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Final Report

Mileage-Based User Fee Demonstration Project:

Potential Public Policy Implications of Pay-As-You-Drive Leasing and Insurance Products

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16. Abstract (Limit: 200 words)

The Federal Highway Administration and the Minnesota Department of Transportation co-sponsored a demonstration to test how consumers would change their driving behavior if some of the fixed costs of owning and operating a car were to be converted to variable costs. Two primary components of the project included a market assessment and report on the experiment findings. An analysis was also conducted of public policy and private sector market implications for pay-as-you-drive (PAYD) products which concluded with recommendations on how to mainstream major findings:

- Target to the most receptive markets in areas where significant travel options exist;
- Explain PAYD concepts clearly to potential markets;
- Structure products so that consumers can manage risk and uncertainty by setting caps on variable costs;
- Enable people to opt out if they are not comfortable with PAYD products;
- Provide significant cost savings potential to make the PAYD option worthwhile.

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Mileage-Based User Fee Demonstration Project

final

report

prepared for

Minnesota Department of Transportation

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1.0 Study Purpose

1.1 THE PROBLEM – PRICING OF AUTO TRAVEL

Automobile is the predominant mode of travel in the United States. For most citizens at most times of the day, it is a highly efficient mode of transportation which takes people from where they are directly to where they want to go in great comfort and personal privacy. However, in dense urban areas and in rapidly growing suburban areas, these individual utility choices often lead to negative societal impacts characterized by high degrees of congestion and resulting externalities such as air pollution, energy consumption, high accident rates, and wear and tear on the infrastructure. For the past several decades, vehicle miles of travel (VMT) has increased faster than measures of population and economic growth. The societal implications of the continuation of this trend are severe.

Large portions of the costs of auto travel are hidden or sunken over long periods of time in a way that appears unrelated to day-to-day trip decision-making. Therefore, people often take many uncoordinated, individual trips without considering their cost impacts. Parking is the most obvious out-of-pocket cost associated with auto travel, and these costs have long been found to heavily influence travel behavior. Cities such as Boston and New York with very high downtown parking costs (typically over $25 per day) have much higher transit mode shares than cities such as Atlanta and Minneapolis with lower parking costs (typically under $10 per day), even though they all have traffic congestion. However, many auto trips, particularly in the suburbs, involve little or no parking cost.

Fuel is the second most apparent out-of-pocket cost. During the 1980s and 1990s, fuel prices reached record low levels in real dollar terms – lower even than during the golden age of cheap energy in the 1950s. Fuel consumption almost disappeared as a factor in travel choice. The recent run-up in prices following the Gulf Coast hurricanes seems to have anecdotally changed this equation. Tolls are another obvious cost factor where they exist, as are transit fares.

However, the biggest cost components of auto travel – ownership (the cost of acquiring the vehicle), insurance, and to some extent depreciation (the vehicle's decline in value over time) – have little obvious relationship to mileage. Since vehicles depreciate whether or not they are driven, people are often motivated to drive more so that they "get their money's worth" from their ownership investment in the car. Insurance rates are typically determined by the place in which the vehicle is garaged, rather than by how much it is driven. Most people buy their vehicles, and do not perceive the fact that the more they drive the faster the vehicle will depreciate, resulting in a lower trade-in value. This "cost" is completely hidden until people go to buy their next car – there are no immediate price signals to influence their day-to-day behavior.

We can all cite many anecdotes in which you ask someone why they drive instead of taking public transit. A typical answer is: "It is cheaper. I only pay $6 to park. If I took the train, it would cost me $5 for the round trip, plus $3 to park." The difference is, of course, the $8 for the train is the total cost to the traveler of the transit trip, while the $6 to park is only the apparent cost of the auto trip. The goal of PAYD is to develop products which help people think about the true costs of driving.

1.2 PAYD – A NEW OPPORTUNITY

Government is always looking for new ways to improve transportation service for its citizens. Traditionally, this has involved construction of more facilities: highways being the most prevalent in the United States. However, there are limits to government's ability to deliver more and more highway lane-miles, and such projects are often accompanied by adverse impacts from air and noise pollution and social disruption. As a result, over the last few decades, government has turned to travel management tools to reduce the demand for travel, especially during peak periods. Carpool and vanpool promotional programs, high-occupancy vehicle (HOV) lanes, and encouragement of flextime and telecommuting are among the mechanisms in today's toolbox.

The goal of Pay-as-you-Drive (PAYD) products is to provide another public policy management tool to help in reducing or managing auto travel. It has long been understood that drivers typically do not factor in all relevant costs in their decisions involving auto travel. This behavior can impact all aspects of travel choice: 1) whether to make the trip in the first place; 2) whether to combine the trip into a multipurpose trip; 3) what destination to select; and 4) what mode of travel to select.

While outright auto ownership has no mileage component, auto leasing has traditionally been related to miles driven. Most standard leases are for two to four years at 12 to 15,000 miles per year. At the end of the lease, the lessee must typically pay a fee for every mile driven in excess of the lease terms. However, since this fee is not assessed until the end of the lease and is relatively modest, drivers do not often track their mileage that closely during the course of the lease. Experienced lessees also know that the fee can be "negotiated away" as part of the dealings for the replacement vehicle. Also, people who lease cars are usually confident that they will more or less stay within the lease mileage terms.

The idea behind PAYD is to transform sunk insurance or ownership costs to costs with more frequent price signals (real-time, daily, monthly, or quarterly), resulting in different transportation decision-making, and ultimately less driving. This change in behavior would reduce the need for either costly public sector investments in transportation infrastructure, or invasive public policy programs which seek to alter people's behavior. People would make monthly ownership/leasing and/or insurance payments based on a combination of a fixed monthly charge and a variable rate based on miles driven. In this way,

people would receive the same kind of usage-based pricing signals which they today receive from their typical home utility bills. Data collection and transmittal devices now exist which can be installed in vehicles to automatically collect and transmit usage data in the aggregate, or disaggregated by such factors as time of day or route choice. Thus, drivers could be charged not only based on how many total miles they drive, but on whether they drive at peak or off-peak times, or along congested or uncongested routes. In this way, peak-period/peak-route usage could be charged at higher rates, much like utilities do today.

Thus far, the most interest in PAYD products has been in the auto insurance industry. Several PAYD insurance pilot programs have been established by insurance providers (with and without partial public support) that are interested in testing the market demand and profitability of PAYD insurance products. These programs include:[1]

- Progressive Insurance "Autograph" test product offered to more than 1,000 drivers in Texas from 1999 to 2001. Participants' insurance charges included a fixed cost element and variable cost elements based on the amount of time they drove, where they drove, and the time of day of when they drove.
- Progressive Insurance "TripSense" test product offered to 5,000 Minnesota drivers. With this program, Progressive is monitoring participants' driving characteristics; including mileage, time of day, speeds, and hard acceleration/braking.
- Aviva in Ontario has established a similar pilot study, which includes vehicle tracking and low-mileage discounts.
- GMAC Insurance/OnStar has begun offering OnStar account customers discounts on insurance based on mileage categories.
- In the U.K., Norwich Union is collecting data from 5,000 customers in order to establish mileage-based insurance rates. In addition, Norwich Union recently established a pilot test of a PAYD insurance product for drivers aged 18 to 21. According to the Norwich Union web site, the demand for this product has far exceeded the 1,500 driver limit established by the company.
- Similar pilot tests are also being implemented by insurance providers in The Netherlands and in South Africa.

[1] Allen Greenberg, *Applying Mental Accounting Concepts in Designing Pay-Per-Mile Auto Insurance Products*, prepared for the 2006 Transportation Research Board Annual Meeting (November 21, 2005).

1.3 THE DEMONSTRATION PROJECT

The attractiveness of PAYD products was empirically tested in the Twin Cities of Minneapolis and St. Paul by means of a demonstration project conducted under the auspices of the Minnesota Department of Transportation (MnDOT) supported by a value pricing grant from the Federal Highway Administration (FHWA).

The study consisted of two elements – Market Assessment Surveys and Field Experiment.

The Market Assessment Surveys consisted of the following elements:

- A general market telephone survey of 400 randomly selected households in the Twin Cities region;
- A vehicle lessee survey of 100 additional households in the region with recent experience in vehicle leasing; and
- A stated-preference survey conducted by mail with those households from the first two surveys willing to answer additional questions regarding specific tradeoffs involved in vehicle acquisition and insurance purchases.

The field experiment consisted of recruiting 130 households that were willing to participate in a demonstration of the impact of PAYD products on driving behavior. Some households participated in a control group, while others participated in both a control protocol and a pricing protocol. The vehicle usage of participants was monitored over the course of the experiment. At certain points in the study, the participants assigned to the pricing protocol were offered cash rewards for reducing their vehicle mileage in response to the experiment's price signals. The control group and the control periods for households that participated in the pricing experiment allowed for the comparison of individual behavior in response to mileage or nonpriced, mileage, and across individuals within common time periods. Participants were offered cash rewards for participation, as well as for reducing their mileage in response to the experiment's price signals. However, participants could not lose money in the demonstration.

An electronic data collection device (CarChip) was placed in the participating vehicles to collect total mileage and mileage by time of day. The participants were required to periodically swap out the devices, mail them back to the study team, and replace them with new devices before they filled up with data. In addition, participants were asked to track and report odometer readings on other household vehicles which were not included in the pricing experiment. While these self-reported readings were not judged to be as reliable as the CarChip data, they were included so that we could assess the impact of vehicle substitution (driving the priced vehicles less and the nonpriced vehicles more). In the context of this experiment, there was no penalty for doing so.

Each participant was given a unique pricing protocol (mileage budget) based on their mileage levels during an initial pre-experimental period. Per-mile charges

ranged from $0.05 to $0.25 and were assigned to participating households on a random basis. Some participants had their mileage charge vary by peak versus off-peak period. After the initial random price assignment, a few households with similar demographic characteristics and pricing protocols were reassigned to ensure that these similar households experienced the full range of pricing protocols. After two months of driving during the control period (with their driving habits reported by the CarChips), household mileage budgets were established so that if they drove the same amount of miles in the experiment period they would receive zero payments.

Because the experiment was designed to assess the response to generic mileage-based costs, the vehicle usage results can be generalized to most PAYD products. To further assess the participants' levels of interest in PAYD leasing and insurance products, and to gain further insights into how and why participants changed their driving behavior, an exit survey of participants was conducted at the end of the study.

At the beginning of the project, an effort was made to partner with a private sector auto industry firm. If such a partnership had come to fruition, the sample size of the demonstration could have been much larger, and the demonstration could have taken on the aspect of a true market test of a real product. Unfortunately, the lack of such a partner limited the scale and scope of the demonstration project. The lessons learned from the project itself, and the effort to find a private sector partner, are discussed below.

2.0 Lessons Learned

The data generated by the surveys and field experiments involved in the PAYD demonstration in the Twin Cities begin to point the way for implementation of PAYD concepts.

The stated-preference survey component of the study showed a preference for the insurance versus the leasing versions of PAYD, with 25 percent of the stated-preference survey respondents probably or definitely interested in mileage-based insurance compared to 16 percent of respondents expressing similar interest levels in mileage-based leasing. There is much more the government can do to facilitate the development of insurance PAYD compared to ownership/leasing PAYD. Auto insurance is already heavily regulated by state governments. They can use these regulatory powers to encourage or require the private insurance sector to offer PAYD products. As noted above, several such products are already being sold by insurance companies such as Progressive in Houston and in the Twin Cities (with a small PAYD component). On the other hand, vehicle ownership is largely a private sector activity. There are fewer policy levers available to the public sector to influence this marketplace.

PAYD concepts, if implemented, would likely be targeted to niche markets. The data from this study show that 25 to 30 percent of the marketplace might be interested, and that a similar percentage had no interest at all. It is interesting to note, however, that among vehicle leasers, 50 to 75 percent might be interested. Almost every driver has auto insurance, and 21 percent of new vehicles acquired in the United States in 2006, totaling 3.6 million vehicles, will be leased[2] (currently, 6 percent of all vehicles on the road are leased).[3] Based on the study participants' interest levels, the availability of PAYD leasing could substantially increase the percentage of newly acquired vehicles that are leased.

Based on this study's data, compared to people who own vehicles, people who lease vehicles tend to have slightly higher incomes, are more likely to be self-employed, drive more miles (15,200 versus 13,900 annually), acquire new cars more frequently, are generally more comfortable with technology, and are more likely to feel that choice of vehicle reflects one's lifestyle. While only about 35 percent of the study participants said that they had a good understanding of vehicle leasing, consumer knowledge can change rapidly. A decade ago, few Americans had much understanding of SUVs, hybrids, cell phones or iPods.

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[2] CNW Market Research.

[3] This statistic is based on the 2001 National Household Travel Survey and the 2003 Consumer Expenditures Survey.

Determined marketing campaigns, consumer preferences, and external factors change over time.

Beyond a preference for leasing itself, there are three other characteristics of the target market which should be understood: 1) the personal characteristics of the market, 2) the types of trips most likely to be impacted, and 3) the strategy for packaging PAYD products.

Based on the findings of the field experiment and experiment participant surveys, key characteristics of the target market (besides proclivity for leasing) include the following:

- **Comfortable with new technologies.** Households which are most intrigued by new technologies and like to try new gadgets reduced average daily mileage by about 10.4 percent when subjected to pricing, compared to a 0.7 percent decrease in average daily mileage by households which are less comfortable with new technologies.
- **Less concerned about privacy issues**. Households which are less concerned about their daily habits being monitored reduced their average daily mileage by about 8.0 percent, compared to a 2.5 percent reduction in average daily mileage for households which are more concerned about privacy issues.
- **Tend to be concerned about environmental issues.** At the time of the experiment, this characteristic was more important than saving fuel, but this equation may have changed in the interim. For example, households which like driving vehicles with good gas mileage to help the environment reduced their average daily mileage by about 5.4 percent; on the other hand, households which are less concerned about environmental issues reduced their mileage by about 3.3 percent.
- **Often think about ways to control driving costs**. Households which think most actively about ways to reduce their auto operating and ownership costs reduced average daily mileage by about 12.3 percent, compared to a 4.3 percent reduction for households which are least concerned about controlling their driving costs. (It is certainly possible that the percentage of such households could increase in response to regular and more salient communication of pricing information.)
- **Relatively young**. The greatest reductions in average daily mileage were among households where the head of the household is less than 35 years old (10.1 percent reduction); and an 8.6 percent reduction in average daily mileage occurred where the head of the household was over 65 years old.

Data analyzed from the field experiments showed the types of trips most likely to be impacted (i.e., reduced) include the following:

- **Weekend trips and summer seasonal travel.** These trips are the most discretionary in nature. While they have less impact on congestion and air pollution, reductions would still impact overall VMT and hence fuel consumption.

This is supported by the study results, which show that while the weekday 24-hour reduction in average daily miles due to pricing was 4.9 percent, the weekend 24-hour reduction was 8.1 percent. Moreover, households whose vehicles were priced during the summer were more receptive to the pricing (6.8 percent reduction in average daily miles) relative to households whose vehicles were priced during the fall and winter seasons (little or no change in average miles).

- **Peak-hour trips.** These are primarily commuter trips, and of course are key to reducing congestion and resulting air pollution. They are the trips for which the most robust travel options exist, particularly in terms of transit service. The data from this study show that while the weekday off-peak period reduction in average daily miles due to pricing was 3.3 percent, the weekday peak-period reduction was 6.6 percent. On the other hand, midday weekday travel was reduced the least in the study. These trips are often related to personal management issues (such as doctors' appointments) and are typically nondiscretionary with few travel alternatives. They also impact congestion less than peak-period trips do.

The third set of lessons learned was in regard to how best to package PAYD products, and include the following:

- Target to the most receptive markets, as described above, in areas where significant travel options exist;
- Explain the concept extremely clearly;
- Structure the product so as to manage the degree of risk and uncertainty which the buyer would experience, such as by setting upside mileage limits on how high the variable costs could go;
- Enable people to opt out if they are not comfortable with the product; and
- Provide significant cost savings potential.

There are clearly caveats to the above conclusions: 1) they are based on a relatively small sample size for the field experiment; 2) not all of the findings pointed in the same direction depending on which variables were tested; 3) the participants were playing with "house money" – in other words, they could make money by altering their behavior but they could not lose money as might be possible with actual PAYD products; and 4) participants who did not anticipate reducing their mileage from the control period saw no financial incentive to limit their driving. Real life situations may make people more likely to alter their behavior than a carefully controlled field experiment. Also, this experiment was conducted in the Twin Cities of Minneapolis and St. Paul, an urban area with relatively few alternatives to auto travel (a single rapid transit line opened during the course of the study), a high degree of affluence, increasing suburban sprawl, and relatively modest congestion levels outside of the peak hour. All of these factors would make people less likely to alter their driving behavior than in urban areas with a different set of characteristics.

An additional lesson was learned through the efforts at the beginning of the project to conduct this study in partnership with an auto industry partner, including manufacturers (both General Motors and Honda were approached), rental car companies (such as Enterprise), insurance companies (Progressive and Travelers), and new market entrants (such as ZipCar and Flexcar). The discussions were most advanced with GM which, despite apparent interest in the concept, could not (at the time) make the business case for a mileage-based ownership or leasing product. By and large, and notwithstanding the nascent interest in PAYD insurance products discussed above, the industry today appears not to see a unique product, market, or profit potential in PAYD leasing.

However, these perceived market conditions could certainly change in the future as the structure of the automobile industry continues to evolve and external factors impacting auto ownership and use (such as the price of fuel, for example) change. Several years ago, there was no market for shared auto use in the United States, which was already a vibrant product in Europe. Today, there are two major providers of these services – Zipcar and Flexcar – operating in several major United States cities such as Boston, Seattle, and Washington. Local governments have facilitated this trend by providing municipally owned parking spaces and requiring real estate developers to set aside privately owned spaces. The public sector could offer similar tax and other incentives to facilitate the introduction of PAYD products.

3.0 Potential Impact on Travel

The market assessment survey, field experiment, and field experiment participant surveys permitted an evaluation of the level of interest in PAYD leasing and insurance, as well as the potential reductions in mileage. One of the basic quantitative survey approaches used to estimate participation rates in a PAYD leasing or insurance program was to present respondents with concept statements explaining the programs, and then to ask a series of questions measuring respondents' interest levels.

Interest levels were gauged in this way during an initial concept assessment phase through the market assessment survey, then through a priced concept assessment in the stated-preference survey (where respondents were presented with actual representative prices for the insurance and leasing programs), and lastly through an exit survey of experiment participants which was conducted after the field experiment was completed. The different concept assessments represent different stages of familiarity with the product. The initial assessment provided insight into how receptive the overall market would be to these products. The second assessment captures how more thoughtful consideration of actual constraints changes the initial response; and the third assessment reflects how more fully informed consumers (in this case, those who have a better understanding of their ability to change their vehicle usage behavior) feel about the concept. The third assessment can be viewed as a proxy for continued interest of those people already using the products.

The key challenge in the initial full market concept evaluation is to provide respondents with enough information to understand the new product or service offering without biasing their evaluations of the offering. All concept evaluations for new product offerings are susceptible to noncommitment bias, which leads respondents to be more favorable to a new product or service because survey respondents are not actually required to commit to the new offering. To reduce the effect of noncommitment bias, we reduced the shares for the unconstrained stated likelihood questions using the relative responses of the other more focused concept assessments. Specifically, for our volumetric analyses, we took only 60 percent of those who indicated they are "very likely" to use PAYD leasing or insurance, and 30 percent of those who indicated they are "likely" to use them, as estimates of the true percentages of households in the population that will actually use PAYD products if they were available.[4] Using

[4] The factors used to reduce the effect of noncommitment bias are common discount factors, such as those used in "Karl T. Ulrich and Steven D. Eppinger, Product Design and Development (2nd Edition, Irwin McGraw-Hill, 2000)." As an example, 7.1 percent of respondents from the stated preference survey and 10.4 percent of respondents from

Footnote continued

this method together with Census statistics on the number of households and vehicle availability in the Twin Cities, we estimated the number of participating and nonparticipating households as shown in Table 3.1. Under a PAYD insurance program 11.3 percent of all households would be expected to participate in such a program, while under a PAYD leasing program the percentage of participants would be somewhat lower at 7.5 percent of total households. This is probably a conservative methodology which likely places a floor under the levels of participation.

Table 3.1 Participation in PAYD Insurance and Leasing

	PAYD		
	Insurance	Leasing	Comments
All Households in Twin Cities	1,035,908	1,035,908	Source: Year 2000 Census data.
Percent Households with One or More Vehicles	91.5%	91.5%	
Households with Vehicles in Twin Cities	948,244	948,244	
Estimated Percent of Households Participating	11.3%	7.5%	These estimates are derived from the stated-preference survey and the exit survey.
Estimated Nonparticipating Households	841,254	876,813	It is assumed that households participating in a PAYD program will have at least one vehicle available, and that one vehicle will use a PAYD product.
Estimated Participating Households	106,990	71,431	

Given the number of participating households, we projected the change in VMT that would result if PAYD products were available. Table 3.2 shows the peak period and overall VMT estimates, for nonparticipating and participating households, if PAYD insurance and leasing were unavailable. These estimates were obtained from the experiment data. Next, Table 3.3 shows the experimental reduction in weekday peak period, weekday off-peak period, weekend, and overall VMT estimates for participating households if PAYD insurance and leasing were available, as well as the percent reduction in VMT across all households. To simulate the behavior of participating households, the average mileage reductions shown in the table were calculated only for experiment participants who indicated high interest levels for the individual products. As would be expected, the reduction levels were, in general, higher for those with high interest levels in the products.

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the exit survey said they were "very likely" to use PAYD insurance, while 18.2 percent of respondents from the stated preference survey and 22.1 percent of respondents from the exit survey said they were "likely" to use PAYD insurance. Using the 60/30 factors and taking an average of the stated preference and exit survey results, it is estimated that 11.3 percent of households would participate in PAYD insurance.

Table 3.2 Estimated VMT without PAYD Insurance and Leasing

	PAYD		
	Insurance	Leasing	Comments
Mileage Without Pricing (Households in the Field Study)			
Average Weekday Peak-Period Mileage			These mileage statistics are obtained from the unpriced period data of the field experiment.
– Nonparticipating Households	24.14	23.67	
– Participating Households	18.61	21.59	
Average Weekday Off-Peak-Period Mileage			
– Nonparticipating Households	26.29	26.13	
– Participating Households	23.05	23.32	
Average Weekend Daily Mileage			
– Nonparticipating Households	47.70	46.49	
– Participating Households	38.69	49.02	
VMT Estimates Without Pricing (Regional Households)			
Average Annual VMT Estimate			The average annual VMT estimate is computed based on the average weekday and weekend daily mileage from above and the number of weekdays and weekends in a year.
– Nonparticipating Households VMT	18,102	17,811	
– Participating Households VMT	14,877	16,849	
– Total Households VMT	17,739	17,739	
Annual VMT Estimate			
– Nonparticipating Households VMT	15,228,856,139	15,616,989,168	The annual VMT estimate is the product of the average annual VMT estimate and the total number of households.
– Participating Households VMT	1,591,683,192	1,203,550,163	
– Total Households VMT	16,820,539,331	16,820,539,331	
Average Annual Peak-Period VMT Estimate			
- Nonparticipating Households VMT	6,132	6,013	
- Participating Households VMT	4,727	5,484	
- Total Households VMT	5,973	5,973	
Annual Peak-Period VMT Estimate			
- Nonparticipating Households VMT	5,158,163,650	5,272,169,424	
- Participating Households VMT	505,750,671	391,744,896	
- Total Households VMT	5,663,914,320	5,663,914,320	

Table 3.3 Estimated VMT Reduction with PAYD Insurance and Leasing

	PAYD		
	Insurance	Leasing	Comments
Mileage Reduction With Pricing (Households in the Field Study)			
Average Weekday Peak-Period Mileage Reduction			These mileage statistics are obtained from the field experiment analysis results.
– Participating Households	-1.79	-2.26	
Average Weekday Off-Peak-Period Mileage Reduction			
– Participating Households	-1.23	-0.94	
Average Weekend Daily Mileage Reduction			
– Participating Households	-3.87	-3.36	
VMT Reduction Estimates Due to Pricing (Regional Households)			
Average Annual VMT Reduction Estimate			
– Participating Households	-1,197	-1,186	
Annual VMT Reduction Estimate			
– Participating Households	-128,029,584	-84,700,023	
– Total Households	-128,029,584	-84,700,023	
Percent Reduction in Total VMT	-0.76%	-0.50%	
Average Annual Peak-Period VMT Reduction Estimate			
– Participating Households	-455	-574	
Annual Peak-Period VMT Reduction Estimate			
– Participating Households	-48,644,073	-41,004,251	
– Total Households	-48,644,073	-41,004,251	
Percent Reduction in Peak-Period VMT	-0.86%	-0.72%	

The reduction averages used in these volumetric calculations are the differences between the average vehicle mileage for priced vehicles and the average vehicle mileage for control vehicles in the same time period (different alternative comparison calculations were made as part of the experimental findings analyses and are reported in the *Experimental Findings Report*). The reported reductions from which the averages were obtained were made in response to the range of different mileage budgets and per-mile charges to which the experiment participants were subjected. We used this simple average response in part because in the

experiment the effect of varying the pricing levels was much smaller than the effect of having any pricing level at all, and in part because the potential per-mile charges for PAYD leasing and insurance products has not been well established.

Because some experiment participants were priced at a higher level for peak-period travel than for off-peak and weekend travel, the average per-mile price for the peak periods for which the responses were calculated is slightly higher than the prices for the other periods. However, when we analyzed only the participants with high program interest levels that were charged the same rate for all time periods, the peak-period response was actually slightly higher than for those who were charged more for peak-period mileage.

For an average weekday the peak and off-peak periods combine for a total reduction in VMT of 3.02 and 3.20 for PAYD Insurance and PAYD Leasing, respectively. The average weekend reduction in VMT was estimated to be slightly more. This translates into reductions in VMT of 8.0 percent for the average PAYD Insurance participant and 7.0 percent for the average PAYD Leasing participant. Even more importantly is the percent reductions during the peak period which are significantly higher than the day as a whole. These reductions during the peaks are at 9.6 percent and 10.5 percent for PAYD Insurance and PAYD Leasing, respectively.

When factoring in all nonparticipating households, the PAYD insurance peak-period annual VMT reduction is estimated to be 48,644,073 (0.86 percent), and the overall VMT reduction is estimated to be 128,029,584 (0.76 percent). With PAYD leasing, the peak-period annual VMT reduction is estimated to be 41,004,251 (0.72 percent), and the overall VMT reduction is estimated to be 84,700,023 (0.50 percent).

While these percentages appear low, they compare favorably with the results of major public sector capital investments in new system capacity such as new transit lines. Of course, PAYD would cost the public sector little (perhaps in tax breaks) or nothing.

VMT reduction estimates under the PAYD programs were used to estimate impacts to other measures that are related to VMT, such as fuel consumption and emission levels. The relationships used are based on the Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) Model and the U.S. Environmental Protection Agency's (EPA) COMMUTER Model. These reduction estimates are shown in Table 3.4 for both the PAYD Insurance and PAYD Leasing products. Annual fuel consumption would be reduced somewhere between 4.4 and 6.6 million gallons depending on the PAYD product. Comparable emission reductions can be assumed to occur across all pollutants. The impact of the reduction in VMT on fatal accidents was also analyzed, but there was no significant impact.

Table 3.4 Secondary Impacts of PAYD Insurance and Leasing Products

		PAYD Insurance		PAYD Leasing	
	Without Pricing	With Pricing	Reduction	With Pricing	Reduction
Estimated VMT	16,820,539,331	16,692,509,748	128,029,584	16,735,839,309	84,700,023
Fuel Consumption (Gallons)	867,038,110	860,438,647	6,599,463	862,672,129	4,365,981
Emissions (Grams in Thousands)					
HC	10,395,093	10,315,971	79,122	10,342,749	52,345
CO	128,340,715	127,363,849	976,866	127,694,454	646,261
NO_x	13,675,098	13,571,010	104,088	13,606,237	68,861
$PM_{2.5}$	200,164	198,641	1,524	199,156	1,008
CO_2	7,703,807,014	7,645,169,464	58,637,549	7,665,014,403	38,792,611

We also examined the impact of vehicle substitution within households. Generally but uniformly, the presence of a nonpriced vehicle in a household increased the mileage reduction on the priced vehicle, indicating that some vehicle substitution was occurring. But, this substitution effect did not wholly account for the mileage reduction in these households. Also, it should be stressed that the data for the nonpriced vehicles is not as reliable as the priced data. It should also be noted that in a real market situation, the substitution effect is likely to be more of an issue in vehicle leasing (where a household may only chose to price one vehicle), than in vehicle insurance (where a household is more likely to put all vehicles under a similar policy).

4.0 Potential Next Steps

In conclusion PAYD products, particularly in the insurance field, appear to offer another tool for the public and private sectors to use in managing driving behavior, at a time when the need for such tools has never been higher and is likely to increase. Going forward, MnDOT should seek to partner with the Minnesota State Insurance Commissioner and with insurance carriers to promote the development and marketing of PAYD insurance products in the State. Travelers Insurance has already expressed such an interest in the Twin Cities, and companies such as Progressive are offering products today in the Twin Cities and elsewhere. MnDOT could share the results of this study with interested parties, and offer to participate in future data collection and analysis of actual market testing of such strategies.

The ability of state governments to alter vehicle ownership and leasing policies is more subtle and complex. However, there are a number of steps which MnDOT could take today, including:

- Monitor trends in the automobile industry so as to be prepared to encourage and partner with existing or potentially new market entrants which might be interested in offering PAYD products.
- Initiate a dialogue with locally based industry sectors which could influence the development of PAYD products, including auto dealerships, large public-spirited corporations with market influence (such as 3M), large private sector fleet operators, and locally based market players with national reach such as Enterprise rent-a-car.
- Remain actively involved with national players in this field including U.S. DOT, the auto industry, vehicle leasing companies, and new market entrants such as Zipcar and Flexcar.
- Work with the state legislature to investigate the option of offering tax incentives or vehicle registration fee reductions for PAYD leasing products.