

University of Nevada, Reno

**A COMPREHENSIVE REVIEW OF CRITICAL ISSUES ON TRANSITIONING  
TO A VEHICLE MILES TRAVELED FEE SYSTEM**

A thesis submitted in partial fulfillment of the requirements for the degree of Master of  
Science in Civil and Environmental Engineering

by  
Dimitra Maragakis

Zong Z. Tian, Ph.D./ Thesis Advisor

December 2014



THE GRADUATE SCHOOL

We recommend that the thesis  
prepared under our supervision by

**DIMITRA MARAGAKIS**

Entitled

**A Comprehensive Review of Critical Issues on Transitioning to a Vehicle Miles  
Traveled Fee System**

be accepted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE

Zong Tian, Advisor

Hao Xu, Committee Member

Shunfeng Song, Graduate School Representative

David W. Zeh, Ph.D., Dean, Graduate School

December, 2014

## **ABSTRACT**

Due to increased vehicle fuel efficiency, electric vehicles, inflation, and the fuel tax not being raised in the past 20 years, the Highway Trust Fund has been unable to cover the costs associated with expanding and maintaining the transportation system. Despite improved construction methods, better planning and superior materials, municipalities cannot keep up with wear and tear on roadways, let alone keep up with future expansion. There is simply not enough revenue to support the roadway system. This shortfall has led experts to look for alternative solutions to the current major method of funding the Highway Trust Fund: the fuel tax. The most attractive solution to emerge is the Vehicle Miles Traveled (VMT) fee.

A VMT fee is an answer to many of the current problems facing fuel taxes such as increased fuel efficiency in vehicles, the rise in hybrids and electric vehicles, and responding to inflation. The VMT fee has been recommended by a number of professionals and experts as a complete replacement for the current fuel tax for these reasons. However, there are many obstacles to this attractive alternative including perception, administration, and implementation. The purpose of this study is to provide a thorough literature review of several states' approaches to the VMT fee, address prominent issues and concerns associated with the VMT fee, and provide several transition schemes which would minimize the concerns of the public, motorists, and decision-makers. It was found that allowing the motorist to choose the VMT fee collection system eases privacy concerns and thus has less resistance when passing the fee through legislation. It was found that allowing for a longer transition phase will be

most desirable, because the user will have the option of paying the VMT fee or the fuel tax.

## TABLE OF CONTENTS

ABSTRACT .....	i
CHAPTER ONE .....	1
INTRODUCTION .....	1
1.1 Background.....	1
1.2 Objective and Scope .....	2
1.3 Thesis Organization .....	2
CHAPTER TWO .....	4
LITERATURE REVIEW .....	4
2.1 Fuel Tax .....	4
2.2 Highway Trust Fund (HTF).....	6
2.3 University of Iowa Study .....	7
2.4 Oregon .....	9
2.4.1 First Pilot Study .....	10
2.4.2 Second Pilot Study.....	16
2.5 Minnesota .....	19
2.6 Nevada .....	21
2.7 Summary of Chapter.....	22
CHAPTER THREE .....	25
FUNDAMENTAL FACTORS IN IMPLEMENTING A VMT FEE.....	25
3.1 Policy .....	25
3.2 Administration .....	26
3.3 Privacy .....	27
3.4 Technology .....	30
3.4.1 GPS .....	30
3.4.2 OBU Device.....	32
3.4.3 Smartphone .....	32
3.4.4 Advancing Technologies .....	33
3.4.5 Odometer Readings .....	33
3.5 Public Outreach .....	34
3.5.1 Knowledge of Current Fuel Tax .....	34
3.5.2 Public Meetings .....	35
3.5.3 Social Media .....	38

3.5.4 Public Surveys .....	38
3.5.5 Traditional Media .....	39
3.5.6 Pilot Study .....	39
3.5.7 Addressing Questions and Concerns .....	40
3.5.8 Cost Considerations .....	40
3.6 Equity.....	41
3.6.1 Equity of the Current Fuel Tax .....	41
3.6.2 Equity of the VMT Fee.....	42
3.7 Fee Collection.....	44
3.7.1 Current System .....	44
3.7.2 Registration Fees .....	45
3.8 Summary of Chapter.....	46
CHAPTER FOUR .....	48
STEPS, ISSUES, AND METHODS TO TRANSITION FROM A FUEL TAX TO A VMT FEE .....	48
4.1 Steps to Transition to a VMT Fee.....	49
4.2 Issues to overcome before successfully transitioning to a VMT fee .....	50
4.3 Immediate Change .....	53
4.4 A Long Transition Phase .....	54
4.4.1 Phase Out.....	55
4.4.2 Include Technology .....	56
4.4.3 Include with Future Technology.....	56
4.5 Summary of Chapter.....	57
CHAPTER FIVE .....	58
CONCLUSION.....	58
REFERENCES .....	63

## List of Figures

Figure 1: Highway Trust Fund Revenues vs. Expenditures (12) (13). .....	7
Figure 2: Participant Choice of VMT Fee Collection Option (17) .....	18
Figure 3: Minnesota Driver's Fee Rate Expectation (18). .....	20
Figure 4: The level of privacy evasion associated with each option of technology. ....	28
Figure 5: Percentage of Annual Income Spent on Fuel Tax (26). .....	42
Figure 6: Comparison of Immediate versus Long Transition Phase.....	48
Figure 7: Recommended steps to transition to a VMT fee .....	49

**List of Tables**

Table 1: The various VMT Fee payment Options Provided in ODOT 2013 Pilot Study (17). ....	17
Table 2: Summary of Various VMT Fee Studies. ....	24
Table 3: Review of Privacy and Technology from Various VMT Fee Studies. ....	29
Table 4: Advantages and Disadvantages of Public Meetings .....	37
Table 5: Lessons Learned from VMT Fee Studies .....	59

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

For almost 100 years, states have been collecting a fuel tax to generate revenue for the maintenance and expansion of the transportation infrastructure. Since 1956, the federal fuel tax has been the main source of income for the Highway Trust Fund. Since this fee is administered per gallon of fuel purchased, its effectiveness is reduced by higher vehicle fuel efficiencies as well as partially or fully electric vehicles because these vehicles pay less in tax per mile driven since they are more efficient or do not use traditional fuel.

Due to the lack of revenue collected from the fuel tax and the projected future funding deficits, it has been suggested that a Vehicle Miles Travelled (VMT) fee can be used to replace the current fuel tax system. A VMT fee is a distance-based fee and is synonymous to mileage-based user fee and road user fee. The driver will be charged a tax per mile driven, rather than per gallon of gas purchased.

Many public officials and transportation professionals have realized the need to increase roadway revenues and to adapt to improving technology as well as government mandated fuel economies. There is a major limitation associated with the fuel tax because hybrid and electric vehicles use considerably less gasoline, while still utilizing roadways just as much as other vehicles. This change reduces revenue for the maintenance and construction of America's transportation system without reducing the actual amount of maintenance or construction required. One method that adequately addresses this limitation is the VMT Fee. Due to the extreme complexity in initiating a

VMT program, a transition plan that addresses government policy, public perception, and other issues will be required. As with most proposed fees and taxes, there will be much opposition and many obstacles to overcome before it can completely replace the fuel tax.

The purpose of this study was to consolidate the available information about the VMT fee and to summarize various studies that have been conducted. The biggest issues currently identified with the VMT fee are privacy concerns, cost concerns, how to transition from the fuel tax to the VMT fee, and gaining public acceptance. This study will analyze and recommend methods to address these matters.

## **1.2 Objective and Scope**

This thesis suggests the prominent obstacles to a VMT fee and discusses several transition schemes. The main goal of this thesis is to provide several transition options that can be utilized to implement a VMT fee and discuss the advantages and disadvantages of each scheme. This study did not investigate a separate VMT fee scheme for heavy or commercial vehicles. The specific objectives and scope of this research are the following:

1. Perform a thorough literature review. Primarily discussing several VMT fee pilot studies from various states and their findings.
2. Discuss and evaluate the key issues associated with the VMT fee.
3. Provide various transition schemes which could be applied to switch to a VMT fee from the current fuel tax.

## **1.3 Thesis Organization**

This thesis is comprised of five chapters. The organization of the chapters is as follows: Chapter 1 consists of the introduction, objectives, and scope of this study.

Chapter 2 leads the reader through a literature review of the existing fuel tax and VMT fee studies, focusing on the studies conducted in Oregon, Iowa, Minnesota, and Nevada. Chapter 3 discusses the key factors which officials will face when trying to administer a VMT fee. These factors are policy, administration, privacy, technology, public outreach, equity, and fee collection. Chapter 4 discusses the various transitional schemes to implement a VMT fee. Chapter 5 contains a summary, conclusion, and recommendations for future studies.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

The current fuel tax system is unable to supply sufficient revenue to be sustainable because it is not indexed to inflation and does not adapt to steadily increasing vehicular fuel efficiency. Many transportation professionals have recommended a VMT fee system to respond to these issues and several states have experimented with alternative strategies. Oregon, Minnesota, Nevada and Iowa have all tested the viability of this idea by conducting studies on technology and implementation while measuring public opinion.

#### **2.1 Fuel Tax**

The first state in the United States to enact a fuel tax was Oregon in 1919. Within the next decade, all the states had put a fuel tax into effect (1). In 1932, a federal fuel tax also was enforced, and since 1956 the federal fuel tax has been financing the highway systems through the Highway Trust Fund (HTF). The fuel tax is an indirect user fee and its purpose is to support the transportation system. Currently, state fuel taxes vary from state to state. For example, in October 2014, the state gasoline tax was 48.47 cents/gallon in California, 33.15 cents/gallon in Nevada, and 20 cents/gallon in Texas (2). For the past two decades, the federal fuel tax has been 18.4 cents/gallon of gasoline (3).

For almost a century, the fuel tax has successfully generated the necessary funding for transportation expenses primarily consisting of roadways and transit. From 1999 to 2011 the fuel tax was, on average, 87% of the HTF's income (4). As a tax, it is very inexpensive to administer. Current administration costs take approximately 1-2% of the revenues (5). One of the reasons administration costs are so minimal is because the

fuel tax is collected at the distributor level. From there, the distributors are reimbursed by the retail stations that are then compensated by the motorists who pay the fuel tax at the pump (1). Simply, the motorist purchasing the gas will pay the tax, therefore repaying the fuel distributor who has already prepaid the tax to the government.

At the distributor level, fuel tax evasion is possible through bootlegging, in which fuel from a lower taxed state is bought and then sold in a state with higher taxes. Bootlegging is found to occur mostly at state borders (6). At a motorist level, the fuel tax is easier to enforce. At the pump, if a driver tries to evade the fuel tax s/he will simply not receive any fuel. Another way to evade the fuel tax is to use untaxed fuel to operate a vehicle. This is typically more prominent with diesel fuel due to it having alternate uses such as for heating. Because diesel fuel used for heating purposes is exempt from taxation, diesel tends to have higher fuel tax evasion rates than petroleum. In order to discourage people from this behavior, federal criminal penalties and punishment for fuel tax convictions were reformed to felony status (6).

Another advantage to the fuel tax is the privacy of the consumer is protected. The consumer never has to reveal his/her identity. Motorists have many options as to which gas station to purchase fuel, and in order to keep complete privacy, drivers can pay in cash. Also, there is no knowledge of the driver's routes driven by simply paying the fuel tax.

American culture has grown to be very dependent on the personal vehicle, and the United States is the number one gas consumer in the world, consuming 31% more gas than its runner up, Canada (7). Americans consume 1.2 gallons of gas per person per day. Due to this fuel dependency and being accustomed to paying relatively low fuel

prices, politicians have found much opposition when trying to raise the fuel tax. This can be seen in Congress, as only members with secure seats or not seeking re-election will support an increase in the fuel tax (8).

Although there are many advantages to the gas tax, there are also problems arising with the amount of revenue the gas tax is producing lately. Recently, the fuel tax has not been as successful and professionals have noticed the need to replace it. The federal fuel tax in the United States is 18.4 cents/gallon for gasoline and this has not been raised since 1993 (9). In 1993 the fuel tax was 43% of the fuel cost and now it is approximately 17% of the fuel cost (9). Also, since the gas tax is not inflation-proof, it has not been able to keep up with the inflated costs associated with constructing and maintaining the roadways. Due to the higher costs of concrete, steel, other materials, and labor the gas tax in 2012 had only 50% of the buying power than it had in 1993 (10). The increase in vehicle fuel efficiency has caused for a decline in revenue per mile driven. Additionally, four cents per gallon of the Federal gas tax is used to support public transit systems. These factors have contributed to the problem that there is not enough revenue to adequately maintain and improve the roadways.

## **2.2 Highway Trust Fund (HTF)**

In the past years, the Treasury Department has needed to bail out the Federal HTF. Since 2008, a total of \$35 billion from the Federal General Fund has been required to cover the chronic shortfalls the HTF has experienced. This \$35 billion was in addition to the General Fund transfer of \$27.5 billion in 2009 and the \$18.8 billion provided by Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) (11). Due to the fact that MAP-21 funding will expire in 2015, the Congressional Budget Office (CBO) forecasts

that the HTF will face bankruptcy regardless of the General Fund transfers (11). The CBO predicts that HTF deficits will accumulate to a total of \$126 billion within the next decade (11). As shown in Figure 1, since 2000, the Highway Trust Fund has not always been unable to produce as much revenue as it is spending and the gap between expenditures and revenues is steadily increasing.

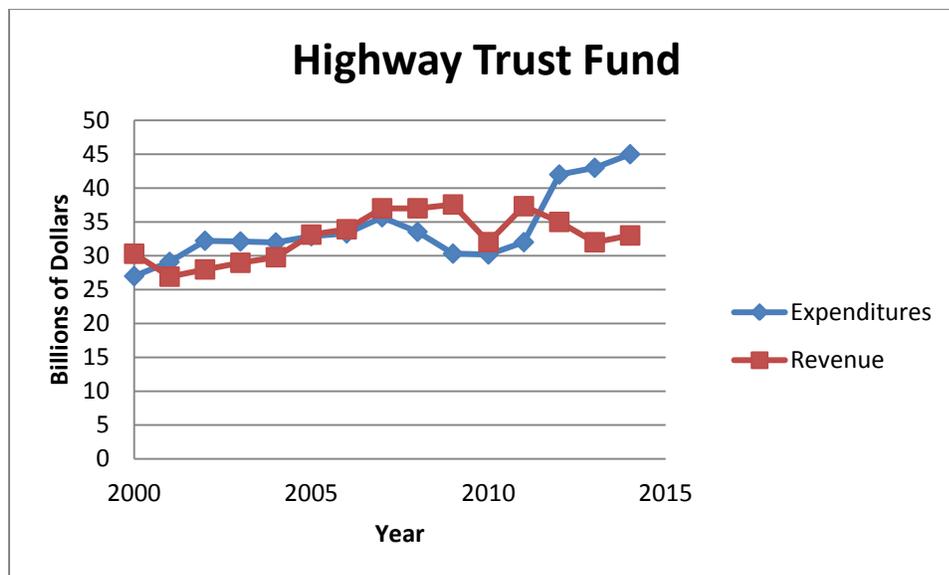


Figure 1: Highway Trust Fund Revenues vs. Expenditures (12) (13).

Due to the lack of revenue being produced by the fuel tax, public officials and transportation professionals have considered many options to increase funding including a VMT fee.

### 2.3 University of Iowa Study

The University of Iowa Public Policy Center conducted a two year VMT fee study concluding in July 2010 to evaluate the feasibility and driver acceptance of the fee. The study solicited volunteers and there were 103,054 responses. Of the responses only 78,140 volunteers were eligible to participate. A total of 200-240 participants were selected from each site and were studied for ten months. To assure a representative

sample, demographic profiles for each location were created. The three stratifying demographic variables used were gender, age, and education level (14). There were a total of 2,650 motorists in this study in areas including: Baltimore, Maryland; the Research Triangle area of North Carolina; eastern Iowa; Austin, Texas; Boise, Idaho; San Diego, California; Portland, Maine; Miami, Florida; Chicago, Illinois; Wichita, Kansas; Billings, Montana; and Albuquerque, New Mexico. To reduce potential for participant dropouts, there was a total compensation of \$895. Since drivers were offered such high incentives, the lead causes for dropping out of the program were equipment incompatibility and selling, crashing, or losing ownership of a vehicle (14).

The fee captured mileage data by using a Global Positioning System (GPS) device and utilizing the vehicle's onboard unit (OBU) device. The OBU device used odometer data to tabulate VMT fee data and the GPS device was used to verify the jurisdiction in which the miles were accumulated. For cases that the odometer was not accessible through the OBU port, the VMT fee was calculated using the speedometer data and integrated it over a period of time. The VMT fee charges were done by an onboard computer (OBC). Periodically the OBC updated a road charge in terms of dollars to the network operations center. In order to protect privacy, no GPS coordinate data could reveal the vehicle's location other than the jurisdiction the VMT were accumulated in (14). The participants acquired a total of 23 million VMT, averaging 990 miles per vehicle per month. With this study, miles were accumulated in all of the 48 contiguous states (14).

In addition to collecting VMT data, the participants were asked questionnaires to assess VMT fee acceptance, privacy concerns, and preferences regarding privacy protection vs. auditability of billing statements (14).

The overall findings were that 71% of the participants had a highly positive to somewhat positive view of replacing the fuel tax with the VMT fee, while only 17% held a highly negative to somewhat negative view of the VMT fee. This was significantly different than the view participants had at the beginning of the VMT fee, in which 60% had a negative or neutral view of the VMT fee. Furthermore, motorists preferred the ability to audit and receive detailed monthly invoices over maximum privacy protection (14). The GPS device showed to be an accurate way to track VMT. Of the 23 million miles accumulated, 6.7% of the miles traveled had to be assigned via interpolation due to GPS outages. Only 0.6% of the total miles were unable to be assigned reliably to a jurisdiction (14).

## **2.4 Oregon**

Oregon was the first state to take initiative and look for methods to replace the current fuel tax. The idea of replacing the fuel tax was first introduced in the 2001 Oregon Legislative Assembly. At this assembly, legislators discussed the new developing energy efficient vehicles and realized that gas tax revenues would be jeopardized by this new trend. In order to continue to maintain, preserve, and expand roadways, Oregonians realized that they had to rely less on fuel tax revenues, and eventually collect funds by another method (1).

### **2.4.1 First Pilot Study**

The Oregon Department of Transportation (ODOT) realized that this would not be an easy task, so in order to design and implement an alternative to the gas tax, they decided to focus on the following core principles: user pays for use of the system, local government control of local revenue, revenue sufficiency, transparent to the public, nongovernmental burden, enforceability, ability to support the road and highway system, and public acceptability (1).

Due to varying gas efficiencies from vehicle to vehicle, the amount drivers pay in gas tax does not actually represent the amount of miles driven. While designing a method to replace the fuel tax, the Oregon task force decided it would be most desirable for the driver to pay a fee that is directly correlated to the road usage. Another goal was for the local revenues to be used by the local government at the local level. The purpose of this new fee is to create revenue for the road and highway system, so it needed to be sufficient enough to replace the current fuel tax. Public transparency was another criterion that transportation professionals had to take into consideration for designing the fuel tax replacement. Therefore, a goal was for the public to have the knowledge of how much they pay in taxes and how the amount per VMT is calculated (1).

The purpose of the VMT fee is to replace the current fuel tax which has low administration costs. Therefore, the goal of the new fee would be for it to also have a low administration costs that will not be transferred to taxpayers and the private sector. Similar to the fuel tax, the new fee needed to be difficult to evade with minimal enforcement. Moreover, the most important criterion to move this fee forward is public acceptability. In order to make it publicly acceptable, the fee needed to have a minimal

burden on the user, as far as the payment methods are considered, while protecting the user's privacy and security (1).

After defining these criteria, the task force focused on alternatives including a VMT fee, congestion pricing, and tolling new roads and bridges. The task force was very much intrigued by a fee in which the driver would be charged per mile driven. The VMT fee was the desirable alternative, because it is a direct user fee and therefore could adapt to technologic advancements in fuel efficiency and alternative fuels. The first Oregon VMT fee pilot study was conducted in 2007 (1).

While designing the VMT fee, Oregon saw this as an opportunity to solve more than just the lack of revenue from the fuel tax. Instead, they saw this as a potential opportunity to relieve congestion by charging variable rates depending on the type of road. In order to do this, Oregon had to avoid human collection of the mileage data, requiring an automated electronic system to be used. The two electronic collection options studied were a central collection system or a collection at the fuel pump. Initially, the task force preferred a central collection system which would transfer data to a center and from there, bill the driver periodically. This option was expected to be too expensive to administer and too difficult to enforce while burdening the driver with periodic bills. Therefore, the central collection system was not tested during the pilot study. Instead, the VMT fee was to be charged at the gas station where the driver would pay for fuel. This system seemed to be most viable, because the driver could not easily evade it as they would not be able to purchase fuel without paying the VMT fee. Likewise, this would have a minimal burden on the driver as their method of paying for the VMT fee would be the same as it was when paying for the fuel tax (1).

In order to account for variable pricing, Oregon split its roadway systems into zones. Therefore, the driver was charged a specific amount depending on the zone s/he was traveling in. The task force wanted to ensure drivers were cognizant of the price zone they traveled, in order to know the direct costs of their trip. The device used for this project had a GPS. The GPS had the capability of capturing the zone the car was driving in. Along with the GPS, the device utilized the vehicle's odometer in order to tabulate the miles driven (1).

At the gas station pump, the system would connect to the vehicular device. From there, the device collected the fee information and charged the driver the VMT fee instead of the fuel tax. The driver was provided a final receipt with the fuel cost, the VMT fee, and the fuel tax which was not paid. Once the driver paid off the VMT fee, the central database was updated to the new mileage (1).

A key issue was security of VMT data. In order to avoid an accidental or an intentional invasion of privacy, the device was incapable of collecting any real time data and travel history. ODOT planned to minimize their involvement in developing the VMT devices at a large scale. The private sector would undertake the responsibilities of first developing the VMT devices and eventually installing, maintaining, and managing them (1).

The studied fee was proposed to be phased in due to the difficulty of requiring everyone to pay the VMT fee by a certain date. This way, people could continue paying the fuel tax until they purchased a new vehicle which would have the VMT fee device built in. This would lower costs and make it easier on the user. Also, the phase-in time

(which was expected to be 20 years), would allow for unforeseen issues to be addressed in an easier manner than if all drivers were already paying a VMT fee (1).

ODOT mainly wanted to test how practical the VMT fee could be and to also test motorist's behaviors during the study to track any changes. In March 2006, a one year pilot study was conducted with 299 motorists of passenger vehicles. These 299 motorists were non-random and self-selected volunteers. It is important to note that sampling bias was unavoidable due to qualification parameters such as program requirements and rewards, proximity to fuel station, vehicle eligibility, and the participant selection process.

For the first five months of the study, the subjects drove normally and continued paying the fuel tax. The only difference in their routine was that their mileage data was collected at the fuel station. After the five months, the motorists were divided into three groups: control group, VMT group, and rush hour group. The control group did not change their routine from the first five months. The VMT group paid a flat rate VMT fee in lieu of the gas tax. This flat rate VMT fee was 1.2 cents per mile. This rate was calculated by dividing Oregon's 24 cent per gallon fuel tax by the 2004 average fuel efficiency of 20 miles per gallon. The rush hour group was charged different rates depending on whether they were driving in congested zones and during peak periods. ODOT defined a congested zone as the area inside the Portland Metropolitan Urban Growth Boundary. Peak periods were from 7:00-9:00 a.m. and 4:00-6:00 p.m. on non-holiday weekdays. The reason for these different groups were to conduct surveys and to see if there were any changes in driving behavior or attitude when paying a flat VMT fee

or the rush hour VMT fee. After implementing the congestion pricing scheme, the rush hour group reduced peak period travels 22% relative to the VMT group (1).

This pilot study revealed a cost effective method which would have minimal potential of evasion. Due to a high reliance on the current method of fuel tax collection, there would be little additional costs to administer the VMT fee if it is collected at the pump like the current fuel tax. At a state level, ODOT would collect the current gas tax as a VMT fee at the distributor level and any additional fees collected would be collected at the station level. The fees which will be collected at the station level will likely have collection issues, but the long phase-in process would theoretically allow for much time to address these issues or create more effective collection systems.

For this VMT fee scheme, evasion methods of the VMT fee are the same as the evasion methods for the fuel tax. An additional form of evasion is possible through tampering with the VMT equipment. In order to deter motorists from tampering with the device, the driver would pay the fuel tax if the collection device could not detect VMT data (1).

Along with the VMT fee study, the drivers completed three surveys. The first survey was administered at the beginning of the study, the second survey in the middle of the study, and the third survey at the end of the pilot study. The first survey had as a goal to find out why drivers were participating in the study. The majority participated for the financial incentive, the next most popular reason (38% of participants) were curious and intrigued by the pilot program, and 18% of participants wanted to assist in finding an alternative to the fuel tax. Most participants were not concerned about the equipment for

the VMT fee, and 96% of the participants were very satisfied or somewhat satisfied with the explanation of the pilot program (1).

The second survey was conducted in the middle of the pilot program. There was an approximate 20% dissatisfaction rate due to malfunctioning equipment. Also, some participants were extremely inconvenienced by the specific gas stations that they had to drive to in order to participate in the VMT fee pilot study (1). 96% of the participants were satisfied with the information they were provided in regards to the program. 84% of the volunteers were satisfied with how privacy was handled with the equipment used in this study (1).

In comparison to the second study, 96% of the motorists were still satisfied with the information provided about the VMT fee program. However, only 69% of participants were satisfied in regards to privacy, a 15% drop from the second survey (1). The third survey showed a 25% dissatisfaction rate due to malfunctioning devices and the inconvenience of putting gas at the specified gas stations. The third survey also showed that 45% of the rush hour group experienced some change in driving behavior to save money; methods included using different modes of transportation, carpooling, combining multiple trips, and not driving during peak periods. Since the studied VMT fee was similar to the gas tax, there was no expected change in behavior and yet ten households changed behavior in order to make shorter trips. If the driver could use any gas station to pay the VMT fee, 91% of the participants were willing to pay a per mile fee in lieu of the gas tax. Overall, the pilot study was successful in showing the feasibility of a VMT fee structure and its ability to replace the fuel tax while maintaining good public opinion (1).

### **2.4.2 Second Pilot Study**

Although Oregon's first pilot study was feasible to implement on a large scale, there was much opposition found when trying to pass the VMT fee through legislation. The issues encountered included public concern due to the use of GPS, a potentially complex and expensive system, and fears of slow and costly technology (15). The required installation of a GPS device made many people very uneasy and eventually ODOT realized that they were hitting a brick wall with the VMT fee. The public did not support any electronic system that will be mandated by the government- especially one using a GPS device. Due to these issues, ODOT decided to conduct a second pilot study in which would address these concerns. This pilot study wanted to focus on user's choice, transparency, ease of use, and protection of privacy to help alleviate the public's concerns (16).

ODOT wanted to take advantage of the rapidly evolving technology and saw potential in mobile phone applications, vehicles with factory installed telematics and current insurance companies' pay as you drive auto insurance (17). ODOT realized that one specific option would not be achievable therefore decided to test multiple alternatives and allow the user to choose. The four VMT fee collection and reporting alternatives were: the basic plan, the advanced plan, the smartphone plan, and the flat fee plan. Of these options, only the flat fee plan did not provide a refund of any fuel tax credit. Table 1 summarizes the various plans tested in the second pilot study. A VMT fee of 1.56 cents per mile was charged, and drivers with more advanced plans did not have to pay for out of state driving. The VMT fee was based on the fuel tax that vehicles with an efficiency of approximately 20 mpg pay and also incorporated an administrative cost (17).

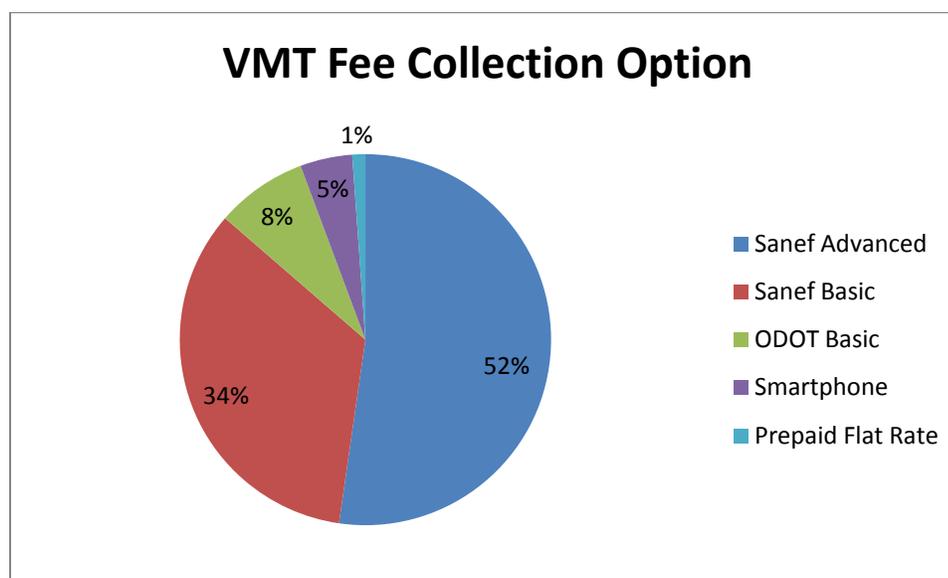
**Table 1: The various VMT Fee payment Options Provided in ODOT 2013 Pilot Study (17).**

<b>Various VMT Fee Payment Options</b>	<b>Description</b>
<b>Basic Plan</b>	The basic plan uses mileage reporting devices with no location determination technologies. The VMT is tabulated through vehicle's odometer. This option was provided both by ODOT and private company, Sanef.
<b>Advanced Plan</b>	The advanced plan reported miles with GPS devices. The device recorded VMT accumulated in Oregon separately to miles driven elsewhere. The VMT is tabulated through the vehicle's odometer. This option was only provided by the private vendor Sanef.
<b>Smartphone Plan</b>	The smartphone plan was a combination of the basic and advanced plan. The VMT fee was collected through a mobile application and the user had control over whether the GPS was active or not. This option was only provided by the private vendor Sanef.
<b>Flat Fee Plan</b>	The flat fee plan did not involve any mileage reporting. This charged users a flat rate of \$45/month. This flat rate was calculated on the assumed maximum miles driven per month. This option was only administered by ODOT. Although this is not a VMT fee, it allowed for maximum protection of driver privacy while ensuring steady roadway revenue.

Motorists in this pilot study were not randomly selected. Instead, ODOT sought to choose participants with policy interest in transportation funding including legislators (17). The main purpose of this study was to demonstrate to decision makers that a VMT fee will be the future of transportation funding and therefore is worthy of legislative action. This test also included residents of Washington and Nevada. Motorists were sent a mileage invoice monthly. Although privacy concerns were a major issue in moving the VMT fee forward, when given the option over half of motorists still chose the advanced

plan administered by the private sector. Several motorists chose the other options.

Figure 2 shows the distribution of drivers and the VMT fee collection options chosen.



**Figure 2: Participant Choice of VMT Fee Collection Option (17)**

Overall, this study showed that an easy-to-use VMT fee that allows participants to choose their charging plans is possible with low costs and high acceptance rates (17). The study indicated that the private sector could be involved, which puts a lower cost on the Department of Transportation (DOT) and also eases the users' concerns on privacy and slow and expensive technology. This study proved to also be feasible like the first study, but it also addressed the issues of privacy concerns, expensive systems, and the fears of slow and costly technology were reduced by allowing the involvement of private sector partners.

Due the success of this project and addressing the concerns from the first study, Oregon passed into legislation a larger scale VMT fee program. Starting in July 2015, this fee will allow up to 5,000 light vehicles to pay 1.5 cents per mile driven and receive a

fuel tax reimbursement (17). This VMT rate of 1.5 cents per mile was set by the Senate Committee on Business and Transportation (17).

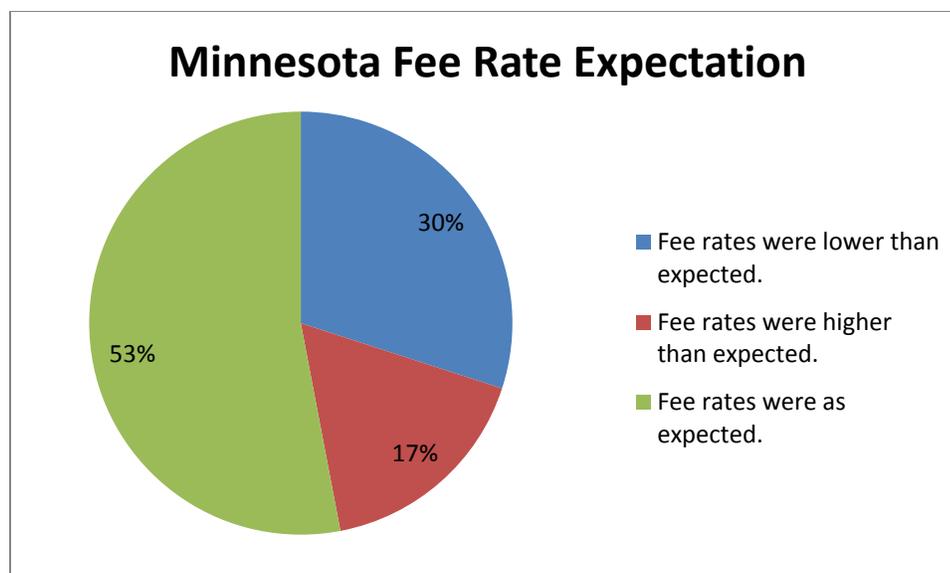
## **2.5 Minnesota**

Minnesota Department of Transportation (MnDOT) has coordinated multiple studies to determine the appropriateness of a VMT fee in Minnesota. Minnesota has been testing connected vehicles, and therefore used the connected vehicles technology as a platform to test a VMT fee. The three studies include a Mileage Based User Fee (MBUF) evaluation study, a MBUF technology study, and a MBUF policy task study.

The MBUF evaluation tested a VMT fee on 500 Minnesotans. Drivers used a GPS device to track their VMT. The GPS captured by the second detailed trip data including location, direction, speed, and time. Minnesota also noticed that the VMT fee technology could evolve in the future to provide travel information such as estimating travel time (18). The major findings in this study were:

- participants were accepting of the monthly VMT fee (18)
- the study was successful in addressing the need to find alternative funds for transportation (18)
- drivers value the simplicity of a VMT fee program (18)

The VMT fee was approximated to \$20/month for each driver. During off peak hours, drivers were charged 1 cent/mile and were charged 3 cents/mile for driving during peak times inside the Twin Cities Metro Zone. Peak hours were considered to be during 7:00-9:00 a.m. and 4:00-6:00 p.m. (18) Figure 3 shows the driver perception of the monthly VMT fee rates.



**Figure 3: Minnesota Driver's Fee Rate Expectation (18).**

Sixty-four percent of the drivers agreed that it was fair to charge variable fees depending on the time of day and location of driving. The method of payment showed to be easy and not tedious for drivers. In this study, drivers had the option to pay online, by mail, or in person. By offering multiple options for the user, fears of VMT fee evasion were lowered, because the easier the payment system, the more likely drivers were to pay it (18).

Participants in the Minnesota study did not express fears on lack of privacy, primarily because they believed this was already possible through mobile devices. Instead, motorists showed concern over data being accessible to hackers and wanted their data to be stored in the form of a security certificate program (18).

Another important finding was 64% of participants preferred raising fuel taxes as opposed to the 5% of participants who were inclined to paying a VMT fee (18). Simplicity is a key reason many motorists prefer the fuel tax over the VMT fee. The fuel tax does not require any involvement from the driver, whereas a fee payment through a

mobile device or online will require the driver to become more involved. Participants preferred that the VMT fee technology be integrated in the vehicle so that it would require little involvement on the driver's behalf (18). As well as creating more work for the driver, the technology practiced in this study had a number of issues, such as the device continuing to record after the trip had ended or not recording trips, therefore complicating the system even more (18).

Overall, this study provided insight on the studied VMT fee, driver perception, and has served as a good starting point for MnDOT to proceed with VMT fee studies.

## **2.6 Nevada**

Nevada Department of Transportation (NDOT) is currently in the third phase of a VMT fee study. The first phase consisted primarily of a comprehensive literature review, which addressed methods considered by other states and issues pertinent to Nevada. The first phase also held several public meetings and workshops. The focus of these meetings was to educate the public as well as gather opinions on relevant issues. Although the public meetings were successful in addressing the public's concerns, there was not good attendance, 75 attendees in Reno and 45 in Las Vegas. Half of the attendees were willing to participate in a VMT fee pilot study, but half of the willing participants refused to use any technology for the study (3).

The second phase of the VMT fee evaluated a data collection method which utilized the vehicle's onboard diagnostic port. Nevada avoided using technology capable of utilizing location information. The VMT fee was analyzed, along with driver perception, and billing option. This study produced policy recommendations which are to be implemented in the third phase (19).

The third phase is currently ongoing. The primary purpose of this stage is to:

- Reassess methods and findings from other states and from there draw conclusions.
- Put into effect a Mass Opinion Business Intelligence (MOBI) system. MOBI is a technology created by the company KPMG. MOBI recognizes web based information and provides real-time data to NDOT about the public sentiment of the VMT fee. From MOBI, NDOT can assess changing trends in public opinion from events such as workshops, public meetings, media updates, etc. This is beneficial due to the fact that public surveys take longer to administer and between results, current events may have altered the public opinion (20).
- NDOT plans to continue public meetings and workshops in Reno and Las Vegas, and also wants extend to rural areas such as Elko and Winnemucca in order to educate more Nevadans as well as address concerns.
- NDOT wants to implement a VMT fee trial to study VMT fee collection technology as well as various payment methods. Currently, NDOT is steering away from using any technology with GPS capabilities.

Overall, these studies took initiative in not only testing VMT fee collection and payment methods, but also on educating the public and addressing their concerns. By doing so, Nevada will know how to proceed with the VMT fee and avoid opposition when trying to further implement the VMT fee.

## **2.7 Summary of Chapter**

The fuel tax is not subject to inflation and is currently threatened by increasing vehicle fuel efficiency. In order to continue to maintain and expand transportation facilities, policy makers have found the need to supplement or replace the fuel tax. Many

states have decided to replace the fuel tax with the VMT fee. Many states found privacy and data collection by the government to be a concern. For example, Oregon had to deviate from its original idea of using a mandatory GPS device to a system which allowed the driver to choose the form of technology which would tabulate the VMT data. While Minnesotans did not worry much about their privacy being invaded, they were concerned with the misuse of data. On the other hand, Nevadans seemed to be so opposed to the idea of technology, that they are considering a pilot study which requires no vehicular devices. Table 2 summarizes the various VMT Fee studies.

**Table 2: Summary of Various VMT Fee Studies.**

	<b>Technology</b>	<b>Privacy</b>	<b>Public Outreach</b>	<b>Fee Collection</b>
<b>University of Iowa</b>	GPS device and OBU device which tabulated mileage data.	13% of participants from first round of the study and 17% of participants from the second round preferred maximum privacy.	-Participant Surveys	Received pseudo monthly invoices.
<b>Oregon 2007</b>	GPS device and OBU device which tabulated mileage data.	Majority of participants did not display privacy concerns. Privacy concerns were a major issue when trying to pass a VMT Fee through legislation.	-Public Meetings -Press Releases -Participant Surveys	At the fuel station.
<b>Oregon 2013</b>	User had the freedom of selecting a wide range of options including: GPS, smartphone, or no technology	Privacy concerns were addressed in this test and the VMT fee was passed through legislation.	-Public Meetings -Press Releases -Successful Passing through Legislation -Optional VMT Fee for interested drivers -Participant Surveys	Various options including online and via mail.
<b>Minnesota</b>	Used Connected Vehicles Technology to administer VMT fee.	32% of participants addressed privacy concerns.	-Focus Group Meetings -Participant Surveys	Received pseudo monthly invoices.
<b>Nevada</b>	Utilized OBU device without the use of GPS. Next phase is considering no technology.	Privacy concerns are a major issue for Nevadans, and VMT fee scheme without technology is being considered.	-Public Meetings -Workshops -Press Releases -Participant Surveys	Received pseudo monthly payments, but next phase will focus on driver desired payment method and frequency of payment.

Overall, the VMT fee is a viable option to replacing the fuel tax but will require solving some problems during the transition phase.

## **CHAPTER THREE**

### **FUNDAMENTAL FACTORS IN IMPLEMENTING A VMT FEE**

A VMT fee is a feasible option to replace the fuel tax and the technology to implement the fee exists, but policy makers must focus on public acceptance. In order for the public to have a favorable opinion of the fee and for the fee to be implementable, policy makers should focus on regulation, administrative costs, privacy concerns, technology options, public outreach, equity concerns, and the various fee collection options.

#### **3.1 Policy**

Many argue that drivers already pay fuel taxes and that the tax money is not spent wisely. It is difficult to counter these arguments, especially when the public hears of controversial roadway projects such as the Bridge to Nowhere in Alaska or do not notice any improvements in the roads they drive. This argument needs to be eased by showing the tax payers how their past tax money was spent and the benefits associated with the previous projects. Also, officials need to show the importance of improving transportation infrastructure for safety and economic reasons and to show how much tax expenditure is needed to continue to improve the transportation network. It is also important to emphasize the depleting fuel tax revenue and also the depreciation of the fuel tax due to inflation and increased cost of materials and labor.

Another important issue is to ensure that the revenue raised from the VMT fee will be invested in transportation expenditures, not general funds. This will help the credibility of the VMT fee if the revenue is spent solely on transportation infrastructure.

Policy is essential, and it is mandatory to ensure that the revenues will be properly used and collected. It is important to sort out the legalities of the VMT fee including the taxes, privacy, and expenditures. Oregon has been the leader in the VMT fee in the United States and in July 2015 will administer the first VMT program. In order to get a VMT Fee Bill approved, a successful pilot study was first conducted. Therefore, it is important that states conduct successful pilot programs which are calibrated to the specific needs and unique demographics of each state.

In order to implement the VMT fee, protect the users, and ensure that the revenue goes towards transportation services, legal changes will have to be made. Legal changes will include VMT fee revenue being appropriated towards transportation purposes. Also, regulations ensuring the protection of VMT data along with penalties for misused VMT information will need to be implemented.

Currently, many states reserve, constitutionally or by legislation the state fuel tax for highway transportation purposes. The federal fuel tax is protected and revenues go into the Highway Trust Fund. New laws or amendments to constitutions must be made in order to protect the VMT fee as to ensure that revenue will go towards the betterment, expansion, and maintenance of the transportation system.

### **3.2 Administration**

In order to replace the fuel tax with a VMT fee, the new system must keep administration costs low. The current fuel tax is superior in the sense that it has very low administration expenses which are approximately 1-2% of the revenue (5). Reasons for this are the efficient payment collection methods and low enforcements costs.

In order to for the VMT fee to have low payment collection costs, it will be important to optimize the user payment frequency and its associated costs. One way to alleviate this would be to utilize the private sector. By having the private sector collect fees, there would be fewer costs to the DOTs and higher efficient systems being used. By allowing for the privatization of this feature, it could experience major positive changes due to the competition among the private sector.

Another way to minimize VMT fee costs would be to minimize the desire for evasion. In order to reduce VMT fee evasion it is important to implement a fair fee which is easy to pay and to enforce large penalties so the driver will not want to evade the VMT fee. Furthermore, transparency on how and where the income from the VMT fee is being invested can motivate the public to pay their dues. Additionally, in order to minimize the evasion it is critical to have a large penalty placed for the possible evaders. As an illustration, the penalty for a civil tax evasion is 75% (21), so a penalty of this level maybe appropriate here in order to discourage motorists from evading the VMT fee.

### **3.3 Privacy**

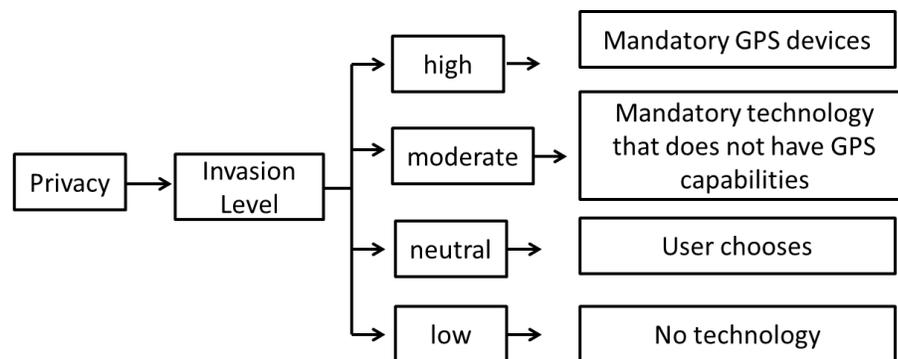
The principal reason for the lack of public support and the biggest argument against the VMT fee has been the issue of privacy. In order to transition towards implementing a VMT fee, the VMT fee cannot jeopardize a drivers' privacy. The VMT fee was originally introduced with a GPS device and therefore the public has felt that the propositions of the VMT fee are the government's attempt at a Big Brother situation.

Oregon had to conduct another pilot study, because the mandating of a GPS device was causing the public and officials to not support a VMT fee (15). Also, Nevada is steering away from the use of technology in order to ease any mistrust in the

government and ease privacy concerns. On the other hand, Minnesotans realized that their privacy was already being jeopardized by mobile phone capabilities and were more concerned of the data being stolen and misused by hackers (18).

Due to many recent security breaches and leak of information over citizen's privacy it is only natural for motorists to be worried about these issues associated with the privacy of the VMT fee. Although many argue that people's privacy can already be easily violated by cell phones and social media, it is still a concern for the majority. This concern is not a light concern and has to be addressed in order for the VMT fee to eventually be implemented in the future. Although at the end of the University of Iowa VMT study, 70% of the participants thought the system was fair, reliable, and accurate; 60% of participants believed the government would track their individual trips (22).

Figure 4 summarizes the level of privacy evasion associated with the proposed methods to collecting the VMT fee.



**Figure 4: The level of privacy evasion associated with each option of technology.**

Any electronic device that is to be used must minimize the potential for privacy evasion. Devices which will be used for the VMT fee must be integrated so that they

cannot store exact trip data. Oregon had addressed this by splitting its roadways into zones. Therefore, the VMT data could not directly show the route driven. Table 3 summarizes the participants' view of privacy during the pilot study and the technology used in each study.

**Table 3: Review of Privacy and Technology from Various VMT Fee Studies.**

	<b>Privacy</b>	<b>Technology</b>
<b>Oregon 2007 Study</b>	69% of participants were satisfied and 13% were neutral with level of privacy associated with equipment.	Mandated the use of a VMT collection device which had GPS capabilities.
<b>Oregon 2013 Study</b>	The structure of the 2007 study was unable to pass through legislation; therefore the 2013 did not mandate the use of technology to ease privacy concerns.	Had a variety of technology with and without GPS capabilities. Also, had an option for no technology.
<b>University of Iowa Study</b>	13% of the first year participants preferred maximum privacy configurations. 17% of second year participants preferred maximum privacy configurations.	Utilized onboard device port and GPS capabilities for accurate VMT recording.
<b>Minnesota Study</b>	32% of the participants noted concerns on the topic of privacy.	Utilized connected vehicle technology to administer VMT fee. This technology had GPS capabilities.
<b>Nevada Study</b>	Survey results show privacy is a major concern for Nevadans. 56% of the Reno Public Meeting Participants refused to have technology in their vehicle. And 73% of the Las Vegas Public Meeting Participants refused to have VMT technology in their vehicle.	Second phase of pilot study utilized onboard device port, but refrained from using GPS device. For next phase, is considering no use of technology.

Policy makers must do their best to address privacy issues at a legal level. Laws and regulations must be put into effect in order to ensure that VMT data is not mishandled. Severe penalties should be in place to punish any misused VMT data.

In order to successfully transition to a VMT fee, technology cannot be forced on the public. If technology, especially GPS is mandatory, the VMT fee will never be implemented. Instead, the public will need to become accustomed to a system that does not require the use of technology. Using devices which protect the VMT data, enforcing laws to discourage the misuse of VMT, and allowing the user to have the ultimate choice of VMT tracking method, account for and minimize privacy concerns.

### **3.4 Technology**

Since technology has become such a prominent part of people's everyday lives, there have been many different approaches on how to apply technology to the VMT fee. The use of technology to implement a VMT fee could be extremely beneficial. On the other hand, technology also adds costs and complications and is a major cause of resistance for the fee. This section will further investigate the proposed forms of technology suggested for the VMT fee.

#### **3.4.1 GPS**

Oregon first conducted a pilot study which required the use of a GPS device and since then many states have considered a GPS based option to administer the VMT fee. A GPS device could help by allowing for variable rates per mile. Additionally by employing this method, a driver will be charged differently for driving on a minor arterial versus a freeway. With this method, drivers will not be charged when they are not driving on public roads. Another benefit to this method is that the revenue collected can go directly towards the roads being used. Currently, drivers indirectly pay the same amount for driving on major arterials as they do on a private road. Therefore, with a GPS

device, a more fair and representative charge for using specific roads could be administered.

The use of technology in a VMT fee could also help control traffic congestion. If drivers are charged extra for driving during peak hours, this could help minimize the unnecessary trips which occur during the peak periods. Controlling congestion will help optimize the pavement life span, reduce travel time, reduce air pollution, and minimize the need to expand roadways. This will be doubly beneficial as the most deterioration of the roadways is due to overusing the system since it is so underpriced (23). Therefore, overtaking of the system during these congested periods will reduce the amount of maintenance required as well.

Currently with residents living on the border of states, fuel can many times be purchased in the neighboring state. This means the revenue from the fuel tax is not necessarily going to the state in which the majority of the miles are being driven. The VMT fee will not be capable of accounting for out-of-state mileage without a GPS device.

Although a GPS device could offer a much more precise measurement of actual road usage, there is extremely strong opposition when GPS devices are suggested for the VMT fee. The privacy issue has been a prevalent obstacle with the VMT fee, and recent discoveries that the National Security Agency (NSA) has been tracking through online communication has increased the people's mistrust in government. It will not be possible to persuade the public that the government will not track people's travels, especially after such incidences. Privacy concerns remained prominent, even after successful pilot studies were conducted. Although at the end of the Iowa VMT participants had a positive view

of the fee and study; 60% of participants believed the government would track their individual trips (22).

### **3.4.2 OBU Device**

In Oregon's second pilot study, the device which could be integrated with the smartphone took advantage of the vehicle's onboard diagnostic port. This On Board Unit (OBU) device which plugs into the on board diagnostic port was able to link mileage data from the odometer and transfer the VMT data to a collection system. Therefore, there was no need for manual or GPS tracking of the miles. This device could be administered without GPS capabilities.

The downfall to this device is that electric vehicles typically do not come equipped with OBU ports. Since electric vehicles do not pay a fuel tax, it is especially preferred that electric vehicles pay a VMT fee. Therefore, an OBU device is not a viable solution for all vehicles.

### **3.4.3 Smartphone**

Since GPS devices were considered to be too invasive, a mobile application was developed which allows the driver to choose whether GPS capabilities should be on or off. The application worked with the vehicle's OBU device to accurately collect VMT data. This mobile application allows drivers to truly have the freedom to their privacy, while also allowing the flexibility for lower fees when GPS devices are on. This was tested by Oregon, in which it was provided by a private vendor. By having the application provided by a private vendor and the driver choosing which data to have tracked, there was an extra assurance of privacy protection (17).

#### **3.4.4 Advancing Technologies**

Along with phasing out the fuel tax, the VMT fee could use other advances in transportation as its platform. The future of transportation looks to inquire many automated vehicles; also most vehicles will have connected vehicle technology which will increase safety. These advances will have GPS capabilities, and could allow for an easier transition to a VMT fee. For example, a VMT fee could be enforced along with connected vehicles and driverless cars. A drawback to this is that it is uncertain of when these technologies will take over the roadways.

#### **3.4.5 Odometer Readings**

Several states might find too much opposition when trying to introduce technology to the VMT fee. For this scenario, a VMT fee could still be implemented, but would rely on the vehicle odometer readings. These readings could be done on an annual basis with the annual vehicle registration fee. As with all devices, the odometers themselves might stop working—especially for older vehicles. Odometers could also be tampered with in order to record lower VMT, but technicians can easily detect odometer tampering. Other difficulties with this method include proportioning the VMT fee when a used car has a new driver and accounting for lost revenue from totaled vehicles.

Each form of technology has its advantages and disadvantages. Oregon's second VMT fee study showed that a VMT fee scheme with multiple options is possible. Moreover, it showed that the private sector could be involved, which puts a lower cost on the DOT and also eases the users' concerns on privacy and slow and expensive technology. The Oregon study proved to also be feasible while addressing the issues of privacy concerns, expensive systems, and the fears of slow and costly technology were

eased by allowing the involvement of private sector partners. By originally integrating the VMT fee with technology, it allows for more innovation and adaptation as the VMT fee is implemented.

### **3.5 Public Outreach**

One of the biggest obstacles in the way of implementing a VMT fee is public acceptance. It is important to note that the technology required to implement multiple types of VMT fees already exists. For this reason, effective public outreach and education is crucial for the success of a VMT fee program.

#### **3.5.1 Knowledge of Current Fuel Tax**

For public acceptance of a VMT fee, an understanding of the current fuel tax issues along with an acknowledgement of the need for a VMT fee are essential. Many drivers are unaware of the existing fuel tax when fueling a vehicle. Also, if they recognize the existing fuel tax, many are unaware of the division of fuel tax between the state and local taxes (24).

The fact that drivers are paying a fuel tax gives them the false opinion that the price being paid to use the roadway is adequate for building, expanding and maintaining the large roadway systems. In reality, the fuel tax has not been sufficient enough to sustain the roadways. The Highway Trust Fund has been bailed out over \$35 billion since 2008 and unless it continues to be bailed out and supplemented by the General Fund it will diminish (11). Within the next decade, the CBO predicts a total of \$126 billion in HTF deficits (11).

In order to help drivers realize they are paying a fuel tax, requiring fuel tax prices be posted clearly at fuel stations would be the first step. By doing this, many would

realize and be reminded of the fuel tax existence. Drivers would then recognize that the amount they pay for the fuel tax does not fluctuate as the actual fuel cost. This would help VMT fee advocates argue that the fuel tax is unable to handle inflation rates and increasing need for revenue increase, which in turn could help the public recognize the need for the VMT fee. Also, there might be less opposition when trying to raise the fuel tax as an immediate remedy to increasing transportation funds.

### **3.5.2 Public Meetings**

To implement an effective VMT fee, the public must be educated on the fee, express their concerns, and also have these concerns be addressed. Public meetings in various locations, on different days and times, and with various methods would help enlighten people. In these meetings, it is important to explain the main reason for the VMT fee, address public concerns, and persuade the public that the fee is necessary for the future well-being of America's roadways. The key to having a successful public meeting is having good attendance. Public meetings should be advertised by the media and invitations should be sent out.

There are several types of public meetings, including: public hearing, open house, workshop, seminar, forum, focus group, citizen committee, etc. Although public hearings and forums could become a little more argumentative as the idea of a new fee could upset drivers, it is a great way for the opposing side to voice their opinion and in turn for VMT fee proponents to be persuasive on why the VMT fee is necessary. On the other hand, a workshop and seminar could be very informative, but will not allow the public to voice their opinion.

From the public meeting in Reno, it was assessed that 74% of the participants left the meeting satisfied or very satisfied. It also addressed 66% of the participants' concerns. This showed that public meetings divided into different sections that focused on a significant VMT fee concern are a successful way to conduct public meetings.

Many of the pilot studies conducted also hosted public meetings in order to educate the public. Oregon held three public meetings during the first study in 2007 with the main purpose to remain as transparent as possible, and since the first study, has had multiple meetings to discuss the future of the VMT fee. Minnesota concentrated more on the participants and had focus group meetings with participants. On the other hand, the focus of Nevada's first phase was public education and public outreach.

Prior to holding public meetings, Nevada tried to reach the public by sending a press release to the local media, posting the event on the NDOT website, and sending out opinion-editorials regarding the VMT fee and the public meeting. With these methods of outreach there were approximately 75 attendees in the Reno event and 45 in the Las Vegas event (3).

Nevada held two public meetings in which the room was split into different sections which had poster boards and VMT experts to discuss the prominent issues such as: the decreasing fuel tax revenue, why the VMT fee, how the VMT fee works, privacy concerns, technology concerns, and equity concerns.

Nevada also held workshops in Reno and Las Vegas. The workshops were developed in order to understand the opinions and concerns about the VMT fee from local agencies. Local agencies included citizen, privacy, and environmental groups; the trucking industry; public and elected officials; and taxpayer organizations. From these

workshops, VMT fee proponents were able to understand the major concerns specific to the state of Nevada (3). It is recommended that all states emulate Nevada's workshops, because they can contribute major advice on how to continue with the VMT fee and eventually pass it through legislation.

Although the public meeting and workshop structures were successful in that a majority of attendees left satisfied with the events, the attendance rate was not satisfactory. A good lesson to take from the Nevada study is the previously mentioned methods of reaching out to the public about the meetings are not enough. Techniques that could be considered in order to enhance the public attendance are utilizing social media, utilizing a higher frequency of traditional media stories, and offering webinars. This will inform more of the public about the event and also cater to citizens that cannot attend the meetings. Moreover, it could be beneficial to create a welcoming environment with complementary food or attractions such as raffles in order to maximize attendance. Table 4 briefly summarizes the advantages and disadvantages of public meetings.

**Table 4: Advantages and Disadvantages of Public Meetings**

<b>Advantages</b>	<b>Disadvantages</b>
<ul style="list-style-type: none"> <li>-Informs public on VMT Fee</li> <li>-Can address public concerns of VMT</li> <li>-Allows for public to state opinion on the fee and the meeting itself</li> <li>-Can administer surveys at meetings and recruit participants</li> </ul>	<ul style="list-style-type: none"> <li>-Costs time and money that agencies might not have available</li> <li>-Unreasonable to believe a majority of motorists will be able to attend</li> <li>-A poorly conducted meeting can severely hurt the reputation of the VMT fee</li> </ul>

Although multiple meetings can be held at various locations, it is unreasonable to believe that a majority of the public will be able and willing to attend the meetings. This is where use of modern technology will help aide with the education of the VMT fee.

### **3.5.3 Social Media**

The modern technology of websites, webinars, Twitter, Facebook, YouTube, and Emails can be used. A website is a great opportunity for curious drivers to visit and briefly read the facts and issues, as well as be redirected to other related links. Webinars are a great solution for motorists unable to attend the public meeting to learn more about the VMT fee. With Facebook and Twitter accounts, VMT fee advocates can post supporting facts and new stories as tweets and Facebook posts, which are available to the public to read. Consistent tweets and posts remind the public frequently about the advantages of a VMT fee.

With these social media updates, public sentiment could be changing moment by moment enabling mechanisms similar to the Nevada's Mass Opinion Business Intelligence (MOBI) to capture the change in public sentiment. MOBI is a mechanism specific to Nevada that captures the changing opinion of the public. With the help of MOBI, VMT administrators will be able to identify events that hurt or helped VMT fee opinions. From there, the VMT fee task force can update social media posts in order to ensure public favor (20).

### **3.5.4 Public Surveys**

Public surveys can involve a large number of people. By having public surveys, people can voice their opinion while simultaneously learning more about the VMT fee. This will give policy makers data as to where motorists stand on this issue. Also, officials can track the change in opinion of the VMT fee as the time progresses.

Many of the studies had conducted before, during, and after surveys. This helped track drivers' change of behavior as they became more involved in the VMT fee.

Questions asked to participants included on issues of privacy, ease of use, technology, and overall experience. In order to conduct an effective and efficient survey it is crucial to have a plan and assure responses are anonymous, emphasize to the participant the importance of their feedback, show how their feedback will be crucial to the future of the VMT fee, and encourage high participation rate. In order to increase survey response rate, it would be beneficial to offer rewards upon completion of the survey and administer the survey in different formats. For example, the survey could be done on paper and sent through the mail or completed online.

### **3.5.5 Traditional Media**

Although social media is an important part of the new generation and is shaping the future, it is crucial to not forget the role the traditional media still plays in society. One report misinforming the public of the VMT fee, and the entire project could fail.

It is important that VMT experts hold meetings with editorial staffs in order to discuss the facts and disprove the myths. This could help avoid misreporting and articles that are completely untrue and could potentially ruin the reputation of the VMT fee. Traditional press releases and press conferences can also be helpful with the object of educating the public.

Another related traditional method is the mailed hardcopy Newsletter. In order to minimize the printing and distribution costs, formal newsletters can be sent via email or posted on websites or social media.

### **3.5.6 Pilot Study**

Allowing people who have showed concern over the VMT fee to participate in the VMT fee pilot studies is a very effective way to ease their trepidations. This way the

participants will see how it actually works and will truly understand the VMT fee. Participants' attitudes towards the VMT fee study can be monitored to see if there is any change in sentiment.

### **3.5.7 Addressing Questions and Concerns**

If the public has a more direct connection with the implementation of a VMT fee, they are more likely to accept it. It will be very helpful to have a telephone hotline for motorists to call, ask questions, and have their concerns addressed. Also, an email account in which drivers can email their questions and concerns could be beneficial. Another way to educate the public and address concerns is to create an informative website with history, facts, and frequently asked questions.

The ultimate purpose of VMT public outreach is to educate the public, identify and address public concerns, and answer all questions raised by the vast majority of the public.

### **3.5.8 Cost Considerations**

Each form of public outreach has cost and time associated with it. Some methods of public outreach could be too costly to use. But proponents could donate time and money in order to minimize the costs. Also, DOTs could allocate part of the VMT study funds towards the public outreach aspect of the VMT fee. Mechanisms such as MOBI could also be utilized in order to determine which method of public outreach is most effective and from there conduct a cost benefit analysis on the methods.

Once public outreach is successfully conducted, the VMT Fee could truly begin to be implemented as public opinion is its biggest obstacle. However, effective outreach is usually costly, especially for complex subject matter implementing a VMT fee program.

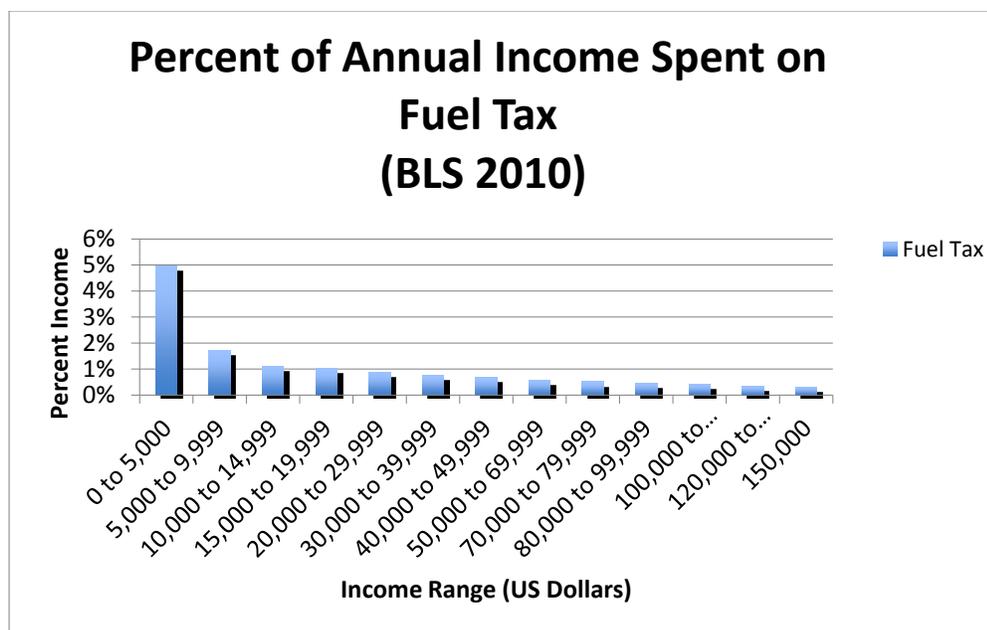
### **3.6 Equity**

One of the many concerns policy makers have stated about the VMT fee is how it will affect the drivers in different economic classes as well as by location and if this new fee will be regressive. Many studies have been done to determine whether or not this is the case when compared to the fuel tax.

#### **3.6.1 Equity of the Current Fuel Tax**

Before analyzing the equity aspect of the VMT fee, it is important to assess the existing fuel tax. The fuel tax is a flat rate tax based on the amount of gasoline purchased. The fuel tax, by nature, is regressive. A regressive tax is a tax which is applied uniformly across all income groups. Therefore, a regressive tax takes a larger percentage from low-income people rather than high-income people (25).

Using data from the 2010 data from the Annual Report of the Bureau of Labor Statistics, the percent of annual income spent on gasoline was calculated by using the median income in each range and then divided to reflect only the fuel tax. As shown in Figure 5, lower income families spend a higher percentage of their income on fuel tax.



**Figure 5: Percentage of Annual Income Spent on Fuel Tax (26).**

Since lower efficiency vehicles get less miles to the gallon, drivers of lower efficiency vehicles pay more in fuel tax than drivers of high efficiency and electric vehicles for an equivalent amount of road usage. Therefore, this tax unintentionally targets low efficiency vehicles.

### **3.6.2 Equity of the VMT Fee**

The VMT fee is equally distributed between high and low efficiency vehicles, because it is based purely on road usage. Therefore, the VMT fee is more equitable than the current fuel tax system, because all users pay an equal amount for the road usage regardless of their vehicular efficiency.

Although the fuel tax itself is regressive, a common argument against the VMT fee is that it will cause a greater economic burden on lower income families and also on rural drivers. Studies have been conducted to address the accuracy of this statement and because of the introduction of high efficiency vehicles and urban driving patterns; it has

been found that the VMT fee is less regressive than the current fuel tax (27). The University of Nevada, Reno and NDOT took interest in this subject and discovered that the mileage fee is less regressive in nature by using data provided by the 2009 National Highway Transportation Survey. It is important to note that technology has drastically changed in the last two decades, and up to 2001 the mileage fee would have benefited higher income families. But now due to new vehicles having higher fuel efficiency and not even needing gasoline, based on the 2009 data, the VMT fee will actually benefit lower income families who tend to have older and less fuel efficient vehicles (27). The VMT fee is also expected to benefit rural drivers more than the current fuel tax. This is due to the fact that rural drivers are more likely to own older vehicles with lower average fuel efficiency (27).

According to Zhang et al, a VMT fee will benefit drivers in all income groups as compared to the fuel tax. The proposed flat rate VMT fee will have a very minimal difference when compared to the fuel tax, because its intended purpose is to replace the fuel tax. The difference between the fuel tax and VMT fee is estimated to be an average of \$1.57-\$5.03 annually per household (28).

Due to the improving technology and more fuel efficient vehicles, the VMT fee will be a less regressive tax than the fuel tax. It is important to note that the VMT fee is intended to replace the fuel tax, therefore there is a minimal cost difference between the two. Another option to increasing transportation revenue is to increase the existing fuel tax. Since the fuel tax is more regressive than the VMT fee, an increase in the fuel tax would be even more regressive and affect lower income and rural drivers more than higher income and urban drivers.

From an equity aspect, there is no reason not to proceed with implementing the VMT fee; therefore it is important that this is clearly stated to drivers. And if an optional VMT fee is offered to drivers such as in Oregon, lower income and rural drivers will be the most likely to switch as they are the ones who will benefit most by this.

It is also important to remember that the VMT fee is not set in stone, and that is why pilot studies are extremely crucial. Pilot studies need to be conducted in order to ensure the calibration of the VMT fee to have a minimal effect on the low income and rural drivers, while providing a more a sustainable revenue for roadways.

### **3.7 Fee Collection**

It is important for professionals to optimize the frequency of payments and the fee collection system in order to minimize costs while providing the most convenient payment method for the motorists.

#### **3.7.1 Current System**

Currently, the fuel tax has a very effective way of being administered without being a burden on the user, because it is paid for as they purchase fuel. The current fuel tax has a very good method of enforcement, protects the drivers' privacy, all while keeping low administration costs.

Oregon tried to take advantage of this collection method in their first pilot study by having participants pay for the VMT fee in lieu of the fuel tax while fueling their vehicles. Although this method would have been easier for consumers to adopt, it would have been too costly to administer and this system would require the use of technology, and probably a GPS device (1). In order for the VMT fee to pass through legislation in Oregon, it required offering the option of no technology (17).

### **3.7.2 Registration Fees**

Some have proposed adding the VMT fee to the registration fees. There are several issues with this idea. The most prominent obstacle for this option is that the Department of Motor Vehicles (DMV) systems are so outdated that they typically cannot handle more fees and complications. For the DMV systems to have the capacity for a VMT fee to be administered, a significant investment would need to be made (29). Adding a VMT reading to a smog test would be simple, but not all states/counties require a smog check for annual registration. To further complicate this idea, many states' current registration processes are handled by multiple agencies including the DMV (29).

It has been suggested that drivers pay the VMT fee as a separate bill just like they currently pay their utilities, mortgage, credit card, etc. The main question that needs to be solved with this is how often should the fee be paid and by what method. Although some motorists may prefer to pay the VMT fee annually with registration fees, this lump sum might be too much of a burden on lower income families. The more frequent the payments, the higher administrative cost this will have.

Also, methods of payments need to be somewhat flexible allowing for multiple methods of payment in order to accommodate drivers. Payments could be done online through a secure server, allowed to be paid through mobile apps, automatic payments, paid in person at local convenient stores, or through the mail. All of these could be useful for drivers, but they will all have an additional administration cost associated with them. Most of the studies reviewed offered monthly invoices which could be paid online or by check via mail.

The frequency and methods of the payments need to be optimized as to accommodate the driver and keep administrative costs as low as possible. This will be tested through pilot studies. While some states have found that online payments are convenient to the user, this might not be feasible to be the only option. With VMT fee pilot studies, states can test various payment methods and ask for user feedback.

### **3.8 Summary of Chapter**

The key factors which need to be addressed in order to implement a VMT fee are as follows:

- **Policy:** The VMT fee will need to be protected so that revenues can only be used towards transportation purposes.
- **Administration:** The administration costs for implementing a VMT fee should be as minimal as possible in order to maximize revenue and properly replace the fuel tax. Also, evasion should be minimized in order to lower costs.
- **Privacy:** Privacy has been a major concern to the public about the VMT fee. It is important that no mandatory GPS is forced on the drivers. Also, location information needs to be protected by law.
- **Technology:** Various technologies have been tested for the VMT fee. It is important that driver privacy is protected with the future implemented technology.
- **Public Outreach:** Public education on the fuel tax is crucial. Public outreach could include: public meetings, workshops, surveys, social media, and traditional media.

- Equity: Equity is another concern raised with the VMT fee. It is important that low income and rural drivers are not unfairly or disproportionately affected by the VMT fee.
- Fee Collection: Fee collection methods and frequencies need to be maximized in order to minimize administrative costs and satisfy the motorists. Studied methods included monthly invoices which could be paid online or through mail.

## CHAPTER FOUR

### STEPS, ISSUES, AND METHODS TO TRANSITION FROM A FUEL TAX TO A VMT FEE

Once the obstacles to implementing a VMT fee have been overcome and public acceptance is underway, an appropriate method to transition to the new fee must be chosen which will minimize administrative costs and minimize the burden on the driver. The most probable transition phase is a long transition phase which will allow both fees to exist simultaneously. Another option is an immediate transition in which both fees coexist in a very small amount of time. As shown in Figure 6, the immediate transition phase has higher costs and lower public support associated with it. On the other hand, a long transition phase allows for lower costs and has a potential for higher public support.

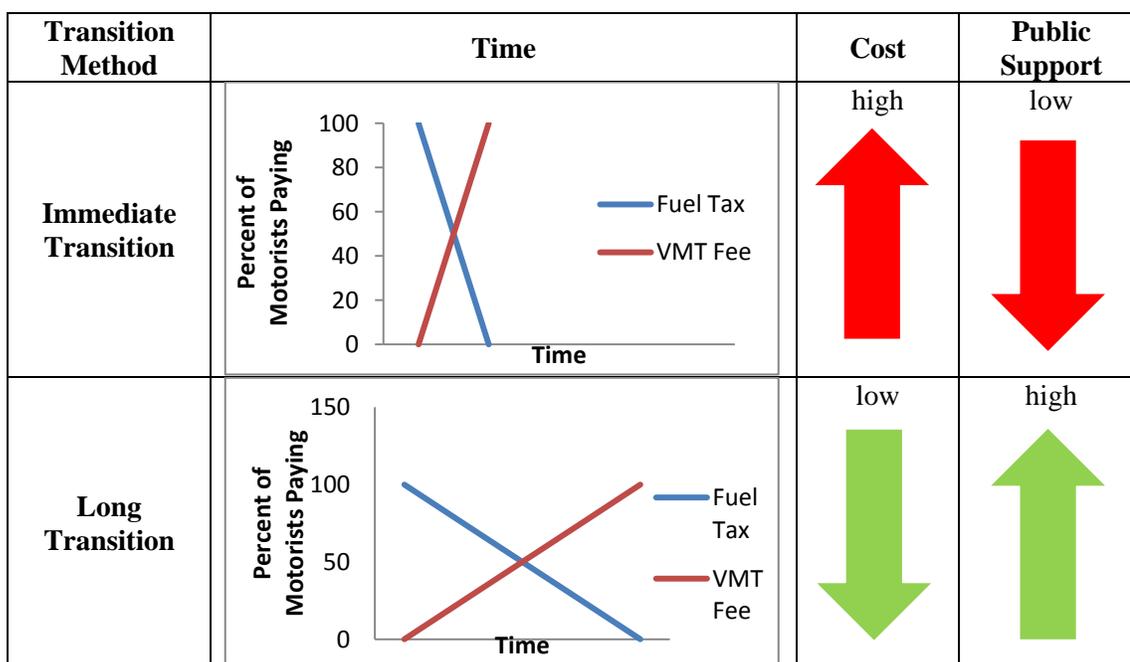


Figure 6: Comparison of Immediate versus Long Transition Phase

#### 4.1 Steps to Transition to a VMT Fee

In order for the public and decision makers to agree to a VMT fee, it must have a smooth adaptation and must allow for minimal burden on the user. There are several different approaches to transitioning from the current fuel tax system to the more effective and efficient VMT fee and each have their advantages and disadvantages. Figure 7 shows the suggested steps for converting to a VMT fee. It is imperative that before transitioning to a VMT fee, the fuel tax be raised in order to temporarily provide adequate source of revenue for the transportation system. From there, public education about the VMT fee and pilot studies must be conducted. Each state will be able to determine the best VMT fee method and transition scheme based on the pilot studies and from there will be able to pass it through legislation and eventually phase out the fuel tax.

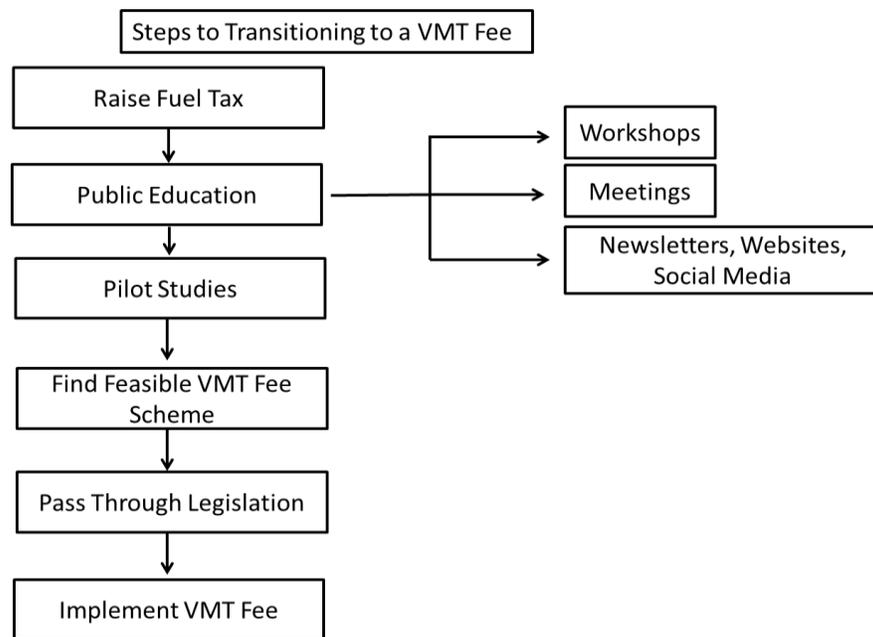


Figure 7: Recommended steps to transition to a VMT fee

## **4.2 Issues to overcome before successfully transitioning to a VMT fee**

Before implementing a VMT fee, certain issues must be resolved by decision makers. Issues include public acceptance, addressing privacy concerns, raising sufficient revenue during the transition period, minimizing evasion, and minimizing administrative and startup costs.

The first issue is public acceptance. A significant amount of emphasis shall be put on the education of the public and the acceptance of the new system. Unless the motorists realize the importance of paying the appropriate fees for transportation, drivers will never adopt it and support the embodiment of this new sustainable taxation form. Once there is a foundation of public education, pilot studies are important in order for the various States to receive significant feedback about the performance of the VMT system. Moreover, a successful execution of pilot studies will contribute to the promotion of the benefits that the VMT fee has for the society by providing specific numbers for each region. Every state has a unique culture, and while some states could implement a highly technologic VMT fee scheme, other states might be unable to allow for any technology due to the privacy concerns of the citizens. Whichever plan of action is chosen, it must minimize effort required for the driver. According to a survey conducted by MnDOT to over 500 people in Minnesota when given various option to increase roadway revenue, 64% preferred an increased fuel tax as opposed to 5% who preferred a VMT fee (18). The reason for this inclination is that the drivers preferred simplicity in the process of the fuel tax collection. Many expressed a desire to incorporate VMT fee technology in the vehicle to minimize driver involvement with the VMT fee (18). Increasing the fuel tax or subjecting it to inflation is a necessary temporary solution to continue to support the

transportation infrastructure, but as vehicle efficiency continues to increase and rely less on fuel another form of revenue collection must be implemented.

Furthermore, political issues need to be resolved before the continuation of the VMT fee. Under the umbrella of the political issues that need to be addressed there are environmental issues, economic equity, and administrative issues.

One environmental argument for opposition to the VMT fee is that there is no incentive to purchasing fuel efficient vehicles, which collectively reduce the environmental footprint of transportation. It must be clear that this fee is not intended to promote or discourage fuel efficiency. Rather it is a method in which users will pay their fair share of road usage and contribute back to the society. Drivers can still derive economic benefits by having a fuel efficient vehicle since the cost of gas is going to stay as a standard cost for the drivers. Moreover, the core motivation of purchasing a fuel efficient car could be to lower the commuting costs but is not the only one, since a significant number of people who own fuel efficient vehicles care about the environmental footprint of their vehicles as well. If the concern that the VMT fee hinders the trend towards more environmental friendly transportation, more fuel efficient vehicles can be given a discounted VMT fee or some other type of reward or incentive such as lower registration costs.

Any system that will be put in effect should not be a heavy burden on lower-income groups. Currently, low-income groups drive less fuel efficient vehicles, because they have lower initial costs. In contrast, high-income groups tend to accumulate more vehicle miles traveled on average, but can afford higher cost, fuel efficient vehicles if they choose (27). Due to these reasons, by implementing the VMT fee, low-income

groups will be relieved of a portion of their current payments and high-income groups will pay more per mile. Currently, if the fuel tax is replaced by the VMT fee, SUVs (average of 16 mpg) will go from currently paying on average \$132 federal fuel tax annually to paying \$108. On the other hand, a hybrid vehicle (average of 40 mpg) will go from the current average annual federal fuel tax of \$53 to \$108 (30). The reason for this difference in price is that the hybrid vehicles get more than twice the miles per gallon. The VMT fee is not trying to target a group in particular and this must be clearly stated to the public; it is only trying to make a sustainable fee based on usage. Therefore, drivers will be charged based on how much they use the roadway system.

The method of payment is another issue that needs to be overcome. Payment cannot be too inconvenient for the user, in terms of time and effort to pay the VMT fee, and cannot be too expensive for the administrator. The VMT fee could be paid in an annual basis. This fee could be due at the same time as the annual registration, but several issues arise from this method. First problem is that not all DMVs can support an extra fee. Many DMV systems are outdated and a lot of the software at the DMVs was created many years ago that it would not be feasible to enforce this new fee (29). Also, it will be difficult to account for VMT from totaled vehicles. Vehicles that are sold will also need to split the VMT fee appropriately from the old and new owner. Furthermore, a concern that is raised is that an annual fee might be too much of a burden for families with economic difficulties since it is a big amount to pay in one installment for a vast number of people. These problems could be solved by allowing fees to be due more frequently, such as monthly, in order to relieve families from having to pay large annual fees at once. Also, fees could be collected by companies other than the DMV since that

could lower the collection costs and increase collection efficiency and security. For example, if a driver is using a GPS device or a mobile phone application system to collect VMT data, then they could be able to pay the fee through the same company in charge of the device or by a secured third party system.

The majority of the issues that need to be addressed before putting a VMT fee into effect can be solved through pilot tests, surveys and public outreach. Once public acceptance and privacy concerns have been addressed, a transition scheme needs to be chosen.

#### **4.3 Immediate Change**

The least preferable option to transitioning from the fuel tax to a VMT fee would be an immediate change. This would give a very small time frame to require all drivers to switch to a per mile fee. This will require immediate action, much enforcement, and a tremendous amount of funds to ensure that drivers are changing over to the VMT fee and not evading it. Due to the high costs associated with retrofitting vehicles to tabulate VMT data and enforcement to ensure the VMT fee is paid, as well as the high inconvenience for the drivers to implement the mandated changes, it is likely that this transition method will not be used.

The easiest way to allow for an immediate change and enforcing the VMT fee would be to collect odometer readings data together with the registration fees. The fuel tax would need to be enforced for the year of the transition while DMVs collect initial odometer data.

#### **4.4 A Long Transition Phase**

Allowing for a longer transition phase and enforce incremental changes is the most optimal path to choose. Ideally, a 20 year transition period will likely cause the least amount of issues because it will allow for sufficient time to phase out older vehicles and to implement the infrastructure required to support the VMT fee. This time frame was suggested by the Oregon 2007 study. Depending on how the fee is structured, there could be a revenue decrease during the transition period. It might be necessary to temporarily increase the fuel tax in order to cover this funding shortfall. This will be more attainable at a state level, as several state tax rates have fluctuated over the past five years. For example, California tax rate was 35.3 cents/gallon in 2009 and increased to 48.7 cents/gallon in 2013 (31). The fuel tax in Nebraska was 27.3 cents/gallon in 2009 and decreased to 25.5 cents/gallon in 2013 (31). At a federal level, increasing the fuel tax will be more difficult, as it has not been raised in 20 years, but increasing both state and federal fuel tax and subjecting it to inflation will help increase transportation revenue for several years. If all drivers had to switch from the fuel tax to the VMT fee in a short period of time, that would be extremely expensive and quite chaotic. By embracing an incremental change, there are factors that can reduce the confusion of the public. As an illustration, new vehicles could come already equipped with the necessary for the VMT fee system equipment and so a smaller number of people would have to worry about acquiring the new needed technology. Stepping away from the user side, a sudden change would be significantly more expensive for the administration since a large amount of funding and manpower would have to be dedicated for the installation of the new systems

and the promotion of the new system's scope. Instead, implementing a system which could accommodate both the fuel tax and the VMT would be desired.

#### **4.4.1 Phase Out**

There are various ways to phase out the fuel tax and start charging only a VMT fee. One way would be to only have alternative fuel vehicles be charged for the VMT fee. In this way gas vehicles will be paying the indirect user fee of the gas tax and alternative fuel vehicles will be paying the VMT fee. The fuel tax would phase out in the future as more electric/hybrid vehicles are purchased and there is less reliance on gasoline powered vehicles. This type of implementation would probably encounter much opposition from environmental organizations, as a large number of drivers will feel that they are being punished for driving eco-friendly vehicles.

Another way to phase out would be to make all drivers pay the VMT fee and also continue to collect the fuel tax. That does not mean that people would have to pay the twice the amount they currently pay with the fuel tax. The needed taxes could be collected initially for example by a 1:3 ratio of VMT fee to fuel tax, and to change this ratio incrementally until the taxes paid be consisted of VMT fees only. Eventually as the VMT fee proves to be successful, it can be raised and the fuel tax can be lowered. This can continue for multiple years until the fuel tax is completely phased out.

Oregon has been the leading state in the implementation of the VMT fee and in 2015 will undergo a pilot study which will allow 5,000 people to opt out of paying the fuel tax in lieu of the VMT fee. This method has the advantage of the driver chooses. This is because it does not force drivers to use a VMT fee; rather it allows them to choose to participate in this new initiative. Of course, to phase the fuel tax out, fuel tax prices will

have to be raised so high as to not benefit the driver, thus incentivizing the drivers to switch to the VMT fee.

A longer transition phase, which incentivizes the user rather than forcing drivers to switch from the gas tax to the VMT fee, will be the most desired way to transition. The feasibility of this option will be confirmed in July 2015 when Oregon begins the pilot study.

#### **4.4.2 Include Technology**

The implementation of the VMT fee can be done more thoroughly by using the proper technology instead of relying on odometer readings. Technology could include OBU device, GPS device, and smartphone applications. Although this technology could need some additional startup costs, such as Research and Development, it can evolve to help administer tolls and congestion pricing as well, which could be helpful in the VMT's future. These evolutions will allow the VMT fee to adapt to changing requirements, such as congestion pricing and road classification differential pricing.

#### **4.4.3 Include with Future Technology**

Along with phasing out the fuel tax, the VMT fee could use other advances in technology to create its platform. An existing platform would utilize the technology and the sources used for other purposes such as connected vehicles or smartphones. Therefore, the VMT fee can employ existing technology rather than creating the appropriate infrastructure from start. As an illustration, a VMT fee could be enforced along with connected vehicles and driverless cars. A drawback to this is that it is uncertain of when these technologies will take over the roadways.

For any phase out scheme but especially for one that waits for future technology, it is imperative that the fuel tax would be raised to support the Highway Trust Fund and other transportation expenses until the VMT fee is into effect. According to Robitaille et al, a ten cent fuel tax increase will result in an increase in welfare of most households as the increased roadway spending will reduce congestion, improve safety, and support economic development (23). This is the necessary next step, but it is not a sustainable solution because of the fuel tax's inability to survive with increased fuel efficiency and the trend towards electric cars.

#### **4.5 Summary of Chapter**

Before implementing a VMT fee, it will be important to raise the fuel tax in order to sustain the HTF and cover transportation expenses. In the meantime, state DOTs can continue to promote public education and pilot studies that will be critical in determining the future route of the VMT fee. Transition schemes could be immediate implementation of the VMT fee or a longer transition period in which drivers will slowly switch from paying the fuel tax to the VMT fee. The longer transition phase is more likely to be chosen, and Oregon will take the lead in 2015 by implementing a VMT fee for up to 5,000 volunteer motorists.

## **CHAPTER FIVE**

### **CONCLUSION**

In order for the United States to maintain its roadways, it is necessary that the current fuel tax system changes to produce the necessary amounts of funding. While the convenient solution would be to simply raise the amount charged per gallon of fuel, it does not solve the long term problem of not equally taxing actual usage of transportation infrastructure because of reasons such as improved vehicular fuel efficiency and alternative fuel vehicles. A long term replacement of the gas tax which addresses these issues could be the VMT fee.

Several VMT fee systems are being studied throughout the United States. The main conclusions and lessons learned which can be taken from pilot studies in Iowa, Oregon, Minnesota, and Nevada are shown in Table 5. It is important to recognize these findings and repeat and improve the successful aspects and not repeat the failures. For example, continuing studies that mandate GPS technology will not be beneficial since there will be too much opposition when trying to successfully pass the fee through legislation. Also, monthly VMT fees seemed to work for Minnesota. Therefore future studies can focus on reaffirming this finding and also focusing on fee collection methods which put the lowest burden on the drivers such as automatic payments and online payments.

**Table 5: Lessons Learned from VMT Fee Studies**

<b>Study</b>	<b>Lessons Learned</b>
University of Iowa	The VMT fee is implementable on a national level. After participating in a study, there was a 40% increase in positive opinion on the VMT fee.
Oregon	Even if a VMT fee study is successful, policy concerns such as privacy could prevent the study from continuing. It is important to study and provide a VMT fee that does not force the motorist to utilize a technology. This could be achieved by offering multiple options for drivers. It is beneficial to have legislators and policy makers participate in studies to have a better understanding of the fee.
Minnesota	Participants are willing to pay the monthly VMT fee, but prefer a tax which minimizes efforts on the driver's behalf, such as a fuel tax.
Nevada	Public outreach is very important to the success of a VMT fee. Mechanisms such as MOBI which monitor public sentiment could be very beneficial in discovering the most effective ways of increasing public sentiment.

The transition to this new system will not be simple, and as with any new or changed tax, it will be faced with many challenges. The key moving forward with a VMT fee is educating the public on the benefits and properly addressing their concerns. Concerns include potential invasion of privacy from government mandated technology to the additional work required by drivers to pay the new fee. The following suggestions are proposed when moving forward with the VMT fee studies.

It is critical to the success of the VMT fee to educate the public on the shortfalls of the current fuel tax and to inform them on the benefits associated with a VMT fee. It

is suggested that future studies implement effective methods of public outreach including traditional and social media while monitoring public perception through mechanisms such as MOBI. By using technology such as MOBI, state DOTs can measure which methods of outreach have the greatest influence on public perception and can focus on the specific methods, rather than waste time and resources on methods which are not as effective. In order to minimize cost of public meetings, VMT fee education and promotion could occur at other events the state DOT is involved with or hosting. For example, information about the VMT fee could be provided in a flyer at another event hosted by the DOT. Also, at public events, the DOT could rent a booth solely focusing on educating the public on the VMT fee. Other cost effective methods of outreach could include email lists, informational webpages, social media outreach, and an email helpline for drivers to address their concerns. These could be more cost effective methods than traditional public meetings while still communicating to the public.

It is suggested that future VMT fee studies utilize the use of technology. The disadvantage to not using technology is it will not allow for easy future advancements of the VMT fee. Whereas, including the option of technology could open the door to future congestion pricing and automatic tolling machines. Since privacy concerns arise when the government mandates the use of technology for the collection of the VMT fee, it is suggested to allow the driver to pay a flat rate fee regardless of miles driven and without the use of technology. This method should be costly in order to provide an economic incentive for the use of technology. For future studies, it is suggested to offer multiple VMT fee collection methods. Focusing on smartphone technology could be the most effective method in having a GPS device. Hardware costs will be minimized since the

driver could use their smartphone and privacy concerns will be lessened since it is not a device mandated by the government, but rather the driver's personal mobile phone. Future studies should focus on the effectiveness and accuracy of the smartphone device. It has been found that a "user chooses method" in the aspect of collection device and whether to pay the VMT fee or the fuel tax is easier to pass through legislation. It is suggested that technology is offered as well as simple options which do not require technology in future studies. Also, it is suggested to incentivize the driver to pay the VMT fee either by increasing the fuel tax or providing rewards such as lower registration fees and could allow for a longer transition period in which both the fuel tax and the VMT fee will coexist. Also, between now and the VMT fee being implemented it is important to provide a short term solution for revenue increase. Therefore, it is suggested that the fuel tax be increased and that state and federal fuel tax to be subject to inflation.

It is important to capture the general public's idea on the VMT fee. Therefore, it is suggested to randomly select participants for future pilot study. Participants could be randomly sent an invitation to participate either via mail, email, or phone. Also, demographic criteria could be selected such as age, gender, education level, and political views. Once a successful pilot study is administered, it is suggested to include policy makers and reporters in the pilot studies. This will help the process of passing a VMT fee through legislation if the legislators participated. Also, this will help minimize false statements in the media since the press will be directly involved.

It is suggested that future studies analyze the effectiveness and success of a monthly fee collection system. In order to maximize convenience for the motorist, it is suggested that the driver has the option of paying online, via mail, or have an automatic

payment system set up. It is recommended to focus on infrastructure which will accurately tabulate, charge, automatically withdraw a VMT fee, and provide the driver with a monthly statement. This way the driver will need to put minimal amounts of effort into paying the VMT fee.

Public knowledge and acceptance will be the biggest hurdle for the implementation, but there are other logistics that need to be addressed. How fees will be collected, how usage is tracked, and what new technology will be required are all questions that need to be answered before VMT fees can completely replace the fuel tax. Specially tailored programs can be used in different cities, states, and even time frames to properly collect the funding needed to sustain and grow our thoroughfares. The VMT is still in a fledgling state, and as more pilot studies are conducted, the most appropriate VMT fee method to implement will emerge.

## REFERENCES

1. **Whitty, James M.** *Oregon's Mileage Fee Concept and Road User Fee Pilot Program*. Salem : Oregon Department of Transportation, 2007.
2. **Institute, American Petroleum.** *State Motor Fuel Taxes Rates Effective 10/1/2014*. 2014.
3. **Nevada Department of Transportation.** *Nevada Vehicle Miles Traveled (VMT) Fee Study Phase 1*. 2010.
4. **U.S. Department of Transportation Federal Highway Administration.** Status of the Highway Trust Fund 1957-2011. *Office of Highway Policy Information Highway Statistics Series*. [Online] February 2014. [Cited: November 15, 2014.] <http://www.fhwa.dot.gov/policyinformation/statistics/2011/fe210.cfm>.
5. **Wachs, Martin.** *A Dozen Reasons for Raising Gasoline Taxes*. s.l. : Institute of Transportation Studies, 2003.
6. *Tax Evasion from a Policy Perspective: The Case of the Motor Fuels Tax*. **Denison, Dwight V. and Eger, Robert J.** 2, s.l. : Wiley, Mar-April 2000, *Public Administration Review*, Vol. 60, pp. 163-172.
7. **Randall, Tom.** Pain at the Pump: Gasoline Prices by Country. *Bloomberg*. [Online] June 2, 2014. <http://www.bloomberg.com/visual-data/gas-prices/>.
8. *End of the Highway Trust Fund? Long-Term Options for Funding Federal Surface Transportation*. **Schank, Joshua and Rudnick-Thorpe, Nikki.** 2221, Washington, D.C. : Transportation Research Record, 2011, Transportation Research Board, pp. 1-9. 0361-1981.
9. **DriveSteady.** Where do Gas Taxes Go? *DriverSteady*. [Online] October 7, 2011. <http://drivesteady.com/where-do-gas-taxes-go>.
10. **Totty, Michael.** The Gas Tax is Running Low. But What Should Replace It? *Wall Street Journal*. [Online] September 17, 2012. <http://online.wsj.com/article/SB10000872396390443864204577619082194372886.html> .
11. **113 Congress.** *Concurrent Resolution on the Budget- Fiscal Year 2014*. s.l. : The Library of Congress, 2013.
12. **Section 1909 Commision Staff.** *Analysis of Alternative Financing Mechanisms and Institutional Options Part A. Advantages and Disadvantages of Alternative Revenue Sources* . s.l. : National Surface Transportation Policy and Revenue Study Commission , 2007.
13. **Congressional Budget Office.** *Projection of Highway Trust Fund Account under CBO's April 2014 Baseline*. s.l. : Congressional Budget Office, 2013.
14. *National Evaluation of Mileage-Based Charges for Drivers*. **Hanley, Paul F. and Kuhl, Jon G.** 2221, Washington D.C. : Transportation Research Board of the National Academies, 2011, Transportation Research Record: Journal of the Transportation Research Board, pp. 10-18.
15. **Whitty, James M.** *Road Usage Charge Pilot Program Preliminary Findings*. s.l. : Oregon Department of Transportation, 2013.
16. **Mileage-Based User Fee Alliance.** Mileage-Based User Fees by Region. *Mileage-Based User Fee Alliance* . [Online] <http://mbufa.org/where.html>.
17. **Oregon Department of Transportation.** *Road Usage Charge Pilot Program 2013*. s.l. : Oregon Department of Transportation, 2014.
18. **Rephlo, Jennifer A.** *Connected Vehicles for Safety, Mobility, and User Fees: Evaluation of the Minnesota Road Fee Test*. s.l. : Minnesota Department of Transportation, 2013.
19. *Public Perceptions and Preferences towards a VMT Fee System in Nevada*. **Paz, Alexander, Nordland, Andrew and Khan, Alauddin.** 2013, Transportation Research Record: Journal of Transportation Research Board, pp. 39-47.
20. **KPMG.** *Vehicle Miles Traveled (VMT) User Fee Study Mass Opinion Business Intelligence (MOBI)*. 2013.

21. **Brager Tax Law Group.** Tax Fraud and Tax Evasion. *Brager Tax Law Group*. [Online] [Cited: November 4, 2014.] <http://www.bragertaxlaw.com/tax-fraud-and-tax-evasion.html>.
22. *Symposium on Mileage-Based User Fees.* **Wood, Nick.** 2011.
23. *Effectiveness and Equity of Vehicle Mileage Fee at Federal and State Levels.* **Robitaille, Andrea M., Methipara, Jasmy and Zhang, Lei.** 2221, Washington, D.C. : Transportation Research Board, 2011, pp. 27-38. 9780309167321.
24. *Consumer Awareness of Motor Fuel Tax Rates and Prices.* **Cook, Kenneth E and Rush, Patrick A.** 138, Washington D.C. : Highway Research Board, 1966.
25. Regressive Tax. *Investopedia* . [Online] <http://www.investopedia.com/terms/r/regressivetax.asp>.
26. **U.S. Department of Labor Statistics.** *Consumer Expenditures in 2010: Lingering Effects of the Great Recession* . 2012.
27. **University of Nevada, Reno.** *Vehicle Mileage Based User Fee Study, Phase III.* 2014.
28. *The Short and Long-Run Impacts of Vehicle Mileage Fee on Income and Spatial Equity.* **Zhang, Lei, et al., et al.** 2009, Transportation Research Record.
29. **I-95 Corridor Coalition.** *DMV Outreach Responses I-95 Corridor Coalition.*
30. **United States Government Accountability Office.** *Highway Trust Fund Pilot Program Could Help Determine the Viability of Mileage Fees for Certain Vehicles.* s.l. : United States Government Accountability Office, 2012.
31. **Tax Foundation.** State Gasoline Tax Rates, 2009-2013. *Tax Foundation* . [Online] March 21, 2013. [Cited: December 3, 2014.] <http://taxfoundation.org/article/state-gasoline-tax-rates-2009-2013>.