

## Pay-As-You-Drive Insurance *Recommendations for Implementation* 8 June 2011

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*Vehicles are safest when parked. PAYD encourages motorists to reduce vehicle travel, providing many benefits.*

### **Abstract**

This paper provides guidance for implementing Pay-As-You-Drive (PAYD) vehicle insurance, which directly incorporates mileage as a rate factor. It describes PAYD pricing options, discusses PAYD benefits and costs, describes regulatory reforms, evaluates various objections to PAYD, and provides specific recommendations for PAYD implementation.

Various data sources indicate that crash costs increase with annual vehicle mileage. As a result, PAYD increases actuarial accuracy (premiums better reflect a vehicle's claim costs). PAYD pricing rewards motorists when they reduce their mileage, providing financial savings and additional benefits including increased safety, congestion reduction, road and parking facility cost savings, energy conservation, emission reductions, and increased insurance affordability. There are many possible ways to implement PAYD insurance; some provide more benefits than others. Insurance regulators can maximize benefits by defining performance standards that policies must meet to be considered PAYD, as described in this paper. Critics raise various objections to PAYD pricing, but many of these are technically inaccurate or can be addressed with appropriate implementation practices.

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## Introduction

*Pay-As-You-Drive (PAYD, also called Distance-Based, Usage-Based and Per-Mile Pricing)* means that vehicle insurance premiums are directly based on the number of miles a vehicle is driven during the policy term.<sup>1</sup> This paper describes PAYD concepts, explores its impacts and requirements, describes factors to consider when establishing a PAYD product rating system, and provides recommendations for implementation.<sup>2</sup>

Many organizations are investigating ways to implement PAYD insurance to achieve various planning objectives, including increased affordability, consumer savings, traffic safety and emission reductions (CDI 2008; Mills 2009; NAF 2009).

Several insurance companies now offer PAYD products:

- Aioi Insurance ([www.ioi-sonpo.co.jp](http://www.ioi-sonpo.co.jp)), Japan
- Aryeh ([www.aryeh.co.il](http://www.aryeh.co.il)), Israel
- Holland PAYD Coverage ([www.payasyoudrive.co.za](http://www.payasyoudrive.co.za)), South Africa
- MileMeter ([www.milemeter.com](http://www.milemeter.com)), United States
- MiDriveStyle ([www.miway.co.za/midrivestyle](http://www.miway.co.za/midrivestyle))
- Pago Por Uso ([www.jovenesdesiguales.com](http://www.jovenesdesiguales.com)), Spain
- PAY PER K Coverage ([www.nedbank.co.za](http://www.nedbank.co.za)), South Africa
- Polis Vor Mij ("Policy for me") ([www.PolisVoorMij.nl](http://www.PolisVoorMij.nl)), The Netherlands
- Polis Direct Kilometre Policy ([www.kilometerpolis.nl](http://www.kilometerpolis.nl)), The Netherlands
- Progressive, *MyRate* ([www.progressive.com/MyRate/myrate-default.aspx](http://www.progressive.com/MyRate/myrate-default.aspx)), USA
- Real Insurance PAYD ([www.payasyoudrive.com.au](http://www.payasyoudrive.com.au)), Australia

Many North American insurance companies are considering or testing PAYD pricing. According to a survey 115 insurance companies, 66 indicated that they had considered offering PAYD products, two planned to offer such products by mid-2009, and twelve planned to do so before the end of 2009 (Exigen 2008). The top market driver for PAYD introduction was readiness to respond to protect their book of business from competitors. Entering a new market to grow revenue was second ahead of entering the market to gain market perception as exercising corporate responsibility with a “green” product.

At least one major new PAYD pilot project will be implemented in 2010. King County Metro, the Washington State Department of Transportation, other partner agencies, and the Unigard Insurance Company of Bellevue, Washington are developing a PAYD product that will be tested by at least 5,000 motorists (Metro 2007).

This all suggests that PAYD insurance will become increasingly important in the near future.

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<sup>1</sup> Although this paper refers to miles and mileage, the same concepts can be applied to comparable units of vehicle use, including vehicle-kilometers, and possibly vehicle-minutes of use.

<sup>2</sup> For more detailed descriptions of PAYD see Butler (1992); Litman (1997 and 2001); Edlin (1999); Harrington and Parry (2005); and Bordoff and Noel (2008).

## Pay-As-You-Drive Concepts

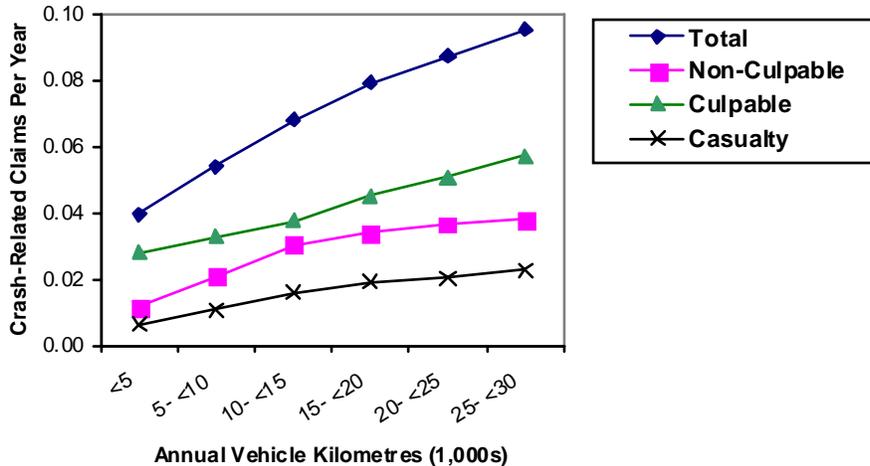
PAYD insurance reflects the principle that prices should reflect costs, and consumers who reduce costs should receive resulting savings. Reduced driving reduces crash risk and insurance claims. With current pricing, claim cost savings that result when motorists reduce mileage are retained as profits by insurers or returned to premium payers as a group. PAYD pricing return these savings to individual motorists who reduce mileage.



*PAYD pricing returns to individual motorists the insurance cost savings that result when they drive less. It rewards motorists for reducing mileage and makes premiums more accurately reflect the insurance costs of each individual vehicle.*

PAYD pricing gives motorists a new opportunity to save money, providing an incentive to reduce mileage, allowing individual consumers decide which miles, if any to forego. Any vehicle-miles reduced consist of lower-value vehicle travel that motorists willingly give up in exchange for savings, increasing their consumer surplus. For example, at 5¢ per mile, motorists would continue driving vehicle miles that they value more than this amount but forego vehicle-miles that they value less than this amount. To the degree that motorists reduce mileage, and therefore crashes and insurance claims, the savings that result are net benefits to society, not just economic transfers.

**Figure 1** Crash Rates by Annual Vehicle Mileage (Litman 2001)



*Annual insurance claims tend to increase with annual vehicle travel.*

In recent years researchers have gained better information about the relationships between vehicle mileage, crashes and insurance claims. New data (such as mileage data collected during vehicle emission inspections matched to insurance claim records of individual vehicles) show a strong positive relationship between mileage and crashes, as illustrated in Figure 1.<sup>3</sup> Even comprehensive claims (theft, vandalism and weather damage) tend to increase with annual mileage (Litman (2001)).

There are confounding factors that affect mileage and crash rates. For example, young and old drivers, people with disabilities, and urban residents who do more driving on surface streets, tend to drive lower annual mileage and have higher per-mile crash rates.<sup>4</sup> However, these factors can be incorporated into rating, either directly or by surrogates such as driving experience. Once these are taken into account (that is, for a given rate class) there is a strong positive relationship between mileage and crashes.

The relationship between mileage and claims is probably even stronger than Figure 1 indicates due to differences between mileage and claims within these large mileage classes, and other confounding risk factors that cannot be perceived until mileage is directly applied as a rating factor (Litman 2001). For example, within the 5,000-10,000 annual mileage range for a particular rate class, motorists who drive 9,000-10,000 may be fitter and drive proportionately more miles on grade-separated highways than those who only drive 5,000-6,000. Once actuaries have experience with PAYD pricing they will have better data for calculating more accurate PAYD rates.

Available data suggest that a change in overall average vehicle travel (that is, travel that includes an equal mix of high- and low-risk vehicle-miles) provides about proportional change in claim costs by those vehicle's insurers, and proportionally larger reductions in *total* crash costs since about 70% of crashes involve multiple vehicles and the average crash results in about 1.5 claims (Vickrey 1968; Edlin 2003). As a result, each vehicle removed from traffic reduces both its chances of causing a crash and of being the target of a crash caused by another vehicle, and each avoided multi-vehicle crash reduces multiple claims. Thus, if most vehicles in an area shift to PAYD premiums, the resulting reduction in total crashes and claim costs should be proportionately larger than the reduction in mileage (a 10% mileage reduction is estimated to provide a 12-15% reduction in total crashes).

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<sup>3</sup> For detailed information on the relationships between mileage and crash rates see Litman (2001); Edlin and Mandic (2001); Litman and Fitzroy (2005); and Bordoff and Noel (2008).

<sup>4</sup> Urban miles tend to have relatively high per-mile crash rates but low fatality rates.

## Benefits and Costs

PAYD can provide these benefits (Litman 1997; Funderberg, Grant & Coe 2003; Bordoff and Noel 2008):

- Increased actuarial accuracy. It makes premiums more accurately reflect the insurance costs of an individual vehicle, which is fairer and more economically efficient.
- Consumer savings. With PAYD pricing average motorists are expected to reduce their annual mileage, crashes and insurance costs by about 10%, providing about \$100 annual savings.
- Increased insurance affordability (Litman 2004). Since annual vehicle travel tends to increase with income, most lower-income motorists would save.<sup>5</sup>
- Increased traffic safety (Perry 2004). Mileage reductions reduce exposure and traffic density, and therefore total crashes. Higher risk motorists pay more per vehicle-mile and therefore have a larger incentive to reduce mileage, providing additional crash reductions. If broadly applied, traffic crashes should decline proportionately more than mileage, so for example, a 10% mileage reduction reduces crashes 12-15% (Edlin and Mandic 2006).
- Reduced traffic congestion, roadway and parking facility costs.
- Energy conservation and pollution emission reductions (CCAP 2005; Harrington and Parry 2005). If applied to all vehicles it can achieve approximately a third of the Kyoto emission reduction targets for private vehicles.
- By increasing affordability it should reduce uninsured driving (Butler 2000).

PAYD implementation can also impose some costs:

- It requires new rate structures, administrative procedures and rate plans. Insurers bear these costs when rate structures change, but PAYD could increase these costs more than average.
- Most PAYD systems increase transaction costs (administrative costs per policy). Incremental costs range from less than \$0 per vehicle-year for self-reporting systems (MileMeter 2009), to more than \$150 per vehicle-year for pricing systems that track vehicle location.
- Until insurers gain experience with this rate structure there will be uncertainties about risks and therefore how to structure rates.
- It can make premiums less predictable to consumers. Motorists and insurers would not know total premiums until the end of the insurance term.
- If universally implemented it may increase premiums for some motorists (those who continue to drive high annual miles in their rate class), although most motorists should save money.

Most motorists should benefit overall, including those who currently drive less than average in their rate class, those who would reduce their mileage to below average in response to this incentive, those who drive uninsured but would purchase insurance if offered PAYD, and motorists who drive high annual miles but value benefits such as reduced traffic congestion, accident risk and pollution emissions.

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<sup>5</sup> Most low-income motorists drive less than 12,000 annual miles and so would save with PAYD pricing.

## Potential Price Structures

Various PAYD insurance pricing options are discussed below.

### 1. Mileage Rate Factor (MRF)

PAYD can be implemented by incorporating annual mileage as a rating factor into premiums. Many insurers do offer small discounts for motorists who drive less than certain levels (such as 7,000 annual miles). However, these are currently based on motorists' self-reported estimates of their expected future mileage; since motorists cannot predict with certainty how much they will drive and there is no verification or adjustment at the end of the policy term, motorists significantly underestimate their annual mileage.<sup>6</sup> As a result, Mileage Rate Factor is currently inaccurate and can only apply a small portion of the actuarially justified weight on mileage.

The Mileage Rating Factor system can be improved by adding more mileage bands (such as every hundred miles),<sup>7</sup> verifying mileage based on a third party odometer reading,<sup>8</sup> and adjusting premiums at the end of the policy term, with a rebate to motorists who drove less than the number of miles they paid for, and a surcharge to motorists who drove more. This requires a mechanism to insure that motorists actually pay such surcharges.

### 2. Per-Mile Premiums (PMP)

This means that vehicle insurance is sold by the vehicle-mile rather than the vehicle-year.<sup>9</sup> Other rating factors are incorporated, so higher-risk drivers pay more per mile than lower-risk vehicles. For example, a \$500 annual premium becomes 4¢ per mile and a \$1,000 annual premium becomes 8¢ per mile, for vehicles in a rate class that averages 12,000 annual miles.

Figure 1 suggests that marginal crash rates vary over the mileage range. This may justify marginally declining per-mile premiums, so, for example, the first 5,000 annual miles could be priced at 10¢ per vehicle-mile, the second 5,000 at 8¢ per vehicle-mile, the third 5,000 miles at 6¢ per vehicle miles, and miles over 15,000 annual miles at 5¢ per vehicle-mile. However, many factors that contribute to the declining marginal crash rate can be incorporated directly into this price structure so the need for marginally declining rates should decline as insurers gain experience with PAYD pricing.

With this system, motorists typically prepay for the miles they expect to drive during the term. For example, some might pay for 15,000 miles at the start of the term, while others might pay for just 5,000 miles at first and make additional payments as needed. Total premiums are calculated at the end of the term based on recorded mileage. Vehicle owners are credited for unused miles or pay any outstanding balance. Insurers would

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<sup>6</sup> Insurers typically find that more than half of all motorists claim to drive less than 7,500 miles per year, although vehicles actually average about 12,000 miles (Butler, Butler and Williams 1998).

<sup>7</sup> Since PAYD typically causes modest mileage reductions, mileage bands must be small so a typical motorist perceives an opportunity to save money.

<sup>8</sup> Current California insurance law allows insurers to *request* mileage verification data, but may not *require* third-party odometer readings, so the resulting data are unverified and unreliable.

<sup>9</sup> In other words, this converts the unit of exposure from the vehicle-year to the vehicle-mile or comparable units such as the vehicle-kilometer or vehicle-minute.

probably require purchase of a minimum number of miles per policy to insure that their transaction costs are recovered. There are several possible approaches to coverage, depending on regulatory requirements and pricing practices:

- A. *Coverage only on prepaid miles/minutes.* For example, if a vehicle owner pays for 5,000 miles, they have no coverage at 5,001 miles. This is the simplest approach and is appropriate for optional coverage, but could result in uninsured driving.
- B. *Coverage regardless of prepayment.* Once a driver makes a minimum payment they have coverage for the policy term and pay for any outstanding miles at the end of the term. For example, at the start of the term a motorist might pay for 5,000 miles of coverage but drive 15,000 miles. At the term end they must pay for the outstanding 10,000 miles. This requires a mechanism to insure that motorists pay outstanding fees, such as a bond or credit card charge that can be invoked if no final odometer reading is recorded, and requirements that outstanding insurance miles be paid before a vehicle can be reinsured and reregistered.
- C. *Coverage regardless of prepayment, with late payment penalties.* This combines options A and B. Coverage is provided for all travel during the policy term but claims on unpaid miles have financial penalties, or post-payment have a surcharge. For example, deductibles could double for claims that occur past the prepaid number of miles, or miles paid after the end of the policy term have a 10% surcharge (6.0¢/mile would cost 6.6¢ if paid after the term). This also requires a mechanism to insure that motorists pay for outstanding mileage.
- D. *Motorists initially pay premiums as they do now, but receive rebates for mileage below a certain level.* For example, they could receive 8¢ for each mile below 12,000 annual miles. However, once motorists reach the threshold they have no incentive to reduce mileage.

Per mile premiums may require *odometer auditing* to collect accurate vehicle-mileage data. Odometer audits would be performed when a vehicle's insurance is renewed, in most cases annually. Audits involve these steps:

1. Check speedometer and instrument cluster for indications of tampering.
2. Record tire size and check that it is within the specified range.
3. Attach a small seal to the ends of mechanical odometer cables to indicate if it has been removed. This is unnecessary on most newer vehicles with electronic speedometers.
4. Check odometer accuracy (this is optional and could be performed on a random basis).
5. Record odometer reading and forward results to the vehicle licensing agency.

Such audits typically take 5-10 minutes and less if performed with other vehicle servicing, estimated to cost \$5-15 per vehicle-year. Auditors could be certified by the state (similar to certification for other vehicle services, such as emission inspecting), by the insurance industry, or even by individual insurance companies. Some PAYD pricing use various electronic systems to automatically report odometer readings.<sup>10</sup>

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<sup>10</sup> Such as Progressive's *MyRate* system ([www.progressive.com/MyRate/myrate-default.aspx](http://www.progressive.com/MyRate/myrate-default.aspx)).

There are concerns that odometer fraud could be a problem, but most tampering can be detected during audits and crash investigations, and fraud would void coverage. Odometers are increasingly tamper-resistant. Odometer audits should provide data as accurate as that used in other common commercial transactions and more accurate than self-reported information now used for insurance pricing. Audits would provide additional benefits, including accurate mileage data for used-vehicle buyers, and allows other charges, such as registration fees, to become distance-based at minimal extra cost.

Per-Mile Premiums could be implemented as a consumer option. Motorists would choose between vehicle-year and vehicle-mile premiums, just as consumers can now choose their telephone service rates. Optional Per-Mile Premiums are likely to attract 25-50% of policies during the first few years, with penetration increasing over time as it become more competitive compared with vehicle-year pricing.

### **3. GPS-Based Pricing**

This system uses GPS (Global Positioning System) transponders installed in vehicles to price insurance based on time and location. For example, a motorist might pay 7¢ per minute for urban-peak driving, 5¢ for urban-off-peak driving, and 3¢ per minute in rural areas. This allows more actuarially-accurate pricing, but typically adds \$150 or more in annual costs for equipment, billing and royalties, and raises privacy concerns, although such can be addressed by controlling vehicle location data management. Under most proposals, GPS-based pricing would be a consumer option. It would tend to attract low-mileage motorists, particularly those who want other GPS-based services and are unconcerned about loss of privacy, probably 2-5% of current policies.

#### **Summary**

The table below summarizes the pricing options evaluated in this report.

**Table 1 Summary of Distance-Based Pricing Options**

Name	Description
MRF	<i>Mileage Rate Factor</i> is incorporated into premiums.
Per-Mile, Mandatory	All vehicle insurance is priced by the mile or kilometer.
Per-Mile, Optional	Motorists may choose between vehicle-year or vehicle-mile premiums.
GPS-Based Pricing	Motorists may choose to purchase insurance based on when and where they drive using a GPS transponder installed in their vehicle.

*This table summarizes the pricing options evaluated in the next section of this report.*

## **PAYD Pricing Product Rating**

Some PAYD products provide greater benefits than others. To minimize confusion and maximize benefits it will be useful to develop a PAYD rating system similar to *LEED Building* (NGBC 2009) and the *Energy Star* (USEPA 2009) standards.

Four factors are considered in the proposed ratings:

1. *Mileage band size (smaller is better)*. Many policies use 100, 500 , or 1,000 mileage bands. The smallest mileage band is a single vehicle-mile.
2. *Minimum number of miles motorists must purchase (smaller is better)*. This insures that policy transaction costs are repaid even for vehicles driven very low annual miles.
3. *Percentage reduction in total premiums provided by a 50% reduction in annual mileage (larger is better)*. This is based on the percentage reduction in total annual premiums (including optional coverages such as fire and theft) provided by a reduction from 12,000 to 6,000 annual miles (from 6,000 to 3,000 miles for a six-month policy).
4. *If unit prices vary between mileage bands, maximum difference between highest and lowest prices in a policy (smaller is better)*. For example, for a particular policy the first 5,000 annual miles could be priced at 10¢ per vehicle-mile, the second 5,000 at 8¢ per vehicle-mile, the third 5,000 miles at 6¢ per vehicle miles, and miles over 15,000 annual miles at 5¢ per vehicle-mile. In this case the maximum difference is two, since 10¢ is twice 5¢.

The ratings are:

### **Gold**

Premiums are priced by the vehicle-mile, incorporating all existing rating factors. A 50% mileage reduction provides at least a 50% premium reduction. Insurers may require up to 2,000 annual miles purchased. Unit prices may not vary by more than a factor of two.

### **Silver**

Maximum bands of 250 miles of driving. A 50% mileage reduction provides at least a 40% premium reduction. Insurers may require the purchase of up to 3,000 annual miles. Unit prices may not vary by more than a factor of 2.5.

### **Bronze**

Maximum bands of 500 miles of driving. A 50% mileage reduction provides a 25% premium reduction. Insurers may require the purchase of up to 4,000 annual miles. Unit prices may not vary by more than a factor of 3.0.

## **Rating Summary**

<b>Rating Factors</b>	<b>Gold</b>	<b>Silver</b>	<b>Bronze</b>
Maximum mileage bands used for pricing	1	250	500
Maximum annual miles that must be purchased	2,000	3,000	4,000
Percentage premium reduction from a 50% mileage reduction	50%	40%	25%
Maximum difference between lowest to highest price unit	2	2.5	3

*This table summarizes minimal performance requirements for PAYD ratings.*

## Responses to Concerns About PAYD Insurance

*This section discusses concerns that have been raised about PAYD pricing.*

*Insurance pricing already incorporates mileage.*

Some insurance companies incorporate mileage-related rate factors such as commute distance or estimated annual mileage, but none begins to approach actuarially accurate, marginal pricing, so they fail to give motorists accurate price signals.

*Mileage is less important in predicting crashes than other rating factors.*

Insurance industry claims that annual mileage is not a significant risk factor are based on inaccurate, self-reported data. New research based on independently-collected mileage data shows a strong relationship between mileage and crashes. Whether mileage is more or less important than other risk factors is irrelevant for PAYD pricing that incorporates other rating factors. Although it would not be actuarially accurate to use mileage instead of other rating factors, for example, to charge all motorists the same 6¢ per mile for insurance, actuarial accuracy increases significantly if mileage is added to other rating factors, so for example, a lower-risk motorist pays 3¢ per mile and a higher risk motorist pays 12¢ per mile.

*Travel foregone could be lower risk than average, resulting in little crash reduction, and less insurance cost savings than reduced premium revenue.*

This concern is technically valid, although there is no evidence that it is true. Available evidence indicates that PAYD reduces both high and low risk travel, and broad vehicle travel reductions result in proportionally greater crash reductions and insurance savings. Additional research and pilot projects that test the effects of distance-based pricing could address this concern.

*PAYD pricing increases costs to low-income motorists.*

PAYD provides significant savings and benefits to most lower-income motorists, including those who currently drive less than average; those who drive somewhat more than average but will reduce their mileage in response to this price incentive and so end up saving money; those who currently drive uninsured because they cannot afford insurance; and those who currently cannot afford to own an automobile due to high insurance costs, but can when PAYD becomes available. Butler (2000) describes how fixed insurance pricing creates a spiral of rising premiums and uninsured driving rates that harm low-income communities.

*PAYD pricing unfairly increases costs to high-mileage drivers.*

PAYD increases premiums for motorists who drive significantly more than average within their rate class. This is justified on actuarial grounds, and so increases fairness. Most motorists save money and benefit overall, particularly lower-income motorists, who tend to drive less than average within their rate groups.

*PAYD pricing unfairly increases costs to rural residents.*

Since territory is a rate factor, only rural motorists who drive significantly more than the average among rural residents would pay more. For example, motorists average 12,000 annual miles but rural motorists average 15,000, rural residents who drive 14,000 annual miles would save money, although this is more than the state average, because it is less than the rural average.

*Automobile insurance reform should focus on equity, affordability and safety.*

PAYD pricing helps achieve all of these goals. It increases equity by making premiums more actuarially accurate. It allows motorists to save money, makes vehicle ownership more affordable, and reduces costs for lower income motorists. It significantly increases road safety.

*Privacy Concerns*

Some people fear that PAYD pricing invades motorists' privacy (Troncoso, et al. 2007). However, privacy is not a legitimate concern for PAYD pricing that is based only on vehicle mileage, since this information is already collected frequently and available to consumers.<sup>11</sup> Privacy concerns are only a risk with GPS-based pricing which tracks when and where a vehicle is driven. Such concerns can be addressed by controlling how data are processed and stored.<sup>12</sup> Many motorists choose to have GPS systems in their vehicles for navigation and emergency services. Privacy is not a concern if PAYD pricing is a consumer option so individuals can decide what data they share with insurers, or if it uses mileage data which indicate nothing about when and where a vehicle is driven, and there are adequate controls over how data are processed and stored.

*Consumers will not accept this change.*

Market surveys and pilot projects indicate significant consumer demand for distance-based pricing. A broad range of interest groups support PAYD pricing. Support should increase as consumers and citizens learn more about this concept.

*Odometer fraud will be a major problem.*

Although some fraud may occur, it should be minor overall, with fraud rates comparable to other common consumer transactions, and far lower than with current insurance pricing based on self-reported predictions of future mileage. Odometers are increasingly tamper resistant, regular odometer audits should discourage tampering, and the financial incentive for fraud is relatively low. Insurers' financial exposure would be minimal since odometer fraud voids coverage.

*It increases administrative costs to insurers and inconvenience vehicle owners.*

Although any price change adds short-term transition costs, these are minor, and tiny compared with total benefits. Odometer audits should cost \$5-\$15, and less if performed in conjunction with scheduled maintenance such as an oil change or emission inspection.

*This type of pricing has never been used before.*

Some vehicle insurance is already distance-based: rates for fleets and commercial vehicle coverage are often based on mileage. Several insurers now offer PAYD policies. There is nothing unique about pricing based on use. Prices for most goods are based on some measure of consumption, such as water and electric meters, and scales used to weigh food. Vehicle rentals and leases incorporate odometer-based price components. Vehicle insurance is unusual for having pricing that allows unlimited consumption (i.e., vehicle mileage).

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<sup>11</sup> CarFax ([www.carfax.com](http://www.carfax.com)).

<sup>12</sup> Such as Skymeter Corporation ([www.skymetercorp.com](http://www.skymetercorp.com))

Table 3 summarizes various obstacles to PAYD implementation and potential solutions. Some obstacles reflect misunderstandings about the concepts and so can be addressed by information. Others obstacles reflect uncertainty and so can be addressed with pilot projects that provide useful information and experience. Others may require regulatory reform or incentives to encourage insurance companies to offer PAYD pricing.

**Table 3 Obstacles and Potential Solutions**

Obstacle	Potential Solutions
Misunderstandings. Many objections to PAYD pricing reflect misunderstandings of the concept. Some people believe it refers to Pay-At-The-Pump (insurance coverage funded through a fuel sales surcharge), are unaware of its full potential benefits, or have exaggerated estimates of its costs.	Educate stakeholders (policy makers, insurance professionals, insurance regulators, consumers) about PAYD, including how it would be implemented, and its real benefits and costs.
Uncertainty. Current rate structures are based on claim cost data collected by the vehicle-year. Although there is ample evidence that mileage is an important risk factor, actuaries have insufficient data to know exactly how to calculate mileage-based premiums.	Begin with a relatively small pilot project, using a basic prorated premium (i.e., current annual premiums divided by average annual mileage for each rate class), with an extra 5-15% margin to account for uncertainty. Adjust this rate as needed as the pilot project provides data.
Data accuracy. PAYD requires accurate mileage data. Self-reported data is unreliable.	Mileage data can be collected in many ways, including self-reporting with spot checks, or odometer audits performed by insurance brokers or service stations.
Exaggerated number of losers. Some people object to PAYD because they believe it would harm many groups, such as rural drivers (PAYD, as recommended here, would only increase costs for rural motorists who drive more than the average for rural motorists) or businesses (premiums for business vehicles already reflect their relatively high mileage).	Educate stakeholders about PAYD insurance real distributional impacts. To the degree that it is effective at reducing mileage and crash costs, most people should benefit overall. Even high mileage drivers can benefit overall due to reduced exposure to traffic congestion, accident risk and pollution emissions, or if they want to own multiple vehicles.
Regulatory constraints. Some insurance regulations discourage pricing reforms. For example, regulators often require insurers to provide data justifying rates, and some prohibit insurers from offering multiple rate structures. Regulations are complex and rate filings are costly (often costing a million dollars or more in data collection, analysis and paper works), which discourages small, innovative pilot projects.	Educate insurance regulators concerning the merits of PAYD with respect to insurance regulatory objectives. Collect data showing the actuarial basis for PAYD. Work with regulatory agencies to address specific obstacles to innovation and small pilot projects. Identify jurisdictions that have suitably supportive regulatory policies. Pass legislation (as in Oregon and Texas) which specifically allows PAYD insurance pricing.
Lack of incentive. Insurance companies currently perceive little incentive to implement innovative pricing options such as PAYD pricing.	Educate insurance professionals concerning ways to profit from PAYD pricing (the first companies to offer this product can attract new clients). Provide financial incentives, such as tax breaks (as Oregon now does). Pass laws requiring insurance companies to offer PAYD, at least as an option. Fund PAYD research programs and pilot projects. Favor insurance companies that offer PAYD pricing in government contracts.

*This table lists various obstacles to PAYD pricing, and potential solutions.*

## Conclusions and Recommendations

Motorists currently perceive vehicle insurance as a fixed vehicle cost with respect to annual vehicle travel. Marginal vehicle mileage reductions generally provide no insurance premium savings. Extensive research indicates that crash and insurance claim costs per vehicle-year increase with annual vehicle mileage. Other risk factors also affect crash rates so it would be inappropriate to charge all motorists the same per-mile fee, but premiums become more actuarially accurate if mileage is incorporated with other rating factors, so lower risk motorists pay less per mile than higher risk motorists. As a result, PAYD insurance, which bases premiums directly on the amount a vehicle is driven during a policy term, increases economic efficiency and equity.

PAYD pricing not a new fee, simply a different way to pay existing fees. It rewards motorists when they reduce mileage with the crash cost saving that result. This provides many benefits including consumer savings and affordability, increased safety, congestion reductions, road and parking cost savings, energy conservation, pollution reductions, and reduced uninsured driving. Even motorists who continue with current insurance pricing would benefit from reduced exposure to traffic risk, congestion and pollution emissions.

Basic PAYD is relatively simple to implement; it only requires verified odometer readings (called “odometer audits”) at the beginning and end of the policy term. More complicated data collection systems may be offered as a consumer option, but they increase implementation costs and raise privacy concerns.

Many objections to PAYD are technically inaccurate or can be addressed with appropriate policies. Most types of PAYD impose neither large transaction costs nor loss of privacy. Mileage data can be collected through annual odometer audits performed by service stations and insurance brokers. With most modern vehicles, odometer fraud is difficult and can be detected with simple precautions. Rural residents as a group would not bear higher premiums; only those who drive more than average among rural residents would pay more with PAYD pricing.

PAYD pricing benefits vary significantly depending on product design. To minimize confusion and maximize benefits it will be important to define performance ratings so insurers, regulators and consumers identify and select the most effective PAYD products. The proposed rating system considers the following factors: mileage band size; minimum number of miles motorists must purchase; percentage reduction in total premiums provided by a 50% reduction in annual mileage; and if unit prices vary between mileage bands, maximum difference between highest and lowest prices in a policy. This is a preliminary proposal. Please contact Todd Litman ([litman@vtpi.org](mailto:litman@vtpi.org)) at the Victoria Transport Policy Institute if you have questions or comments about this concept.

## References and Resources of More Information

Jason E. Bordoff (2008) *Pay-As-You-Drive Car Insurance*, Brookings Institution ([www.brookings.edu/articles/2008/spring\\_car\\_insurance\\_bordoff.aspx](http://www.brookings.edu/articles/2008/spring_car_insurance_bordoff.aspx)).

Jason E. Bordoff and Pascal J. Noel (2008), *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity*, The Brookings Institution ([www.brookings.edu](http://www.brookings.edu)); at [www.brookings.edu/~media/Files/rc/papers/2008/0417\\_payd\\_bordoff/0417\\_payd\\_bordoff.pdf](http://www.brookings.edu/~media/Files/rc/papers/2008/0417_payd_bordoff/0417_payd_bordoff.pdf).

Patrick Butler (1992), *Operation of an Audited-Mile/Year Automobile Insurance System Under Pennsylvania Law*, Cents Per Mile Now ([www.centspermilenow.org](http://www.centspermilenow.org)); at [www.casact.org/pubs/forum/93sforum/93sforum.pdf](http://www.casact.org/pubs/forum/93sforum/93sforum.pdf).

Patrick Butler (2000), *Why The Standard Automobile Insurance Market Breaks Down In Low Income Zip Codes*, Report to the Texas House Committee on Insurance; at [www.centspermilenow.org/633b-4522.pdf](http://www.centspermilenow.org/633b-4522.pdf). Also see “Pay-per-Mile Auto Insurance” *Consumer Economic Issues in America*, (2003); at [www.centspermilenow.org/652Garma.pdf](http://www.centspermilenow.org/652Garma.pdf).

Patrick Butler, Twiss Butler and Laurie Williams (1998), “Sex-Divided Mileage, Accident, and Insurance Cost Data Show that Auto Insurers Overcharge Most Women,” *Journal of Insurance Regulation*, Vol. 6, No. 3&4.

CDI (2008), *NOTICE OF WORKSHOP Regarding "Pay-As-You-Drive" Automobile Insurance*, REG-2008-00020 Notice Date: May 23, 2008, California Department of Insurance ([www20.insurance.ca.gov](http://www20.insurance.ca.gov)); at [www20.insurance.ca.gov/epubacc/REG/112249.htm](http://www20.insurance.ca.gov/epubacc/REG/112249.htm).

Cambridge Systematics (2006), *Mileage-Based User Fee Demonstration Project: Potential Public Policy Implications of Pay-As-You-Drive Leasing and Insurance Products*, Final report 2006-39C, Minnesota Department of Transportation ([www.lrrb.org](http://www.lrrb.org)); at [www.lrrb.org/pdf/200639C.pdf](http://www.lrrb.org/pdf/200639C.pdf).

CCAP (2005) *Transportation Emissions Guidebook: Land Use, Transit & Transportation Demand Management*, Center of Clean Air Policy ([www.ccap.org/guidebook](http://www.ccap.org/guidebook)). This Guidebook provides information on various smart growth and mobility management strategies, including rules-of-thumb estimates of VMT and emission reductions.

*Cents Per Mile For Car Insurance* ([www.centspermilenow.org](http://www.centspermilenow.org)) is a website that promotes “cents per mile” vehicle insurance as allowed by legislation passed in the state of Texas in 2001.

Stephen J. Dubner and Steven D. Levitt (2008), “Freakonomics: Not-So-Free Ride,” *New York Times*, April 20, 2008, ([www.nytimes.com/2008/04/20/magazine/20wwln-freakonomics-t.html](http://www.nytimes.com/2008/04/20/magazine/20wwln-freakonomics-t.html)).

Aaron S. Edlin (2003), “Per-Mile Premiums for Auto Insurance,” *Economics for an Imperfect World: Essays In Honor of Joseph Stiglitz*, MIT Press; at: [http://works.bepress.com/aaron\\_edlin/28](http://works.bepress.com/aaron_edlin/28).

Aaron S. Edlin and Pinar Karaca Mandic (2006), “The Accident Externality from Driving,” *Journal of Political Economy*, Vol. 14.5, pp. 931-955; at [http://works.bepress.com/aaron\\_edlin/21](http://works.bepress.com/aaron_edlin/21).

*Environmental Defense PAYD Website* ([www.actionnetwork.org/campaign/payd](http://www.actionnetwork.org/campaign/payd)) provides information on a campaign to promote pay as you drive vehicle insurance.

Exigen (2008), *Pay-Only-As-You-Drive Survey*, Exigen Insurance Solutions ([www.exigeninsurance.com](http://www.exigeninsurance.com)); at [www.exigeninsurance.com/fsp/enews/Exigen\\_PAYD\\_Survey\\_Report.pdf](http://www.exigeninsurance.com/fsp/enews/Exigen_PAYD_Survey_Report.pdf).

Keri Funderberg, Michael Grant and Ed Coe (2003), “Changing Insurance One Mile At A Time,” *Contingencies* ([www.contingencies.org/novdec03/changing.pdf](http://www.contingencies.org/novdec03/changing.pdf)), Nov./Dec. 2003, pp. 34-38.

Allen Greenberg (2009), “Designing Pay-Per-Mile Auto Insurance Regulatory Incentives,” *Transportation Research D*, Volume 14, Issue 6, August, pp. 437-445; earlier version at [www.vtppi.org/07-3457.pdf](http://www.vtppi.org/07-3457.pdf).

Allen Greenberg (2009), *Costs and Benefits of Varying Per-Mile Insurance Premiums Based Upon Measured Risks Specific to Each Mile Driven*, TRB Annual Meeting ([www.trb.org](http://www.trb.org)); at [www.vtppi.org/AG\\_PAYD.pdf](http://www.vtppi.org/AG_PAYD.pdf).

Randall Guensler, Adjo Amekudzi, Jennifer Williams, Shannon Mergelsberg and Jennifer Ogle (2003), “Current State Regulatory Support for Pay-as-You-Drive Automobile Insurance Options,” *Journal of Insurance Regulation*, National Association of Insurance Commissioners ([www.naic.org](http://www.naic.org)) Volume 21, No. 3, Spring 2003.

Christine Hagerbaumer (2004), “Drive-By Rates: Can Pay-As-You-Drive Insurance Attract Good Risks And Gain Insurers An Environmentally Responsible Image?” *Best’s Review*, April, pp. 68-69.

Winston Harrington and Ian W.H. Parry (2005), “Pay-As-You-Drive Car Insurance,” *New Approaches on Energy and the Environment*, Resources for the Future ([www.rff.org](http://www.rff.org)).

Todd Litman (1997), “Distance-Based Vehicle Insurance as a TDM Strategy,” *Transportation Quarterly*, Vol. 51, No. 3, Summer 1997, pp. 119-138; at [www.vtppi.org/dbvi.pdf](http://www.vtppi.org/dbvi.pdf).

Todd Litman (2001), *Distance-Based Vehicle Insurance Feasibility, Benefits and Costs: Comprehensive Technical Report*, VTPI ([www.vtppi.org](http://www.vtppi.org)); at [www.vtppi.org/dbvi\\_com.pdf](http://www.vtppi.org/dbvi_com.pdf).

Todd Litman (2004), *Pay-As-You-Drive Pricing For Insurance Affordability*, VTPI ([www.vtppi.org](http://www.vtppi.org)); at [www.vtppi.org/payd\\_aff.pdf](http://www.vtppi.org/payd_aff.pdf).

Todd Litman (2005), “Pay-As-You-Drive Pricing and Insurance Regulatory Objectives,” *Journal of Insurance Regulation*, Vol. 23, No. 3, National Association of Insurance Commissioners ([www.naic.org](http://www.naic.org)), Spring; at [www.vtppi.org/jir\\_payd.pdf](http://www.vtppi.org/jir_payd.pdf).

Todd Litman (2007), *Pay-As-You-Drive Pricing in British Columbia: Backgrounder*, VTPI ([www.vtppi.org](http://www.vtppi.org)); at [www.vtppi.org/paydbc.pdf](http://www.vtppi.org/paydbc.pdf).

Todd Litman (2007), *Win-Win Emission Reduction Strategies: Smart Transportation Strategies Can Achieve Emission Reduction Targets And Provide Other Important Economic, Social and Environmental Benefits*, VTPI ([www.vtppi.org](http://www.vtppi.org)); at [www.vtppi.org/wwclimate.pdf](http://www.vtppi.org/wwclimate.pdf).

Todd Litman (2011), *Pay-As-You-Drive Vehicle Insurance in British Columbia*, Pacific Institute for Climate Solutions ([www.pics.uvic.ca](http://www.pics.uvic.ca)); at [www.pics.uvic.ca/assets/pdf/publications/PAYD%20Insurance\\_May2011.pdf](http://www.pics.uvic.ca/assets/pdf/publications/PAYD%20Insurance_May2011.pdf).

Todd Litman and Steven Fitzroy (2005), *Safe Travels: Evaluating Mobility Management Traffic Safety Impacts*, VTPI ([www.vtpi.org](http://www.vtpi.org)); at [www.vtpi.org/safetrav.pdf](http://www.vtpi.org/safetrav.pdf).

METRO (2007), *Pay-as-You-Drive (PAYD) Insurance Pilot Project*, King County Metro (<http://your.kingcounty.gov>); at <http://your.kingcounty.gov/exec/news/2007/pdf/Payasyougofacts.pdf>.

MileMeter ([www.milemeter.com](http://www.milemeter.com)).

Evan Mills (2009), *From Risk to Opportunity: Insurer Responses to Climate Change*, Ceres, Investors and Environmentalists for Sustainable Prosperity ([www.ceres.org](http://www.ceres.org)); at [www.ceres.org/Document.Doc?id=417](http://www.ceres.org/Document.Doc?id=417). Also see, *Insurance in a Climate of Change – Resources \ Publications* (<http://insurance.lbl.gov/bibliography.html>).

NAF (2009), *Review of State Climate Action Plans*, New America Foundation Climate Policy Program ([www.newamerica.net](http://www.newamerica.net)); at [www.newamerica.net/files/State%20Climate%20Policy%20Tracker%205-4-09.xls](http://www.newamerica.net/files/State%20Climate%20Policy%20Tracker%205-4-09.xls). Justin Horner of the Natural Resources Defense Council described this analysis in the following blog: [http://switchboard.nrdc.org/blogs/jhorner/thirteen\\_states\\_say\\_ok\\_lets\\_ha.html](http://switchboard.nrdc.org/blogs/jhorner/thirteen_states_say_ok_lets_ha.html).

NCTCOG (2008), *Pay As You Drive (PAYD) Insurance Pilot Program*, Progressive County Mutual Insurance Company and the North Central Texas Council of Governments ([www.nctcog.org](http://www.nctcog.org)); at [www.nctcog.org/trans/air/programs/payd/index.asp](http://www.nctcog.org/trans/air/programs/payd/index.asp).

NGBC (2009), *Leadership in Energy and Environmental Design (LEED) Green Building Rating System*, National Green Buildings Council ([www.usgbc.org/LEED](http://www.usgbc.org/LEED))

NMA (2007), *NMA's Position on Auto Insurance*, National Motorists Association ([www.motorists.org/insurance](http://www.motorists.org/insurance)).

Ian W. H. Parry (2004), "Comparing Alternative Policies to Reduce Traffic Accidents," *Journal of Urban Economics*, Vol. 54, No. 2 ([www.elsevier.com/locate/jue](http://www.elsevier.com/locate/jue)), Sept. 2004, pp. 346-368.

Ian W.H. Parry (2005), *Is Pay-As-You-Drive Insurance a Better Way to Reduce Gasoline than Gasoline Taxes?*, Resources for the Future ([www.rff.org/Documents/RFF-DP-05-15.pdf](http://www.rff.org/Documents/RFF-DP-05-15.pdf)).

Ian W. H. Parry, Margaret Walls and Winston Harrington (2007), *Automobile Externalities and Policies*, Discussion Paper 06-26, Resources for the Future ([www.rff.org](http://www.rff.org)); at [www.rff.org/rff/Documents/RFF-DP-06-26-REV.pdf](http://www.rff.org/rff/Documents/RFF-DP-06-26-REV.pdf).

Andrew Schwartz (2004), *Evaluating Insurer Compliance with Proposition 103: Promoting Fair and Affordable Auto Insurance Pricing in California*, U.S. Environmental Protection Agency.

Sightline (2003), *NEW Facts: Pay-As-You-Drive Car Insurance*, NorthWest Environment Watch ([www.sightline.org/research/sust\\_toolkit/solutions/payd](http://www.sightline.org/research/sust_toolkit/solutions/payd)).

Carmela Troncoso, George Danezis, Eleni Kosta, Bart Preneel (2007), *PriPAYD: Privacy Friendly Pay-As-You-Drive Insurance*, Workshop on Privacy in the Electronic Society, 2007 ([www.csc2.ncsu.edu/workshops/wpes07/accepted.html](http://www.csc2.ncsu.edu/workshops/wpes07/accepted.html)), COSIC; at [www.cosic.esat.kuleuven.be/publications/article-944.pdf](http://www.cosic.esat.kuleuven.be/publications/article-944.pdf).

USEPA (2009), *Energy Star Appliance Standards*, U.S. Environmental Protection Agency ([www.energystar.gov](http://www.energystar.gov)).

William Vickrey (1968), “Automobile Accidents, Tort Law, Externalities and Insurance: An Economist’s Critique,” 33 *Law and Contemporary Problems*, pp. 464-470; at [www.vtpi.org/vic\\_acc.pdf](http://www.vtpi.org/vic_acc.pdf).

Tanja Vonk, Marten Janse, Jos Dings and Huib van Essen (2003), *Pay As You Drive (PAYD): Scope for a Variable Car Insurance Premium in the Netherlands?* CE Delft ([www.ce.nl/eng/redirect/thema\\_pricing\\_index.html](http://www.ce.nl/eng/redirect/thema_pricing_index.html)).

VTPI (2008), “PAYD Insurance,” *Online TDM Encyclopedia*, Victoria Transport Policy Institute ([www.vtpi.org](http://www.vtpi.org)); at [www.vtpi.org/tdm/tdm79.htm](http://www.vtpi.org/tdm/tdm79.htm).

Tom Wenzel (1995), *Analysis of National Pay-as-you-Drive Insurance Systems and other Variable Driving Charges*, Energy & Environment Division, Lawrence Berkeley Laboratory; at [www.osti.gov/energycitations/product.biblio.jsp?osti\\_id=125357](http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=125357).

Steve Winkelman (2007), *Travel Demand and Urban Form: Lessons and Visions*, Asilomar Conference on Transportation and Climate Policy August 22, 2007; at [www.its.ucdavis.edu/events/outreachevents/asilomar2007/presentations/Day%201%20Session%2003/Winkelman%20Intro%20to%20Asilomar%20Demand%20Session%20\(8.22.07\).pdf](http://www.its.ucdavis.edu/events/outreachevents/asilomar2007/presentations/Day%201%20Session%2003/Winkelman%20Intro%20to%20Asilomar%20Demand%20Session%20(8.22.07).pdf).

Jacobus Zantema, Dirk Van Amelsfort, Michiel Bliemer and Piet Bovy (2008), *Pay-As-You-Drive: Case Study Into Safety and Accessibility Effects of PAYD Strategies*, Transportation Research Board Annual Meeting ([www.trb.org](http://www.trb.org)); at [www.payasyoudrive.com.au/mediaroom/research.aspx](http://www.payasyoudrive.com.au/mediaroom/research.aspx).

[www.vtpi.org/payd\\_rec.pdf](http://www.vtpi.org/payd_rec.pdf)