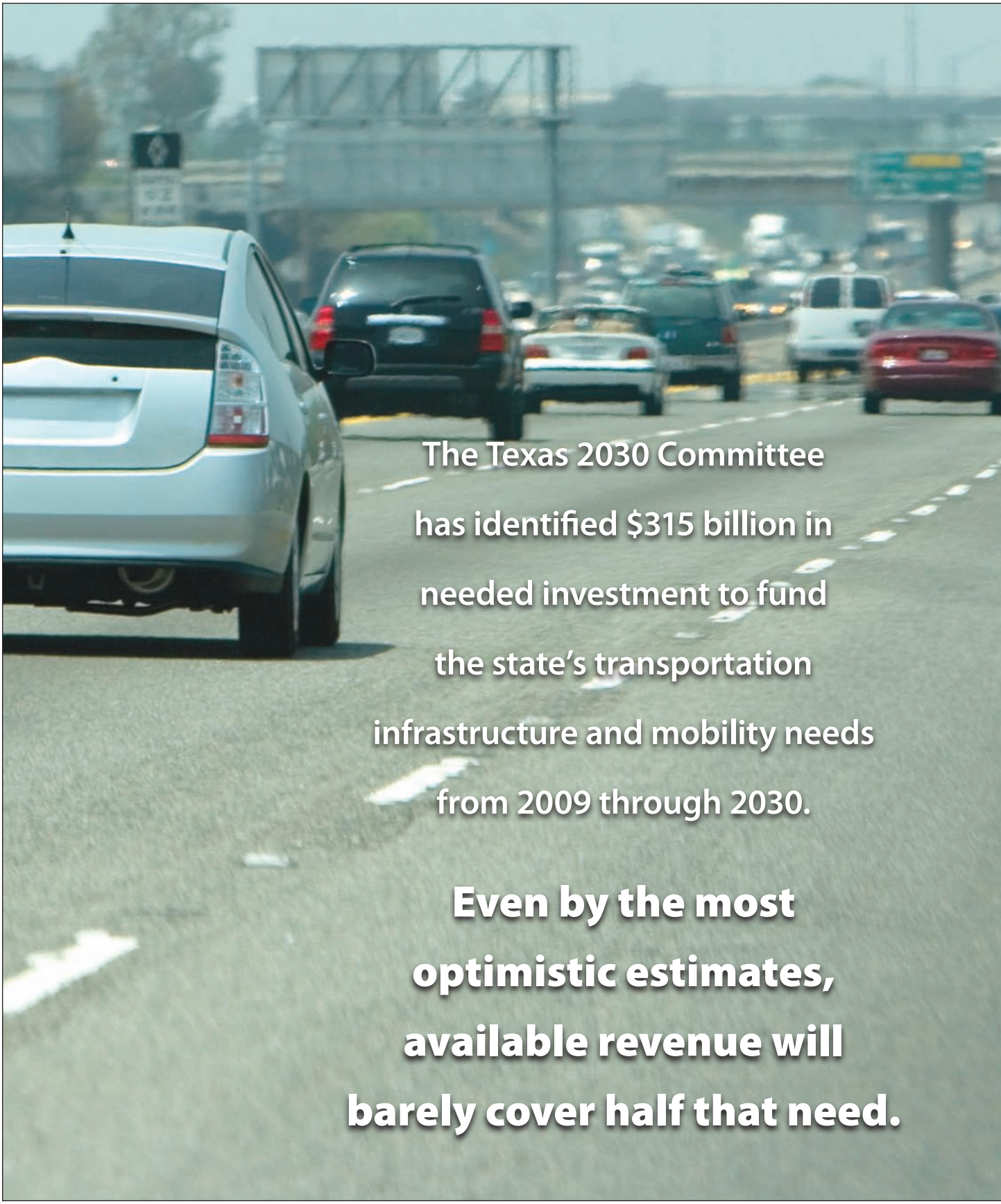

VMT
VEHICLE MILEAGE FEE PRIMER
Texas
Department
of Transportation
December 2009


The Texas 2030 Committee has identified $315 billion in needed investment to fund the state's transportation infrastructure and mobility needs from 2009 through 2030.
Even by the most optimistic estimates, available revenue will barely cover half that need.

By 2025, according to the Transportation Research Board (TRB), government regulation and continued increases in fuel prices could cut fuel consumption in the U.S. by 20 percent. This fact, combined with increasingly fuel-efficient and alternative-fuel vehicles and the $315 billion in needs identified by Texas 2030 Committee, demonstrate the inadequacy of the fuel tax as a viable long-term funding mechanism for maintaining and expanding highways in the Lone Star State.

One alternative funding mechanism is the vehicle mileage fee. This is a fee assessed on every mile driven on the roadway by a vehicle, rather than on every gallon of fuel purchased. As such, the fee's assessment more accurately reflects actual road usage compared to the fuel tax.

Various agencies at the local, state, and federal levels have begun assessing the efficacy of vehicle mileage fees as a replacement or supplemental funding mechanism. Implementing vehicle mileage fees would fundamentally change how road users pay for use of the road network and how maintenance and expansion of that network is funded. Thus, there are numerous issues and challenges facing proponents of this alternative. These issues include but are not limited to:

- Shaping policy related to the implementation of the new fee,
- Creating the technological architecture that supports implementation, and
- Addressing public concerns about a new fee.

This primer provides an overview of vehicle mileage fees and is structured to highlight and illuminate a number of different topics:

- Frequently asked questions about vehicle mileage fees,
- Long-term concerns with the current fuel tax system,
- The argument for vehicle mileage fees,
- Experiences with mileage fees and other road pricing strategies in the U.S. and abroad,
- Assessing , collecting, and enforcing vehicle mileage fees,
- The public policy questions, and
- The challenges to implementation, namely the public acceptance barriers.

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Sponsor: Texas Department of Transportation

Project Number: 0-6581-TI

Authors:

Ginger Goodin, Senior Research Engineer, Texas Transportation Institute

Richard T. Baker, Associate Transportation Researcher, Texas Transportation Institute

Chris Pourteau, Research Editor, Texas Transportation Institute

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FREQUENTLY ASKED QUESTIONS

What is the fuel tax?

Federal and state fuel taxes are paid at the pump by consumers when they purchase fuel. The fuel tax is the primary funding mechanism for the maintenance and expansion of Texas' highway infrastructure. A type of "use fee," the tax is levied on the amount of fuel purchased by an individual.

What's wrong with the fuel tax?

The fuel tax is assessed on each gallon of gasoline sold, not actual roadway use, making it, at best, an indirect funding mechanism. As fuel prices and vehicle fuel efficiencies increase, fuel consumption in the U.S. (and, therefore, tax revenues generated by it) are expected to drop by 20 percent by 2025. Yet, road maintenance and expansion needs continue to increase as our state's population grows, generating an estimated $315 billion in needs through 2030. A funding mechanism more directly tied to roadway usage appears to be a viable option to meet these needs.

What is a vehicle mileage fee?

The vehicle mileage fee, sometimes referred to as the vehicle miles traveled (VMT) fee, is a fee for every mile driven on the roadway network. Because its assessment more accurately reflects road usage, the vehicle mileage fee could more reliably fund maintenance and expansion of Texas roads.

What are the major issues regarding the vehicle mileage fee?

Issues facing proponents of this alternative include but are not limited to:

- Shaping policy related to the implementation of the new fee,
- Creating the technological architecture that supports implementation, and
- Addressing public concerns regarding the new fee.

Would this new fee replace or supplement the fuel tax?

This depends on the goals of policy makers. Both are possibilities. If supplemented by the vehicle mileage fee, for example, the fuel tax could act more specifically as an emissions tax, perhaps targeted at reducing pollution and improving air quality. There would likely be strong public opposition to a new fee on top of the old tax, so implementing vehicle mileage fees as a replacement to the fuel tax might be the more politically feasible option.

How will revenue be collected and distributed?

A technological architecture, based on public policy implemented by lawmakers, will determine how fees are collected from drivers, and policies adopted by lawmakers will determine how these revenues are distributed. If the fee replaces the fuel tax, revenues will most likely be dedicated to the state highway fund. If more specific goals are adopted, then policies addressing revenue distribution will have to be developed specific to those goals.

Won't these fees require you to know where and when I'm driving, and wouldn't that violate my privacy?

Policy will define what data are collected and how information is used and stored. Studies conducted in Oregon and at the University of Iowa demonstrate that data collection can be extremely limited yet provide the information needed to properly assess user fees. Proper policy making on the front end can both guarantee a motorist's privacy and secure the data needed to make the system work efficiently.

How can drivers be sure that this fee will be applied fairly?

There are numerous issues related to this question, such as the question of regressive taxation on lower-income drivers and the perception that individuals living in rural areas might have to pay more than those living in urban areas. Again, policy makers will ultimately have to address these concerns, but there are many potential policy options available for doing so.

THE CURRENT SYSTEM – THE FUEL TAX

THE FUEL TAX IS PAID at the pump by consumers when they purchase fuel. The tax is the primary funding mechanism for the maintenance and expansion of Texas' highway infrastructure. A type of "use fee," the tax is levied on the amount of fuel purchased by an individual.

The federal fuel tax has been 18.4 cents per gallon since 1993, while the Texas state fuel tax has been 20 cents per gallon since 1991. Since the fuel tax is originally assessed at the point where fuel is purchased wholesale by a supplier, what motorists pay represents a reimbursement to fuel suppliers and distributors.

Over 80 percent of funding for transportation in Texas comes from the state and federal fuel taxes. During 2008 and 2009, state motor fuel tax revenues accounted for 32.1 percent of state highway fund revenues, and federal funds accounted for 48.6 percent (*1*).

How the Fuel Tax System Works

When a supplier removes fuel from a refinery or other wholesale fuel distribution system, the fuel tax is assessed on the volume removed. From that point, each purchaser of fuel, down to the retail level, effectively reimburses every entity that had possession of the fuel before them. Thus, whenever a driver purchases fuel, fuel tax reimburses the gas station for the taxes already paid on that fuel.

The fuel tax is relatively cheap to collect at roughly 0.2 percent to 1 percent of gross receipts (*2, 3, 4*). This cost includes administration and enforcement. In Texas, one cent of every dollar in fuel taxes collected is retained by the State Comptroller of Public Accounts for administration and enforcement efforts.

Why the Fuel Tax System Will Become Outdated

Because this tax is on fuel consumed, not roadway used, it is only a proxy for actual road use. The Transportation Research Board estimates that government regulations and sustained fuel price increases could drive a 20 percent reduction in fuel consumption per vehicle mile by 2025 (*5*). As vehicle fuel efficiency increases and the market for alternative fuel vehicles grows, the fuel tax system fails to serve as a reasonable proxy for road use into the future, creating a deficit between funding needed for road maintenance/expansion and funding secured through fuel tax revenues. In fact, vehicles using fuels other than fossil fuels, notably electric vehicles, will essentially operate for free on Texas roadways if an alternative to the fuel tax is not adopted.

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A significant gap has already developed between growth in actual roadway space and growth in the state's population of drivers and their vehicles

There are several primary factors threatening the long-term sustainability of the fuel tax.

1. An upward trend in fuel efficiency due to:
   - Environmental interest in reducing emissions,
   - Strengthening of federal environmental regulations,
   - National interest in reducing reliance on foreign oil, and
   - Consumer interest in offsetting the effects of high fuel prices.
2. As alternative-fuel vehicles gain greater market penetration, a large segment of the auto fleet will eventually fall outside of the traditional fuel tax collection framework.
3. Fuel taxes are largely a hidden cost to consumers and fail to send appropriate market signals to drivers, leading to overutilization of scarce roadway resources at peak periods of the day.

Furthermore, a significant gap has already developed between growth in actual roadway space and growth in the state's population of drivers and their vehicles (see Figure 1). This gap will likely increase as funding for expansion of capacity dwindles.

The Texas 2030 Committee, formed in 2008 to provide an independent assessment of the state's transportation infrastructure and mobility needs from 2009 through 2030, has identified $315 billion in funding needs over that period (see Figure 2) (*6*). Even by the most optimistic estimates, available revenue will barely cover half of that need.

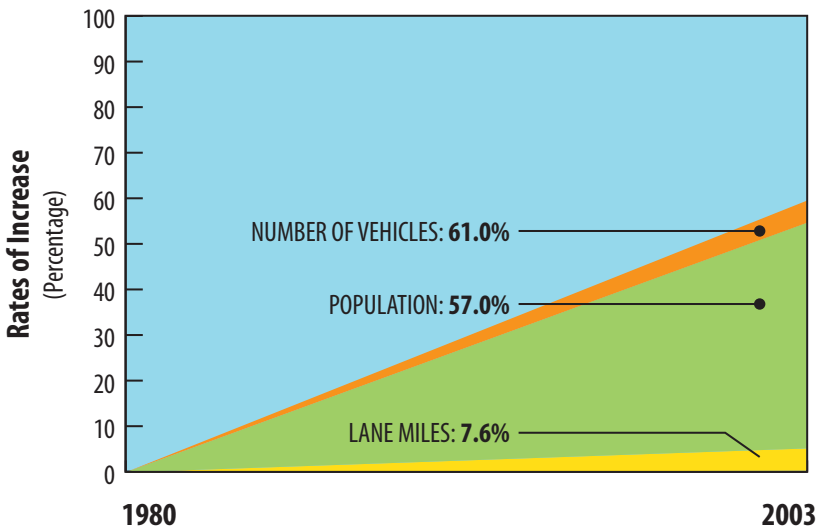


Figure 1. *Rates of Growth in Population, Vehicle Registration, and Highway Lane Miles. (Texas Department of Transportation*)*

*Obtained from TxDOT maintained data sources such as the District and County Statistics (DISCOS) database and state vehicle and title registration records.

Total Investment Needed

(2008 $ Billions)

	Pavements	Bridges	Urban Mobility	Rural Mobility and Safety	TOTAL
PER YEAR	$ 4.0	$ 1.6	$ 7.8*	$ 0.9	**$14.3**
2009–2030	$ 89	$ 36	$171*	$ 19	**$315**

*Historically, about 2/3 of urban mobility is the responsibility of the state, while the remaining 1/3 is a local responsibility.

These needs do not take into account other, non-highway related services provided by the Texas Department of Transportation such as port and waterway maintenance and development.

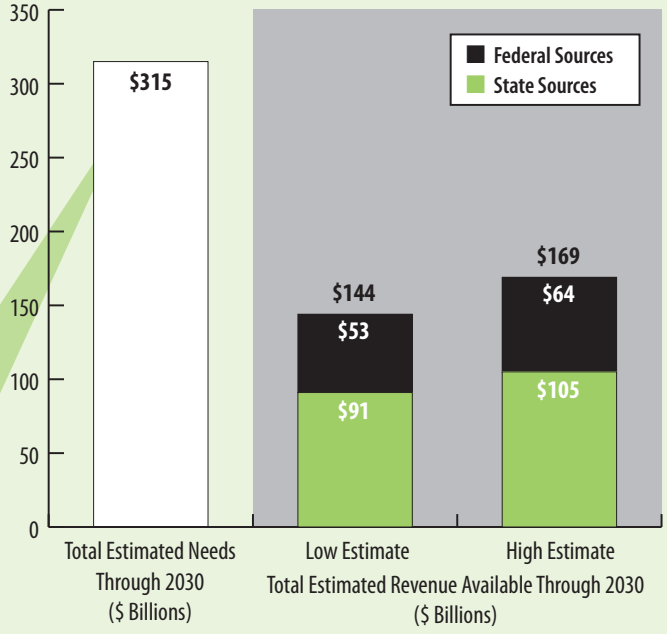


Figure 2. *Needed State Transportation Investment as Identified by the Texas 2030 Committee (6).*

If Not a Fuel Tax, Then What?

One potential answer to these problems is a fee based on actual roadway use. The vehicle mileage fee, sometimes referred to as the VMT fee, is a fee for every mile driven on the roadway network.

As one would expect, the prospect of a wholesale change in the current form of taxation for transportation services comes with a significant number of questions, challenges, and obstacles, as well as a considerable level of potential public resistance. This primer seeks to introduce and explain the concept of the vehicle mileage fee, raise significant issues associated with the concept, and explain the technological and implementation challenges associated with such a fee.

AN ALTERNATIVE SYSTEM – VEHICLE MILEAGE FEES

TWO PILOT STUDIES REGARDING vehicle mileage fees have already been completed, and a national evaluation is underway (7, 8, 9). Many states are looking at implementation studies of their own.

Legislatively appointed commissions, research agencies, stakeholder groups, and professional organizations have all weighed in on the topic. Several themes have developed (*5, 10, 11*):

- The nation's transportation system is facing a crisis in terms of long-term financial sustainability.
- Fuel taxes should remain the primary source of transportation revenue in the short term.
- For the long term, alternatives to the fuel tax as the primary means of funding infrastructure need to be evaluated.
- Any alternatives that are implemented should be based on a "user pays" principle.

Some of the specific findings of these entities are presented in Table 1.

Table 1. *Highlights of Findings from National Studies on Transportation Funding (5, 10, 11).*

RESEARCHING ENTITY	CONCLUSIONS
National Surface Transportation Infrastructure Financing Commission	Concerns regarding global climate change and domestic dependence on foreign energy are creating a drive for greater fuel efficiency and alternative fuel technology, undermining the ability of the fuel tax to sustain long-term transportation investment.
	Fuel taxes do not send appropriate market signals to drivers, leading to inefficient allocation of roadway resources.
	In the medium and long term, user charges based directly on miles traveled are the best option available.
National Surface Transportation Policy and Revenue Commission	A comprehensive, performance-based approach to allocating necessary maintenance and infrastructure expansion funding should be developed.
	In the short term, fuel taxes should remain a staple of transportation investment revenue.
	In the long term (over 20 years), fuel taxes will be unsustainable and mileage-based user fees are among the most preferred alternatives.
Transportation Research Board	Fuel consumption and fuel tax revenue could be depressed by advances in automobile technology, rising fuel prices, and energy and/or environmental regulations.
	The user fee principle of the fuel tax may be eroding as revenues are increasingly being spent on non-highway related programs and transportation agencies increasingly rely on non-user fee sources of revenue for highway development and maintenance
	Road use metering and mileage charging are the most promising techniques for directly assessing road user charges.

Examples of Implementation

While actual implementation of vehicle mileage fees has occurred only outside of the United States, there have been several domestic demonstration projects. Two of these were conducted at the state and local level, but there is currently an ongoing national U.S. Department of Transportation-funded assessment being conducted by the University of Iowa.

Oregon Department of Transportation

The first domestic demonstration of vehicle mileage fees was conducted under was conducted under Oregon's Mileage Fee Concept and Road User Fee Pilot Program. Launched in 2006, the Oregon Department of Transportation's road user-fee study equipped vehicles with an on-board unit that recorded mileage driven within specified zones. These units connected to the odometer to tally mileage and used global positioning system (GPS) satellite signals to determine the zone the vehicle was in. Mileage totals were transmitted to a billing center whenever a study participant would fuel the vehicle at a participating service station.

Since program participants still paid fuel taxes whenever they refueled their vehicles, the vehicle mileage fee was applied as a credit against the state fuel taxes paid. Over 90 percent of participants stated they would agree to continue paying the mileage fee in lieu of the gas tax if the program were extended statewide. Oregon is interested in moving into a new phase with potentially broader implementation (*7*).

Puget Sound Traffic Choices Study

Using only incentives (participants could earn cash by reducing travel), this experiment aimed to determine the feasibility of using GPS-based on-board units (OBUs) with a cellular-based transmission system. Puget Sound's primary goal was to reduce vehicular trips and maintain a high level of public acceptance. Transportation finance was not a main consideration in the experiment.

The study showed that participants reduced their travel in a manner that, if aggregated across the whole Puget Sound Region, would have a "major effect on transportation system performance." The net benefit generated by the system over a 30-year period was estimated at $28 billion in today's dollars (*8*).

A study in Puget Sound estimated benefits of an incentive-based system at $28 billion over 30 years.

US DOT/University of Iowa Road User Charge Study

This U.S. Department of Transportation (US DOT) study is a national evaluation of technological and pricing options for a potential VMT-based fee. The system being tested uses on-board receivers that work in conjunction with GPS satellite technology to determine each vehicle's location in relation to geographic information system files stored in the on-board unit.

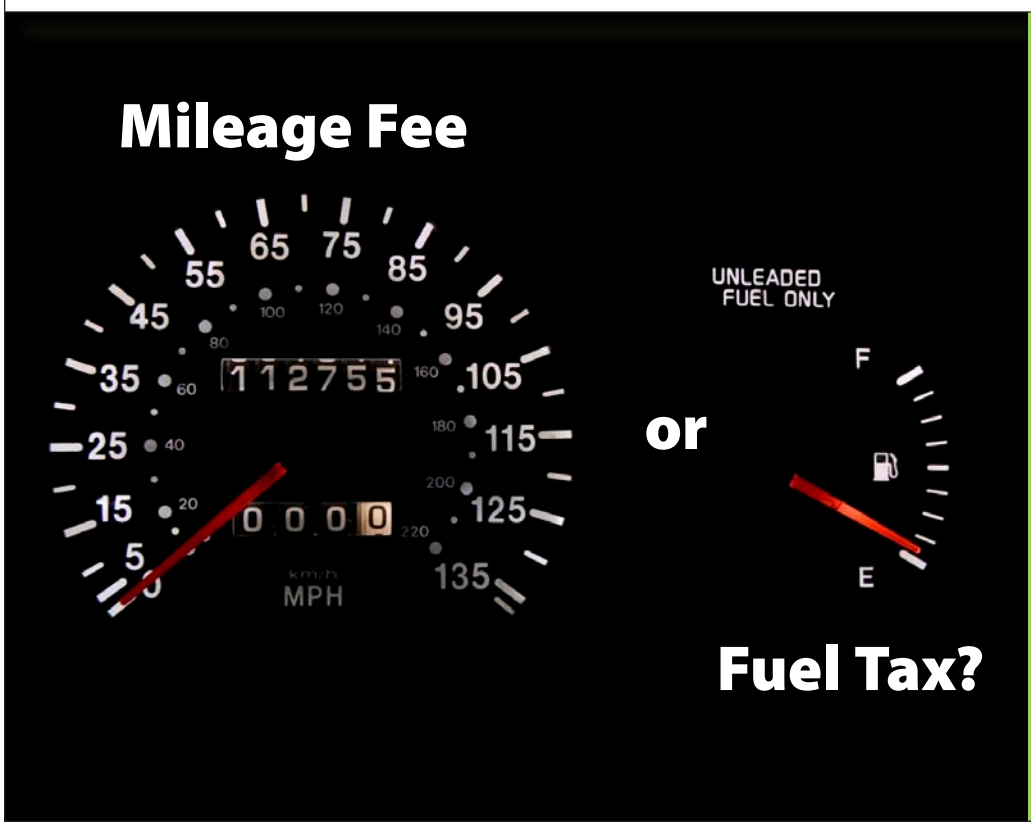
Depending on the vehicle's location, a price per mile will be affixed to that particular trip. This price per mile will be applied to the number of miles traveled as provided by the vehicle's odometer, with price changes occurring whenever the GPS system indicates that the vehicle has entered into an area with a different per-mile price or into a new jurisdiction. Data stored in the on-board unit will be uploaded via cellular technology to a billing and dispersal center on a pre-programmed schedule.

The system is being tested by 2,700 volunteers representing 20 vehicle classes in six areas throughout the U.S., including Austin (*9*).

Germany's Heavy-Vehicle Charging System

The European Union restricts tolls on trucks to vehicles over 12 tons, limits roadways that can be tolled, and limits the aggregate charge to direct capital and operating costs imposed by truck traffic. As such, the main revenue objectives of this system are to recover system costs associated with truck use and to finance ongoing maintenance and improvements.

Other system goals include environmental mitigation via shifts to lower-emission commercial vehicles and the shifting of freight transport to rail. Fee amounts vary based on the different operational parameters of the vehicles participating in the program and include factors such as axle loads, the type of road being traveled on, and a "fairness component" applied to minimize cross subsidization between user categories (*2*).



Over 90% of participants were willing to pay a mileage fee in lieu of a fuel tax.

COLLECTING AND ENFORCING VEHICLE MILEAGE FEES

THE COMBINATION OF TECHNOLOGIES and systems used to levy and collect vehicle mileage fees is referred to as the system "architecture." The system architecture encompasses many interrelated aspects and affects every stage of the vehicle mileage fee system from collection of raw data to the payment of the bill. The determination of this technological architecture should primarily flow from a clearly articulated policy framework. The policy goals defined for a vehicle mileage fee system will help determine technology requirements which, in turn, will help define how fee assessment and payment occur.

Examples of Policy Considerations

For example, if a system is needed strictly to replace the fuel tax and assess a fee based on total miles driven regardless of where the vehicle goes, then periodic odometer readings would likely suffice for the purposes of assessing the fee. However, if the system will charge different rates for urban and rural roadways, for example, then what technological capabilities will be required to accurately determine vehicle location? What if there is a desire to prevent charging for miles driven on private farms and ranches? How will the system accommodate that policy objective? Governmental agencies will also need to decide how they want their fees collected:

- At the pump?
- By mail?
- Over the Internet?
- By a financial institution and reimbursed to the government?

Finally, what is the balance between personal privacy of travel data and the ability for the motorist to receive a detailed accounting of road usage? (See "Addressing Privacy and Data Security Concerns" on page 22.) How does the technology design support the desired balance? Policy makers will have to answer these and other questions before a technological architecture supporting a vehicle mileage fee-based system can be established.

Mileage counter and wireless mileage transmitter utilized in Oregon pilot program.

Determining the Fee Amount

Technology options for assessing and ultimately collecting vehicle mileage fees are numerous, ranging from low-tech approaches, such as periodic odometer readings, to high-tech methods involving sophisticated on-board devices that offer a range of consumer services. There are also a multitude of factors that can influence technology decisions:

- Interoperability with federal and state fee systems,
- Consumer interest in flexibility of use and alternative payment methods,
- Generational differences in "comfort level" with technology, and
- Future technological developments, including smart vehicle technologies and the explosive growth in the use and functionality of personal information devices such as smartphones.

At the core of these questions is the structure of the overall system known as the *logical architecture*, which describes how the raw data collected by the system are ultimately converted to a bill paid by road users (*12*). The three components of a vehicle mileage fee architecture are: roadway use assessment, charge computation, and vehicle-to-back-office communication.

Roadway Use Assessment

This refers to the collection of raw data describing vehicular movement. There are several options available for the collection of these data, ranging from low-tech to high-tech:

- Certified manual odometer readings,
- Data from vehicle on-board diagnostics to compute distance traveled, and
- Detailed time and location stamping with a vehicle device on board, such as a GPS used with a map stored on the device.

Charge Computation

This refers to data processing, where raw data are used to assess an amount owed. Depending on how the system is designed, this stage may occur entirely on board the vehicle, at an administrative account office, or through a combination of the two. This stage may also involve a third, private party.

There are several possibilities for computing the charge:

- Retrieving the raw data from the vehicle and processing it in a billing center,
- Processing the usage data within the on-board vehicle device itself, or
- Retrieving usage data and sending information to a third party, where it is processed before being sent to a billing office.

Vehicle-to-back-office communication

This refers to the transmission of data for the purposes of calculating an amount owed or the transmission of the already-computed amount owed from the vehicle to an administrative back office. This is the final stage in a vehicle mileage fee system's logical architecture. The three communication configurations discussed below are not mutually exclusive and could be implemented in combination with each other.

- The least complex method by which to accomplish this would be to simply **manually read** the odometer and then generate a bill, perhaps at annual vehicle inspections or with vehicle registration.
- A **localized, detection-based transmission** configuration would have data uploaded via localized infrastructure, such as roadside beacons or tolling gantries, and sent to a billing center. This transfer would occur whenever the vehicle is near one of these structures.
- A **wide-area, constantly online** configuration would use a widely distributed network of data readers that download data from vehicles within a large radius and forward the data to a back office. Cell phone technology, such as the global system for mobile communications (GSM), might be used to collect and forward information in this manner.

Payment Methods

For actual payment of mileage fees, there are two payment options available: point-of-sale (pay at the pump) and periodic billing.

Point of Sale (Pay at the Pump)

Oregon has tested this method, which has an advantage in that it is similar to how drivers already pay for road use through fuel taxes. It would require technology attached to a gas pump (Figure 3) and access to service station point-of-sale software in order to credit drivers for any fuel taxes included in the purchase price of their fuel.

Paying at the pump could also more easily accommodate cash payments and would help ensure drivers pay the fees, since vehicles could not be refueled without paying either the mileage fee or the fuel tax. However, the costs of adapting fuel stations to accommodate a pay-at-the-pump vehicle mileage fee system could potentially be significant. Furthermore, a pay-at-the-pump configuration would likely not accommodate payment of fees by vehicles that run on alternative fuels.

***Figure 3.** Wireless receiver (white box) mounted to fuel pump in Oregon pilot program.*

Periodic Billing

In periodic billing, travel data or an amount owed would be processed by a billing service on a periodic basis, such as weekly or monthly, and bills could then be mailed or e-mailed to users. Depending on how it is structured, this option would require more administrative functions, and drivers might be resistant to paying another bill every month. Another form of periodic billing could entail payment through a credit card transaction with a financial institution or associating payment with vehicle inspections or registration. Payment over the Internet through online billing capabilities is another possibility. The current statewide toll collection and payment system, TxTAG, operates in a similar manner.

Enforcement

It is important that vehicle mileage fees be seen as fair, meaning that everyone who is required to pay them does so. (See also "Equity Concerns Regarding Vehicle Mileage Fees" on page 24.) Due to the potential complexity of vehicle mileage fees, the likely reliance on advanced technology, and the fact that they might be collected through the mail or online, real potential exists for significant numbers of drivers avoiding paying the fees. Listed here are a few options to help ensure that this does not happen.

- Enforcement can be **built into the means of payment**. Both payment at the time of vehicle registration and payment at the pump provide this, since drivers would not be able to register or refuel their vehicles without paying the fee.
- In **mobile enforcement**, responsibility would fall on designated law enforcement entities that would be notified by the system back office that a particular vehicle is in violation.
- **Automatic number plate recognition (ANPR)** is another enforcement option. Roadside cameras would be set up to scan license plate numbers. Cameras would be used to catch users in the act of driving with unpaid vehicle mileage fee bills or malfunctioning on-board device.

Considerations for Developing On-Board Technology

If the proposed system is to rely on in-vehicle technology, policy makers will have to address issues associated with the transition in terms of the vehicle "fleet" (i.e., the total number of vehicles to be converted). Once a decision is made to install a specific device at the manufacturer level, it may take 10 to 15 years before the full vehicle fleet has the technology (*12*).

The use of after-market devices addresses a need to implement the system without full fleet turnover, but has the drawback of not being available to all users (see Table 2 for implications). Technologies with open system standards would allow a mileage charging system to evolve with technology advances and consumer needs, facilitating organic development of service options and flexible methods of payment (*13*).

Leveraging On-board Technology for Value-added Services

The proposed technology could potentially lead to the development of numerous value-added services that could enhance the overall utility of the system to potential users (see Figure 4). Value-added services could facilitate a transition by helping the new fee gain public

Table 2. *Implications of After Market Devices.*

	QUESTION	IMPLICATIONS
After-market Devices versus Original Equipment Manufacturers (OEM)	Should after-market devices be allowed, or will all vehicles need to be equipped with the necessary equipment by the manufacturer?	Using after-market devices could bring the cost of on-board units (OBUs) down significantly, as a market for these devices (such as personal GPS units) already exists. Furthermore, after-market devices could also enable greater customization for users. After-market devices ensure that already-manufactured vehicles can participate in a vehicle mileage fee program. However, some drivers may not ever buy an after-market device on their own, meaning they may not be acceptable for a total transition away from the fuel tax.
Installation	Should OBUs require certified installation, or can self installation be accommodated?	OBUs that connect to the vehicle's diagnostic port will likely require certified installation, while those using only GPS to measure distance could conceivably be self-installed. Certified installations could constitute a significant startup cost but would likely result in a device that is more reliable. Self-installed devices may be more prone to user error.

POTENTIAL VALUE-ADDED APPLICATIONS		
Safety Applications	**Mobility Applications**	**Personal Applications**
In-vehicle signage	Travel time studies	Parking locator
Curve speed warning	Congestion pricing	Pay-as-you-drive insurance
Signal and stop sign violation warning	Planning studies	Personal navigation
Road and traffic condition warning	Routing assistance	Parking payment
Collision warning	Environmental mitigation	
	Real-time traffic information	

Figure 4. *Potential Value-added Applications*

acceptance, since the public may prefer a new fee system that provides extra services compared to the old, more limited system. Mileage fees alone, while potentially enhancing the overall transportation system, do not offer added value to the individual driver. However, the ability to provide these services will depend a great deal on how open the fee system's architecture will be. Open systems, as opposed to closed systems, are dynamic, very adaptable, and allow for various applications to be developed and applied to the system from external sources. The iPhone may be thought of as a type of open system, as it allows for the utilization of numerous applications developed on an on-going basis. Thus, developing an open vehicle mileage fee system architecture will allow for users to customize how they use it outside of merely paying for road use.

MAJOR POLICY ISSUES ASSOCIATED WITH THE NEW SYSTEM

SIGNIFICANT POLICY ISSUES, such as those presented below, should be addressed before laying the groundwork for a future vehicle mileage fee system. How these questions are answered will influence how a future system is designed and administered.

What policy goals should be considered?

Vehicle mileage fees could potentially provide a platform for addressing numerous transportation-related policy goals outside of revenue generation. As such, they can be structured in numerous ways. These include:

- Congestion pricing,
- Variable fee based on vehicle type,
- Fee based on pavement impacts,
- Fee based on emissions, or
- Pricing to attain regional air quality initiatives.

Do vehicle mileage fees replace or supplement the fuel tax?

There are both pros and cons to either replacing or supplementing the fuel tax with the vehicle mileage fee. Implementing the vehicle mileage fee as a supplemental revenue source to the fuel tax would allow the fuel tax to remain in place and function more as a true emissions tax. Owners of less fuel-efficient vehicles would continue to pay more in fuel taxes on a mile-by-mile basis, and incentives to purchase more fuel-efficient vehicles would remain. Furthermore, there would be no need to integrate the mileage fee with the fuel tax system, since there would be no need to credit drivers for fuel taxes paid. However, there would likely be strong public resistance to the imposition of a new fee on top of the existing fuel tax.

Which fee would the vehicle mileage fee replace?

If vehicle mileage fees are implemented as a replacement to an existing revenue source, they do not necessarily have to replace fuel taxes. For example, vehicle registration fees are typically based on the type of vehicle in terms of year, make, model, and weight. They do not reflect actual roadway use. These fees, rather than fuel taxes, could be adapted to account for mileage, which could potentially have numerous advantages over replacing fuel taxes with vehicle mileage fees.

- With registration fees there would be no need to account for fuel taxes paid at the pump.
- Fuel taxes could remain in place as an emissions tax, preserving incentives for the purchase of more environmentally friendly vehicles.
- Accounting systems are already in place for the collection of vehicle registration fees, so capital costs with regard to implementation would be

minimized relative to implementation of a technology-intensive replacement to the fuel tax.

What are the considerations when phasing in the new fee system?

Depending on the phase-in schedule adopted, drivers might be in danger of paying both taxes at once, since the vehicle mileage fee could be operating in parallel with any fees replaced. Double charging motorists for road use should be avoided if the new fee system is to maintain high public acceptability. One approach for implementation may involve opt-in participation by motorists who gain access to other consumer-oriented services facilitated by on-board fee collection technology, such as real-time traveler information, distance-based car insurance, and payment for parking.

Should the fees be voluntary or compulsory?

This decision will depend a great deal on system goals. If the system is developed to replace the fuel tax, then participation will be mandatory. If the system operates parallel with the fuel tax, it could be voluntary. Its success will depend largely on the incentives offered to participate. These incentives may take many forms, but for the most part they will need to be an added value to the system user. For example, offering motorists the choice of manually reporting their mileage at a flat rate versus electronic metering may provide a publicly acceptable transition strategy.

How will revenue be distributed?

How revenues are distributed will depend on system goals. If the system is developed to replace the fuel tax, then revenues will most likely be dedicated to state highway fund accounts. However, if more specific goals are adopted—such as covering maintenance costs on specific roadways or mitigating the impact of congestion on the environment—then policies addressing revenue distribution will have to be developed specific to those goals.

Cost Allocation

A vehicle mileage fee system directly reflects the amount of travel on the system, a key factor affecting the costs of supplying, operating, and maintaining highway services. It thereby has the potential to transform the way transportation resources are allocated. Under some vehicle mileage fee proposals, revenue generation could be determined down to the facility level. This means that transportation officials could determine how much revenue specific roadway facilities generate. Such a configuration would allow transportation officials to better target funding to areas and facilities most heavily used, since vehicle mileage fees are directly related to use and the most heavily used facilities will generate the most revenue.

There are both pros and cons to either replacing or supplementing the fuel tax with the vehicle mileage fee.

System Management

Vehicle mileage fees can provide for a more efficient use of roadway facilities through pricing. Fuel taxes do not encourage drivers to take into account the added strain they place on the area network by traveling during congested periods of the day. Drivers are charged the same regardless of whether they travel during periods of high congestion or during off-peak periods.

Vehicle mileage user fees could potentially be structured to vary the price by facility, time of day, or congestion levels. As a result, travelers may be more likely to shift trip times from peak to off-peak, reduce trips and trip distances, increase ridesharing modes, or telecommute. Such a system could also set price according to impacts to the physical infrastructure, such as vehicle size and weight.

Pricing for System Management — Stockholm Cordon Pricing

Since 2006, the city of Stockholm, Sweden, has used road pricing to manage demand within the congested core of the city. The test system began by levying a congestion tax on vehicles entering a cordon area surrounding the central inner city. The congestion tax was levied on certain vehicles (excluding alternative fuel vehicles, emergency vehicles, and buses) entering the cordon between 6:30 am and 6:30 pm, Monday through Friday. The charge varied, with peak periods having the highest charge.

The goal of the program was to reduce traffic congestion, cut greenhouse gas emissions, and increase transit ridership. Vehicles entering the central cordon area were equipped with a transponder that communicated with 18 "gateways" bordering the cordon area for the purpose of assessing the fee. Mounted cameras photographed front and rear license plates for enforcement purposes.

During the initial trial of the tax, the number of vehicles entering the priced cordon was reduced 18 percent, transit use increased 7 percent, and CO_2 emissions dropped 10 percent (*2*).

Since implementing its experiment with road pricing in 2006, Stockholm has seen an 18% percent reduction congestion, a 7% increase in transit use, and a 10% drop in CO_2 emissions.

CHALLENGES TO IMPLEMENTATION: PUBLIC ACCEPTANCE

THERE ARE NUMEROUS CHALLENGES in developing and implementing vehicle mileage fees. However, issues of public acceptance may be one of the most challenging, especially regarding privacy. The public might associate a vehicle mileage fee with the notion of being "tracked." Furthermore, there are strong public concerns about information security. Fuel taxes are easy to pay, cheap to collect, and perhaps most important, anonymous. If vehicle mileage fees are to gain a high level of public acceptance, systems for the security of information and privacy protection must be demonstrated.

Addressing Privacy and Data Security Concerns

Some potential strategies for addressing privacy concerns (*14*) include:

- Not allowing the collection of more data than needed for the primary purpose of the system,
- Clearly articulating the level of accuracy expected from data collection tools,
- Clearly stating when data are to be collected and what they are to be used for,
- Refraining from using data for new purposes without consent,
- Ensuring data are safe and secure and that only needed data are retained,
- Allowing users the opportunity to correct faulty data, and
- Proactively supporting the above principles.

In the study of mileage-based user fees (See "Oregon Department of Transportation" on page 11.), Oregon helped protect driver privacy by establishing a zone-based system. Only general location data were required to determine what zone the driver was in. This allowed for accurate in-state mileage to be calculated without the need for specific trip data.

The on-board units used in the University of Iowa's road user-fee assessment study (See "US DOT/University of Iowa Road User Charge Study" on page 12.) retain location data only for the minimal time necessary to calculate fee charges. All charges are computed on the vehicle itself, and only the aggregated mileage charges are transmitted to the network operation center. It is impossible for the system to "track" participants.

Concerns about Efficient Spending

Much of the public's aversion to a new transportation financing system stems from the perception that the transportation funding and financing system is wasteful. The notorious Alaskan "bridge to nowhere" is viewed by much of the public as the perfect illustration of wasteful transportation spending. Much of the public's perception of wasteful spending, however, is rooted in a lack of understanding about transportation financing in general.

One example of this is the public's general lack of understanding of how the fuel tax works (*15, 16, 17*). This presents an additional barrier to gaining public acceptance of the need for alternatives to the fuel tax.

For example, most people do not know:

- How much they spend at any given time on fuel taxes,
- What the federal and state fuel tax rates are,
- Fuel taxes are affixed to the gallon, not the purchase price,
- Federal and state fuel taxes have not been raised in over 15 years, or that
- One quarter of *gross* state fuel tax collections is dedicated to the Available School Fund.

The Texas Department of Transportation receives only about 86 percent of net state fuel tax revenues.

Concerns about Losing an Incentive for Fuel Efficiency

Concerns have been expressed about vehicle mileage fees essentially amounting to punishment for the drivers of fuel-efficient cars and hybrids. Furthermore, there is widespread belief that implementing such a fee system would remove the incentive to purchase fuel-efficient vehicles. While it is true that these drivers will be paying more under a vehicle mileage fee system than they would in fuel taxes, the increased cost in terms of taxes paid is minimal compared to the other savings that these vehicles provide. Analysis shows that while a hybrid driver would indeed pay more in mileage-based fees than fuel taxes annually, these drivers will still see substantial savings in terms of fuel purchased over the drivers of less fuel-efficient vehicles (*18*). In other words, a vehicle mileage fee will not have enough of an impact in terms of overall vehicle ownership costs to make hybrids and similar vehicles undesirable to drivers.

Furthermore, mileage fees do not have to be the same for all types of vehicles. Rates could vary based on attributes like vehicle weight and/or emissions class. Assessing differential mileage rates by emissions class would preserve existing incentives for purchasing fuel-efficient vehicles, if this is a policy objective.

An incentive such as reduced fuel taxes (or in the case of electric vehicles, no fuel taxes) can be environmentally desirable. Still, "green" vehicles nonetheless contribute to wear and tear of the highway system and use scarce road space in congested urban communities. During times of high congestion, an electric vehicle (depending on size) uses an equivalent amount of road space as a fuel-tax-paying vehicle. This consumption impacts the pavement as well as the overall cost of congestion to all vehicles.

Vehicle mileage fees represent one solution to capturing some of this cost. Similarly, vehicles that have a greater impact on pavement deterioration could pay a higher mileage rate.

A vehicle mileage fee will not have enough of an impact in terms of overall vehicle ownership costs to make hybrids and similar vehicles undesirable to drivers.

Highway maintenance and congestion costs may be lower in rural areas, so vehicle mileage fees can be structured to vary based on whether travel is occurring in the city or the country.

Equity Concerns Regarding Vehicle Mileage Fees

There are likely to be concerns about equity (or fairness) with regard to mileage-based user fees, which can be structured to collect the same amount of revenue as the gas tax currently does. Because the public is unaware of the impact of greater fuel efficiencies on gas tax revenues, however, vehicle mileage fees might be seen as an added tax.

Research into possible relationships between personal income and fuel efficiency is ongoing (*19*), but it is hypothesized that individuals with lower income are more likely to drive less fuel-efficient vehicles. If this is the case, lower-income drivers currently shoulder more of the burden of financing the transportation system because they are most likely paying more per mile of travel in fuel taxes. Vehicle mileage fees would equalize this cost across user groups and could even be structured in a progressive manner to charge less for travel by low-income drivers.

Equity concerns with regard to transportation development have often been addressed through transit development. Transit, where available, is often utilized to a higher extent by lower-income individuals without access to personal vehicles and, therefore, unable to benefit from roadway development. Designing a vehicle mileage fee system where a portion of the revenues collected is dedicated to transit development may alleviate potential income equity issues.

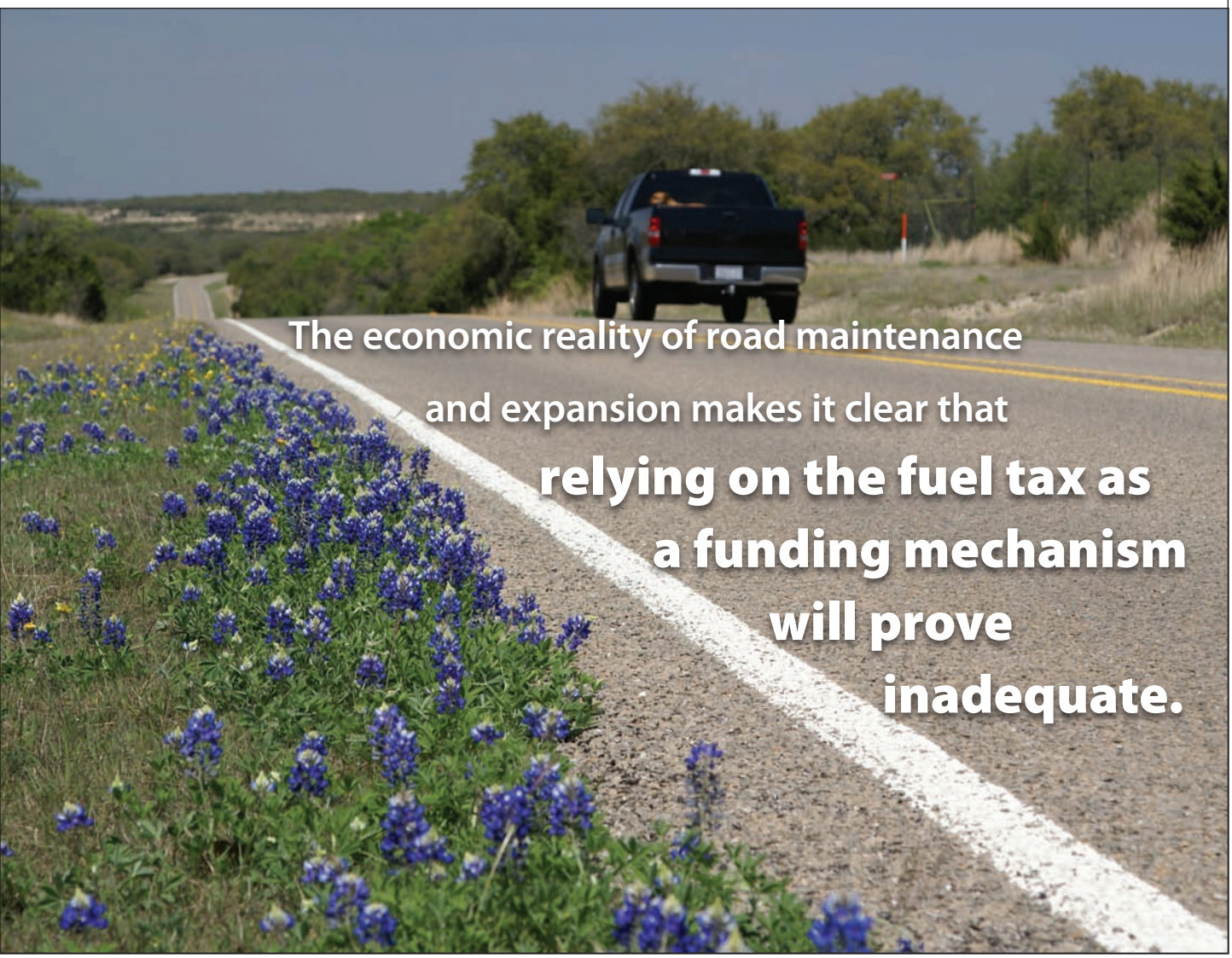
Rural areas, specifically, have expressed concern that fees based on actual miles traveled would disproportionately burden residents of remote rural areas that generally make long-distance trips (*17*). Furthermore, rural areas generally lack the availability of transit service found in larger metropolitan areas. This means that there are fewer (if any) options available for those not wishing to travel by personal vehicle and incur the fee.

Structuring a mileage fee so the rate varies based on whether travel is occurring in urban versus rural areas is logical, given that costs of highway maintenance and congestion can be lower in rural areas. It might also be necessary to develop fee systems that accurately account for and discount mileage accrued on private property. This could be a particularly important issue for ranchers and farmers, since they are more likely to generate significant mileage on their own property and should not have to pay fees for that mileage.

CONCLUSION

TEXAS WILL CONTINUE to grow and so will its transportation network. The economic reality of road maintenance and expansion over the next two decades makes it clear that relying on the fuel tax as a funding mechanism will prove inadequate. An alternative funding mechanism better correlated to road usage is a logical approach to avoiding the financial shortfall.

Already under study in the U.S. and abroad, road use fee strategies are proving to be a promising way to bridge this economic gap. With thoughtful policy decisions on the front end, the implementation of an efficient technological architecture, and real attention to public needs and concerns, the vehicle mileage fee has the potential to be an effective alternative to the state fuel tax. Though there are many challenges facing implementation of a new fee system, the application of a vehicle mileage fee in Texas is worth exploring.



REFERENCES

1. Legislative Budget Board. 2008. "Overview of State Highway Fund 0006 Revenues and Allocations, the Texas Mobility Fund, and the Texas Rail Relocation and Improvement Fund." Austin, TX.
2. Paul A. Sorenson and Brian D. Taylor. 2005. *Review and Synthesis of Road-Use Metering and Charging Systems*. University of California Los Angeles, Institute of Transportation Studies. Commissioned by the Committee for the Study of the Long-term Viability of the Fuel Taxes for Transportation Finance, Transportation Research Board. Washington, DC.
3. Erik A. Guderian. 2003. "A New Revenue Generating Method for Transportation Funding: The Vehicle Miles Travelled Fee." Compendium: Papers on Advanced Surface Transportation Systems, 2003. Southwest Region University Transportation Center, Texas Transportation Institute, Texas A&M University System. College Station, TX.
4. Todd Litman. 1999. Distance Based Charges: A Practical Strategy for More Optimal Vehicle Pricing. Presented at the Transportation Research Board 78th Annual Meeting, January 1999, Paper No. 99-0678. Washington, DC.
5. Committee for the Study of the Long Term Viability of Fuel Taxes for Transportation Finance. 2006. *The Fuel Tax and Alternatives for Transportation Funding: Special Report 285*, Transportation Research Board. Washington, DC.
6. 2030 Committee. 2009. "Texas Transportation Needs Summary." texas2030committee.tamu.edu. Report to the Texas Transportation Commission. Austin, TX.
7. Oregon Department of Transportation. 2005. *Oregon's Mileage Fee Concept and Road User Fee Pilot Program*, Report to the 73rd Oregon Legislative Assembly. Salem, OR.
8. Puget Sound Regional Council. 2008. *Traffic Choices Study – Summary Report*. Prepared for the Value Pricing Pilot Program, Federal Highway Administration. Washington, DC.
9. David J. Forkenbrock, and Jon G. Kuhl. 2002. *A New Approach to Assessing Road User Charges*. Public Policy Center, University of Iowa. Iowa City, IA.
10. National Surface Transportation Infrastructure Financing Commission. 2009. *Paying Our Way: A New Framework for Transportation Finance*. Report to Congress. Washington, DC.
11. National Surface Transportation Policy and Revenue Study Commission. 2007. *Report of the National Surface Transportation Policy and Revenue Study Commission*. Report to Congress. Washington, DC.

12. Mathew Bomberg, Richard T. Baker and Ginger Goodin. 2009. *Mileage–based User Fees—A Path Toward implementation Phase 2: An Assessment of Technology Issue*s. University Transportation Center for Mobility, Texas Transportation Institute, Texas A&M University. UTCM Project # 09-39-07. College Station, TX.

13. James M. Whitty and John Svadlenak. 2009. "Discerning the Pathway to Implementation of a National Mileage-Based Charging System." Presented to the Transportation Research Board Executive Committee. Washington, DC.

14. A.M. McDonald and L.F. Cranor. 2006. "How Technology Drives Vehicular Privacy," *A Journal of Law and Policy for the Information Society*, Volume 2, Issue 3, Ohio State University. Columbus, OH .

15. Robert Fichtner and Nicole Riggleman. 2007. *Mileage-Based User Fee Public Opinion Study: A Summary Report*. The Dieringer Research Group, Inc. Prepared for the Minnesota Department of Transportation, Report No. MN/RC-2007-50, St. Paul, MN.

16. Tina Geiselbrecht, Timothy Lomax and Joan Hudson. 2009. *Public Perceptions Regarding the Texas Department of Transportation: Focus Group Results*. Texas Transportation Institute, Prepared for the Texas Department of Transportation. Austin, TX.

17. Richard T. Baker, Ginger Goodin, Eric Lindquist, and David Shoemaker. 2008. *Feasibility of Mileage-Based User Fees: Application in Rural/Small Urban Areas of Northeast Texas*. University Transportation Center for Mobility, Texas Transportation Institute, Texas A&M University, UTCM Project #08-11-06. College Station, TX.

18. Richard T. Baker and Ginger Goodin. 2009. *Revenue Forecasts for a VMT-based User Fee System*. Texas Transportation Institute, Prepared for the Texas Department of Transportation. Austin, TX.

19. Ginger Goodin and Richard T. Baker. 2009. "The Relationship Between Income and Personal Vehicle Fuel Efficiency." Ongoing research funded by the Southwest University Transportation Center, Texas Transportation Institute, Texas A&M University System. College Station, TX.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of Transportation