



NATIONAL TRANSPORTATION CENTER

RESEARCH REPORT

The Mediating Role of Motorists' Evaluation of Current Roadway Conditions in Determining Their Willingness to Pay for Future Improvements

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16. Abstract America's transportation infrastructure significantly impacts the autonomy, mobility, and economic well-being of its citizens. However, there is growing concern for the vitality of the nation's highways given the dwindling balances in the Federal Highway Trust Fund. Researchers have begun to focus on the citizens' evaluation of various revenue-generating initiatives. This study adds to the existing literature by focusing on attitudinal, demographic, and behavioral criteria for segmenting the user base. A survey of Maryland residents was used to test the mediating role of motorists' evaluation of current roadway conditions in determining their willingness to pay for future improvements. A total of 450 surveys were completed from a random sample of 4,300 residents. Though there were significant differences in opinion among the various segments, overall there was favorable opinion for three revenue-generating initiatives: (1) variable rates for inspection and licensing fees, (2) increases in registration and licensing fees, and (3) General Obligation Bonds. There were neutral opinions towards toll-related initiatives and increasing the state gas tax, and negative evaluations of non-road usage fees, sales tax increases, and a mileage fee. The findings also suggest that dissatisfaction with roadway conditions, pollution, safety, and congestion are important determinants for shaping motorists' preferences for these alternatives. Even though there is a general level of dissatisfaction with current roadway conditions, motorists tend to be reluctant to support revenue-generating initiatives, unless it is clear that the additional revenue will be used for projects aimed at improving important roadway concerns.			
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EXECUTIVE SUMMARY

The highway system is a vital element of America's transportation infrastructure and it significantly impacts the autonomy, mobility, and economic well-being of U.S. citizens. However, there is growing concern regarding the vitality of the nation's highways given the dwindling balances in the Federal Highway Trust Fund and states' transportation trust funds. State legislators, in particular, are faced with finding other revenue sources to maintain and improve their highway systems. Issues such as effectiveness, social justice, and equity have been considered when evaluating the pros and cons of various revenue-generating initiatives. More recently, researchers have begun to focus on the citizens' evaluation of these initiatives.

This study adds to the existing literature by focusing on attitudinal criteria as well as demographic and behavioral criteria for segmenting the user base. These segmentation variables are used to identify similarities and differences among the various groups that relate to their preferences for various revenue-generating initiatives. We propose that users' attitudinal disposition towards their daily travel experiences on the roads will determine their perceived need for prioritizing funding projects that improve roadway conditions, safety, congestion, and pollution. At the same time, it is expected that these attitudes and priorities will mediate the relationship between demographic/behavioral variables and the preference for alternative types of revenue-generating initiatives.

In order to test the mediating role of motorists' evaluation of current roadway conditions in determining their willingness to pay for future improvements, a survey was conducted using a random sample of residents in the state of Maryland. Maryland serves as an excellent example of the issues facing the nation's highway system because the region's expected increase in population, income, and suburbanization will place increased strain on the state's current highway system. A total of 450 surveys were completed from a random sample of 4,300.

Respondents were moderately dissatisfied with current state of the roads in Maryland, ranking road safety as the main concern, followed roadway pollution, congestion, and finally roadway conditions. Differences emerged among the respondents when they were grouped based on gender, education level, hours travelled, income level, race/ethnicity, and location.

The high level of dissatisfaction with roadway safety translated into the number one priority for funding projects aimed at improving roadway safety. However, whereas roadway pollution was second in terms of overall dissatisfaction, the perceived need to fund projects that reduced air pollution on the roads dropped to fourth place in terms of priorities. Instead, respondents were more interested in funding projects aimed at reducing traffic congestion and improving road conditions.

Respondents were asked to evaluate various revenue-generating initiatives aimed at funding the state's road infrastructure. Overall, there was favorable opinion for three revenue-generating initiatives: (1) variable rates for inspection and licensing fees, (2) increases in registration and licensing fees, and (3) General Obligation Bonds. There was generally a neutral opinion towards toll-related initiatives and increasing the state gas tax, and a negative opinion towards non-road usage fees and taxes, and the mileage fee. There were significant differences in opinions among

the various segments. Notably, those who were dissatisfied with roadway pollution were more likely to prefer variable and fixed registration and licensing fee increases, gas tax increases, and toll-related initiatives, but were less inclined to support the use of General Obligation Bonds. Those who were dissatisfied with congestion were more likely to prefer toll-related initiatives for raising revenue. There were also significant differences in preferences based on political affiliation, education level, income level, location, race/ethnicity, gender, and road usage rate, although some of these differences were mediated by user dissatisfaction with roadways.

The findings of this study suggest that dissatisfaction with roadway conditions, pollution, safety, and congestion are important determinants for shaping motorists' perceived priorities for funding roadway improvement projects. In addition, our findings suggest that these attitudinal variables along with demographic and behavior variables, are useful in segmenting motorists and differentiating their preferences for different revenue-generating initiatives. The results suggest that there is a general level of dissatisfaction with current roadway conditions. At the same time, there is a general reluctance among motorists towards revenue-generating initiatives, particularly if it is unclear where these additional funds will be used. Therefore, it is important to explain how any increases in fees, tolls, etc. will help improve the roadway system in terms of specific areas related to roadway safety, congestion, conditions, and pollution.

INTRODUCTION

A recent report from the National Surface Transportation Policy and Revenue Study Commission (NSTPRSC) highlighted the importance of a quality surface transportation infrastructure in maintaining the global economic leadership of the United States. The report's call to action underscored the need to increase the amount of investment in highways, since they constitute "the backbone of the Nation's transportation system, connecting every State and region of the country. The extensiveness and vitality of this highway network helped position the United States as one of the world's superpowers" (NSTPRSC, 2007, pg. 3-2). American motorists enjoy the autonomy, mobility, and economic well-being that the highway system provides at the national, regional, state, and local levels.

The highway plays an integral role in the nation's ability to distribute goods, develop markets, enhance personal mobility, improve health and safety, and support homeland security and national defense. Unlike other transit infrastructures, the publicly funded roads are mainly used by privately owned vehicles. Trucks on U.S. roadways "carried 60 percent of the 19 billion tons of goods shipped in 2002" (NSTPRSC, 2007, pg. 3-3). Highways are the most popular mode of transportation for daily and long-distance trips among Americans. At the same time, balances in the Federal Highway Trust Fund and state transportation trust funds are rapidly declining (NSTPRSC, 2007). The prospect of decreasing funds has led federal and state policy makers to examine a variety of revenue-generating initiatives for maintaining and improving the country's highway system.

The state of Maryland serves as an example of the issues facing the nation's highway system. In the Baltimore-Washington metro area, future private transportation travel demand is expected to grow as we see increases in population, income, and suburbanization in the region (Ellis and Vadali, 2007). The Base Realignment and Closure (BRAC) program is expected to bring in an additional 45,000 federal and private sector jobs to the state, mostly in high technology fields that pay well (Maryland Department of Business & Economic Development, 2007). The lure of the stability of government jobs in today's economic climate is also likely to see increased migration to the region. The population growth will put further strain on the existing highway system in the region; thus, there is a need for significant transportation infrastructural maintenance and development. At the same time, the citizenry are generally aware of the deteriorating transportation infrastructure, but skeptical about the state's ability to deliver improvements (Wilson, 2010).

As the costs of maintaining and improving the nation's highway system are expected to increase for the foreseeable future, researchers, responding to the need for federal and state leaders to consider various options for increasing revenues for highway and transportation trust funds, have conducted a number of studies such as Podgorski and Kockelman (2006) and Harrington et al. (2001). While issues such as effectiveness, fairness, social justice, and equity have been examined in these studies, less attention has been paid to user perspectives. Thus, the present study investigates motorists' opinions and preferences. Specifically, it examines current levels of satisfaction with and evaluation of highway infrastructure, and user willingness to pay for future transportation expenditures aimed at improving congestion, pollution, and safety. In particular, the project will apply various demographic, psychographic, and product usage variables to

segment the motorist market in order to analyze attitudinal similarities and differences among the various groups. Insights into the various constituents that may be directly impacted by future revenue-generating initiatives will help policy makers make better-informed decisions not only in relation to road infrastructure funding, but also in the development of public relations campaigns that help explain potential user-desired benefits.

The perceived benefits and costs of the various initiatives will be evaluated from the consumer's perspective. It is expected that the results will provide additional insight into ways in which the state can communicate to different target populations the need for increasing user fees and/or taxes in order to maintain and make improvements in the highway system. It may be the case that different segments (based on demographic, behavioral, and/or attitudinal criteria) have different priorities, preferences, or concerns. Understanding these differences among Maryland's various groups of motorists will help to better target public relations campaigns aimed at raising public support for increasing state revenues for the state's transportation trust fund. For instance, would private drivers be willing to support an increased gas tax if they felt it would help reduce pollution, help decrease commuter travel time, or improve road and bridge safety? The relative importance of these benefits is expected to fluctuate among different motorist segments. Some revenue-generating initiatives may also be perceived to be better remedies for specific nuisances than others. For instance, congestion-minded motorists may be more willing to pay more if the money is put toward high occupancy toll (HOT)¹ lanes, whereas safety-minded motorists may be willing to pay more if the additional revenues were directed at road and bridge safety or truck-only toll (TOT)² lanes. The remainder of this paper covers a review of the literature, followed by a discussion of the conceptual framework, methodology, and findings.

¹ A HOT lane is an underused carpool lane that is opened to solo drivers who are willing to pay a toll.

² A TOT lane is a toll lane that runs parallel to the freeway and is used exclusively by trucks. Trucks are required to use the TOT lane instead of the freeway.

LITERATURE REVIEW

While there have been substantial public opinion polls run by news organizations that look at the public's reaction towards specific policy initiatives regarding transportation funding, there has been limited academic research that examines motorist attitudes and preferences. Prior research has primarily highlighted regional and demographic differences that may have an impact on whether motorists are for or against certain types of revenue-generating initiatives (Figure 1).

Several studies suggest that residents may prefer initiatives that are less likely to affect them. For instance, Kockelman et al. (2006) found more support for tolling among residents from rural or small urban areas and theorized that this may be because these residents may have felt that the tolls were more likely to appear in large, urban areas.

A number of studies focused on demographic variables such as age, gender, income, and education differences. Podgorski and Kockelman (2006) found greater support for congestion pricing among more educated respondents in Texas. In contrast, Harrington et al. (2001) found a negative relationship between education and income for congestion pricing in Los Angeles. Whereas Podgorski and Kockelman (2006) found significant gender differences regarding support for various initiatives, a study by the Io Data Corporation (2006) found no significant gender differences regarding attitude towards toll roads. There have also been several studies comparing ethnicity. Harrington et al. (2001) found Hispanics and Asians more supportive of congestion pricing than whites and blacks. Myers et al. (2006) found Hispanics more supportive than whites towards local sales taxes for transportation in California. Dill and Weinstein (2007) included demographic variables, travel behavior, and attitudes in an examination of resident preference for a variety of tax and fee options for funding transportation in California. The list of options for revenue-raising initiatives included HOT lanes, tolls, increased gas taxes, and dedicated sales taxes. More recently, Agrawal and Nixon (2011) examined support for sales, gas, and mileage tax increases using a national sample and found general support for higher taxes for transportation under certain conditions. Support for tax increases changed depending on whether the additional generated revenue was to be used on specific types of improvements and projects. In addition, their findings suggest that there was more support for gas tax increases than sales tax and mileage tax increases.

The majority of previous studies have focused on demographic and/or behavioral differences among respondents and their preference for one or various types of revenue-generating initiatives. Previous research has, by and large, overlooked attitudinal variables that may better explain user preferences. For instance, would one expect those motorists who are dissatisfied with the current roadway system to be more amenable to a fee increase to pay for infrastructure upgrades aimed at improving services than those who are satisfied with the current roadway system? In other words, certain motorists are more likely to appreciate the benefit that the increased cost would help create, whereas those who are already satisfied with their daily road-use needs are more likely to view the cost as less necessary or beneficial. The potential mediating effect of users' level of satisfaction and perceived importance of roadway improvements is, therefore, an important issue that merits attention.

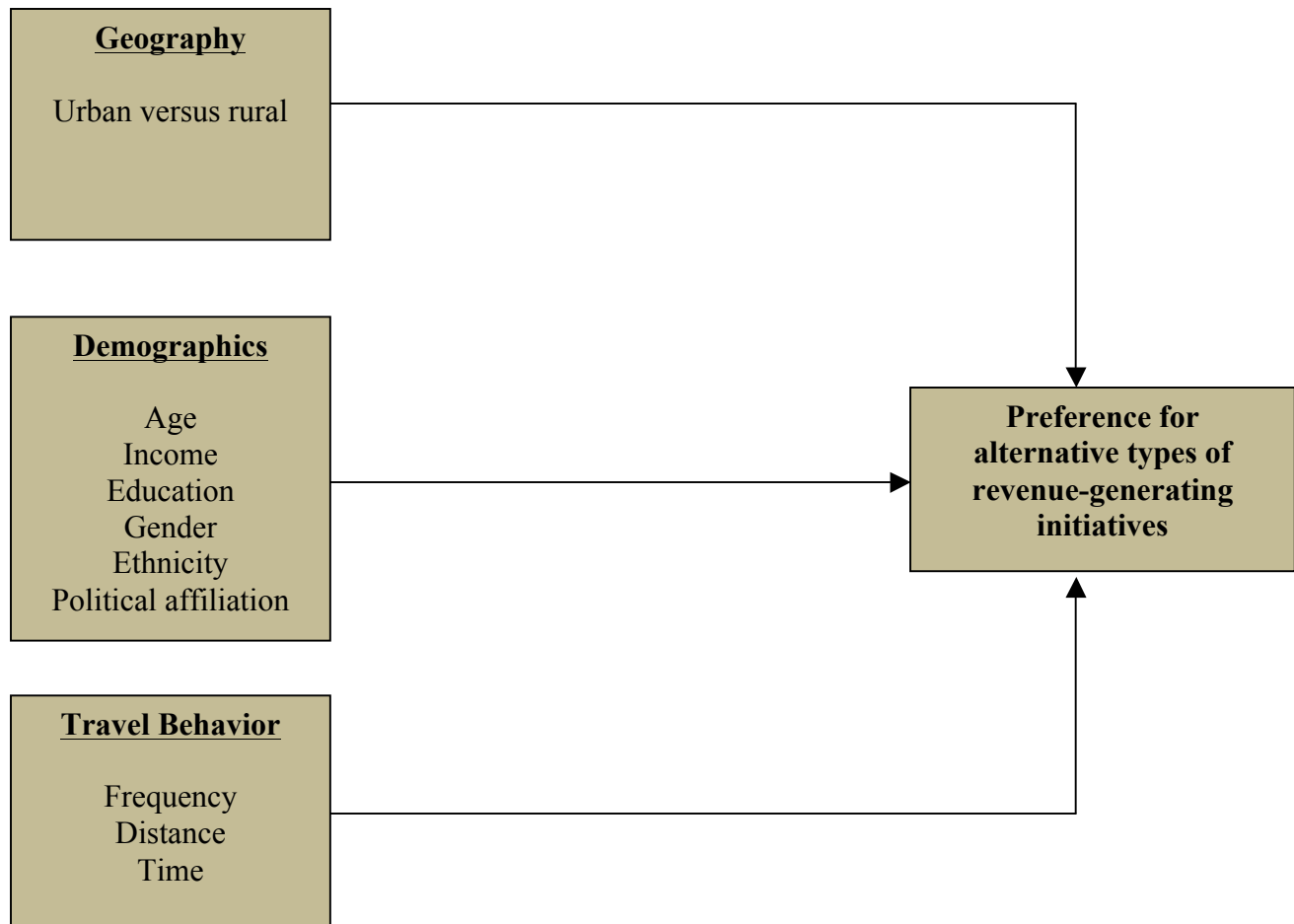


Figure 1: Previous Research on Consumer Preferences

CONCEPTUAL FRAMEWORK

This study examines motorists' attitudinal disposition towards their daily travel experiences on the roads. It seeks to explore the mediating roles these attitudinal variables have on linking demographic, geographic, and behavioral classification variables to favoring certain types of revenue-generating initiatives (Figure 2). The motorists' reported level of satisfaction with travel on roadways is expected to play a significant role in determining the perceived need for improvements in the transportation infrastructure. One would assume that those who are satisfied with their current usage of highways are less likely to perceive a need for significant improvements when compared to those who are less satisfied. A felt need for improving existing services may in turn lead to a greater willingness to pay additional money for funding these improvements, since the motorist expects to benefit directly. The type of improvements that the motorist feels are needed (i.e., reducing congestion and travel time, increasing safety of roads and bridges, or decreasing air pollution) is expected to play a role in determining a preference for a particular revenue-generating initiative.

The identification of varying levels of dissatisfaction for the highway system among different groups of motorists will provide policy makers with a clearer picture of how to best craft messages for educating the public as to the need for increasing revenue for the transportation trust fund. It may be the case that lower income groups are more interested in improvements related to reducing traffic congestion, whereas higher income and more educated groups are more interested in improving air quality, and young family drivers are interested in road safety as well as air quality. By segmenting the market in such a way, the state will be able to customize appeals for specific segments. For instance, the implementation of TOT lanes can be highlighted as a way to reduce congestion or to improve safety on regular freeways.

Figure 2 depicts the proposed mediating effects relating to users' level of dissatisfaction with various roadway issues and their perceived need for improvements. It is expected that these attitudinal variables will mediate the relationship between various demographic/behavioral groups and preferences for certain types of revenue-generating initiatives.

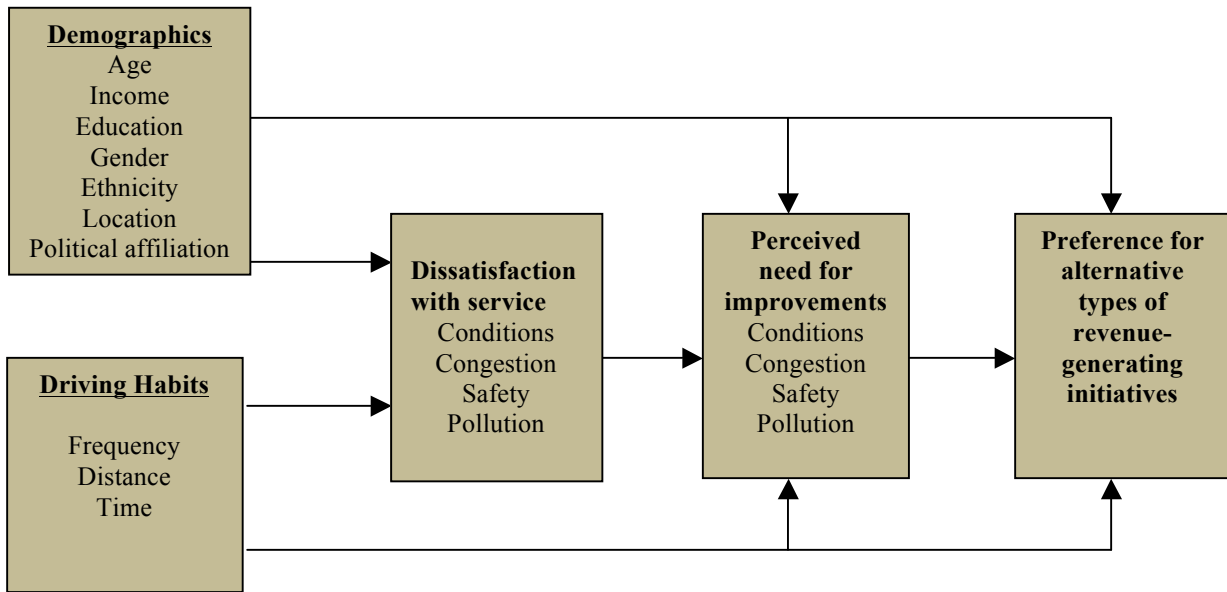


Figure 2: Proposed Model

METHODOLOGY

After a review of measures used in a selection of transportation research studies—including Agrawal et al (2010), Baldasaare (2004), Dill and Weinstein (2007), Krupnick et al (2001), Lawrence (2006), Podgorski and Kockelman (2004) and Sukhai (2003)—a survey was developed and submitted for feedback to three external reviewers with considerable transportation research track records. Upon receiving the feedback and making changes as appropriate, a pre-test of the survey was done on a small, non-random sample of 15 respondents and the responses were analyzed. The survey instrument was refined before it was submitted to Morgan State University's Institutional Review Board (IRB) for approval.

The survey had three parts. It has been argued that people have a tendency to exhibit travel behavior reflective of their abilities, needs, and preferences (Wee, 2009; Van Vugt et al, 1995). As a result, the first part of the survey asked respondents about their current level of satisfaction with Maryland's highways, the felt need for improving the highway system, and their driving behavioral patterns (e.g., frequency of trips, time spent on road, and average travel distance). It also included questions relating to opinions about road conditions, traffic congestion, road safety, and road pollution. The second section focused on revenue-raising options. Respondents were provided with descriptions and purposes for a set of established revenue-generating initiatives (e.g., toll fees, gas taxes, sales taxes, registration fees, and vehicle license fees). They were asked to evaluate each option using a list of questions that included overall preference as well as their perception that these options would help improve traffic flow and safety and minimize pollution. The third section asked a variety of demographic and geographic questions, including age, gender, income, education, and marital status.

A random list of 4,300 Maryland residents (i.e., both drivers and non-drivers), drawn from all of the state's 24 counties, was acquired from a consumer list company, and the finalized survey packet was mailed to them. Each packet contained the survey, a cover letter, and a self-addressed, stamped envelope for returning the completed survey. A total of 450 surveys were completed and returned. Another 165 surveys were returned as undeliverable. Therefore, the response rate for the study was 10.9 percent.

Measurement Variables

The measurement variables were separated into three categories: independent, mediating, and dependent. The independent variables included demographic and behavioral variables. The mediating variables included respondents' dissatisfaction with current conditions of Maryland's roads as well as their preferences for funding roadway projects and improvements. Finally, the dependent variables included respondents' evaluations of various revenue-generating initiatives.

Independent Variables

An array of single-item demographic and behavioral variables was included in the survey, including age, gender, race/ethnicity, income, education, political affiliation, location, and driving behavior.

Mediating Variables

Three items were used to measure dissatisfaction with the current conditions of the roadways ($\alpha = .79$), three items were used to measure dissatisfaction with roadway congestion ($\alpha = .60$), three items were used to measure perceived safety of the roads ($\alpha = .76$), and two items were used to measure perceived pollution on the roads ($\alpha = .74$, $n = 443$). Each item asked respondents the extent to which they agreed that the roadways were in poor condition, had too much traffic congestion, were unsafe, and had high levels of pollution due to the traffic. For each construct, a single score was computed by adding the items together and dividing by the number of items. Each variable ranged on a scale of 1 (strongly disagree) to 7 (strongly agree).

Four single-item measures were used to measure respondents' preferences for different types of road improvements and projects. They were asked to prioritize various functions of the Maryland Department of Transportation using a seven-point scale, with one representing a low priority and seven representing a high priority. The proposed projects focused on improving road conditions (potholes, street lighting, etc.), reducing traffic congestion, increasing road safety (speeding, accidents, bridge maintenance, etc.), and reducing air pollution (curbing vehicle emissions, etc.).

Dependent Variables

Respondents were asked to evaluate various revenue-generating initiatives aimed at funding improvements in the state's road infrastructure. The initiatives focused on modifications to tolls, the gas tax, mileage fees, registration and licensing fees, and non-road usage fees. The toll-related scale consisted of six items that measured the respondent's evaluation of initiatives relating to increasing toll rates, developing new toll roads, TOT lanes, HOT lanes, cordon tolling, and increasing all existing tolls by 10 percent. Frequency tables for each variable are shown in Appendix D. A single score was computed by adding and averaging across the six items (reliability = .71).

Two items were used to measure attitude towards increasing the gas tax ($\alpha = .72$). Respondents were asked whether the gas tax should be increased by 1 cent per gallon per year for the next ten years, and whether the gas tax should be indexed to inflation (i.e., the gas tax increases in proportion to inflation).

One item was used to measure attitude towards a mileage fee program. Respondents were asked the extent to which they agreed with the statement "Motorists should pay a mileage fee instead of a gas tax. Instead of paying a tax on how much gas is used (currently 23 cents per gallon), motorists would pay a mileage fee (e.g., \$1 per 100 miles) based on the number of miles a vehicle is driven. Each vehicle would be equipped with an electronic means to keep track of miles driven in the state." The main appeal of this plan is a more stable source of income (since gas tax revenues fluctuate based on changes in retail gas prices).

A single item was used to measure attitude towards increasing registration and licensing fees. Respondents were asked whether they agreed that the state should pay for road improvements from an overall increase in vehicle registration and licensing fees. A separate question linking variable vehicle inspection and licensing fee rates to car pollution rates was also included.

Respondents were asked whether they agreed with the statement “Owners of vehicles that pollute more and get less miles per gallon should pay higher state vehicle inspection and licensing fees. Vehicles that pollute less and get better gas mileage should pay lower fees.”

Three items were used to measure non-road usage fee increases: (1) increasing the state’s sales tax by 0.5 percent, (2) increasing bus and rail transit fares, and (3) increasing airport fees. A single score was computed by adding and averaging across the three items (reliability = .61).

A single item was also used to measure respondents’ affinity towards the use of General Obligation Bonds to pay for road improvements and maintenance.

RESULTS

Descriptive Statistics

The average respondent was male (59.3%), white (75.8%), married (64.6%), traveled on the road five to seven days a week (82.6%), and drove one to two hours daily (54%). The median age was 41 to 55 years old. Some 66.6 percent had earned an undergraduate degree or higher. The median income was \$50,000-99,999, with 43.7 percent of the sample reporting an income greater than \$100,000. Approximately 80.1 percent of the sample resided in urban or suburban counties of Greater Washington or Greater Baltimore, with 19.9 percent residing in the rural counties of western Maryland, southern Maryland, or the Eastern Shore. The regional profile of the sample reflects the geographic characteristics of the state of Maryland (Appendix A). In addition, 49.2 percent identified as Democrats compared to 28.4 percent who identified as Republican and 18 percent who identified as Independent. An extensive breakdown of the demographic profile and driving behavior of the sample is provided in Appendices B and C.

Residents' Perceptions on the State of the Roads in Maryland

Respondents were asked the extent to which they agreed with statements relating to the conditions of the road, the congestion on the road, the safety of the roads, and the amount of pollution on the roads. The mean results for all respondents for each scale are shown in Table 1.

Overall, respondents were moderately dissatisfied with the state of the roads in Maryland, mainly in terms of safety (mean = 5.3, $s = 1.2$) and pollution (mean = 5.0, $s = 1.5$), followed by congestion (mean = 4.7, $s = 1.2$) and roadway conditions (mean = 4.5, $s = 1.5$). Regression analyses were run on each variable to determine whether there were differences based on demographics and road usage. The method used for selecting the variables used in the model was stepwise regression.

For roadway conditions, gender ($\beta = .20$, $p < .001$), household income ($\beta = -.16$, $p = .001$), ethnicity ($\beta = .13$, $p = .012$), location ($\beta = -.41$, $p = .023$), hours travelled on the roads per day ($\beta = .11$, $p = .015$), and age ($\beta = .10$, $p = .046$) were added into the model using stepwise criterion. Women were more dissatisfied with roadway conditions than men ($\mu_{\text{women}} = 4.9$, $\mu_{\text{men}} = 4.2$). Household income had a negative relationship with dissatisfaction, whereby the higher income respondents were generally more satisfied with roadway conditions than the lower income respondents were. For example, those with an income of less than \$15,000 had a mean dissatisfaction level of 5.3 out of 7, whereas those with an income of over \$100,000 had a mean dissatisfaction level of 4.2. Minority respondents were more dissatisfied than the white respondents were ($\mu_{\text{minority}} = 5.0$, $\mu_{\text{majority}} = 4.3$). Respondents who lived in urban counties were generally more dissatisfied with conditions than those who lived in rural counties ($\mu_{\text{urban}} = 4.5$, $\mu_{\text{rural}} = 4.1$). Those who travelled on the roads for seven or more hours a day were more dissatisfied ($\mu = 5.4$, $s = 1.0$) than those who used the roads less. Nonetheless, even those who travelled less than one hour a day on the roads were generally dissatisfied with the roadway conditions ($\mu = 4.4$, $s = 1.5$). Finally, age was positively correlated with dissatisfaction with roadway conditions, although the group that was most dissatisfied with the roadway conditions

was the youngest cohort, those 18 to 24 years old ($\mu = 5.8, s = .3$). However, there were only four respondents within this age bracket.

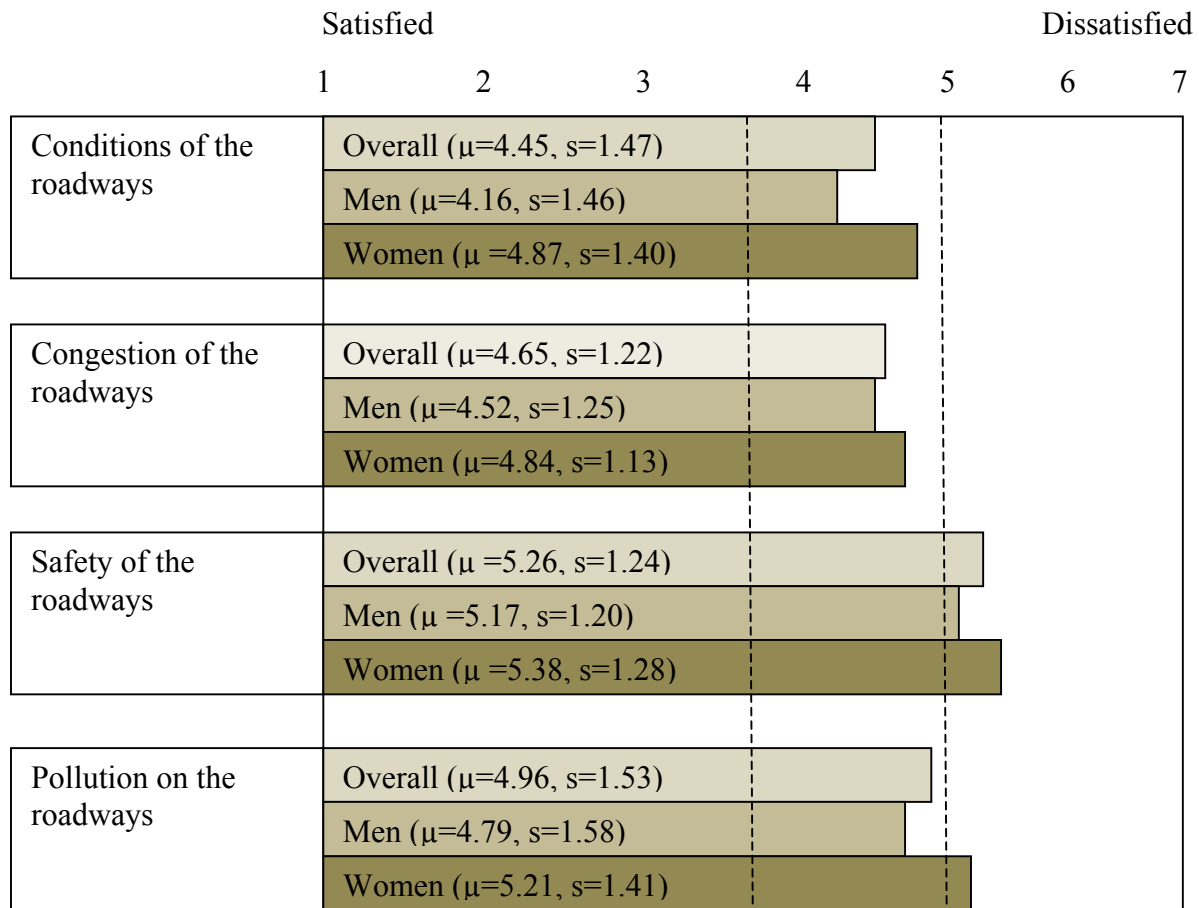


Figure 3: Level of Dissatisfaction with Maryland's Roadways

For traffic congestion, only hours travelled on the roads per day ($\beta = .15, p = .003$) and gender ($\beta = .14, p = .005$) were included in the stepwise regression model. Hours travelled was positively correlated with traffic congestion, suggesting that those who travel more are likely to be more dissatisfied with the amount of congestion. At the same time, women reported moderately higher levels of dissatisfaction than men did ($\mu_{\text{women}} = 4.8, \mu_{\text{men}} = 4.5$).

For roadway safety, level of education and political affiliation were included in the regression model. The lower the level of education, the more dissatisfied the respondents were with roadway safety ($\mu_{\text{high school}} = 5.6, \mu_{\text{bachelors}} = 5.2, \mu_{\text{graduate}} = 5.1$). In addition, those who identified as Democrats reported higher levels of dissatisfaction with roadway safety ($\mu = 5.4, s = 1.2$) than Republicans ($\mu = 5.1, s = 1.4$) and Independents ($\mu = 5.2, s = 1.2$). Once again, however, all groups were generally dissatisfied with roadway safety.

For roadway pollution, three variables were entered using stepwise regression: Democratic political affiliation ($\beta = .23$, $p < .001$), education level ($\beta = .16$, $p = .001$), and gender ($\beta = .11$, $p = .029$). Democratic respondents tended to be more preoccupied with pollution ($\mu = 5.3$, $s = 1.44$) than their Republican ($\mu = 4.5$, $s = 1.5$) and Independent ($\mu = 4.9$, $s = 1.5$) counterparts. Those with a higher level of education were also more likely to be dissatisfied with the level of roadway pollution ($\mu_{\text{high school}} = 4.8$, $\mu_{\text{bachelors}} = 4.9$, $\mu_{\text{graduate}} = 5.2$). Finally, women expressed greater concern with roadway pollution than men did ($\mu_{\text{women}} = 5.2$, $\mu_{\text{men}} = 4.8$).

Residents' Priorities for Roadway Improvements and Projects

Respondents were asked to prioritize various functions of the Maryland Department of Transportation on a scale of 1 to 7, with one representing a low priority and seven representing a high priority. The various functions included improving road conditions (potholes, street lighting, etc.), reducing traffic congestion, increasing road safety (speeding, accidents, bridge maintenance, etc.), and reducing air pollution (curbing vehicle emissions, etc.). The mean results for all respondents were grouped by political affiliation since this was the primary demographic variable that differentiated the groups (Figure 4).

The average priority rating ranged from medium to high for all four functions. Increasing road safety exhibited the highest mean score ($\mu = 5.49$, $s = 1.6$), followed by reducing traffic congestion ($\mu = 5.38$, $s = 1.6$), improving road conditions ($\mu = 5.29$, $s = 1.6$), and reducing air pollution ($\mu = 4.25$, $s = 1.9$). In the previous section, respondents were on average mostly dissatisfied with road safety, and so it came as no surprise that their first priority concentrated on this function. However, whereas pollution came in second as a source of dissatisfaction for our respondents, the perceived need for reducing air pollution dropped to fourth place in terms of priorities.

Regression analyses were repeated on each variable to determine whether there were differences based on demographics and road usage. In addition, dissatisfaction with roadway conditions, traffic congestion, road safety, and air pollution were included in step 2 of the regression to determine their mediating effects. The model's variables were identified with stepwise regression. The overall regression results for each of the four dependent variables can be seen in Tables 1-4.

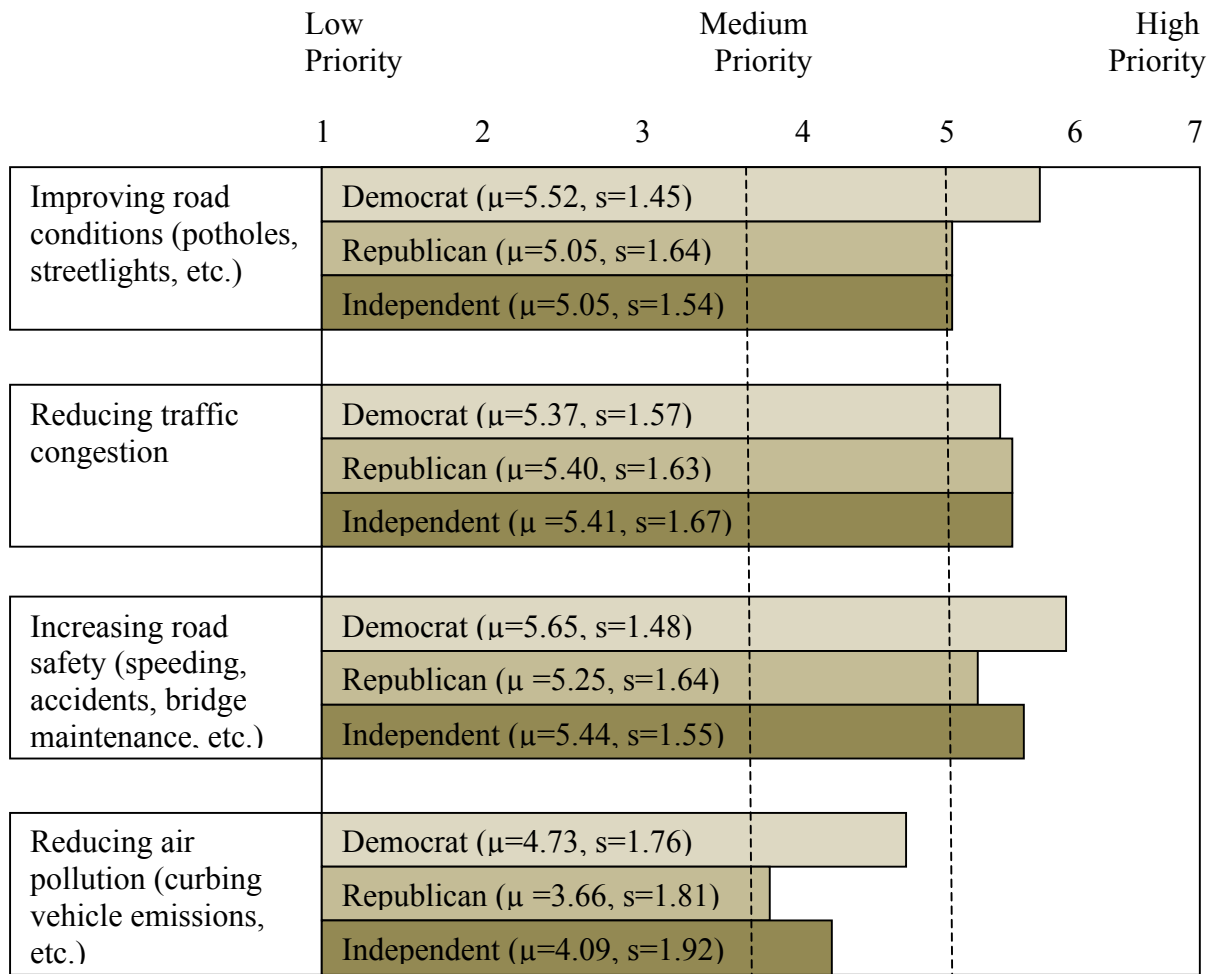


Figure 4: Respondents' Priorities for Improvements and Projects of the Maryland Department of Transportation by Political Affiliation

Model	β	t	p-value
1. Democrat	.146	2.870	.004
Race/ethnicity	.100	1.972	.049
2. Democrat	.108	2.251	.025
Race/ethnicity	.039	.808	.420
Dissatisfaction with road conditions	.353	7.380	.000

Dependent variable: Prioritizing projects that improve road conditions

Table 1: Predictors for Prioritizing Projects that Improve Road Conditions

Model	β	t	p-value
1. Dissatisfaction with congestion	.408	7.725	.000
Dissatisfaction with road conditions	-.167	-3.154	.002

Dependent variable: Prioritizing projects that improve road congestion

Table 2: Predictors for Prioritizing Projects that Improve Road Congestion

Model	β	t	p-value
1. Democrat	.118	2.348	.019
2. Democrat	.095	1.942	.053
Dissatisfaction with road safety	.231	4.712	.000

Dependent variable: Prioritizing projects that improve road safety

Table 3: Predictors for Prioritizing Projects that Improve Road Safety

Model	β	t	p-value
1. Democrat	.205	4.126	.000
Race	.177	3.571	.000
2. Democrat	.090	2.003	.046
Race	.188	4.282	.000
Dissatisfaction with road pollution	.465	10.593	.000

Dependent variable: Prioritizing projects that improve road pollution

Table 4: Predictors for Prioritizing Projects that Improve Road Pollution

For prioritizing the improvement of road conditions, political affiliation and race were the only variables loaded in step 1 of the regression analysis. Democrats exhibited higher means for prioritizing the improvement of road conditions than Republicans and Independents ($\mu_{\text{democrat}} = 5.52$, $\mu_{\text{republican}} = 5.05$, $\mu_{\text{independent}} = 5.05$). For race and ethnicity, whites ($\mu = 5.19$, $s = 1.5$) and Asians ($\mu = 5.00$, $s = 1.7$) exhibited a lower mean score than Hispanics ($\mu = 5.63$, $s = 1.5$) and blacks ($\mu = 5.71$, $s = 1.7$). For political affiliation and race, all of the subgroups had mean scores of at least five on the seven-point scale.

When the mediating variables were included in step 2, dissatisfaction with road conditions was added to the model. As one would expect, dissatisfaction with road conditions was positively correlated with the prioritization of projects that help improve road conditions. In addition, dissatisfaction with road conditions mediated the relationship between race and prioritization of projects that target road improvements, but it did not mediate the relationship for political affiliation. In other words, blacks and Hispanics were more likely to prioritize improvements in road conditions than whites because they were less dissatisfied with current road conditions. Democrats, on the other hand, were more likely to prioritize road improvements than others, regardless of their level of dissatisfaction with current road conditions.

For prioritizing the reduction of traffic congestion, no demographic or road-usage variables were loaded into the regression model. Two of the dissatisfaction variables, congestion and road conditions, were included in the model in step 2. As expected, the results suggested that dissatisfaction with traffic congestion was positively related to prioritizing the reduction of traffic congestion. Interestingly, dissatisfaction with roadway conditions was negatively related to prioritizing traffic congestion. It seems that higher levels of dissatisfaction with another road nuisance decrease the perceived importance of reducing traffic congestion, in essence acting as a tradeoff. In other words, someone who is highly dissatisfied with current roadway conditions will likely want to prioritize improvements in road conditions, but will in turn give a lesser priority to reducing traffic congestion. Indeed, the two other dissatisfaction variables also had negative correlations with prioritizing traffic congestion, even though they were not statistically significant ($\beta_{\text{safety}} = -.012$, $p = .82$; $\beta_{\text{pollution}} = -.011$, $p = .83$).

For prioritizing improvements in road safety, Democratic political affiliation was the only demographic or behavioral variable that had a statistically significant effect on the model. Democratic affiliation was positively correlated with prioritization of safety projects. However, when the dissatisfaction variables were included in the model, dissatisfaction with safety mediated the effect between political affiliation and the priority of safety projects, since the political affiliation variable was no longer statistically significant at the .05 level. Dissatisfaction with roadway safety conditions, therefore, explains why Democrats exhibit higher priority scores for improving roadway safety.

For prioritizing projects for improving roadway pollution, Democratic political affiliation and race were the only demographic and behavioral variables that were statistically relevant to the model. Democratic affiliation was positively related to prioritizing roadway pollution efforts. For race and ethnicity, whites ($\mu = 4.02$, $s = 1.9$) and Asians ($\mu = 4.67$, $s = 1.1$) had lower priority levels for reducing air pollution than blacks ($\mu = 5.04$, $s = 1.8$) and Hispanics ($\mu = 5.50$, $s = 1.8$). As expected, dissatisfaction with pollution was positively related to the priority level of pollution

improvements. Dissatisfaction with roadway pollution mediated the relationship between political affiliation and prioritization of roadway improvements, but did not do so for race. In this instance, it seems that whites have a lower priority level for reducing pollution than minorities, regardless of their perceived dissatisfaction with roadway pollution. Indeed, the upper bound (95% confidence interval) limit for whites was 4.125, compared to the 4.634 lower bound limit for blacks.

Evaluation of Revenue-Generating Initiatives Aimed at Funding Improvements in the State's Road Infrastructure

An overview of the mean scores for each revenue-generating initiative is provided in Figure 5. Overall, variable rates for inspection and licensing fees that are based on vehicle pollution levels and gas mileage rates were most preferred. Respondents were asked whether motorists who owned vehicles that pollute more and get lower gas mileage should pay higher state vehicle inspection and licensing fees, while those with vehicles that pollute less and get better gas mileage should pay lower fees. A general increase in registration and licensing fees was the second most preferred option. The top five revenue-generating initiatives were, on average, above the halfway mark (neutral position), whereas the two bottom-ranked initiatives were below the halfway point. The least preferred option, mileage fees, asked whether motorists should pay a mileage fee instead of a gas tax (i.e., each vehicle would be equipped with an electronic means to keep track of miles driven in the state). Raising revenue through non-road usage fees (increases in bus, rail, and airport fees) was generally viewed unfavorably. The only other non-road related initiative, the use of General Obligation Bonds, was generally viewed favorably.

	Strongly Disagree						Strongly Agree
	1	2	3	4	5	6	7
1. Variable inspection and licensing fees	4.25 (2.21)*						
2. Increasing registration and licensing fees	3.80 (1.99)						
3. General Obligation Bonds	3.69 (1.95)						
4. Toll-related initiatives	3.56 (1.28)						
5. Increasing the state gas tax	3.54 (1.96)						
6. Non-road usage fees	3.04 (1.42)						
7. Mileage fee to replace gas tax	2.25(1.83)						

*Standard deviation in parenthesis

Figure 5: Evaluation of Revenue-Generating Initiatives for Funding Maryland’s Roadways

Generating Revenue with Toll-Related Initiatives

Regression analyses were run on the toll-related variable to determine whether there were demographic and road-usage differences. In addition, the dissatisfaction variables were included in step 2 and the priority variables were included in step 3. The model's variables were identified with stepwise regression.

In the first step of the regression, income, political affiliation, and hours travelled on the road per day were loaded into the model (Table 5). The higher the income, the more favorable the evaluation of toll-related initiatives. In addition, Republicans were less likely than Independents and Democrats to have a favorable view of toll-related initiatives. Finally, those who travelled on the road more hours per day were less supportive of toll-related initiatives.

When the dissatisfaction variables were added in step 2, congestion and pollution were included in the model. In step 3, none of the priority variables were included in the model. We, therefore, only discuss step 2 of the model.

Dissatisfaction with congestion was positively related to toll-related initiatives, as was dissatisfaction with pollution. When these two variables were included in the model, household income and hours travelled remained statistically significant. However, political affiliation was no longer significant ($p > .05$), which suggests that dissatisfaction with pollution mediates the effect of political affiliation on toll-related initiatives.

Model	β	t	p-value
1. Income	.126	2.553	.011
Republican	-.113	-2.289	.023
Hours travelled on the roads per day	-.104	-2.106	.036
2. Income	.129	.009	.009
Republican	-.074	.141	.141
Hours travelled on the roads per day	-.107	.033	.033
Dissatisfied with congestion	.106	.039	.039
Dissatisfied with pollution	.145	.006	.006

Dependent variable: Toll-related initiatives

Table 5: Predictors for Toll-Related Initiatives for Raising Revenue

Generating Revenue by Increasing the Gas Tax

A three-step regression analysis was run on the gas tax variable, starting with demographic and road-usage variables, followed by dissatisfaction variables, and finally priority variables.

In step 1, education, gender, political affiliation, and hours travelled on the road per day were all significantly related to respondents' attitudes towards gas tax increases (Table 6). Education level was positively related to more favorable opinions towards gas tax increases. Being a Republican and travelling more hours on the road had a negative impact on respondents' evaluation of any increase in the gas tax. A univariate analysis of gender differences revealed that women were less supportive than men of any gas tax increase ($\mu_{\text{men}} = 3.86$, $\mu_{\text{women}} = 3.11$; $t = 15.82$, $p < .001$). In step 2, dissatisfaction with pollution was positively related to gas tax initiatives. The pollution variable did not mediate the relationship between the demographic and usage variables and the dependent variable, since all variables remained statistically significant. No additional variables were entered in step 3.

Model	B	T	p-value
1. Education	.194	3.967	.000
Gender	-.196	-4.087	.000
Republican	-.183	-3.835	.000
Hours travelled on the roads per day	-.123	-2.522	.012
2. Education	.151	3.041	.003
Gender	-.215	-4.423	.000
Republican	-.134	-2.722	.007
Hours travelled on the roads per day	-.109	-2.223	.027
Dissatisfaction with pollution	.238	4.791	.000

Dependent variable: Gas tax increases

Table 6: Predictors for Gas Tax Initiatives for Raising Revenue

Generating Revenue by Introducing a Mileage Fee in Place of the Gas Tax

The mileage fee proposal received the least support among the respondents. Those who spent more hours travelling on the roads and had higher incomes generally had lower evaluation scores for the mileage fee proposal. However, those who had a higher education level had higher evaluation scores. In addition, those who felt that the state should prioritize projects that reduce air pollution viewed the mileage fee more positively (Table 7).

Model	β	T	p-value
1. Hours travelled on the roads per day	-.126	-2.392	.017
Income	-.205	-3.437	.001
Education	.167	2.850	.005
2. Hours travelled on the roads per day	-.117	-2.222	.027
Income	-.194	-3.272	.001
Education	.158	2.709	.007
Prioritizing projects for reducing air pollution	.139	2.577	.010

Dependent variable: Mileage fee

Table 7: Predictors for Introducing the Mileage Fee

Generating Revenue by Increasing Registration and Licensing Fees

Respondents were asked whether they agreed that the state should pay for road improvements from an overall increase in vehicle registration and licensing fees. Only two variables were loaded into the model: race in step 1 and dissatisfaction with pollution in step 2 (Table 8).

Univariate analyses of the differences among the various races/ethnicities revealed that whites were less predisposed towards fee increases ($\mu = 3.7, s = 1.9$) than blacks ($\mu = 4.3, s = 2.1$), Asians ($\mu = 4.7, s = 1.9$), and Hispanics ($\mu = 4.8, s = 2.7$).

Dissatisfaction with pollution on the roadway was positively related to fee increases. This variable did not mediate the relationship between race and fee increases.

Model	β	t	p-value
1. Race	.172	3.327	.001
2. Race	.167	3.262	.001
Dissatisfaction with pollution	.143	2.798	.005

Dependent variable: Registration and licensing fees

Table 8: Predictors for Increasing Registration and Licensing Fees

Generating Revenue by Linking Vehicle Gas Mileage and Pollution Levels to Inspection and Licensing Fees

A separate question that linked variable vehicle inspection and licensing fee rates to car pollution rates was also analyzed. In this instance, education, political affiliation, hours travelled on the roads, and dissatisfaction with roadway pollution were all entered into the model (Table 9).

Education level was positively related to evaluation of variable rates, whereas being a Republican and travelling longer hours per day were negatively related. In step 2, dissatisfaction with pollution was positively related to the evaluation of variable rates, although it did not have a significant mediating effect on the demographic and usage variables.

Model	β	t	p-value
1. Education	.204	4.036	.000
Republican	-.216	-4.371	.000
Hours travelled on the roads per day	-.109	-2.150	.032
2. Education	.160	3.327	.001
Republican	-.142	-2.983	.003
Hours travelled on the roads per day	-.100	-2.108	.036
Dissatisfaction with pollution	.334	6.936	.000

Dependent variable: Variable inspection and licensing fees

Table 9: Predictors for Variable Rates for Vehicle Inspection and Licensing Fees

Generating Revenue through Non-Road Usage Fees

Finally, respondents were asked to evaluate revenue-generating initiatives that were not tied to road usage (sales tax, and increasing airport, bus, and rail fees). Results from the regression analysis are shown in Table 10. A separate item was used to measure respondents' affinity towards the use of General Obligation Bonds to pay for road improvements and maintenance. Results of the regression analysis for this variable are shown in Table 11.

Income was negatively related to support for non-road usage fees. In other words, lower income groups preferred these initiatives more than higher income groups did. Location was also included in the model. A univariate analysis of location differences revealed that respondents from urban and suburban counties had lower attitudes towards these types of fees than those from rural counties ($\mu_{\text{urban/suburban}} = 2.96$, $\mu_{\text{rural}} = 3.42$; $t = 7.34$, $p = .007$). Dissatisfaction with road conditions was also positively related to non-road usage fee increases, although it did not mediate the relationship with the two demographic variables.

Model	β	t	p-value
1. Income	-.211	-4.144	.000
Location (urban vs. rural counties)	.118	2.315	.021
2. Income	-.177	-3.426	.001
Location (urban vs. rural counties)	.141	2.769	.006
Dissatisfaction with road conditions	.155	2.996	.003

Dependent variable: Non-road usage fee increases

Table 10: Predictors for Raising Revenue through Non-Road Usage Fees

For General Obligation Bonds, education level had a negative effect, whereas Republican affiliation had a positive effect (Table 11). Republicans had a significantly higher average than Independents and Democrats ($\mu_{\text{Republican}} = 4.35$, $\mu_{\text{Independent}} = 3.57$, $\mu_{\text{Democrat}} = 3.36$). Dissatisfaction with pollution was negatively related to respondents' affinity for General Obligation Bonds, and it had a partial mediating effect on education.

Model	β	t	p-value
1. Republican	.228	4.516	.000
Education	-.130	-2.577	.010
2. Republican	.189	3.723	.000
Education	-.105	-2.101	.036
Dissatisfaction with pollution	-.177	-3.444	.001

Dependent variable: General Obligation Bonds

Table 11: Predictors for Using General Obligation Bonds

DISCUSSION

Demographic/Behavioral Segments and Dissatisfaction with the Roads

On average, our survey suggests that respondents were moderately dissatisfied with Maryland's roads. According to our results, Marylanders ranked roadway safety (speeding, accidents, bridge maintenance) as the number one complaint, followed by pollution, congestion, and roadway conditions.

When the sample was clustered into segments based on demographic and road usage criteria, differences emerged between the various groups (Figure 6). Dissatisfaction levels with Maryland's roads are in some part influenced by the person's gender, income, education, ethnicity, location, usage rate, and political affiliation. For example, women were more preoccupied with roadway pollution, congestion, and conditions than men. Those who travelled more hours per day on roads were more likely to view Maryland's roads as congested and in poor condition than those who travelled fewer hours. Democrats, on the other hand, were more concerned about road safety and pollution issues than Republicans and Independents, but there were no differences among these groups in terms of perceived congestion levels and roadway conditions. Those who had a higher education level were more dissatisfied with roadway pollution, whereas those who had a lower education level were more dissatisfied with safety issues. Condition of the roadways was of greater concern to those who lived in urban and suburban counties than those who lived in rural counties, and it was also a greater concern of blacks and Hispanics than whites and Asians.

Roadway concern	Segments with a higher level of dissatisfaction
Safety (speeding, accidents, bridge maintenance)	Lower education Democrats
Pollution	Democrats Women Higher education
Congestion	Women More hours travelled on roads
Conditions (potholes, street lighting)	Women Lower income Blacks, Hispanics Urban/suburban counties More hours travelled on roads

Figure 6: Segmenting of Respondents' Concerns Based on Demographic and Usage Criteria

Prioritizing Roadway Projects and Improvements

The results suggest that respondents have a medium to high priority for all four functions. On average, increasing road safety was the highest priority, followed by reducing traffic congestion, improving road conditions, and reducing air pollution. Given that respondents were, on average, mostly dissatisfied with road safety, it comes as no surprise that they would see this function as having the highest priority. However, the same cannot be said for roadway pollution. Pollution came in second as a source of dissatisfaction for our respondents, yet the perceived need for reducing air pollution dropped to fourth place in terms of priorities.

When the respondents were clustered into market segments based on demographic and road-usage criteria, only minor differences emerged among the groups. Differences in priorities exist based on political affiliation and race/ethnicity.

Political affiliation had a significant effect on respondents' prioritization of roadway conditions, safety, and pollution. Democrats prioritized improving roadway conditions, increasing road safety, and reducing air pollution higher than Republicans and Independents did. Race/ethnicity also played a differentiating role for improving roadway conditions and reducing air pollution. Blacks and Hispanics had higher priority levels for improving roadway conditions than whites and Asians. In addition, reducing pollution levels was a higher priority among blacks and Hispanics than whites.

Not surprisingly, dissatisfaction with the roads was a strong predictor for determining the priority levels for funding roadway improvements and projects. Those who were dissatisfied with roadway conditions were more likely to perceive a higher need for projects that improve roadway conditions, and so on. Our results also suggest that dissatisfaction levels are better predictors than demographic and behavioral criteria and, in some instances, act as a mediating variable. For instance, it seems that political affiliation is only indirectly related to the perceived need to improve road safety and traffic pollution. In other words, a person who is dissatisfied with road safety is going to feel that road safety projects and improvements should be a high priority for the Maryland Department of Transportation, no matter the person's political affiliation. It just happens that there is a strong correlation between political affiliation and dissatisfaction with road safety and pollution (Democrats are more likely to be dissatisfied with road safety and pollution than Republicans or Independents). However, it is dissatisfaction with road conditions that determines priority levels for safety and pollution, not political orientation. The same situation occurs for race/ethnicity and the felt need for improving roadway conditions. Whereas blacks and Hispanics felt a higher need for improving roadway conditions than whites and Asians, this was primarily because they tended to be more dissatisfied with roadway conditions.

Attitude toward Revenue-Generating Initiatives

Of the seven proposed options for generating additional revenue for Maryland's transportation trust fund, variable inspection and licensing fees were most preferred (Figure 7). The three highest-rated initiatives were favorably viewed, with mean scores significantly above the neutral zone. Respondents, on average, were neutral towards the fourth and fifth rated initiatives, yet

they tended to dislike the bottom-two options (mean scores significantly below the neutral zone). In general, vehicular fees were viewed favorably, whereas opinions about initiatives that were linked to road usage frequency (tolls and gas tax) were neutral. The mileage-fee initiative was the most disliked option. There were, however, differences in opinion among various segments within the sample population.

Ranking	Revenue-generating initiative
1	Variable rates for inspection and licensing fees
2.	Increasing registration and licensing fees
3.	General Obligation Bonds
4.	Toll-related initiatives
5.	Increasing the state gas tax
6.	Non-road usage fees (tax, bus, rail, airport) and taxes
7	Mileage fee (replaces state gas tax)

Favorable	Neutral	Unfavorable
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Figure 7: Average Rankings for Revenue-Generating Initiatives

Vehicular Fee Increases

Increases in registration, inspection, and licensing fees were the most preferred initiatives for generating additional revenue. Respondents seemed to prefer the variable rates option, whereby owners of vehicles that pollute more and get poor gas mileage would pay higher state vehicle inspection and licensing fees than owners of vehicles that pollute less and get better gas mileage. Those who were more educated, travelled less on the roadway, and identified as Independents or Democrats were most likely to prefer this option. In addition, those who were more dissatisfied with pollution preferred this option. This comes as no surprise, since the variable rate option incentivizes ownership of fuel-efficient vehicles that pollute less. Whites were less predisposed towards overall registration and licensing fee increases than blacks, Asians, and Hispanics. Dissatisfaction with pollution also had a positive effect on individuals' attitude towards overall fee increases.

General Obligation Bonds

Overall, there was moderate support for the General Obligation Bonds, whereby respondents were informed that paying off the bond would require the use of money that would otherwise be spent on other state programs and services. Respondents' opinions differed by political affiliation and income level. Republicans were more supportive of this option than Independents and Democrats. Indeed, among Republicans, this was clearly the most preferred alternative revenue-

generating option (Appendix E). At the same time, those with higher education levels were supportive of this revenue-generating initiative. In addition, those who were more dissatisfied with traffic pollution were less inclined to support the use of General Obligation Bonds.

Toll-Related Initiatives

Toll-related initiatives included TOT lanes, tolls for new lanes alongside existing roadways, HOT lanes, new toll roads, a 10 percent toll increase, and cordon tolling. In general, the most preferred alternatives were TOT lanes and new toll lanes along existing highways (Appendix D). Cordon tolling was the least preferred option.

In general, income, road usage rate, political affiliation, and dissatisfaction with pollution and traffic congestion affected respondents' approval of the toll-related initiatives (Figure 8). Respondents with higher income levels generally preferred the toll-related options when compared to lower income groups. This makes sense, since people with higher incomes will find increased tolls more affordable than others. Indeed, the higher income group had greater affinity for all six toll-related initiatives than the lower income group (Appendix F). The number of hours spent on the roads was negatively related to these proposals. In this case, people who used the roads more were possibly more concerned with the increased costs of using the roadways.

Those who were more dissatisfied with traffic congestion were more likely to favor toll-related initiatives than those who were less dissatisfied. These people tended to prefer toll-related options that helped reduce congestion (i.e., toll lanes next to existing roadways, HOT lanes). Dissatisfaction with traffic pollution was positively related to these initiatives, and mediated the effects of political affiliation. Opposition of toll-related initiatives was higher among Republicans than Democrats. However, this was because of their level of concern for traffic pollution. Democrats tended to be more concerned with traffic pollution than Republicans. Those who were more concerned with traffic pollution were more supportive of tolls. This may be because they believe that those who use the roads the most are adding significantly to traffic pollution and, therefore, should pay more for the right to use the highways. These same respondents favored variable rates for inspection and licensing fees in order to promote initiatives that reduce pollution.

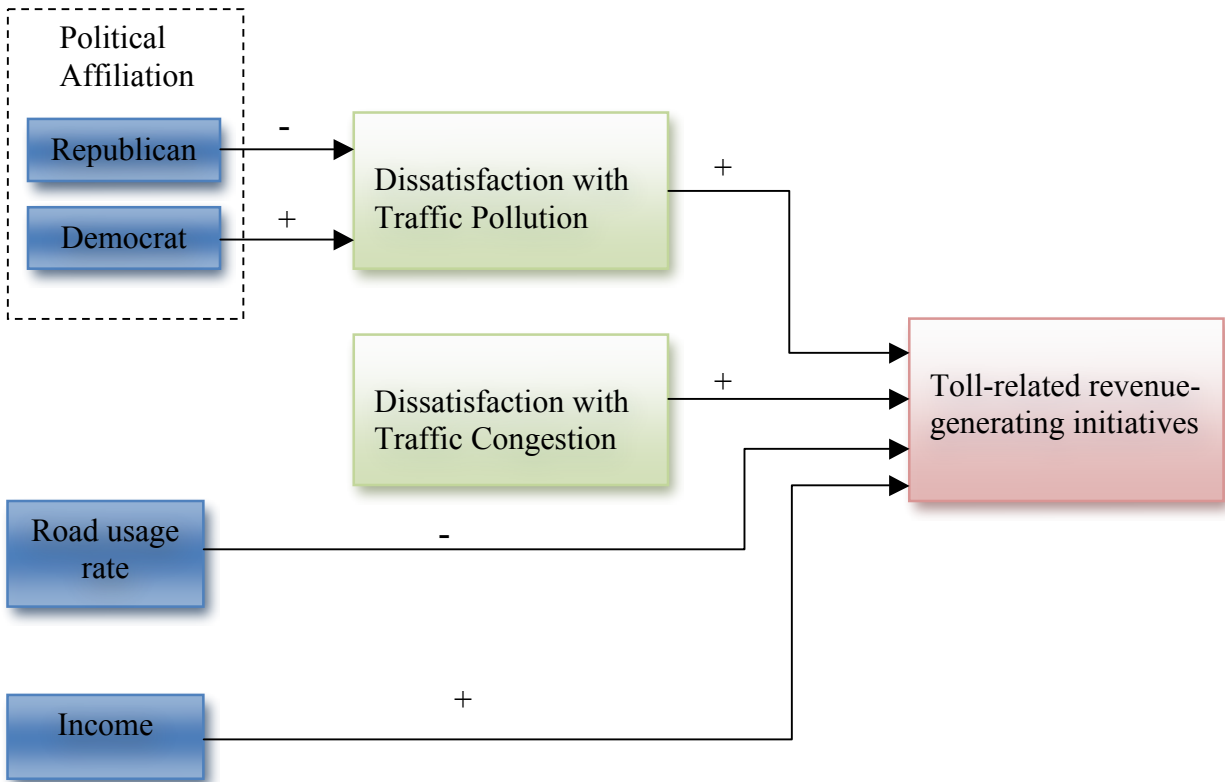


Figure 8: Predictors of Toll-Related, Revenue-Generating Initiatives

Increasing the State Gas Tax

Raising the state’s gas tax was ranked fifth of the seven presented options, suggesting that there was lukewarm support for this proposal. Respondents were presented with the proposal that, in order to pay for road improvements, the gas tax should be increased by one cent per gallon per year for the next ten years (the gas tax is currently 23.5 cents per gallon). Another option was to index the gas tax to inflation, whereby the state gas tax increases in proportion to inflation. Of the two options, the one cent per year increase was generally preferred.

Disapproval of a state gas tax increase was highest among Republicans. As one might expect, those who travelled more hours on the road per day (and would, therefore, end up buying more gas on average) disliked this option more than those who travelled fewer hours. Women were less inclined to favor this initiative than men. Level of education was positively related to increasing the gas tax, as was dissatisfaction with roadway pollution.

Non-Road Usage Fee Increases

Non-road usage fee increases included increasing the state’s sales tax by 0.5 percent, increasing bus and rail transit fares, and increasing airport fees. There was little general support for any of these three items. In terms of group differences, the higher income respondents were less

supportive of these non-road, revenue-generating initiatives than the lower income respondents, maybe because they would be more affected financially by the sales tax and airport fees. At the same time, rural respondents were more supportive of these initiatives than urban and suburban respondents, possibly because they were less likely to use public transportation in their rural area. Finally, those who were more dissatisfied with road conditions viewed this option more favorably than those who were less dissatisfied. However, even among those groups who were more supportive, the overall feeling was that these types of fee increases were less desirable than other options.

Mileage Fees

A mileage fee instead of a gas tax (whereby each vehicle would be equipped with an electronic device that tracked miles driven in the state) was the least desirable option among our respondents. Even among those groups who were more supportive, the average scores suggest that there was general dislike for this option. Principal concerns may have been related to fairness (out-of-state or out-of-region vehicles would not be electronically monitored and would, therefore, not pay when using Maryland's or the region's roads) or privacy (the ability to track and monitor a vehicle's whereabouts). This option was least favored by frequent drivers and those with higher incomes. While support was higher among those who felt that reducing air pollution should be a priority and those who had a higher education level, their evaluations were still in the negative.

CONCLUSIONS

Policy makers need to consider a variety of factors when weighing the benefits and costs of various revenue-generating initiatives. One important factor is the Maryland resident, and his or her attitude towards various issues as well as preferences for specific revenue-generating initiatives. Sometimes policy makers make assumptions about their constituents' thoughts and desires, without considering whether these assumptions are valid. This report looks at the opinions of a sample of Maryland residents. It focuses on their level of dissatisfaction with the current highway infrastructure, improvement priorities, and preferences for various revenue-generating initiatives.

This study's findings are based on a random sample of 450 Maryland residents. Therefore, one should be cautious in extrapolating these findings to the state, regional, or national level. However, our results suggest that various demographic, behavioral, and attitudinal measures can be used to differentiate clusters of individuals based on their likes and dislikes of various revenue-generating initiatives. Our findings suggest that the attitudinal measures are particularly important variables in segmenting the market, sometimes mediating the relationship between the demographic and behavioral variables and preferences. This suggests that issues such as dissatisfaction with roadway conditions are important determinants for whether people support a particular revenue-generating initiative, perhaps more so than gender, income, political affiliation, and so on. Indeed, marketing practices generally suggest that attitudinal and behavioral segmentation variables better explain consumer preferences than demographic variables do (i.e., those who are dissatisfied with roadway congestion are more supportive of toll-raising initiatives that help reduce congestion since a clear benefit can be seen). These attitudinal variables, however, are sometimes related to certain demographic variables (women tend to be more dissatisfied with traffic congestion than men). The important thing is to understand that opinions—not identifiers—shape preferences.

There is general dissatisfaction with current road conditions, safety, pollution, and congestion. This dissatisfaction helps shape individuals' perception that improvements are needed in these areas. However, whereas most respondents are dissatisfied with current pollution levels on the roads, the perceived need to prioritize projects that reduce this pollution takes a backseat to other projects related to road safety, road conditions, and traffic congestion. Respondents, therefore, feel that the main priority should be improved road safety, such as curbing speeding, reducing accidents, and maintaining bridges.

Despite the fact that respondents identify a clear need for improvements in Maryland's roads, there is a general resistance to new revenue-generating initiatives. Individuals are aware that services need improvement, but they are not as willing to fork out more money to pay for these improvements. This explains the appeal of the General Obligation Bonds, particularly among Republicans, where the increased revenue would come from money that would otherwise be spent on other programs.

Therefore, policy makers should consider how the various revenue-generating initiatives may appeal to different groups within Maryland. For example, respondents tend to prefer increases in registration, inspection, and licensing fees over other initiatives. The variable rate option was

viewed as most appealing, particularly among Democrats, Independents, those who travel fewer hours per day on the road, and those with a higher education level. Dissatisfaction with road pollution, however, helped differentiate the most between groups. If the variable rate option, which incentivizes ownership of fuel-efficient vehicles, were implemented, a campaign focusing on the initiative's environmental benefits would appeal to those who are dissatisfied with road pollution. However, highlighting the fact that any increase in revenues would go towards road safety and congestion reduction projects would appeal to a much wider group. Thus, by targeting specific groups and highlighting the initiative's environmental appeal as well as the fact that the additional revenue would be used on projects aimed at improving road safety, policy makers can draw support from diverse groups within Maryland.

Finally, our findings suggest that Marylanders are aware that the state's highway system needs improvement. As with most products or services that need repair, the user is wary of paying too much, particularly during difficult economic times. It is, therefore, important for the state to explain how the various initiatives will help improve the current roadway infrastructure, particularly in terms of road safety, traffic congestion, road conditions, and road pollution.

APPENDIX A
COMPARISON OF SAMPLE TO TARGET POPULATION BY REGION

<i>REGION</i>	<i>COUNTY</i>	<i>POPULATION (2010 Census)</i>	<i>%</i>	<i>SAMPLE</i>	<i>%</i>
1. Greater Washington	Frederick	233,385	4.0	21	4.8
	Montgomery	971,777	16.8	63	14.5
	Prince George's	863,420	15.0	57	13.2
		2,068,582	35.8	141	32.5
2. Greater Baltimore	Anne Arundel	537,656	9.3	47	10.9
	Baltimore County	805,029	13.9	65	15.0
	Baltimore City	620,961	10.8	28	6.5
	Carroll	167,134	2.9	18	4.2
	Harford	244,826	4.2	17	3.9
	Howard	287,085	5.0	31	7.2
		2,662,691	46.1	206	47.6
	Urban/Suburban	4,731,273	81.9	347	80.1
3. Western	Allegany	75,087	1.3	5	1.2
	Garrett	30,097	0.5	1	0.2
	Washington	147,430	2.6	13	3.0
		252,614	4.4	19	4.4
4. Southern	Calvert	88,737	1.5	5	1.2
	Charles	146,551	2.5	13	3.0
	St. Mary's	105,151	1.8	13	3.0
		340,439	5.9	31	7.2
5. Eastern Shore	Caroline	33,066	0.6	4	0.9
	Cecil	101,108	1.8	7	1.6
	Dorchester	32,618	0.6	2	0.5
	Kent	20,197	0.3	2	0.5
	Queen Anne's	47,798	0.8	6	1.4
	Somerset	26,470	0.5	2	0.5
	Talbot	37,782	0.7	3	0.7
	Wicomico	98,733	1.7	6	1.4
	Worcester	51,454	0.9	4	0.9
		449,226	7.8	36	8.3
	Rural	1,042,279	18.1	86	19.9
Total		5,773,552	100	433	100

APPENDIX B
FREQUENCIES OF DEMOGRAPHICS

<i>Question</i>	<i>Response</i>	<i>Frequency</i>	<i>%</i>	<i>Cumulative %</i>
1. What is your gender?	Male	255	59.3	59.3
	Female	175	40.7	100
	<u>Total</u>	<u>430</u>	<u>100</u>	
2. What is your race/ethnicity?	White	323	73.9	75.8
	Hispanic	7	1.6	77.5
	Black	77	17.6	95.5
	Asian	12	2.7	98.4
	Other	7	1.6	100
	<u>Total</u>	<u>426</u>	<u>100</u>	
3. What is your marital status?	Single	70	16.2	16.2
	Married	279	64.6	80.8
	Divorced/Separated	49	11.3	92.1
	Widowed	30	6.9	99.1
	Other	4	0.9	100
	<u>Total</u>	<u>432</u>	<u>100</u>	
4. What is your household's annual gross income?	< \$15,000	9	2.2	2.2
	\$15,000 - \$19,999	6	1.5	3.6
	\$20,000 - \$24,999	16	3.9	7.5
	\$25,000 - \$49,999	63	15.3	22.8
	\$50,000 - \$99,999	138	33.5	56.3
	\$100,000 +	180	43.7	100
	<u>Total</u>	<u>412</u>	<u>100</u>	

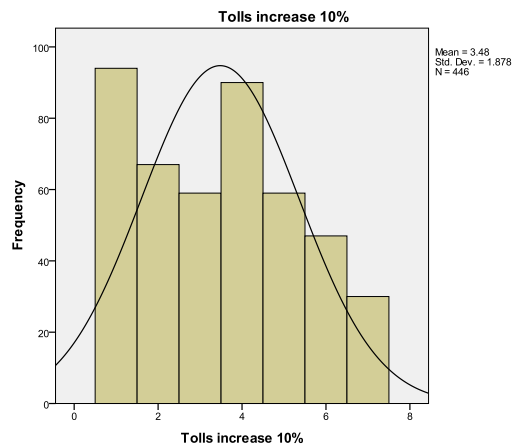
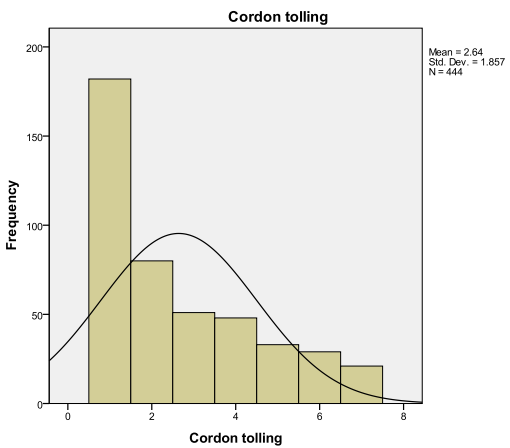
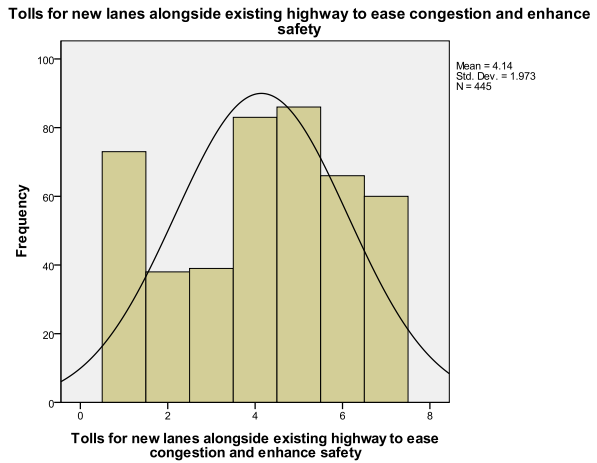
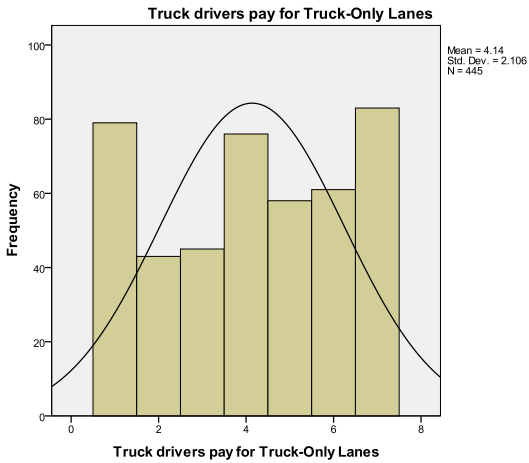
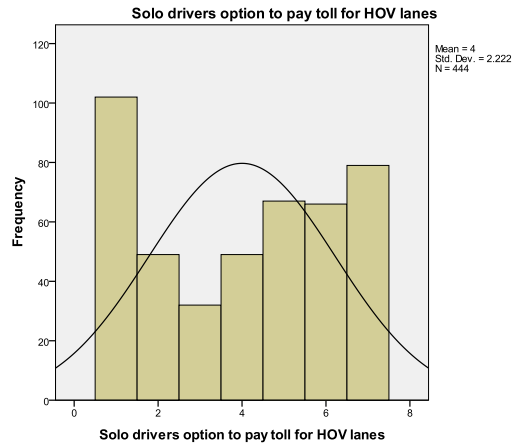
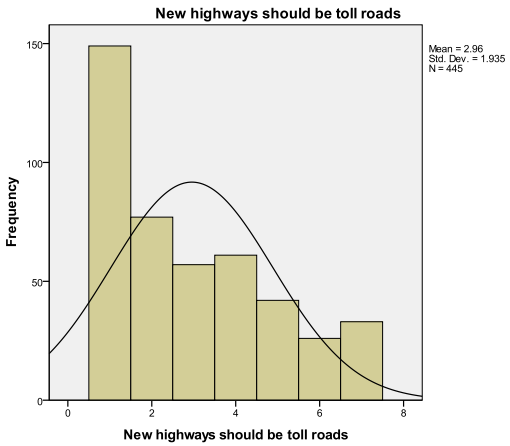
<i>Question</i>	<i>Response</i>	<i>Frequency</i>	<i>%</i>	<i>Cumulative %</i>
5. What is your highest level of formal education?	None	2	0.5	0.5
	High school	91	21.1	21.6
	Associate	51	11.8	33.4
	Bachelor's	115	26.7	60.1
	Master's	123	28.5	88.6
	Doctoral	49	11.4	100
	<u>Total</u>	<u>431</u>	<u>100</u>	
6. What is your political affiliation?	Democrat	208	49.2	49.2
	Republican	120	28.4	77.5
	Independent	76	18.0	95.5
	Other	19	4.5	100
	<u>Total</u>	<u>423</u>	<u>100</u>	

APPENDIX C
FREQUENCIES OF ROAD USAGE

<i>Question</i>	<i>Response</i>	<i>Frequency</i>	<i>%</i>	<i>Cumulative %</i>
1. How many days in a week do you travel on the road?	0-2 days	11	2.5	2.5
	3-4 days	65	14.9	17.4
	5-7 days	361	82.6	100
	Total	<u>437</u>	<u>100</u>	
2. How many miles do you travel on the roads per day?	< 5 miles	38	8.8	8.8
	5-15 miles	93	21.5	30.3
	16-25 miles	118	27.3	57.6
	26-50 miles	106	24.5	82.2
	>50 miles	77	17.8	100
	Total	<u>432</u>	<u>100</u>	
3. How many hours do you travel on the roads per day?	< 1 hour	118	27.1	27.1
	1-2 hours	235	54.0	81.1
	3-4 hours	62	14.3	95.4
	5-6 hours	10	2.3	97.7
	7 + hours	10	2.3	100
	Total	<u>435</u>	<u>100</u>	

APPENDIX D

EVALUATION OF TOLL-RELATED, REVENUE-GENERATING OPTIONS



1 = strongly disagree
7 = strongly agree

APPENDIX E

**EVALUATION OF REVENUE-GENERATING INITIATIVES BY
POLITICAL AFFILIATION**

	Democrat	Independent	Republican
Variable inspection and licensing fees	4.5 (2.2)	4.4 (2.1)	3.7 (2.2)
Increasing registration and licensing fees	4.0 (2.0)	3.5 (1.9)	3.7(2.1)
General Obligation Bonds	3.4 (1.9)	3.6 (1.9)	4.4(2.0)
Toll-related initiatives	3.6 (1.3)	3.6 (1.3)	3.4 (1.3)
Increasing the state gas tax	3.8 (2.0)	3.8 (1.9)	3.0 (1.9)
Non-road usage fees	3.1 (1.4)	2.9 (1.4)	3.1 (1.4)
Mileage fee to replace gas tax	2.3 (1.8)	2.2 (1.8)	2.1 (1.8)

Mean score (standard deviation)

Scale: 1 = strongly disagree with initiative, 7 = strongly agree with initiative

APPENDIX F

**EVALUATION OF TOLL-RELATED, REVENUE-GENERATING
INITIATIVES BY INCOME LEVEL**

	< \$50k	\$50k - \$99,999	\$100k +
Any new highways should be toll roads	2.8 (1.9)	2.9 (1.9)	3.1 (2.0)
Solo drivers can pay to use HOV lanes	3.6 (2.2)	4.1 (2.2)	4.2 (2.2)
Truck drivers should pay a toll for new truck-only lanes	3.9 (2.1)	4.1 (2.2)	4.4 (2.0)
Pay tolls for new lanes that are built alongside existing highways	3.8 (2.2)	4.2 (2.0)	4.3 (1.8)
Increase all tolls by 10%	3.2 (2.0)	3.7 (1.9)	3.5 (1.8)
Cordon tolling (fee for entering congested urban areas)	2.3 (1.8)	2.7 (1.9)	2.8 (1.9)

Mean score (standard deviation)

Scale: 1 = strongly disagree with initiative, 7 = strongly agree with initiative

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