Quantifying the effect of local government actions on VMT
VMT Impact Tool
Summary for Policy Makers

March 2014

Overview

A VMT Impact Tool is now available to assist cities, counties, and regions with estimating changes in vehicle miles traveled (VMT) that are unique to their community and mix of neighborhood types. Changes in VMT are estimated for eight different land use and transportation system variables that can be impacted by policies implemented at the local level.

Recommended Tool Users: Local policy makers such as elected officials and professional planners

Best phase in the planning process to use the tool: General Plan Updates and Climate Action Plans

How does this research relate to local governments and their choices?
The objective of this research was to give local and regional governments an idea of the differential effectiveness of certain actions in different sorts of neighborhoods to assist with targeting actions.

Background

On-road vehicles generate more than one-third of California's greenhouse gas (GHG) emissions annually. While the state is moving forward with vehicle emission standards and low-carbon fuel standards to reduce transportation emissions to meet the goals of AB 32, an overall reduction in VMT is also critical to achieve climate goals in 2020 and beyond. In 2008, SB 375 was adopted requiring California regions to prepare a Sustainable Community Strategy that identifies how the region will achieve GHG reduction targets through integrated land use, housing and transportation planning. To comply with AB 32 and SB 375, California local and regional governments are working to develop and implement new policies that aim to reduce VMT. To develop targeted policies with scarce resources, cities, counties, and regions need guidance as to which policies will be most effective for their jurisdiction.

ARB has published a series of reviews evaluating the impact of key land use and transportation strategies on VMT and greenhouse gas emission reductions found in the literature. The California Air Pollution Control Officers Association's (CAPCOA) guidance document "Quantifying Greenhouse Gas Mitigation Measures" also provides ranges of VMT impacts for a host of transportation and land use strategies. However, the challenge is that the particulars of the local and regional context play a large role in determining which actions will be most effective where, but existing research provides little evidence on how context affects policy effectiveness. Local estimates were needed because a policy likely does not have the same impact across all neighborhood types. For instance, increasing public transit capacity in an urban area that already has a robust system may lead to a greater change in VMT than introducing public transit to a rural area with little ridership potential. This research study begins to fill this research gap and quantify changes in land use and transportation variables and their effect on VMT as a function of the local or regional context. The results of this study are expected to provide local and regional assistance to meet statewide targets to reduce GHG emissions and overall VMT.

Function of the Tool

The VMT Impact Tool created by this project allows users to select a city, county, or metropolitan planning region to obtain estimates of how much VMT may change due to changes in land use and transportation system variables in the selected region. Users can also use this tool to look at how much VMT may change in individual neighborhood types. The tool can be used to assist local governments with evaluating and prioritizing future actions based on their existing local context.

After selecting the desired jurisdiction, the VMT Impact Tool displays the results of eight policy-sensitive variables on three measures of VMT: Household VMT, Non-work VMT, and Home-To-Work VMT. The variables evaluated in the tool, as well as the policies that likely influence them are listed below:

Corresponding Variables and Policies in Tool	
Variable in the Tool	**Example Policies**
Gasoline Price	- Road pricing - Possibly parking pricing
Percent of Commuters Riding Transit to Work	- Add transit routes - Increase service frequency (i.e. reduce headways) - Add real-time transit vehicle arrival information to stations and stops - Add premium (e.g. faster, more comfortable) service for an additional charge - Provide additional amenities (e.g. wi-fi access) on transit vehicles and at major transfer hubs
Local and Regional Job Access	- Incentivize development that brings housing to job centers and/or brings jobs to housing centers - Implement mixed-use zoning
Activity mix	Implement mixed-use zoning
Percent of Commuters Walking/Biking to Work	- Implement complete streets - Sidewalk and path construction and maintenance - Bicycle lane and path construction and maintenance - Create bicycle boulevards - Implement road diets to improve pedestrian safety - Implement traffic calming measures - Improve pedestrian crossings - Implement mixed-use zoning - Incentivize infill development
Road Density	Improve connected-ness of road network
Percent Single Family Homes	Allow multifamily housing development

How can the tool be used by local governments?

Local governments are required to comply with SB 97, which requires projects under CEQA to mitigate for GHG emissions, including VMT. Many local governments have adopted climate action plans or plans with the primary purpose of addressing climate change, but in many cases moved forward with little guidance. In 2009, following the passage of SB 97, the Natural Resources Agency added Section 15183.5 to the State Guidelines Implementing the California Environmental Quality Act (CEQA Guidelines), which recognized the important role of such plans in the CEQA process. This section also laid out a basic framework for developing a plan to reduce GHG emissions and acknowledges the role CEQA plays in ensuring the impacts of climate change is addressed. Local governments can use the VMT Impact Tool

to assess how their General Plans or Climate Action Plans may affect changes in VMT and indirectly comply with CEQA.

How to Interpret the Tool Results
When users select a jurisdiction of interest, they can quickly see the jurisdiction-level effects in the spreadsheet tab "Result Total." The results provided include both VMT marginal effects and VMT elasticities for each of the eight policy-relevant variables. All results are reported in lower and upper bounds for a 95% confidence interval, indicating there is a strong likelihood that the actual VMT effect falls within that bound.

Estimated Change in VMT	Definition
Marginal Effect	Absolute change in VMT when a variable increases by one unit.
Elasticity	Percent change in VMT when the variable increases by one percent.

Marginal Effect Example: For Los Angeles, the marginal effect of VMT for the variable 'percent of commuters who use transit' falls between -.29 and -.10. This means that if the percentage of commuters using transit in LA increases by an additional one percent (for LA, this would mean an increase from 11.74 percent to 12.74 percent), total household VMT in the region would decrease by .10 to .29 percent.

Elasticity Example: For Los Angeles, the VMT elasticities for the percent commuters riding transit is between -.14 and -.05. This means that if the percent of commuters using transit grows 1 percent (for LA, this would mean an increase from 11.74 percent to 11.86 percent – note that this is different from a one percentage point increase), household VMT would be reduced between .05 and .14 percent.

Methods and Approach

The project used data from numerous sources and required the use of multiple statistical methods to estimate the effect of land use and transport system variables on VMT, differentiated by local context. To create the dataset, the Principal Investigator (PI) merged observations from five household travel surveys conducted in California, calculated the distance for each trip taken in a vehicle, and added a number of variables to represent the built environment. The main analysis consisted of three main steps. First, the PI used quantitative methods to classify the census tracts of California into neighborhood types. Second, the PI estimated a multinomial logit (MNL) model of household choice between these neighborhood types. An MNL model is the most commonly applied model to explain and forecast discrete choices for more than two alternatives. The PI used the tobit model to address the statistical challenge presented by the large number of zero VMT observations and estimate VMT for each neighborhood type. Tobit models are similar to linear regressions, but help deal with situations in which the dependent variable is censored in some way. In this instance, it is used to better address the significant number of zero VMT observations which likely do not actually reflect zero VMT households. The PI connected the tobit analyses to the MNL model to control for residential neighborhood type self-selection. Next, the PI used these models to calculate the marginal effects and elasticities for three measurements of VMT: total household VMT, individual non-work trip VMT, and individual commute trip VMT using the following land use and transportation system variables: average gasoline price, local job access, regional job access, transit access, pedestrian and bicycle friendliness, percent of housing that is single family detached, road density, and land use mix. Because the proposed analysis was complex, the PI first developed and tested their methods using only one of the travel surveys – the

Caltrans Statewide Household Travel Survey – and later added observations from the remaining four surveys. The report provides details for each of these steps of data preparation and analysis.

Results

The VMT Impact Tool can be used to assist cities, counties, and regions to quantify changes in land use and transportation variables and their effect on VMT as a function of the local or regional context. The results of this work should provide targeted information for local decision makers about how changes in these variables are likely to affect VMT based on the land use types that are present in their community. This study finds that the effects of some land use and transportation system characteristics do depend on neighborhood type, in ways that are intuitive but had not previously been empirically verified. For instance, the effect of a change in gasoline price on VMT is effectively zero in both "Central City" and "Rural" neighborhoods. This likely reflects the fact that residents who drive in these neighborhoods do not have flexibility to choose to drive less when gas prices are high. They already are minimizing the amount that they drive. In all other neighborhood types, the VMT effect of pricing is uniformly large and statistically significant. The effect on VMT of improving job access is highly variable across neighborhood types, with the largest absolute effect of local jobs seen in the "Rural" and "Suburb, Single Family Homes" neighborhood types. As would be expected, changing road density is an important determinant of VMT only in neighborhoods with relatively lower road densities. Understanding the differences in effectiveness of policies on VMT will help to prioritize local actions to reduce VMT to assist with meeting the goals of AB 32 and SB 375.

Implications and Recommendations

This research has shown that average VMT varies dramatically by California neighborhood type. The "Central City" neighborhood type has an average household VMT of 18 miles, whereas the "Suburban Single Family Home" neighborhood type has an average household VMT of nearly 60 miles — three times higher. This analysis also found that strategies to reduce VMT should be tailored to the neighborhood type and local context. For instance:

- Changing gasoline prices reduces VMT the most for urban, high transit use neighborhoods, likely reflecting that residents here have more mobility options and thus more flexibility to choose to drive less when gas prices are high.
- The effect on VMT of improving job access likewise is highly variable across neighborhood types, with the largest absolute effect of local jobs seen in the "Rural" and "Suburb, Single Family Homes" neighborhood types, where current job access is somewhat limited.
- Road density is an important determinant of VMT only in areas with relatively lower road densities.

The analysis also shows that there are large VMT differences between people living in different neighborhood types in California. In fact, average household daily weekday VMT is—on average—three times larger in suburban, single-family home neighborhoods than in central city neighborhoods in California. ARB hopes that this VMT Impact tool will be a useful way to share the results of this research with those making real-world policy decisions, and that it can help to inform more targeted local policies throughout the state.

The tool, final report, and summary for policy makers for the research project, "Quantifying the Effect of Local Government Actions on Vehicle Miles Traveled," are posted on the following ARB website: http://www.arb.ca.gov/research/single-project.php?row_id=64861