HM-60

Unfortunately, lane miles are not published on a monthly basis so it's impossible to extend these ratios forward to capture the recent drops in total VMT. If we take an educated guess, though, that lane mileage has not decreased amidst the 2.4 percent drop in total VMT since 2006, the situation certainly may have intensified.

Focusing on the 2002 to 2006 period, the falling ratios show that the country may be on the path towards misallocating its valuable, and limited, transportation investments. Simply put, a declining VMT to lane mile ratio means either roadway lane mileage is expanding faster than traffic can fill it or current roadways are carrying less traffic than they previously did.

These declines deserve the attention of policy makers. Roadway infrastructure could put significant maintenance stress on governments, especially with the looming state fiscal crises of the upcoming years. Transportation planners and officials should be careful to assess their jurisdiction's travel patterns based on current trends and updated projections, not outdated formulas and models.

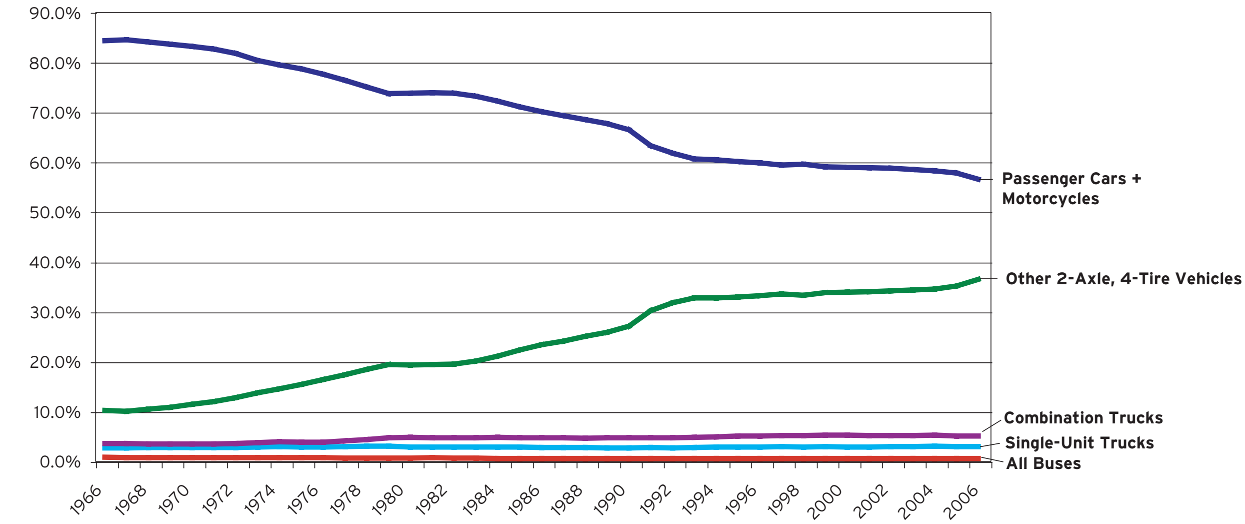
C. While all vehicle types increased their total driving from 1991 to 2006, passenger vehicles—specifically cars and personal trucks—consistently dominate the national share of VMT.

When considering all five distinct vehicle groups, each has experienced overall VMT growth since 1991.[34] Passenger cars increased their annual driving by 24.0 percent over that time, while buses nearly matched that group with growth of 21.6 percent. Both groups, however, were far out-paced by the 67.7 percent growth in the other passenger vehicles group. Meanwhile, both single-unit trucks (51.9 percent) and combination trucks (47.7 percent) added considerable mileage to their odometers over the same period. Combined, all five vehicle groups produced national VMT growth of 38.8 percent in those years.

While these numbers show that VMT growth was shared by all five vehicle groups, examining the share-splits allows us to understand which vehicle groups maintain the most dominant presence on the roadways. Not surprisingly, passenger vehicles are by far the leading producer of total VMT. When considering all three groups of passenger vehicles, their total share of national VMT was 92.6 percent in 2006.

Interestingly, passenger vehicles have contributed roughly the same share of total VMT since 1966—their total share has never receded below 92 percent or exceeded 95 percent. However, there has been significant variation within the primary two passenger vehicle types' shares. The share of VMT attributed to standard passenger cars and motorcycles declined precipitously since the 1970s, while those considered "other passenger vehicles" such as SUVs, pickup trucks, and vans rose in the reciprocal during that time. This reflects the explosion in the use of SUVs, pickup trucks, and vans as a popular form of passenger transportation. Figure 4 visualizes the massive shift within VMT shares of these two passenger vehicle groups.

Figure 4. Share of Total VMT, By Vehicle Type, 1966-2006



Source: Highway Statistics, 1966–2006, Table VM-1

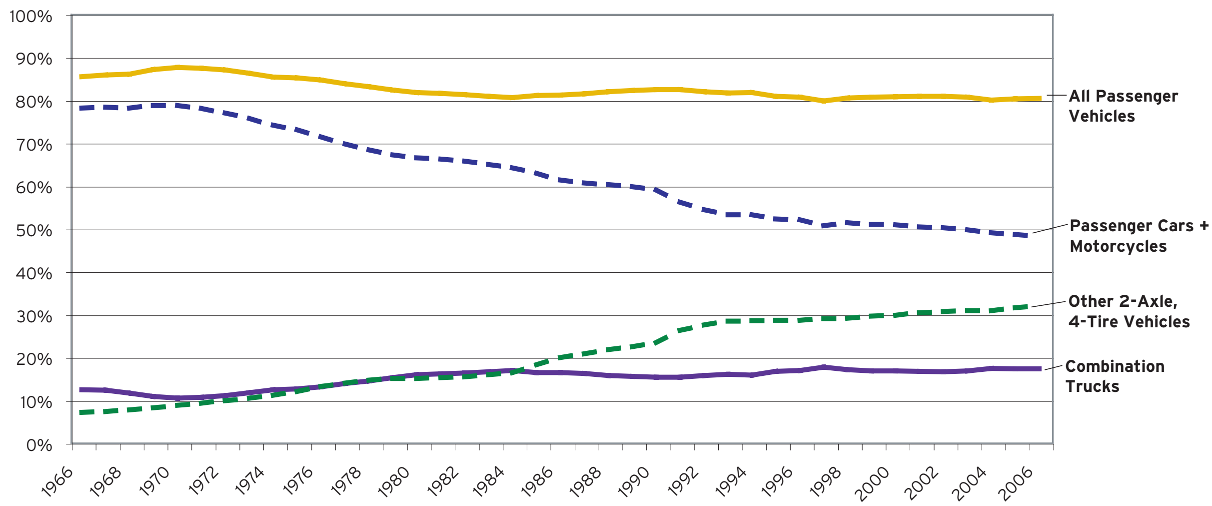
One explanation for this shift is the rapid rise of other passenger vehicle registrations over this period. Whereas passenger cars experienced a marginal increase in registrations over the period (7.3 percent), the number of other passenger vehicles on the road nearly doubled (86.9 percent) between 1991 and 2006. This rise in SUV, pickup truck, and van registrations has serious policy implications for the nation due to these vehicles' traditionally lower fuel efficiencies and their unique place in the tax code.

In contrast to the shifts within passenger cars and other passenger vehicles, the other three vehicle categories all maintained similar shares over the multiple decades. Specifically, combination trucks always exceed the share of single-unit trucks, and both outweigh the minor VMT shares of bus travel.

In general, this ordering pattern is also found within each separate roadway type: passenger cars produce over half of roadway VMT, other passenger vehicles increase their share with time, and the two truck categories and buses each produce less than ten percent of roadway VMT. However, the one exception to this is rural interstates. Compared to their total VMT share, combination trucks generate significantly more of rural interstate VMT. The explanation for this is the role of combination trucks as freight vehicles, moving goods between metros as their business requires an extensive amount of rural interstate travel to reach delivery points. Yet it is important to point out that all three passenger vehicle groups still generated, in total, 80 percent of all rural interstate VMT in 2006.

Another method to assess share-splits is through the vehicle groups themselves; in other words, on which roadways does each vehicle travel the most?[35] Passenger cars and other passenger vehicles consistently drove around half of the time on non-Interstate urban streets in 2006. Including urban interstates pushes the urban driving of these two vehicle groups to two-thirds of total driving, reflective of the 2000 urbanized area share of 68 percent of total population. Compared to the other two passenger vehicle groups, buses drove significantly less on other urban streets (about 30 percent of the time) but similarly on urban interstates. Single-unit trucks also drive the most on non-Interstate urban streets, increasing their share of travel on that roadway from 34 percent in 1991 to 42 percent in 2006. Since single-unit trucks are the optimal vehicle for urban goods deliveries, the growth in the

Figure 5. Share of Rural Interstate VMT, by Vehicle Type, 1966–2006



Source: Highway Statistics, 1966–2006, Table VM-1

share of local urban travel reinforces the notion of expanding clustered economic activity and shorter distances for freight deliveries.[36] Combination truck VMT shares have remained relatively stable between the roadway types, with rural interstates maintaining the greatest roadway share. Shares of combination truck travel tend to decrease as the roadway capacities and population densities decrease.

There is one final detail regarding average annual travel per vehicle. Excluding combination trucks, the average annual miles traveled in 2006 ranges from 8,509 miles for buses to 12,427 miles for passenger cars. Each combination truck, however, averages 65,773 miles traveled per year. Stated another way, each combination truck travels enough each year to travel roundtrip from Boston to Seattle almost eleven times. Combined with their extensive use of both urban and rural interstates—over 50 percent of their total VMT share—it becomes clear that federal policies should pay particular attention to combination trucks. First, by consistently crossing state lines due to their long journeys, it is the federal government's responsibility to ensure these vehicles maintain adequate emissions standards. Second, their inability to maintain speeds at complex interstate junctions causes significant delays for all drivers, meaning the federal government must pay attention to what routes trucking companies prefer.[37]

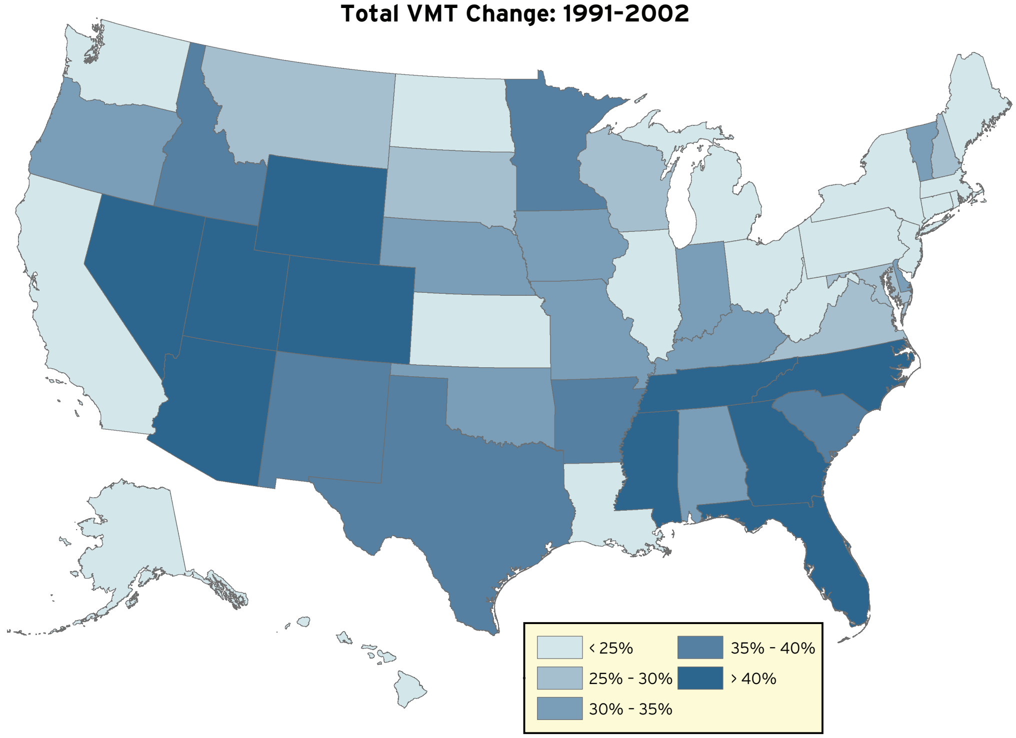
D. Southeastern and Intermountain West states experienced the largest growth rates in driving between 1991 and 2006, while the Great Lakes, Northeastern, and Pacific states grew at a slower pace.

While every state increased its VMT between 1991 and 2006, the rates differed widely by state and geographic region—and have fallen dramatically since 2006.

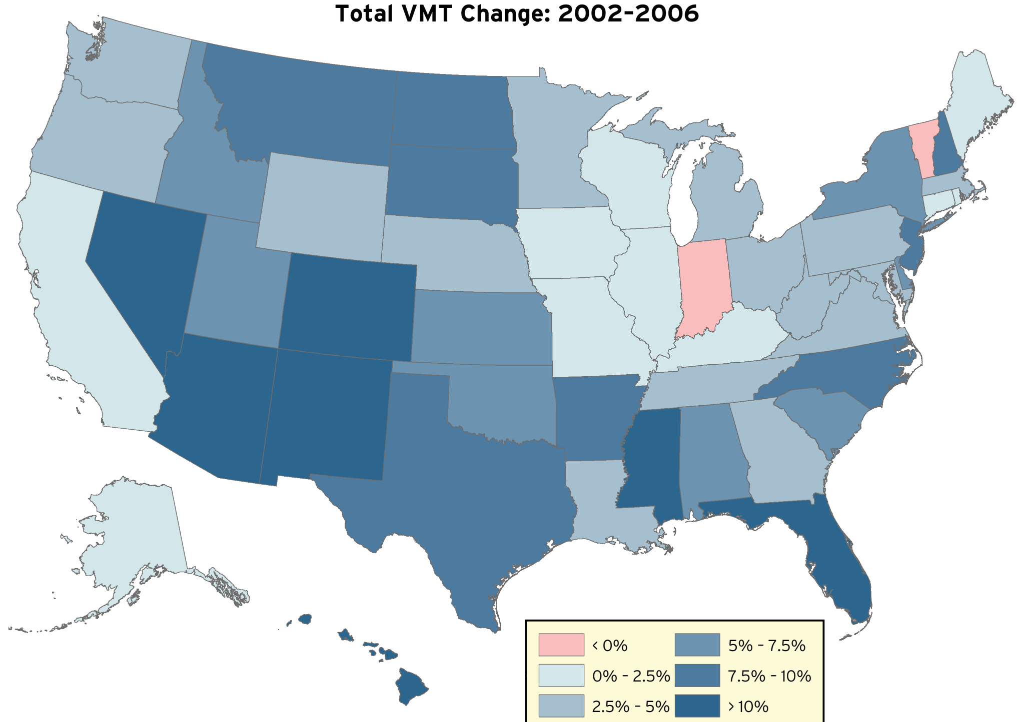
From 1991 to 2002, every state experienced an increase in total VMT. Some of those increases were extremely large; Nevada was by far the largest, as its VMT grew 70.9 percent in those eleven years. Ignoring the District of Columbia, which experienced an increase in total VMT of 3.4 percent, the next smallest increase was for Hawaii at 9.1 percent. The median VMT increase across all fifty states and the

Figure 6a and 6b. Total VMT Change, by State

Total VMT Change: 1991-2002



Total VMT Change: 2002-2006



Source: Highway Statistics, 1991-2006, Table VM-2

District of Columbia was the average annual growth rate for all states was 2.9 percent.

Figure 6a shows that the states with the largest growth rates were in the Intermountain West, including five of the seven largest statewide increases—Nevada, Utah, Colorado, Wyoming, and Arizona—and Southeast, including five states with growth rates over 40 percent—Florida, Georgia, Mississippi, Tennessee, and North Carolina.[38]

Due, in part, to the law of large numbers, the small state triumvirate of Connecticut, Massachusetts, and Rhode Island were three of the slowest growth states, but other states across the Northeast and the Eastern Great Lakes also grew at a relatively slower clip. The particular grouping of states along the Great Lakes—including Pennsylvania, Ohio, and Michigan—share the common characteristics of older, denser cities and slower-growth economies.[39] A series of Pacific Coast states—Alaska, California, Hawaii, and Washington—also drove more but kept their growth rates well under 30 percent.

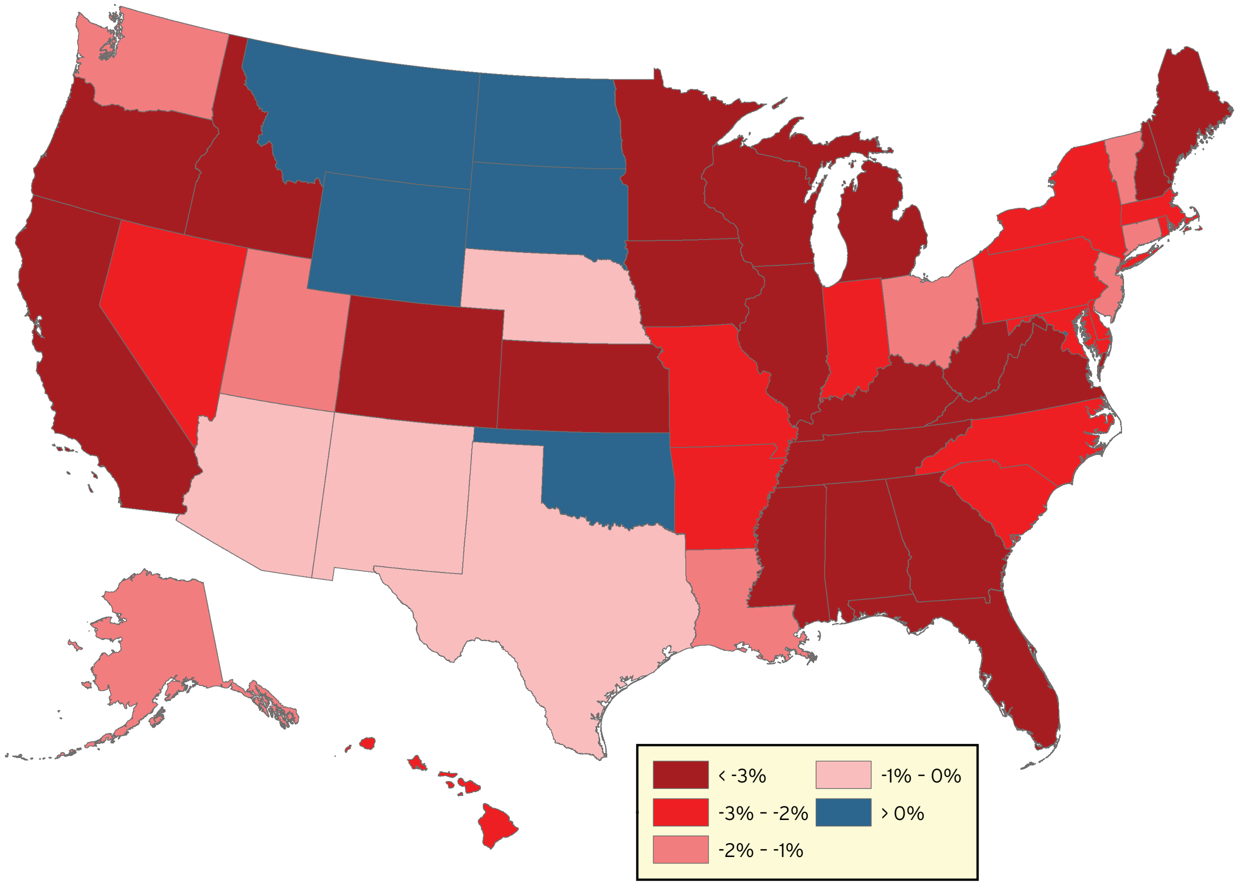
Many of the extreme states listed above did have population growth rates that were similar in national ranking to that of their VMT growth rates. This includes the Great Lakes states and the Northeastern states. However, this is not always the case. Washington increased its population by over 20 percent from 1991 to 2002, the tenth largest growth in the nation, but maintained the seventh slowest VMT growth rate. Conversely, Wyoming had the seventeenth slowest population growth while maintaining the fifth largest VMT growth rate. In sum, population is one potential explanation for total VMT change, but certainly not the only one.

Figure 6b shows that the period between 2002 and 2006 begins to reveal a shifting picture of statewide VMT growth. First, the average annual growth rate drops from 2.9 percent to 1.4 percent. Second, two states—Indiana and Vermont—actually drove less during that five-year period.[40] Both states are found in different regions, although both are relatively rural in comparison to the majority of other states.

However, the trend of decreased VMT that began in Indiana and Vermont spread throughout the country by 2008 (Figure 7). The most recent data shows dramatic drops in driving throughout the nation from the end of 2006 to September 2008.[41] First, the states that were slow-growing between 1991 and 2006 have now become states that are experiencing decreased total driving. In addition, each state that borders the Atlantic and Pacific Oceans did not experience VMT growth in the 21 months. Conversely, only five states and the District of Columbia experienced VMT growth over the period.[42]

Maine, which lost 5.2 percent of its VMT, experienced the largest drop in driving since the end of 2006. And while Maine led the declining rates, every Great Lakes state lost annualized VMT over the period. In addition to these states and the coastal stretches, a portion of the Southeastern states reversed their growth trends, especially Florida, one of the growth leaders from the previous sixteen years. In sum, 45 states hosted less annualized driving in September 2008 than they did during December 2006. Moreover, the most recent annualized numbers from September 2008 show that 48 states lost VMT when compared to annualized totals from September 2007. Simply put, the recent national VMT changes we described in Finding A have been felt in the vast majority of states.

Figure 7. Annualized VMT Change, by State, December 2006-September 2008



Source: TVT

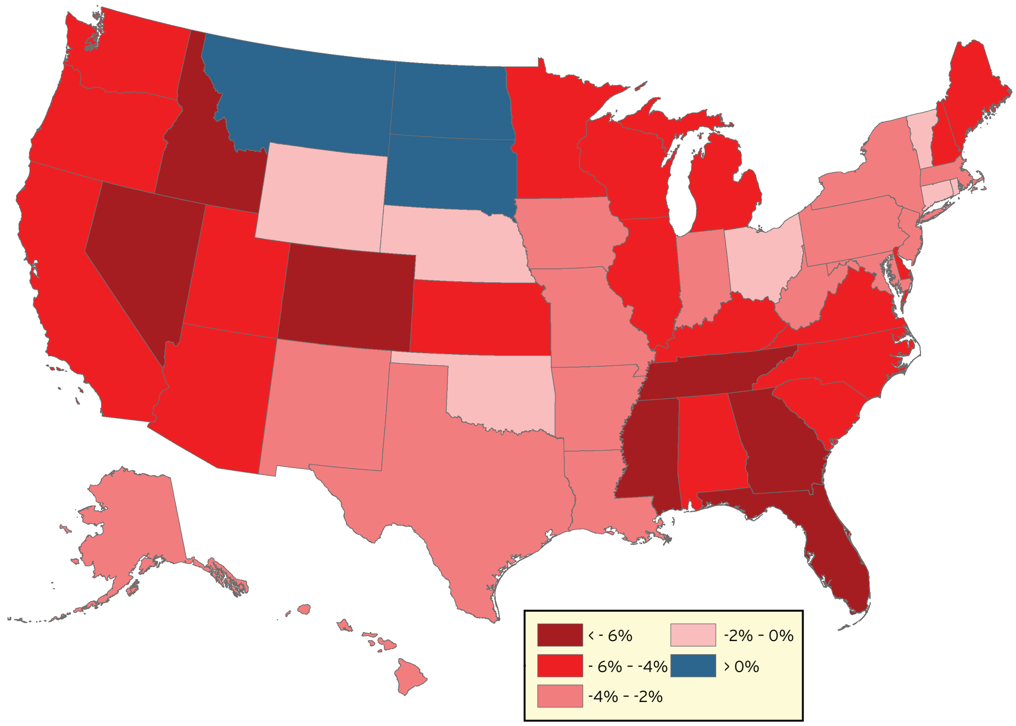
Table 3. Statewide Annualized VMT Changes, All Roads, 1991–September 2008

State	Total VMT Change 1991-2002	Total VMT Change 2002-2006	Total VMT Change Dec. 2006–Sep. 2008	VMT per Capita Change 1991-2002	VMT per Capita Change 2002-2006	VMT per Capita Change Dec. 2006–Sep. 2008
Alabama	34.0%	5.0%	-3.8%	22.8%	2.3%	-5.1%
Alaska	21.8%	1.5%	-1.8%	8.0%	-3.8%	-3.2%
Arizona	47.0%	21.7%	-0.6%	2.3%	7.5%	-5.1%
Arkansas	37.1%	9.7%	-2.5%	20.9%	5.6%	-3.9%
California	24.4%	2.0%	-3.3%	8.4%	-1.6%	-4.7%
Colorado	57.0%	11.7%	-4.0%	17.9%	5.6%	-7.1%
Connecticut	17.2%	1.7%	-1.5%	12.1%	0.4%	-1.8%
Delaware	32.0%	6.4%	-2.7%	12.1%	0.4%	-4.9%
Dist. of Columbia	3.4%	2.1%	1.2%	7.3%	1.0%	0.4%
Florida	57.4%	14.2%	-4.4%	26.3%	5.4%	-6.1%
Georgia	48.4%	4.8%	-3.3%	14.9%	-3.6%	-6.7%
Hawaii	9.1%	14.6%	-3.0%	1.0%	10.1%	-3.5%
Idaho	37.3%	7.3%	-3.4%	6.5%	-1.6%	-7.1%
Illinois	23.4%	1.4%	-5.0%	13.5%	-0.2%	-5.9%
Indiana	33.6%	-1.8%	-2.7%	22.0%	-4.2%	-3.8%
Iowa	34.0%	1.6%	-3.1%	27.9%	0.2%	-3.9%
Kansas	22.7%	6.2%	-3.5%	13.0%	4.6%	-4.7%
Kentucky	33.0%	1.9%	-4.2%	21.1%	-0.9%	-5.5%
Louisiana	24.7%	4.9%	-1.3%	18.8%	10.4%	-3.2%
Maine	24.3%	2.2%	-5.2%	18.8%	0.5%	-5.5%
Maryland	29.9%	4.8%	-2.9%	16.3%	1.7%	-3.3%
Massachusetts	14.5%	3.5%	-2.2%	7.1%	3.5%	-2.6%
Michigan	22.2%	4.0%	-4.5%	14.4%	3.4%	-4.0%
Minnesota	39.0%	3.6%	-3.4%	22.9%	0.9%	-4.8%
Mississippi	46.3%	13.9%	-4.9%	33.0%	12.3%	-6.0%
Missouri	33.7%	1.0%	-2.4%	21.8%	-1.8%	-3.5%
Montana	25.0%	8.4%	2.2%	11.2%	4.2%	0.3%
Nebraska	32.8%	3.7%	-0.7%	22.8%	1.5%	-1.8%
Nevada	70.9%	21.5%	-2.7%	2.2%	5.6%	-7.3%
New Hampshire	26.6%	8.2%	-4.4%	10.5%	5.0%	-4.9%
New Jersey	18.0%	7.8%	-1.7%	7.7%	6.4%	-2.0%
New Mexico	35.9%	13.2%	-0.7%	14.2%	7.8%	-3.0%
New York	23.6%	6.2%	-2.5%	17.1%	5.4%	-2.7%
North Carolina	43.2%	9.3%	-2.6%	16.8%	2.5%	-6.0%
North Dakota	23.3%	7.6%	4.1%	23.6%	6.9%	3.5%
Ohio	16.0%	3.1%	-1.7%	11.2%	2.7%	-1.8%
Oklahoma	33.6%	6.5%	0.3%	21.7%	3.7%	-1.6%
Oregon	34.2%	2.6%	-3.2%	11.6%	-2.1%	-5.6%
Pennsylvania	19.7%	3.6%	-2.5%	16.6%	2.8%	-2.9%
Rhode Island	13.8%	1.9%	-2.0%	7.8%	2.4%	-1.4%
South Carolina	37.2%	6.2%	-2.9%	19.4%	0.6%	-5.8%
South Dakota	26.6%	7.9%	3.6%	16.9%	4.2%	2.0%
Tennessee	44.3%	3.5%	-4.3%	23.6%	-1.2%	-6.5%
Texas	39.2%	7.8%	-0.1%	11.5%	0.1%	-3.5%
Utah	59.6%	5.7%	-1.7%	21.6%	-4.2%	-5.8%
Vermont	33.7%	-0.2%	-1.6%	23.6%	-1.1%	-1.7%
Virginia	26.8%	4.7%	-3.0%	9.7%	-0.2%	-4.5%
Washington	17.9%	3.2%	-1.9%	-2.2%	-1.9%	-4.2%
West Virginia	24.8%	4.4%	-3.7%	24.7%	3.9%	-4.0%
Wisconsin	29.2%	1.1%	-3.7%	17.8%	-1.2%	-4.5%
Wyoming	50.2%	4.5%	1.5%	38.7%	1.4%	-1.7%
NATIONAL TOTAL	**31.4%**	**5.6%**	**-2.7%**	**15.5%**	**1.7%**	**-4.3%**

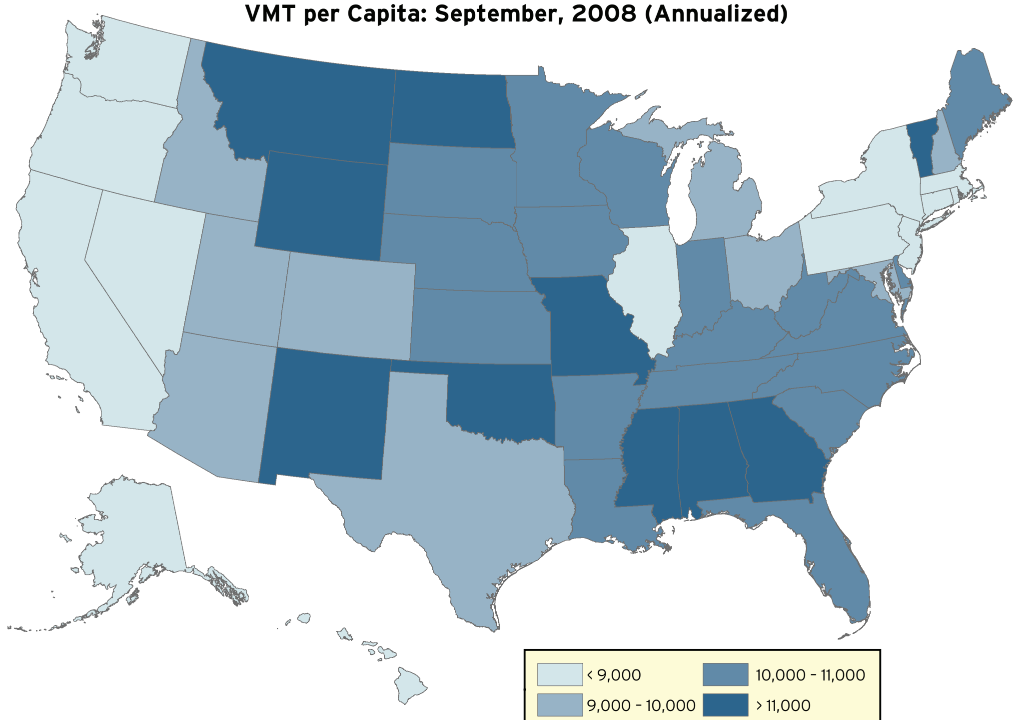
Source: Highway Statistics (1991-2006) and TVT (December 2006-September 2008)

Figure 8a and 8b. Total VMT per Capita, by State, Annualized

VMT per Capita Change: December, 2006–September, 2008 (Annualized)



VMT per Capita: September, 2008 (Annualized)



Source: TVT

Overall, a small group of states host a proportionally large share of total VMT. Four states—California, Florida, New York, and Texas—produced over 30 percent of national VMT in September 2008. These share ratios are relatively in line with the most recent national population estimates from these four states (33 percent).[43] Besides these four, no other state carried at least five percent of national VMT, with the next closest states being Georgia (3.8 percent), Ohio (3.7 percent), and Pennsylvania (3.6 percent). The consequence is that the trends in these states will have a significant effect on national VMT trends.

Regardless of a state's total share of national driving, per capita indexes of VMT create a method to cross-compare states that may have incredibly different driving and development profiles.[44] First, Washington was the only state to have a drop in VMT per capita between 1991 and 2002. From 2002 to 2006, the number jumped to 15 states with declining VMT per capita. However, in the most recent period from 2006 to September 2008, 47 states experienced declining VMT per capita.[45] Figure 8a visualizes the breadth of how many states, regardless of region, experienced less driving over this 21 month period. Again, this reinforces the idea that the entire country has been driving less since 2006.

Overall, when viewing annualized per capita driving in September 2008, the map of per capita VMT (Figure 8b) reads quite differently than the other VMT maps presented so far. The smallest per capita states are primarily in the Northeast and Pacific. In addition, several Intermountain West states (e.g. Nevada and Utah) have low per capita rates. The primacy of metropolitan areas in these states—and the shorter drives and transit alternatives that are associated with them and the metros in the Northeast—clearly affect the per capita ranking.[46]

Conversely, there are five states in between the Mississippi and Colorado Rivers that both have relatively large VMT per capita rates and are characterized by wide open spaces—Montana, New Mexico, North Dakota, Oklahoma, and Wyoming. Three Southeastern states also find themselves in the highest per capita quartile, as well as Vermont. In addition to these states large rural areas, their per capita travel is also beefed up by the presence of freight throughways.[47] Since combination trucks drive significantly more per year than standard vehicles roadways carrying a large share of trucks will generate more VMT than the average roadway.

E. Total driving on principal arterials is concentrated in the 100 largest metropolitan areas, but the greatest driving per person occurs in low density Southeastern and Southwestern metros.

Overall, the 100 largest metropolitan areas produced over 64.1 percent of national principal arterial VMT in 2006. Interestingly, the 10 largest metropolitan areas based on total employment actually produce 23.5 percent of all national VMT. They do this while housing 26.3 percent of the national population, which reinforces the idea that residents of these large metros actually drive less than the average American on principal arterials.

Table 4. National VMT Shares, Principal Arterial Roadways, 2006

Geography	VMT (Millions)	National VMT Share	Population	National Population Share
United States	1,651,077	100.0%	298,754,819	100.0%
Top 100 Metros	1,058,350	64.1%	194,665,692	65.2%
Top 50 Metros	865,860	52.4%	161,035,834	53.9%
Top 25 Metros	651,441	39.5%	123,913,530	41.5%
Top 10 Metros	388,240	23.5%	78,678,829	26.3%
Top 5 Metros	252,108	15.3%	52,351,483	17.5%

Source: HPMS and US Census Bureau

In contrast, the growth rates of VMT in the 100 largest metropolitan areas have generally exceeded those of the nation as a whole. Between 1997 and 2006, VMT grew in the 100 largest metropolitan areas by 21.8 percent, faster than the national growth rate of 20.1 percent.[48] When reducing the time period to 2002-2006, the rates were 7.5 and 6.9 percent, respectively. Progressing through this five-year period, the annual VMT growth in the 100 largest metropolitan areas steadily leveled off, similar to the national annualized VMT pattern from 2002–2006.[49]

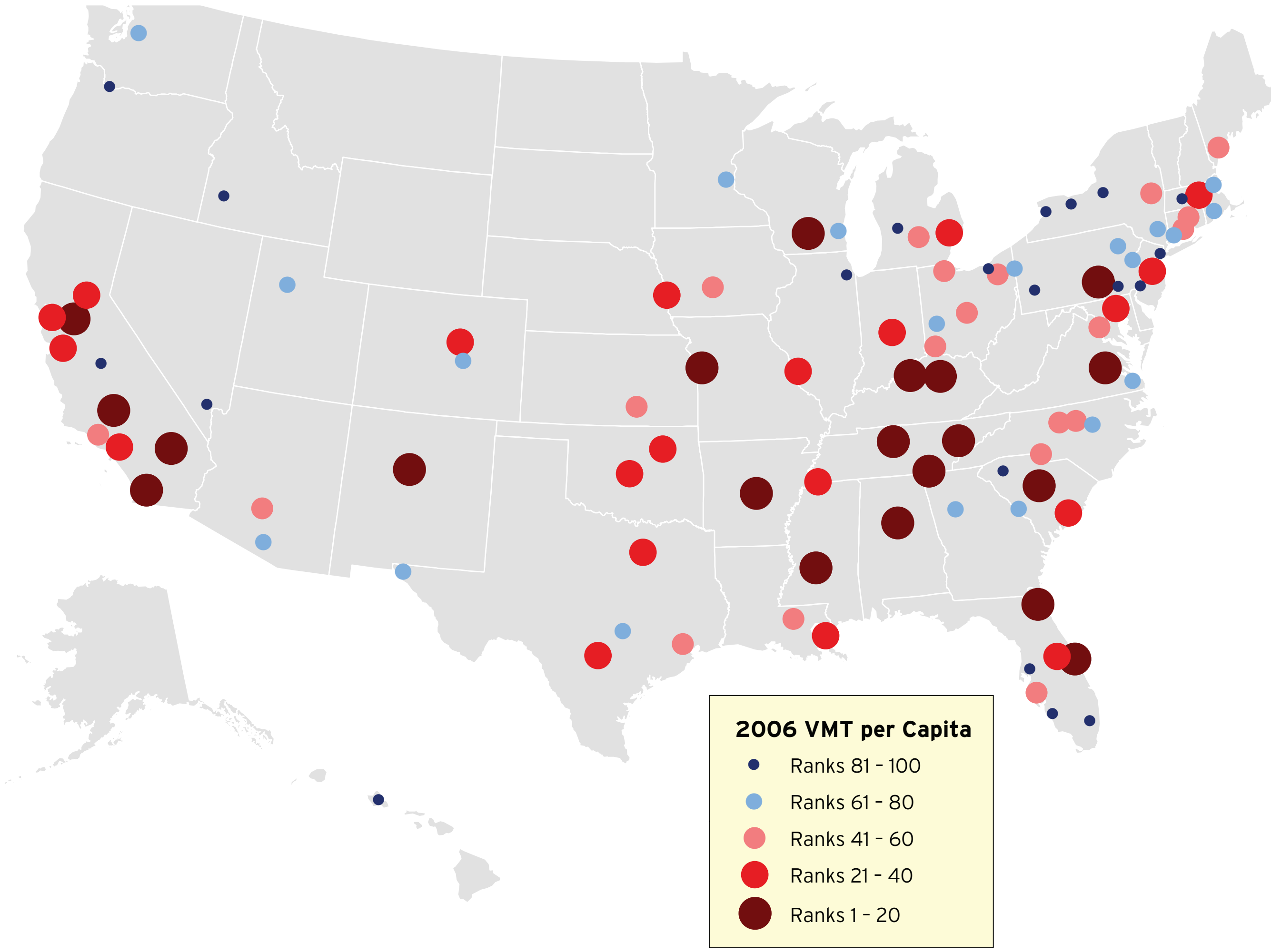
Not only are the 100 largest metropolitan areas experiencing steadily declining VMT growth rates since 2002, but as they grow in size their growth rates actually drop more. Thus, just the 5 largest metropolitan areas—New York, Los Angeles, Chicago, Washington, and Dallas—are showing a VMT decrease of 0.9 percent between 2005 and 2006. Extending this analysis to the 10 largest metropolitan areas also shows a decrease in VMT (-0.3 percent) between 2005 and 2006. To put this decrease in perspective, national VMT was up 0.8 percent from 2005 to 2006.

Broadening the comparisons to separate principal arterial road types, there are multiple trends seen between the 100 largest metropolitan areas and the nation as a whole. Not surprisingly, the travel on rural interstates and other rural principal arterials grew less in the 100 largest metropolitan areas than the entire country during the period between 1997 and 2006. Limiting the analysis to 2002–2006, when we know rural travel decreased across the county, the VMT decreases on these rural road types were much larger in the 100 largest metropolitan areas than the national trend.

The flip-side of this expectation is that urban VMT would increase at a higher rate in the 100 largest metropolitan areas versus the national total. This was the case between 1997 and 2006 for other freeways and expressways. However, urban interstate and other principal arterial VMT actually increased more for the nation as a whole than it did in the 100 largest metropolitan areas. Even more surprising was that, during 2002 to 2006, national VMT growth on all three urban roadways actually exceeded the VMT growth in the largest metro areas.

The population sizes of these metro areas vary considerably, making it difficult to compare their total VMT numbers to one another. For example, the New York metropolitan area—and its 18.8 million residents—will always produce more total VMT than smaller metropolitan areas like Palm Bay, FL.

Figure 9. VMT per Capita on Principal Arterials, 100 Largest Metropolitan Areas, 2006



Source: HPMS

However, one way to remedy this incomparability is to index a metropolitan area's VMT numbers to its population, thereby creating a VMT rate per capita.

When looking at 2006 alone, the highest principal arterial VMT per capita rates are littered across the Southeast, Sun Belt, and California. There are also two high-rate centers in Harrisburg and Madison. In Jackson, MS—the metro area with the largest VMT per capita—residents average nearly 8,200 miles a year driven on these principal arterials (interestingly, 7 out of the 12 highest driving metros per capita are state capitals.)

Contrary to these proportionally heavily-driven metros, many of the metros with the lowest per capita driving are of higher densities that also maintain relatively vibrant transit systems. This includes New York, which has the lowest per capita VMT in the country at 3,658 miles, Chicago, and Portland. Other

cities with extensive rail transit systems— Philadelphia, Boston, and Washington, DC—also dropped when comparing total VMT to VMT per capita. Eleven of the metros in the top 20 based on total 2006 VMT dropped at least 40 places when transitioning to their per capita VMT ranking.
Transit, however, is not the only explanation for lower VMT per capita rankings. For example, dense development will promote more trip chaining, as well as more walking and cycling, which could lead to lower driving per year. Dense development could also minimize the distances between destinations, which would produce more driving on local roadways and lead to less principal arterial driving per capita. In sum, there are a series of complex factors in each metropolitan area that will either encourage or discourage principal arterial driving.

Switching the analysis to specific road type shares, the general pattern is that the share of urban driving in the 100 largest metropolitan areas surpasses the national urban driving share. Specifically, the shares for the 100 largest metropolitan areas' urban driving in 1997, 2002, and 2006 were 83.0 percent, 82.4 percent, and 86.3 percent, respectively. Comparatively, the national urban driving shares in the same years were 65.9 percent, 65.2 percent, and 70.3 percent.

Masked in these numbers is the expanding urban driving among the 100 largest metropolitan areas. In 1997, there were 66 metro areas where at least 70 percent of the principal arterial driving was on urban roads. In addition, four metro areas actually experienced more driving on rural roads than urban ones. In 2006, 83 metros carried over 70 percent of their driving on urban roads and only three (Lexington, KY, Bakersfield, CA, and Portland, ME) drove more on rural roadways than urban ones.

A subset of urban arterial driving is the combined share of driving taking place on all urban freeways and expressways, including federal interstates. The 100 largest metropolitan areas carried 55.0 percent of their traffic on these high-density roads in 2006, greater than the 42.1 percent share found throughout the country. Only four metro areas maintained a share of urban freeway and expressway driving that exceeded 70 percent in 2006: Bridgeport (CT), New Haven, San Diego, and San Francisco. On the flip side, six metro areas drove less than 30 percent of the time on these roadways: Tucson, Augusta (GA), Sarasota, Portland (ME), Lexington (KY), and Bakersfield. See Figure 10 for national information.

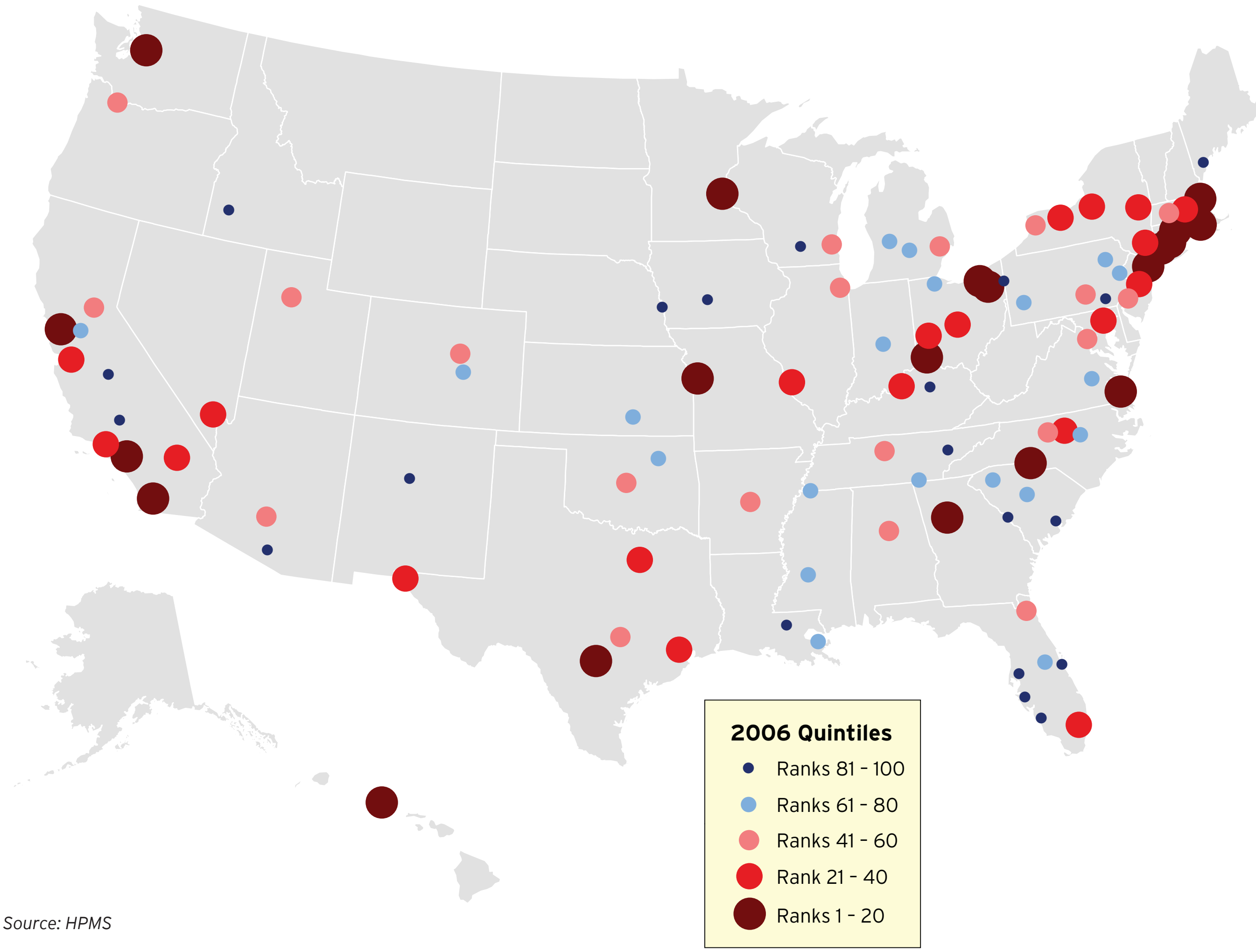
Table 5. 100 Largest Metropolitan Areas Ranked by VMT per Capita on Principal Arterials

Metro Areas - Top 15 by VMT per Capita	2006 VMT per Capita	Per Capita Change from 2002	2006 Total VMT (Millions)	Total VMT Ranking
Jackson, MS	8,182.4	13.0%	4,346.6	66
Little Rock-North Little Rock-Conway, AR	7,761.3	11.8%	5,102.2	53
Richmond, VA	7,535.2	3.4%	9,006.5	35
Stockton, CA	7,490.8	-1.5%	4,978.5	57
Harrisburg-Carlisle, PA	7,382.1	1.0%	3,873.4	73
Nashville-Davidson-Murfreesboro-Franklin, TN	7,171.8	0.3%	10,662.3	29
Bakersfield, CA	7,117.4	-0.8%	5,499.4	50
Columbia, SC	7,078.4	4.5%	4,981.7	56
Chattanooga, TN-GA	7,067.0	-1.3%	3,601.6	82
Palm Bay-Melbourne-Titusville, FL	7,057.7	15.8%	3,754.4	79
Madison, WI	7,035.8	5.1%	3,854.7	74
Lexington-Fayette, KY	6,892.1	2.3%	3,038.2	89
Knoxville, TN	6,782.7	-1.3%	4,546.3	64
Riverside-San Bernardino-Ontario, CA	6,764.5	4.1%	27,022.1	10
Jacksonville, FL	6,731.3	6.5%	8,606.8	36

Metro Areas - Bottom 15 by VMT per Capita	2006 VMT per Capita	Per Capita Change from 2002	2006 Total VMT (Millions)	Total VMT Ranking
Grand Rapids-Wyoming, MI	4,688.5	12.0%	3,623.3	81
Springfield, MA	4,604.0	4.7%	3,145.6	86
Pittsburgh, PA	4,532.5	2.8%	10,711.2	28
Fresno, CA	4,497.1	1.0%	3,982.3	71
Buffalo-Niagara Falls, NY	4,436.9	11.2%	5,028.6	54
Greenville-Mauldin-Easley, SC	4,405.9	5.5%	2,645.8	94
Portland-Vancouver-Beaverton, OR-WA	4,402.8	-2.2%	9,394.7	33
Boise City-Nampa, ID	4,189.7	1.0%	2,378.7	97
Chicago-Naperville-Joliet, IL-IN-WI	4,163.0	-1.0%	39,375.1	3
Cape Coral-Fort Myers, FL	4,138.4	23.9%	2,359.2	98
Honolulu, HI	4,097.7	1.7%	3,715.4	80
Rochester, NY	3,991.2	4.3%	4,114.9	68
Las Vegas-Paradise, NV	3,911.1	3.8%	6,950.6	45
Lancaster, PA	3,680.7	-3.3%	1,817.7	100
New York-Northern New Jersey-Long Island, NY-NJ-PA	3,657.6	6.7%	68,700.1	2

Source: HPMS

Figure 10. Urban Freeway Share of Total Principal Arterial VMT, 100 Largest Metropolitan Areas, 2006



Source: HPMS

These urban freeways constituted, on average, 24.3 percent of the total principal arterial mileage in the 100 largest metropolitan areas in 2006. However, as previously noted, they carried 55.0 percent of all principal arterial driving. This imbalance signifies that many individuals are using these limited roadways as their primary method to move within or through the metropolitan areas. In some states, public policy may actually encourage a shift in driving from local streets to these high-volume routes.

These types of driving patterns, combined with the emphasis on mobility by these freeways, are proof that many drivers in these metropolitan areas are making longer distance movements within the metropolitan area. Because freeways' limited access design provides minimal access to specific properties, driving on these roadways represents an effort to move between entirely different neighborhoods, suburbs, or separate metropolitan areas entirely. Such long distance movements reinforce the economic linkage of widespread areas throughout a single metropolitan area.[50]

V. Implications and Recommendations

The historic drop in driving that the nation is currently experiencing is undeniable. The conventional wisdom maintains that high gas prices are fueling the drop. Yet, the long-term effects of recent price spikes, now abating, on driving patterns are unclear. Though updated VMT data has not caught up to reflect recent gas price volatility, there are many signs and speculation that suggest these are permanent, long term changes.

For one, as this research points out, the decline in driving can be detected before the recent run up in gas prices.[51] Further, despite the significant easing of prices at the pump, up-to-date data from the U.S. Department of Energy shows that overall U.S. demand for petroleum is at its lowest level since 1999.[52]

Box 2. Gas Prices and Consumer Behavior

Current research does not paint a clear picture about whether the demand for gasoline is overly responsive to its price. Empirical evidence from 1980 to 1990 found that a 10 percent increase in the price of gas is estimated to reduce gas demand by 0.3 to 0.35 percent in the short run and 0.6 to 0.8 percent in the long run.[53] More recent research estimates the short run effect of gas prices on the demand for gasoline to be about -0.6 percent.[54] This reinforces the sense that the demand for gasoline has the potential to influence behavior if the price changes significantly.

The short run effect of gas prices on total driving is smaller than the gas demand elasticity. A 10 percent increase in gasoline prices is estimated to reduce VMT by 0.2 to 0.3 percent in the short run and by 1.1 to 1.5 percent in the long run.[55] A recent study by the Congressional Budget Office (CBO) estimates a traffic volume elasticity of -0.035 with respect to the price of gasoline.[56] Again, these findings suggest that a large one year price spike has the potential to significantly affect driving levels.

Several critical points should be made. In terms of behavioral change, gasoline price changes have a larger impact on aggregate fuel consumption than on traffic levels.[57] This result may point towards higher fuel efficiency of cars on the road and not towards reduction in VMT. However, the current available estimates of the price elasticities of gas demand and VMT are based on data up to 2001 or the latest 2006.[58] Therefore, they do not reflect the recent slump in VMT analyzed here. Similarly, they do not consider the enormous spike in gasoline prices to over $4 a gallon or the rapid drop back to historically average prices.

Nor is the literature broadly reflective of transportation alternatives within metropolitan areas. Examining driving trends in a dozen metropolitan highway locations in California, the CBO found gas prices do impact driving on metropolitan highways that are adjacent to rail systems (light rail and subways), with little impact in those places without. Further, they found that the increase in ridership on those transit systems is just about the same as the decline in the number of vehicles on the roadways. This suggests that freeway traffic volume—and VMT—is responsive to changes in gasoline prices and commuters will switch to transit if service is available that is convenient to employment destinations.[59]

Of course, modal alternatives will not be the only explanation for falling VMT in metropolitan areas. Rising unemployment, the development of more localized commercial centers, or housing relocation based on rising energy prices can all lead to decreased driving. Thus, there are multiple metropolitan areas in Appendix 1 without major transit systems, such as Indianapolis and Oklahoma City, which are also producing less VMT per capita over time.

Furthermore, the plateauing of total VMT and the drops in rural VMT came at a time of gas price consistency. Thus, there are many factors beyond gas prices and modal choice that may explain changes in driving patterns.

More broadly, there are intuitive connections between the current economic downturn and driving levels. As economic activity declines there is likely an effect on travel behavior.[60] Yet this should not lead to the conclusion that VMT must grow in order for our economy to prosper.[61] Issues such as energy independence and climate mitigation, goals which are made more reachable through declining VMT, also affect economic competitiveness and are important to consider. It is still too early to determine exactly how the 2008 financial crisis, and its ripple effects on the national economy, will affect consumer and business-driven driving levels.

Overall, there are many complex reasons for the recent drop in total and per capita driving and multiple signs that these drops could continue.[62] Yet it is impossible to predict future national and international events and innovations that could strongly influence American driving patterns (the wholesale introduction of super fuel-efficient vehicles, for example).

What the federal government and lower level governments can do is respond to these driving patterns with updated growth plans and transportation scenarios.

Brookings' new initiative to promote an economic agenda for the nation—*The Blueprint for American Prosperity*—asserts that true prosperity is based on achieving three types of growth: **productive** growth that boosts innovation, generates quality jobs and rising incomes; **inclusive** growth that expands educational and employment opportunities, reduces poverty, and fosters a strong and diverse middle class; and **sustainable** growth that strengthens existing cities and communities, conserves natural resources, and advances U.S. efforts to address climate change and achieve energy independence. Infrastructure—especially transportation infrastructure—can determine how efficiently and rapidly goods, people, and information move within and across markets and can also help improve air quality, conserve land and natural resources, and reduce consumption of gas and electricity.[63]

It is with an eye toward these broad goals that policymakers should grapple with the implications of reduced driving.

Reduced driving diminishes national and state transportation revenue streams, creating budgetary stresses

Declining VMT also raises important questions about transportation funding and finance. As many have pointed out—most notably the U.S. Department of Transportation—less driving (along with increased fuel efficiency and diversified fuel types) means less revenue because transportation funding is tethered to the gas tax.

The result? In September 2008 President Bush signed emergency legislation to transfer over $8 billion in U.S. general fund revenue to the Highway Trust Fund (HTF) to make up for historic shortfalls.[64] Without the legislation the fund would have run out of money, presenting a range of policy, legal, and financing challenges and forcing the FHWA to ration weekly payments to its grantees: the states.[65]

While it is hoped that this short term patch is sufficient to bolster the HTF through the end of the fiscal year, there is little clarity about the future effects of increased energy and fuel prices. Recent estimates from the U.S. Treasury Department show that the Highway Trust Fund collected $3 billion less in fiscal year 2008 than it in fiscal year 2007.[66]

The long term impacts of reduced VMT also affect two other oft-cited sources of potential new revenues for transportation: tolling and mileage-based fees. One recent analysis found significant drops in revenue and individual charges collected among toll agencies that report monthly, such as in metropolitan Orlando, Los Angeles, Riverside, Denver, and others.[67] These trends recently caused Fitch Ratings to downgrade U.S. toll road bonds from stable to negative.[68]

Meanwhile, declining VMT may dim the prospects of transitioning to revenue based on mileage fees. A mileage fee is a direct user fee that charges drivers for miles traveled rather than fuel used, as is done now with the gas tax. A mileage fee would be unaffected by the move to more fuel-efficient vehicles but is obviously impacted as driving declines. Conversely, a mileage fee utilizing peak-hour pricing could still generate sizable revenue streams in a less driving scenario while also producing more efficient use of infrastructure. A mileage-based fee will require careful consideration of both the policy specifics and current driving patterns.

Therefore, if VMT continues to slip it will impact transportation planning and programming, and in turn the financing needed to accommodate those plans.

Congress should raise the federal gas tax in the short-term to counter the decrease in revenue that accompanies the drop in driving. It should aim to ensure the recent $8 billion transfer in funds from the general fund to the HTF was a one-time event. Similarly, the federal government should repeal the 'gas guzzler tax' exemption for SUVs and light trucks to increase revenues. However, the federal government must begin serious consideration of other revenue streams that reflect historical changes in travel patterns. For example, a carbon tax is a good idea as an environmentally-motivated tax that could potentially generate revenues for a range of transportation choices such as transit.

State legislatures should also consider increasing their gas tax and implementing appropriate indexing mechanisms. Indexing the state gas tax to a reasonable measure of inflation would rationalize the process of increasing the tax rate and allow revenues to keep pace with rising costs. Furthermore, it would reduce the need for state legislatures to use general fund appropriations to compensate for shortfalls in transportation spending. Indexing tax rates is an efficient means to ensure stable tax receipts and reliable transportation budgets. States should also remove their "highways-only" restrictions and allow application of their state gas tax revenues to a balanced variety of transportation modes and projects, especially transit.[69]

Less driving helps reduce the country's GHG emissions

What is often lost in this discussion—especially around funding and finance—is that these trends are largely positive for the nation as a whole. Lower fuel consumption is vital to our energy security which, coupled with the leveling off of VMT, is important for the health of our metropolitan areas and for mitigating the challenges associated with climate change.

Yet policy discussions concerning reducing GHG emissions from transportation focus almost exclusively on identifying alternative types of transportation fuel and increasing vehicle fuel efficiency. To be sure, vehicle fuel efficiency issues are extremely important. As Finding C displayed, other passenger vehicles such as SUVs continue to produce more and more of the nation's VMT, mostly at the expense of typical passenger vehicle share. This has serious ramifications because other passenger vehicles' fuel efficiencies tend to be 6 miles per gallon less than typical passenger vehicles.[70] Moreover, the federal tax code only exacerbates this fuel efficiency discrepancy by exempting SUVs, pickup trucks, and vans from the aforementioned gas guzzler tax on fuel inefficient vehicles.[71]

However, largely absent in these policy discussions are strategies for reducing VMT.

A goal of reduced GHG emissions from transportation may benefit from a more holistic approach of increasing fuel efficiency (MPG), transitioning to lower carbon content fuels, and decreasing travel demand (VMT). All are important given that the benefits from improvements in one indicator—say, MPG—risk being offset by lack of progress in others. Increased fuel efficiency is good, but combining that with more VMT may result in no improvement on emissions.[72] Whether or not large changes in VMT represent a cost-effective way of reducing GHG emissions, the virtual absence of VMT strategies in climate change policy proposals is noteworthy. Short-term strategies that reduce VMT via price effects and longer-term land use and infrastructure changes that reduce VMT over time (or at least limit any increases) by shortening commutes and expanding transit options deserve attention in any transportation-related climate change policies.

One method to promote these environmental improvements is to create important new mechanisms to spark innovation and creativity in places that want to link disparate transportation, housing, energy, and environmental policies to create better outcomes. One such mechanism is "Sustainability Challenge Contracts" awarding competitive grants—as much as $100 million each—to partnerships of states, metros, localities, or other entities that devise the boldest, most interdisciplinary proposals for promoting sustainable development patterns or reducing carbon emissions. Such funding could come from either the HTF or in collaboration between USDOT and partnering agencies that control other federal funding sources such as revenues generated under a climate protection act or Community Development Block Grants (Brookings' "Shrinking the Carbon Footprint of Metropolitan America" has more detail on sustainability challenge grants).

Reduced driving leads to fewer traffic fatalities

Reduced VMT also positively effects outcomes around safety; perennially cited as a key area of policy focus. And for good reason. Studies show that the costs of accidents and crashes on our nation's roadways impose a considerable financial burden on households and on metropolitan areas in general. These costs include property damage, lost wages, and medical and legal costs. In the nation's largest metropolitan areas alone, the cost of traffic crashes is far greater than the bill for congestion in those places ($164.2 billion vs. $67.6 billion), with the largest metropolitan areas absorbing the largest share of the cost.[73]

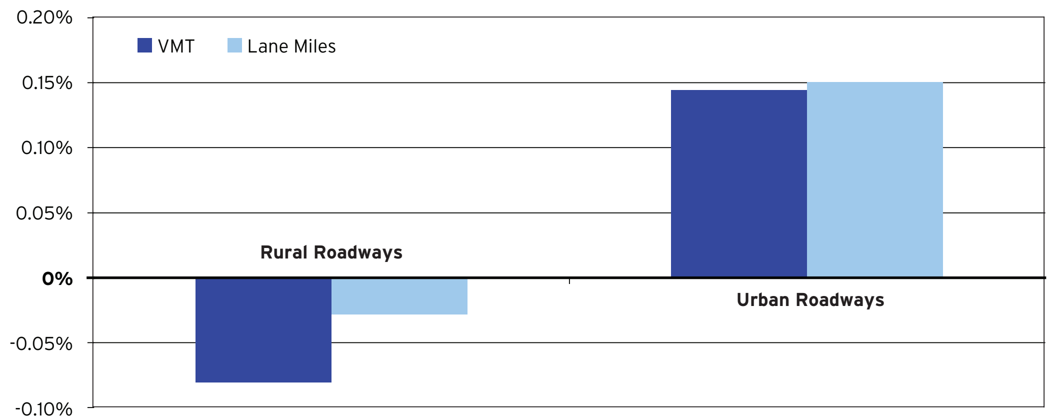
The latest data from the National Highway Traffic Safety Administration shows that not only has the overall number of traffic fatalities declined to its lowest total amount since 1994, the fatality rate of deaths per 100 million VMT was 1.37, the lowest on record.[74] The implication is that if roadway safety is an important policy goal, reducing VMT is a requisite strategy since deaths plummet as VMT goes down.

Declining VMT also raises questions about what kind of transportation network America builds and maintains into the future

Many statewide and metropolitan transportation plans assume ever-increasing VMT and pick projects and investments according to those projections and assumptions. Yet the declining rural and urban VMT to lane mile ratios discussed earlier—which did not include the more recent national VMT drops since 2006—means the nation is already on a course to have inefficiently-assigned roadway capacity in its rural and urban areas. As Figure 11 shows, rural VMT fell faster than its reduction in lane miles, while urban lane mileage expanded faster than its VMT. If VMT continues to fall—and states continue to build more roads—the nation may be wasting scarce transportation dollars on unneeded roads.

These trends should force a hard look at the correlation between metropolitan development, accessibility characteristics, and the effects on VMT and auto ownership patterns.

Figure 11. Percent Change in VMT and Lane Miles, 2002-2006



Source: Highway Statistics, Tables VM-2 and HM-60

Accessibility is defined here, simply, as the ease with which an individual can reach their desired destinations. Closer distances and more transportation alternatives between one's home and final destination create a more accessible environment.

At the metro level, a study of cities in Washington state found that jobs-housing balance and retail-housing balance, as well as housing and population density, affected driving patterns.[75] A study at the neighborhood level in San Francisco located similar results when comparing dense, urban neighborhoods to suburban counterparts.[76] Reinforcing these results was a follow-up study that included neighborhoods in three other California cities; the results were replicated.[77] A more recent study at the neighborhood level combined several other accessibility variables (jobs and shopping within specific distances, proximity of transit, and bicycle/pedestrian friendliness) to better understand VMT and auto ownership in Chicago, Los Angeles, and San Francisco.[78] The results were generally consistent with previous findings.

These researchers' results were echoed in our results from the 100 largest metro areas. Many of the metropolitan areas with high density development and robust transit systems, such as New York and Washington, tend to have lower VMT per capita rates on their primary arterial routes. Conversely, the metropolitan areas with lower density and nonexistent transit systems, such as Little Rock and Bakersfield, have some of the highest VMT per capita.

What this series of research results tell us is that land use decisions, specifically urban design and the characteristics associated with varying densities, will directly affect the transportation decisions of its residents. They also consistently find that compact development coupled with viable transit systems have the opportunity to reduce dependency on the automobile. In turn, these types of developmental decisions will have profound impacts on carbon emissions. Thus, as the country attempts to reach certain market outcomes, policy makers must consider how land consumption will indirectly affect those outcomes through land uses influence over VMT.

These land use decisions are made more complex for states and localities based on population projections. Even if individuals maintain similar driving rates, population growth will lead to increases in total VMT for certain locations. Such population increases will require land use and transportation plans that respond accordingly just as decreases in VMT, VMT per capita, and increasing transit use will.

VI. Conclusion

As the National Surface Transportation Policy and Revenue Study Commission pointed out in their comprehensive report, *Transportation for Tomorrow*, the factors that contributed to VMT growth over the past several decades do not appear to be as relevant for the future. Vehicle ownership, which contributed to VMT growth, cannot get much higher because "there is near saturation of vehicle availability for the able-bodied adult population."[79] Women entering the workforce several decades ago also had a significant impact on VMT which will not be repeated.

The commission's findings are reflected in the recent VMT data, both in the plateau during the middle of the decade and the reduction in the most recent years. Just as importantly, national VMT per capita has followed a similar, but steeper, curve. These national results are another suggestion there may be a ceiling on the amount of driving that Americans are capable of, especially on an individual basis.

If these VMT trends continue, whether those are further reductions or an extended plateau, there will be serious implications for policymakers at all levels of government. Financially, reduced driving will only intensify the federal and state governments' need to seriously reconsider their current reliance on the gas tax to fund surface transportation. Environmentally, stalled or reduced driving should offer a positive development in the creation of a more environmentally-sustainable transportation network. Developmentally, reduced driving demand will instinctively lead to more demand for development less reliant on the automobile and could signal a continued reinvigoration of this nation's cities and inner suburbs.

The synthesis of these travel trends, their significant implications, and the heightened interest in rethinking federal infrastructure policy create a unique moment. With important conversations underway about infrastructure spending as economic stimulus, the reauthorization of the current federal transportation law, and other legislative priorities like climate change and energy looming, our nation's policy opportunities are unprecedented.

It is therefore critical to recognize and address the long term implications of these travel trends and use this as an occasion to put forth a new vision that reflects new realities.

Appendix A. 100 Largest Metropolitan Areas Based on 2005 Employment, Ranked by VMT per Capita on Principal Arterials

Metro Areas - Ranked by VMT per Capita	2006 VMT per Capita	Per Capita Change from 2002	2006 Total VMT (Millions)	Total VMT Ranking
Jackson, MS	8,182.4	13.0%	4,346.6	66
Little Rock-North Little Rock-Conway, AR	7,761.3	11.8%	5,102.2	53
Richmond, VA	7,535.2	3.4%	9,006.5	35
Stockton, CA	7,490.8	-1.5%	4,978.5	57
Harrisburg-Carlisle, PA	7,382.1	1.0%	3,873.4	73
Nashville-Davidson-Murfreesboro-Franklin, TN	7,171.8	0.3%	10,662.3	29
Bakersfield, CA	7,117.4	-0.8%	5,499.4	50
Columbia, SC	7,078.4	4.5%	4,981.7	56
Chattanooga, TN-GA	7,067.0	-1.3%	3,601.6	82
Palm Bay-Melbourne-Titusville, FL	7,057.7	15.8%	3,754.4	79
Madison, WI	7,035.8	5.1%	3,854.7	74
Lexington-Fayette, KY	6,892.1	2.3%	3,038.2	89
Knoxville, TN	6,782.7	-1.3%	4,546.3	64
Riverside-San Bernardino-Ontario, CA	6,764.5	4.1%	27,022.1	10
Jacksonville, FL	6,731.3	6.5%	8,606.8	36
Birmingham-Hoover, AL	6,605.7	3.3%	7,266.8	44
San Diego-Carlsbad-San Marcos, CA	6,600.2	14.3%	19,459.8	15
Albuquerque, NM	6,587.7	6.1%	5,387.4	51
Louisville-Jefferson County, KY-IN	6,570.6	6.9%	8,019.0	40
Kansas City, MO-KS	6,526.8	-0.2%	12,803.5	21
San Jose-Sunnyvale-Santa Clara, CA	6,511.5	-0.8%	11,561.0	27
Tulsa, OK	6,486.0	5.3%	5,792.3	48
San Antonio, TX	6,452.9	12.9%	12,497.6	24
Oklahoma City, OK	6,417.3	-2.8%	7,546.4	43
Denver-Aurora, CO	6,409.1	7.5%	15,457.7	20
Worcester, MA	6,395.7	5.5%	4,985.9	55
Baltimore-Towson, MD	6,358.7	2.0%	16,935.1	18
Dallas-Fort Worth-Arlington, TX	6,334.9	-0.8%	37,900.5	4
St. Louis, MO-IL	6,232.7	-1.4%	17,412.4	17
Memphis, TN-MS-AR	6,230.4	3.1%	7,923.3	41
Sacramento-Arden-Arcade-Roseville, CA	6,177.8	5.8%	12,743.1	22
Trenton-Ewing, NJ	6,122.4	11.6%	2,232.5	99
Charleston-North Charleston, SC	6,118.9	4.2%	3,776.4	78
San Francisco-Oakland-Fremont, CA	6,076.1	3.0%	25,303.9	12
New Orleans-Metairie-Kenner, LA	6,063.1	36.9%	6,005.4	47
Omaha-Council Bluffs, NE-IA	6,060.3	2.3%	4,974.0	58
Detroit-Warren-Livonia, MI	6,053.4	3.2%	27,209.7	9
Indianapolis-Carmel, IN	5,981.4	-8.1%	9,990.9	32
Los Angeles-Long Beach-Santa Ana, CA	5,958.8	0.1%	76,670.8	1
Orlando-Kissimmee, FL	5,917.2	2.4%	11,824.7	25
Columbus, OH	5,872.4	2.3%	10,186.0	30
Akron, OH	5,866.3	3.4%	4,107.0	69
Toledo, OH	5,839.2	5.2%	3,810.9	77
Oxnard-Thousand Oaks-Ventura, CA	5,829.7	-2.9%	4,628.8	61
Des Moines-West Des Moines, IA	5,822.3	-0.1%	3,119.3	87
Wichita, KS	5,792.9	10.2%	3,413.6	84
Greensboro-High Point, NC	5,773.4	10.3%	3,964.9	72
Charlotte-Gastonia-Concord, NC-SC	5,756.9	1.6%	9,123.9	34
Hartford-West Hartford-East Hartford, CT	5,754.6	-0.3%	6,821.5	46
Albany-Schenectady-Troy, NY	5,729.1	4.7%	4,876.5	60

Appendix A. 100 Largest Metropolitan Areas Based on 2005 Employment, Ranked by VMT per Capita on Principal Arterials (continued)

Metro Areas - Ranked by VMT per Capita	2006 VMT per Capita	Per Capita Change from 2002	2006 Total VMT (Millions)	Total VMT Ranking
Houston-Sugar Land-Baytown, TX	5,721.0	-5.2%	31,508.6	5
Phoenix-Mesa-Scottsdale, AZ	5,693.5	11.1%	23,041.3	14
Durham, NC	5,675.5	1.1%	2,662.9	93
Sarasota-Bradenton-Venice, FL	5,653.9	7.0%	3,847.5	76
Washington-Arlington-Alexandria, DC-VA-MD-WV	5,600.2	1.2%	29,461.1	6
Baton Rouge, LA	5,579.2	7.9%	4,265.3	67
Lansing-East Lansing, MI	5,529.4	-3.4%	2,525.5	96
Portland-South Portland-Biddeford, ME	5,518.4	-5.9%	2,824.6	91
Cincinnati-Middletown, OH-KY-IN	5,515.9	4.2%	11,699.9	26
New Haven-Milford, CT	5,460.0	-0.7%	4,605.2	62
Milwaukee-Waukesha-West Allis, WI	5,451.9	15.8%	8,398.8	38
Seattle-Tacoma-Bellevue, WA	5,412.2	-1.6%	17,656.9	16
Poughkeepsie-Newburgh-Middletown, NY	5,388.6	12.2%	3,590.5	83
Colorado Springs, CO	5,349.7	16.8%	3,223.1	85
Scranton-Wilkes-Barre, PA	5,344.8	7.5%	2,932.4	90
Raleigh-Cary, NC	5,343.1	-3.8%	5,346.2	52
Atlanta-Sandy Springs-Marietta, GA	5,334.8	-7.4%	27,355.8	8
El Paso, TX	5,310.3	14.6%	3,852.9	75
Providence-New Bedford-Fall River, RI-MA	5,279.8	4.3%	8,470.7	37
Dayton, OH	5,254.3	7.0%	4,404.1	65
Minneapolis-St. Paul-Bloomington, MN-WI	5,242.3	3.3%	16,628.7	19
Boston-Cambridge-Quincy, MA-NH	5,237.8	3.3%	23,390.5	13
Tucson, AZ	5,199.1	17.3%	4,932.4	59
Salt Lake City, UT	5,197.1	2.3%	5,602.1	49
Allentown-Bethlehem-Easton, PA-NJ	5,160.9	-0.4%	4,104.5	70
Bridgeport-Stamford-Norwalk, CT	5,089.0	2.0%	4,549.5	63
Austin-Round Rock, TX	4,974.1	-12.3%	7,621.7	42
Augusta-Richmond County, GA-SC	4,966.8	2.0%	2,595.7	95
Youngstown-Warren-Boardman, OH-PA	4,861.5	5.6%	2,803.2	92
Virginia Beach-Norfolk-Newport News, VA-NC	4,860.5	-5.1%	8,073.3	39
Miami-Fort Lauderdale-Pompano Beach, FL	4,845.0	9.0%	26,238.1	11
Cleveland-Elyria-Mentor, OH	4,814.0	4.3%	10,134.9	31
Syracuse, NY	4,810.1	4.6%	3,110.1	88
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	4,756.6	5.6%	27,639.6	7
Tampa-St. Petersburg-Clearwater, FL	4,715.0	6.7%	12,702.4	23
Grand Rapids-Wyoming, MI	4,688.5	12.0%	3,623.3	81
Springfield, MA	4,604.0	4.7%	3,145.6	86
Pittsburgh, PA	4,532.5	2.8%	10,711.2	28
Fresno, CA	4,497.1	1.0%	3,982.3	71
Buffalo-Niagara Falls, NY	4,436.9	11.2%	5,028.6	54
Greenville-Mauldin-Easley, SC	4,405.9	5.5%	2,645.8	94
Portland-Vancouver-Beaverton, OR-WA	4,402.8	-2.2%	9,394.7	33
Boise City-Nampa, ID	4,189.7	1.0%	2,378.7	97
Chicago-Naperville-Joliet, IL-IN-WI	4,163.0	-1.0%	39,375.1	3
Cape Coral-Fort Myers, FL	4,138.4	23.9%	2,359.2	98
Honolulu, HI	4,097.7	1.7%	3,715.4	80
Rochester, NY	3,991.2	4.3%	4,114.9	68
Las Vegas-Paradise, NV	3,911.1	3.8%	6,950.6	45
Lancaster, PA	3,680.7	-3.3%	1,817.7	100
New York-Northern New Jersey-Long Island, NY-NJ-PA	3,657.6	6.7%	68,700.1	2

Source: HPMS

Endnotes

1. Annualized VMT is the addition of the most recent twelve months of VMT data to create a moving one-year measure of driving. This enables the user to control for seasonal variations and still consider the most recent monthly data.

2. The American Public Transportation Association's Ridership Report documented over 10.2 billion unlinked passenger trips in 2007, the highest annual total since 1957. Moreover, 2008 is on track to exceed 2007's ridership. Amtrak set its all-time ridership record in FY 2008, reporting over 28.7 million in annual ridership.

3. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Highway Apportionment formulae provides 18 percent of funding to states based solely on VMT. For all five fiscal years in which SAFETEA-LU is enacted, this amounts to $33.8 billion in total funding. See Office of Highway Policy Information, "Highway Statistics 2006," Federal Highway Administration, Table FA-4.

4. For example, Kansas and Nebraska specifically base the disposition of state fuel tax receipts to their counties on average daily vehicle miles traveled. See e.g., Office of Highway Policy Information, "Highway Statistics 2008," Federal Highway Administration Table MF-106.

5. Source: Authors' analysis of federal highway statistics series data

6. Office of Highway Information Management, "Highway Statistics 1966 and 2006," Federal Highway Administration, Tables MV-201, MV-1 and VM-1.

7. Office of Highway Policy Information, "Highway Statistics 2006," Federal Highway Administration, Table FE-10.

8. This continued growth was due, in part, to states that index their fuel tax or have raised their fuel tax. See: Office of Highway Information Management, "Highway Statistics 2006," Federal Highway Administration, Tables MF-1

9. Clifford Krauss, "As Gas Prices Go Down, Driving Goes Up," *New York Times*, October 29, 2008.

10. Aaron Brady and Samantha Gross, "Drivers Turn the Corner in the United States: Gasoline 'Peak Demand' Sooner than Expected?" Cambridge Energy Research Associates, Inc. 2008. http://www.cera.com/aspx/cda/public1/news/pressReleases/pressReleaseDetails.aspx?CID=9568.

11. David L. Greene and Andreas Schafer, "Reducing Greenhouse Gas Emissions from U.S. Transportation," Pew Center on Global Climate Change, May 2003, page 4.

12. U.S. Environmental Protection Agency, "Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006," Report 430-R-08-005, 2008.

13. U.S. EPA, 2008. Table 2–15

14. U.S. Department of Transportation, Federal Highway Administration, 2002. "Vehicle Miles Traveled (VMT) and Vehicle Emissions," available at www.fhwa.dot.gov/environment/vmtems.htm. Because CO2 emissions are dependant primarily on MPG and VMT, and because MPG remains relatively constant, any increase in VMT coincides with a proportionate increase in CO2 emissions.

15. U.S. EPA, 2008. Table ES–2.

16. Robert Puentes, "Caution: Challenges Ahead, A Review of New Urban Demographics and Impacts on Transportation," in *The Future of Urban Transportation*, Eno Transportation Foundation, 2006.

17. John Pucher and John L. Renne, "Urban-Rural Differences in Mobility and Mode Choice: Evidence from the 2001 NHTS," Bloustein School of Planning and Public Policy (New Brunswick: Rutgers University, 2004).

18. ibid

19. Robert E. Lang, Thomas Sanchez and Jennifer LeFurgy, "Beyond Edgeless Cities: Office Geography in the New Metropolis," National Center for Real Estate Research (Washington: National Association of Realtors, 2006).

20. Reid Ewing and others, "Measuring Sprawl and Its Impact," Washington: Smart Growth America, 2002.

21. For an analysis of these trade-offs, see: The Center for Neighborhood Technology and the Center for Transit-Oriented Development, "The Affordability Index: A New Tool for Measuring the True Affordability of a Housing Choice," Brookings: 2006.

22. Office of Highway Information Management, "About Highway Performance Monitoring System (HPMS)," Federal Highway Administration, available at http://www.FHWA.dot.gov/policy/ohpi/hpms/abouthpms.htm.

23. HPMS monitors each roadway's traffic, but only primary arterials are monitored to a degree that produces a comprehensive traffic statistic. These roadway types are considered the "Universal" roadways. One remaining subgroup, "Sampled" roadways, is monitored but requires an expansion factor to generate valid traffic results. These expansion factors are calibrated by software and only accurate at the state and urbanized area level. The final subgroup, "Summary" roadways, due to incomplete monitoring, summarizes results only by state and urbanized area. Thus, the statistics from these roadways have the largest margin of error. For more information on how the HPMS system works, see Office of Highway Information Management, "Highway Performance Monitoring System Field Manual for the Continuing Analytical and Statistical Database," Federal Highway Administration OMB Report No. 21250028, available at http://www.fhwa.dot.gov/ohim/hpmsmanl/hpms.cfm.

24. Office of Highway Information Management, "Traffic Volume Trends," Federal Highway Administration, available at http://www.FHWA.dot.gov/ohim/tvtw/tvtpage.htm.

25. Preliminary statistics, in the case of *TVT*, includes some production of statistics based on previous trends and extrapolation of incomplete data.

26. According to the FHWA, "All highway data are submitted by the States. Each State is analyzed for consistency against its own past years of data and also against other State and Federal data. The finished product is as close as possible to the original submission with only minor adjustments. Major issues are resolved with the help of the data provider." See: Office of Highway Information Management, " About Highway Statistics," Federal Highway Administration, available at http://www.fhwa.dot.gov/policy/ohpi/hss/abouthss.cfm.

27. Information per email correspondence with Robert Rozycki, Transportation Specialist at FHWA.

28. For the complete list of criteria that defines the roadway types, see Office of Planning, Environment, and Realty, " FHWA Functional Classification Guidelines," Federal Highway Administration, available at http://www.fhwa.dot.gov/planning/fcsec2_1.htm.

29. Passenger cars include motorcycles. While motorcycles have been split from passenger cars since 1996, it made sense to combine them since it would've rendered the 1966-1995 period incomparable.

30. TVT data was used throughout this subsection, excluding the chart data prior to 1983.

31. During this time states reclassified their roadways' rural and urban designation based on Census boundaries, a process described in the Methodology section. Unfortunately, the data does not allow us to separate which roadways switched from rural to urban categories, which roadways were new construction, and which roadways were closed.

32. VMT data for all twelve roadway types is only released with *Highway Statistics* publications. Thus, we are only able to assess this type of roadway-specific VMT data through 2006, which is the most current *Highway Statistics* release.

33. Similar to the breakdown of the twelve roadway types, lane mileage data is only released with *Highway Statistics* publications. Thus, we are only able to assess the VMT/Lane Mileage ratios through 2006, which is the most current Highway Statistics release.

34. VMT by vehicle type is only provided in *Highway Statistics* publications (Table VM-1) through 2006.

35. The only source for vehicle group statistics, *Highway Statistics* Table VM-1, only divides urban roadways into two categories: Interstates and non-Interstate streets. The rural roadway divisions are limited to Interstates, other arterials, and other rural roads.

36. Jean-Paul Rodrigue and others, *The Geography of Transport Systems*, London: Routledge, 2006.

37. Robert Puentes, "A Bridge to Somewhere: Rethinking American Transportation for the 21st Century," Brookings: 2008.

38. Vermont data over this period appears to be problematic. Specifically, Vermont's VMT increased 41.2 percent between 2000 and 2001, only to register drops of 14.1 and 5.5 percent in 2003 and 2004, respectively. To remove this irregularity we used Vermont DOT's VMT data from 2001 and 2002. Similar conversions were made to Vermont's data by Steve Polzin, Director of Mobility Policy, USF's Center for Urban Transportation Research, in his modeling work for the National Surface Transportation Policy and Revenue Study Commission's *Transportation for Tomorrow*.

39. The Bureau of Economic Analysis' most recent release of state economic growth from 2006 to 2007 showed the Great Lakes states from Pennsylvania to Wisconsin with economic growth rates ranging from 1.6 to -1.2 percent. All six states—Pennsylvania, Ohio, Michigan, Indiana, Illinois, and Wisconsin—were in the two lowest quintiles of state economic growth. See: Bureau of Economic Analysis, "State Economic Growth Slowed In 2007," U.S. Department of Commerce, http://www.bea.gov/newsreleases/regional/gdp_state/2008/gsp0608.htm.

40. See footnote 38 regarding Vermont

41. This is a comparison of TVT data from the end of 2006 to September 2008. We elected to use TVT data for 2006—instead of Highway Statistics data from that year—to maintain source consistency with the TVT data from September 2008.

42. This includes North Dakota, South Dakota, Montana, Wyoming, Washington, DC, and Oklahoma.

43. The most recent statewide population estimates from the U.S. Census Bureau are for July 2007. To produce September 2008 population estimates, we calculated each state's population growth rate from July 2006 to July 2007. We then multiplied that growth rate by 1 and 2/12, to give us a 14 month growth rate. Finally, the 14 month growth rate was applied to the July 2007 population estimate to produce a September 2008 population estimate. The equation was as follows: (((*2006 to 2007 Growth Rate*)*(1+(2/12)))**2007 State Population*)+(*2007 State Population*).

44. Since a state's VMT is not produced entirely by its population, these per capita statistics represent VMT as a share of population and not the average annual travel per state resident. This is especially applicable to states that are along busy trucking routes, where a sizable amount of their interstate travel is likely produced by trucks driven by non-state residents.

45. See Footnote 43 regarding the September 2008 population estimate.

46. For more information on the Intermountain West's megapolitan areas, see: Robert Lang, et. al., "Mountain Megas: America's Newest Metropolitan Places and a Federal Partnership to Help Them Prosper," Brookings: 2008.

47. A freight throughway in this instance is considered a route that carries a larger proportion of trucks than the standard roadway. According to the most recent Freight Analysis Framework data from 2002, a product of the Office of Freight Operations and Management at USDOT, the states in the highest VMT per capita quartile all maintain some of the highest truck ratio roadways in the country. More information can be found online at http://ops.fhwa.dot.gov/freight/freight_analysis/faf/index.htm.

48. 1997 was used as the baseline year because it was the first year without the use of area-wide control totals. Information per email correspondence with Robert Rozycki, Transportation Specialist at FHWA.

49. Metropolitan level data for 2008 will not be available until at least late 2009. Yet the sustained annualized VMT drops since November 2007 naturally lead to an assumption that the Top 100 Metros will show a similar decrease.

50. Similarly, the relatively higher usage of urban freeways in the metro areas between Philadelphia and Boston support the close proximity of these Northeastern locations.

51. At the onset of 2005, the first year where the national growth rates began to slide, the average gas price for regular unleaded was $1.75 a gallon. This amount is still significantly less than the $2.40 per gallon reported on November 11, 2008, which was after the enormous drop in oil barrel pricing on world markets. See the Energy Information Administration for more detailed information on gas prices.

52. Energy Information Administration, "Weekly Petroleum Status Report," October 16, 2008. http://www.eia.doe.gov/oil_gas/petroleum/data_publications/weekly_petroleum_status_report/wpsr.html.

53. Steven L. Puller, and Lorna A. Greening, "Household Adjustment to Gasoline Price Change: An Analysis Using Nine Years of U.S. Survey Data." Energy Economics, Vol, 21(1): 1999, 37-52; Daniel J. Graham and Stephen Glaister, "The Demand for Automobile Fuel: A Survey of Elasticities," *Journal of Transport Economics and Policy* Vol. 36(1): 2002, 23.

54. This is a median of a range of estimates produced recently. Kenneth A. Small and Kurt Van Dender, "Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect," Energy Journal, Vol. 28(1): 2007, pp. 25–51. Jonathan E. Hughes, Christopher R. Knittel, and Daniel Sperling, "Evidence of a Shift in the Short-Run Price Elasticity of Gasoline Demand," University of California, Davis, Institute of Transportation Studies Research Report UCD-ITS-RR-06-16, 2006.

55. Small and Van Dender, 2007.

56. This elasticity factor refers only to the weekday travel behavior in metropolitan highways with rail access in California. The study employs traffic volume (total vehicles per day) instead of VMT; however, the indicators are highly correlated. Congressional Budget Office, "Effects of Gasoline Prices on Travel Behavior and Vehicle Markets", Publication No. 2883, 2008.

57. Graham and Glaister, 2002.

58. Small and Van Dender, 2007; and CBO, 2008.

59. CBO, 2008.

60. Anthony Downs has argued that rising metropolitan traffic congestion levels may be a symptom of economic success, though congestion may have other negative impacts in addition to externalities such as carbon emissions. He cities the high traffic congestion levels in the San Francisco Bay region that peaked at the height of the dot.com boom and declined as unemployment and office vacancies soared when the bubble burst. For a comprehensive discussion of the causes of congestion, its dynamics, and its relative incidence in various parts of the country, see Anthony Downs, *Still Stuck in Traffic: Coping with Peak-Hour Traffic Congestion*, Brookings, 2004.

61. The causation is from national output to VMT and not the reverse. VMT is a proxy for driving, which is an indicator of mobility. Mobility is a requirement of economic activity because individuals must be able to reach certain locations where their economic activities take place. If an individual's same level of mobility is achieved through other means, less driving does not have a negative effect on their economic actions. Thus, aggregated up, declining VMT for a large geographic area will not be an indication of declining economic activity. This is especially true in modern times with other substitutes for mobility, such as telecommuting and online retail.

62. There is a substantial body of literature regarding VMT saturation and or how close to saturation the nation might be. See e.g., Steve, Polzin, Ram Pendyala, and Lavenia Toole-Holt, "Two Minutes per Person per Day each Year: An Exploration of the Growth in Travel Time Expenditures," *Transportation Research Record* 1917, 2005: 45-53.

63. Puentes, 2008.

64. PL 110-318, 15 September 2008.

65. "Daily Highway Payments to States Resume Today After President Signs Trust Fund Transfer," *AASHTO Journal,* Vol. 108(37), September 19, 2008.

66. "Highway Trust Fund Collections Drop by Nearly $3 Billion in Fiscal Year 2008," *AASHTO Journal*, Vol. 108(41), October 16, 2008.

67. Peter Samuel, "The Great Crisis and Tolling—Declining Traffic and Dismal Prospects," *TOLLROADSnews*, October 5, 2008.

68. Michael McDermott and others, "U.S. Transportation Assets: Facing a Temporary Decline or a Permanent Change?" Fitch Ratings, Ltd.: New York, 2008.

69. Robert Puentes and Ryan Prince, "Fueling Transportation Finance: A Primer on the Gas Tax," in *Taking the High Road: A Metropolitan Agenda for Transportation Reform*, B. Katz and R. Puentes, eds., Brookings, 2005.

70. Environmental Protection Agency, "Light-Duty Automotive Technology and Fuel Economy Trends: 1975 through 2006."

71. Salvatore Lazzari, "Energy Tax Policy", Congressional Research Service of The Library of Congress, 2005.

72. See e.g., Reid Ewing and others, *Growing Cooler: Evidence on Urban Development and Climate Change*, Urban Land Institute, 2007.

73. American Automobile Association, "Crashes vs. Congestion —What's the Cost to Society?" prepared by Michael D. Meyer and Cambridge Systematics, Inc., 2008.

74. National Highway Traffic Safety Administration, "Traffic Safety Facts: 2007 Traffic Safety Annual Assessment—Highlights," Report DOT HS 811 017: 2008.

75. Gary Pivo and others, "Land Use Trends Affecting Auto Dependence in Washington's Metropolitan Areas, 1970–1990," Washington State Department of Transportation Report WA-RD 380.1, 1995.

76. John Holtzclaw, "Explaining Urban Density and Transit Impacts on Auto Use," Natural Resources Defense Council in California Energy Commission, Docket No. 89-CR-90, 1991.

77. John Holtzclaw, "Using Residential Patterns and Transit To Decrease Auto Dependence and Costs," Natural Resources Defense Council and California Home Energy Efficiency Rating Systems, 1994.

78. John Holtzclaw and others, "Location Efficiency: Neighborhood and Socioeconomic Characteristics Determine Auto Ownership and Use – Studies in Chicago, Los Angeles and San Francisco." Transportation Planning and Technology, 2002, 25:1, 1-27.

79. National Surface Transportation Policy and Revenue Study Commission, "Transportation for Tomorrow," 2008, Section 2-4.

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