Washington State Transportation Commission

January, 2015

Road Usage Charge Assessment

Financial and Equity Implications for Urban and Rural Drivers

Washington State Transportation Commission

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Executive Summary

Study Process

The 2014 Legislature directed the Washington State Transportation Commission (WSTC) to undertake a study of the urban and rural financial and equity implications of a potential road usage charge (RUC) system in Washington (ESSB 6001, Sec 205 (7)). The study was to be completed within existing funds. The directive in the 2014 Supplemental Transportation Budget states:

> ***"(7)*** *Within existing resources, the commission shall undertake a study of the urban and rural financial and equity implications of a potential road usage charge system in Washington. The commission shall work with the department of transportation and the department of licensing to conduct this analysis. For any survey work that is considered, the commission should utilize the existing voice of Washington survey panel and budget to inform the study. The results must be presented to the governor and the legislature by January 15, 2015."*

This study compared estimated annual payments for Washington State personal light-duty vehicles using current fuel tax rates with estimated annual payments under a hypothetical road usage charge. The study achieved this via a three part analysis: 1) Created a model to compare estimated fuel tax payments using current fuel tax rates with estimated road usage charge payments for light duty vehicles registered to urban and rural residents in Washington State 2) a household inventory and mileage survey of vehicles via the Voice of Washington State (VOWS) survey panel and 3) the use of Washington labor data on commuting patterns.

It is important to note that the *fuel economy and vehicle miles traveled (VMT) allocation model* analysis is intended simply to serve as an illustration of a hypothetical change in the manner in which driving is taxed and the resulting effect on users. In conducting the analysis, staff assumed that the amount of gross revenue generated from the hypothetical road usage charge would be the same as the fuel tax gross revenue for calendar 2014. However, it should be noted that the policies ultimately adopted by the Legislature and the Governor could deviate from a gross revenue neutral outcome which could thus create different impacts on urban and rural drivers than is demonstrated in this study.

Key Findings

Fuel Consumption and VMT Allocation Model

The comparison between rural and urban extended to drivers and households. **The modeling found that the tax burden for each group does not appear to significantly change with a switch from fuel taxes to a hypothetical road usage charge.**

The results of the Fuel Consumption and VMT Allocation Modeling effort show that with road usage charges, rural drivers would benefit slightly from the change and urban drivers would likely pay slightly more than they do in fuel taxes. The model produced this result because it found that rural residents tended to drive less fuel efficient vehicles and more miles per year than those residents living in an urban area, on average.

Under a hypothetical RUC, the Fuel Consumption and VMT Allocation model shows that the greatest impact of the change relates to factors other than whether the drivers live in urban or rural areas. The factors that have a strong effect relate to characteristics of the vehicle the driver uses. For example, the model finds that drivers with newer and more fuel-efficient vehicles would pay more in road usage charges then they would pay in fuel taxes.

Voice of Washington State (VOWS) Survey

The Voice of Washington State (VOWS) Survey analysis was not designed to yield a conclusion one way or the other regarding the urban and rural impacts of switching to a hypothetical road usage charge. Instead, it was designed to gather household vehicle information and assess perceptions of vehicle miles driven and miles per gallon. As is the case with all surveys, the responses reflect the respondent's perceptions. **The VOWS survey results indicate significantly higher perceived miles driven for rural over urban drivers/households, but indicate no significant differences between urban and rural in regards to perceived fuel economy of vehicles owned.**

Commuting Patterns of Washington Residents

In order to examine the differences between rural and urban residents, the commute distances for rural and urban workers in Washington State were examined. The US Census OnTheMap national database has commuting patterns for Washington state residents for years 2002-2011.

Examining the commuting patterns over time reveals a trend that **more individuals are commuting longer distances over the past ten years for both urban and rural commuters.** The percentage of urban commuters with a one-way work commute to their primary job of less than 10 miles is higher, at 54.4 percent, than that for rural commuters, at 42.6 percent, in 2011.

The opposite is true in the longest commute category of greater than 50 miles. More than 20 percent of rural commuters drive more than 50 miles, one way, to work, versus only 9 percent of urban commuters. This data supports the observation that rural residents have longer work commutes than urban residents.

Evaluation of the Impact of a Road Usage Charge Urban versus Rural Drivers

Project History

In 2012, the Washington State Legislature directed the Washington State Transportation Commission (WSTC) to undertake an assessment of a road usage charge (RUC) as a possible replacement for the fuel tax. The WSTC has conducted the assessment in close cooperation with the Washington State Department of Transportation (WSDOT), and with guidance from a multi-stakeholder steering committee. The WSTC found that a RUC was indeed feasible.

In 2013, the Legislature and Governor directed the RUC work to continue, requesting the WSTC and the RUC Steering Committee to determine if there is a business case to be made for a road usage charge in Washington State. In response, the WSTC and the RUC Steering Committee reported that there appeared to be a business case for a road usage charge as an alternative, sustainable, long-term revenue source. The Commission estimated that such a system would yield $2.1 billion to $3.1 billion more in revenue than the current fuel tax system over the period 2015-2040.

In 2014, the Legislature directed the WSTC to continue the RUC work, requiring a work plan that included:

- The refinement of the initial policy analysis and development;
- A concept of operations; and
- An updated financial analysis

To date (December 2014), the WSTC has completed this work.

The 2014 legislative direction also required the evaluation of potential impacts of a road usage charge, with respect to urban and rural financial and equity implications. This report specifically addresses this directive.

Background

This assessment begins with building an understanding of the factors contributing to the flattening in fuel consumption – and therefore fuel tax revenues – in Washington State. These factors provide context to the analysis of urban and rural driver trends, therefore informing the assessment of the urban and rural financial and equity implications of a potential road usage charge.

Since the mid-2000's, the tax base for the fuel tax – consumption of gasoline and special fuel (i.e., mostly diesel fuel) – has stagnated, relative to the preceding period. Several factors impacted fuel consumption, including a historically substantial economic recession, an

apparent change in consumer transportation mode choice preferences, federal adoption of higher Corporate Average Fuel Economy (CAFÉ) standards for the first time since the 1980's, technological improvements in vehicle motor efficiency, more telework opportunities, and an apparent change in consumer preferences for more fuel efficient vehicles. At the same time, the amount of vehicle miles traveled (VMT) has also appeared to stagnate for some of the same reasons as the fuel consumption changes.

Figure 1 depicts these trends in Washington State. From fiscal year (FY) 1990 to 2004, consumption of gasoline increased, growing at an average annual rate of 1.5 percent. Overall, total fuel consumption (gasoline and special fuels) also increased, growing at an average annual rate of 1.8 percent. However, from FY 2004 to 2014, consumption of gasoline decreased, changing at an average annual rate of -0.2 percent, while overall fuel consumption was nearly stagnant, growing by an average annual rate of just 0.1 percent. As noted in Figure 1, the high points for gasoline consumption (2,770 million gallons) and special fuels consumption (777 million gallons) occurred in FY 2004 and FY 2008, respectively. Looking at statewide VMT growth from FY 1990 to 2004, the average annual growth rate was 1.7 percent, similar to the growth in fuel consumption. However, VMT growth from FY 2004 to 2014 was slightly more positive than fuel consumption growth, at an average annual rate of 0.6 percent. More detail about fuel trends can be found in the Road Usage Charge business plan.

Figure 1. Historical Fuel Consumption and Vehicle Miles Traveled (VMT) reported

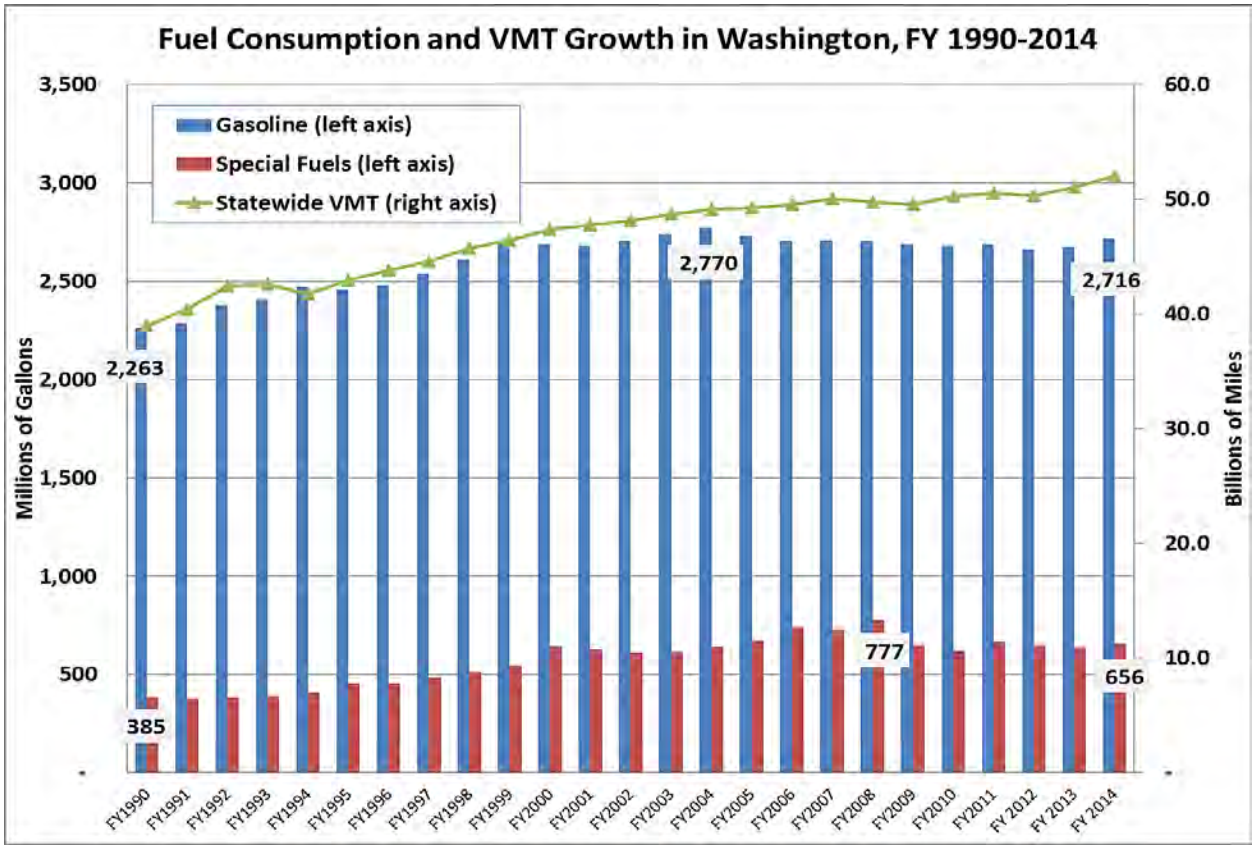


Figure 1. Source: WSDOT Quarterly Revenue Forecast Materials

Study Approach and Assumptions

To evaluate the potential urban and rural impacts of a road usage charge, with respect to financial and equity implications, the WSTC assembled a staff work group representing the Washington State Transportation Commission, Department Of Licensing, Department Of Transportation, and the Transportation Committees of the Legislature. The staff work group selected a three-prong approach to conduct the evaluation:

1. Fuel Consumption and VMT Allocation Model: Evaluate the differences in tax impacts of a hypothetical change to a road usage charge from the current fuel tax on urban and rural drivers, based on the household locations where the vehicles were registered (see Appendix C) and results from the 2009 National Household Travel Survey.
2. Voice of Washington State (VOWS) Survey: Use the VOWS Survey panel maintained by the Commission to inventory vehicles by household and gain an understanding of perceived miles driven and miles per gallon of each vehicle owned.
3. Commuting Patterns of Washington residents: Investigate a portion of driving activity on roads in urban and rural areas using U.S. Census Bureau by the Bureau of Labor Statistics (BLS) data for Washington State on commuting patterns.

The body of this report describes the approach and findings from the three prongs. The appendix contains detailed descriptions on assumptions, methodologies, and detailed findings for each of the three prongs.

Please note that the **Fuel Consumption and VMT Allocation Model** and VOWS survey yielded different results for several of the same major driving activity indicators. However, the staff study group concluded that with an understanding of the approaches, methods, and biases, the differences were explainable. A comparison of key results and of the approaches, methods, and biases are included after the Commuting Patterns results on page 12 in this report.

Fuel Consumption and VMT Allocation Model

The staff group evaluated a hypothetical road usage charge (RUC) by estimating the dollar impact to the taxpayer of switching to such a road usage charge from the current fuel tax. The model focused only on personal vehicles. No vehicles registered to businesses or government agencies were included in the analysis. This allowed for a comparison to the national household survey data, and to the VOWS survey results.

To estimate the impacts, staff developed a vehicle-based model coupled with vehicle miles traveled assumptions to simulate distributional differences in travel, fuel consumption, and tax or fee payments. Staff developed this model using several data sources: data from the Department of Licensing (DOL) Vehicle Headquarters System covering the personally owned vehicles in the Washington active light duty vehicle fleet; 2011-13 data from the Washington

Department of Transportation Highway Performance Monitoring System; U.S. Environmental Protection Agency fuel economy estimates for 1984-2014; and the 2009 National Household Travel Survey.

The model was based on, for each household vehicle in the state, an estimate of annual vehicle miles of travel (VMT) and an estimate of fuel economy associated with the vehicle. Staff merged the DOL vehicle database with EPA estimates for fuel economy estimates for all vehicle types and then utilized the national household travel survey results to estimate vehicle miles traveled for all light duty vehicles in Washington State. The model estimated the fuel consumption for each vehicle by dividing the VMT by the fuel economy. To obtain a RUC estimate, staff applied a single RUC rate to the vehicle's VMT estimate. Staff determined the RUC rate by assuming that the gross revenue yielded under the RUC scenario would be the same as under fuel tax for FY2014; this is referred to as a "gross revenue neutral" scenario.

In the process, the staff group also evaluated the financial impacts to drivers of different vehicle types, of different vehicle ages, and of vehicles of different fuel economy. The staff group also explored the distributional impacts by county.

See Appendix A for a full description of the fuel consumption and VMT model and detailed findings.

Key Findings:

- The "average" household-based light-duty vehicle fuel economy for June 2014 is estimated at 19.5 mpg.

- The modeling indicates that rural drivers on average drive more miles per year than urban drivers, rural drivers consume more fuel per year than urban drivers, and rural drivers on average pay more in fuel taxes per year than urban drivers. See Table 1.

- For calendar year 2014, the rural light duty vehicle drivers would have paid slightly less in road usage charges than they did in fuel taxes (about $4 less per year). Meanwhile, urban light duty vehicle drivers would have paid slightly more (about $2 more per year).

- The model found that there was a great range of potential impacts to drivers of vehicles based on certain characteristics. Drivers of highly fuel-efficient "hybrid" cars, for example, could be expected to pay more than two times as much as that paid at the current fuel tax rate (37.5 cents). On the other hand, drivers of older, less fuel-efficient pickup trucks could be expected to pay a third less than under the current fuel tax rate.

The Fuel Consumption and VMT Allocation Modeling approach used for this analysis suggests a change from the fuel tax payments to road usage charge payments would have *very little effect on the amount of tax paid by rural or urban drivers, on average*. As described, this is based on a gross revenue-neutral scenario selected for modeling June 2014 light-duty household-based

vehicle data, with rates set at the current fuel tax rate of $0.375 per gallon, and a road usage charge rate set at $0.0192 per mile.

Table 1. (*Excerpt from Table 5, Appendix A)*
Comparison of a Fuel Tax with a Hypothetical Road Usage Charge – Calendar Year 2014

	Average Annual:				
Comparison Basis:	VMT (miles)	Fuel Consumed (gallons)	Fuel Tax Paid ($,Current Law)	Road Usage Charges ($, Hypothetical Scenario)	Impact of Change to Hypothetical Scenario ($)
By Geography					
Rural	9,288	484	$ 182	$ 178	($ 4)
Urban	8,611	436	$ 163	$ 165	+ $ 2

Model data sources include June 2014 DOL VHS data, EPA fuel economy estimates for 1984-2014, 2011-13 WSDOT HPMS, and the 2009 NHTS.

Rural drivers would likely pay a few dollars less per year in road usage charges, and urban drivers a couple dollars more, on average. This is because, while the model finds that rural drivers drive more miles annually than do urban drivers, the rural based-vehicles are not as fuel efficient on average and so consume even more fuel, and the rural drivers thus pay even more fuel tax, than urban vehicles and urban drivers do. The greater mileage means that the rural drivers would indeed have to pay more in road usage charges than urban drivers, but this is more than offset by the fuel tax savings for the rural drivers, relative to that for urban drivers.

Impacts of the change from fuel taxes to hypothetical road usage charges on drivers in other vehicle type categories are worth noting: drivers of cars would tend to pay more in road usage charges; drivers of SUVs, pickup trucks, and vans would tend to pay less. Drivers of newer and more fuel-efficient vehicles would tend to pay more; those of older and less fuel-efficient vehicles, less. *See Table 5 in Appendix A for more information*.

Voice of Washington State (VOWS) Survey

The Washington State Transportation Commission (WSTC) conducted a statewide survey using the Voice of Washington State (VOWS) survey panel to inform the WSTC's RUC urban/rural impact analysis. The WSTC designed the survey to help better understand the makeup of our state's residential vehicle fleet and residents' usage of our roads and highways, from the survey respondent's perspective.

The survey gathered household data on each survey respondent's total number of vehicles, total miles driven per year, and the proportion of in-state, out-of-state, and off-public road driving. The survey asked specific questions about characteristics of each household vehicle (up to six vehicles), including: make/model, year, engine type, transmission, miles per gallon, and miles driven. Five thousand six hundred and thirty eight (5,638) surveys were completed out of the 30,000 active members of the statewide Voice of Washington State (VOWS) panel. The surveys were weighted by age within a county, and the counties were weighted by population

in proportion to the state total. The weighting by age within a county was done to address under reporting by the younger age ranges.

See Appendix B for further details on the VOWS survey results.

Key Findings:

Household Findings

Statewide, the reported average number of vehicles per household is 2.2 (excluding motorcycles/motorhomes)

- Rural areas have the highest reported vehicle average with 2.7 vehicles per household, followed by suburban areas (2.3 vehicles), and urban areas (1.7 vehicles).

Survey responses indicate that the average household drives 17,742 miles per year

- Rural area respondents report the most driving: the average household drives its vehicles 22,243 miles per year. This is followed by suburban households (18,368 miles) and then urban households (13,206 miles).

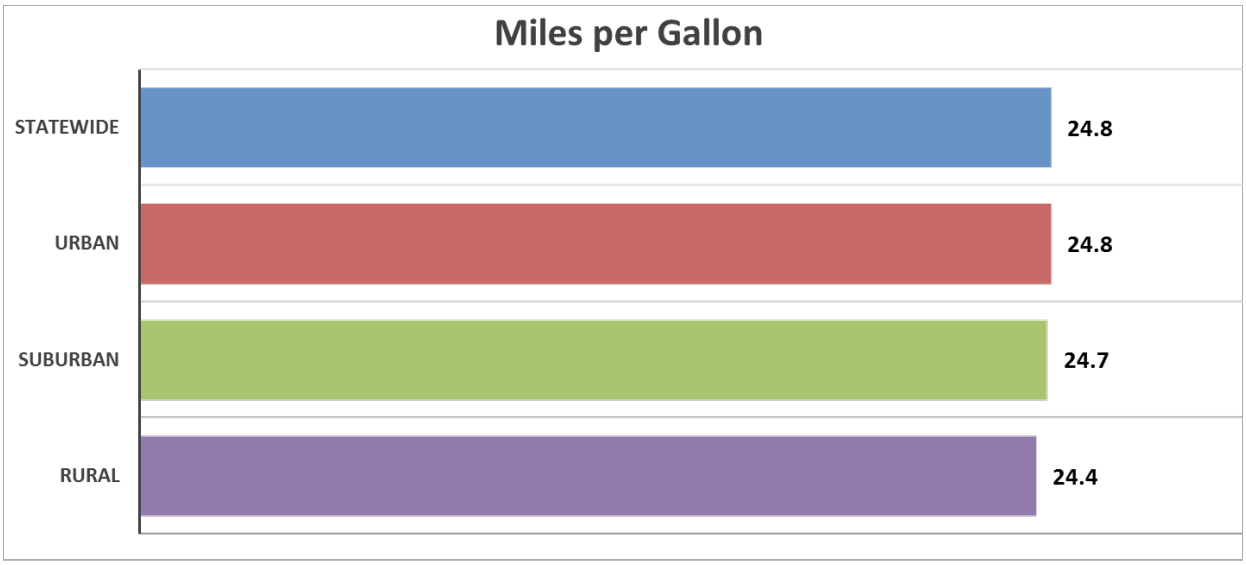
Survey respondents indicate that the vast majority (86 percent) of driving is done in state

- Responses indicate that households in rural areas are twice as likely as urban/suburban households to drive on non-public roads, although the overall percentage is still quite small at 4 percent.
- Responses indicate that households spend 10 percent of their driving outside of Washington State.

Statewide, the average fuel economy reported for all vehicles a household owns is 24.8 MPG *(See Figure 2 on following page.)*

- Responses indicate that most households with a vehicle own a Gas only vehicle, 6 percent own a Hybrid, 1 percent owns an Electric vehicle, and 9 percent own a Diesel vehicle.
- Survey respondents in urban, suburban and rural areas reported little difference in their combined average MPG

Figure 2. Perceived average miles per gallon, of a household, reported by VOWS respondents

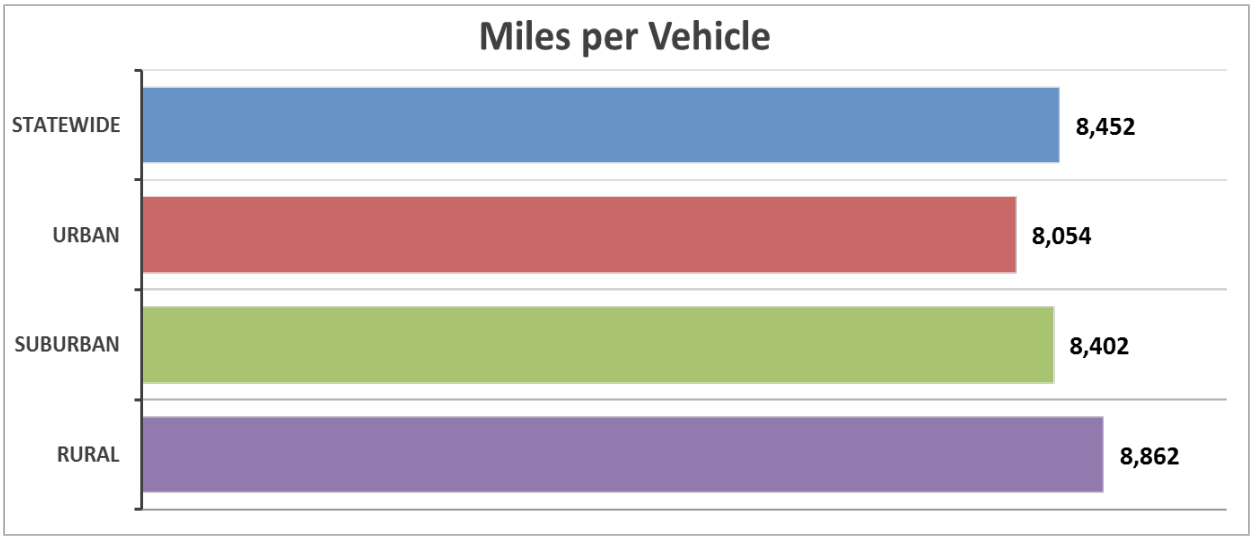


Vehicle Findings

Survey respondents report driving an average of 8,452 miles per vehicle per year (Figure 3)

- Residents in rural areas reported driving an average of 8,862 miles per vehicle
- Residents in suburban areas reported driving an average of 8,402 miles per year
- Residents in urban areas reported driving an average of 8,054 miles per year

Figure 3. Perceived Average miles per Vehicle reported by VOWS respondents



Commuting Patterns of Washington Residents

Commuting to work is one of the primary uses of our "road" network. As such, the staff group decided to evaluate actual commuting patterns in Washington State through the US Census *OnTheMap* dataset. The OnTheMap tool, which is based on historical commuting data from 2002 through 2011, allows the user to calculate one-way distances between employees' home addresses and employment locations. The tool allows the user to categorize commute trips into four distance categories: less than 10 miles, 10 to 25 miles, 25 to 50 miles, and greater than 50 miles.

The staff group investigated the state of Washington commuting patterns by county with workers' home addresses as the determining factor in classifying the worker as urban or rural. The staff group mapped each urban or rural area for each county in the state in conjunction with the US Census commuter data. Then staff summarized the commuter distances for all residents in the rural and urban areas in the state utilizing WSDOT and Federal Highway Administration definitions of rural and urban. In 2002, there were 1.8 million commuters (75.7 percent of total) on urban roads and 0.57 million commuters (24.3 percent of total) on rural roads. Ten years later, commuters on urban roads rose to 1.98 million (75.3 percent of total) and commuters on rural roads rose to 0.65 million (24.7 percent of total).

See Appendix D for further details.

Key Findings:

On average, Washington residents over time have seen a longer commute distance between 2002 and 2011

- The commuters on urban roads with the shortest commute distance, less than 10 miles, saw a decline in their percentage from 58.6 percent in 2002 to 54.4 percent in 2011.
- All other longer commuting distance categories saw their shares rise with the longest commuting distance category, greater than 50 miles, with the largest increase from 6.3 percent of all commuters on urban roads in 2002 to 9.1 percent of commuters on urban roads by 2011.
- Commuters on rural roads showed similar results as urban over the same time period.

On average, Washington rural commuters have a longer commute than urban commuters

- Consistently, a smaller proportion of commuters from rural areas have had a short work commute, less than 10 miles, compared to commuters from urban areas.
- Consistently, a much larger proportion of commuters from rural areas have had a long commuting distance, greater than 50 miles, compared to commuters from urban areas.

Comparison of Fuel Consumption and VMT Allocation Model and the VOWS Survey

As noted in the Approach and Assumptions section, the Fuel Consumption and VMT Allocation Model and VOWS survey yielded different results for several of the same major driving activity indicators.

For example:

- For annual VMT, the model yielded an average of 8,891 miles per year per light-duty vehicle, while the VOWS survey yielded an average of 8,452 miles per year per light-duty vehicle.
- For fuel economy, the model yielded an effective statewide average of 19.5 mpg per vehicle in the inventory modeled, while the VOWS survey yielded an average of 24.8 mpg per vehicle.

The Commuting Patterns Study ("OntheMap") did not investigate the same indicators on an annual basis.

The staff study group concluded that with an understanding of the approaches' methods and biases, the differing results are not necessarily surprising.

The model is based on institutional data from the DOL, the WSDOT, and the U.S. EPA. While derived from sources that rely on long-standing protocols, the institutional data is not without error. For instance, the same protocols used to measure VMT on state facilities may not be followed on local facilities. In addition, individual vehicle fuel economy depends on how a vehicle is driven and maintained so utilizing EPA rating for fuel economy may overstate fuel economy.

The VOWS survey results are perceptions of travel activity that are self-reported via an online survey from a panel of self-selected statewide citizens who have shown interest in discussing transportation issues. These aspects of the survey may impact the representation of the results to the state as a whole. As such, efforts were taken to address the concern of potential representation impacts by "Weighting" the survey results. The raw survey results were weighted by age within a county and county within the state to represent Washington's population. The survey approach taken relies on respondents' perceptions of mileage driven and miles per gallon achieved instead of having respondents track data by a travel diary or tracking device. While this creates the possibility of perceptional errors, it does accurately reflect the perceived reality of mileage and MPGs of Washington respondents.

The staff study group believes that corrections for bias in each case could yield results from the two approaches that are more consistent with one another. Resources were not available to make those corrections for this study.

APPENDICES

Appendix A
Fuel Consumption and VMT Allocation Model
Detailed Findings and Methodology

The staff group evaluated a hypothetical road usage charge (RUC) by estimating the dollar impact to the taxpayer of switching to such a road usage charge from the current fuel tax. The approach focused on the revenue-side taxpayer impacts only; staff did not evaluate the administrative, expenditure-side impacts in this study.

To estimate the impacts, staff developed a vehicle-based model to simulate distributional differences in travel, fuel consumption, and tax or fee payments. Staff developed this model using several data sources: data from the Department of Licensing (DOL) Vehicle Headquarters System covering the entire Washington active light-duty vehicle fleet; 2011-13 data from the Washington Department of Transportation (WSDOT) Highway Performance Monitoring System; U.S. Environmental Protection Agency (EPA) fuel economy estimates for 1984-2014; and the 2009 National Household Travel Survey (NHTS).

The model was based on, for each vehicle, an estimate of annual vehicle miles of travel (VMT) and an estimate of fuel economy associated with the vehicle. The fuel economy estimate was obtained from the EPA data and the VMT estimate was obtained initially from the NHTS survey data and then adjusted to conform to WSDOT and DOL aggregate fuel consumption data. Staff modeled the per-vehicle fuel consumption by dividing the VMT by the fuel economy. Fuel tax estimates were calculated by multiplying the fuel consumption estimate by the fuel tax rate. To obtain a RUC estimate, staff applied a single RUC rate to the vehicle's VMT estimate. Staff determined the RUC rate by assuming that the gross revenue yielded under the RUC scenario would be the same as under statewide fuel tax; this is referred to as a "gross revenue neutral" RUC rate.

The model results allowed staff to compare impacts of switching to a hypothetical RUC to rural and urban drivers. In addition, the staff group also evaluated impacts to drivers of different vehicle types, of different vehicle ages, and of vehicles of different fuel economy.

Model Development

The first step in the development of the distributional model was to assess the nature of the 2014 Washington light-duty fleet. Based on the 5.1 million active household-based light duty vehicles in June 2014, described further in Appendix C, the staff group analyzed the data for distributions by various characteristics. Figure 1a shows these distributions for each characteristic. Comparison of this information with analogous information for the national fleet is discussed further below.

For comparison purposes, the distribution of the 2009 NHTS data is analyzed according to the same categories as were used for the DOL data; the results are shown in Figure 1b. Of note, the national light-duty household-based fleet in 2009 was much newer and more urban than the Washington light-duty household-based fleet in 2014: Figure 1b shows that about two-thirds of the household light-duty vehicles in 2009 were ten years old or less, while Figure 1a shows that 45 percent of Washington household light-duty vehicles in June 2014 were ten years of age or less. The national survey shows that 72 percent of all household light-duty vehicles are registered in urban areas, while for Washington the share is less than 60 percent.

Figure 1a. Characteristics of the 5.1 Million Light-Duty Vehicles in Washington Households in June, 2014.

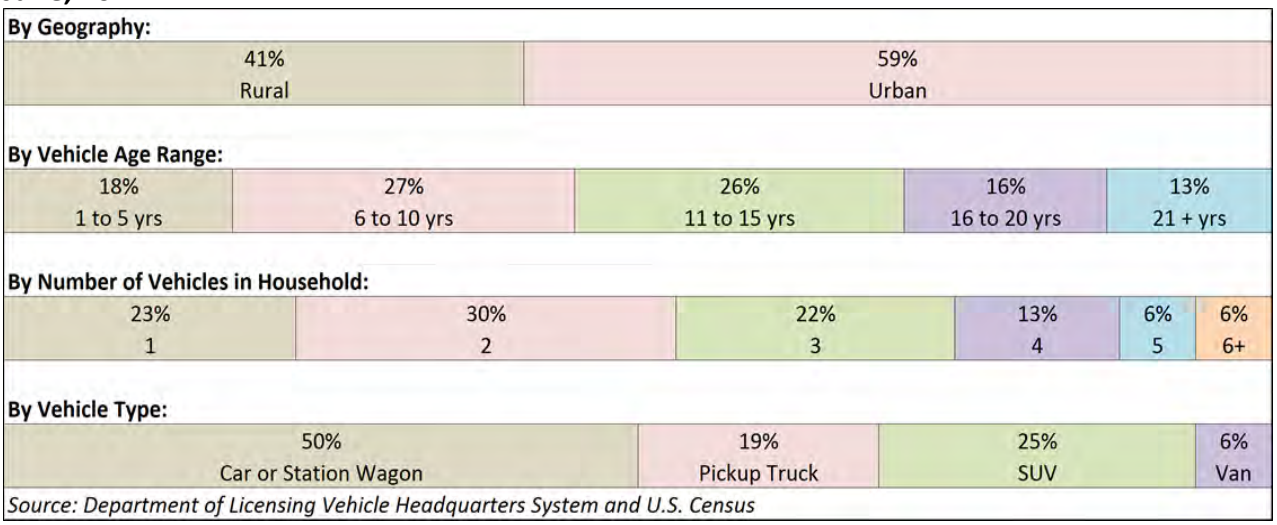
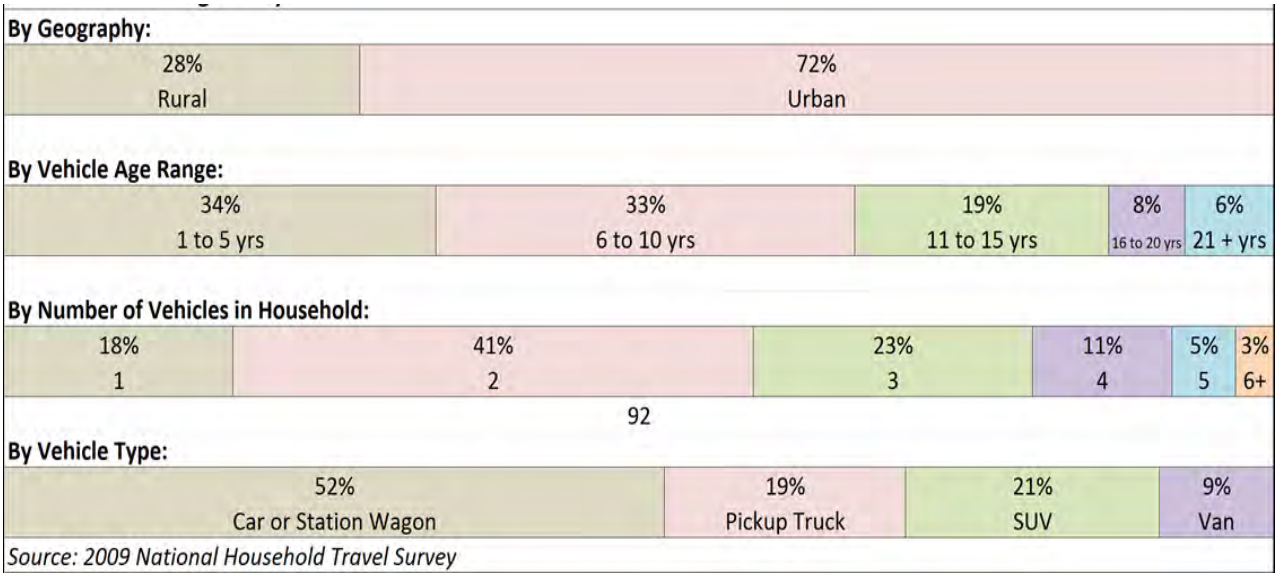


Figure 1b. Characteristics of the 189.6 Million Light-Duty Vehicles of U.S. Households in mid-2009.



The second step in developing the distributional model was adding corresponding fuel economy estimates for each vehicle in the June 2014 light-duty fleet. Since DOL does not collect fuel economy data, it was necessary to obtain the data from an external source: the United States Environmental Protection Agency (EPA). The EPA determines fuel economy ratings according to specific protocols, and composite highway/city ratings are accessible online for regulated vehicles going back to 1984. Regulated vehicles include most light-duty cars and trucks under 8,500 GVW (and under 10,000 GVW since 2011).

For the purposes of this analysis, the staff group matched fuel economy ratings from the EPA data to the DOL data using information common to both data sets, such as engine configuration data. The procedure to supplement the DOL data involved both one-to-one matching and a statistical matching process called hot deck imputation. In brief, hot deck imputation involves, for a given record in a dataset, the identification of potential "matches" of one or more records in a second dataset, based on variables and values common to both, such as make, model, model year, engine displacement, and others. When more than one match was identified, staff then selected one of the matches at random and assigned the fuel economy value to the record in the first dataset.

In some other studies and analyses that have included the EPA fuel economy ratings, the values have been adjusted downward to account for real-world driving experiences that degrade actual fuel economy performance. The staff group investigated the effect of modifying the EPA fuel economy ratings downward but found that such an adjustment caused the model to over predict aggregate fuel consumption. So for the purposes of this study, staff did not modify the nominal EPA fuel economy ratings in the final version of the model.

The third step in the development of the model was to assign an initial estimate of annual VMT to each vehicle in the household-based light-duty vehicle fleet and then to calculate an estimate of annual fuel consumed. As with fuel economy, DOL does not collect annual VMT data. To develop the model, the staff group assigned estimates of annual VMT using data from the 2009 National Household Travel Survey (NHTS). The U.S. Department of Transportation (USDOT) conducts this survey periodically to better understand driving behavior and household characteristics. As part of the 2009 NHTS, USDOT collected information about travel behavior for over 150,000 households in the sample set. This included information on the more than 309,000 vehicles owned by the households in the sample. The annual VMT associated with each vehicle was not self-reported by the survey participants but rather developed using odometer and other survey data by a national science and energy research laboratory.

The 2009 NHTS results showed that there were statistically significant differences in VMT depending on several vehicle characteristics: registration location (i.e., urban or rural), vehicle type (e.g., passenger car, sport utility vehicle, etc.), vehicle age, number of vehicles in the household, vehicle fuel economy, and vehicle luxury status (i.e., whether the vehicle cost $60,000 or more when bought new). The staff group assigned initial estimates of VMT using

the hot deck imputation statistical matching process, as described above, using the aforementioned variables. The staff group then modified the VMT values by multiplying each value by the ratio of the average VMT for light-duty vehicles in Washington to the average VMT nationally from the NHTS data. Staff obtained the in-state VMT data from WSDOT. As required by the Federal Highway Administration (FHWA), WSDOT collects traffic count data for all state-system roadways and then derives estimates of VMT driven on those roadways using roadway mileage data. WSDOT supplements this information with estimates of VMT driven on local roadways, provided by local governments. WSDOT is further able to estimate VMT for light-duty vehicles because the traffic counters distinguish vehicles with differing numbers of axles and tires. For this study, the staff group determined the average VMT by dividing the VMT for light-duty vehicles by the number of registered light-duty vehicles in the state (per DOL).

After the modification of the VMT vehicle record, the staff group further developed the model to calculate an annual estimate of fuel consumption. The staff group estimated the annual fuel consumption for each vehicle by dividing the annual VMT estimate by the EPA fuel economy rating. The staff group then compared the aggregate estimate of the modeled annual fuel consumption to known recent historical fuel consumption derived from fuel tax collections. To more closely attain the estimated fuel consumption amounts, the staff group then calibrated the model over several iterations, with adjustments made to the average VMT estimate and the VMT distribution across vehicle age. These adjustments are shown in Table 1.

Table 1: Estimation of Average Vehicle Miles of Travel for Light-Duty Household Vehicles

1	WSDOT HPMS Estimate of annual VMT for FHWA classes 1-3, 2011-13 average	51,255,782,000
2	Estimated annual VMT for FHWA class 1-3 vehicles other than cars and light trucks	2,366,910,300
3	Total Light-Duty VMT, cars and light trucks only, 2011-13 average ([Row 1] - [Row 2])	48,888,871,700
	Adjustment factors:	
4	Estimated growth from historical 2011-13 average to calendar year 2014	103.7%
5	Percent of total VMT driven on-road within taxable in-state jurisdictions	93.0%
6	Effective Annual VMT, light-duty vehicles ([Row 3] x [Rrow 4] x [Row 5])	47,148,241,700
7	Total number of household-based light-duty vehicles modeled (from DOL Vehicle Headquarter System, June 2014)	5,109,406
8	Business-based light-duty vehicles and household light-duty vehicles above 10,000 GVW	194,013
9	TOTAL Statewide light-duty fleet ([Row 7] + [Row 8])	5,303,419
10	Average Annual VMT per light-duty vehicle in WA ([Row 6] / [Row 9])	8,890

Source: WSDOT and DOL.

The fourth and final step in the model development was to add steps to estimate the gross revenue generated by the current fuel tax and gross revenue generated from a hypothetical

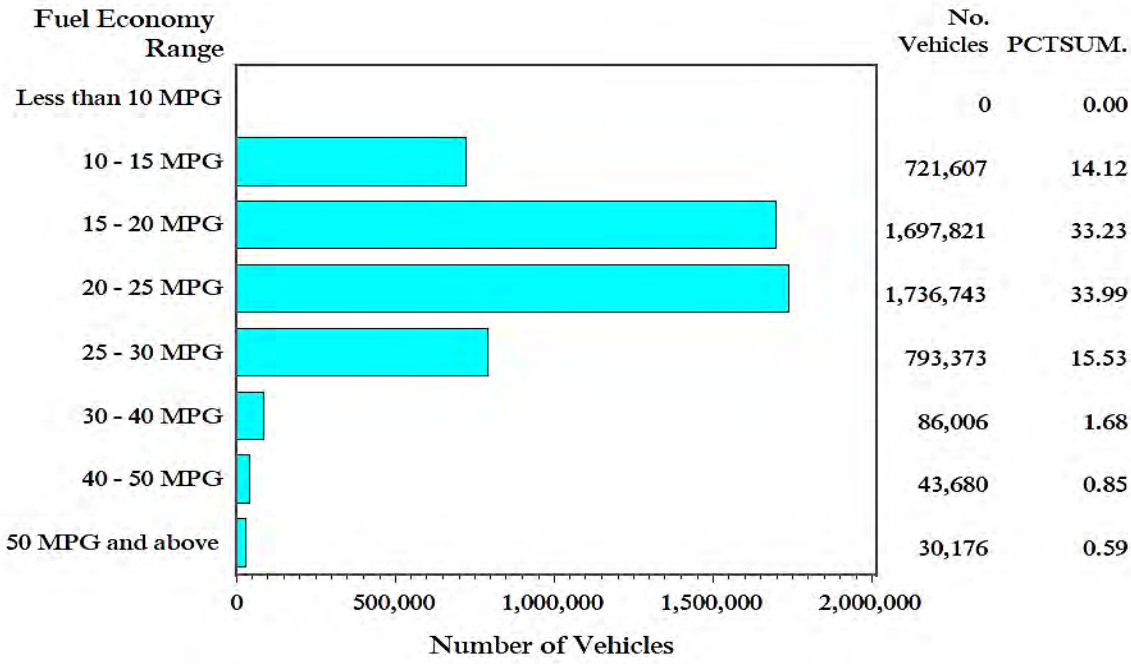
road usage charge, had the RUC been in place instead of fuel taxes for the time period modeled. An annual fuel tax estimate was determined for each vehicle by multiplying the estimated number of annual gallons of fuel consumed at the current state fuel tax rate of $0.375 per gallon. A road usage charge estimate was determined by multiplying the estimate of annual VMT for the vehicle by a hypothetical road usage charge rate ($0.0192).

The hypothetical road usage charge rate, for the purposes of this analysis, was derived assuming a gross revenue-neutral approach: under the hypothetical scenario, the amount of aggregate revenue was assumed to be equal to the amount generated under current law in fiscal year 2014. The charge rate was then calculated by taking the aggregate fuel tax estimated by the model and dividing by the aggregate VMT estimated by the model.

Findings

The fuel economy matching process results are shown below in Figure 2. In June 2014, a plurality of light-duty household-based vehicles (about 1.74 million, or 34 percent of the 5.1

Figure 2.
Number of Washington Vehicles in the Light-Duty Fleet in June 2014
By Fuel Economy Range



Model data sources include June 2014 DOL Vehicle Headquarters System data and EPA fuel economy estimates for 1984-2014.

million vehicles) had an EPA rating of 20-25 miles per gallon (mpg). The nominal average fuel economy across the entire light-duty fleet of household vehicles was 20.4 mpg. However, the nominal average fuel economy for household light-duty vehicles was a bit higher than the effective average fuel economy (19.5 mpg). The effective average fuel economy for light-duty household vehicles is based on aggregate VMT and fuel consumption, as shown in Table 2. For context, as shown in Table 2, the estimated effective average fuel economy for all Washington vehicles – household, business, government, and other – and including light-, medium-, and heavy-duty - is 16.9 mpg. This estimate is based on dividing the statewide VMT by the statewide fuel consumption, from the Washington September 2014 forecast update documents.

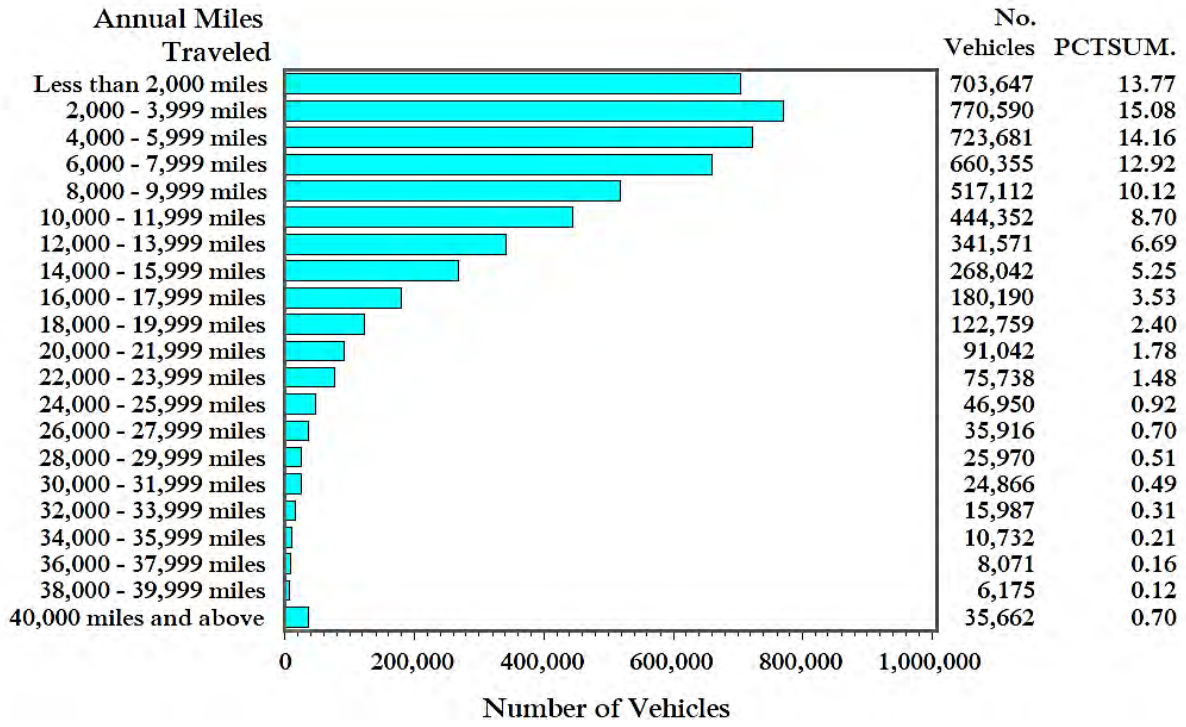
Table 2. 2014 Modeled Light-Duty Vehicle Activity Compared to 2014 All-Vehicle Activity*

Measure	**Household Light-Duty Fleet** ***Modeled*** *estimates*	**All Washington Vehicles** ***Forecast-based*** *estimates*
Vehicle Miles of Travel	45.4 billion miles	57.1 billion miles
Gallons of Fuel Consumed	2.329 billion gallons	3.384 billion gallons
Estimated MPG	19.5 mpg	16.9 mpg

**Modeled figures shown represent estimates for calendar 2014 activity. Model data sources include June 2014 DOL Vehicle Headquarters System (VHS) data, EPA fuel economy estimates for 1984-2014, 2011-2013 estimates of VMT from the WSDOT Highway Performance Monitoring System, and the 2009 National Household Travel Survey (NHTS). Forecast-based estimates are averages of FY 2014 and FY 2015 figures in the September 2014 Transportation Revenue Forecast.*

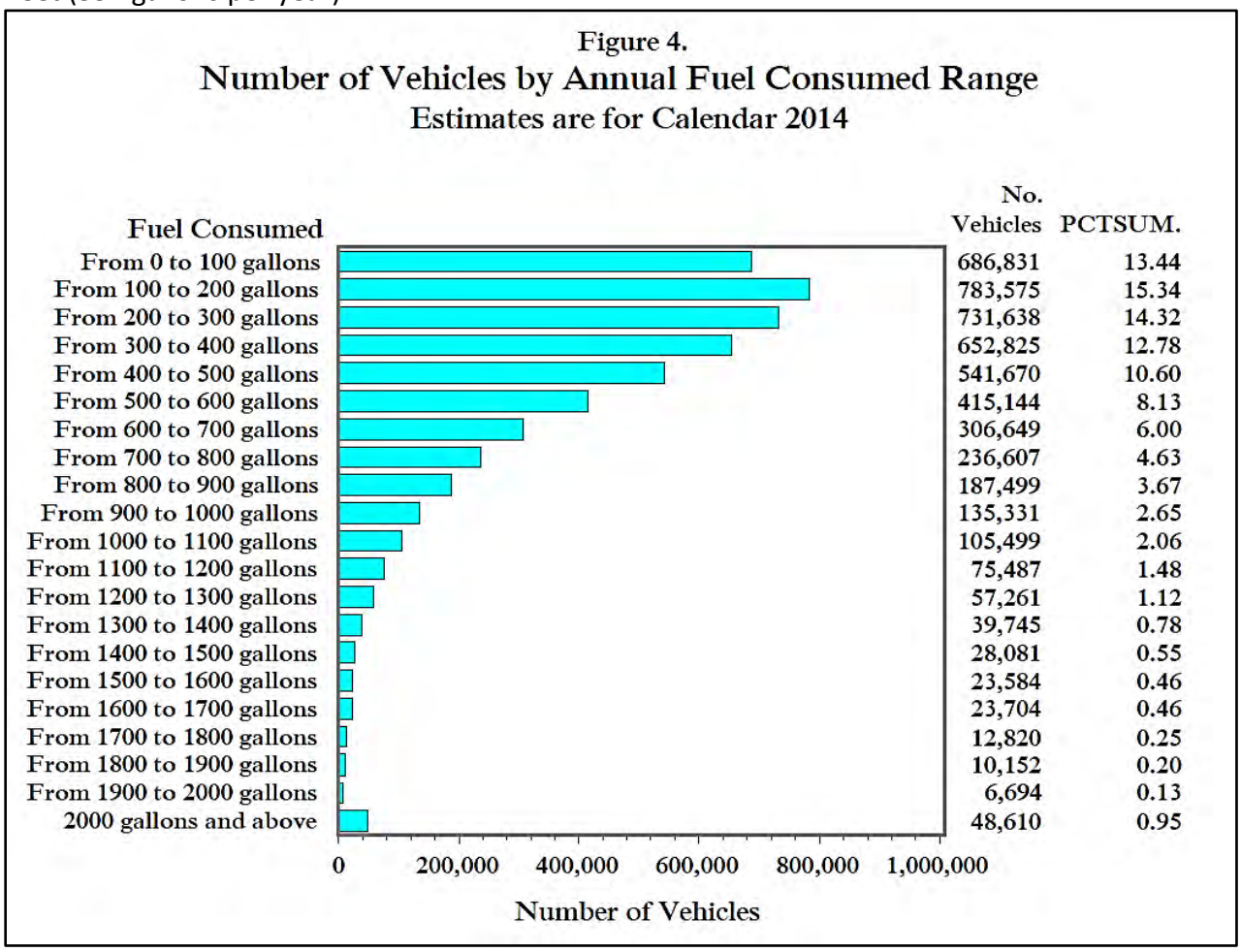
Figure 3 shows the distribution of the Washington light-duty household-based vehicle fleet by VMT ranges. The fleet's mean VMT is 8,891 miles. However, as demonstrated in the chart, the fleet skews toward the lower-end of VMT ranges. Over half of all vehicles are driven less than 8,000 miles per year in Washington, with the median at 7,035 miles.

Figure 3.
Number of Vehicles by Annual Vehicle Miles of Travel Range
Estimates are for Calendar 2014



Model data sources include June 2014 DOL VHS data, EPA fuel economy estimates for 1984-2014, 2011-13 WSDOT HPMS, and the 2009 NHTS.

Figure 4 shows the fleet's distribution by fuel consumption ranges. As the chart shows, the distribution is very similar to the fleet's VMT distribution. This again results in a higher mean fuel consumption for the fleet (456 gallons per year) than median fuel consumption for the fleet (352 gallons per year).



Model data sources include June 2014 DOL VHS data, EPA fuel economy estimates for 1984-2014, 2011-13 WSDOT HPMS, and the 2009 NHTS.

Table 3 shows a comparison of estimated gross revenue from the fuel tax and a road usage charge. This estimate is based on the road usage charge rate of $0.0192 derived from the vehicle-based model.

Table 3. Comparison of Gross Revenue from 2014 Modeled Light-Duty Vehicle Activity to Gross Revenue from 2014 All-Vehicle Activity*

Measure	Rate	Household Light-Duty Fleet ***Modeled*** *Estimates*	All Washington Vehicles ***Forecast based*** *Estimates*
Fuel Tax	$0.375	$873 Million	$1.269 Billion
Road Usage Charge	$0.0192	$872 Million	N/A

**Modeled figures shown represent estimates for calendar 2014 activity. Model data sources include June 2014 DOL VHS data, EPA fuel economy estimates for 1984-2014, 2011-13 WSDOT HPMS, and the 2009 NHTS. Forecast-based estimates are averages of FY 2014 and FY 2015 figures in the September 2014 Transportation Revenue Forecast.*

Using the modeled estimates for the household light-duty fleet shown above, the staff group developed an evaluation of the potential impact on users of a change from a fuel tax to a road usage charge. The results of this evaluation are shown in Table 4.

Table 4.
Comparison of a Fuel Tax with a Hypothetical Road Usage Charge – Calendar Year 2014

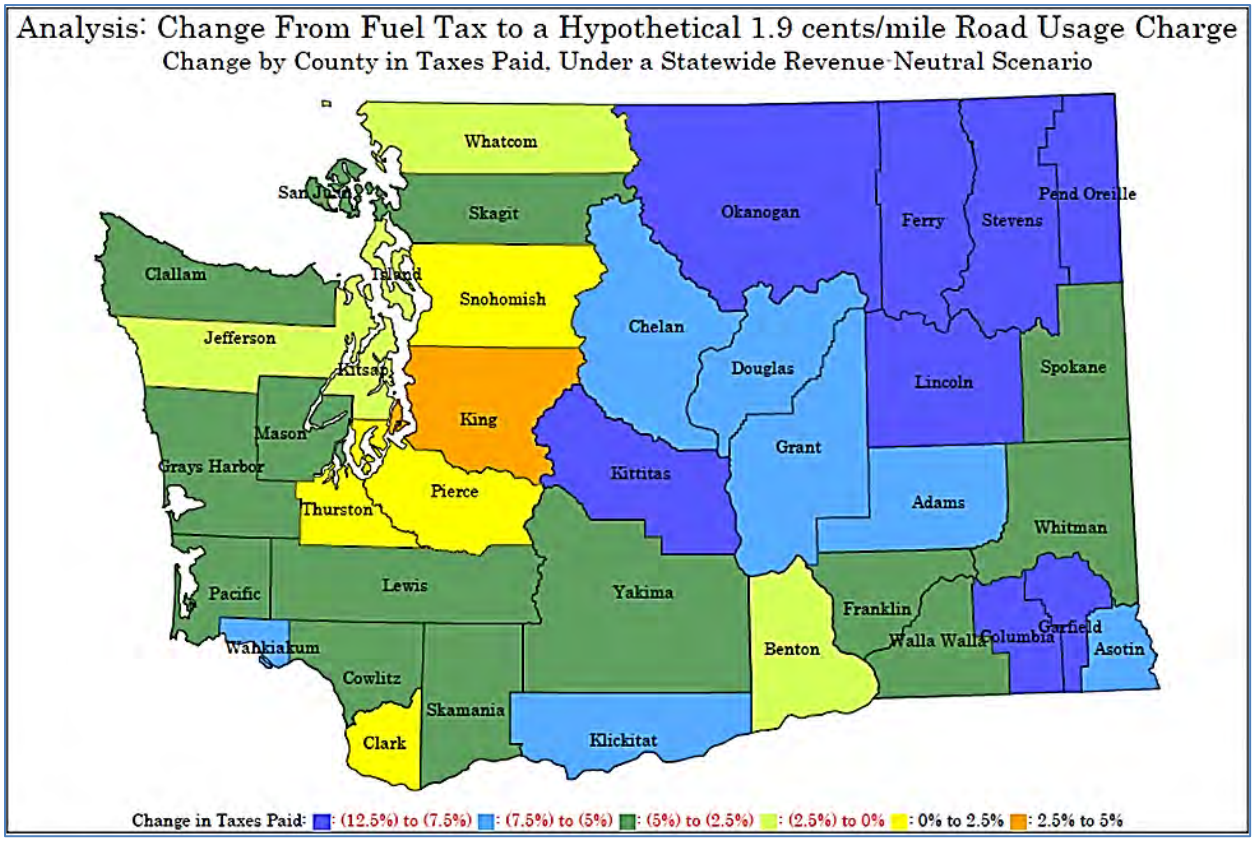
	Average Annual:				
Comparison Basis:	VMT (miles)	Fuel Consumed (gallons)	Fuel Tax Paid ($, Current Law)	Road Usage Charges ($, Hypothetical Scenario)	Impact of Change to Hypothetical Scenario ($)
By Geography					
Rural	9,288	484	$ 182	$ 178	($ 4)
Urban	8,611	436	$ 163	$ 165	+ $ 2
By Vehicle Type					
Car/Station Wagon	8,586	369	$138	$165	+ $ 27
Pickup	7,791	510	$191	$150	($ 41)
Sport Utility Vehicle	10,268	580	$218	$197	($ 21)
Van/Minivan	9,025	498	$187	$173	($ 14)
By Vehicle Age Range					
1 year	13,121	549	$206	$252	+ $ 46
2 years	12,873	558	$209	$247	+ $ 38
3 – 5 years	12,582	576	$216	$242	+ $ 26
6 – 10 years	11,422	596	$223	$219	($ 4)
11 – 15 years	8,253	451	$169	$158	($ 11)
16 – 20 years	5,426	294	$110	$104	($ 6)
21+ years	3,546	212	$80	$68	($ 12)
By Fuel Economy Range					
10 – 15 mpg	7,055	533	$200	$135	($ 65)
15 – 20 mpg	8,881	523	$196	$171	($ 25)
20 – 25 mpg	8,916	412	$155	$171	+ $ 16
25 – 30 mpg	9,916	373	$140	$190	+ $ 50
30 – 40 mpg	11,015	348	$131	$211	+ $ 80
40 – 50 mpg	10,746	246	$92	$206	+ $ 114
50+ mpg	12,654	205	$77	$243	+ $ 166
Overall Averages	8,891	456	$171	$171	$ 0

Model data sources include June 2014 DOL VHS data, EPA fuel economy estimates for 1984-2014, 2011-13 WSDOT HPMS, and the 2009 NHTS.

With respect to impacts on rural and urban drivers, the model showed that the change to a hypothetical road usage charge results in very little change to the annual amounts of taxes paid: $4 less for rural drivers and $2 more for urban drivers. For both rural and urban drivers, this is a change of less than 2 percent in annual taxes paid. The change slightly benefits rural drivers because currently, though they drive more each year, they also consume more fuel on a per-mile basis than do urban users.

While the statewide effect of a direct transition from fuel tax to a RUC is marginal across urban and rural drivers as a whole, the effect is more pronounced for drivers in certain areas. At the county level, the impact of the modeled transition in terms of amount of annual taxes paid ranges from -11 percent in Ferry County to almost 5 percent in King County; see figure 5. That is, under a scenario in which the current fuel tax of 37.5 cents is replaced by a 1.9 cent/s mile RUC, Ferry County drivers would see their tax bill drop by 11 percent on average, whereas drivers in King County would see their tax bill rise by 5 percent on average. The reason for this is because such a change (from fuel tax to RUC) would benefit current drivers of light-duty vehicles that are less fuel efficient than average, and would be a cost to drivers of light-duty vehicles that are more fuel efficient than average. The model shows that, Ferry County drivers' vehicles are the least fuel efficient, compared to the state average, while King County drivers' vehicles are the most fuel efficient. Therefore, Ferry County drivers' tax payments would drop the most and King County drivers would increase the most.

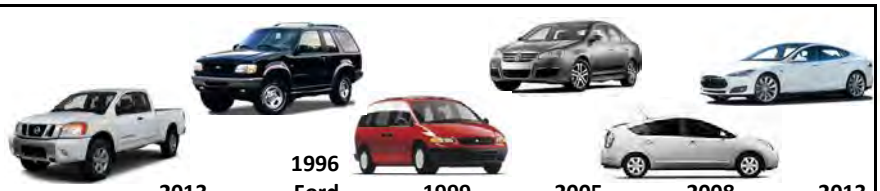
Figure 5. County Comparison of Change in Taxes Paid under Fuel Tax and Hypothetical RUC



The impacts in categories of analysis other than geography are starker. For example, drivers of cars and station wagons would pay about $27 more per year on average, while drivers of other vehicle types would obtain a benefit, with the average tax for pickup truck drivers dropping by $41. In addition, newer vehicles and more fuel efficient vehicles would tend to pay more, with the taxes paid by the most fuel efficient vehicles more than tripling. On the other hand, drivers of older and less fuel-efficient vehicles would see a benefit.

Figure 6 illustrates the effects of a potential change from the current fuel tax to the hypothetical road usage charge for selected vehicle models. The effect depends on how a vehicle's fuel economy compares to the effective statewide average of 19.5 mpg. Drivers of vehicles for which the fuel economy is significantly better than the effective average would pay more, such as with the Prius ($121 more) and the Tesla ($253 more). Those with vehicles for which the fuel economy is less than the effective average, such as with the 2013 Nissan Titan, would benefit ($99 less, in the case of the Titan).

Figure 6. Potential Impacts from a Change from the Current Fuel Tax to a Hypothetical Road Usage Charge for Calendar Year 2014:
An Illustration Using Selected Makes and Models.



Make/Model:	2013 Nissan Titan	1996 Ford Explorer 2WD	1999 Plymouth Voyager	2005 VW Jetta 5-cylinder	2008 Toyota Prius	2013 Tesla Model "S"
Number of Vehicles in WA in June 2014	73	360	1,319	1,386	5,674	834
Estimated Annual VMT (miles)	13,068	5,724	8,327	10,909	10,992	13,157
Fuel Economy (miles/gal)	14	16	18	22	46	∞
Estimated Fuel Consumed (gal)	933	358	463	496	239	-
Estimated Fuel Tax Paid ($)	$350	$134	$173	$186	$90	$0
Hypothetical Road Usage Charge ($)	$251	$110	$160	$209	$211	$253
Impact of Change to Hypothetical RUC	($99)	($24)	($14)	$24	$121	$253
Current-Law: Annual Fuel Bill + Tax ($)	$3,455	$1,326	$1,714	$1,837	$885	$0
Current Law: (Ann'l Fuel Bill+Tax) / VMT	26.4 ¢/mi	23.2 ¢/mi	20.6 ¢/mi	16.8 ¢/mi	8.1 ¢/mi	0.0 ¢/mi
Hypothetical: Annual Fuel Bill + RUC ($)	$3,357	$1,301	$1,700	$1,861	$1,007	$253
Hypothetical: (Ann'l Fuel Bill+RUC) /VMT	25.7 ¢/mi	22.7 ¢/mi	20.4 ¢/mi	17.1 ¢/mi	9.2 ¢/mi	1.9 ¢/mi

There are other observations about the illustration in Figure 6 that may be worth noting. First, the estimated annual mileage of the late-model vehicles shown here is similar, at 11,000 to 13,000 miles. For this reason, the amount that would be paid under the hypothetical road usage charge scenario is similar, in the $210-250 range. On the other hand, under the current fuel tax law, there is a sizeable discrepancy in annual tax payments for fuel consumed by these

vehicles. The Titan drivers are estimated to pay about $350 on average, whereas the Prius drivers are estimated to pay about $90 on average. Of course, Tesla Model S drivers pay $0, though purely electrically powered vehicles such as the Tesla Model S must pay an additional registration fee of $100 each year.

Second, even under a hypothetical road usage charge, the annual cost per mile of operating the vehicle based on fuel and tax payments is still substantially less for the more fuel efficient vehicles than for the less fuel efficient vehicles. For example, based on the nationally forecasted price of about $3.70 per gallon for the western states for 2014, the Prius owner would pay about 9.2 cents per mile in fuel and road usage charge costs, while the Titan owner would pay about 25.7 cents per mile.

Appendix B
Voice of Washington State (VOWS) Survey
Detailed Findings

Background:

The Voice of Washington State (VOWS) survey panel was established in 2011 and as of October 2014 has grown to over 30,000 active panel members statewide. It is comprised of people from all over the state who want to share their views and preferences on transportation issues. Individuals interested in joining the survey panel can sign up anytime on the VOWS website (http://voiceofwashingtonsurvey.org/). All VOWS surveys are emailed to panel members and are completed by them online. Surveys are conducted periodically throughout the year and vary in length and topic. All results from the surveys are sent to the Governor and Legislature for their consideration and review.

The entire VOWS Survey on Vehicle Type and Miles Drive in Washington report can be found at: (http://www.wstc.wa.gov/StatewideTransportationSystem/documents/2014_RUCFleetJunesurvey_Report_000.pdf)

Road Usage Charge VOWS Survey Methodology:

The following was the methodology used for the survey:

- The RUC questions were appended to the end of WSTC's Washington State Ferries General Public Survey, since the study of RUC urban and rural impacts was not funded.
- The WSF/RUC survey was sent via email to the Voice of Washington State (VOWS) panel on June 12th, with seven follow-up reminders sent before the survey's close on June 28th.
- 5,708 surveys were submitted by panel members; 5,638 were usable.

Weighting of The VOWS Data to Reflect Washington Population by Age / County:

A total of 5,638 completed surveys from all parts of the state were weighted by age within a county and the
Counties were weighted to their state proportion as follows:

- The weighing was based on the Census 2000 Summary File 1 Data Population by Age, Sex, and Race/Ethnicity for Washington State and Counties prepared by Washington State Office of Financial Management (http://www.ofm.wa.gov/census2000/sf1/tables/ctable19.htm).
- The actual numbers of men and women over 18 were added together for each age groupings by county and for the state as a whole.

- (County population over 18 / Statewide population over 18) was used to determine each “Counties weight.”
- (County age group / County population over 18) was used to determine each “County Age Groups weight.”
- (County weight * County Age Group weight) was used to determine the “County to State Age Groups weight.”
- An adjustment to the “County to State Age Groups weight” was made to compensate for age groupings that we did not have any actual surveys in.
- The “Adjusted County to State Age Group weight” was applied to each respondent in that county age group.

The outcome is a weighted data set proportional to age groups at both the state and county levels.

Key VOWS Survey findings:

When comparing rural, urban, and suburban respondents we found the following:

- Rural households reported having the highest **average number of people in their household**(3.2) compared to Suburban (2.7) or Urban (2.6)
- Rural households tend to report earning lower **incomes** than suburban and urban households
- Rural households reported having the highest **average of licensed drivers**(2.4) compared to Suburban (2.1) or Urban (2.0)
- Rural households reported having the highest **average of vehicles per household**(2.7) compared to Suburban (2.3) or Urban (1.7)
- Rural households reported driving the highest **total miles per year**(22,243) compared to Suburban (18,368) or Urban (13,206)
- Rural households reported driving the highest **average of miles per vehicle**(8,862) compare to Suburban (8,402) or Urban(8,054)
- Rural households reported driving the highest **average of miles per driver**(9,268) compared to Suburban(8,747) or Urban (6,603)
- Rural households reported only a slightly lower **MPG average** (24.4) compared to Suburban (24.7) and Urban (24.8)

VOWS Survey Respondent Weighted Profile:

The following tables outline how representative the VOWS respondents that completed the June RUC survey are to that of the State of Washington. Certain VOWS demographics are compared to the 2013 American Community Survey (ACS) one-year estimates for Washington State. The American Community Survey is a nationwide mandatory survey that collects and produces information on demographic, social, economic, and housing characteristics about our nation's population every year. This survey is administered by the US Census Bureau and is used by Federal, State, Local, Non-governmental entities for planning and informational

purposes. The American Community Survey was selected as proxy for reasonable representation of residents in the State of Washington.
Below is a comparison of VOWS survey and the ACS on four profile characteristics including Gender, Age, Education, and Household Income.

Note: All profile comparisons are based on Adults 18 years and over in Washington State.

Gender	**Washington VOWS RUC Respondents**	**WA - ACS**
Male	61%	50%
Female	39%	50%

Age Range	**Washington VOWS RUC Respondents**	**WA – ACS**
18-24	9%	13%
25-34	19%	18%
35-44	23%	17%
45-54	21%	17%
55-64	12%	17%
65 and over	16%	18%

Education	**Washington VOWS RUC Respondents**	**WA - ACS**
Some High School or less	<1%	11%
High School Graduated	6%	24%
Vocational / Technical School	4%	N/A%
Some College / Associates Degree	30%	35%
Four-Year College Degree	36%	20%
Post Graduate Degree	23%	10%
Other	01%	00%

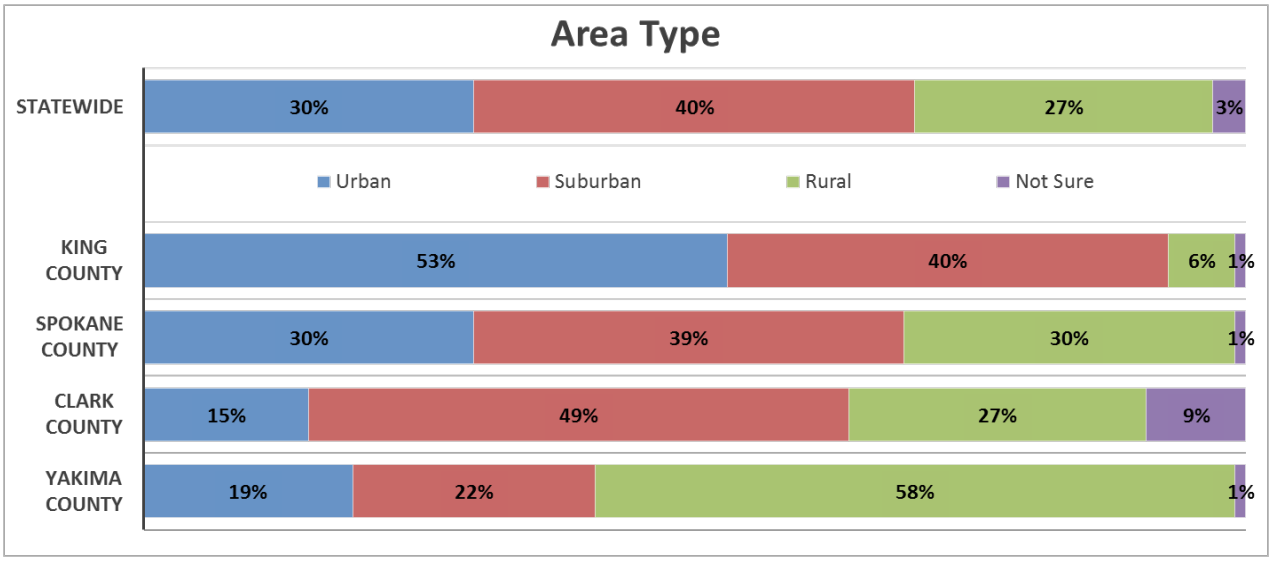
Household Income Range	**Washington VOWS RUC Respondents**	**WA - ACS**
Less than $14,999	04%	11%
$15,000 to $24,999	06%	09%
$25,000 to $34,999	07%	09%
$35,000 to $49,999	12%	13%
$50,000 to $74,999	23%	19%
$75,000 to $99,999	20%	13%
$100,000 to $149,999	20%	15%
$150,000 or more	09%	11%

Voice of Washington State (VOWS) Survey Statewide results:

SELF CLASSIFICATION (Urban, Suburban, and Rural):

A similar number of respondents classified their household as being located in an urban (30%) or rural (27%) area, though the largest number of respondents chose the suburban category (40%):

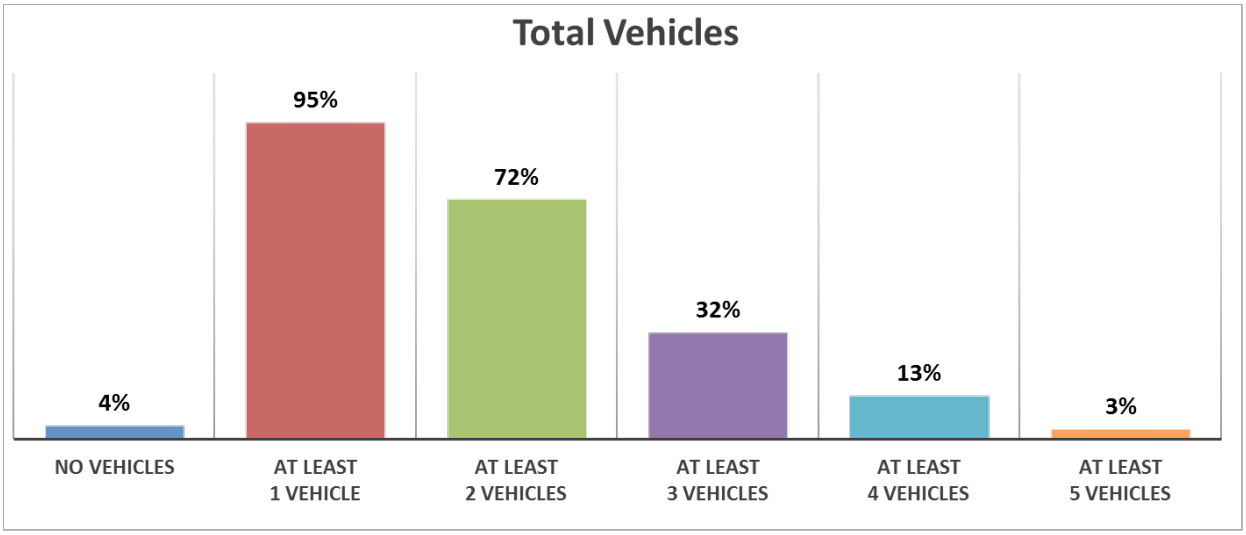
- 30% urban
- 40% suburban
- 27% rural
- 3% unsure



TOTAL VEHICLES (excluding motorcycles, motorhomes):

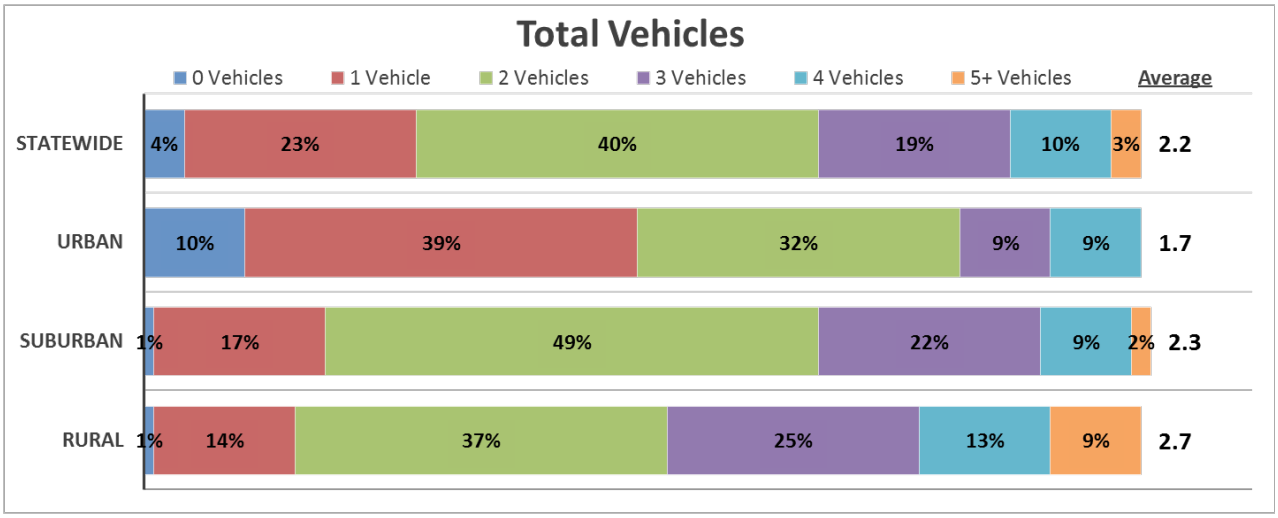
Survey respondents reported having households with at least the following number of vehicles:

- 95% with at least one vehicle
- 72% with at least two vehicles
- 32% with at least three vehicles
- 13% with at least four vehicles
- 3% with at least five vehicles
- 4% with zero vehicles



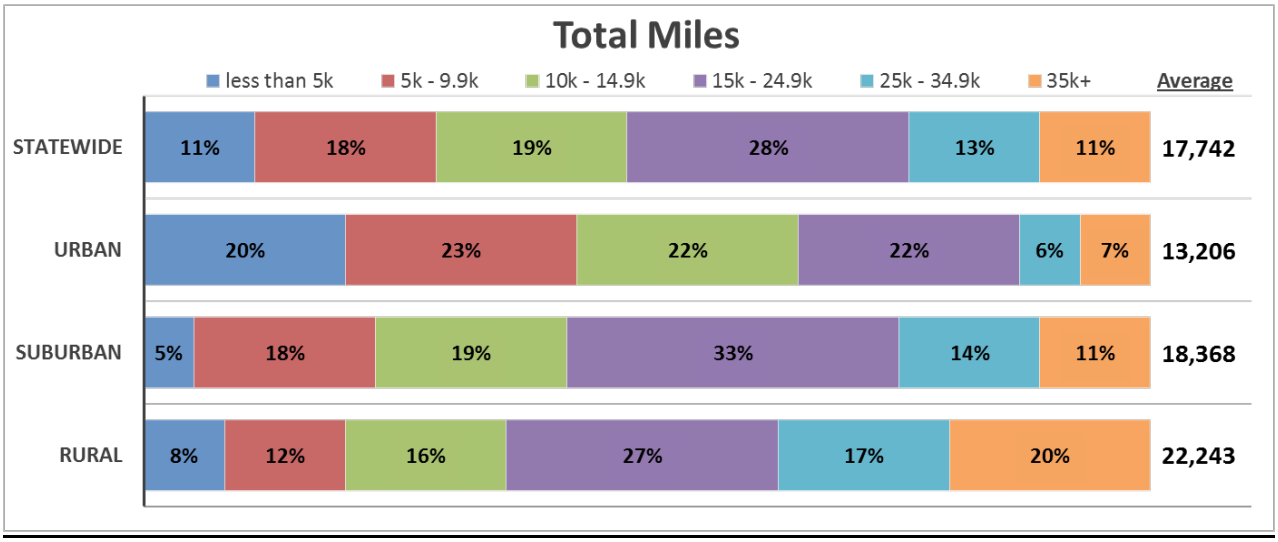
TOTAL VEHICLES by Urban, Rural, Suburban (excluding motorcycles, motorhomes):

- Statewide survey respondents, the average number of vehicles per household reported is **2.2**
- Rural areas have the highest average with 2.7 vehicles per household, followed by Suburban areas at 2.3 vehicles, and Urban areas at 1.7 vehicles



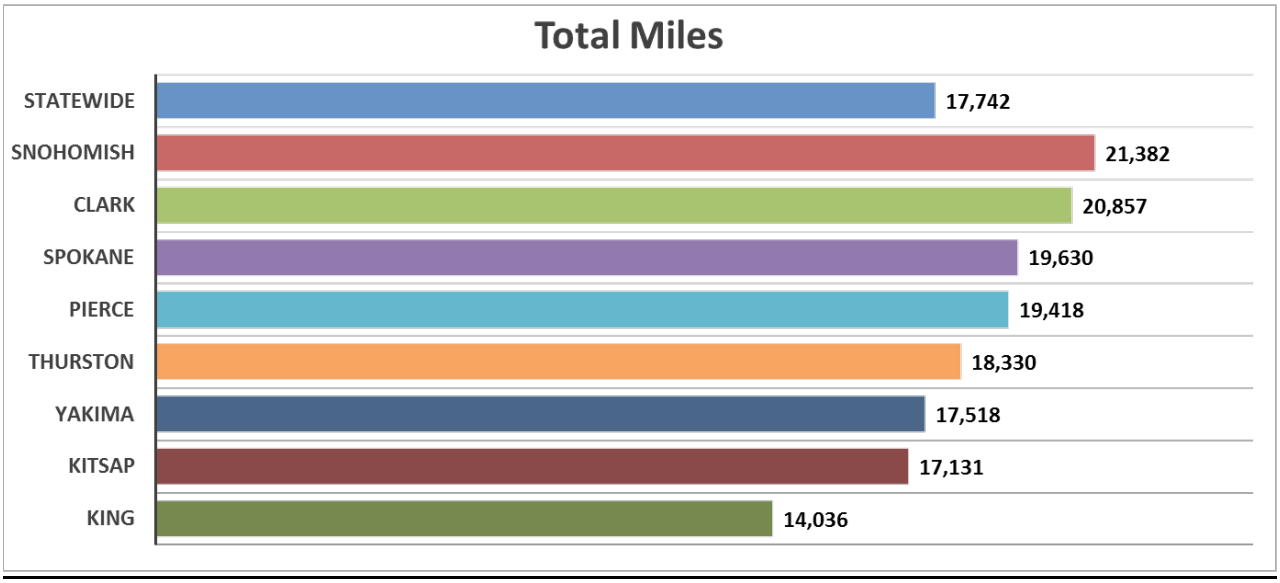
TOTAL MILES DRIVEN:

- The average household drives 17,742 miles per year
- Residents in Rural areas drive the most: 22,243 miles per year for the average household
- Residents in Urban areas drive the least: 13,206 miles for the average household



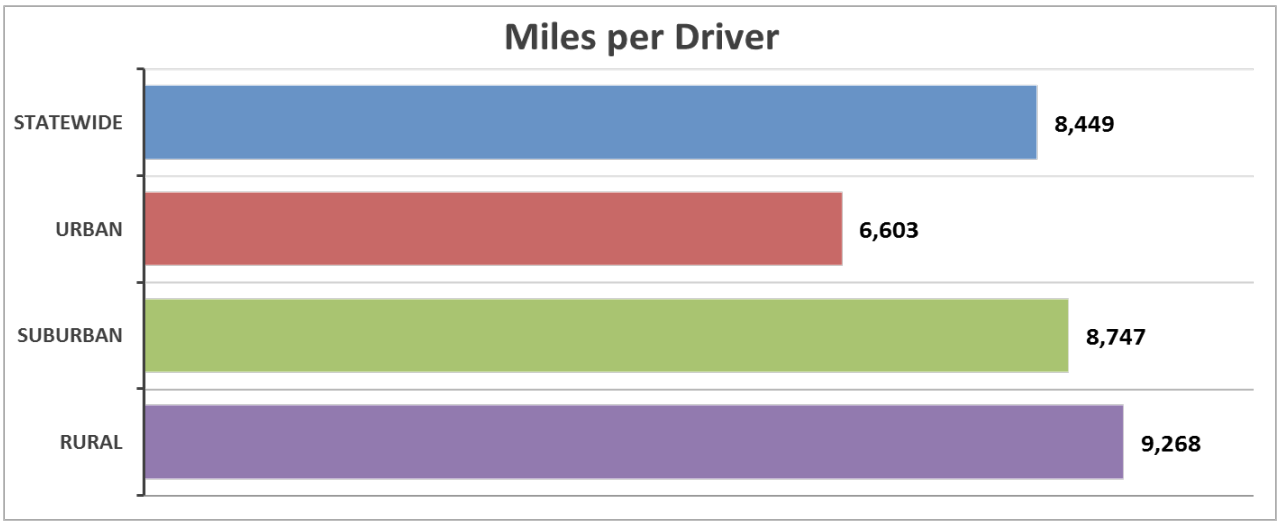
TOTAL MILES DRIVEN: Select Counties

- King County households report driving less per year than the state average and less than households in other major counties
- Snohomish and Clark County households report driving the most



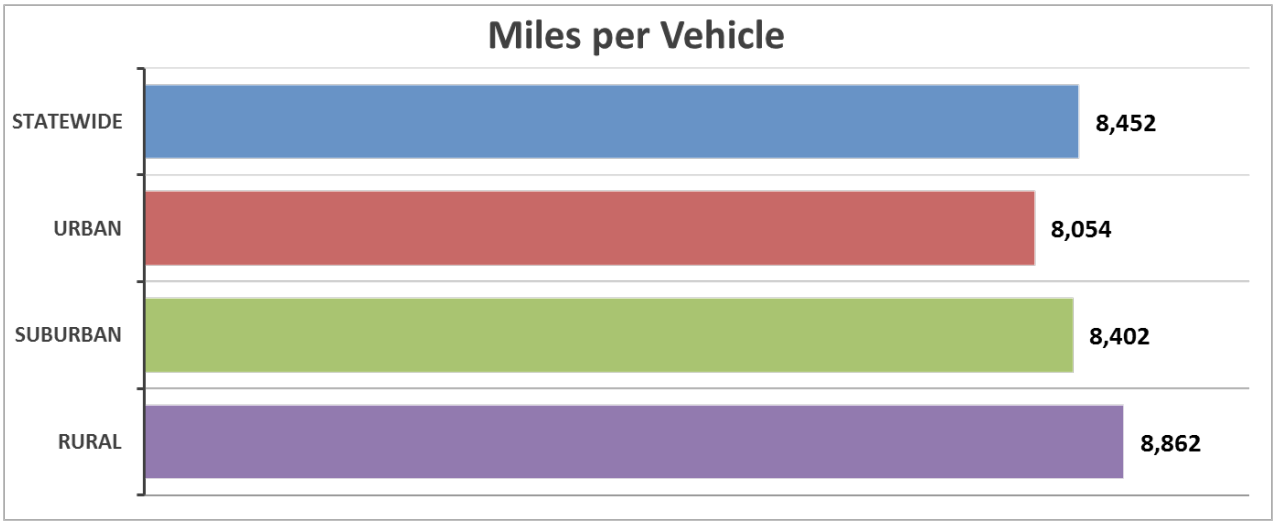
AVERAGE MILES DRIVEN PER DRIVER:

- Based on a statewide average of 2.1 licensed drivers per household, each driver averages 8,449 miles per year (17,742 miles / 2.1 drivers)
- Rural households average 9,268 miles per driver, compared to 8,747 miles per driver in Suburban areas, and 6,603 miles per driver in Urban areas



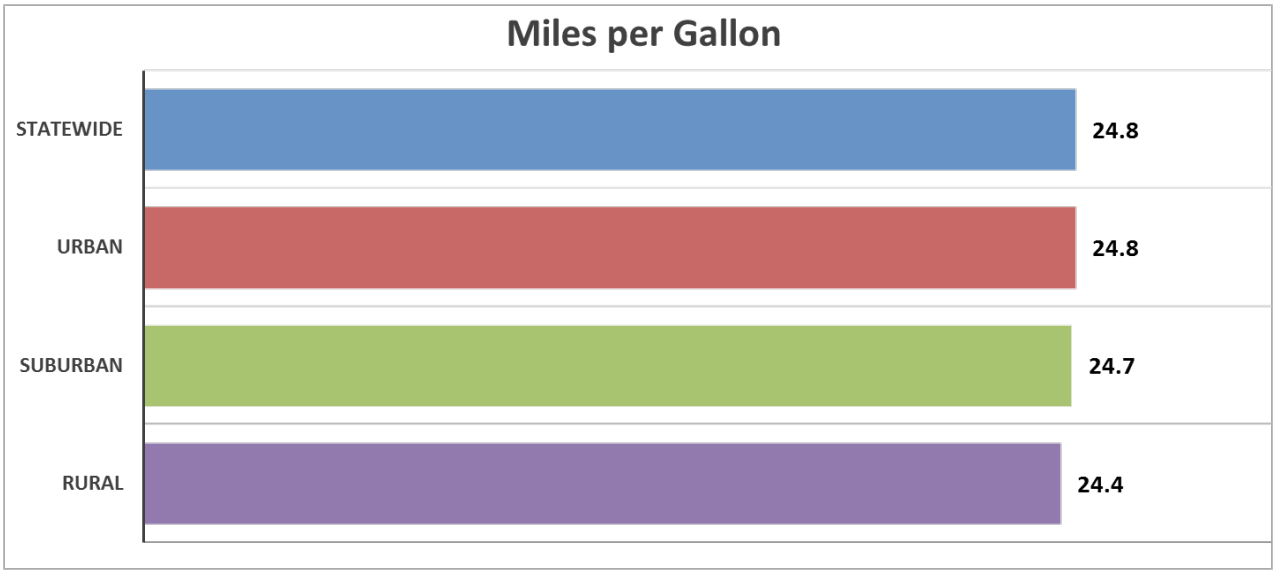
AVERAGE MILES DRIVEN PER VEHICLE:

- The average vehicle is driven an average of 8,452 miles per year
- Residents in Rural areas drive an average of 8,862 miles per vehicle
- Residents in Suburban areas drive an average of 8,402 miles per year
- Residents in Urban areas drive an average of 8,054 miles per year



MILES PER GALLON:

- Survey respondents reported a statewide combined average miles per gallon for all vehicles a household owns is 24.8 MPG
- Survey respondents reported little difference in their combined average MPG



Appendix C
DOL Source Data: Defining Washington's Light-Duty Household Vehicle Fleet

In support of this study, the Department of Licensing (DOL) was asked to generate an account of approximately how many currently registered light-duty vehicles resided in each household (VPH) in Washington State. In response to this request, DOL took the following steps:

- Used data from DOL's Vehicle Headquarters System (VHS) database
- Defined light-duty as passenger vehicles and light trucks with gross weight of 10,000 lbs. or less
- Selected unexpired motor vehicles with Washington addresses
- Excluded business-owned vehicles
- Standardized address formats to promote better matching
- Identified each group of vehicles with matching addresses as a 'household'

The resulting dataset contained about 5 million currently registered light-duty motor vehicles owned by people in Washington households.

Appendix D
Commuter Patterns of Washington State Residents and US Census OnTheMap Data Results

Given the legislative charge to study the urban and rural financial and equity implications of a potential road usage charge in the state, actual commuting patterns in the state were examined through US Census OnTheMap data. Given that commuting to work is the primary reason for road usage, examining commuting patterns can explain a lot of differences between rural and urban drivers and how they would be impacted by a new road user charge.

This national GIS based database titled OnTheMap has matched the addresses of both employment and employees' home address locations. This database is provided to the U.S. Census Bureau by the Bureau of Labor Statistics (BLS) through their Quarterly Census of Employment and Wages (QCEW). QCEW covers 98 percent of U.S. jobs. These jobs are those covered by unemployment insurance and do not include non-covered employment typically performed by sole proprietors or members of partnerships. Users of OnTheMap can query the database in a web based GIS system for commuting distances in various locations throughout the US. WSDOT-Economic Analysis has queried the state of Washington commuting patterns, by county and WSDOT delineated rural versus urban areas. Our results include just primary jobs even though OnTheMap provides other filter choices such as all jobs (including secondary jobs). Primary jobs were selected for this analysis in order to avoid double counting certain individuals' commutes to secondary jobs which may not be on a regular basis.

The OnTheMap national database has commuting patterns for years 2002-2011. Examining the commuting patterns over time reveals a trend that more individuals are commuting longer distances over the past ten years. OnTheMap calculates one-way distances between employees' home address and employment locations and categorizes them into four distance categories: less than 10 miles, 10 to 25 miles, 25 to 50 miles, and greater than 50 miles.

Figures 1 and 2 reveal the commuting trends since 2002 for all commuters in the state. The results indicate that in 2002, there were 2.378 million people commuting to primary jobs in Washington state and by 2011 total commuters had increased 10.7% to 2.631 million. The commuting patterns indicate that in 2002, 56.9% of the commuters in the state had less than 10 miles to commute to work and by 2011 that percentage had declined to 51.5%. In addition, all other longer commuting distance categories saw an increase in their share of commuters between 2002 and 2011. The longest commuting distance category increased the most. Initially, 7.9% of all commuters had to drive more than 50 miles to work in 2002 and that increased to 11.8% by 2011. The same results for all commuters are also revealed in the rural and urban commuter pattern results.

In 2002, there were 1.8 million urban commuters (75.7% of total) and 0.57 million rural commuters (24.3% of total). Ten years later, urban commuters rose to 1.98 million (75.3% of total) and rural commuters rose as well to 0.65 million (24.7% of total). Figure 3 shows the trends in the urban commuters' shares. The urban commuters with the shortest commute distance, less than 10 miles, saw a decline in their percentage from 58.6% in 2002 to 54.4% in 2011. All other longer commuting distance categories saw their shares rise with the longest commuting distance category, greater than 50 miles, with the largest increase from 6.3% of all urban commuters in 2002 to 9.1% of urban commuters by 2011. Rural commuters showed similar results as urban with some notable differences. Figure 4 demonstrates the change in shares of rural commuters by commuting distances between 2002 and 2011. These results reveal that rural commuters have consistently had a smaller percentage of all rural commuters with a short work commute, less than 10 miles, and a much larger percentage of all rural commuters with a longer commuting distance of greater than 50 miles than urban commuters.

Figure 1: Number of All commuters by length of work commute – 2002 - 2011

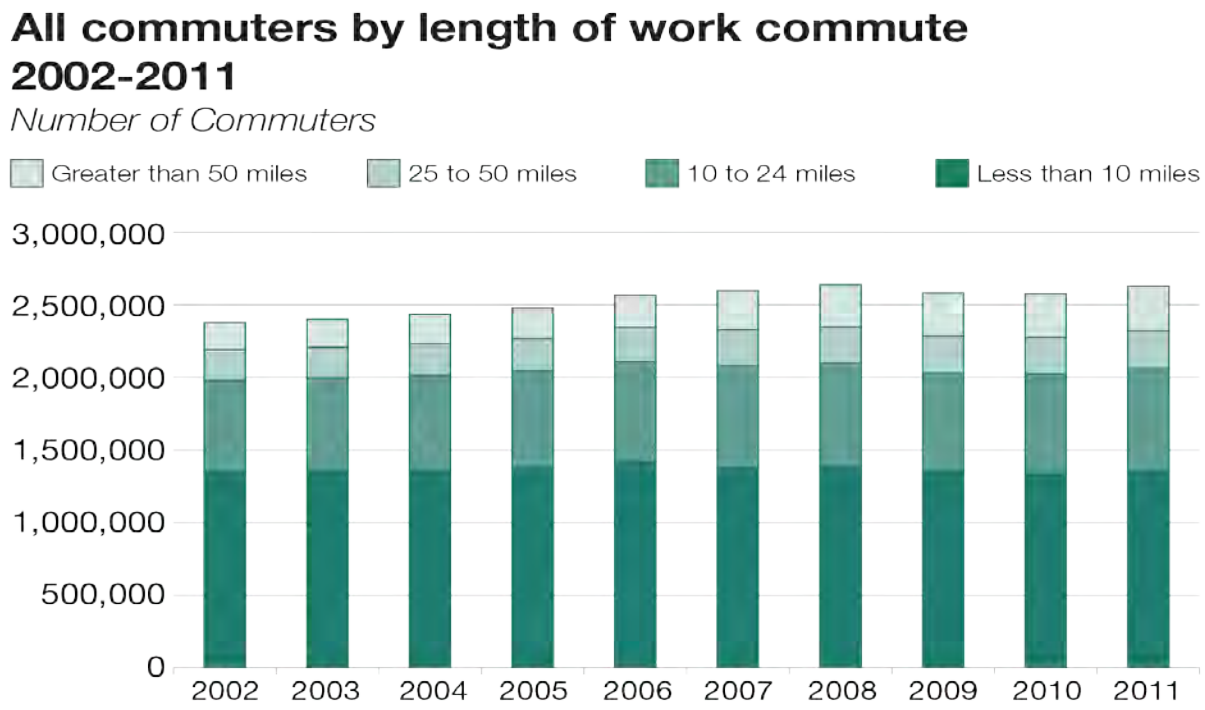


Figure 2: Share of All commuters by length of work commute – 2002 – 2011

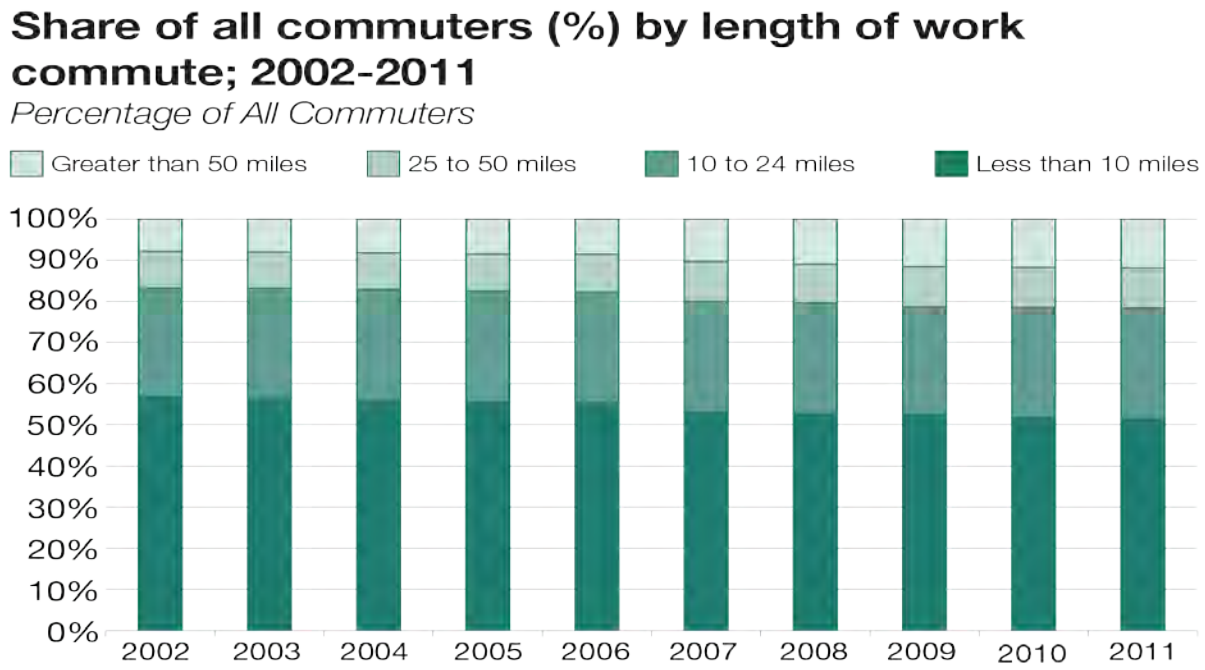


Figure 3: Share of Urban commuters by length of work commute – 2002 – 2011

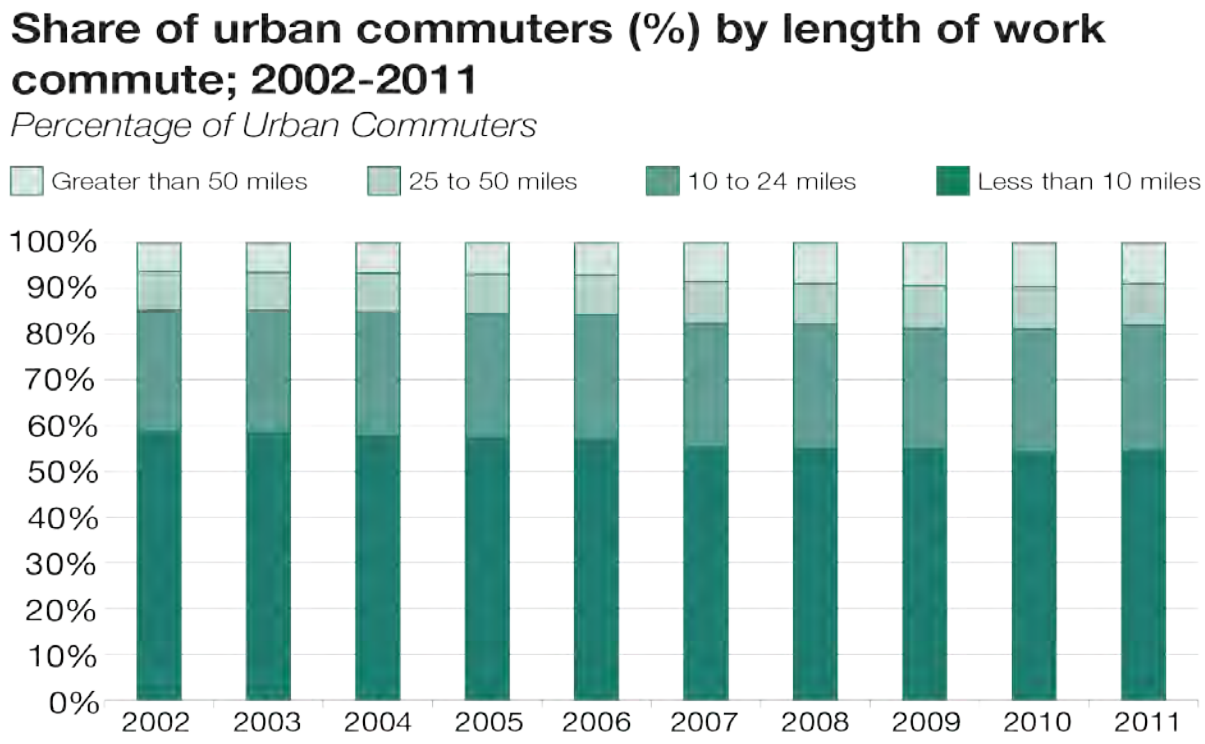


Figure 4: Share of Rural commuters by length of work commute – 2002 – 2011

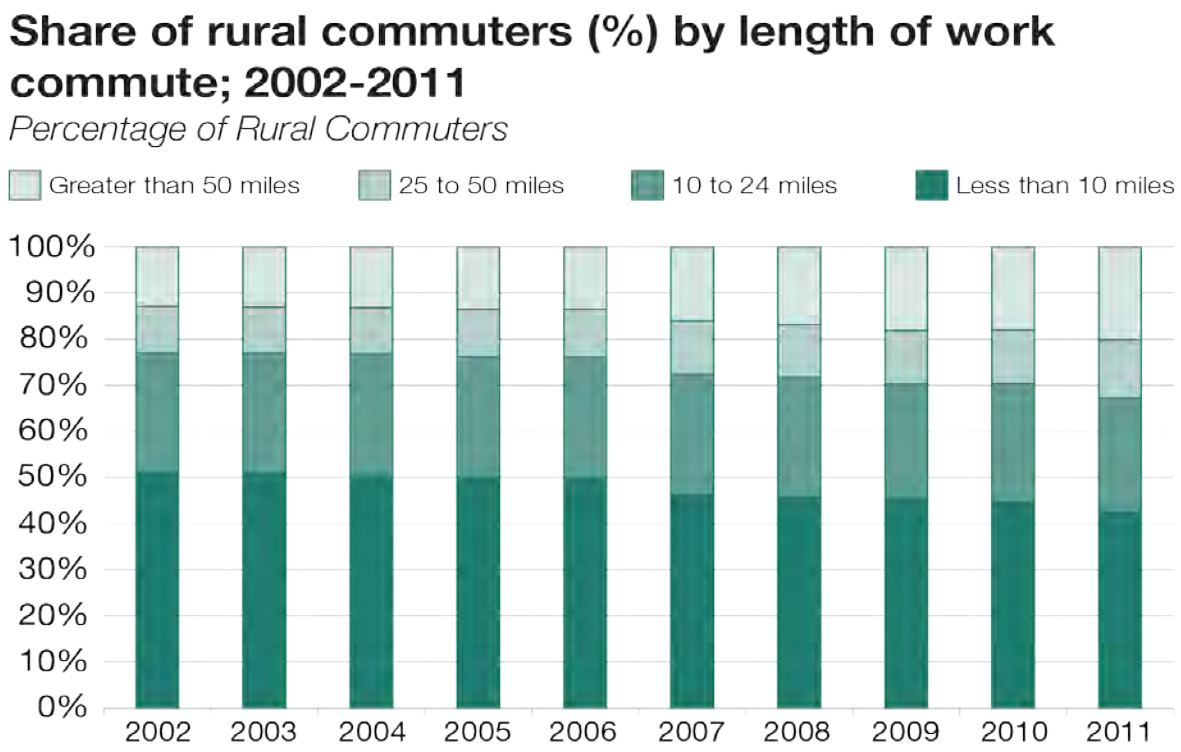


Figure 4 reveals that rural commuters have had a decline in percentage of commuters with a short work commute since 2002. In 2002, 51.2% of all rural commuters drove less than 10 miles to work and that share decreased to 42.6% in 2011, which is consistent with urban commuter results. Overall, rural commuters have a smaller share of all commuters at 42.6% of all rural commuters in 2011 than urban commuters at 54.4% of all urban commuters. In addition, rural commuters driving between 10-25 miles one way to work declined 1.2% to 24.6% of rural commuters where urban commuters' share of commuters in this category grew to 27.6% over the last ten years. Rural commuters also have a much higher portion of all rural commuters driving more than 50 miles, one way, to work. That trend has been growing. In 2002, 12.9% of all rural commuters drove more than 50 miles, one way, to their primary work. By 2011, more than 20% of all rural commuters had driven more than 50 miles to work. That rural share of 20% is more than double the share of urban commuters at 9.1% driving more than 50 miles to work in 2011.

Figures 5-8 compare the urban and rural areas share of all commuters by distance for the Top 25 rural and urban areas. Figure 5 ranks the urban and rural areas with the largest share of commuters driving less than 10 miles. This chart reveals that of the Top 25 areas with the largest share of the commuters driving less than 10 miles, only 5 areas were from rural areas, all the rest were urban areas. This again reinforces the result that residents' from urban areas in the state have shorter work commutes than workers' from rural areas except for rural areas in counties like Spokane and Yakima. For commutes between 10-25 miles, the Top 25 areas were rural areas having the largest percentage of their commuters falling in this distance category

with a few notable exceptions. Spokane's urban area had the largest percentage of its commuters, 54%, driving between 10-25 miles and six other urban areas also had large percentages of their commuters driving 10-25 miles. For commuting distances between 25-50 miles, the top 25 areas were rural areas except for four urban areas in these counties, Island, Mason, Jefferson and Pierce. The rural area with the largest share was Mason county with 30.9% of its rural commuters driving between 25-50 miles, one way. The areas with the largest share of its commuters driving more than 50 miles were rural counties, with Ferry county rural area having the largest share at 53.4%. The top 17 of the 25 rural and urban areas with the largest share of commuters, driving the longest distance, were in rural counties. The urban county with the largest share of total commuters driving more than 50 miles was Lewis urban area residents with 32.7% of its commuters. The other six urban areas also had shares which hovered around 31 - 32% of commuters driving more than 50 miles.

In conclusion, these OnTheMap results reveal that commuting patterns have been changing over the past 10 years for both rural and urban commuters. Even though urban commuters have seen their share of short commutes decline, their share of urban commuters with a work commute of less than 10 miles is still higher, 54.4%, than rural commuters at 42.6% of all rural commuters driving less than 10 miles, one way, to their primary job in 2011. Rural commuters also have a smaller share of commuters with work commutes between 10 and 25 miles, 24.6%, than urban commuters at 27.6%.

The opposite is true in the longer commute categories. The rural residents have 12.7% of all commuters driving between 25 and 50 miles versus the urban commuters at 8.9% of all urban commuters driving longer distances in 2011. The same is true in the longest commute category of greater than 50 miles. More than 20% of rural commuters drive more than 50 miles, one way, to work versus 9% of urban commuters which drive more than 50 miles, to work. The longer work commutes of rural residents could result in higher road user charges compared to urban commuters given the differences in the commute distances to drive to their primary work locations given all other factors being the same among commuters.

All Commuters: Counties' Rural and Urban Area Commutes Top 25 Ranked by Percentage of Commuters and Distance

Figure 5. Commuting Distance Less Than 10 Miles: Top 25 Urban and Rural Counties

Less than 10 miles	Area	Percentage of total Commuters
1	Franklin Urban	75.8
2	Asotin Urban	70.8
3	**Spokane Rural**	**67.6**
4	Walla Walla Urban	65.2
5	Whitman Urban	63.3
6	Benton Urban	61.8
7	King Urban	61.0
8	Whatcom Urban	60.8
9	Jefferson Urban	60.1
10	Douglas Urban	59.9
11	**Yakima Rural**	**59.7**
12	Chelan Urban	58.0
13	Kittitas Urban	56.1
14	Clark Urban	55.8
15	Thurston Urban	55.2
16	Yakima Urban	53.7
17	Adams Urban	53.3
18	Grant Urban	51.5
19	Kitsap Urban	49.7
20	Cowlitz Urban	49.5
21	Pierce Urban	45.8
22	Clallam Urban	45.6
23	**Whatcom Rural**	**44.1**
24	**Asotin Rural**	**43.6**
25	**Columbia Rural**	**42.7**

Figure 6. Commuting Distance Between 10-25 Miles : Top 25 Urban and Rural Counties

10-25 miles	Area	Percentage of total Commuters
1	**Spokane Urban**	**53.8**
2	Clark Rural	47.0
3	King Rural	45.4
4	Asotin Rural	41.6
5	Kitsap Rural	40.9
6	Franklin Rural	40.3
7	Pierce Rural	39.8
8	Benton Rural	39.6
9	Snohomish Rural	39.3
10	**Snohomish Urban**	**38.9**
11	**Kitsap Urban**	**35.8**
12	Walla Walla Rural	31.9
13	**Pierce Urban**	**30.4**
14	Thurston Rural	30.4
15	**King Urban**	**29.9**
16	Whatcom Rural	29.8
17	Mason Rural	29.6
18	Whitman Rural	28.0
19	Cowlitz Rural	27.7
20	**Clark Urban**	**27.4**
21	Island Rural	27.0
22	Stevens Rural	26.5
23	Skamania Rural	24.2
24	Wahkiakum Rural	23.7
25	Grays Harbor Rural	23.0

<u>All Commuters</u>: Counties' Rural and Urban Area Commutes Top 25 Ranked by Percentage of Commuters and Distance…Continued

Figure 7. Commuting Distance 25-50 Miles: Top 25 Urban and Rural Counties

25-50 miles	Area	Percentage of total Commuters
1	Mason Rural	30.9
2	Pend Oreille Rural	30.7
3	Jefferson Rural	29.4
4	Pierce Rural	27.7
5	Island Rural	27.6
6	Skamania Rural	27.4
7	**Island Urban**	**26.8**
8	Snohomish Rural	26.5
9	Lincoln Rural	26.2
10	Douglas Rural	25.6
11	Garfield Rural	24.6
12	**Mason Urban**	**23.6**
13	Franklin Rural	22.9
14	Lewis Rural	22.7
15	**Jefferson Urban**	**22.2**
16	Walla Walla Rural	21.7
17	Ferry Rural	21.2
18	Thurston Rural	19.4
19	Cowlitz Rural	19.3
20	Grant Rural	19.2
21	Grays Harbor Rural	18.2
22	Kittitas Rural	18.1
23	**Pierce Urban**	**17.5**
24	Adams Rural	17.4
25	Stevens Rural	17.0

Figure 8. Commuting Distance Greater Than 50 Miles: Top 25 Urban and Rural Counties

Greater than 50 miles	Area	Percentage of total Commuters
1	Ferry Rural	53.4
2	Lincoln Rural	46.2
3	Okanogan Rural	42.0
4	Grays Harbor Rural	41.5
5	Clallam Rural	41.3
6	Douglas Rural	40.2
7	Pacific Rural	39.7
8	Wahkiakum Rural	39.7
9	Pend Oreille Rural	37.7
10	Klickitat Rural	37.4
11	Garfield Rural	37.1
12	Lewis Rural	36.5
13	San Juan Rural	36.2
14	Chelan Rural	35.6
15	Kittitas Rural	35.5
16	Grant Rural	33.7
17	Adams Rural	33.1
18	**Lewis Urban**	**32.7**
19	**Grays Harbor Urban**	**32.5**
20	**Chelan Urban**	**31.6**
21	**Whitman Urban**	**31.5**
22	**Clallam Urban**	**31.4**
23	**Cowlitz Urban**	**31.2**
24	Stevens Rural	30.9
25	**Skagit Urban**	**30.7**

Caveats to the OnTheMap Database

1. OnTheMap measures commutes as the one-way distance between locations from residence to work. Miles travelled is calculated as Euclidean distance (straight line or "as the crow files").

2. Employers in Washington occasionally list all employees at the location of their head office rather than the actual physical location of the employment office. The Employment Security Department makes every effort (especially for large employers) to correct for this location misrepresentation in their submittals of Washington employment data to QCEW. These adjustments are reflected in the OnTheMap database on the Census Bureau's web site.

3. Since OnTheMap only provides distances between home and work locations in four distance categories: less than 10 miles, 10 to 25 miles, 25 to 50 miles, and greater than 50 miles, there is no direct measure of central tendency such as the mean or median for the distance categories. Origin-Destination Employment Statistics (LODES) used by OnTheMap are available for download. Unfortunately, the downloaded data does not include the Euclidean distance between the employees' home address and their work locations either. As a result, an average commute distance for each of the 4 distance categories is not readily available but a simple average of the distance category could be calculated but it would not be a true mean for that distance category.

Figure 9. Urban Commuters in 2002 Commuting Distance breakdown

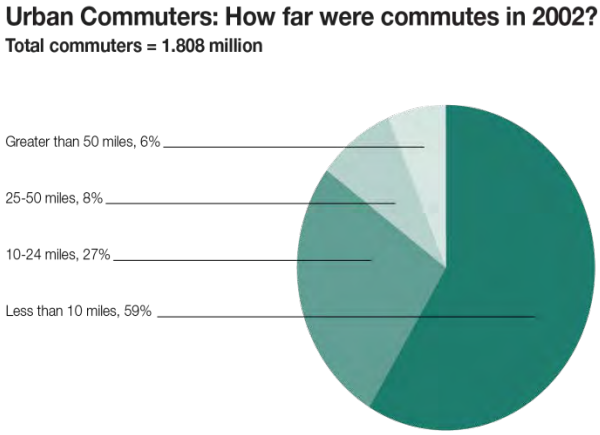


Figure 10. Urban Commuters in 2011 Commuting Distance breakdown

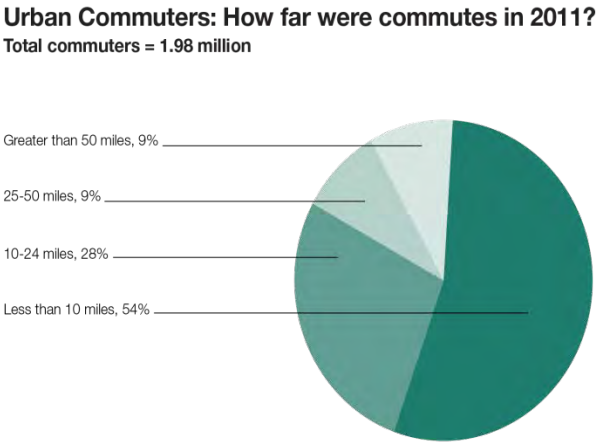


Figure 11. Rural Commuters in 2002 Commuting Distance breakdown

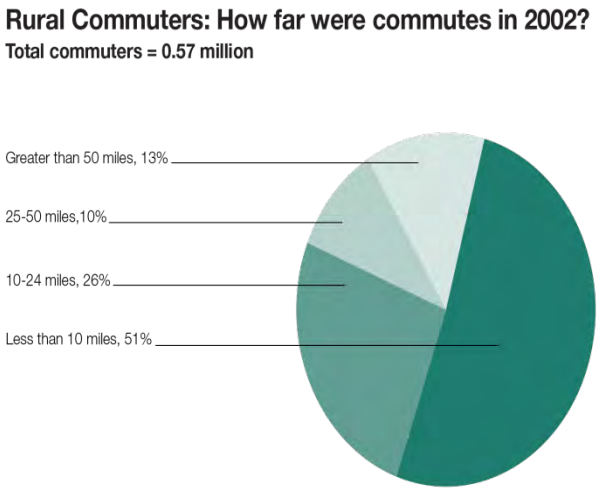
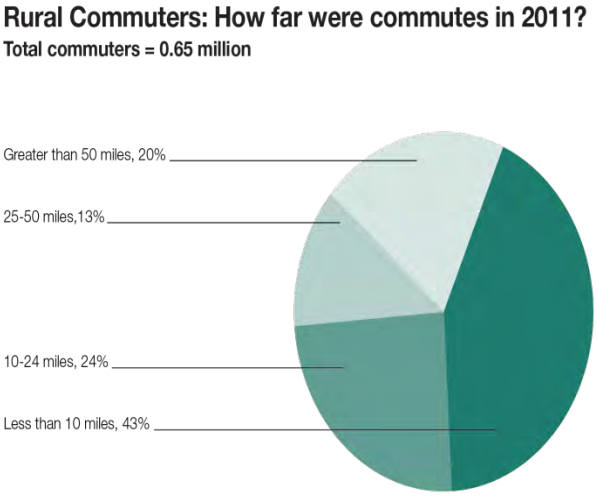


Figure 12. Rural Commuters in 2011 Commuting Distance breakdown



<u>Urban Commuters</u>: Counties' Urban Area Commutes Ranked by Percentage of Urban Commuters by Distance

Note: There were 12 counties which did not have an urban area, thus, only 27 out of 39 counties had a classification of urban area.

Figure 13. Commuting Distance Less Than 10 Miles: Urban Counties' Rankings

Less than 10 miles	Area	Percentage of urban commuters
1	Franklin	75.8
2	Asotin	70.8
3	Walla Walla	65.2
4	Whitman	63.3
5	Benton	61.8
6	King	61.0
7	Whatcom	60.8
8	Jefferson	60.1
9	Douglas	59.9
10	Chelan	58.0
11	Kittitas	56.1
12	Clark	55.8
13	Thurston	55.2
14	Yakima	53.7
15	Adams	53.3
16	Grant	51.5
17	Kitsap	49.7
18	Cowlitz	49.5
19	Pierce	45.8
20	Clallam	45.6
21	Snohomish	41.1
22	Spokane	39.5
23	Grays Harbor	38.7
24	Skagit	38.2
25	Island	36.3
26	Mason	36.1
27	Lewis	35.9

Figure 14. Commuting Distance Between 10-25 Miles: Urban Counties' Rankings

10-25 miles	Area	Percentage of urban commuters
1	Spokane	53.8
2	Snohomish	38.9
3	Kitsap	35.8
4	Pierce	30.4
5	King	29.9
6	Clark	27.4
7	Skagit	22.5
8	Yakima	21.9
9	Island	20.4
10	Mason	18.4
11	Whatcom	18.1
12	Thurston	16.6
13	Grays Harbor	16.1
14	Grant	15.7
15	Adams	14.6
16	Lewis	14.6
17	Clallam	12.5
18	Benton	11.7
19	Franklin	8.6
20	Asotin	7.2
21	Douglas	7.0
22	Chelan	4.7
23	Cowlitz	4.7
24	Whitman	4.3
25	Jefferson	3.8
26	Walla Walla	3.3
27	Kittitas	3.2

<u>Urban Commuters</u>: Counties' Urban Area Commutes Ranked by Percentage of Urban Commuters by Distance-Continued…

Note: There were 12 counties which did not have an urban area, thus, only 27 out of 39 counties had a classification of urban area.

Figure 15. Commuting Distance Between 25-50 Miles: Urban Counties' Rankings

25 to 50 miles	Area	Percentage of urban commuters
1	Island	26.8
2	Mason	23.6
3	Jefferson	22.2
4	Pierce	17.5
5	Lewis	16.8
6	Thurston	15.6
7	Cowlitz	14.6
8	Yakima	14.6
9	Snohomish	13.5
10	Walla Walla	13.4
11	Grays Harbor	12.8
12	Adams	11.9
13	Kittitas	11.7
14	Kitsap	10.5
15	Clallam	10.5
16	Franklin	9.8
17	Skagit	8.6
18	Grant	6.4
19	Benton	6.1
20	Chelan	5.6
21	King	4.8
22	Spokane	4.8
23	Douglas	4.6
24	Whatcom	3.3
25	Clark	2.6
26	Asotin	2.5
27	Whitman	1.0

Figure 16. Commuting Distance Greater than 50 Miles: Urban Counties Rankings

Greater than 50 miles	Area	Percentage of urban commuters
1	Lewis	32.7
2	Grays Harbor	32.5
3	Chelan	31.6
4	Whitman	31.5
5	Clallam	31.4
6	Cowlitz	31.2
7	Skagit	30.7
8	Kittitas	29.0
9	Douglas	28.5
10	Grant	26.4
11	Mason	21.9
12	Benton	20.5
13	Adams	20.2
14	Asotin	19.4
15	Walla Walla	18.0
16	Whatcom	17.8
17	Island	16.5
18	Clark	14.2
19	Jefferson	13.9
20	Thurston	12.6
21	Yakima	9.9
22	Snohomish	6.5
23	Pierce	6.2
24	Franklin	5.8
25	King	4.3
26	Kitsap	4.0
27	Spokane	2.0

<u>Rural Commuters</u>: Counties' Rural Area Commutes Ranked by Percentage of Rural Commuters by Distance

Figure 17. Commuting Distance Less Than 10 Miles: Ranked 1-39

Less than 10 miles	Area	Percentage of rural commuters
1	Spokane	67.6
2	Yakima	59.7
3	Whatcom	44.1
4	Asotin	43.6
5	Columbia	42.7
6	San Juan	42.2
7	Skagit	41.0
8	Chelan	36.4
9	Kittitas	35.4
10	Clallam	35.3
11	Adams	34.4
12	Benton	33.1
13	Thurston	32.9
14	Island	32.8
15	Jefferson	32.4
16	Kitsap	32.0
17	Cowlitz	30.7
18	Whitman	29.8
19	Klickita	29.5
20	Franklin	28.7
21	King	28.4
22	Walla Walla	28.3
23	Pacific	28.0
24	Okanogan	27.0
25	Garfield	26.0
26	Stevens	25.7
27	Clark	25.3
28	Grant	24.6
29	Snohomish	24.4
30	Mason	21.6
31	Skamania	21.0
32	Wahkiakum	20.4
33	Lewis	18.6
34	Pend Oreille	18.2
35	Grays Harbor	17.3
36	Ferry	16.0
37	Douglas	14.0
38	Pierce	13.7
39	Lincoln	9.6

Figure 18. Commuting Distance Between 10-25 Miles: Ranked 1-39

10-25 miles	Area	Percentage of rural commuters
1	Clark	47.0
2	King	45.4
3	Asotin	41.6
4	Kitsap	40.9
5	Franklin	40.3
6	Pierce	39.8
7	Benton	39.6
8	Snohomish	39.3
9	Walla Walla	31.9
10	Thurston	30.4
11	Whatco	29.8
12	Mason	29.6
13	Whitman	28.0
14	Cowlitz	27.7
15	Island	27.0
16	Stevens	26.5
17	Skamania	24.2
18	Wahkiakum	23.7
19	Grays Harbor	23.0
20	Grant	22.5
21	Lewis	22.1
22	Chelan	20.5
23	Douglas	20.2
24	Klickita	20.1
25	Spokane	19.3
26	Pacific	19.3
27	Skagit	19.1
28	Columbia	18.9
29	Jefferson	18.3
30	Lincoln	18.0
31	Okanogan	15.6
32	Adams	15.1
33	Yakima	13.8
34	Clallam	13.7
35	Pend Oreille	13.4
36	Garfield	12.3
37	Kittitas	11.0
38	Ferry	9.5
39	San Juan	8.4

<u>Rural Commuters</u>: Counties' Rural Area Commutes Ranked by Percentage of Rural Commuters by Distance-Continued…

Figure 19. Commuting Distance Between 25-50 Miles: Ranked 1-39

25 to 50 miles	Area	Percentage of rural commuters
1	Mason	30.9
2	Pend Oreille	30.7
3	Jefferson	29.4
4	Pierce	27.7
5	Island	27.6
6	Skamania	27.4
7	Snohomish	26.5
8	Lincoln	26.2
9	Douglas	25.6
10	Garfield	24.6
11	Franklin	22.9
12	Lewis	22.7
13	Walla Walla	21.7
14	Ferry	21.2
15	Thurston	19.4
16	Cowlitz	19.3
17	Grant	19.2
18	Grays Harbor	18.2
19	Kittitas	18.1
20	Adams	17.4
21	Stevens	17.0
22	Skagit	16.9
23	King	16.3
24	Wahkiakum	16.2
25	Okanogan	15.3
26	Kitsap	15.1
27	Benton	14.9
28	Columbia	13.8
29	Whitman	13.2
30	San Juan	13.2
31	Klickitat	13.0
32	Pacific	12.9
33	Clark	10.3
34	Asotin	10.0
35	Clallam	9.7
36	Chelan	7.5
37	Yakima	5.5
38	Whatcom	5.0
39	Spokane	2.0

Figure 20. Commuting Distance Greater than 50 Miles: Ranked 1-39

Greater than 50 miles	Area	Percentage of rural commuters
1	Ferry	53.4
2	Lincoln	46.2
3	Okanogan	42.0
4	Grays Harbor	41.5
5	Clallam	41.3
6	Douglas	40.2
7	Pacific	39.7
8	Wahkiakum	39.7
9	Pend Oreille	37.7
10	Klickita	37.4
11	Garfield	37.1
12	Lewis	36.5
13	San Juan	36.2
14	Chelan	35.6
15	Kittitas	35.5
16	Grant	33.7
17	Adams	33.1
18	Stevens	30.9
19	Whitman	29.0
20	Skamania	27.4
21	Columbia	24.6
22	Skagit	23.0
23	Cowlitz	22.3
24	Whatcom	21.2
25	Yakima	20.9
26	Jefferson	19.9
27	Pierce	18.8
28	Walla Walla	18.1
29	Mason	17.8
30	Clark	17.4
31	Thurston	17.4
32	Island	12.7
33	Benton	12.4
34	Kitsap	12.0
35	Spokane	11.1
36	King	9.8
37	Snohomish	9.8
38	Franklin	8.1
39	Asotin	4.7

Appendix E
Rural and Urban Areas in Washington State

Given the legislature's interest in understanding equity and financial impacts of a potential road usage charge on the state's urban and rural areas, a delineation of rural and urban areas throughout the state was required for this study. Part of the study used the Census Bureau definitions of rural and urban, other analysis relied on WSDOT definitions of rural and urban approved by FHWA and another part of the study used rural, urban and suburban as reported by survey respondents for rural, suburban and urban areas.

Rural and Urban Areas – Census Bureau

The staff workgroup developed the fuel consumption and vehicle miles of travel (VMT) allocation model using a distribution pattern based on the 2009 National Household Travel Survey (NHTS), including whether the household (and the vehicle registered to the household) is in a rural or urban area. The NHTS variable selected for the purpose of statistical matching the Washington Department of Licensing data (see Appendix A) was the "URBRUR" variable, which indicates whether the address is in an urban or rural area, based on the 2000 Census definition. For Census 2000, the Census Bureau classifies as "urban" all territory, population, and housing units located within an urbanized area (UA) or an urban cluster (UC). It delineates UA and UC boundaries to encompass densely settled territory, which consists of:

- core census block groups or blocks that have a population density of at least 1,000 people per square mile and
- surrounding census blocks that have an overall density of at least 500 people per square mile

In addition, under certain conditions, less densely settled territory may be part of each UA or UC. The Census Bureau's classification of "rural" consists of all territory, population, and housing units located outside of UAs and UCs.

The rationale for using the Census Bureau's classification for the model was that the model was developed to ascribe VMT, fuel consumption, and taxes paid to the location at which the vehicle was registered (and, by inference, where the driver lives), rather than the location where the driving activity occurred. On the other hand, the analysis of commuting patterns analyzed vehicle activity based on the location of the activity. This is described below.

Figure 1. 2000 Census Urban Areas (in Dark Blue)

Source: WSDOT

Rural and Urban Areas – Description – WSDOT and OnTheMap Analysis

WSDOT works with the Federal Highway Administration (FHWA) to define the state's Highway Urban and Urbanized areas. The following link provides an overview of the current FHWA adopted rural and urban areas in Washington State.

http://wsdot.maps.arcgis.com/home/item.html?id=eaada5497acd49e1b4db15f3efad14e7

The Federal Highway Administration (FHWA) requires a review of highway urban and urbanized areas after each decennial US Census. The Census Bureau determines boundaries for urbanized areas with 50,000 or more people. Highway urbanized areas must include all areas defined as urbanized by the Census bureau but can and usually do include areas beyond the Census Bureau 's defined boundaries. For urban areas of 5,000 through 49,999 people, FHWA uses city limits or Census Designated Place boundaries, with some adjustments, as the minimum area. This data set is based on data from Census 2010 and is used for identification of Urban Areas. Adjustments to the boundaries of Urban Areas are determined by meetings between Washington State Department of Transportation and Regional and Metropolitan Transportation Planning Organizations. Proposed changes are sent to FHWA for approval each year. After urban and urbanized areas are determined statewide, all other areas in the state are

considered rural areas. FHWA only has urban and rural distinctions in Washington state. Most counties have both a rural and urban area, but 11 counties in 2013 did not have an urban area.

This definition of urban and rural is used as the basis for the reference layer for geographic information systems (GIS) at the Washington State Department of Transportation. This same definition of urban and rural has been applied to other datasets (like OnTheMap and Department of Licensing vehicle registrations) used in the road user charge equity study.

Regional Results

Given the urban and rural delineations, WSDOT calculated the road lane miles throughout the state of Washington based on the rural and urban areas of each county. In addition, WSDOT also calculated the average daily traffic volume for each county's urban and rural areas. Figures 2 and 3 reveal the maps of the state's urban and rural areas with 2012 lane miles and average daily vehicle miles traveled data. Figure 2 has the average daily vehicle miles traveled (DVMT) for all vehicles in 2012. Figure 3 reports the average daily vehicle miles traveled for light duty vehicles only in 2012. Light Duty vehicles include all passenger cars and light trucks and exclude large trucks and busses in FHWA vehicle classes 4-13. Figures 2 and 3 both reveal that in 2012, the significant majority of the 83,879 lane miles, 72%, were in the rural areas and 28% in urban areas throughout the state. The opposite is true of the average daily vehicle miles traveled. For all vehicles in 2012, the average daily vehicle miles traveled had 70% of the statewide miles traveled in urban areas and 30% in rural areas. This is nearly the same result for light duty vehicles with 72% of the statewide daily miles traveled in urban areas and 28% in rural areas.

Typically, the lane miles in the state do not change significantly year over year, but different counties urban and rural areas lane miles can fluctuate some year to year. Sometimes lane miles are re-categorized from rural to urban or vice versa, or road policy changes set at the local level can reduce certain lanes for various purposes. Figure 4 provides the statewide lane miles and daily vehicle miles traveled for years 2011 through 2013 for all vehicles and light duty vehicles only. Total lane miles were 83,743 miles in 2011. Lane miles increased minimally to 83,879 in 2012 and fell 1.7% in 2013 to 82,447 miles. The year-over-year decline in lane miles in 2013 was only in rural areas. Urban areas' lane miles increased 7.6% over the same period. Generally, lane miles have not changed much over the past three years.

Figure 2: Map of 2012 Urban and Rural Areas' Lane Miles and Average Daily Vehicle Miles – All Vehicles

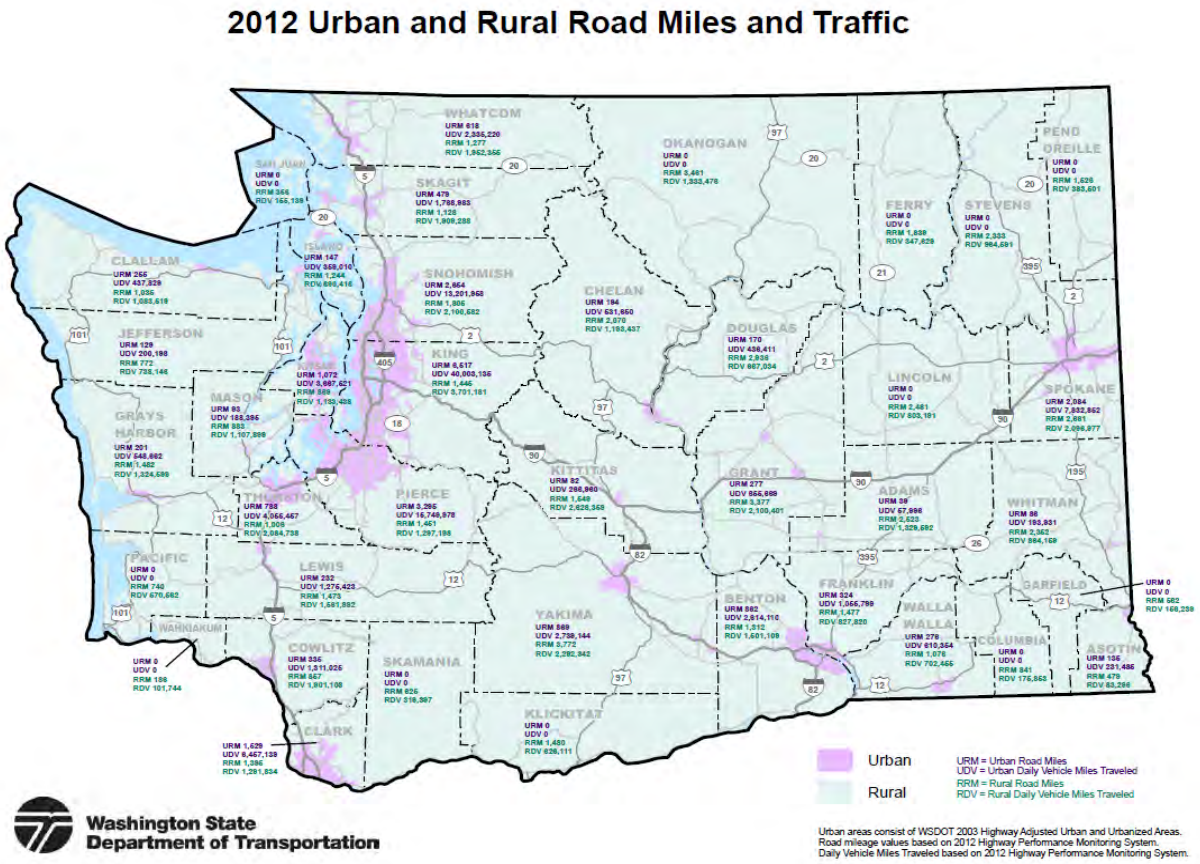
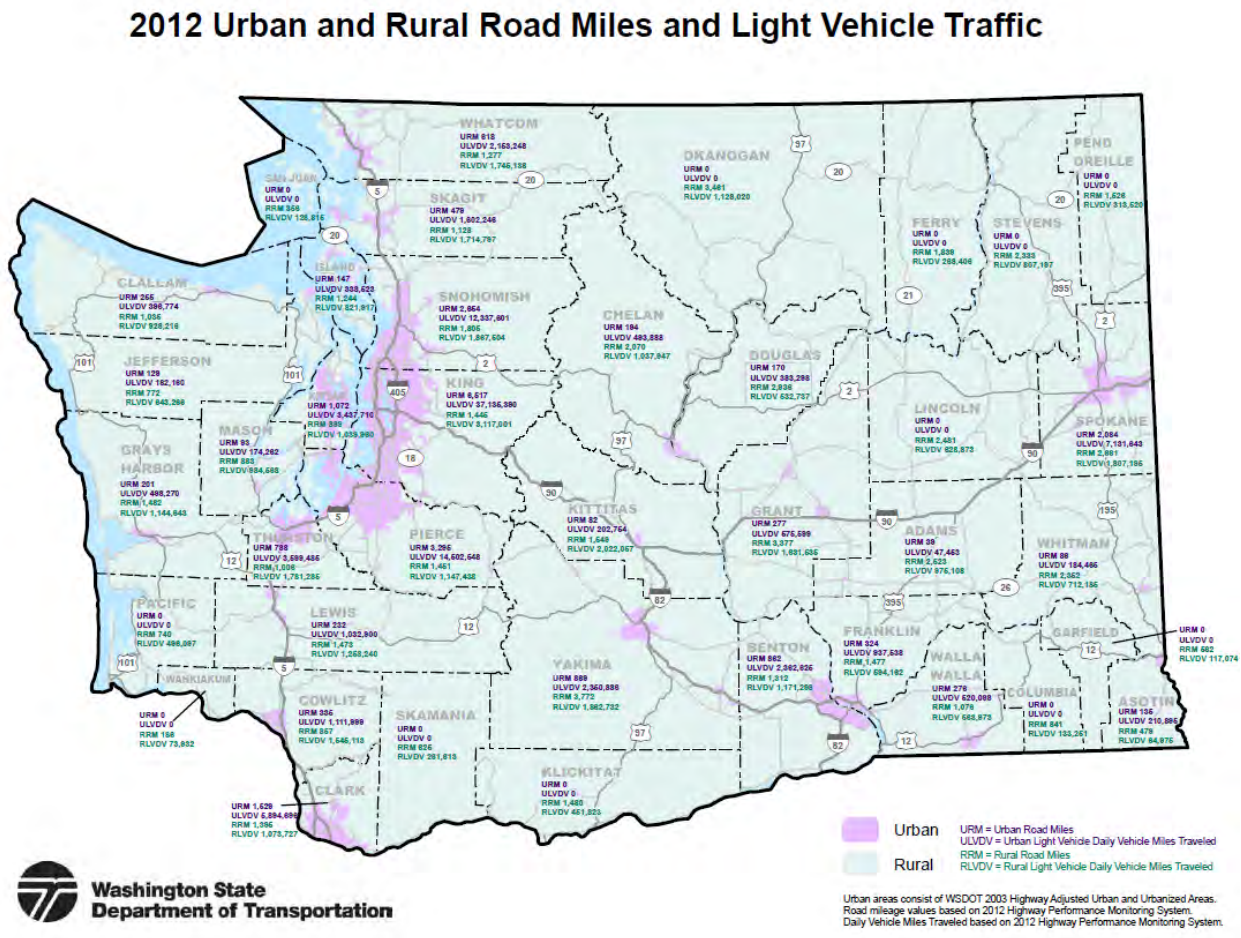


Figure 3: Map of 2012 Urban and Rural Areas' Lane Miles and Average Daily Vehicle Miles – Light Duty Vehicles



Daily vehicle miles traveled (DVMT) is a key component in the annual calculation of our statewide vehicle miles traveled (VMT). Given the flat nature of our recent statewide VMT history, it is not surprising that DVMT also has not changed much over the past three years. In 2011, total statewide DVMT was 156.07 million miles and fell to 155.1 million miles in 2012. It rose back to 156.74 million miles in 2013. The urban areas' total DVMT shows the same trends as the statewide DVMT for the past three years. As expected, King county urban area had the highest DVMT in the state at 40.497 million miles, which represented nearly 36% of total urban areas' DVMT statewide in 2013. Rural areas' DVMT experienced a steady decline over this three year period. In 2011, rural areas' total DVMT was 46.58 million miles. In 2012, DVMT fell to 46.3 million miles and, in 2013, DVMT fell, year-over-year by 7.5% to 42.8 million miles. This declining rural DVMT may be due to more people commuting longer distances and driving on urban areas roads to go to work or to conduct other personal business. Also, the declining rural DVMT could be a function of the declining rural lane miles. This same declining DVMT over the past three years in rural areas for all vehicles is also seen in the light duty DVMT as well.

Figure 4. WSDOT Total Lane Miles and Daily Vehicle Miles Traveled
All Vehicles and Light Duty Vehicles 2011-2013.

Fiscal Year	Total Miles Statewide	Total Daily Vehicle Miles Traveled (DVMT)	Light Duty DVMT
2011	83,743	156,069,006	139,021,232
2012	83,879	155,089,000	138,396,292
2013	82,447	156,743,000	141,442,054

1 Light Duty Vehicles includes passenger cars and light trucks and excludes large trucks and busses in FHWA vehicle classes 4-13

Rural and Urban Areas – Voice of Washington State (VOWS) survey

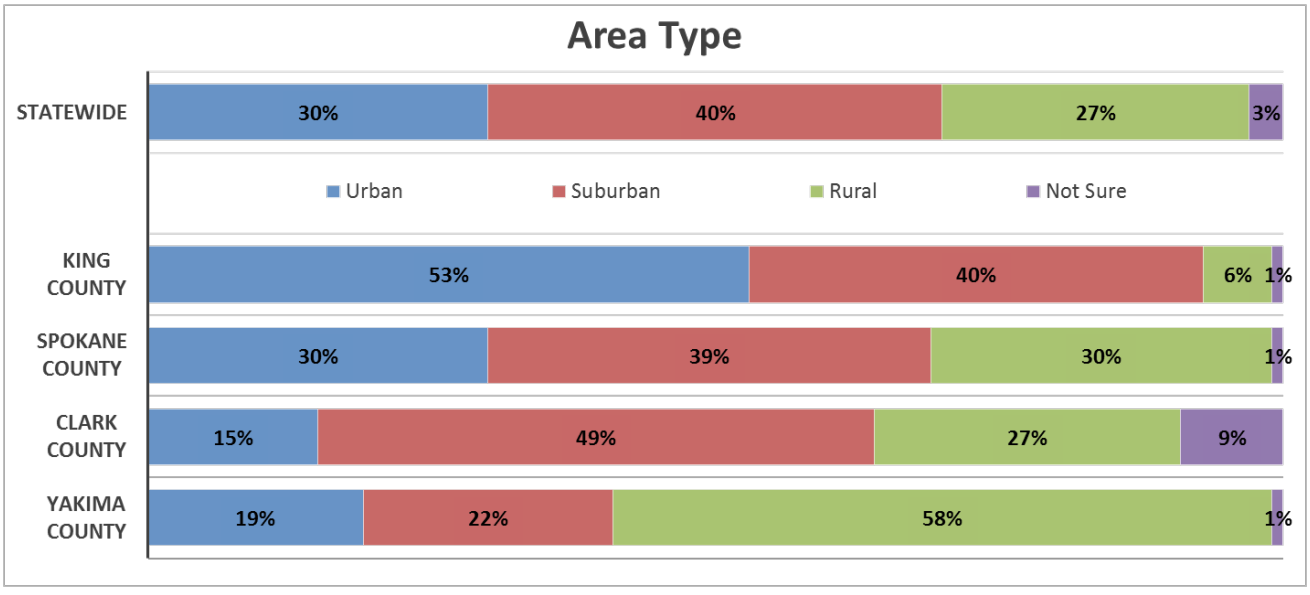
Respondents were asked to classify their local living area into Urban, Rural, Suburban or Not Sure based on their own definition using the following question:

Question: "Would you describe the area you live in as

1. Urban
2. Rural
3. Suburban
4. Not Sure

No further information or definitions were offered to the respondent to answer this question. Rather, the question was designed to identify where the respondents perceived they lived based on their own criteria of Urban, Suburban, and Rural.

Figure 5. Breakdown of VOWS Survey Respondents Self Classification Results: Urban, Rural, Suburban, Not sure.



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