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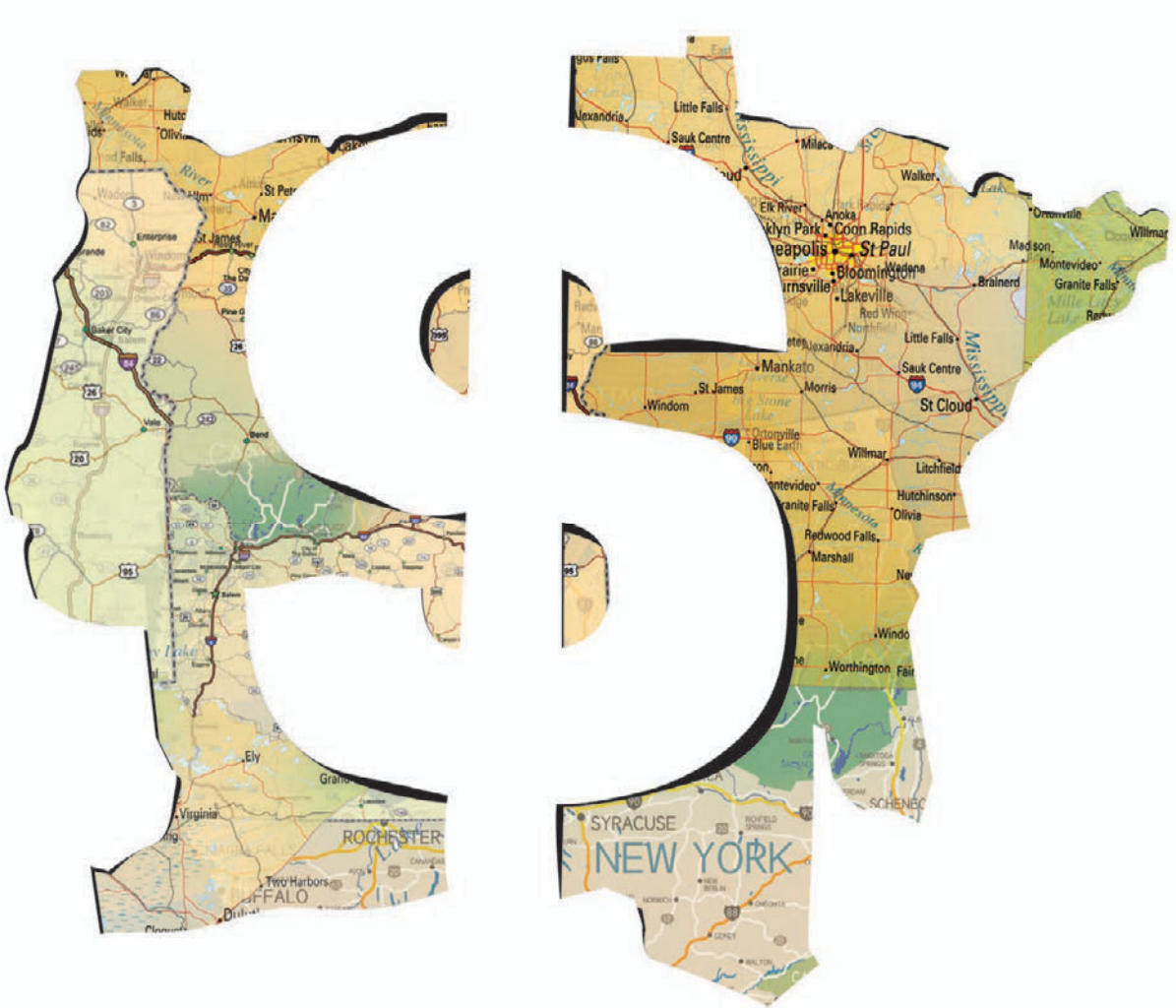
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MILEAGE-BASED USER FEES FOR TRANSPORTATION FUNDING

A Primer for State and Local Decisionmakers

Paul Sorensen | Liisa Ecola | Martin Wachs



Why Mileage Fees, and Why Now?

Promising Strategies

Innovation in Action



The RAND Transportation, Space, and Technology Program gratefully acknowledges the support of Charles Zwick, whose generous donation to RAND is assisting our researchers' efforts to extend the impact of their policy work, and of Michael Rich, president and CEO of RAND, for recognizing the current challenges in federal and state transportation funding and choosing to support this project with a share of Mr. Zwick's donation.



C O N T E N T S

- 4** Why Mileage Fees, and Why Now?
- 6** Potential Advantages of Mileage Fees
- 8** Technical Design Choices
- 11** Innovation in Action
- 14** Key Challenges
- 16** Promising Strategies
- 32** Ask the Authors
- 34** Transportation Research at RAND

Why Mileage Fees, and Why Now?

For much of the past century, federal and state fuel taxes have provided most of the funding for U.S. highway construction and maintenance—and more recently for investments in transit. Generally speaking, because the tax reflects the amount traveled, those who drive the most also pay the most. In addition, fuel taxes are relatively inexpensive to administer and enforce, and offer a modest additional incentive, beyond the underlying price of fuel, to choose vehicles with higher fuel economy.

But the federal government and most states levy fuel taxes on a cents-per-gallon basis, so real revenues will inevitably decline unless the per-gallon tax rates are periodically increased to offset the effects of both inflation and improved fuel economy. And over the past several decades, elected officials have grown increasingly wary of taking on this unpopular task. As a result, fuel tax rates at the federal level and in many states have stagnated, resulting in growing shortfalls in funding for surface transportation programs. **Transportation funding shortfalls will grow even more acute in the coming years as improved vehicle fuel economy and the adoption of alternative-fuel vehicles reduce federal and state fuel tax revenues by billions of dollars per year.**

How to address transportation funding shortfalls remains controversial in Congress. With little prospect for near-term federal action, some state decisionmakers, and even some local and regional officials, are beginning to explore a transition from taxing fuel to taxing vehicle miles of travel within their own jurisdictions. A system of mileage fees—while challenging to design and implement and more costly to administer—would offer a significantly more stable source of funding in future decades and could support additional policy goals as well.

The transportation field uses several terms interchangeably—“mileage fees,” “mileage-based user fees,” “vehicle miles traveled (VMT) fees,” “road-use charges,” and “road-user charges,” among others. In this primer, we stick to the first two.



Recently issued and significantly more stringent CAFE standards (the federal Corporate Average Fuel Economy standards) will culminate in a required average fuel economy of 54.5 mpg by 2025—roughly double the most recent standard of 27.5 mpg for passenger vehicles. And the rate of adoption for hybrid, electric, and perhaps even hydrogen vehicles, whose owners pay little or no fuel tax, is projected to expand over the next several decades. So the increasing shortfall in fuel tax revenues will be due not only to inflation but also to changes in fuel economy and fuel type.



This guide provides a brief introduction to emerging mileage-fee design strategies for reducing system costs and building public support.

Potential Advantages of Mileage Fees

Mileage fees would be keyed to the amount of vehicle travel rather than to fuel consumption, and this should provide a more stable revenue stream in future decades. Mileage fees offer several additional policy benefits as well. Depending on how the system is implemented, per-mile fees could be structured to alleviate vexing transportation-related problems; improve driver experience through technology-based innovations; and collect detailed, and anonymous, travel data to support better planning and operations.



Mileage fees could support fee structures that would reduce traffic congestion, excessive road wear, and harmful emissions.

REDUCING TRAFFIC CONGESTION. By varying the per-mile charge based on time of day and travel location, mileage fees could facilitate congestion pricing across all crowded segments of the road network. The Puget Sound Regional Council conducted trials several years ago to examine this concept and found it to be generally effective in reducing overall traffic, especially during peak hours. The state of Minnesota is exploring a similar concept in its ongoing mileage-fee trials.

REDUCING ROAD WEAR. Heavy commercial trucks cause significantly more road damage than lighter passenger vehicles. To help reduce excessive road wear, mileage fees for trucks could vary based on axle weight (higher for trucks with fewer axles) and type of route (higher for travel on lightly engineered routes). This would encourage truckers to adopt trailer configurations designed to reduce

axle loads and to travel, where possible, on heavily engineered highways or main arterials. The state of Oregon, which has levied manually recorded weight–distance truck tolls for many years, has recently been experimenting with automated, electronic recordings.

REDUCING HARMFUL EMISSIONS. Mileage fees could be set higher for more-polluting vehicles and lower for less-polluting vehicles. This would create an incentive for drivers, when purchasing a new vehicle, to select models with lower emissions. This approach has been used for a truck toll in Germany, where the least-polluting vehicles pay almost 50 percent less per kilometer than the most-polluting vehicles. Since its launch in 2005, the emissions-based price structure has rapidly accelerated the replacement of older trucks with newer, low-emissions models.



Mileage-metering equipment could provide new, value-added amenities for drivers.

PAY-AS-YOU-DRIVE AUTO INSURANCE.

Instead of paying a fixed annual insurance premium, drivers could pay by the mile. Such a system would give those who drive fewer miles the opportunity to save hundreds of dollars on their insurance each year.

AUTOMATED PARKING PAYMENT. In-vehicle metering equipment could be configured to allow for automated payment of parking charges, eliminating the need to pay at meters or multispace parking machines. Drivers could pay for the actual time that they occupied the space, with no more need to “leave extra time on the meter.” Systems could be designed to generate payment summaries for those who need to report parking fees as a business expense. And cities might forgo issuing parking tickets and instead allow drivers to remain in parking spaces beyond the posted time limit but at a significantly higher rate.

AUTOMATED TOLL PAYMENT. On toll roads where both cash and electronic payments are accepted, and for users who have not yet acquired an electronic tolling transponder, in-vehicle metering equipment could support automated toll payments, eliminating the need to stop at the tollbooth and have cash in hand.

LOCATION-DEPENDENT TRAVEL SERVICES.

The in-vehicle equipment could share many features associated with personal navigation devices, such as real-time routing assistance based on current traffic conditions or identification of nearby points of interest.

COMMUNICATIONS. In-vehicle devices could provide satellite radio or serve as a Wi-Fi node for passengers. This could lead to a broad range of in-vehicle wireless applications such as parking location and reservation services, as well as more general web-based commercial services.

IMPROVED SAFETY. As envisioned by the U.S. Research and Innovative Technology Administration’s connected vehicle program, sophisticated in-vehicle equipment could support numerous potential safety features, such as alerting the driver of school zones, construction zones, hazardous conditions, or traffic incidents; warning the driver of imminent collisions from sudden lane changes or braking vehicles; and allowing the driver to send emergency distress signals.



A mileage-fee system could generate a wealth of anonymous travel data to support enhanced planning and operations.

BETTER PLANNING AND OPERATIONS.

Detailed travel data, stripped of personal information, could provide real-time information on traffic conditions throughout the road network to help make local traffic management operations

more effective and to better calibrate regional transportation planning models, which in turn could provide a more reliable guide for making system improvements.

Technical Design Choices

A mileage-fee system must at minimum be able to accurately meter mileage, collect payment, prevent evasion of fees, and protect driver privacy. Multiple technical options exist for achieving each of these requirements, presenting system planners with a range of considerations.

METERING MILEAGE. The system must accurately determine the total miles traveled by each vehicle and potentially, depending on system design, the location of travel as well. Most of the metering options considered or used in recent studies, trials, and programs fall into five basic categories:

Odometer. Periodic odometer inspections, perhaps in conjunction with annual registration, would serve as a basis for determining mileage fees owed.

Simple OBU. A vehicle would be equipped with a simple device—likely connected to the on-board diagnostics port—capable of computing miles of travel electronically. This device, or on-board unit (OBU), would also include some form of electronic communication to transmit mileage data without the need for periodic vehicle inspections.

OBU with cellular location. The OBU would include cellular technology capable of determining the jurisdiction of travel in addition to supporting communication requirements.

OBU with GPS. A more advanced option, the on-board unit would include a global positioning system receiver along with wireless communications, making it possible to determine the specific route, and potentially even the specific lane, of travel.

Smartphone application. Rather than relying on expensive in-vehicle equipment, mileage could be metered with a smartphone application, which provides GPS and cellular communications for metering and reporting mileage data.

PRIVACY PROTECTION. A mileage-fee system must protect the privacy and security of personal travel and billing data. Four approaches to privacy are possible: relying on metering options that provide no information about the location of travel, relying on a trusted third party to protect and secure private data, designing the technology with built-in privacy safeguards, and establishing privacy legislation that clearly distinguishes between permissible and impermissible uses of personal travel data. To strengthen privacy protection, several of these could be applied jointly.

REPORTING AND BILLING. The system must provide mechanisms for reporting mileage and collecting payment. Relevant issues include the frequency and method of payment along with appropriate public- and private-sector roles in collecting payment and managing accounts. Payment options might include automated debit accounts, monthly billing, annual payment with registration, or even payment with fuel purchases.

ENFORCEMENT. The system must include effective strategies for preventing or detecting efforts to evade payment of mileage fees—for example, tampering with an odometer or disabling an in-vehicle metering device.

In selecting among the possible technologies for implementing mileage fees, there are important trade-offs for the planner to consider. Relying on odometer readings, for example, would reduce privacy concerns and eliminate the need to install costly metering equipment. On the other hand, as summarized in the chart below, many of the potential objectives for a mileage-fee system would require more-sophisticated metering approaches.

Objectives	Technical Choices				
	Odometer	Simple OBU	OBU w/ Cellular	OBU w/ GPS	Smartphone App
Apportion revenue by jurisdiction			■ ■	■ ■	■
Structure fees to reduce traffic congestion		■	■	■ ■	■
Structure fees to reduce emissions	■	■	■ ■	■ ■	■
Structure truck fees to reduce road damages	■	■	■	■ ■	■
Support value-added motorist services		■	■	■ ■	■ ■
Collect anonymous detailed travel data				■ ■	■

■ ■ Use of this technology could partially support the stated objective.
 ■ Use of this technology could support the stated objective to a limited degree.





As transportation-related challenges grow more severe, policymakers and planners increasingly recognize that the manner in which transportation is financed can have a direct impact on outcomes.

Innovation in Action

The concept of charging drivers based on travel distance has already been successfully implemented for freight trucks in several European nations, and for both diesel-fueled passenger cars and trucks in New Zealand. Much of the interest in mileage fees within the United States to date has focused on system designs that could apply to passenger vehicles and potentially to trucks as well. Here we briefly describe some of the past and ongoing U.S. trials and initiatives in this vein.

EARLY EXPERIMENTS Three early pilot projects with federal funding support demonstrated the viability of GPS-based metering and examined how drivers respond to alternate fee structures, whether drivers prefer more privacy or more-detailed billing statements, and how support for mileage fees can increase as drivers better understand motivations and supporting technology.

OREGON. In 2006–07, the Oregon Department of Transportation (DOT) conducted a 12-month pilot study of mileage fees involving almost 300 participants. Each vehicle was equipped with GPS-based metering equipment, and aggregated billing data (total amount owed, but not detailed travel records) were reported via short-range wireless communications when drivers purchased fuel at two specially equipped gas stations. One group of drivers was assessed a flat rate of 1.2 cents per mile for all travel in Oregon, while another paid a lower rate of 0.43 cents per mile for most travel, but 10 cents per mile when traveling in congested areas during peak hours. In addition to demonstrating the technical capability of metering mileage and protecting privacy using GPS-equipped metering devices, the study also showed that drivers respond to mileage-fee pricing structures by reducing travel, especially during peak periods.

PUGET SOUND REGIONAL COUNCIL. In 2005–06, the Puget Sound Regional Council (the metropolitan planning organization for the Seattle region) conducted a trial in which metering equipment configured with GPS and cellular communications was used to implement congestion pricing across the urban road network. Approximately 275 households, with 500 total vehicles, participated. Depending on the time and route, the per-mile rate ranged from 0 to 40 cents per mile. The study demonstrated that drivers did in fact change their travel behavior in response to the charges, and that the equipment functioned as planned.

UNIVERSITY OF IOWA. The University of Iowa Public Policy Center conducted a study authorized in the 2005 federal transportation bill to look at technical options for implementing mileage fees in multiple jurisdictions, as well as user acceptance. The study enrolled more than 2,500 drivers in 12 cities throughout the country, who drove a collective 21 million miles over the two-year study period. To test ideas about privacy protection, participating drivers were asked which type of bill they preferred—one with all the details of their travel, one with virtually none (just a total amount owed), and an intermediate one that provided some detail. By the end of the study, more than 80 percent preferred the intermediate level of detail. Based on greater familiarity with the concept of mileage fees and the technologies for implementing them, support for mileage fees among participants rose from 41 to 71 percent from the beginning of the study to the end.

CUTTING-EDGE INNOVATIONS Three jurisdictions are developing or evaluating innovative system design and transition strategies that could set the stage for near-term implementation of mileage fees.

OREGON. While the earlier Oregon trials were a technical success, they also yielded valuable lessons on user acceptance. Despite technical precautions to protect privacy, considerable resistance to a government mandate for the installation of GPS-based metering equipment remains. Building on this and other insights, the state is now planning a more flexible and innovative approach to mileage fees. Under the revised concept, drivers would be able to select among different metering technologies; at least one option would exclude the ability of any outside party to determine the location of travel.

Additionally, the state might provide a flat annual-fee option for drivers who remain strongly opposed to mileage fees. For drivers, one advantage of choosing metering equipment that can determine the location of travel is that they would qualify for certain price breaks, such as the exemption of fees for out-of-state travel or travel on private roads. More-sophisticated metering devices could also come equipped with value-added motorist services. To foster such an outcome, Oregon is developing an “open standards” approach under which vendors can modify existing products, such as personal navigation devices, to meter and collect mileage fees; drivers would then be able to select, on the basis of price and features, from any certified third-party device vendors.

In the fall of 2012, Oregon began conducting a pilot test of its new system, which also includes private-sector tax processing and account management as an alternative to public-sector operation of these functions. If the trials are successful, the Oregon legislature may mandate mileage fees as early as 2015 for certain classes of vehicles that would otherwise pay little or no road-use fees.

MINNESOTA. Minnesota is testing an innovative mileage-fee concept that features a smartphone app. This pilot test, which involves 500 smartphones used by volunteers in two counties spanning urban, suburban, and rural areas, also includes a billing and payment collection system using real money distributed at the beginning of the pilot.

One challenge of relying on a smartphone to meter mileage is that drivers might not always have their phones with them or turned on. For this reason, in the Minnesota concept, each vehicle’s odometer would be checked periodically, and the odometer reading would serve as the default measure of mileage fees owed. By using the smartphone metering app, however, drivers could qualify for certain discounts, such as no fees for out-of-state miles and reduced fees for rural or off-peak

miles. Drivers concerned with privacy, on the other hand, could simply rely on the odometer for all of their miles, or could selectively turn off the smartphone metering for any trips that they do not want recorded.

NEW YORK CITY. Many have assumed that mileage fees will ultimately be collected by states or at the federal level to replace existing fuel taxes. With its DriveSmart initiative, however, New York City recently developed a conceptual approach under which mileage fees might be collected by local jurisdictions. The DriveSmart program, which has yet to be initiated, envisions the emergence of smart metering devices capable of supporting an attractive array of traveler services providing greater convenience, opportunities to save money, safer travel, and better environmental performance. Some services, such as pay-as-you-drive insurance, automated parking payment, and automated toll payment, would create a significant revenue stream, and the firms that provide the metering devices and billing services would keep a share of this revenue. Driver participation would be voluntary, but firms would have an incentive to develop more innovative services to attract more customers. Over time, as the number of participating drivers increases, the system could support mileage fees as well.

BUILDING MOMENTUM There is growing interest in mileage fees in other states as well, as indicated by recent efforts in Colorado, Nevada, Texas, and Washington and among members of the I-95 Corridor Coalition.

THE I-95 CORRIDOR

COALITION. This coalition consists of member agencies from 16 states, as well as the District of Columbia, sharing the I-95 corridor along the eastern seaboard. The coalition sponsored recent research on how a multistate mileage-fee system might work, using Delaware, Maryland, and Pennsylvania as examples. New institutional entities such as billing and payment processing organizations and clearinghouses will likely be needed to ensure that revenues are appropriately calculated and distributed, according to their findings; still, states should be able to cooperate across boundaries and yet retain significant autonomy on how to implement mileage fees for their own residents.

COLORADO. In 2008, a state task force looking at Colorado's transportation infrastructure concluded that the gap between revenues and needs was large and growing, and recommended that the Colorado DOT consider a mileage-fee pilot program. The state is currently conducting a study to examine mileage fees along with several other potential funding options. The mileage-fee concepts include both flat and variable fees, and the study is looking at several possible metering and payment mechanisms.

Outreach to gather public and stakeholder opinion is currently under way, and a decision on whether to further pursue mileage fees is expected by the end of 2012.

NEVADA. The Nevada DOT began to examine mileage fees in 2008. While the initial planning phase considered GPS, the prevalence of privacy concerns led the state to consider less-sophisticated metering options that would not include location data. Seven possible fee structures have been developed, and the study is exploring their potential impact on drivers of different income levels. Another key concern for Nevada is out-of-state drivers: The number of annual visitors is 18 times greater than the in-state population. As a result, Nevada has considered partnering with other Western states (California, Oregon, and Washington) on a possible multistate pilot study.

TEXAS. The Texas DOT funded an exploratory mileage-fee study, drawing on interviews with stakeholders, technology experts, and the general public. The main obstacles involved public acceptance, including concerns over privacy, cost, enforcement, and fairness, as well as skepticism about why the system is needed and its feasibility. The study examined several mechanisms

for metering and collecting fees, ranging in sophistication from simple odometer readings to GPS. Legislation that proposes to conduct a pilot trial is expected to be introduced in January 2013.

WASHINGTON. In 2012, the Washington State Legislature authorized the Transportation Commission to look at how mileage fees might be implemented. Key objectives for the study include establishing a policy framework, assessing institutional readiness, and examining the fairness and equity implications of mileage fees. The initial work will produce interim recommendations in January 2013, with a final report by the summer of 2013. These may include recommendations for a pilot that could be carried out in 2013–15, possibly in conjunction with other Western states.

Key Challenges

System Cost and Public Acceptance

State and local decisionmakers who consider transitioning from fuel taxes to mileage fees will find themselves confronted by two significant obstacles: potentially high system costs and lack of public acceptance.

Other challenges—technical, institutional, and operational—are by no means insignificant. Many complexities associated with mileage fees, however, can in principle be resolved through careful policy analysis and detailed system engineering once an implementation decision has been made. In contrast, questions related to cost and public acceptance are fundamental to the calculus of whether it even makes sense—economically or politically—to pursue mileage fees in the first place.



**Challenges
ahead.**

THE ADMINISTRATIVE COSTS OF COLLECTING MILEAGE FEES. Fuel taxes, collected from a small number of fuel wholesalers around the country, are relatively cheap to administer, typically costing less than 1 percent of revenue. Mileage fees, in contrast, could involve collecting taxes from tens or even hundreds of millions of drivers—an inherently more complex undertaking. This raises a legitimate concern that the advantages of mileage fees would be outweighed by the increased cost of collecting them. System costs may vary based on technology choices and the number of vehicles subject to mileage fees, but recent evidence and modeling suggests that for a well-run state-level system under which most drivers pay mileage fees, costs as a share of revenue could fall in the range of 5 or 6 percent. Even with greater administrative costs, however, mileage fees can be expected to yield far more net revenue over the coming decades than fuel taxes given the shifts toward higher fuel economy and alternative-fuel vehicle technologies. Still it is important—financially and in terms of public perception—to design mileage fees to be as administratively efficient as possible.

PUBLIC RESISTANCE TO MILEAGE FEES. Public acceptance challenges center to a large degree around privacy and security concerns. When they first hear about mileage fees, especially in conjunction with GPS-based metering, many Americans think, “The government is tracking where I drive, and I don’t like it.” And with technologies changing so quickly, legal issues pertaining to privacy are still evolving. It’s also difficult to prove that a state is *not* collecting information on individual drivers. In short, the privacy issue entails suspicion of government, unclear legal protections, changing technological standards, and lack of transparency. There are other reasons for public resistance as well, of course—new taxes and fees of any type are a difficult political sell. But assuring the public that mechanisms to record miles traveled and collect mileage fees are fair and secure—and would not in fact involve a “Big Brother–style” intrusion of privacy—will be critical for public acceptance.

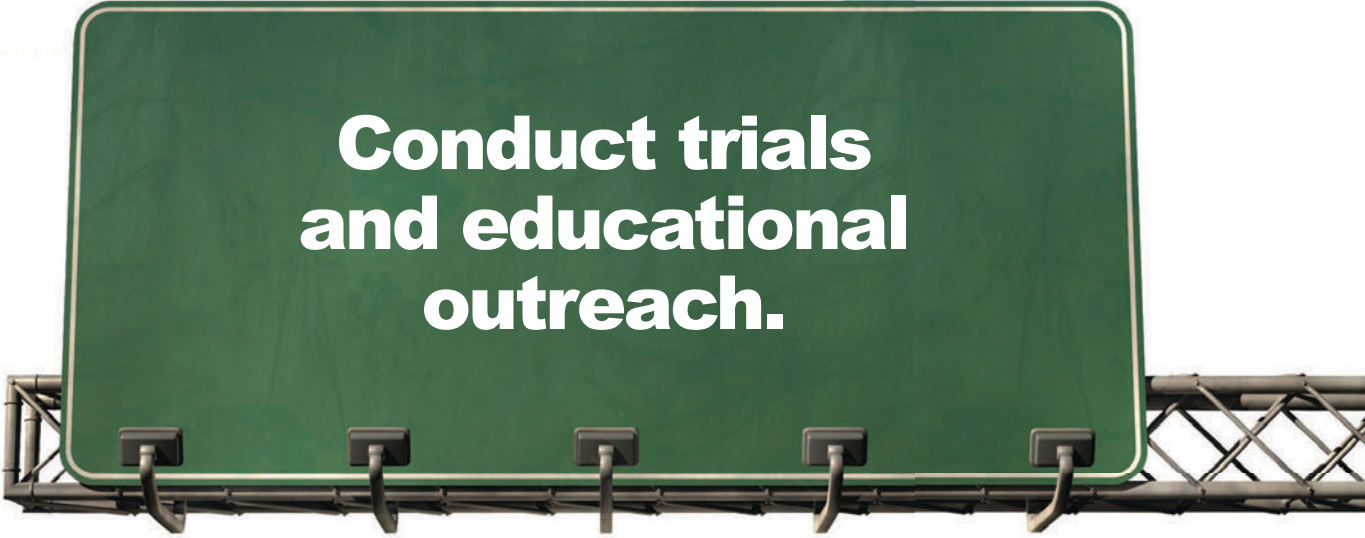
Promising Strategies to Reduce System Cost and Increase Public Support

Planners and policy analysts have been aware for some time now that potentially high system costs and low initial public support represent perhaps the greatest obstacles to shifting from fuel taxes to mileage fees. In response, they have developed an array of innovative system design and transition concepts intended to overcome these two core challenges.

Drawing on the approaches explored in the recent and ongoing mileage-fee initiatives discussed earlier, we now present 15 promising strategies for reducing system cost and increasing support. As indicated in the summary chart below, system costs as a share of revenue can be lowered by either reducing actual costs or increasing the amount of revenue that flows through the system. Likewise, public support can be enhanced by fostering more positive views of mileage fees or, alternatively, by defusing sources of opposition.

Many of these approaches are just now being explored and thus should be viewed as promising rather than proven. Some pose complex implementation considerations and further planning and analysis would be necessary to determine how these ideas might be applied in specific state or regional contexts. In the pages that follow, we briefly introduce the 15 strategies and describe the intriguing and often compelling logic about how they could reduce costs or improve public acceptance.

Strategies	Reduce Cost as Percent of Revenue		Foster Public Acceptance	
	Increase System Revenue	Decrease System Cost	Increase Support	Defuse Opposition
Conduct trials and educational outreach		—	—	—
Include elected officials in trials			—	—
Engage stakeholders in system planning			—	—
Enroll privacy watchdogs				—
Begin with a simple odometer-based system				—
Provide drivers with a choice of technologies			—	—
Make mileage fees a smartphone app		—		—
Design the system to support value-added features	—		—	
Integrate with ITS investments		—	—	
Encourage competition among vendors		—	—	
Initiate a transition with voluntary adoption				—
Focus initially on alternative-fuel vehicles			—	—
Provide a fixed-fee option				—
Convert other funding mechanisms to per-mile fees	—			
Work with other states to develop a multijurisdictional system	—			



Conduct trials and educational outreach.

RESEARCH HAS SHOWN THAT PUBLIC SUPPORT INCREASES considerably as individuals develop a greater understanding of motivations for mileage fees and of supporting technologies. Trials involving a significant share of a state's population would be cost-prohibitive, suggesting the need for a more traditional education and outreach campaign to reach a broader audience. Still, it would be valuable to conduct moderate-sized trials—not just to familiarize drivers with the concept of mileage fees but also to explore implementation and policy options under more realistic conditions—with the ultimate aim of designing a system that is cost-effective and also acceptable to the public.



Include elected officials in trials.

BUILDING ON THE LOGIC THAT GREATER FAMILIARITY WITH mileage fees can increase support, Minnesota has included elected officials as ex officio participants in its trials. Taking it one step further, Oregon is planning to include several legislators as actual participants who will pay mileage fees and receive fuel tax rebates in its upcoming trials. It is too early to discern whether the experience will turn these officials into public champions of mileage fees, but at minimum it should help them to make more-informed policy decisions.



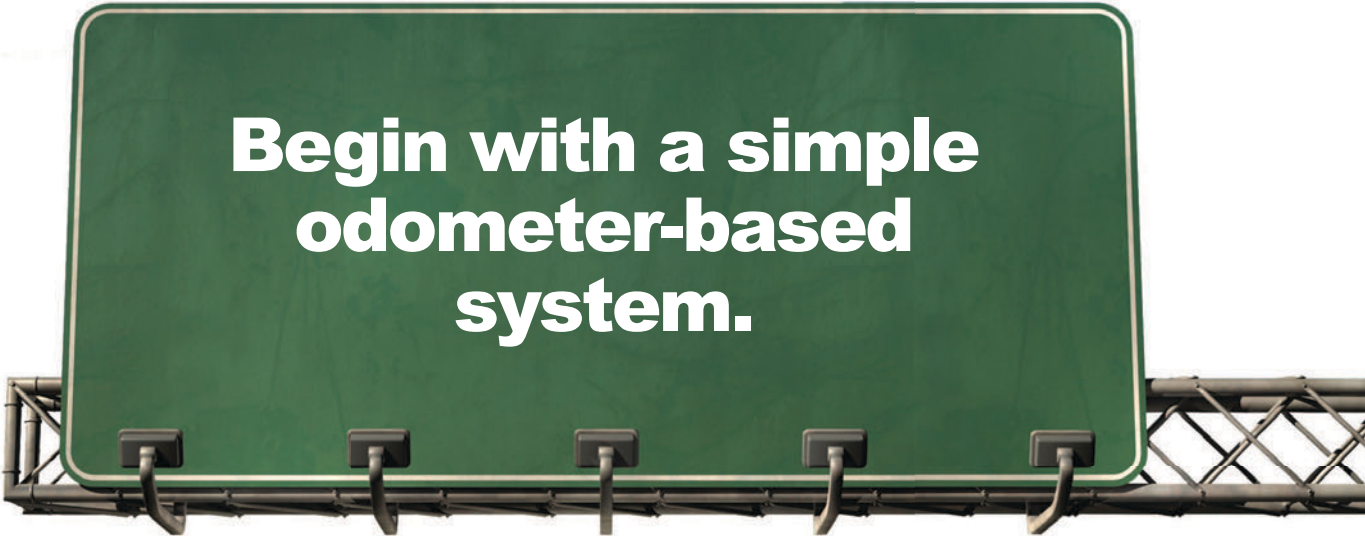
Engage stakeholders in system planning.

THE IMPLICATIONS OF A TRANSITION FROM FUEL TAXES TO mileage fees are likely to interest many stakeholders—cities and counties; auto clubs and trucking associations; business interests; the tolling industry; the construction industry; transit proponents; and environmental, social justice, and civil liberties advocates. Some may be inclined to support mileage fees, while others may harbor valid reservations. Inviting stakeholders to participate in considering policy goals for mileage fees—providing a forum in which they can discuss possibilities, concerns, and lessons learned—could help develop a more acceptable and robust design for mileage fees that strengthens support from some quarters and eases concerns from others. The state of Minnesota, for example, created a mileage-based user fee task force with diverse stakeholder representation to consider the advantages and drawbacks of shifting to mileage fees and to outline broad principles and policy objectives that a mileage-fee system should embody.



Enroll privacy watchdogs.

THE MERE ASSERTION THAT PRIVACY SAFEGUARDS ARE IN place may be insufficient to allay the concerns of strong privacy advocates. The state of Minnesota therefore included a member of the American Civil Liberties Union on its mileage-fee task force to help ensure that the approach to privacy protection was both appropriate and rigorous. Other states can identify third-party organizations dedicated to privacy concerns that could provide independent assurance that privacy issues are taken seriously in the design and implementation of mileage-fee programs.



Begin with a simple odometer-based system.

A MAJOR CONCERN REGARDING SOPHISTICATED METERING options that use cellular- or GPS-based location data is that such technology would enable the government to track individual travel. The odometer, in contrast, offers a simple approach that provides no information about the location of travel, thus reducing privacy concerns. For states that routinely inspect vehicles, such as for annual safety checks, relying on odometer readings could offer a relatively low-cost initial approach to mileage fees. Not every state has the infrastructure for such inspections, though, and even those that do might need to undertake major changes in their vehicle registration and billing systems. Nevada and Texas have already begun to examine this approach along with other possibilities.



Provide drivers with a choice of technologies.

ANOTHER OPTION FOR ADDRESSING PRIVACY CONCERNS WOULD be to let drivers choose between metering options that provide no location information—an odometer or a simple on-board unit (OBU)—and options that provide both location and distance of travel. Those choosing the latter could gain access to value-added functionality provided by the in-vehicle equipment and might also qualify for certain fee exemptions (for example, no charges for off-road travel, for travel on private roads, or for out-of-state miles). Those with strong privacy concerns, however, could choose a metering approach that simply indicates total miles of travel. Drivers could also select their preferred method of payment (e.g., prepaid debit accounts vs. monthly or annual billing) and choose among alternate forms of privacy protection. Trials in Minnesota and the mileage-fee system under development in Oregon exemplify different operational concepts that allow drivers to select from among different metering technologies.



Make mileage fees a smartphone app.

DRIVERS WHO ALREADY OWN SMARTPHONES MIGHT BE OFFERED the choice of using an app to meter mileage. This approach—being developed as an option in the planned Oregon system and tested in the current Minnesota trials—could reduce costs associated with dedicated metering devices and communication services. It could also enhance user acceptance, as many smartphone owners are already accustomed to using their GPS-enabled devices for a broad range of services.



Design the system to support value-added features.

COUPLING VALUE-ADDED SERVICES WITH MILEAGE FEES COULD help build greater public acceptance and increase cost efficiency as well. The technologies capable of metering mileage by location, including GPS and wireless communications, can also provide motorists with faster or more convenient travel, enhanced safety, and opportunities to save money. And some value-added services, such as pay-as-you-drive auto insurance, automated payment of parking fees, automated payment of tolls, and more generalized commercial services, might generate revenue to help defray the costs of collecting mileage fees. While mileage-metering devices able to support value-added services could be designed from scratch, existing products such as personal navigation devices could also be modified and certified to meter mileage. Value-added services are a central theme in New York City's DriveSmart initiative and are also possible with the approach being explored in the Minnesota trials and in the mileage-fee system under development in Oregon.



WITH THE ADDITION OF DSRC (OR DEDICATED SHORT-RANGE communications) capabilities, an in-vehicle metering device might be configured to support many of the vehicle-to-vehicle and vehicle-to-infrastructure intelligent transportation system (ITS) applications envisioned under the U.S. Research and Innovative Technology Administration's connected vehicle program. This suggests an opportunity for states to merge funding streams for ITS research and development and the exploration of mileage fees in a way that either reduces total cost or results in greater total returns on investment.



Encourage competition among vendors.

ANOTHER STRATEGY FOR ENHANCING PUBLIC SUPPORT AND reducing costs is to design the system such that multiple vendors can be certified to provide metering devices and account management services, competing for customers based on price and the quality of value-added services. This can be accomplished through an “open-system” approach, in which firms must configure their devices and services to meet a specified set of mileage reporting and fee collection standards and protocols in order to receive official certification. Ongoing competition in this market should help to drive down system costs over time and spur innovation in the development of ever more compelling service offerings. The system currently under development in Oregon employs an open-system approach to allow for vendor competition, and the strategy is central to the DriveSmart initiative in New York City as well.



Initiate a transition with voluntary adoption.

ASSUMING THAT A MILEAGE-FEE SYSTEM IS DESIGNED TO PROVIDE value-added services, the transition from fuel taxes to mileage fees might be initiated with a period of voluntary adoption. Drivers interested in subsidized access to value-added services would agree to begin paying mileage fees and in turn receive rebates for estimated fuel taxes paid. Note that this approach would be unlikely to yield additional revenue during the period of voluntary adoption, as few drivers would willingly switch to mileage fees if the cost was much more than current fuel taxes. Rather, the logic would be to provide a period of time to demonstrate, with a relatively small number of willing participants, that the system works as intended—that it successfully meters mileage, collects payment, deters evasion, and protects privacy. Once the system has proven successful for voluntary participants, it might then be possible to pursue a more rapid transition to mandatory mileage fees. New York City’s DriveSmart initiative is framed by the concept of voluntary adoption.



Focus initially on alternative-fuel vehicles.

ANOTHER CONCEPT FOR INITIATING A MILEAGE-FEE SYSTEM WITH a relatively limited set of drivers is to begin with alternative-fuel vehicles. Texas, for example, has looked at the possibility of designing a mileage-fee system that would initially apply to electric vehicles, which are not otherwise subject to road-use fees through gasoline or diesel taxes. The envisioned plan in Oregon, another variation on this idea, is to begin by mandating mileage fees for vehicles rated at the equivalent of 55 miles per gallon or more. At present, this mainly includes electric vehicles and plug-in hybrid vehicles, but it will also encompass advanced conventional vehicles in future years because of much more stringent federal fuel economy standards. Recent research highlights public support for the idea that all vehicles should pay their fair share toward maintaining the road network. And because the share of voters who currently own alternative-fuel vehicles is still quite small, opposition to the development of mileage fees could be muted. The main potential drawback with this strategy is that it could slow the adoption of alternative-fuel vehicles, though states have other policy options for incentivizing the purchase and use of such vehicles.



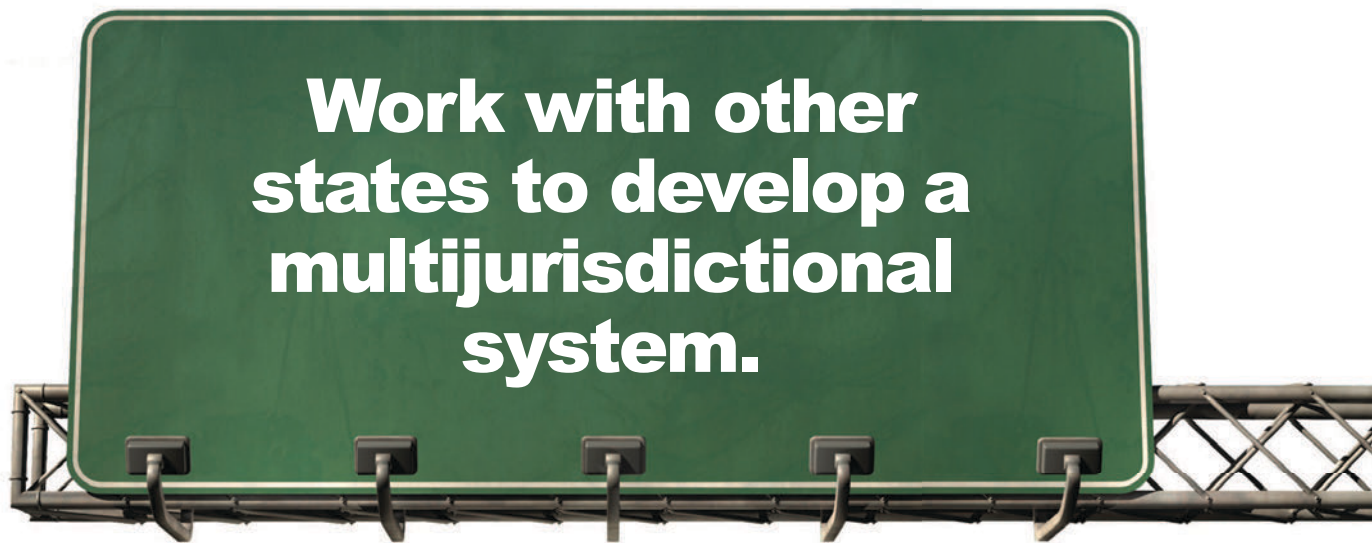
Provide a fixed-fee option.

TO SATISFY RESIDENTS WHO REMAIN STEADFASTLY OPPOSED TO mileage fees on principle, states could offer a fixed-fee alternative—replacing existing fuel taxes with significantly higher registration fees. Drivers would then be presented with the option of paying either the higher registration fee or a per-mile charge that is assessed by an annual odometer reading or more advanced in-vehicle metering equipment. To ensure that the inclusion of a flat-fee option would not result in an overall reduction in revenue—that is, a situation in which all high-mileage drivers simply choose to pay the fixed fee and all low-mileage drivers pay by the mile—the fixed fee would need to be calibrated for higher-than-average annual vehicle miles.




Convert other funding mechanisms to per-mile fees.

THE ADMINISTRATIVE EFFICIENCY OF MILEAGE FEES—THAT IS, THE cost of setting up and operating the system in relation to total revenue—can be improved either by reducing system cost or increasing the revenue collected. One possible strategy for the latter would be to convert other common state and local transportation revenue sources, such as registration fees or dedicated sales taxes, to per-mile fees that would be apportioned, as appropriate, among state and local jurisdictions. That is, rather than solely replacing fuel taxes, mileage fees could be structured as a general-purpose road-funding mechanism that replaces most state and local transportation revenue sources currently in use. Beyond increasing the mileage-fee revenue base and thus reducing the ratio of system costs to gross receipts, this could also reduce or eliminate the administrative costs associated with other revenue mechanisms, many of which are far less efficient than fuel-tax collection. Shifting a greater share of road funding to per-mile fees would also provide a greater incentive for reducing total vehicle travel, which would be helpful in mitigating traffic congestion and air quality challenges.




IF ADJACENT STATES ARE INTERESTED IN SWITCHING TO MILEAGE fees, collaborating to develop an integrated multistate system could present several advantages. These include providing a means for collecting and fairly apportioning revenue for interstate travel among the participating states; defraying some of the fixed capital costs across a broader user base, in turn reducing the system's cost-to-revenue ratio; and reducing the likelihood of needing to undergo a costly system redesign in order to accommodate additional jurisdictions in future years. Research conducted by the I-95 Corridor Coalition on how to implement a multistate system suggests that even with such collaboration, individual states would still have considerable latitude in tailoring most of the elements of the mileage-fee system, such as the specific rate structure, according to their own needs.

Ask the Authors



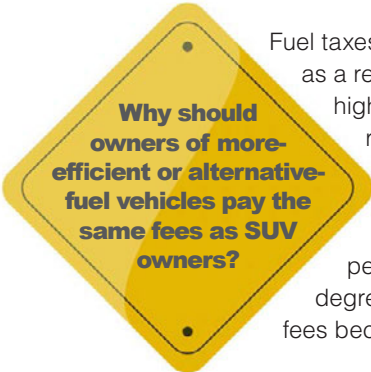
Wouldn't mileage fees disproportionately burden rural drivers?

Rural residents drive farther each year than urban residents, so it seems like rural drivers would be worse off with mileage fees. But typical rural drivers already pay more in fuel taxes than their urban counterparts. Also, rural drivers tend to own larger vehicles with lower fuel economy, so they pay more in fuel taxes for each mile. Assuming that all passenger vehicles pay the same per-mile rate, owners of vehicles with lower fuel economy would pay slightly less in mileage fees than in fuel taxes. On average, then, a flat per-mile fee structure would make rural drivers better off.



Wouldn't mileage fees be a burden on lower-income drivers?

Mileage fees are income-regressive—that is, poorer households would pay more as a percent of their income than wealthier households. But so are fuel taxes. Drivers from lower-income households tend to own older cars with lower fuel economy, so they pay more in taxes for every mile driven. And as wealthier households purchase new vehicles that either run on alternative fuels or meet increasingly stringent federal fuel economy standards, the share of fuel taxes paid by owners of older vehicles with lower fuel economy grows even larger. Replacing fuel taxes with mileage fees would help balance this disparity. As with rural residents, then, lower-income households would likewise be better off on average with mileage fees.



Why should owners of more-efficient or alternative-fuel vehicles pay the same fees as SUV owners?

Fuel taxes were first adopted in Oregon, and later in other states and at the federal level, as a revenue strategy intended to fairly apportion the cost of building and maintaining highways in proportion to use. From that perspective, charging the same per-mile rate for similarly sized vehicles, regardless of fuel economy or fuel type, would be appropriate. Yet fuel taxes also create a modest incentive for purchasing vehicles with higher fuel economy, and some states might wish to preserve this incentive by offering reduced per-mile rates for vehicles with better environmental performance. Structuring rates in this manner, though, could undermine the degree to which rural and lower-income drivers might be better off with mileage fees because they tend to drive less fuel-efficient vehicles.



Why not just charge more tolls?

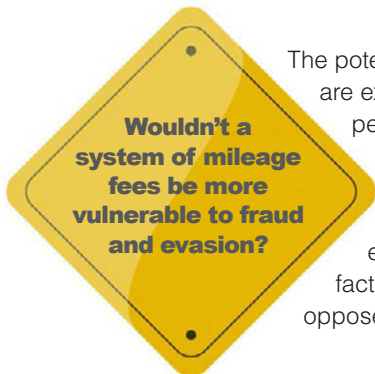
Conventional tolling is another very good option for raising highway revenue, and many states have been considering this alternative with greater interest. But current electronic tolling technology still requires roadside infrastructure, making it expensive or impractical for all but the most heavily traveled corridors. Mileage fees, on the other hand, would allow states and local jurisdictions to levy road-use fees across the entire road network. Mileage-metering equipment could also enable value-added motorist services and the collection of detailed travel data to support better planning and operations, advantages not offered by conventional tolling systems.



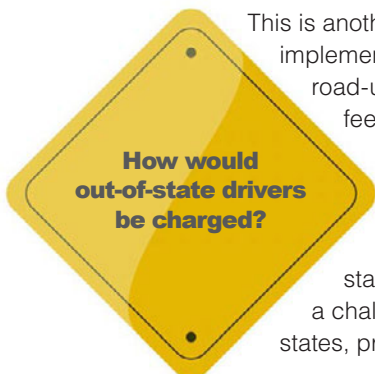
That's a good point—as with fuel taxes, mileage fees would also need to be increased at least occasionally to keep up with inflation in the costs of construction and maintenance. But mileage fees are tied directly to the amount of driving, so they can better keep pace with funding needs. Unlike fuel taxes, mileage-fee revenue would be unaffected by changes in fuel economy or even fuel type. And as new fees, they might be introduced with automatic indexing to keep pace with inflation, as some states do now with gas taxes.



Technology can limit the amount of data linked to a specific driver. For example, with the so-called “fat client” approach, detailed travel data are never transmitted from the OBU. Rather, the OBU stores all of the information needed to determine the amount owed to different jurisdictions based on the amount of travel in each. Periodically, perhaps once a month, the OBU sends two messages to the billing agency. The first includes the vehicle ID and the total amount owed—no location data. The driver is billed based on this total. A second message is sent anonymously—stripped of vehicle ID—with the number of miles traveled in each jurisdiction. The billing agency then aggregates these anonymous messages for all drivers and apportions total revenue across jurisdictions accordingly.



The potential for fraud and evasion is a legitimate concern, and system designers are exploring a variety of preventive measures: tamperproof metering devices, periodic odometer inspections to verify that mileage has been correctly recorded, and roadside enforcement equipment that queries metering devices in passing vehicles to ensure that they are functioning properly, among others. Many of these are promising, but there is little evidence on how much they might cost to implement at scale. A critical factor in cost is the degree to which enforcement can be automated as opposed to requiring manual intervention.



This is another challenging question to be resolved. In the near term, states that implement mileage fees might continue to charge fuel taxes as a means of collecting road-use fees from out-of-state drivers, with in-state drivers subject to mileage fees receiving a rebate for fuel taxes paid. This could potentially be estimated based on vehicle type and miles traveled. Over the longer term, mileage-fee systems in different states should be interoperable, allowing for the proper collection and apportionment of mileage fees across state boundaries. Achieving interoperability—which includes developing common technical standards and implementing some form of certification process—represents a challenging task that will require ongoing collaboration among participating states, private industry, and possibly the federal government.

Transportation Research at RAND

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Featured Transportation Experts



JOHANNA ZMUD is director of the RAND Transportation, Space, and Technology Program. She has 25 years of experience in survey research design, implementation, and statistical analysis. Zmud has pioneered the application of social science and survey science practices in many areas of transportation research. She cochairs the International Steering Committee for Travel Survey Conferences and serves on two policy committees of the U.S. National Research Council: Equity Implications of Alternative Transportation Finance Mechanisms and Strategies for Improved Passenger and Freight Travel Data.



PAUL SORENSEN is associate director of the RAND Transportation, Space, and Technology Program, with research interests in transportation, energy, and urban planning. His recent work includes evaluating mileage-fee implementation options, assessing the potential effects of evolving energy sources and vehicle technologies on state departments of transportation, and examining performance-based accountability as a strategy for improving public service delivery in transportation and other policy arenas. Sorensen received his M.A. in urban planning from the University of California, Los Angeles, and his Ph.D. in geography from the University of California, Santa Barbara.

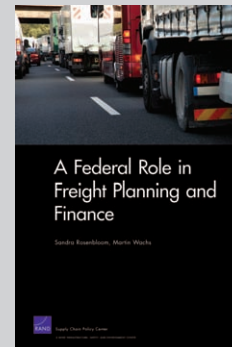
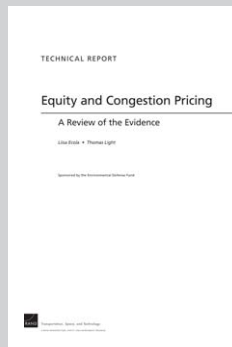
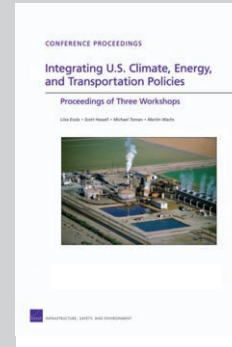
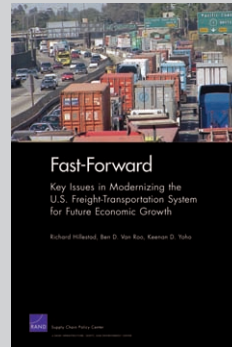
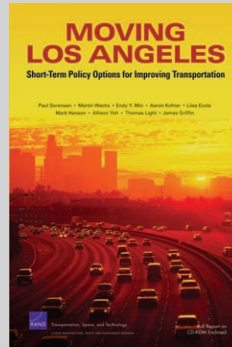
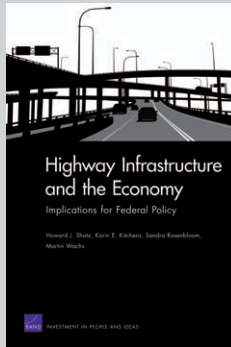


LIISA ECOLA is a transportation planner with interests in transit, transportation demand management, finance, and environmental and land use impacts. She is focused on two primary areas: the intersection of transportation with climate policy, and congestion pricing. She has conducted extensive work in smart growth, and managed the U.S. Environmental Protection Agency's National Award for Smart Growth Achievement for five years. She has also worked on research projects on the effectiveness and best marketing techniques for commuter benefits, and taught at the National Transit Institute. Ecola received her M.C.P. from the University of California, Berkeley.



MARTIN WACHS is a senior principal researcher at the RAND Corporation and a professor at the Pardee RAND Graduate School. He previously served as director of the RAND Transportation, Space, and Technology Program. Prior to joining RAND, he was professor of civil and environmental engineering and professor of city and regional planning at the University of California, Berkeley, where he was also director of the Institute of Transportation Studies. Prior to this, he spent 25 years at the University of California, Los Angeles, where he served three terms as chairman of the Department of Urban Planning.

Recent Transportation Publications from RAND



ADDITIONAL READING ON MILEAGE-BASED USER FEES

Sorensen, P., L. Ecola, M. Wachs, et al., *Implementable Strategies for Shifting to Direct Usage-Based Charges for Transportation Funding*, National Cooperative Highway Research Program, Transportation Research Board of the National Academies, June 2009, www.rand.org/pubs/reprints/RP1395.html

Sorensen, P., M. Wachs, and L. Ecola, *System Trials to Demonstrate Mileage-Based Road Use Charges*, National Cooperative Highway Research Program, Transportation Research Board of the National Academies, October 2010, www.rand.org/pubs/reprints/RP1423.html

A Transition from Fuel Taxes to Mileage-Based User Fees?

This guide presents some promising and innovative system designs and transition strategies.

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- For jurisdictions already engaged in detailed assessments of mileage fees, these concepts can help refine system design—with the ultimate aim of reducing costs and building public support.

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ISBN 978-0-8330-7842-1