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Improving the Cost Effectiveness of Financial Incentives in Managing Travel Demand Management (TDM)

October 2013

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STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION

Improving the Cost Effectiveness of Financial Incentives in Managing Travel Demand Management (TDM)

FDOT Project Number BDK85 977-41

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Metric Conversion

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: volumes greater than 1000 L shall be shown in m^3				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
^oF	Fahrenheit	5(F-32)/9 or (F-32)/1.8	Celsius	^oC

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16. Abstract

Providing financial incentives to commuters to use alternative modes is a common element of managing transportation demand. Although these incentives have become common during the past two decades as elements of transportation demand management (TDM) programs, limited effort has been made to understand how different ways of providing financial incentives affect commuter mode choice. A better understanding of how these components of incentives affect their impact is critical to enhancing the performance of financial incentives as a TDM strategy.

A Web survey was developed and conducted to investigate the feasibility and interest of shifting mode in Florida. A total of 1,031 responses were collected and analyzed. From the survey, researchers found that more than 80 percent of respondents in Florida indicated that they were neither carpooling nor taking public transit. Over 70 percent of the sampled commuters have not considered changing modes. Most respondents indicated that they need a car to reach multiple destinations. In general, respondents agreed that financial incentives can make both carpool and public transit more appealing to commuters, but some systematic improvements are also critical.

While mode shift away from driving alone is the primary purpose for most of the TDM incentive programs reviewed, there are other means for yielding the desired outcomes without shifting mode. One method is to shift the focus on the time of the trip or the quantity of the trip consumed (i.e., vehicle miles of travel (VMT)). Researchers focused the evaluation on the feasibility of reducing individual VMT rather than changing mode as a means of achieving the outcomes of reduced congestion and emissions. A pilot test was conducted and proved that a VMT saving approach is very effective and has great potential to grow to achieve several of the desired outcomes of TDM. Two different incentive schemes in the pilot test produced valuable insights to expand the approach to statewide TDM programs.

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Executive Summary

Providing financial incentives to commuters to use alternative modes is a common element of managing transportation demand. Although these incentives have become common during the past two decades as elements of transportation demand management (TDM) programs, limited effort has been made to understand how different ways of providing financial incentives affect commuter mode choice. A better understanding of how these components of incentives affect their impact is critical to enhancing the performance of financial incentives as a TDM strategy.

After a comprehensive literature review on various commuter incentive programs in TDM, it was determined that there is a great potential to improve the role of financial incentives in TDM. The objective of this study was to understand how the elements (form, amount, and structure) of financial incentives determine their effectiveness in changing commuting behavior and to investigate the process of developing a habitual mode choice behavior. This research drew on behavioral economics, empirical data, and a controlled field experiment with commuters to understand these relationships.

Prior to the actual controlled field experiment with different incentive schemes, a Web-based survey was developed and conducted. The survey aimed to collect information related to the mode choice behavior of commuters in Florida and measure the feasibility of adopting non-Single Occupancy Vehicle (SOV) options, including telecommuting. The results suggest that people change their preferences based on the framing of the incentives. In addition, the majority of respondents were interested in a VMT-savings TDM program. This suggests that shifting modes is not a realistic option for many respondents, especially where there is limited availability of reasonable alternative transportation. Therefore, VMT savings may be the most efficient TDM option for curbing SOV use.

After analyzing the results of the Web-based survey, the study team developed a controlled quasi-experiment including the rules and program guidelines specific to each incentive scheme. The experiment aimed to evaluate the effectiveness of different variants of financial incentives on commuter behavior. The pilot test was called the “Idriveless” program, and it was designed to provide a certain level of financial reward to people who reduced their VMT compared to their baseline VMT. Participant’s VMTs were measured every two weeks throughout the study period. After VMT was measured, participants were compensated based on the number of miles they reduced from their baseline VMT.

Two incentive schemes were adopted, and participants were randomly assigned to one scheme for the study. Group A was assigned to the “traditional incentive scheme,” which provided cash rewards after participants completed and reported their saved VMT. This retroactive payment scheme is a typical financial incentive method in TDM programs. Group B was assigned to the “new incentive scheme,” which was designed to provide a financial incentive in advance of VMT savings based on a pre-committed VMT reduction. If participants were unable to meet the VMT savings they committed to based on the payment schedule, they were required to return the financial incentive. This scheme was developed based on the idea of “prospect theory” and the “loss aversion effect.” In general, people have a tendency to strongly prefer avoiding losses to acquiring gains. Group C was the

control group. The control group was used to monitor the potential external factors that could have an effect on mode shift behavior during the study period. The incentive schemes can control only for the incentives and not for other factors that can affect the mode change behavior. For example, changes in gas prices can lead to a commute mode shift irrespective of the incentives offered. The control group helped capture the impact of external factors affecting the mode change behavior.

Overall, Group A maintained nearly 10 percent or higher VMT reduction each week throughout the study period, and Group B achieved significant VMT savings in the first six weeks but the amount of VMT reduction decreased during the rest of the study period. Analysis revealed that more than 75 percent of Group A participants were able to save VMT during the course of the study. The highest variation in VMT savings was indicated in Group B. In both Group A and Group B, approximately 50 percent of the participants were able to save VMT during the course of the study. Further analysis of the records of the two groups also revealed that a significant amount of VMT was saved in both groups beyond the level of compensation. In addition, Group C showed an average 0 percent change in VMT from the baseline VMT.

Participants completed an exit interview with a study team member at the end of the study to gather feedback on their experience during the study, including VMT savings strategies, challenges experienced, and uses of alternative modes of transportation during the time they had participated in the study. The interview also aimed to collect recommendations and/or comments participants had for the study staff. In general, the responses indicate that the study was well run and thorough.

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Chapter 1 Introduction

Background

Given declining resources, pressing problems, and environmental constraints, many government agencies, such as state Departments of Transportation (DOTs), metropolitan planning organizations (MPOs), and local governments are increasingly motivated to manage demand for vehicle trips to reduce emissions of greenhouse gases (GHGs), improve air quality, mitigate congestion, and improve overall performance of their roadway systems (which is secondary for this study).

Providing financial incentives to commuters to use alternative modes is a common element of managing transportation demand. This is preferred over other negative enforcements, such as parking fees, which are politically difficult to implement. In principle, incentives can make alternative modes much more attractive to commuters by lowering the out-of-pocket cost of travel. However, the form (cash vs. reward card, payment vs. reimbursement), amount, and structure (one-time payment vs. recurring payments) can vary and have different impacts both on the cost of an incentive program to change travel behavior and on the effectiveness of the incentive program in bringing about these changes. Although incentives have become common during the past two decades as elements of transportation demand management (TDM) programs, limited effort has been made to understand how different ways of providing financial incentives affect commuter mode choice. A better understanding of how components of incentives affect their impact is critical to enhancing the performance of financial incentives as a TDM strategy.

At present, employers who offer financial incentives to their employees to promote changes in travel behavior do so because these incentives, in general, have been shown to be effective and/or popular with employees. However, different ways of offering incentives have different costs to the employers and different degrees of effectiveness. Employers who want to work with public agencies to reduce emissions or mitigate traffic congestion would benefit from knowing how to offer the most effective incentives for the lowest cost. As an example, while incentives are effective, they suffer from a “free-rider” problem of making payments to people who had already decided to change their behavior and who would have made the change whether or not they received the incentive. An incentive program that makes recurring payments for desired behavior is likely to have higher costs per free rider than one that offers a one-time payment for a short period of performing the desired behavior.

Previous studies have demonstrated how financial incentives influence the use of alternative modes of transportation, but these studies also found that the success of TDM programs is influenced by many other factors, such as the use of human resources-related incentives and location factors. Due to the level of complexity in mode shift decisions by commuters, well-designed data collection and controlled field experiments are necessary to enhance our understanding regarding the effectiveness of various financial incentives in TDM programs.

Objectives and Supporting Tasks

The objective of this study was to understand how the elements (form, amount, and structure) of financial incentives determine their effectiveness in changing commuting behavior and to investigate the process of developing a habitual mode choice behavior. This research drew on behavioral economics, empirical data, and a controlled field experiment with commuters to understand these relationships. The goal was to improve the cost-effectiveness of financial incentives as a tool for transportation agencies to use in transportation demand and reducing emissions.

The tasks of this study are as follows:

- Perform a literature review to produce a synthesis of effectiveness of different financial incentive schemes for promoting the use of alternative commuting modes and the effects of rational and habitual factors on mode choice behaviors.
- Conduct a web-based survey with employees to collect their stated preference information related to financial incentives and mode choice.
- Develop and conduct a controlled field experiment with different financial incentives.
- Analyze the results of the controlled field experiment and summarize findings.

Chapter 2 Literature Review

What is Travel Demand Management and How It Has Evolved

Transportation demand management (TDM) has evolved substantially from its carpooling roots to where it is today. Federal Highway Administration defines TDM as any action or set of actions intended to influence the intensity, timing and spatial distribution of transportation demand for the purpose of reducing the impact of traffic or enhancing mobility options. As this section will highlight, much of the incentive efforts in TDM have focused on modifying the mode of travel.

In the early years, financial incentives were not needed. TDM began as a patriotic act for conserving resources for use in World War II. It was not until the 1970's before carpooling was a response to another crisis – this time the energy crisis. However, ridematching to help form carpools were an isolated activity by large employers and a few regional governments in response to rapidly rising prices and tightening supplies of gasoline. This period saw the creation of regional ridematching programs in about 25 urban areas and the beginning of corporate-sponsored vanpooling.

As the energy crisis subsided, the share of commuters who carpooled declined from its peak of 19.7 percent in 1980 to 13.4 percent in 1990 (Chan & Shaheen, 2012). Still, communities began viewing TDM as another tool in the toolbox for addressing other major problems such as air pollution from mobile sources and traffic congestion. For example, local or regional trip reduction regulations were introduced in areas with the worst air quality problems such as Southern California. These regulations often required employers with 100 or more employees to develop and carry out trip reduction plans. At the federal level, the Clean Air Act Amendment of 1990 required employers in severe or extreme ozone nonattainment areas (e.g., New York City, Houston, Chicago, Philadelphia, etc.) to increase average passenger occupancy by 25 percent within two years. Even as states were striving to comply, this federal mandate was short-lived. Congress made the Employee Commute Options a voluntary program in 1995 and, effectively, ended the federal mandate for employer trip reduction plans in most of these metropolitan areas.

While the "stick" approach to reducing SOV trips was snapped at the federal level, the Energy Policy Act of 1992 dangled a "carrot" to help influence travel behavior in the form of increasing commuter tax incentives for transit and vanpool offered via employers. Equally notable to increasing the transit and vanpool benefit was the establishment of a tax-free limit on qualified parking. While the parking limit of $155 per month was initially set much higher than the transit/vanpool benefit limit at $60 per month, setting any limit on parking was a landmark action. More pricing experiments designed to influence travel behavior followed, including high occupancy toll lanes, pay as you drive insurance, and commuter financial incentive programs. For example, Cash for Commuters (CFC) in Atlanta provided 90 day cash incentives to SOV commuters to try alternatives. The CFC $3 a day incentive program was effective in encouraging commuters to begin and continue using commute

alternatives. Follow-up studies found seven in ten (71%) survey respondents continued to use a non-SOV mode three to six months after the subsidy ended (Gregory).

In 2007, the federal Urban Partnership Agreements (UPAs) sought a comprehensive application of tolling, transit, technology and telecommuting/TDM. The federal value pricing program also examined variable parking pricing (e.g., SFPark) and fostering pay as you drive insurance (PAYD).

Qualified Transportation Fringe Benefits

The Energy Policy Act of 1992 ushered in the expanded use of financial incentives for transit and vanpool offered via employers. The Act broadened the tax code term *qualified transportation fringe benefits* to include transit passes and transportation in commuter highway vehicles (i.e., vanpools) in addition to qualified parking. Employers, for the first time, could offer vanpool benefits tax-free up to $60 per month. It also allowed transit passes valued up to $60 per month to be provided to employees tax-free at a higher value than allowed for a de minimis fringe.

Equally notable to the expansion of the transit and vanpool benefit was the establishment of a tax-free limit on qualified parking. While the parking limit of $155 per month was initially set much higher than the transit/vanpool benefit limit at $60 per month, it did mark a shift in policy to tackle "free parking."

From 1992 to 2009, the limits increased with respect to changes in cost of living. In 2009, the American Recovery and Reinvestment Act (ARRA) increased the monthly tax exclusion for parking, employer-provided commuter highway vehicle transportation and transit pass benefits to $230. This law made all the exclusion amounts equal and set them at the higher rate for qualified parking. It also allowed employees to be reimbursed for reasonable expenses of qualified bicycle commuting up to $20 per qualified bicycle commuting month (Center for Urban Transportation Research, 2013). As of 2012, six percent of all private industry workers have access to subsidized commuting benefits (excluding subsidized parking) (U.S. Bureau of Labor Statistics, 2012).

This federal codification of commuter benefits (Section 132(f) of the Internal Revenue Code) supports the notion that providing a financial incentive will encourage commuters to reduce SOV use. Considering that people are making mode choice decisions based on the cost of travel, including travel time and convenience, the financial incentive would make non-SOV modes become more attractive by lowering out-of-pocket costs. The common programs in the U.S. include transit voucher programs, parking cash-out programs, vanpool incentive programs, and bike incentive programs. A brief description of each program can be found below.

Transit Voucher Programs

Third-party benefit administrators and/or transit agencies issue paper-based or electronic-based vouchers that riders give to participating transportation providers to acquire fare media. Employers may subsidized the costs of the vouchers creating an incentive to use

public transit. Transit voucher programs are widely implemented in major cities including San Francisco, Philadelphia and New York City. An analysis of transit voucher programs indicates voucher recipients' commute travel shifts approximately 20 percent from auto to transit (Oram Associates, 1995; Schwenk, 1995). More recent research conducted for the Transportation Research Board found that commuter benefits generally increase transit ridership, but not in all cases. These benefits also help convince commuters to shift from drive alone to riding transit while inducing changes in commute and non-commute behavior. Finally, the research found that the effectiveness in changing travel behavior differs among programs, based on factors including transit availability, level of employer payment, and supporting programs (ICF Consulting and Center for Urban Transportation Research, 2005).

Parking Cash Out Programs

Most employers provide free or subsidized employee parking which encourages employees to drive to work. The idea behind parking cash-out is simple: given a choice of cash or a parking space, some would prefer to receive cash. They have been proven as an effective means to curb SOV commuting and mange parking demand. An analysis of eight California firms implementing cash-out found that SOV dropped from 76 to 63 percent, carpooling increased from 14 to 23 percent of employees, transit use increased from 6 to 9 percent of employees and combined bicycling and walking increased from 3 to 4 percent of employees. Parking cash out programs can help employers in several ways: reduce the need for employee parking and costs associated with leasing parking space; reduce the maintenance costs by reducing the amount of parking; enable businesses to convert employee parking spaces for different uses such as customer parking; and eliminate the need for new parking construction (United States Environmental Protection Agency, 2005).

Vanpool Incentive Programs

Basically, it is a similar idea to the transit voucher program. Employers may provide up to $245 per month for vanpooling and/or allow most employees to use up to $245 in pre-tax income to pay for vanpool fares.

Bike Incentive Programs

Beginning in 2009, employers could reimburse employees for qualified bicycle commuting for reasonable expenses. Reasonable expenses include the purchase of a bicycle and bicycle improvements, repair, and storage. The IRS considers these to be reasonable expenses as long as the bicycle is regularly used for travel between the employee's residence and place of employment.

While numerous studies demonstrated the effectiveness of these programs to reduce the number of trips by SOV or increase transit ridership, less attention was given to the correlation between the amount of the final incentive and outcome, as well as the potential impact of incentive framing in TDM. For some entities, the amount of the financial incentive was commonly decided by the maximum allowance in the federal tax exemption or the amount of available funding with the simple notion that more financial incentives mean less SOV share.

The Role of Incentives in TDM

Research in many fields has found that incentives can be a powerful tool that can be used to change human behavior. Frequent flier programs, buy-one-get-one deals, and early bird parking discounts are a few of the examples of how such financial incentives been widely adopted in many places of our daily life and business. To use the incentive in an effective and efficient manner the ability to predict how people change their behavior in response to changes in incentives is very important, yet the underlying motivation of human behavior with incentives is still not fully understood.

Kamenica summarized the various aspects of behavioral economics and psychology of incentives. He concluded that monetary incentives are clearly powerful tools to motivate people, but he also added that it is helpful to understand that the type of tasks may affect if people may or may not engage in, depending on the details of their choice-making environments. He also discussed and explained why standard incentives can backfire, including the impact of framing (Kamenica, 2012).

Fehr and Falk indicated that it is desirable to carefully analyze the social and cultural factors that form human behavior to make incentive strategies successful. By expanding our knowledge of human motivation, it can certainly provide a better insight on the effect of economic incentives with behavior (Fehr & Falk, 2002).

In TDM, various financial incentives have been used to affect travel behavior, including mode choice. Rutherford and colleagues studied the effect of economic incentives on SOV rates in 1995. The study concluded that the impacts of incentives are affected by the magnitude of the benefits, the quality of travel choices, and demographics (Rutherford, Badgett, Ishimaru, & MacLachlan, 1995). Figure 2-1 is from Rutherford's paper and displays the findings of a linear relationship between SOV travel and the monthly financial incentive amount. At the highest rate of the financial incentive ($180), SOV travel is expected to comprise only 20 percent of all travel.

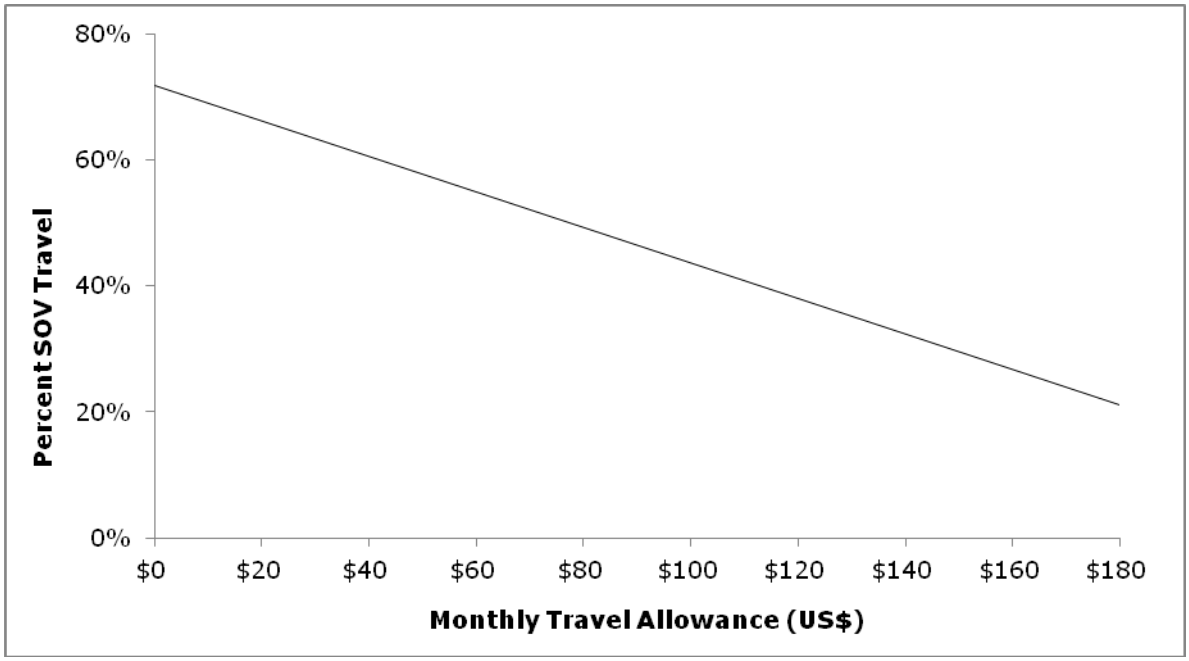


Figure 2-1 Effect of Economic Incentives of SOV Rates (Rutherford, Badgett, Ishimaru, & MacLachlan, 1995)

It has been argued that the linear relationship demonstrated by Rutherford doesn't exist (MVA Consultancy, 1987; Accent Marketing and Research, 1994). An increase in subsidy or financial incentive doesn't necessarily produce a linear reduction of the SOV rate. The consumption of time and the time budget constraint play an important role in determining the amount of time that an individual allocates to specific activities, and how this time is traded with other resources to establish willingness-to-pay. Taking financial incentives into consideration, commuters are utility maximizers, and their valuation of time savings is the sum of the opportunity cost-of-time and the relative marginal disutility of spending time in one activity compared to another (de Palma, Lindsey, Quinet, & Vickerman, 2011).

A recent study by the Center for Urban Transportation Research analyzed the Commute Trip Reduction (CTR) program in Washington State and also confirmed the non-existence of a linear relationship between the increase of financial incentives and the reduction of SOV share (Winters, Lee, Hillsman, & Labib Georggi, 2010). Figure 2-3 shows that the change of SOV share by 338 employers in CTR programs between 1993 and 2005. BA represents a worksite's first survey which is supposed to be done before the program starts (or before any changes to its established program are made). Two years later, the site does its first survey (G1) to measure progress against its baseline and the survey is repeated every two years. Overall, the most significant reduction of SOV share occurred in the first two survey cycles and then tends to flatten out, although the number/amount of subsidy offered by employers has been continuously increasing during the same period.

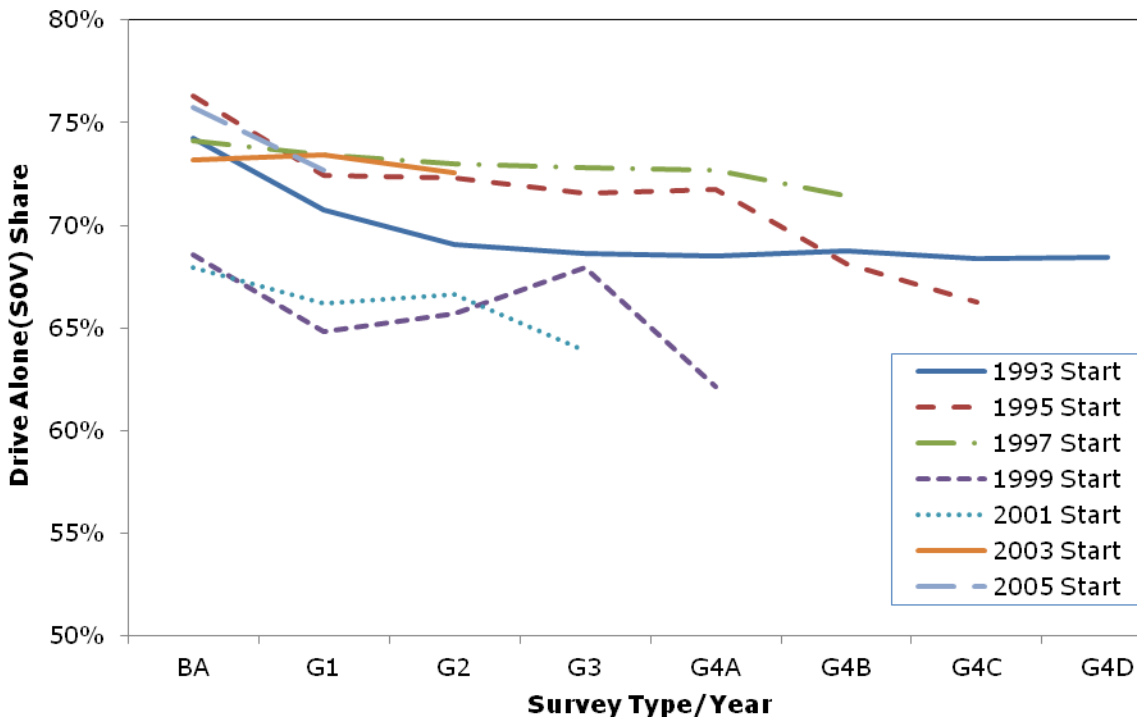


Figure 2-2 SOV Share by Survey Years in CTR program

Two general TDM strategies are incentive strategies known as "carrots" and disincentive strategies known as "sticks." Commuters are typically more accepting of carrots than they are of sticks (Jou, Chen, & Chen, 2011). Examples of carrot TDM strategies include providing transit vouchers and improving convenience of public transit, while examples of stick TDM strategies include increasing parking costs and congestion pricing. Changing the framing of the incentive may change how it is perceived and the reaction it invokes. A bonus-frame may be perceived as less hostile than a fine-frame. Fehr and Falk's experimental economic research shows that voluntary cooperation is substantially higher when the incentive is framed in terms of a bonus payment (Fehr & Falk, 2002). It is believed that a better understanding of the psychology behind human behavior in response to financial incentives will allow financial incentives as tools to have a greater and lasting impacts in TDM.

State-of-Practice of Incentive Schemes for TDM

Some research has been conducted to explore new and innovative financial incentive TDM strategies to address a range of TDM strategies from encouraging alternative modes, reducing SOV commuting, shifting trips out of the peak and reducing vehicle miles traveled. A summary of their methods and findings are presented below.

INSTANT (INfosys-STANford Traffic) Program – Bangalore, India

An incentive scheme called INSTANT (INfosys-STANford Traffic) was deployed in Bangalore, India over a six month period with employees of a local company (Merugu, Prabhakar, & Rama, 2009). The goal of the study was to reduce commute time and congestion-related costs such as pollution and fuel. INSTANT was developed to encourage commuters to avoid traveling during rush hours. Instead of giving commuters a flat rate payment according to arrival time, they received credits that qualified them for a monetary award at the end of each week. Reward amounts varied from Rs. 500 ($10) to Rs. 12,000 ($240) and were paid out through a raffle mechanism. The more credits commuters had, the higher the reward amount they could win and the higher their probability of winning. The INSTANT project had a significant effect on the commuting patterns of the participating employees. The number of commuters arriving in various pre-rush-hour periods doubled. The average morning commute time per bus commuter, averaged over all bus commuters, dropped from 71 minutes to 54 minutes. This study also suggested that the use of tradable permits and congestion credits could be another possible approach to congestion charging.

Capri (Congestion and Parking Relief Incentives) – Stanford University

Similar to the INSTANT project in Bangalore, this study was designed for motivating people more efficiently by offering a chance at a larger reward rather than a guaranteed small one. The system, which pools individual rewards, and pays out a few large sums through raffles may carry adequate incentives. Regular commuters to campus earn points for biking or walking or driving on the main Stanford University campus at designated off-peak hours Monday through Friday. Drivers receive a unique radio frequency identification (RFID) cling tag. Scanners installed at the main campus entry points detect users who avoid the weekday 8-9 a.m. rush hour by arriving between 7-8 a.m. or 9-10 a.m. or depart 4-5 p.m. or 6-7 p.m. The system automatically awards credits to those drivers for an online game that pays random cash prizes of $2 to $50. Seeking to leverage the value of social media, users can then see the prize and value when a friend has won. As the frequency of non-peak commutes increase so does the user's status. The higher status levels receive larger sized of rewards. A second phase of the study will reward drivers for parking at less-used lots.

Spitsmijden Program – The Netherlands

The Spitsmijden program was a 13 week pilot study conducted in the Netherlands to assess the potential of rewards as an effective policy tool for congestion management (Ben-Elia & Ettema, 2011). This study was completed in 2006 and involved 340 participants. Following license plate observations of frequent morning rush-hour car commuters, potential participants were contacted by mail to participate in the program. Participants could choose between two incentives, either 3 to 7 € or credits to earn a “Yeti” Smartphone (market value around € 500 at the time). A total of 232 participants selected the monetary reward and 109 selected the Yeti reward. Rewards were the main motivation to participate, but the main reason for nonparticipation was lack of flexibility in daily schedules.

Each participant was placed into one of four reward classes based on their frequency of driving during the morning rush-hour time period. Three stages of data collection were conducted: 1. Pre-test survey; 2. Tracking participants’ observed behavior; 3. Post-test

survey. Pre-test surveys revealed a relatively homogenous population with high education levels (56%), moderate to high incomes and mostly families (81%), and the majority of participants were men. The most commonly used transport mode reported in the pre-test survey was a personal vehicle (80%). About one third of participants considered public transport a realistic alternative to driving alone. In addition, almost half of the participants could depart earlier from home and more than half could depart later from home.

The study found that the rewards available to participants were significant. Participants reduced rush-hour driving and increased their weekly shares of driving earlier and/or later as well as of "not driving" compared to both pre and post-test levels. Among the monetary reward group, the 3€ level of reward had the largest influence on behavior change while the 7€ level had only a marginal effect. Gender had a significant effect on rush-hour driving, suggesting men tend to change behavior more often than women. Higher education levels had a significant and negative effect on driving later. It was also discovered that attitudes in relation to public transport and cycling as realistic alternatives to driving are important. Participants with positive attitudes towards public transport were less likely to change behavior by driving at other times, and participants with positive attitudes to cycling were more likely to change behavior by not driving.

Post-test surveys revealed that less than 10% of participants made a very high effort to change their behavior and only about one third of participants reported making any effort. All participants reported social support as a way to facilitate behavior change. While the main reason to participate remained the reward; the Yeti group gaining experience with the Yeti and traffic information was important in addition to the reward. When looking at habitual behavior, participants that drove 2.5 to5 rush-hour trips per week during the pre-test were more likely to continue driving during rush-hour when compared to participants that only drove 0 to2.5 rush-hour trips per week. The study concluded that the use of rewards in changing commuter behavior in the short run appears to work, but there is still an open question as to whether the change can be sustained without rewards in the long run. In addition, the magnitude of change in rush-hour avoidance is not determined by the reward, but rather by different factors relating to the participants and their particular situations. Thus, the ability to obtain accurate estimates of road users' values of time could assist in implementing the correct incentive scheme.

Survey of Employed Solo Drivers – Orange County, CA

Surveys are a commonly used tool for assessment of road user's reactions to incentive schemes and other TDM strategies. In 1992 in Orange County, CA a telephone survey of employed solo drivers was conducted that asked about the likelihood of changing from solo driving to another means of commuting given the implementation of two different policies (Baldassare, Ryan, & Katz, 1998). Two diverse strategies were presented to survey participants. The first strategy involved a program that would impose fees on automobile use, which would raise the cost of solo trips by car. The second strategy proposed would provide incentives to make transportation alternatives more attractive and less expensive. By considering the stated preferences for different policies aimed at reducing solo driving, the study aimed to gain an understanding of public support for and opposition to various efforts to reduce solo driving.

This study found that solo drivers were about twice as likely to say they were very much inclined to switch from driving alone in response to an incentive as opposed to a new fee. Solo drivers who were lower status (low income, low education), young, and spent less time driving to work were more likely than others to say that they would change from driving alone if there was a parking fee at their workplace, commuting fees, and/or smog fees. Young and lower status drivers were also more likely than others to say they would change from solo driving if there were cash bonuses and more carpools, but not if there was more public transit. Drivers with longer commutes were more likely than others to change if there was more public transit. Solo drivers who frequently need their automobile at work were less likely than others to say they would change their commuting habits if there were more carpools and more public transit, but not if there were cash bonuses. Those with liberal views were more likely than others change if there were more carpools and more public transit, but not if they received cash from employers for switching from driving alone. In addition, those who perceived environmental problems were more likely than others to say that smog fees would change their current solo driving habit.

There is an increasing trend towards suburbanization, and policymakers seeking to reduce solo driving need to identify the political acceptability of various proposals to reduce solo driving. In this study, few solo drivers were willing to change if any of the policies are implemented, which implies considerable resistance to both policies. Solo commuters are much more likely to change their driving habits when offered bonuses and incentives than when presented with fees. A weakness of this study is that there may be a difference in stated preferences and actual commuter behavior. Actual behavior may vary when commuters are confronted with real fees and incentives. Policymakers must carefully weigh the balance between what may be the more effective yet less politically acceptable fees, and the less effective yet more politically acceptable incentives for changing solo driving. They also need to keep in mind demographic groups that policies could be tailored to, and that travelers from lower socioeconomic groups may bear a greater burden than higher income commuters when faced with certain fees.

One Less Car Program – Seattle, WA

This program offered households information and financial incentives to help them reduce their car use and try other means of transportation and to rethink the way they use their car for all their trips including commuting to work, running errands, and going to entertainment. Three rounds of the study were conducted in fall 2000, spring 2001, and fall 2002. A total of 86 households participated in the study for a period of 6 to 9 weeks. A variety of households were represented, including single people and couples – both with and without children, roommates and relatives, renters and homeowners, and young and old. To be eligible for the study, participants could not have more cars than drivers in their household. During the study, households stopped using one of their cars. They kept a diary of where they went and how they traveled there. Participating households received a weekly stipend of $85 to compensate them for the extensive data they recorded and the public resources they saved. The stipend also served as an economic incentive which simulated the savings they would have if they did not own the car they gave up during the study period.

Participants reduced their drive-alone car miles traveled by 27%. Overall, bicycling mileage increased by 38%, transit use (bus) mileage increased by 25%, carpooling increased by 23%, and walking mileage increased by 30%.A number of factors were also identified which assisted participants in making the change: increased awareness about their actual car costs, education about the full variety of travel options available to them, and an immediate tangible economic incentive.

In Motion Program – King County, WA

Social marketing techniques are now being used to better improve the effectiveness of incentives. The In Motion program in King County, WA used community-based social marketing techniques to increase transportation awareness and influence commuter behavior (Cooper, 2006). Community-based social marketing involves identifying specific perceived barriers and benefits of carrying out sustainable behavior and designing a responsive strategy with behavior change tools. The behavior change tools consist of commitment, prompts, norms, communication, and incentives. The In Motion program focused on neighborhood-based outreach instead of an employer-based trip reduction program. It also addressed the potential to change any trip from drive alone to an alternative mode. In Motion provided neighborhood residents with incentives to drive less and raised individual awareness of alternative travel options. Residents were encouraged to reduce all solo driving trips, not just those during rush hour, which is better equipped to impact overall travel demand. Using social marketing in tandem with incentives can help to educate and motivate individuals, which has the potential to create a long term impact.

Program participants committed to change two trips per week from drive alone to another mode for 12 weeks. Participants were required to submit trip logs detailing where they went, how they traveled, and trip distance. For every week they reported successfully changing two drive alone trips to an alternative mode they received a $5 voucher. The voucher could be used to purchase transit passes, biking and walking gear, or gasoline for carpooling. At the end of the program, participants completed a survey on their experience and their opinion of the program. The trip log data reported by program participants indicated that most trips were converted from drive alone to bus (40%), followed by walking (25%). Overall, program participants reduced their drive alone trips by 24%.

In addition to program participant evaluation, two telephone surveys were conducted (pre- and post- program) to survey program area residents that were potentially exposed to the community outreach and marketing. Significant changes in communitywide attitudes were found between the pre-program and post-program surveys. One third of the post-program survey respondents were aware of the In Motion program. Those aware of the program found they could use transportation alternatives most of the time (50% compared with 30% of those not aware). The program also changed people's perceptions about perceived barriers to using alternative transportation modes. Fifty percent of pre-program survey respondents reported that they could bus, bike, or walk more than they currently do, while 69% percent of post-program survey respondents reported that they could bus, bike, or walk more than they currently do. The In Motion program was successful in educating individuals in the community about their travel options and motivating them to try

alternative ways of travel. This program can be replicated and tailored to many types of communities.

Survey of Travelers – Taipei, Taiwan

In this study, the level of satisfaction towards the existing TDM strategies for road users in Taipei City was explored, and the level of acceptance for strategies not yet implemented was analyzed (Jou, Chen, & Chen, 2011). A total of 600 paper and pencil survey questionnaires were issued in front of buildings located in the central business area in Taipei and 309 were completed. The questionnaires included questions about socioeconomic characteristics, trip types (commuting, shopping, and leisure), and six TDM strategies. A stated choice experiment was also included to capture the traveler's choice behavior under different scenarios of TDM strategies.

The six TDM strategies included strategies that were currently implemented at the time of the survey (strategies 1–3) and unimplemented strategies (strategies 4–6). The respondents rated each strategy on a scale of 1-5 (5 = very satisfied, 3 = neutral, 1 = very dissatisfied). The strategies presented are outline below.

(1) The cost of using public transportation modes is lowered by integrating the systems of easy-travel cards and providing a two-way discount when transferring between different public transportation modes. A two-way discount refers to when a passenger transfers his (her) transportation modes from a bus to MRT system and vice versa in the travel process, he (she) can enjoy a cost discount of the second mode by using the easy-travel card.
(2) The convenience of using public transportation modes is increased by setting up bus exclusive lanes and constructing a bus transfer network.
(3) The cost of using private transportation modes is increased by increasing the parking cost of private automobiles, thereby lowering the travelers' willingness to drive an automobile.
(4) Tolled parking areas of motorcycles are expanded by imposing a parking fee on motorcycles to decrease motorcycle use.
(5) Congestion road pricing is utilized to increase the travel cost of private transportation modes.
(6) Carpooling is encouraged by setting up an HOV lane, and requesting companies to help their employees find carpool partners. As for shopping and leisure trips, the supply of priority parking space for high occupant vehicles is the main focus.

Two general TDM strategies are demonstrated above, one is incentive strategies known as Carrots and the other is disincentive strategies known as Sticks. The satisfaction of the already implemented Carrots (strategies 1 and 2) was higher than the implemented Sticks (strategy 3). As for the unimplemented strategies, Carrots (strategy 6) were found to be more acceptable than the Sticks (strategies 4 and 5). The study also found that for the three different trip types (commuting, shopping, and leisure) there is no significant difference in satisfaction towards strategies 1-3. In terms of degrees of acceptance for strategies 4-6 (unimplemented), there were significant differences between strategies 4 and 6 but no significant difference between strategy 5 and the three trip purposes.

Commute Trip Reduction (CTR) Performance Grant Program – State of Washington

Perhaps one of the most innovative approaches for applying financial incentives for influencing travel behavior was the Washington State DOT Commute Trip Reduction (CTR) Performance Grant Program. In 2003, WSDOT began testing whether the department could gain transportation capacity by purchasing the removal of single occupant vehicle (SOV) trips. TRPP funds were awarded on a competitive basis to entrepreneurs, private employers, public agencies, nonprofit organizations, developers and property managers who provided financial incentives to commuters for using alternatives to driving alone. WSDOT grantees were awarded funds on the basis of the number of SOV trips their programs eliminated. The award amount was determined on the basis of a trip price bid by the contracted organization. This monetary value of an avoided trip was multiplied by the number of trips that the project was forecasted to remove. The grantee proposed the actual prices, up to a maximum amount set by WSDOT. In the first round, WSDOT set the maximum annualized trip reduction price at $460.

Selected grantees were guaranteed up to 50 percent of the award during the grant period to cover start-up costs. The balance of the award was based on performance. Performance was determined by before-and-after surveys of employees' commute patterns. The remainder was awarded on the basis of the number of trips the grantee succeeded in reducing. If the grantee removed 100 percent of the estimated trips, the organization received the full award. If the grantee removed only 65 percent of the trips, the organization received 65 percent of the award. However, if they exceeded 100 percent of the estimated trips, the organization could receive even more (within budget limitations). The final program results exceeded the trip reduction goal by 27%. WSDOT paid over $1 million, which includes $210,595 in bonuses for 4,379 reduced vehicle commute trips. The average price per reduced trip (annualized) was $233 (Washington State Department of Transportation, 2007).

Pool Rewards – Metropolitan Washington, DC

Pool Rewards is a cash for commuters type program available through the Metropolitan Washington Council of Government's Commuter Connections program. It is designed to encourage current drive alone commuters to start carpooling and vanpooling. New vanpool groups of seven or more commuters may qualify for a $200 monthly 'Pool Rewards' subsidy. If a SOV commuter starts or joins a new carpool, each carpool member can earn $2 per day ($1 each way) for each day they carpool to work over a consecutive 90-day period. The maximum incentive for the 90-day trial period is $130. Carpools must consist of two or more people.

Startup – Tampa, FL

The Startup 275 program provides individual and team financial incentives for carpooling as part of a traffic mitigation strategy during a major reconstruction project. A local radio station is giving away $10k to fund an idea generated by a carpool team. The idea can be something to benefit the community, the environment or education. According to Tampa Bay Area Regional Transportation Authority (TBARTA), the idea can be a small business, a short film, or the next big app. This program runs through the end of 2013 and the winning

idea will be selected by the public via the website (www.startup275.com). The first 500 active carpoolers can earn a $25 Visa® Gift Card each month.

Chapter 3 Web-Based Survey

Survey and Sampling

After a comprehensive literature review on various commuter incentive programs in TDM, it was determined that there is a great potential to improve the role of financial incentives in TDM. Prior to the actual pilot test with different incentive schemes, a Web-based survey was developed and conducted. The survey aimed to collect information related to the mode choice behavior of commuters in Florida and measure the feasibility of adopting non-SOV options, including telecommuting. As it can be seen in Figure 3-1, a survey website (www.idriveless.com) was developed and launched in December 2012. Potential respondents who owned at least one registered vehicle in Florida were invited by email to participate.

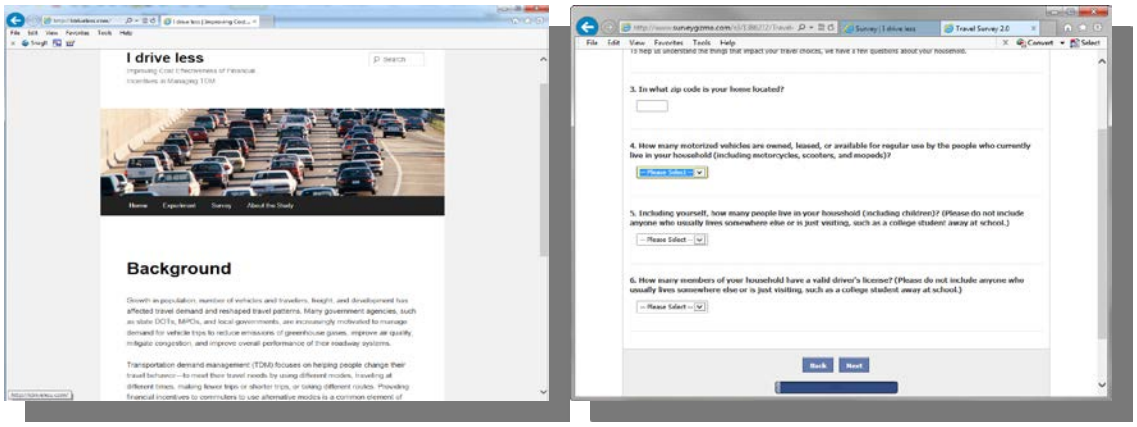


Figure 3-1 Survey website, www.idriveless.com

The survey sampling was done primarily in densely populated areas in Florida, including Broward County (Fort Lauderdale), Duval County (Jacksonville), Hillsborough County (Tampa), and Miami-Dade County (Miami). It was assumed that commuters in these geographic locations were likely to have access to alternate transportation options, including public transit. Table 3-1 shows the walk/transit score of the selected cities in Florida and other comparable cities.

Table 3-1 Walk/Transit Score of Cities in Florida

City	State	Walk Score	Transit Score	Bike Score	Population
New York	NY	85.3	80.8	62.3	8,175,133
Minneapolis	MN	69.3	68.8	78.5	382,578
Pittsburgh	PA	64.1	54.9	38.5	305,215
Miami	FL	72.5	57.1	56.4	399,457
Tampa	FL	51.1	30.8	51.0	355,709
Jacksonville	FL	32.6	NA	NA	821,784
Orlando	FL	47.0	NA	52.0	243,195

source: www.walkscore.com

A total of 50,769 registered vehicle owners were invited to participate in the survey, and 654 complete responses were obtained. In addition, 377 partial responses were obtained, and 194 survey takers were disqualified because their employment/student status was retired, unemployed, or stay-at-home (excluded because the survey's aim was to collect information regarding commuting). All complete and partial responses were including in the data analysis. Figure 3-2 shows the mapped location of individual response in Florida.

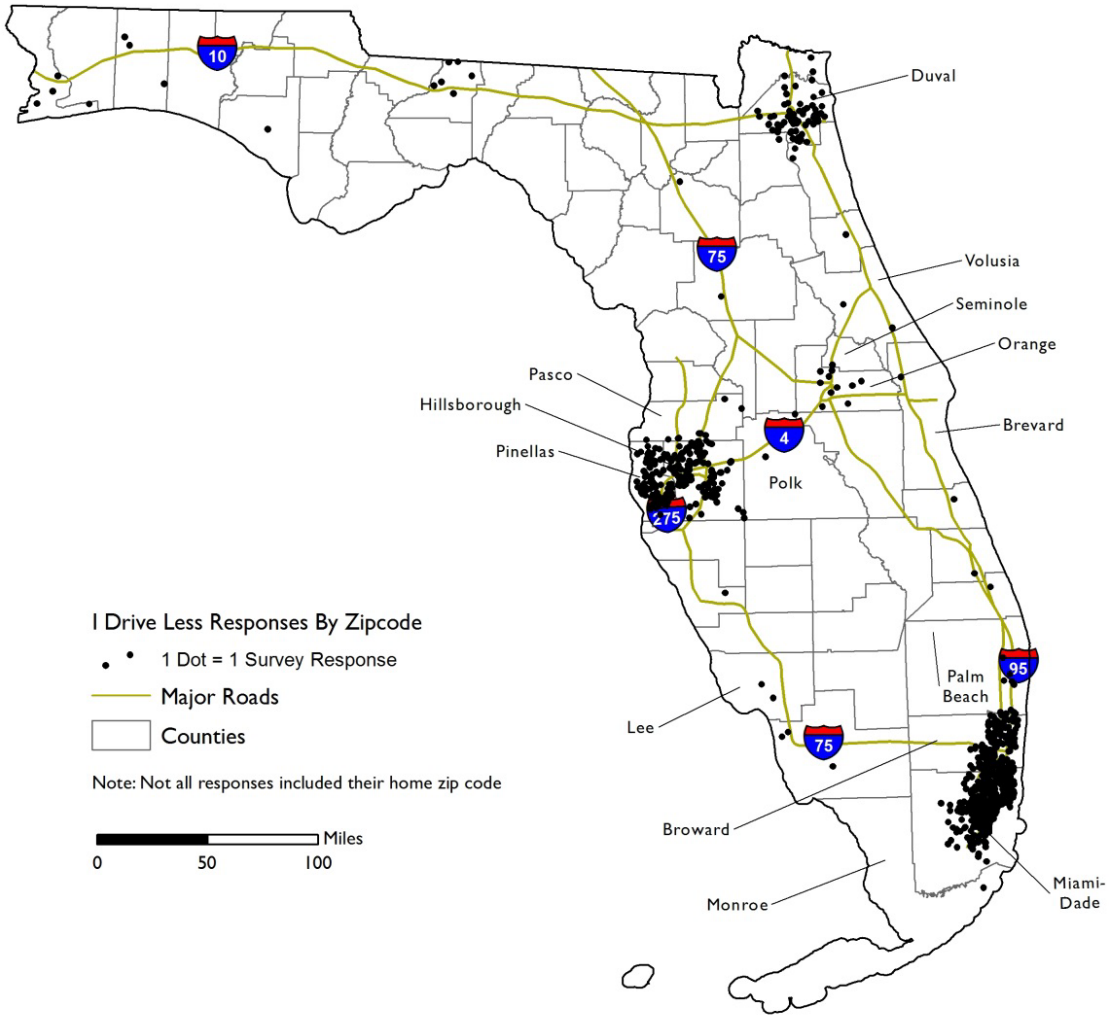


Figure 3-2 Geocoded location of survey responses

Respondent Demographics

As it can be seen in Figure 3-3, nearly 80 percent of respondents reported being employed by an employer. Other respondents were self-employed, both employed and a student, or student only. These groups were included in the survey because they all potentially have regular commuting needs. Individuals who reported being retired, stay-at-home, and unemployed were not eligible to participate in the survey.

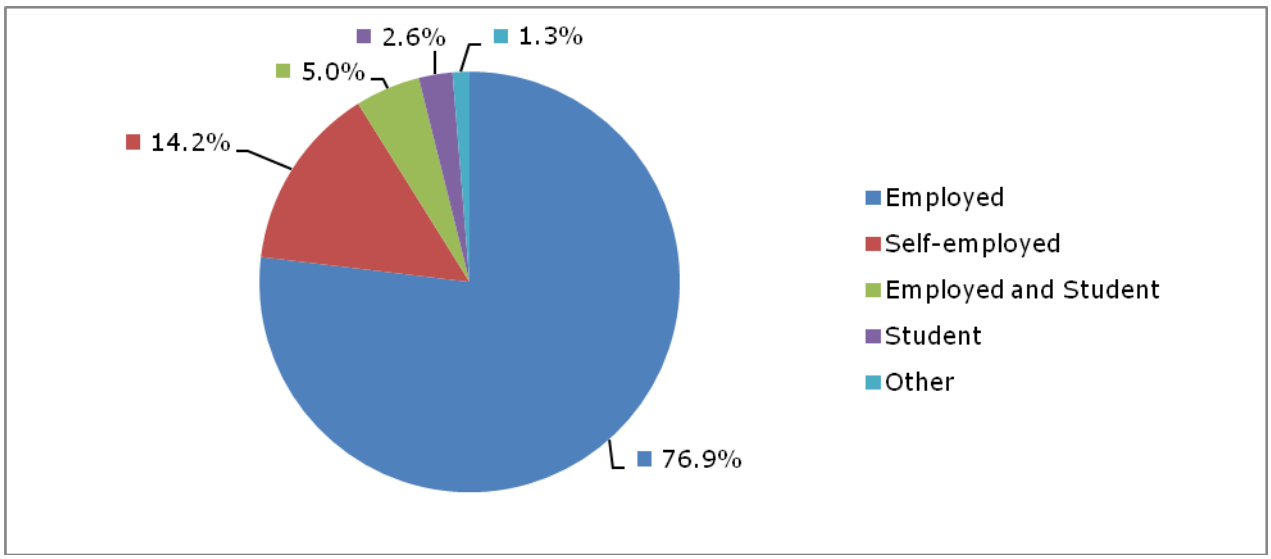


Figure 3-3 Employment status of respondents

Survey participants were required to be at least age 18 to take the survey. The age distribution of respondents is presented in Figure 3-4. The majority of respondents were between the ages of 25 and 64. The gender distribution of respondents was 50.4 percent male, 49.0 percent female, and 0.6 percent refused to participate.

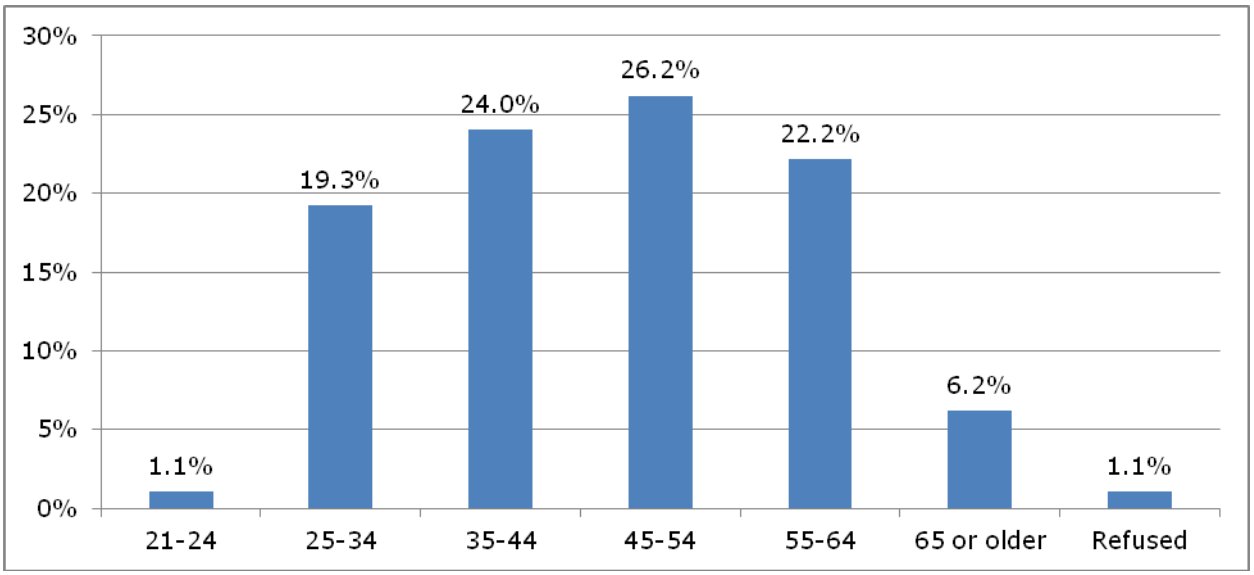


Figure 3-4 Respondent age distribution

Previous research has shown income plays a role in travel behavior. National Household Travel Survey (NHTS) data show walking and the use of public transportation decline for travelers with higher household income (Florida Department of Transportation, 2013). Figure 3-5 shows the income of respondents.

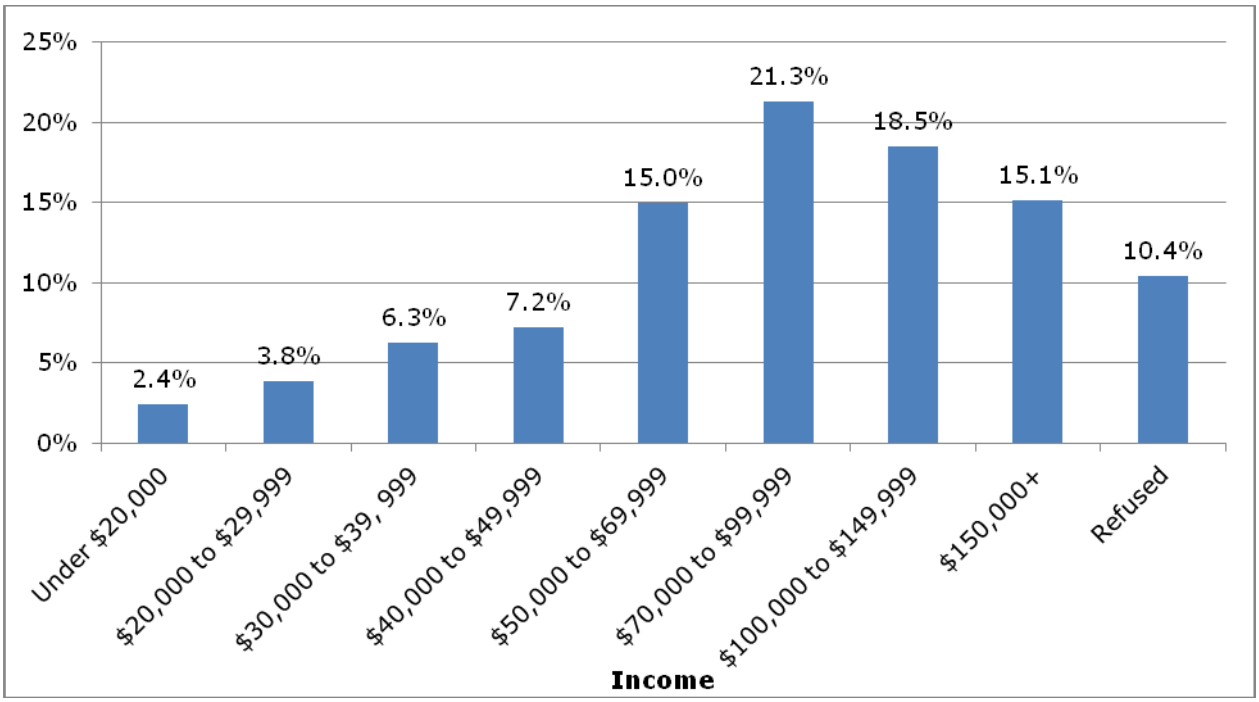


Figure 3-5 Respondent income

Vehicle Ownership and Commuting Distance

The ratio of the number of vehicles to number of persons in a household is important for TDM. In general, higher ratios correspond to higher SOV commuting. The survey collected this information with three questions:

1. How many motorized vehicles are owned, leased, or available for regular use by the people who currently live in your household (including motorcycles, scooters, and mopeds)?

2. Including yourself, how many people live in your household (including children)? (Please do not include anyone who usually lives somewhere else or is just visiting, such as a college student away at school.)

3. How many members of your household have a valid driver's license? (Please do not include anyone who usually lives somewhere else or is just visiting, such as a college student away at school.)

As it can be seen Table 3-2, the number of people with a valid driver license and the number of available vehicles per household are highly correlated, with a Spearman Correlation value of 0.705. Nearly 18.4 percent of respondents (green cells) indicated that they have more than one vehicle per licensed driver, while 68.9 percent of respondents

(yellow cells) have one vehicle per licensed driver. In other words, a total of 87.2 percent of respondents have a vehicle to drive to work.

Table 3-2 Number of Vehicles and People with Valid Driver License

Number of Available Vehicles	Number of People with a Valid Driver License								
	1	*2*	*3*	*4*	*5*	*6*	*9*	*10+*	*Total*
0	4						1		5
1	156	51	3	1					211
2	25	394	35	5	1				460
3	5	80	86	15	1	1			188
4	0	22	23	28	2	1			76
5	2	9	7	5	4	2		1	30
Total	192	556	154	54	8	4	1	1	970

As can be seen in Figure 3-6, the average distance of a one-way commute trip was 16.55 miles. About 25 percent of respondents stated that their commuting distance was less than 6 miles one-way, and 25 percent of respondents stated that their commuting distance is more than 20 miles one-way.

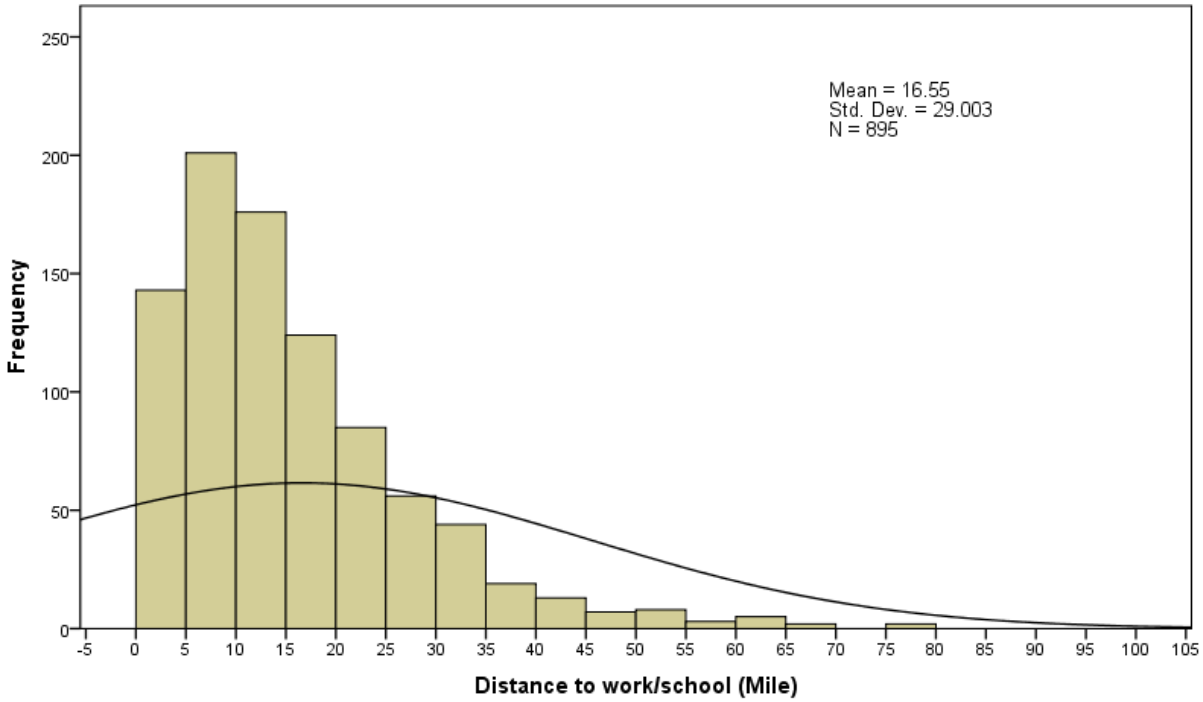


Figure 3-6 Histogram of commuting distance

Table 3-3 shows the cumulative percentage of the stated travel time and corresponding average commuting distance for each category. Approximately 25 percent of respondents stated that their commuting time is 15 minutes or less, and 10 percent have commutes longer than 50 minutes.

Table 3-3 Commuting Time and Average Distance

Travel Time (min)	Cumulative Percentage	Average Distance (mi)
Less than 5	4%	1.5
5 – 10	13%	3.6
11 – 15	25%	11.5
16 - 20	40%	9.8
21 – 25	52%	12.2
26 – 30	64%	18.7
31 – 35	70%	17.7
36 – 40	78%	19.9
41 – 45	85%	20.9
46 – 50	90%	26.9
51 – 55	92%	31.1
56 – 60	96%	32
More than 60	100%	58.4

Carpooling

Only a small percentage of respondents (3.8%) reported that they were currently in a carpool for their commute. This percentage closely matches the most recent NHTS work-related carpool statistic for Florida (Florida Department of Transportation, 2013). A large percentage of respondents have not considered carpooling for their commute in the past 12 months.

As it can be seen in Table 3-4, 85.4 percent of respondents (red cells) stated that in the past 30 days, they either had little consideration for carpooling or did not consider carpooling at all for their commute.

Table 3-4 Carpool Participation vs. Consideration

	Frequency	To what extent have you considered carpooling for your commute in the past 12 months (not including with family members)?					
		I am currently in a carpool	*I have not considered it*	*Small extent*	*Some extent*	*Very great extent*	*Total*
In the past 30 days, how often did you carpool for your commute (not including with family members)?	Not at all	0	602	107	39	14	762
	Rarely/ Sometimes	4	23	16	19	3	65
	1 or 2 days per week	6	3	2	4	5	20
	3 or 4 days per week	7	1	1	2	4	15
	5 days per week	10	1	0	1	1	14
Total		27	630	126	65	27	875

It is important to understand commuters' reasons for not considering carpooling as an option. For some, obligations such as dropping off and/or picking up a child at school may restrict carpooling availability. The observed trend of carpool consideration among

commuters who are involved in school drop off/pick up is mixed. It is interesting to note that people who drop off/pick up a child everyday showed a rather higher interest in carpooling than those who do the same task on only a few days per week.

Table 3-5 School Drop-off/Pick-up vs. Carpool Consideration

School Drop-off/ Pick-up Frequency	Carpool Consideration					
	I am currently in a carpool	*Very great extent*	*Some extent*	*Small extent*	*I haven't considered it*	*Total*
Not at all	3.9%	2.4%	6.6%	17.8%	69.2%	100.0% (409)
Rarely/Sometimes	3.0%	3.0%	12.1%	21.2%	57.6%	100.0% (33)
1 or 2 days per week	0.0%	0.0%	7.7%	11.5%	80.8%	100.0% (26)
3 or 4 days per week	3.7%	0.0%	11.1%	7.4%	77.8%	100.0% (27)
5 days per week	3.7%	6.5%	8.3%	13.9%	67.6%	100.0% (108)

Respondents who considered carpooling only to a small extent or did not consider it at all were asked to indicate the reasons why they do not carpool for their commute. The top reasons given are as follows:

- I need my car to reach multiple destinations. (36%)
- I need my car in the case of an emergency. (18%)
- I cannot find a carpool partner. (16%)
- Carpooling adds too much inconvenience to my commute. (16%)
- I like the privacy of driving alone. (14%)

However, it is notable that there is a slight difference in reasons between commuters who have not considered carpooling and commuters who have at least considered it. As can be seen in Table 3-6, both groups stated that they need a car to reach multiple destinations. However, “I cannot find a carpool partner” is the second most cited reason for the group that stated that they had at least considered carpooling. This indicates that finding a carpool partner could potentially be a barrier for carpooling.

Table 3-6 Reasons Not in Carpool vs. Carpool Consideration

Reason	Carpool Consideration	
	I haven't considered it (771)	*Small extent (157)*
I need my car to reach multiple destinations.	39.8%	33.1%
I cannot find a carpool partner.	12.6%	24.2%
Carpooling adds too much inconvenience to my commute.	13.2%	17.8%
I need my car in the case of an emergency.	17.8%	14.6%
I like the privacy of driving alone.	16.6%	10.2%

Respondents were asked to rank five options in the order that would make carpooling a more appealing option. No significant difference was observed among respondents with different levels of carpool consideration. As can be seen in Table 3-7, "Guaranteed ride home (GRH) in case of emergency" and "Financial incentives (ex. gift card)" received a higher ranking, on average.

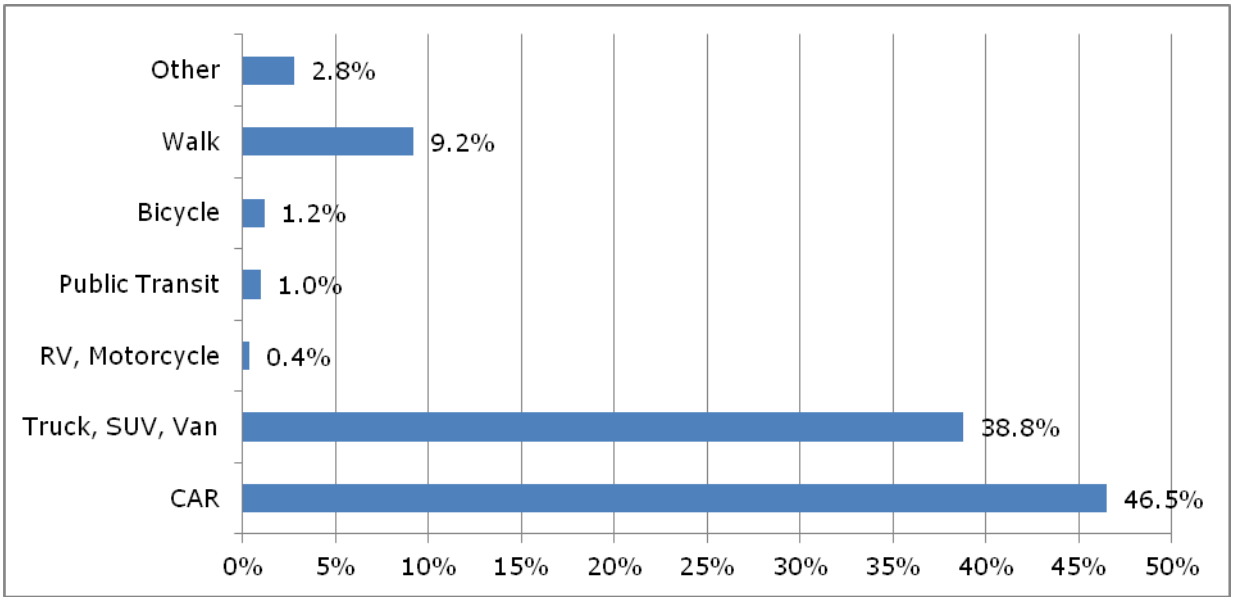
Table 3-7 Programs to Make Carpooling More Appealing vs. Carpool Consideration

Program	Carpool Consideration					
	I am currently in a carpool	*I haven't considered it*	*Small extent*	*Some extent*	*Very great extent*	*Average*
Reduced cost of parking permits	3.8	3.7	4.1	3.9	3.0	3.7
Reserved parking spaces for carpoolers	3.3	3.5	3.3	2.6	3.3	3.2
Free assistance finding other carpoolers	3.4	3.1	2.7	2.7	3.3	3.0
Guaranteed ride home (GRH) in case of emergency	2.3	2.2	2.1	1.9	2.8	2.3
Financial incentives (ex. gift card)	2.1	2.3	2.1	2.8	2.8	2.4

(1 = most appealing, 5 = least appealing)

Public Transit

According to the survey, only 3.6 percent of respondents stated that they used public transit to commute at least one day per week in the past 30 days. As it can be seen in Figure 3-7, public transit represents 1.0 percent of mode share in Florida.



source: 2009 NHTS

Figure 3-7 Florida mode share

Table 3-8 shows that in the past 30 days, 80.1 percent of respondents (red cells) had little or no consideration of public transit for their commute. Nearly 14.4 percent of respondents (green cells) indicated that they had not used public transit, but would consider it in some extent or to a very great extent.

Table 3-8 Current Use of Public Transit vs. Public Transit Consideration

	Frequency	To what extent have you considered using public transit (bus, rail) for your commute in the past 12 months?					
		I currently use public transit	***I haven't considered it***	***Small extent***	***Some extent***	***Very great extent***	***Total***
How often did you use public transit (bus, rail) for your commute in the past 30 days**?**	Not at all	3	500	108	52	28	691
	Rarely/ Sometimes	2	25	32	23	17	99
	1 or 2 days per week	4	1		1	4	10
	3 or 4 days per week	6				1	7
	5 days per week	20	1			2	23
	Total	35	527	140	76	52	830

As can be seen in Table 3-9, three major reasons for commuters not to take public transit are (1) increase of commute time, (2) no reasonable access to transit service, and (3) the need of reaching multiple locations. The availability to reach multiple locations is still an important concern for commuters, but the increase of travel time or the availability of public transit is even more critical reason preventing commuters from considering public transit as an option.

Table 3-9 Reasons Respondents Did Not Take Public Transit

Primary Reason	Percentage
It would increase my commute time significantly.	26%
I do not have access to the transit system from my home.	20%
I need my car to reach multiple destinations.	18%
I need my car in the case of an emergency.	9%
I am concerned that public transit is unreliable.	9%
I am responsible for taking my child to school.	7%
I like the privacy of driving alone.	6%
I am unfamiliar with the public transit system.	4%

Table 3-10 shows that improving travel time of public transit is the best way to make public transit more appealing to commuters, followed by a Guaranteed Ride Home (GRH) program and financial incentives.

Table 3-10 Programs That Would Make Public Transit More Appealing

Program	Percentage
Commute time similar to or better than my personal vehicle	31%
Guaranteed ride home(GRH) in case of emergency	13%
Financial incentives (ex. gift card)	13%
Providing real-time arrival information	11%
Increase in gas prices	11%
Free transit vouchers	10%
Receiving better information about available transit service and schedule	9%
Increase in the cost of parking	2%

It is notable that respondents agreed that financial incentives can make both carpool and public transit more appealing to commuters, but some systematic improvements are also critical such as a better travel time of public transit and GRH in case of emergency. As for public transit, it seems that simply a better outreach effort could result the improvement of ridership. Respondents were asked how far (in miles) the closest transit stop (bus or rail) is to their home. Only 9.9 percent of respondents have a transit stop within one half mile of their home. It is interesting to note that 54.9 percent of respondents did not know how far the closest transit stop was to their home.

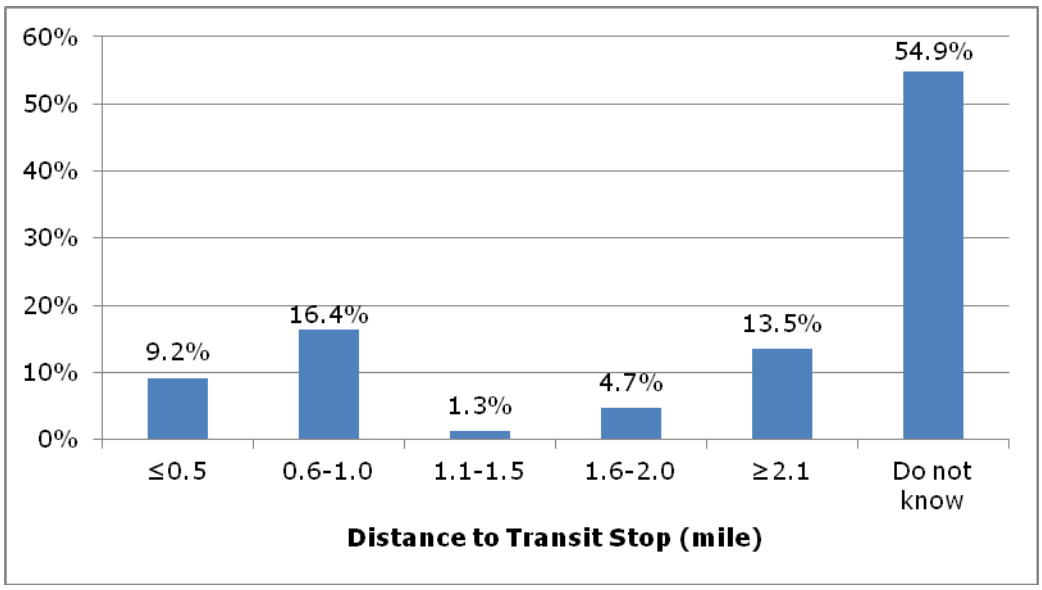


Figure 3-8 Distance to closest transit stop

Telecommuting

After carpool and public transit questions, the survey asked about telecommuting. In this survey, telecommuters were defined as "wage and salary employees who at least occasionally work at home or at a telework or satellite center during an entire work day,

instead of traveling to their regular work place." Table 3-11 shows that 12.7 percent of respondents identified themselves as regular telecommuters who telecommute at least one day per week. A total of 57.1 percent of respondents indicated that they never telecommute. Major reasons that they never telecommute are "Not feasible due to the type of work" (65%) and "Employer's policy" (25%).

Table 3-11 Telecommuting Experience

How often do you usually telecommute?	Percent
3 or more days a week	6.8%
2 days a week	2.7%
1 day a week	3.2%
1–3 times a month	8.9%
Less than one time per month/only in emergencies (e.g., sick child, weather)	6.3%
Occasionally for a special project	12.5%
Other (specify)	2.4%
I never telecommute	57.1%

Vehicle Miles Traveled (VMT)

The analysis of questions related to carpools, public transit, and telecommuting revealed the difficulty of mode shifting in Florida. A study demonstrated that individuals make their residential choice consistent with their lifestyle and transportation preferences (Pinjari, Pendyala, Bhat, & Waddell, 2007). In other words, people decide where to live with consideration of commuting modes. Therefore, it is challenging to ask people to shift their mode or choose non-SOV options when they have already selected their place to live.

The survey also asked about Vehicle Mile Traveled (VMT). Figure 3-9 shows the estimated VMT of respondents. About 60 percent of respondents stated that their estimated mileage for the past 30 days is less than 600 miles. According to the 2009 NHTS, average VMT for a household is 19,850 miles per year, and the average number of persons per household in this survey is 2.1.

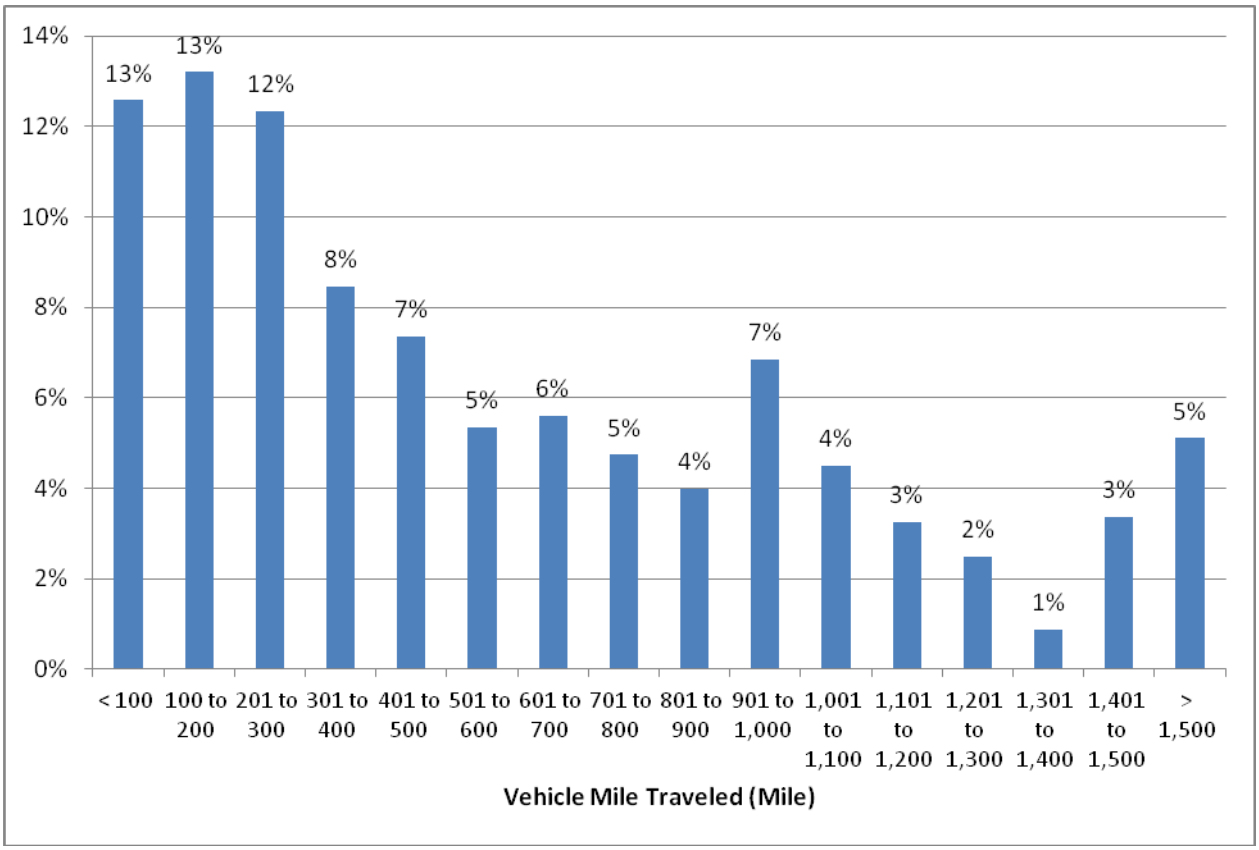


Figure 3-9 VMT distribution of respondents

One of the primary objectives of any TDM program is to reduce SOV VMT. To gauge respondents' ability to reduce their VMT, they were asked how much VMT they estimate they could save per month if needed. As expected, a large percentage of respondents stated that they probably could not reduce their monthly VMT. However, some respondents reported that they could reduce their monthly VMT by as much as 151 miles or more. This demonstrates that a small percentage of commuters have the ability to reduce their monthly VMT. In addition, it is assumed that commuters who expressed an ability to reduce their VMT are not free riders. Free riders would most likely not be able to reduce their monthly VMT beyond current levels because they are already using alternative modes.

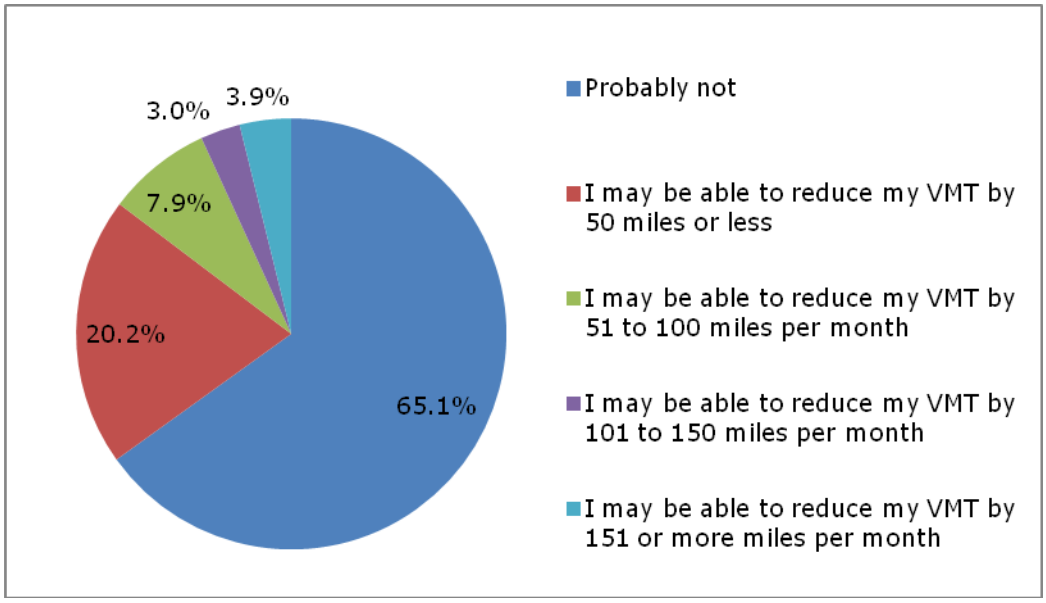


Figure 3-10 Ability to reduce VMT

Overall, about 65 percent of respondents stated that they probably cannot reduce their VMT. It is expected that people who drive very few miles would not be able to further reduce their VMT. On the other end of the spectrum, people who drive a lot may need to drive for business or some other purpose, and therefore may not be able to reduce their VMT.

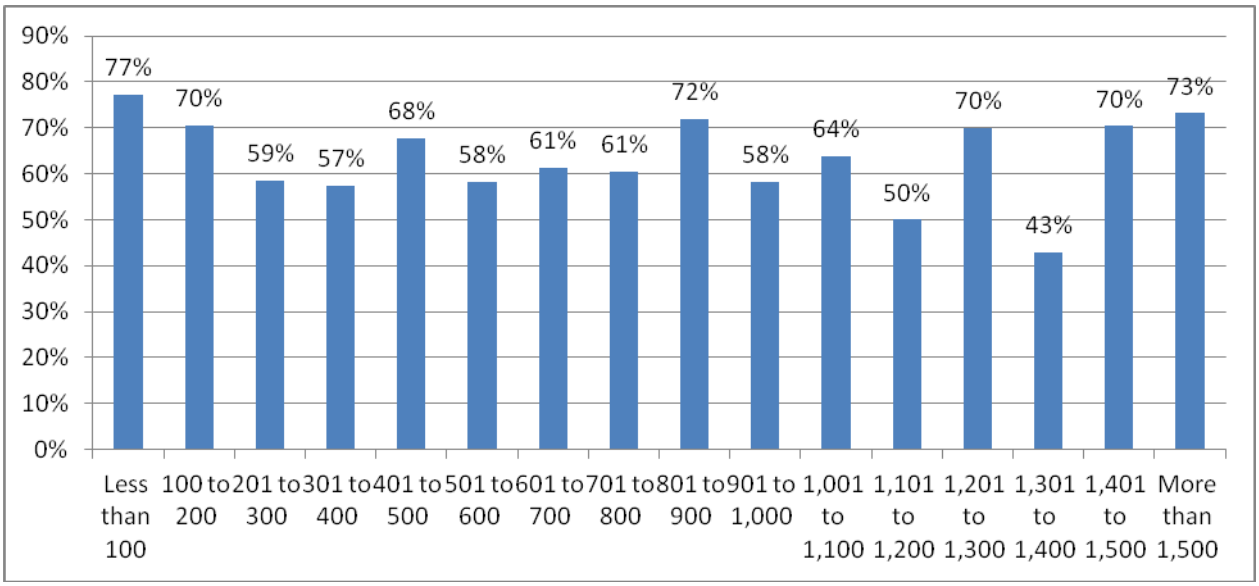


Figure 3-11 "Probably not" responses by monthly VMT

Respondents also were asked if they thought they could reduce their VMT more, the same, or less than their peers with similar household characteristics living in the same area. Almost 20 percent of respondents (18.9%) stated that they can reduce their VMT more than their peers. Feedback regarding what would enable them to reduce VMT was requested, and respondents provided various strategies including carpool, telecommute, walk, bike, combine trips, more efficient routes, and reduce leisure trips. Respondents who stated that they can reduce their VMT less than their peers (34.9%) attributed their inability to reduce their VMT primarily to work-related reasons or the fact that they already have low VMT.

Incentive Framing

The stated preference survey included a hypothetical incentive experiment to gauge respondents' behavioral responses to various financial incentive options to encourage VMT reduction. In the experiment, financial incentives were offered in varying framing schemes for engaging in the following strategies to curb SOV use:

- Reduce VMT (Program A) – Cash-reward program for VMT savings; participants offered $5 for every 20 miles saved on vehicle mileage up to $100 in next 30 days
- Bike or Walk (Program B) – Cash-reward program for biking or walking to work and/or school; participants offered $5 for every day they bike or walk, up to $100 in next 30 days.
- Public Transit (Program C) – Cash-reward program for commuting via public transit; participants offered $5 for every day they commute by transit, up to $100 in next 30 days.
- Carpool (Program D) – Cash-reward program for carpooling; participants offered $5 for every day they carpooled, up to $100 in next 30 days.

Participants were asked which program is the most feasible and desirable for them to participate in, considering their current commuting options and circumstance. The percentage of respondents who expressed interest in each program is presented in Table 3-12. As can be seen, 36 percent of respondents stated that they liked Program A, which aims to provide a financial incentive for reduced VMT instead of providing a financial incentive for the use of a specific alternate mode. Note that 25.8 percent of respondents were not interested in any of these TDM programs.

Table 3-12 Preferred TDM Program

TDM Program	Count	Percent
Program A ($5 for every 20 miles saved)	261	36.0%
Program B ($5 for every day biked or walked)	79	10.9%
Program C ($5 for every day public transit taken)	83	11.4%
Program D ($5 for every day carpooled)	116	16.0%
None of the above	187	25.8%
Total	726	100.0%

Depending upon which program respondents selected, they were directed to questions specific to their preferred program presented in the following framing schemes with varying incentives:

- Retroactive Payment (1): Receive payment for mileage saved or SOV trips saved at end of period.
- Advance Payment with Commitment (2): Commit to number of miles to be saved on VMT or SOV trips saved and receive lump sum payment. At end of period, if commitment not met, entire lump sum payment must be returned.
- Lottery Payment (3): At end of period, receive one lottery ticket for each day a non-SOV mode used or amount of VMT saved; tickets are entered into a drawing.

Each program (A, B, C, D) was presented with each framing scheme (1, 2, 3). The questions and results for each program and framing scheme are presented on the following pages. If respondents indicated that they were not interested in any of the programs, they bypassed all framing scheme questions.

Reduce VMT: Program A

Assume that your employer or the government is offering you a financial incentive in regards to your daily commute. You will be paid differently based on your choice. You must choose one of two offered financial incentives (Scheme A and Scheme B). Please read each incentive scheme carefully, and let us know which you prefer.

- **Incentive Scheme A (Retroactive Payment)** – Over a 30-day period, you are offered $5 for every 20 miles you save on your typical monthly vehicle miles traveled (VMT). At the end of the 30-day period, you will receive $5 for every 20 miles you saved, up to $100.
- **A1: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of miles you will save on your typical monthly VMT and receive an instant lump sum payment of $5 for every

20 miles you committed to save, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **A2: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of miles you will save on your typical monthly VMT and receive an instant lump sum payment of $10 for every 20 miles you committed to save, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **A3: Incentive Scheme B (Lottery)** – At the end of a 30-day period, you will receive 1 lottery ticket for every 20 miles you saved on your typical monthly VMT. You can earn up to 20 tickets over the 30-day period, and the tickets will be used to enter a drawing for $1,000. Each ticket has 1/200 or higher chance to win, depending on the number of tickets entered into the drawing. For example, if you earn 20 tickets, you will have a 1/10 or higher chance to win $1,000.

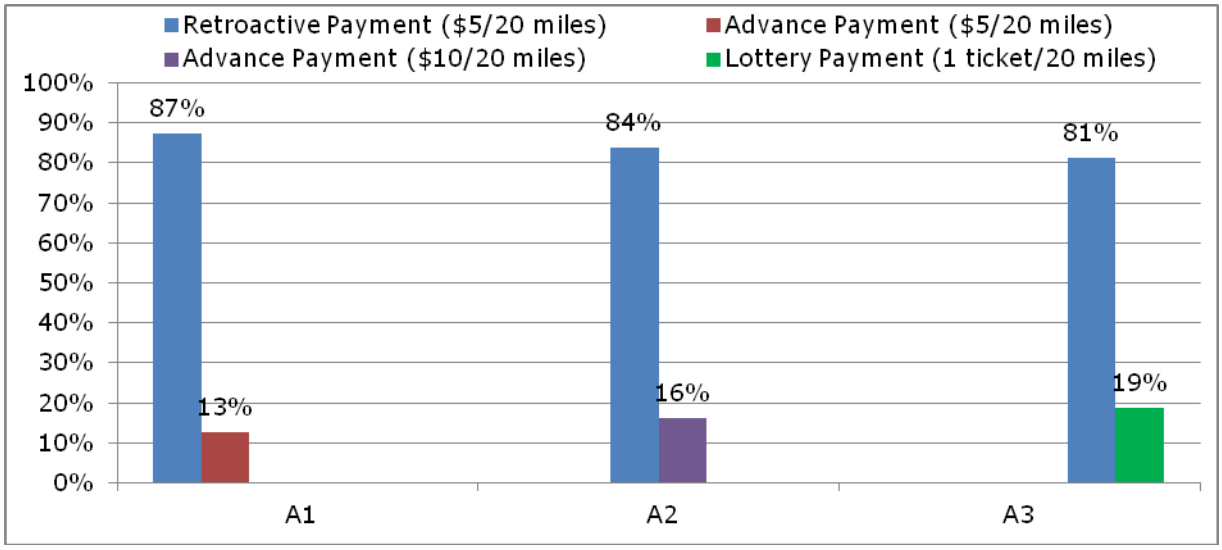


Figure 3-12 VMT savings for incentive by scheme

Bike or Walk: Program B

Assume that your employer or the government is offering you a financial incentive in regards to your daily commute. You will be paid differently based on your choice. You must choose one of two offered financial incentives (Scheme A and Scheme B). Please read each incentive scheme carefully and let us know which you prefer.

- **Incentive Scheme A (Retroactive Payment)** – Over a 30-day period, you are offered $5 for every day you bike or walk to work and/or school. At the end of the 30-day period, you will receive $5 times the number of days you biked or walked, up to $100.

- **B1: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will bike or walk to work and/or school and receive an instant lump sum payment of $5 times the number of days you committed to bike or walk, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **B2: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will bike or walk to work and/or school and receive an instant lump sum payment of $10 times the number of days you committed to bike or walk, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **B3: Incentive Scheme B (Lottery)** – At the end of a 30-day period, you will receive 1 lottery ticket times the number of days you biked or walked to work and/or school. You can earn up to 20 tickets over the 30-day period, and the tickets will be used to enter a drawing for $1,000. Each ticket has 1/200 or higher chance to win, depending on the number of tickets entered into the drawing. For example, if you earn 20 tickets, you will have a 1/10 or higher chance to win $1,000.

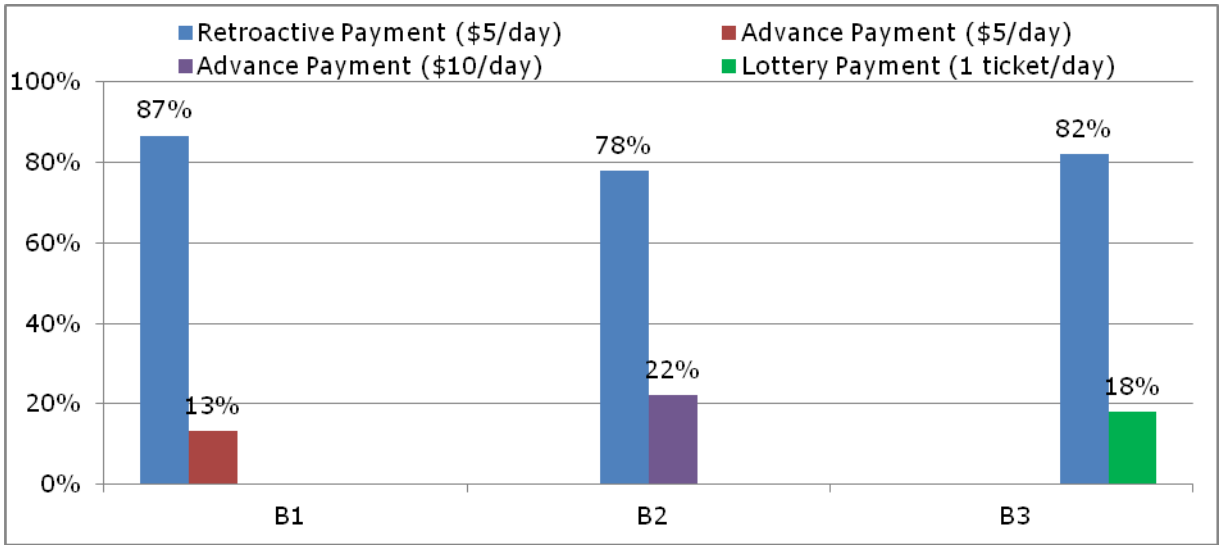


Figure 3-13 Bike or walk for incentive by scheme

Public Transit: Program C

Assume that your employer or the government is offering you a financial incentive in regards to your daily commute. You will be paid differently based on your choice. You must choose one of two offered financial incentives (Scheme A and Scheme B). Please read each incentive scheme carefully and let us know which you prefer.

- **Incentive Scheme A (Retroactive Payment)**: Over a 30-day period, you are offered $5 for every day you take public transit. At the end of the 30-day period, you will receive $5 times the number of days you took public transit.

- **C1: Incentive Scheme C (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will take public transit and receive an instant lump sum payment of $5 times the number of days you committed to take public transit. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **C2: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will take public transit and receive an instant lump sum payment of $10 times the number of days you committed to take public transit. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **C3: Incentive Scheme B (Lottery)** – At the end of a 30-day period, you will receive 1 lottery ticket times the number of days you took public transit to work and/or school. You can earn up to 20 tickets over the 30-day period, and the tickets will be used to enter a drawing for $1,000. Each ticket has 1/200 or higher chance to win, depending on the number of tickets entered into the drawing. For example, if you earn 20 tickets, you will have a 1/10 or higher chance to win $1,000.

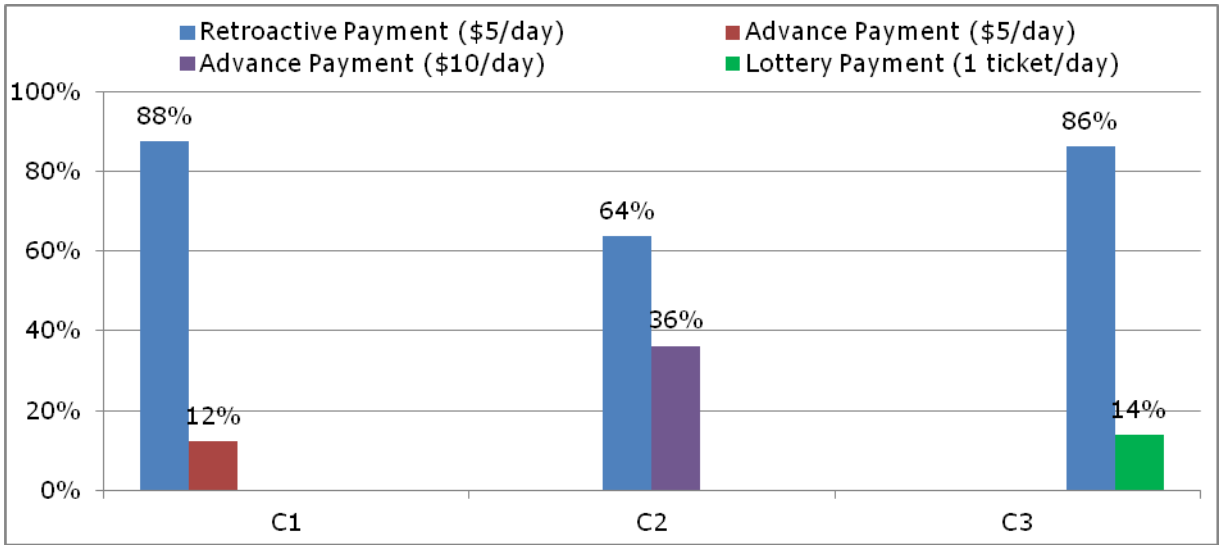


Figure 3-14 Public transit for incentive by scheme

Carpool: Program D

Assume that your employer or the government is offering you a financial incentive in regards to your daily commute. You will be paid differently based on your choice. You must

choose one of two offered financial incentives (Scheme A and Scheme B). Please read each incentive scheme carefully and let us know which you prefer.

- **Incentive Scheme A (Retroactive Payment)** – Over a 30-day period, you are offered $5 for every day you carpool. At the end of the 30-day period, you will receive $5 times the number of days you carpooled up to $100.

- **D1: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will carpool and receive an instant lump sum payment of $5 times the number of days you committed to carpool, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **D2: Incentive Scheme B (Advance Payment with Commitment)** – At the beginning of a 30-day period, you commit to the number of days you will carpool and receive an instant lump sum payment of $10 times the number of days you committed to carpool, up to $100. At the end of the 30-day period, if you do not meet your commitment, you must return the entire lump sum payment.

- **D3: Incentive Scheme B (Lottery)** – At the end of a 30-day period, you will receive 1 lottery ticket times the number of days you carpooled to work and/or school. You can earn up to 20 tickets over the 30-day period and the tickets are used to enter a drawing for $1,000. Each ticket has 1/200 or higher chance to win, depending on the number of tickets entered into the drawing. For example, if you earn 20 tickets, you will have a 1/10 or higher chance to win $1,000.

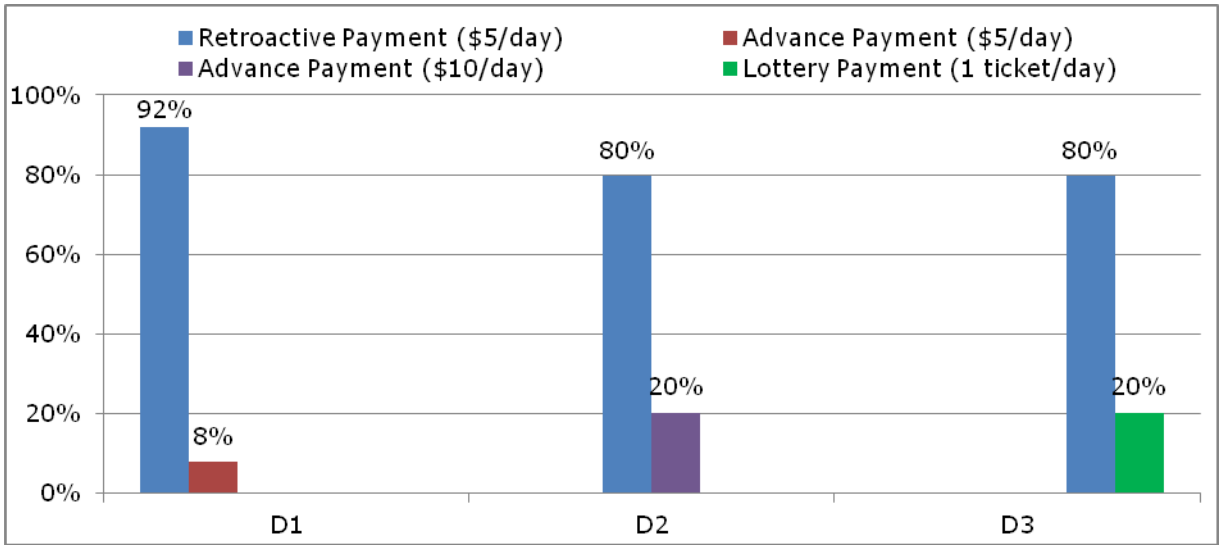


Figure 3-15 Public transit for incentive by scheme

The results presented suggest that people change their preferences based on the framing of the incentives. For all programs, retroactive payment was the preferred payment method across framing schemes. However, preferences were revealed for various schemes across programs. The most significant difference was observed in the carpool program. When

respondents were presented with a $10-per-day advance payment, the percentage of respondents who selected the advance payment over the retroactive payment more than doubled from the $5-per-day advance payment. In addition, it was found that many respondents (25.8%) were not interested in any TDM program. The largest percentage of respondents was interested in the VMT savings TDM program. This suggests that shifting modes is not a realistic option for many respondents, especially where there is limited availability of reasonable alternative transportation. Therefore, VMT savings may be the most efficient TDM option for achieving outcomes such as reductions in traffic congestion and emissions.

Incentive Amount

Once an effective TDM program is selected, it is important to determine a sufficient financial incentive amount. To gauge respondents' required financial incentive amount and to examine behavioral reactions to changes in amount, respondents were asked the following questions:

- In your opinion, what amount of financial incentive must be offered to motivate you to save 10 percent VMT over the next 30 days?
- In your opinion, what amount of financial incentive must be offered to motivate you to save 5 percent VMT over the next 30 days?

It was discovered that a significant number of respondents (240) required the same amount of financial incentive to save 5 percent VMT as they did to save 10 percent VMT. Given that the increase in required financial incentive to increase VMT savings from 5 to 10 percent is impacted by respondents who had a $0 change, the results are presented, both including and excluding those responses. Including them, on average, respondents required $148 to reduce VMT by 10 percent and $115 to reduce VMT by 5 percent. This results in the average required financial incentive to increase by $33 to go from 5 percent VMT reduction to 10 percent. Excluding them, on average, respondents required $141 to reduce VMT by 10 percent and $78 to reduce VMT by 5 percent. This results in the average required financial incentive to increase by $64 to go from 5 percent VMT reduction to 10 percent.

This information is important for determining a sufficient financial incentive amount required to induce the desired VMT savings. For example, if someone drives 10,000 miles per year (about 833 miles per month) and the objective is to reduce their monthly VMT by 10 percent, on average, they would require around $150 per month to do so. This would result in nearly 1,000 VMT savings per year at a cost of $1,800, which demonstrates a financial incentive requirement of $1.80 per mile saved.

Chapter 4 Pilot Test (Idriveless Program)

Pilot Test Design

After analyzing the results of the web-based survey, the study team developed a controlled quasi-experiment including the rules and program guidelines specific to each incentive scheme. The experiment aimed to evaluate the effectiveness of different variants of financial incentives on commuter behavior.

The pilot test was called the "Idriveless" program, and it was designed to provide a certain level of financial reward to people who reduced their VMT compared to their baseline VMT. Table 4-1 shows the payment plan that was adopted in this study. Participant's VMTs were measured every two weeks throughout the study period. After VMT was measured, participants were compensated based on the number of miles they reduced from their baseline VMT. For example, a participant who reduced his/her VMT by 35 miles compared to his/her baseline VMT would receive a $5 incentive payment.

Table 4-1 Payment for VMT Savings

Miles Saved from Baseline VMT	Payment
Reduce VMT by less than 20 miles over baseline	No incentive
Reduce VMT by 20-39 miles over baseline	$5
Reduce VMT by 40-59 miles over baseline	$10
Reduce VMT by 60-79 miles over baseline	$15
Reduce VMT by 80-99 miles over baseline	$20
Reduce VMT by 100-199 miles over baseline	$25
Reduce VMT by 120-139 miles over baseline	$30
Reduce VMT by 140-159 miles over baseline	$35
Reduce VMT by 160 or more miles over baseline	$40

Two incentive schemes were adopted, and participants were randomly assigned to one scheme for the study. Group A was assigned to the "traditional incentive scheme," which provided cash rewards after participants completed and reported their saved VMT. This retroactive payment scheme is a typical financial incentive method in TDM programs. Table 4-2 shows the payment schedule of the study. To establish a baseline, participants were instructed to drive their car as they normally would for two weeks and report their mileage at the beginning and end of that period by submitting a time- and date-stamped picture of their vehicle's odometer. After this initial two-week period (baseline), all participants received $20 following week 2 to compensate them for their time in registering for the study and for providing the baseline VMT information. For each two-week period after that, participants' most recent previous odometer reading was deducted from their latest odometer reading to calculate their two-week mileage. If it was determined that participants met one of the reduction thresholds, they would receive the specified incentive amount via mail. An additional $20 was added to the week 10 payment to attract participants to stay in the study and complete the exit interview in a timely manner.

Table 4-2 Payment Schedule for Idriveless program

Baseline		Study Period						Follow-Up		Maximum Compensation
Wk1	Wk2	Wk3	Wk4	Wk5	Wk6	Wk7	Wk8	Wk9	Wk10	Per Person
$20		Up to $40		Up to $40		Up to $40		($20+$40)		Up to $200

Group B was assigned to the "new incentive scheme," which was designed to provide a financial incentive in advance of VMT savings based on a pre-committed VMT reduction. If participants were unable to meet the VMT savings they committed to based on the payment schedule, they were required to return the financial incentive. This scheme was developed based on the idea of "prospect theory" and the loss aversion effect. In general, people have a tendency to strongly prefer avoiding losses to acquiring gains. This was also demonstrated in the stated preference survey conducted as part of research. Respondents to the survey clearly displayed a preference for retroactive payment over advance payment in all scenarios. Some studies suggest that losses are twice as powerful, psychologically, as gains. For example, people would not feel the same way when they receive $40 in advance and return $20 vs. simply receiving $20. It is presumed that people who receive $40 in advance and have to return a certain amount or all if they are unable to meet the requirements would engage more in VMT-saving compared to people who would receive financial incentives as rewards after the completion of the task.

However, it was learned that actual money transactions, including collecting money from participants, is cumbersome under University requirements. Therefore, the study was altered to meet University requirements while still simulating the new incentive scheme for Group B. Participants in Group B were required to commit to how many miles they could save in the next two weeks. Actual mileage savings based on odometer readings was compared to their committed mileage savings. If the participant saved more than they estimated, there was no additional compensation. However, if they saved less than they estimated, they "owed" the difference to the study team. The amount that they "owed" was repaid by deducting from their reserve compensation. Their reserved compensation comprised the $40 payment for the final odometer reading and the $20 payment for the exit interview. For example, if a participant committed to saving 110 miles in a 2-week period, then he/she would receive a $25 check immediately. However, if he/she actually ended up saving only 50 miles in two weeks, then the compensation would be $10, not $25. The study team would then deduct $15 from the participant's reserve compensation ($60). So, at the end of study, he/she would receive $45 instead of $60, even if they have completed all required odometer readings and the exit survey. To be sure those participants in Group B were adequately exposed to the loss aversion effect; they were continually reminded of the money deducted from their reserve compensation as a result of under-achievement. Participants who exhausted their reserve compensation before the end of the study period they were released from the study.

Group C was the control group. The control group was used to monitor the potential external factors that could have an effect on mode shift behavior during the study period.

The incentive schemes can control only for the incentives and not for other factors that can affect the mode change behavior. For example, changes in gas prices can lead to a commute mode shift irrespective of the incentives offered. The control group helped capture the impact of external factors affecting the mode change behavior.

Participant Recruitment

Initial recruitment for study participants was done via email. The first round of recruitment included emails sent in April 2013 to people who had responded to the Web-based stated preference survey. The experiment was briefly explained in the email, including time period, financial incentives, and expectations. The study team asked them to fill out an eligibility survey and provided them with a link to learn more about the study. The eligibility survey included the following questions:

- Are you at least 18 years old?
- Are you a commuter?
- Do you have a smartphone? A smartphone is a mobile phone with Web connectivity and features such as digital cameras and mobile applications.
- How many motorized vehicles are owned, leased, or available for regular use by the people who currently live in your household (including motorcycles, scooters, and mopeds)?
- Do you have reasonable access to alternative transportation modes (ex. public transit, biking, telecommuting, carpool)?

Additional attempts were made to recruit study participants using a database of registered vehicle owners in Florida. Nearly 50,000 registered vehicle owners in Miami-Dade, Broward, Hillsborough, and Duval counties were contacted by email. A total of 587 people responded to the eligibility survey. Of these, 110 (19%) were partial responses with no contact information, and 22 people responded after the recruiting deadline. After reviewing the responses to the eligibility survey, the following guideline was applied to recruit experiment participants:

- At least 18 years old
- Regular commuter
- Own two or less cars in household
- Smartphone preferred
- Reasonable access to alternative transportation modes (ex. public transit, biking, telecommuting, carpool)

Commuters with a smartphone were preferred because it would be easier to submit the required time-stamped odometer photos to track VMT savings progress. Those who did not meet the study qualifications were rejected or assigned to Group C. All other participants were randomly assigned to Group A or B.

Emails were then sent out letting participants know they were qualified to participate in the study. Participants were asked to review the study's Informed Consent form and return it electronically if they were interested in enrolling into the study. The email also further explained the version of the study to which they had been assigned (A, B, or C) and their particular payment scheme. In total, the study team sent out 425 emails inviting people to participate in the study, of which 78 (21%) returned signed consent forms on time. A minimum of 20 participants for each group, including the control group, were recruited to participate in the 10-week study (for a total of 60 or more controlled field experiment participants). The sample size of 20 participants for each incentive scheme and control group was selected to ensure the ability to conduct statistical analysis with the study results and stay within the available resources of study.

After returning the signed consent form, participants were sent another email confirming their involvement in the study, assigned a participant number, given further payment information, and asked to send their initial odometer photo reading with a date/time stamp. The day the participant sent in his/her initial odometer reading was his/her official start date. Every two weeks thereafter, the participants were required to send another odometer reading. For participants that did not send in photos by the appointed time, the study team sent reminders to them by email to make sure that their odometer readings were completed in a timely manner.

Lessons Learned

It was learned that the timing of the study might have resulted in a lower response. With school ending and summer vacation beginning, many people were unable to participate in the study because they would be on vacation or out of town during times that the study team needed photos from them. A few others also said they were too busy with school finals to participate. Another problem identified with the study was the difficulty participants had with adding a date/time stamp to their photos. Finding a mobile app that worked correctly on their smartphone was an issue for some people, and some could not find the photo on their camera once it had been taken. For those without a smartphone, if they did not have a camera on which they could change the settings to show the date and time the photo was taken, the study team did not accept them. Several people also emailed back to let the team know that they thought they would not be good candidates for the study because they already drove very little or they had already actively reduced their driving by walking, biking, carpooling, etc. Other people thought the study paid too little and that there was too much hassle. They felt that what the study asked them to do did not justify the amount of money they would be earning. Additional people also mentioned that they would be unwilling to change their driving behavior regardless of how much we paid them. Several

people in sales jobs felt this way, since it is vital to their job to drive, and they have little control over how much they drive.

Chapter 5 Analysis of "Idriveless" Program (Pilot Test)

Number of Participants

In total, 78 recruited participants were successfully enrolled into the study. The pre-qualified participants were assigned to one of three groups and given a participant number after submitting a signed consent form and their initial date/time stamped odometer reading photo (Week 1). There were 25 participants assigned to Group A, 26 participants assigned to Group B, and 27 participants assigned to Group C. Study participants were then required to submit a second odometer photo two weeks after submitting their initial odometer reading in order to establish a baseline VMT.

Seven participants failed to submit the second odometer reading photo and were subsequently dropped from the study. The remaining study participants (71) were then asked to submit odometer reading photos every two weeks during the remainder of the study period. There was an additional loss of 10 study participants throughout the study; a total of 61 participants completed the study (Table 5-1). Group B comprised the largest percentage of participant loss with 47.1 percent, followed by Group C (29.4 percent), and Group A (23.5 percent). Table 5-1 shows that there was a steady loss of participants in Group C in comparison to the rapid loss of participants in Group B. Some Group B participants that failed to continue the study claimed that there was too much pressure involved in having to commit to a reduction in VMT with the possibility of having to return the financial incentive they received if they were unable to meet the requirement of saving VMT based on the payment schedule. Some participants who left the study stated that they merely forgot to take an odometer reading and submit it on time.

Table 5-1 Number of Participants by Week of Study

	Week 1	Week 2	Week 4	Week 6	Week 8	Week 10
Group A	25	24	21	21	21	21
Group B	26	22	20	18	18	18
Group C	27	25	24	24	22	22
Total	78	71	65	63	61	61

Data for three participants were removed from the dataset prior to further analysis. It was learned during an exit interview that Participant 126 had established his baseline VMT average (1,062 miles) during a week that he had participated in lengthy motorcycle rides not typical to his weekly commute (80 miles). Participant 323 was removed when it was learned that he had been away on a five-day vacation during the week he had established his baseline VMT average (26 miles). Participant 211 was removed when she revealed that she had to make several unusually lengthy trips (more than 1,000 miles) due to her business, which resulted more than 200 percent increase in her VMT log. The elimination of the three participants resulted in a final data pool of 58 participants: Group A (20), Group B (17), and Group C (21).

Figure 5-1 shows the distribution of reported baseline VMT (two weeks) for study participants. A general cluster for all three groups is indicated between 250 and 650 miles.

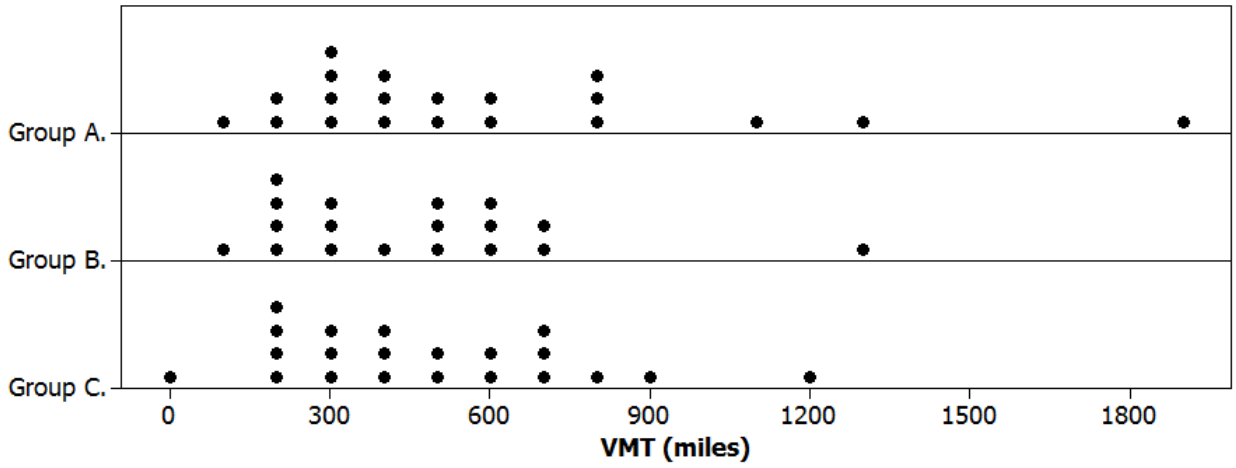


Figure 5-1 Dotplot of baseline VMT by group

VMT Saving

Table 5-2 shows the observed average VMT by group during the pilot test. It is notable that Group C, the control group, revealed a natural fluctuation week to week, possibly due to the various factors in everyday life. It seems that the fluctuations of VMT by week may have been the result of the study timing where the overlap of the end of school and the beginning of summer vacation occurred. Study participant start and end dates ranged from 5/11/2013 to 8/30/2013.

Overall, Group A maintained nearly 10 percent or higher VMT reduction each week throughout the study period, and Group B achieved significant VMT savings in the first six weeks but the amount of VMT reduction decreased the rest of the study period.

Table 5-2 Observed VMT by Group

	GROUP A (20)	GROUP B (17)	GROUP C (21)
Baseline VMT	582.0	447.1	472.9
Week 4	533.4 (-8%)	396.5 (-11%)	500.5 (6%)
Week 6	460.3 (-21%)	330.5 (-26%)	382.2 (-19%)
Week 8	483.6 (-17%)	441.3 (-1%)	537.6 (14%)
Week 10	477.9 (-18%)	426.5 (-5%)	469.7 (-1%)
Average Percent Δ	-16%	-11%	0%

(): Percent Δ from baseline

Figure 5-2 indicates the reach of the outliers (*) and the distribution of the average VMT savings. In all three groups, the saved VMT is skewed left indicating that VMT savings were realized within each group. The Group A interquartile range (IQR), represented within the

gray box, reveals that more than 75 percent of Group A participants were able to save VMT during the course of the study. The highest variation in VMT savings is indicated in Group B. In both Group A and Group B, approximately 50 percent of the participants were able to save VMT during the course of the study.

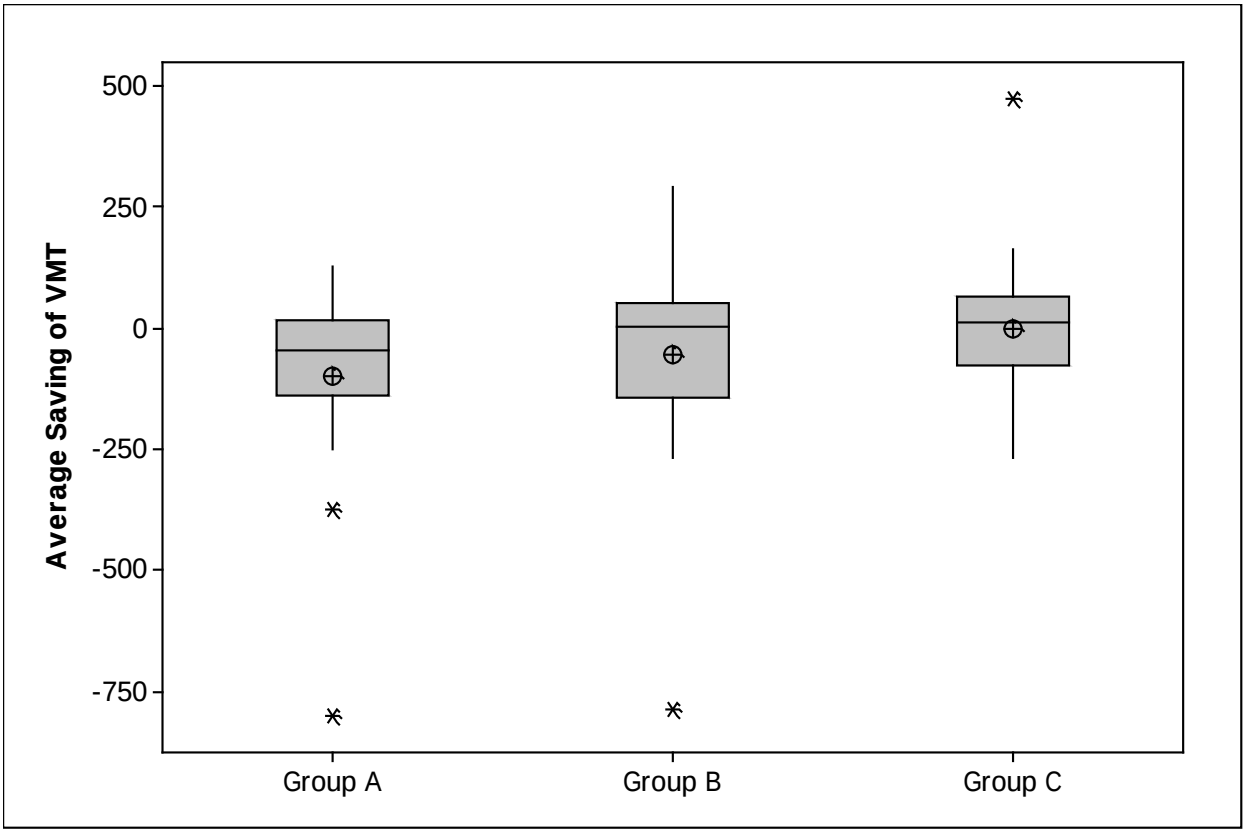


Figure 5-2 Boxplot of saved VMT by group

Table 5-3 shows the average participant percentage reduction of VMT by group. On average, participants in both Group A and Group B reduced their VMT by around 11 percent throughout the study. During the same period, a 17 percent increase was observed in Group C which is a controlled group for the study.

Table 5-3 Average of VMT Reduction by Percent for Individual Participant

	Week 4	Week 6	Week 8	Week 10	Average
Group A (20)	-4.5%	-8.7%	-17.6%	-13.5%	-11.1%
Group B (18)	-7.4%	-14.1%	-8.1%	-16.2%	-11.5%
Group C: Controlled Group (21)	13.7%	-0.4%	31.5%	24.2%	17.2%

Overall, the participants in Group A reduced 97 miles per person, and the participants in Group B reduced 52 miles per person during the 8 weeks of the pilot test. Group B participants committed to save around 22–25 percent of VMT compared to their baseline VMT. It was noted that several participants significantly reduced their committed VMT for

rounds following a round in which they failed to achieve what they had committed to save. Figure 5-3 shows the average of committed VMT saving vs. actual VMT saving by participants in Group B.

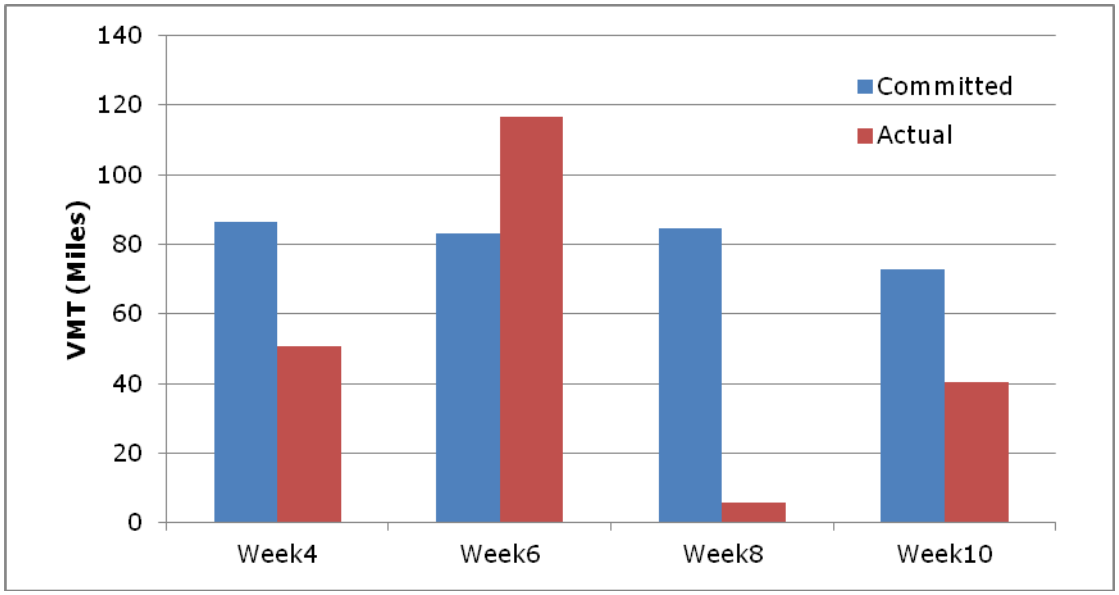


Figure 5-3 Group B average VMT: Committed vs. Actual

The analysis of the records of the two groups revealed that the significant amount of VMT was saved in both groups beyond the level of compensation. In group A, if a participant saved more than 160 miles per two weeks, he/she would still receive the payment of $40. Any additional miles saved beyond the 160 miles were considered uncompensated VMT savings. In group B, each participant was asked to commit to their VMT savings in advance, and this commitment became the ceiling of their compensation in each period. For example, if a participant committed to save 100 miles and he/she actually saved 160 miles, he/she received a financial compensation for 100 miles and the additional 60 miles became uncompensated VMT savings. Table 5-4 shows the total amount of uncompensated VMT savings for group A and group B.

Table 5-4 Uncompensated VMT Savings for Group A and Group B (miles)

	Week4	Week6	Week8	Week10	Total
Group A	697	1,602	859	2,309	5,467
Group B	888	1,670	782	1,080	4,420

The pilot test was initially designed to provide a savings of 25 cents per mile. By including the uncompensated VMT savings into the calculations, it was learned that the total savings was 16 cents per mile in group A and 17 cents per mile in group B. Certainly, the results of this pilot test have to be interpreted with caution due to the relatively small sample size. In addition, the reliability of the baseline VMT for each participant can be improved.

Exit Interview

Participants completed an exit interview with a study team member at the end of the study after they submitted their final odometer readings. The purpose of the exit interview was to gather feedback on the participants' experience during the study including VMT savings strategies, challenges experienced, and uses of alternative modes of transportation during the time they had participated in the study. The interview also aimed to collect recommendations and/or comments participants had for the study staff.

The exit interview was scheduled after the completion of the study period with an email requesting the participant to schedule an interview session. The interviews were conducted over the telephone over a period of two weeks. The individual interviews took approximately 10–20 minutes per participant. A specific set of questions was asked, but the interviews were response-driven. There were two sample groups interviewed (Group A and Group B), which required group-specific questions. The following section summarizes the responses of participants by question.

Question #1: "How did you feel about the study in general?"

The initial response for most of the participants included statements that expressed the opinion that the study was "interesting" (87.5%). Study team members who conducted the interviews asked the participants to be specific regarding their feedback. The responses typically fell into three main categories: comments on the study procedures, personal statements, and comments on saving VMT. In general, the responses indicate that the study was well-run and thorough.

Suggestions for improvement included many statements that noted more communication such as email reminders for odometer reading due dates would have been helpful. Participants who used bicycling to save VMT were grateful that the study motivated them to ride more and actually improved their physical fitness. Several participants stated that the study made them more aware of their VMT and driving habits, which ultimately motivated them to drive less (21.9%). Participant comments seemed to indicate that there is a definite need for a program like the TDM study or other types of public service announcements in order to bring a general awareness to the public about saving VMT.

Question #2: "Were there any major changes in your life during the study that may have affected your commuting or driving mileages such as new job, moving, marriage, etc."

This question was asked to clarify any anomalies that may have shown up in the participant's odometer reading records. The majority of participants stated that there were no changes during the study period (71.5%). Participants who claimed to have a major change most frequently noted that the study had commenced during the last two weeks of school, which required more driving. Their baseline average had been established during this period, so the records indicated that they were able to save VMT during the study, but the savings should be attributed to the fact that they had driven less when summer vacation had begun. To correct for this, the study team recommends scheduling the study around the local school schedules to avoid any erroneous data collection.

Question #3: "What were your primary strategies for saving VMT during the study?"

The majority of participants claimed to have a strategy when they started the study (87.5%). The following strategies were the most common responses given by participants:

- Reduced number of trips/trip chaining
- Carpooling
- Public transportation
- Biking/walking to work
- Telecommuting

Question #4: "What were some of the hurdles you faced that may have prevented you from saving VMT?"

The majority of participants indicated hurdles related to public transportation, weather conditions, and unforeseen work-related issues. Participants felt that they would have been able to save more VMT had public transportation been available in the area (15.6%). For those participants who had public transportation available, the two biggest complaints were lack of bus routes and long travel times. Several participants noted that a 10–15 minute drive could take 1–2 hours by bus due to the fact that the route required transfers which caused major delays in travel times.

Due to the hot temperatures and typical rainy weather during the summer months in Florida, participants who attempted to ride bicycles to work noted that unpredictable weather conditions, heavy rain, and high temperatures prevented them from riding on a consistent basis (15.6%). There was also a general opinion among bicycle-riding participants that there are not enough bike lanes in Florida to accommodate the riding public. Participants also cited construction as a factor preventing them from following their intended routes (9.3%). One participant noted that even when a bike lane was available, riding was dangerous due to reckless driving by motorists. Telecommuting was a popular strategy to save VMT, but on-site requirements for meetings made it difficult for some participants to maintain their savings strategy.

Question #5: "How much do you spend on gas per week on average?"

Answers to this question were used to verify the mileage records recorded by the participants. It should be noted that many participants indicated a savings of 50 percent or more on fuel costs during the study.

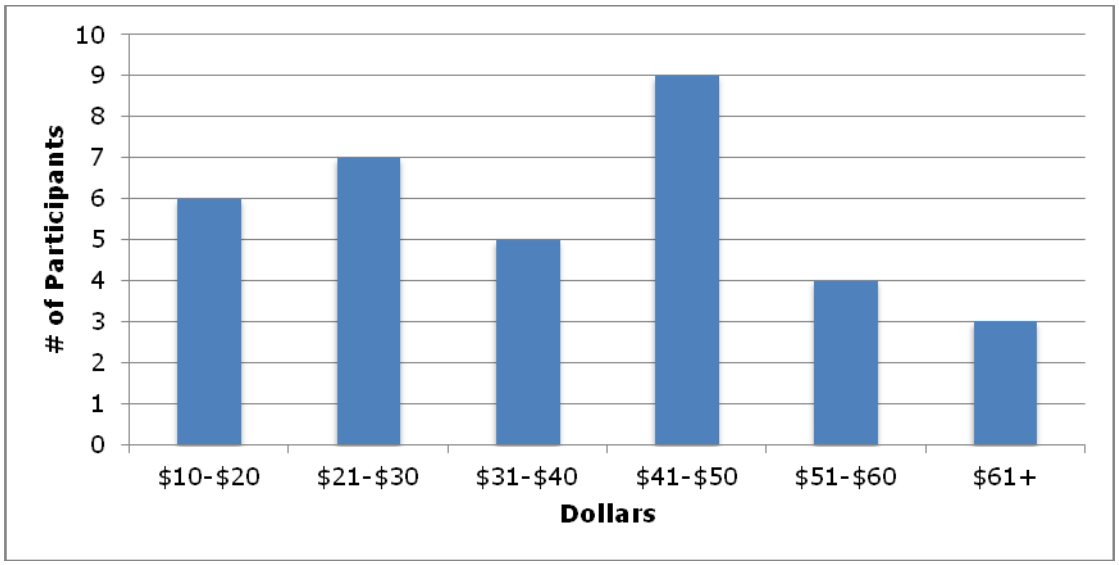


Figure 5-4 Average gas cost per week

Question #6: How do you feel about your commitment strategy? (Group B only)

Most participants indicated that they did not have a specific strategy with regards to the amount of savings they committed to per period (84%). Only a few participants tracked their own mileage each period and would adjust according to their driving patterns (33%). Participants claimed that it was a lot more complicated to plan for the next two weeks than they had initially realized.

Question #7: Did you change your strategy after first two weeks? (Group B only)

Participants who realized their savings strategies were successful tended to increase their VMT savings commitment. Several participants were fearful of going over their committed miles, so they chose to commit to a low number of miles. They were fearful of losing money due to the structure of the incentive plan.

Most of the participants with two or more vehicles indicated that they would use the other vehicle in the household to save VMT on their own vehicle. Some participants indicated that this was their main strategy. Some participants indicated that they combined trips with the other household member and ultimately saved VMT for both vehicles. The majority of participants (82.4%) indicated that they were unable to cancel trips or reduce the number of trips due to family and work commitments. One participant indicated that he cancelled all driving on the weekend to save VMT. Although most participants had not heard the term "trip chaining," they indicated that they had indeed done so once the term was defined. Several participants noted that they had always planned their trips efficiently to save on time, but now they were doing so to save on mileage.

Question #8: "Did you carpool?"

A small minority of participants indicated that they were able to carpool to save VMT (12.5%). Participants noted that it was too difficult to give up the convenience of having

their own vehicle and freedom to drive where and when they wanted to. One participant stated that they would have to be compensated a large amount of money to give up that convenience.

Question #9: Did you ride a bicycle?"

Only eight participants indicated that they had used their bicycle to save VMT (25%). Most of these participants claimed that bad weather, construction, or technical difficulties prevented them from using their bicycle more during the study. Two participants were grateful that they had been entered into the study and realized that riding a bicycle to work was a healthy alternative to driving (6%).

Question #10: "Did you use public transportation?"

Most participants indicated that public transportation was not a viable option (75%). The main issues included lack of bus routes, long commute times, bad weather conditions, and a general dislike for public transportation. One participant found public transportation to be so effective that he was able to sell his vehicle.

Question #11: "Would more money or different incentives make you save more VMT?"

Most participants indicated that they had saved as much VMT as possible during the study so a change in incentives would not make a difference. Participants indicated that they felt the payment structure was adequate. Many Group B participants indicated that they would have preferred to have had the Group A incentives – being paid for actual miles saved. They noted that they would have been more motivated knowing that they would not have to be concerned about exceeding the mileage savings they had committed to.

Question #12: "Did making an effort to reduce your VMT motivate others in your family or workplace?"

The majority of participants did not discuss the study with friends and coworkers and did not indicate a specific reason for not doing so. There were a few participants who noted that their spouses became motivated to save VMT.

Overall, participants showed positive responses about the study and felt this approach should be extended statewide as a solution in TDM. However, they also shared some concerns including the reliability of odometer reporting.

Chapter 6 Conclusion

The research project began with a review of literature related to TDM financial incentives to gather information related to how the amount and form of incentives affect behavior. Similar approaches were found in the literature to reduce SOV commuting via short-term payments. Other strategies reviewed sought to modify the form of the incentives (e.g., prize drawings). Based on this information, a web survey was developed and conducted to investigate the feasibility and interest of shifting modes in Florida. A total of 1,031 responses were collected and analyzed. From the survey, researchers found that more than 80 percent of respondents in Florida indicated that they are neither carpooling nor taking public transit. Over 70 percent of the sampled commuters have not considered changing modes. Most respondents indicated that they need a car to reach multiple destinations. In general, respondents agreed that financial incentives can make both carpool and public transit more appealing to commuters, but some systematic improvements are also critical such as a better travel time of public transit and guaranteed ride home programs to assure they would not be stuck in case of emergency if they need to leave work early.

While mode shift away from driving alone is the primary objective of most of the TDM incentive programs reviewed, there are other means for yielding the desired outcomes without shifting mode. One method is to shift the focus on the time of the trip or the quantity of the trip consumed (i.e., vehicle miles traveled (VMT). Researchers focused the evaluation on the feasibility of reducing individual VMT rather than changing mode as a means of achieving the outcomes of reduced congestion and emissions. Respondents were asked how much VMT he or she could save per month. The research team used this information to gauge respondents' ability to reduce their VMT. Similar to interest in switching modes, a large percentage of respondents stated that they probably could not reduce their monthly VMT. However, the respondents indicated VMT reduction was the preferred approach compared to the mode shifting approach. The survey also investigated respondents' preference toward different incentive schemes including the amount of incentives.

After the completion of survey, a pilot test called the "Idriveless" program was conducted. It was designed to provide a certain level of financial reward to people who reduced their VMT compared to their baseline VMT. Participant's VMTs were measured every two weeks throughout the study period. After VMT was measured, participants were compensated based on the number of miles they reduced from their baseline VMT. Two incentive scheme groups (Group A:Retroactive payment and Group B:Advance payment) and one control group (Group C) were used. The program study period was10-12 weeks and the first two weeks were used to establish the baseline VMT for each participant.

Overall, both Group A and Group B reduced nearly 11 percent VMT at the individual level, while Group A reduced a total of 7,791 miles and Group B reduced a total of 3,714 miles respectively. During the same period, a 17 percent increase was observed in Group C, the control group for the study. The analysis of the records of the two treatment groups revealed that a significant amount of VMT was saved in both groups beyond the level of compensation. As a result, total savings was 16 cents per mile in Group A and 17 cents per

mile in Group B. Certainly, the results of this pilot test have to be interpreted with caution due to the relatively small sample size.

The pilot test proved that a VMT saving approach is very effective and has great potential to grow to achieve several of the desired outcomes of TDM. Two different incentive schemes in the pilot test produced valuable insights to expand the approach to statewide TDM programs.

The study design was limited to demonstrating the process of changing habitual mode choice behavior utilizing the loss aversion effect. Based on the loss aversion effect theory, people typically have a tendency to strongly prefer avoiding losses to acquiring gains. Participants who received $40 in advance and had to return a certain amount or the entire amount if they were unable to meet the requirements were presumed to have engaged more in VMT savings compared to people who would receive retrospective financial payments after the completion of the task based on their performance. Although the study observed anecdotal evidence that participants in Group B were more engaged, it appears the fear of losing money deterred participants from engaging in the program. Many participants committed to a low VMT savings out of fear of not being able to change their driving habits in order to meet that commitment. This concern was alleviated when participants realized that if they did not meet their commitment they would lose the certain amount of compensation. Overall, this resulted in lower VMT savings compared to Group A

Having an option to choose how many VMT miles the participants would commit to each week allowed the participants to commit to a low VMT savings which limited engagement to actually saving VMT. There were a small percentage of participants who committed to a high bi-weekly VMT savings compared to those who committed to a lesser amount that they felt they could easily obtain. Participants frequently committed to zero savings due to the fact that they were unable or unwilling to change their driving habits. According to the result of pilot test, Group A performed better, including achieving a higher uncompensated VMT savings. Ultimately, one challenge made the advance payment approach a less viable option for encouraging people to make a desirable behavior change. University financial management constraints eliminated the ability of the researchers to make two-way financial transactions with participants. Therefore, the uncontrolled role of loss aversion (the fear of having to return incentive money) made this approach a less viable option for encouraging people to make a desirable behavior change.

There are several factors to consider going forward. The first consideration is the issue surrounding the establishment of the participant baseline average. This study had used a two-week period to calculate a baseline average for each participant. Several comments were made during the exit interviews which indicated that the two-week period used to establish the baseline was inconsistent with the participants' typical schedules. In order to eliminate such issues regarding the establishment of the baseline average, another method needs to be developed. One option would be to extend the length of the baseline establishment period to more than two weeks. Participant vehicles could be fitted with a global positioning system (GPS) unit (capable of automatically transmitting data) affixed to the vehicle for the duration of the study. Mileage data would be uploaded to a data center for calculation on a biweekly schedule. This would eliminate the need for the participants to

send in odometer photos, which caused many issues related to late submissions or submissions without date/time stamps. Once the odometer readings are sent to the calculation center, an automated system would notify the participants of several calculations: miles driven, miles saved, incentive earnings, and lost incentives. This could present an opportunity for study staff to include motivational messages or warnings regarding the status of the participants VMT savings. This system could be a tool to increase participant engagement into the study.

Driving in the United States is nearly a culture of unlimited consumption where drivers are largely unaware of their usage and travel patterns. For example, the majority of participants in this study were unaware of how many miles they were driving. They were just as unaware of potential ways to reduce their VMT. Many participants were surprised by their odometer records indicating their actual VMT. They stated that they might not be able to make major changes in their lives to reduce VMT, but the study did help them become aware of the issues and to become more cognizant of their driving habits. Understanding current behavior is a first step for being ready to change.

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