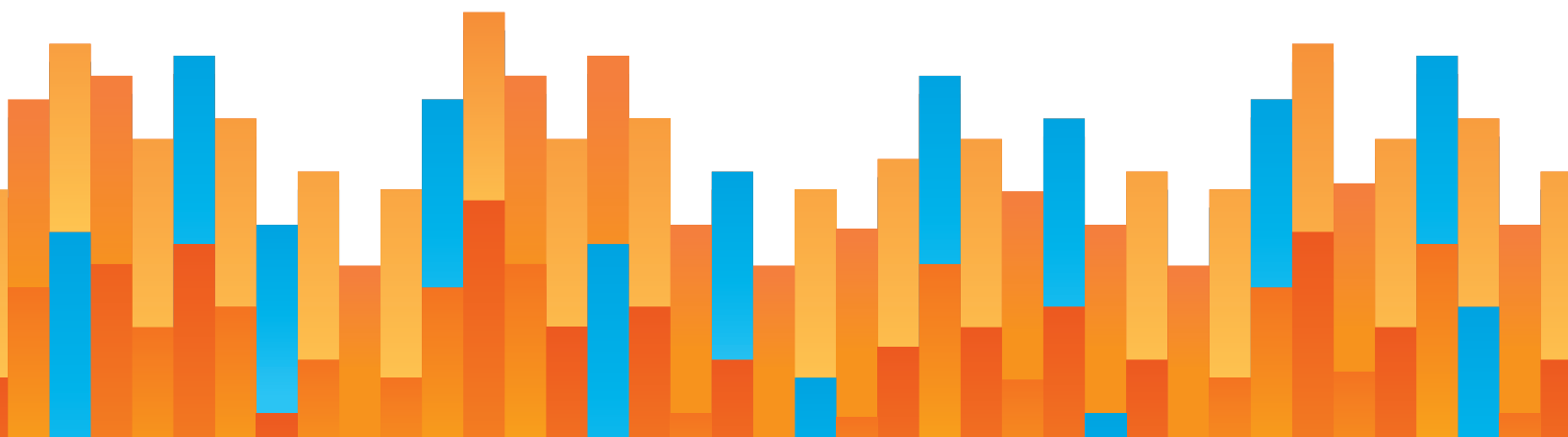




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HOW A STATE COULD TRANSITION FROM PER-GALLON TAXES TO PER-MILE CHARGING

by Robert W. Poole, Jr.
September 2019





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PART 1

INTRODUCTION

There is a growing consensus among U.S. transportation researchers, and increasingly among state departments of transportation (DOTs), that our main highway funding source—per-gallon taxes on gasoline and diesel fuel—will not be sustainable on a long-term basis. This is due to a number of factors, including increasingly stringent federal fuel economy regulations and the growth of non-petroleum power sources (especially electricity) for both personal vehicles and trucks.

The first serious study of this problem was commissioned by the Transportation Research Board in 2004. A special committee (on which this author served) concluded that fuel taxes would not remain viable as the primary highway funding source for the 21st century, and that research and planning should begin to figure out alternatives.¹ Several years later, Congress authorized the creation of the National Surface Transportation Infrastructure Financing Commission. Its members did research and held hearings, and after evaluating a large number of possible alternatives, concluded that (1) the users-pay/users-benefit principle that began with gas taxes should be retained, and (2) charging vehicle operators per mile driven was the best alternative.² It also recommended that the mileage-based user

¹ *The Fuel Tax and Alternatives for Transportation Funding*. Special Report 285. Transportation Research Board. 2006.

² *Paying Our Way: A New Framework for Transportation Finance*. National Surface Transportation Infrastructure Financing Commission. February 2009.

fee (MBUF) be introduced as a *replacement for*, rather than as a supplement to, existing per-gallon fuel taxes.

In the current decade, Congress has allocated modest federal funds for individual states (and, later, groups of states) to operate pilot projects to test various methods of recording miles driven and reporting them to the relevant transportation agency. A non-profit organization, the Mileage Based User Fee Alliance (MBUFA), has held conferences and worked with those operating MBUF pilot projects to share knowledge of what works technically, as well as to find out what concerns individuals and trucking companies have about paying per mile.

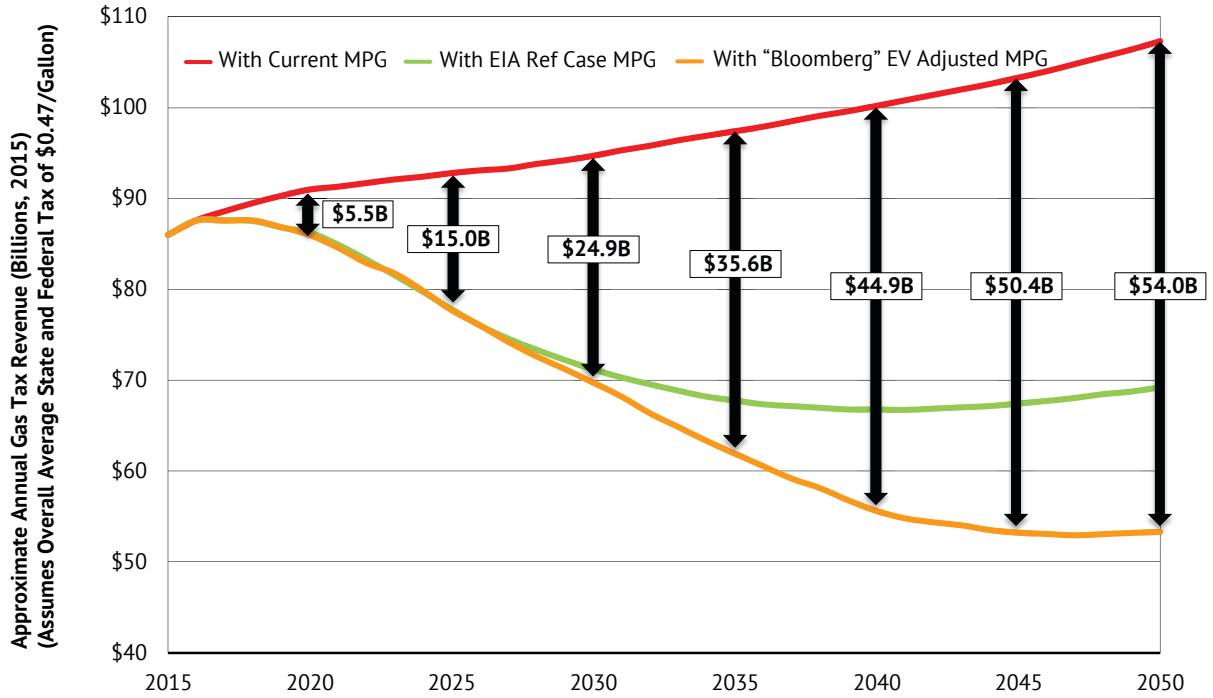
In addition, the research community continues to make projections of future revenues from federal and state fuel taxes, taking into account currently legislated fuel economy standards and projections of electric vehicle penetration. The federal Corporate Average Fuel Economy (CAFE) regulations apply to new vehicles only. New vehicles use less fuel than older vehicles to go the same number of miles, so as old (low-mpg) vehicles are scrapped and replaced by newer (high-mpg) vehicles, the reductions in fuel consumption grow over time. Figure 1 is a 2017 projection made by a leading firm that does traffic and revenue forecasts for highways.³ The top line in the graph is total fuel tax revenues if 2017 CAFE mpg levels remained constant. The line below that shows what happens as the impact of the current 2025 mpg requirements rolls through the fleet over the next two decades, with high-mpg vehicles increasingly replacing low-mpg vehicles. And the lowest line adds the impact from a projection of electric vehicle penetration from Bloomberg New Energy Finance. As can be seen, by 2045 the shortfall from business-as-usual fuel tax revenues could exceed \$50 billion per year.

This is an unfortunate consequence of a situation that has short-term benefits for highway users. We enjoy better fuel economy and can go a lot farther on a tank of fuel than we could 20 or 30 years ago, but that means dwindling fuel tax revenues. The impending fuel tax crisis comes at a difficult time, because much of our highway infrastructure is aging and will need major investment in coming decades.

³ Regan, Ed. "The Motor Fuel Tax: A Critical System at Risk." CDM Smith. 2017.

FIGURE 1: PROJECTED FUEL TAX REVENUE THROUGH 2050

2017 DOLLARS; ASSUMES NOMINAL \$0.47/GAL. COMBINED AVERAGE TAX



Source: Regan, Ed. "The Motor Fuel Tax: A Critical System at Risk." CDM Smith. 2017.

PART 2

FIXING THE FLAWS OF THE 20TH CENTURY FUEL TAX

The per-gallon fuel tax has been with us for 100 years, having been created as the highway funding source in Oregon in 1919. All the other states adopted dedicated fuel taxes over the next decade, and the federal government adopted its own fuel tax (for deficit reduction, not highways) in 1932. Replacing such a long-established funding source will be a major change, requiring a great deal of effort and savvy politics. Given how large a change this will be, it behooves us to consider—and try to fix—what we now understand to be *all the shortcomings* of per-gallon fuel taxes, not just their failure to keep pace with changing vehicle propulsion sources. Here is a brief discussion of these shortcomings.

#1 Not applicable to all vehicles

This is the most common justification for shifting from per-gallon to per-mile. As of 2019, every major manufacturer of personal vehicles and commercial vehicles (trucks) is developing electric models. Most are battery electrics, able to be recharged by plugging them into a recharging source. Others are developing electric propulsion based on hydrogen fuel cells, which offer the prospect of longer range and much quicker “refueling” than battery electrics, but which will require a new hydrogen fueling infrastructure. There

are also various hybrid systems (a conventional petroleum-fueled engine plus battery-powered electric motors) and small numbers of propulsion systems based on compressed natural gas (CNG) or liquefied natural gas (LNG). The mix of propulsion sources 20 or 30 years from now is impossible to project, since it will depend on future fuel economy regulations, technological developments, vehicle performance, and customer acceptance. Therefore, it makes sense to change to a highway funding method that is independent of how the vehicle is propelled: a per-mile charge.

#2 Not keeping pace with roadway needs

Roadways need ongoing maintenance. And in states and metro areas experiencing rapid growth, additions to the road system are often needed. Roads eventually wear out when the underlying sub-base is no longer structurally sound, and the entire road must be reconstructed. The costs of maintenance and construction tend to increase at a somewhat greater rate than the consumer price index (CPI). Although recent years have witnessed historically low annual inflation rates, throughout U.S. history inflation has generally been in single digits or low double digits. An annual inflation rate of 3% means that a dollar today buys only 97 cents worth (for example, of paving materials) the next year. As an extreme example, the federal gas tax was last increased in 1993, to 18.4¢/gallon. By 2019, the purchasing power of that 18.4¢ had fallen to just 11¢. Some states have indexed their fuel tax rate to an inflation index such as the CPI, but many people object to that as “putting tax increases on automatic pilot.” In most other infrastructure, periodic rate increases occur only after approval by an external oversight body. It would be desirable to provide such a mechanism for mileage-based user fees.

#3 Not transparent

The current highway funding system is complex and opaque to highway users. Highways are paid for mostly by a combination of federal and state fuel taxes, but highway and road funding may also include revenue from tolls, general funds (if the state DOT issues general-obligation bonds for highway purposes), vehicle registration fees (in many states) and transportation sales taxes. The average motorist has no idea how much or how little she pays for highway services, given these various funding sources, and no idea whom to hold accountable for highways that perform poorly. This is in sharp contrast to most other vital infrastructure. In the case of electricity and water supply, for example, customers receive a monthly bill that itemizes how many kilowatt hours or thousands of gallons of water they used, the rate per unit of use, and the amount due. This is completely transparent, and the

customer knows that the electric company or the water department is the provider that is responsible for good or poor performance. Nothing like this exists for highways (except for toll roads). A mileage-based user fee offers the possibility of “highway bills” and a direct customer/provider relationship.⁴

#4 No effect on congestion

In nearly all large urban areas, traffic congestion is chronic, and has increased greatly over the past 30 years (when it was already serious). The addition of variably priced express toll lanes around the country has demonstrated that variable pricing of freeway lanes can restore free flow most of the time, even during peak periods. One *option* that is available with a per-mile charge is to make the charge *variable* on those limited-access freeways that suffer the most congestion. This should not be a requirement of all mileage-based user fees, since it is more complicated and costly to include. But on chronically congested freeway corridors, it is an option worth considering (just as electric utilities increasingly offer time-of-day rates).

#5 Not fully dedicated to user benefits

State fuel taxes were originally intended to be pure user taxes; 100% of every dollar raised was dedicated to creating, improving, and maintaining the highways desired by those who paid the gas taxes. This dedication to highways was via legislation in some states, but was also protected by constitutional amendments in many states.⁵ The original Depression-era federal gas tax was purely a revenue-raiser for the deficit-strapped federal budget. But when Congress created the federal program to build the Interstate highway system in 1956, it authorized new federal gasoline and diesel taxes that were 100% dedicated to a new Highway Trust Fund (HTF), for the sole purpose of building the Interstate system. That dedication to highway uses was gradually watered down by Congress: first allowing spending on non-Interstate highways, later on infrastructure to aid bus transit, and in 1982 by adding a transit account to the HTF. Today, some 23% of all federal fuel tax money is spent on an array of *non-highway* purposes, including two safety regulatory agencies (NHTSA and FMCSA), air quality grants (CMAQ), ferryboat subsidies, sidewalks, bikeways,

⁴ Poole, Robert W., Jr. *Rethinking America's Highways*. Chapter 8. University of Chicago Press. 2018.

⁵ Davis, Jeff. “The History of the Gasoline Tax, Part 1.” *Transportation Weekly*. April 20, 2010.

recreational trails, etc.⁶ A more recent study estimated diversion of *state* “highway user tax revenue” to non-highway purposes, *averaging* 24% across the states, and from as high as 60%–70% in four states to a low of zero in three states.⁷

The ever-increasing diversion of “highway user taxes” to non-highway uses helps explain resistance to fuel tax increases. At the federal level, despite repeated campaigns by highway and transit groups since 1993, Congress has failed to increase federal gasoline and diesel tax rates for two and a half decades. Governors and state DOTs have overcome this distrust and opposition in a number of cases, but generally only by presenting detailed lists of projects that can only be carried out if voters approve increased state fuel tax rates. All too often, however, the “gas tax” is seen by many voters as just another tax that they don’t want increased.

2.1

SHOULD MBUF BE A TAX OR A FEE?

The above discussion raises the question of what the replacement of per-gallon fuel taxes should be. Should it be a *tax* or a *fee for service*? The literature on this subject uses two different terms, without clearly distinguishing between them. Some call for a “Vehicle Miles Tax” that would be a direct replacement for federal and state fuel taxes, funding all the current programs that those taxes support. Others call for a “Mileage-Based User Fee,” which implies a fee paid for using roadways, similar to one’s electric bill, smartphone bill, or water bill. Some MBUF advocates have referred to highway infrastructure as a kind of utility, for which people should be billed based on how many miles they drive. But even with this description, generally left vague is what the revenues should (*and should not*) be used for. An electric bill pays for the capital and operating costs of the electric utility. The same is true of a natural gas bill, water bill, phone bill, cable bill, etc. Each of those is paid directly to the infrastructure provider, which uses those funds to pay for the capital and operating costs of that specific infrastructure.

Considerable state-level case law establishes that a user fee and a tax are two different things. This was especially true after states such as California enacted limits on property taxes in the late 1970s, leading local governments to implement user fees for specific services. Generally, a tax is paid by everyone and is spent at the government’s discretion. A

⁶ Poole, Robert W. Jr. and Adrian Moore. “Restoring Trust in the Highway Trust Fund.” Reason Foundation. August 2010.

⁷ Edwards, Chris. “Highways and Gas Tax Diversions.” *Cato at Liberty*. Sept. 19, 2018.

user fee is paid only by those who use a service and is generally used to pay for the costs of providing that service. In the highway sector, tolls (which are usually a pure highway user fee) have sparked litigation. In Virginia, opponents of a billion-dollar toll tunnel developed under a long-term public-private partnership concession filed suit, arguing that the state, by allowing a private company to finance, build, operate, and maintain a toll facility, was illegally delegating its *taxing* authority. In that case, the Virginia Supreme Court ruled unanimously that a toll is not a tax but is a user fee, because:

- Those who pay the tolls receive a specific benefit not shared by the general public;
- No one is compelled to use the tolled facilities; and,
- The tolls are collected solely to fund the facility, not to raise general revenues.⁸

Likewise, a per-mile fee paid directly to the roadway provider and used to pay for its roadways would be a fee, not a tax.

When some form of MBUF applies to all roads, the situation would be analogous to monopoly utilities (like water supply and much of electricity). Water bills and electric bills are still user fees, not taxes. But consumers are protected by external oversight of rate increases.

The above is a condensation of a lengthier discussion of the advantages of paying a per-mile charge rather than a per-gallon tax.⁹

⁸ *Elizabeth River Crossings OPCO, LLC v. Record No. 130954 Danny Meeks et al.* Virginia Supreme Court. Oct. 31, 2013. (www.courts.state.va.us/opinions/opnscvwp/1130954.pdf)

⁹ Poole, Robert W., Jr. and Adrian T. Moore. "Ten Reasons Why Per-Mile Tolling Is a Better Highway User Fee than Fuel Taxes." Reason Foundation. January 2014.

PART 3

CUSTOMER-FRIENDLY MILEAGE CHARGING

As of 2019, public perception of mileage-based user fees is mostly negative. A meta-analysis of 38 public opinion surveys on transportation funding that included MBOFs found that the average level of support for replacing fuel taxes with MBOFs was only 24%.¹⁰ In part due to mass-media portrayals, many people equate MBOFs with “Big Brother in their car,” tracking them wherever they go. Many conservative and taxpayer groups see per-mile charges as yet another tax, sending more money to government to be spent irresponsibly. For example, the leader of a ballot campaign that came close to repealing a large increase in California fuel taxes in 2018 has blasted proposals for a California MBOF as “a Congestion Tax where drivers are charged a fee for every mile they drive on freeways.”¹¹ Consequently, the politics of gaining consensus on replacing per-gallon with per-mile appears daunting.

One approach to dealing with this problem is education: explaining to large numbers of drivers/voters/taxpayers what MBOFs are intended to be (and what they are not intended to be). There is some evidence in favor of this education approach. Before-and-after surveys of individuals who take part in state MBOF pilot programs show that their understanding of and

¹⁰ Agrawal, Asha Weinstein, Hilary Nixon and Ashley M. Hooper. *Public Perception of Mileage-Based User Fees*. NCHRP Synthesis 487. National Academies Press. 2016.

¹¹ Email blast from Carl DeMaio of Reform California. “New Tax on Your Mileage.” May 22, 2019.

support for replacing a per-gallon tax with a per-mile fee increases significantly due to their participation. However, these trials can reach only a very small fraction of the population in each state, so relying on trials and broader educational efforts can do only so much.

Part of the problem is the numerous conceptions of what an MBUF system would be and do. A number of transportation researchers see MBUFs as a way to (1) make driving more expensive, so that people will do less of it, and (2) pay for an array of externalities associated with motor vehicle use, such as noise, pollution, resource depletion, congestion, etc. For example, a research paper from the University of California, Berkeley proposes a per-mile charging system that would assign different rates to vehicles based on “weight class, vehicle use, level of automation, propulsion system, and value,” as well as greenhouse gas emissions.¹² Others focus explicitly on increased funding. A report from the National League of Cities presents a future federal road user charge (RUC) as “a potential sustainable funding solution for the USA’s transportation infrastructure deficit,” implying that this would offer a substantial increase in funding, rather than being revenue-neutral, and would use the revenues for all modes of transportation.¹³

To the extent that motorists, trucking companies, and taxpayers perceive MBUFs in these ways, their already-negative impressions will be strengthened. The transportation community, which appreciates the importance of making the transition *and* the difficulty of gaining public and political consensus on this, must think hard about making the proposed change as customer-friendly as possible.

Here are some suggested principles for how a state can make a per-mile charge customer-friendly.

#1 Make it simple and understandable.

This calls for a simple charge to use roadways, based on how many miles each vehicle drives per year. The purpose is simply to pay for those roadways, because fuel taxes will not be viable within a few decades. This means paying for the capital and operating and maintenance costs of those roadways.

¹² Bayen, Alexandre, et al. “An Equitable and Integrated Approach to Paying for Roads in a Time of Rapid Change.” University of California Institute of Transportation Studies. February 2019.

¹³ National League of Cities. “Fixing Funding by the Mile: A Primer and Analysis of Road User Charge Systems.” March 2019.

#2 Replace the fuel tax, don't add to it.

At the outset, the aim should be dollar-for-dollar replacement of the then-current annual revenue generated by the state's fuel taxes. From the state DOT's perspective, this will still be an improvement over the fuel tax, because (a) all vehicles will pay it, regardless of propulsion source, and (b) there will be a process to permit cost-justified increases in the per-mile rate, to ensure proper stewardship of the roadways.

#3 Make it fair to all highway users.

Fairness has several dimensions. One is that all vehicles should pay for their use of the roadways. Another is that different kinds of vehicles impose different amounts of pavement damage, and should pay accordingly. Highways are generally built strong enough that differences in weight among personal vehicles make no practical difference to pavement wear. But heavy trucks do significantly more damage to pavements than personal vehicles, and they put stress on bridges (which justifies gross-weight limits).¹⁴ So larger trucks must pay a significantly higher per-mile rate than personal vehicles, as they do on toll roads (and also do, to some extent, with current fuel and other user taxes). In addition, some kinds of roads cost far more to build and maintain than others—for example, urban freeways and Interstate highways are far more costly than two-lane country roads and local streets. It makes sense to charge a higher per-mile rate for major (limited-access) highways than for all other roads. That way, people who seldom or never use freeways or Interstates would not have to share in paying for them.

#4 Make it transparent.

Just as with electric bills, water bills, and phone bills, individuals and companies should receive bills that document the miles driven, the rates that apply, and the total amount charged.

#5 Foster accountability for roadway providers.

Roadway bills should come from roadway providers, establishing a customer/provider relationship that has been lacking in transportation (compared with other infrastructure).

¹⁴ Small, Kenneth A., Clifford Winston, and Carol A. Evans. *Road Work: A New Highway Pricing & Investment Policy*. The Brookings Institution. 1989. Chapter 3: "Pavement Wear and Road Durability."

And the revenues should go directly to those providers as user-fee revenue, not to the state treasury. Roadway users would then know which entity is responsible for each roadway and could hold the providers responsible for the conditions and performance of those roadways. As discussed below, in most states the principal recipient would be the state DOT, but there would be exceptions (e.g., for toll roads and for local streets and roads).

#6 Offer a choice of methods to record miles driven.

The various MBUF pilot programs have all offered participants a choice of ways to record their miles. Methods have included annual odometer readings, a flat annual charge based on a multiple of the average vehicle-miles of travel in the state (e.g., 1.5 times), a non-GPS device plugged into the vehicle's diagnostic port, or a GPS device that can distinguish between miles driven on different kinds of roads. Since individual preference will vary widely, it seems wiser to structure an MBUF program to include several choices.

#7 Report only miles, not travel details.

All miles driven are recorded *in the vehicle*, using one of the above methods. A separate question is how they are reported—and to whom. The simplest approach is to report only total miles driven in the state per time period (month, year, or some other time period). If different per-mile rates apply to different roads, the vehicle's recording capability must be able to separate them into the relevant categories. What gets reported then is only the *total miles* for each category of road (probably only two: limited-access and all other). Most MBUF pilot programs have also used one or more commercial companies as the recipients of the mileage data, as a further safeguard on privacy (since many people would rather not have their miles reported directly to a government agency). This approach avoids reporting details of where the vehicle went. (See also Text Box 1 on GPS.)

#8 Include strict privacy protections.

Most state MBUF pilot programs have established data privacy rules to assure participants that specifics about their travel will be neither reported nor retained. One analysis has suggested the following provisions:

- Collect only the amount of data needed to record miles needed for billing;
- Retain data only as long as needed to accomplish charging, audits, and dispute resolution;

- Require a court order based on probable cause before granting law enforcement access to data;
- In criminal cases, preserve data and make it available to the defense until the exhaustion of remedies; and,
- Impose criminal liability for intentional data breaches and misuse.¹⁵

Oregon's MBUF privacy laws and regulations are considered by many as a model of good practice. Oregon was the first state to implement a pilot program on per-mile charging, and now has the nation's first statewide MBUF transition under way.

TEXT BOX 1: What GPS Does and Does Not Do

GPS uses a constellation of earth-orbiting satellites to generate very low-power signals. When a GPS receiver (in a building, in a vehicle, in a cell phone, etc.) receives GPS signals from three or more satellites, software in the receiver can use the signals to calculate the geographical location of the receiver, in real time. If the receiver is in motion (such as a person walking with a cell phone, or a GPS receiver in a vehicle), as long as the signals from the satellites are not blocked (e.g., by mountains or skyscrapers), the receiver can keep track of where it is while travel is under way.

The *GPS receiver* knows where it is, but that information is not shared with anyone else. Hence, the common perception that GPS reports vehicle location to a third party somewhere else is wrong. Only if a reporting/communications capability is paired with the GPS receiver is its location information shared with a third party.

For simple mileage reporting, as discussed in Part 3, only total miles driven in a specific time period would be reported. If the system must record several mileage totals (e.g., in-state vs. out-of-state, or limited-access highways vs. all other roads), then the reporting device must accumulate the miles in each category and report each of those totals. None of this requires reporting details of specific trips, and such reporting should be allowed only when explicitly agreed to by individuals.

¹⁵ Scribner, Marc. "Transforming Surface Transportation Reauthorization." Competitive Enterprise Institute. June 10, 2019.

PART 4

FEDERAL- OR STATE-LED TRANSITION?

How would the transition from per-gallon fuel taxes to per-mile charges (MBOFs) come about? There are two schools of thought on this question. Some argue that the federal government is the best moving force, as well as being the government with the most serious transportation revenue shortfall. Others maintain that, since there are many policy and technology questions still to be worked out, the states should continue to experiment with pilot programs, which will lead to successful implementations by early adopters that other states (and the federal government) could learn from.

The case for a *state-led* transition includes the following points:

- The states (and their local subdivisions) own and operate the roads and highways (including the Interstates).
- As highway owners, states have the primary stewardship responsibility for roads and highways, and it is incumbent on them to experiment and figure out the best ways forward for the needed transition from per-gallon to per-mile funding.
- State governments are more credible regarding transportation funding than the federal government, and are better at explaining the value proposition of properly managed roadways. This helps to explain Congress' unwillingness to increase

federal fuel tax rates (since 1993) compared with 40 of the 50 states having done so at least once since then.¹⁶

- States are still the “laboratories of democracy,” better suited to trying out new ideas state by state, rather than the federal government imposing a major change on all 50 states.
- States pioneered the per-gallon fuel tax as the main highway funding source, starting with Oregon in 1919, and within a decade all other states did likewise.

By contrast, others argue that there are significant advantages to the federal government taking the lead, as it did with the Interstates in 1956—or simply assume that this is the logical way forward. For example, a Congressional Research Service study on how per-mile charging would work stated (without citing evidence) that “Most studies of road use charges envision a single national system that would distribute revenue to the HTF [Highway Trust Fund] and directly to the states.”¹⁷ The CRS study also pointed out that “A road user charge that funded both highway and public transportation might arguably be seen more as a tax than a user fee,” and offered a detailed footnote on the legal differences.

A more recent study by the Information Technology & Innovation Foundation (ITIF) called explicitly for the federal government to lead the transition.¹⁸ It urged the federal government to enact a federal Road User Charge (RUC) to replace federal gasoline and diesel taxes, on which the states could piggyback (since the federal RUC would be collected in every state in any case). Arguments presented in favor of this approach included:

- Ensures nationwide inter-operability;
- Provides political cover for state officials if the federal government takes the lead on a controversial change;
- Provides large economies of scale for the needed equipment and costs of collection; and,
- Solves the revenue shortfall in the federal Highway Trust Fund.

¹⁶ Schaper, David. “It’s Been 25 Years Since the Federal Gas Tax Went Up.” *NPR Morning Edition*. Oct. 5, 2018.

¹⁷ Kirk, Robert S. and Marc Levinson. “Mileage-Based Road User Charges.” Congressional Research Service. Report 7-5700. June 22, 2016.

¹⁸ Atkinson, Robert D. “A Policymaker’s Guide to Road User Charges.” Information Technology & Innovation Foundation. April 22, 2019.

The ITIF proposal is coercive in several ways. First, it would mandate that all trucks be the first participants. Second, it would require that all original equipment manufacturers (producers of cars and trucks to be sold in the United States) build in an on-board unit (OBU), consisting of a GPS receiver and an onboard computer to record travel miles in all new vehicles. Third, it would require that states implement a state RUC only via the federal system.

The technical points made by the ITIF proposal are valid, but the politics of attempting to implement MFUFs in this way are daunting. First, it seeks to begin by requiring the staunchest opponent of MBUFs—the trucking industry—to be the first to convert.¹⁹ And the rationale is to force that specific industry to pay more than it is paying now in current highway user taxes. This is the same trucking industry that has successfully fought against expansions of Interstate tolling and has helped to defeat weight-distance taxes on trucks in a number of states.

Second, it seeks to invent the one best way to implement MBUFs based only on the limited knowledge obtained from pilot projects in less than one-quarter of the states. Even if there is eventually a case for a federal MBUF, it would be prudent to wait until at least several states had resolved the technical and political issues involved in implementing a sustainable MBUF replacement for fuel taxes.

Third, it would play into the hands of populist opponents by explicitly calling for more revenue (to beef up the HTF) rather than allowing natural growth as per-gallon revenue continues to shrink and an ever-greater share of vehicles pays for miles rather than gallons.

This is not the only proposal for a federal-government-led transition, and this debate will continue in coming years. One important marker will be whether the 2020 reauthorization of the federal highway and transit program does or does not include a *federal* MBUF pilot program, as some legislators are calling for.

For the purposes of this report, the ongoing assumption is that the case for a state-led transition is stronger, and will inform the discussion in the remaining sections.

¹⁹ Pitcher, Robert C. “A Framework for Evaluating Tax Proposals, Case Study: The Oregon Vehicle Mile Tax Pilot.” American Trucking Associations (no date, but likely 2008 or 2009).

PART 5

STARTING THE TRANSITION: LIMITED- ACCESS HIGHWAYS

As of mid-2019, only Oregon has begun to implement a statewide transition to per-mile charging. It was the first state to create a pilot program (which used the term RUC rather than MBUF), and has subsequently carried out several more pilots. In 2015, its legislature authorized an ongoing, voluntary program called OReGo, open to 5,000 people who could opt to pay a per-mile charge instead of the state fuel tax. All revenue was dedicated to highway and bridge purposes. In June 2019, Oregon's Gov. Kate Brown signed legislation that will remove the 5,000-person cap, opening the program to all owners of vehicles getting at least 20 mpg.²⁰ The charge is 1.7¢ per mile, to raise the same average revenue per vehicle as current state fuel taxes. The law calls for adjusting the per-mile charge to keep pace with any subsequent increases in fuel tax rates, for as long as state fuel taxes remain in effect. During the (probably lengthy) transition period, each vehicle will pay either the state fuel tax or the state RUC, not both.

While the OReGo program is well beyond what other states have done (only small pilot projects), it does not ensure that all vehicles will shift from per-gallon to per-mile, and

²⁰ Lamb, Eleanor. "Oregon Gov. Kate Brown Expands Road-Usage Charge Program." *Transport Topics*. June 25, 2019.

there is no way to predict the rate of adoption. Given the growing highway infrastructure needs and a revenue source that will decline considerably in coming years, a more aggressive transition approach would be desirable. Yet that seems like a tall order, given the lack of public understanding of the need for this transition.

A 2019 report from Reason Foundation suggests that a larger-scale transition might be possible if there were strong support for fixing a major problem that is *more visible* to the public than declining revenue projected from fuel taxes. It suggested that the best candidate is the need to replace the aging and inadequate Interstate highway system.²¹ This need was extensively documented in a 635-page report requested by Congress and carried out by an expert committee appointed by the Transportation Research Board (TRB) of the National Academy of Sciences.²² Based on a mid-range projection of annual growth in vehicle-miles of travel over the next 20 years, the TRB report estimated the cost of reconstructing and selective widening of the system as *\$57 billion per year*—a sum that is far beyond the current resources of the federal government.

The TRB report acknowledged the need to replace per-gallon taxes with per-mile charges, and discussed the merits of long-term financing of such projects with revenue bonds. The Reason report noted that the Interstates, with only 2.5% of all roadway lane-miles, handle 25% of all vehicle-miles of travel (VMT). Hence, if a state converted its Interstates to per-mile charging, on average, that would *shift 25% of all its VMT* from per-gallon to per-mile. That would be a major step toward the needed overall transition.

In many states, the need to replacing aging Interstate pavement and bridges (and adding lanes where clearly warranted by current and projected levels of traffic) should be an easier case to make to motorists, trucking companies, policymakers, and opinion leaders than the need to replace gas taxes with mileage charges. The business community and the road-building community, as well as the bond market, would likely support such a program.

The Reason report proposed that, in the 2020 surface transportation bill, Congress include a voluntary program open to all states, under which the provision of the 1956 Interstate highway law that forbids tolls on currently non-tolled Interstates would be waived for

²¹ Poole, Robert W., Jr. "The Case for Toll-Financed Interstate Replacement." Reason Foundation. March 2019.

²² Augustine, Norman (Chair). *Renewing the National Commitment to the Interstate Highway System*. National Academies of Sciences, Engineering, and Medicine. December 2018.

states that agree to a customer-friendly program of toll-financed Interstate modernization based on mileage-based user fees. Six provisions were proposed to that end:

1. Tolls must be collected electronically and charged *per mile* of travel.
2. Tolls on any modernized corridor would be charged *instead of* state fuel taxes.
3. Toll revenues would be used *only* for the capital and operating/maintenance costs of the state's Interstate highways, bridges, and tunnels.
4. Tolls on a corridor would begin only *after* the corridor was rebuilt and open to traffic.
5. Tolls would apply to all vehicles using the rebuilt Interstates.
6. For a given category of vehicle, tolls must be the same for in-state and out-of-state vehicles.

The above provisions are designed to win support from highway user groups, in particular motorists (e.g., AAA) and the trucking industry (e.g., AHUA, ATA).

As of mid-2019, toll-financed reconstruction of all or portions of a state's Interstate system is under serious consideration in a number of states:

- Alabama: replacement of a major bridge on I-10
- Connecticut: reconstruction and widening of major Interstates
- Illinois: reconstruction and bridge replacement of a major portion of I-80
- Indiana: reconstruction and widening of all long-distance Interstates
- Louisiana: two I-10 bridge replacements
- Rhode Island: a set of bridge refurbishments or replacements (under way)
- South Carolina: reconstruction and widening of I-95
- Wisconsin: reconstruction of all Interstates
- Wyoming: reconstruction of I-80.

Hence, if a voluntary program like that suggested above were offered by Congress, states with demonstrated interest might well request inclusion.

Customer-friendly provision #2 requires that as long as fuel taxes remain in effect in a state, motorists and truckers paying the new tolls on Interstates must receive state fuel tax

rebates for their tolled miles. This is consistent with per-mile charges being a *replacement* for fuel taxes, not an additional charge. It is easy to calculate the rebate amount via a subroutine in the electronic tolling software (see Text Box 2). Two existing toll roads—the Massachusetts Turnpike and the New York Thruway—have long offered fuel tax rebates to trucking companies. Until recently, that system required submitting paper receipts, but trucking industry service provider Bestpass now includes rebate calculations as part of its electronic toll billing service.²³ Bestpass also provides trucking companies with a universal electronic tolling transponder that works in all 48 contiguous states and adjacent Canadian provinces.

That 48-state transponder, produced by TransCore, is also available to individual motorists. Unlike pilot MBOF methods, electronic tolling via transponder is used nationwide today, and is generally well-accepted by motorists and truckers. Transponder tolling also permits variable toll rates to be charged, as on HOT lanes and express toll lanes now operational in more than 50 projects nationwide on congested urban freeway systems.

The same approach to electronic per-mile charging would be cost-effective to use on other limited-access highways, such as urban freeways that are not Interstates and other major non-Interstate highways. That would be a logical next step once the toll-financed Interstate replacement program was under way. This would be a better fit for these other limited-access highways, since—like the Interstates—they are significantly more costly to build and operate than ordinary open-access roadways. As noted previously, a higher per-mile charge for these costly highways is fair to those who seldom or never use them and should therefore not be charged for them. And since most farm-to-market roads are lower-cost open-access roads, lower per-mile charges for them is also fair to rural populations.

When a state subsequently replaces fuel taxes with per-mile charges for all its *other* roadways, rebates of the state MBOF will still be needed for those paying the (higher) electronic toll on the limited-access highways, since otherwise those customers would end up paying twice—the per-mile electronic toll plus the general MBOF.

²³ Poole, Robert W., Jr. “Truck-Friendly Tolls for 21st Century Interstates.” Reason Foundation. July 2015.

TEXT BOX 2: Automating Fuel Tax Rebates

This discussion applies to fuel tax rebates on limited-access highways that use all-electronic tolling. The tolling system knows the vehicle make and model year (otherwise it could not charge the owner). The software would access a table of highway miles per gallon, as defined by the Environmental Protection Agency. Using the miles driven on the toll road and the mpg figure permits the number of gallons used to be computed. That number multiplied by the state fuel tax rate provides the amount of the fuel tax rebate for that trip.

Trucks in interstate travel already report their miles driven in each state under the International Fuel Tax Agreement (IFTA) between the lower 48 states of the United States and the provinces of Canada. Its purpose is to allow fuel taxes paid by trucks to be properly attributed to the states (and provinces) traversed. At the end of each quarter, companies with an IFTA license report all miles traveled in those states and provinces and all gallons purchased. The system applies the relevant truck mpg figure to determine the fuel tax liability to each jurisdiction, and companies that underpaid receive bills and those that overpaid receive refunds. Trucking service provider Bestpass handles this process for subscribing trucking companies.

A similar process will be needed among states once adjacent states begin implementing MBUFs. Multi-state MBUF pilot projects are figuring out ways to do this; examples include a project involving California, Oregon, and Washington and another involving most of the states traversed by I-95, managed by the I-95 Corridor Coalition.

PART 6

TRANSITIONING ALL OTHER ROADWAYS

Assuming that a state has begun the transition from per-gallon to per-mile by launching toll-financed modernization of its Interstates and other limited-access highways, how might the remainder of its roadways and highways shift from fuel taxes to mileage-based user fees? How would the level of those fees be determined? How would accountability for roadway conditions and performance be improved?

With today's big-data technology, the total vehicle-miles of travel (VMT) in a state should be known shortly after the conclusion of each calendar or fiscal year. Moreover, the VMT data should be sub-dividable by (1) type of roadway, and (2) geographical area (e.g., by county). If the Interstates and other limited-access highways are paid for by per-mile electronic tolls, then the state's total VMT minus the VMT using tolled highways is what we can call "All Other VMT—AOV." Once all the limited-access highways are converted to per-mile electronic tolling (at a higher rate per mile than all other roads), then the remaining task is to designate the responsible stewards for all the other roadways and allocate those "other" miles (AOV) and the associated MBUF revenues to those stewards.

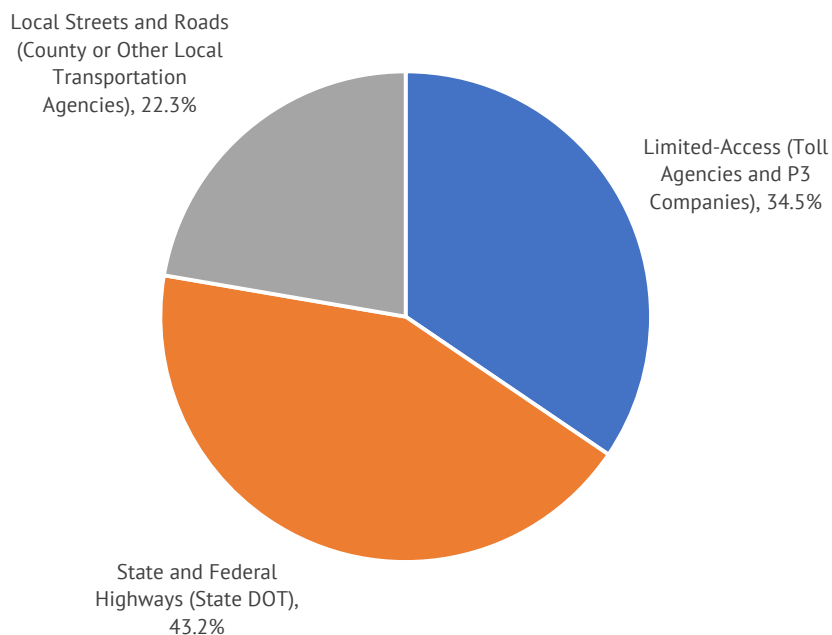
As a starting point, assume that the state DOT will be responsible for all the principal intercity highways that are *not* limited-access. This would include most traditional

highways with U.S. numbers, such as US 1, US 27, US 41, etc. which tend to go through cities and are open-access, as well as most state-numbered highways. In those states (such as California and Florida) where some major urban arterials are key mobility supplements to the freeway/expressway system and have state highway numbers, those arterials would likely also be part of the state DOT's responsibility. Separating the VMT for these state highways from the total AOV leaves the remainder of VMT to be allocated to the roadways in each county. (Each county's VMT responsibility would be total county VMT minus that taking place on limited-access highways and state highways in that county.) Table 1 shows FHWA figures on 2017 VMT by type of highway. Using the totals from that table, Figure 2 illustrates how overall VMT would be divided up.

TABLE 1: U.S. 2017 VMT BY TYPE OF ROADWAY

	VMT	Percent
<u>Limited-Access Highways</u>		
• Interstates, rural	252,550 billion	
• Interstates, urban	567,210	
• Other freeways, rural	36,526	
• Other freeways, urban	<u>251,152</u>	
Subtotal:	1,207,438	34.5%
<u>State Highways and Arterials</u>		
• Other principal arterials, rural	190,989	
• Other principal arterials, urban	482,738	
• Minor arterials, rural	144,878	
• Minor arterials, urban	410,196	
• Major collectors, rural	<u>160,445</u>	
Subtotal:	1,389,246	43.2%
<u>Local Roadways</u>		
• Minor collectors, rural	44,655	
• Local roads, rural	133,162	
• Major collectors, urban	206,209	
• Minor collectors, urban	17,141	
• Local roads, urban	<u>314,495</u>	
Subtotal	715,662	22.3%
Total VMT	3,212,346	100.0%

Source: FHWA Highway Statistics 2017, Table VM-202

FIGURE 2: MBOF REVENUE DIVISION AMONG ROADWAY PROVIDERS

The state DOT would annually estimate the capital and operating costs of the state highways for which it is responsible. Knowing the VMT on those highways in the recently completed year, it would then calculate the rate per mile needed for the coming year. Likewise, each county would follow the same process, using the VMT attributable to the roadways within the county that are neither limited-access nor state highways, and the estimated capital and operating costs of those roadways in the county. The total VMT charge to residents of each county would be the county rate plus the state rate, and people's highway bills would reflect those rates and the amounts entrusted to each jurisdiction (similar to the way in which property tax bills show which governmental units get which amounts of the household's property taxes). Users of roadways would know which entity is responsible for which roads, and therefore which party to hold accountable for the conditions and performance of which roads. Figure 3 shows a hypothetical roadway user fee statement. The charges would most likely be calculated on an annual basis, but many people might prefer to pay every month, as they do for other utilities.

FIGURE 3: SAMPLE ROADWAY USER FEE BILL



What about the limited-access highways? By assumption in this paper, the stewards of the limited-access roads would be either state or local toll agencies (many of which exist today) or investor-owned companies that win long-term public-private partnership (P3) concessions to finance, build, operate, and maintain the modernized Interstates, freeways, and other limited-access highways. These highway operators would charge per-mile electronic tolls, as discussed in Part 5, and their customers would pay only the tolls for the

miles driven on those highways. The lower state and county per-mile rates would apply to all other miles driven in the state.

All three levels of road operator—limited-access, state highways, and county roads—would be permitted to charge rates that reflect the large differences in the impact of vehicle weight on roadways. The lowest rate would be for personal vehicles, whose weight has essentially zero impact on pavement wear. Heavy trucks (technically Class 8 truck/trailer combinations) would pay the highest rate. And trucks of intermediate weight categories would pay rates per mile intermediate between that charged to personal vehicles and heavy trucks. This is long-established tolling policy on America’s toll roads.

While the assumption in the above discussion is that the state DOT would be the developer/operator of rural roads and that county agencies would carry out this role for local streets and roads, another alternative for those cases might be user cooperatives, analogous to those which exist in many parts of America for utilities such as electricity and telephones.

TEXT BOX 3: Highway User Co-ops: An Alternative Roadway Steward

In the author’s book, *Rethinking America’s Highways*, the discussion of transitioning to per-mile charging introduced the concept of highway user co-operatives.²⁴ That discussion is based on a paper presented at a 2014 transportation finance conference of the Transportation Research Board. Researchers Chris Swenson and David Ungemah acknowledged that the transition to per-mile charging would face some political challenges, in part due to public distrust of state DOTs, toll agencies, and city and county governments.²⁵ They reviewed the relatively large role played by user co-ops in agriculture, rural utilities, and banking (credit unions) and suggested that this model could be used to manage road systems on a nonprofit basis.

The direct-user roadway co-op would be formed to represent all the users of specific roadways in a jurisdiction (e.g., all the local roads in a particular county). As with other co-ops, those users (presumably, all licensed drivers and trucking companies) would elect some of their numbers as the governing board of the co-op, which

²⁴ Poole. *Rethinking America’s Highways*. 195–197.

²⁵ Ungemah, David and Chris Swenson. “Transportation Co-operatives,” presented at the TRB Transportation Finance Conference. Irvine, CA. July 11, 2014.

would have stewardship responsibilities, primarily operations and maintenance, but occasionally the need to finance improvements—rebuilding aging roads or adding new roads to serve new development. The stream of annual mileage fee revenue would be available as a revenue source to pay debt service on bonds issued for such projects, in addition to covering ongoing operating and maintenance costs. Routine roadway maintenance could be contracted out to either the state or county DOT or to a highway maintenance company.

The author's book also noted examples of transportation user co-ops in aviation, such as the original nonprofit provider of U.S. air traffic control (ARINC), the current aviation communications provider SITA, airline fueling co-ops at major airports (e.g., LAXFuel), and the current Canadian air traffic service provider, Nav Canada. While the concept has not been applied to roadways, it has many precedents in transportation and utilities.

CONCLUSION

This policy brief has sought to make a number of points about how a state could make an orderly transition from per-gallon fuel taxes to per-mile charges. The discussion acknowledges that MBOFs currently lack majority support among taxpayers, motorists, and the trucking industry. To address this challenge, the paper argues that MBOF advocates must do a number of things besides encouraging and drawing lessons from state MBOF pilot projects. Specifically, MBOF advocates should:

- Propose fixing all the major shortcomings of per-gallon fuel taxes, not simply projected revenue shortfalls;
- Ensure that at the time a transition program is launched, the starting point will be revenue-neutral, and that no roadway user will pay both a state fuel tax and a state MBOF;
- Restore the roadway funding mechanism to the original users-pay/users-benefit principle that underlay both the original state fuel taxes and the new federal fuel taxes that were created to pay for building the Interstate highways; and,
- Ensure that the MBOFs are simple, fair, customer-friendly, and analogous to the payment mechanisms for other utilities such as electricity and water supply.

Given the need to experiment with different ways to structure MBOF systems (mileage recording, mileage uploading, privacy protection, provider accountability, etc.), the transition should be led by the states as the laboratories of democracy. States are more

trusted on transportation than the federal government, and trust is essential for this transition.

Since the need for transitioning to per-mile charges is still poorly understood, it would be wiser to begin the transition based on a more understandable and more urgent need: reconstructing and modernizing the aging Interstate highways, state by state. About a dozen states are already considering toll finance for this purpose, and the new electronic toll collection systems could state their toll rates on a per-mile basis. Since the Interstates handle 25% of all U.S. vehicle-miles of travel, a state that converted its Interstates to per-mile electronic tolling would shift 25% of its VMT to per-mile rather than per-gallon funding. Adding in other limited-access highways also suitable for transponder tolling could bring the total to nearly 35% of all VMT—a major fraction of the eventual 100% conversion to per-mile charging.

Per-mile charging for limited-access highways would get people used to paying per mile, and rebates of state fuel taxes for those miles would set a precedent for no one having to pay both a per-mile charge and a per-gallon fuel tax for the same roadway miles as the transition to MBUFs proceeded to other roadways.

With accountability to customers established by a direct users-pay/users-benefit system for limited-access highways, the case for creating similar accountability for state and local roadways would be more understandable. At the end of the transition from per-gallon to per-mile, direct customer-provider relationships would exist as follows:

- Limited-access highways → Toll agencies and/or P3 concession companies
- State highways → State DOT
- Local roadways → County or other local transportation agencies

This would provide a transparent system by which all vehicle operators (individuals and companies) would know what they pay for each category of roads in their state, and whom to hold accountable for road performance. These would be very important benefits of the transition from per-gallon taxes to per-mile charges.

ABOUT THE AUTHOR

Robert W. Poole, Jr is director of transportation policy and the Searle Freedom Trust Transportation Fellow at Reason Foundation, a national public policy think tank based in Los Angeles.

His 1988 policy paper proposing supplemental privately financed toll lanes as congestion relievers directly inspired California's landmark private tollway law (AB 680), which authorized four pilot projects including the highly successful 91 Express Lanes in Orange County, the world's first express toll lanes. Over two dozen other states have enacted similar public-private partnership legislation. In 1993 Poole oversaw a study that introduced the term HOT (high-occupancy/toll) Lane, a concept which has become widely accepted since then.

Poole has advised the Federal Highway Administration, the Federal Transit Administration, the White House Office of Policy Development and National Economic Council, the Government Accountability Office (GAO), and the California, Florida, Georgia, Indiana, Texas, Utah, Virginia, and Washington State Departments of Transportation. He served 18 months on the Caltrans Privatization Advisory Steering Committee, helping oversee the implementation of AB 680. He was appointed by Gov. Pete Wilson as a member of California's Commission on Transportation Investment in 1995-96. He has also served on transportation advisory bodies to the California Air Resources Board and the Southern California Association of Governments, including SCAG's REACH task force on highway pricing measures.

Poole is a member of the board of the Public-Private Partnerships (P3) division of ARTBA and a member of the Transportation Research Board's Managed Lanes Committee. From 2003 to 2005, he was a member of the TRB's special committee on the long-term viability of the fuel tax for highway funding. In 2008 he was a member of the Study Committee on Private Participation in Toll Roads, appointed by Texas Gov. Rick Perry. In 2010 he was a member of the Washington State DOT's Expert Review Panel on the proposed Eastside Managed Lanes Corridor. Also in 2010, he served as a transportation policy advisor on the transition team of Florida Gov. Rick Scott.

Poole is the author of dozens of policy studies and journal articles on transportation issues. His book, *Rethinking America's Highways*, was published by the University of Chicago Press in 2018. Poole's popular writings have appeared in national newspapers, including *The New York Times* and *The Wall Street Journal*; he has also been a guest on such programs as "Crossfire," "Good Morning America," and "The O'Reilly Factor," as well as ABC, CBS and NBC News, NPR and PBS. He writes a monthly column on transportation policy issues for *Public Works Financing*, and produces the monthly e-newsletter, *Surface Transportation Innovations*. *The New York Times* has called him "the chief theorist for private solutions to gridlock."

Poole received his B.S. and M.S. in mechanical engineering at MIT and did graduate work in operations research at NYU.

APPENDIX: QUESTIONS NEEDING FURTHER RESEARCH

This policy brief is presented as a concept paper. It explains a broad vision of what the transition from per-gallon taxes to per-mile charges could bring about in terms of reforming the 20th century institutional structure of how roadways are paid for and managed. A concept paper is intended to start a conversation, and as such, it does not attempt to provide detailed answers to every possible question. Herewith are five such questions that will have to be addressed to pursue a transition such as that presented in this policy brief.

#1 How would the MBUF rate be controlled to prevent MBUFs from becoming a “cash cow” for roadway providers?

Other vital infrastructure operates either on a monopoly basis (most electricity, natural gas, and water supply) or a competitive basis (cell phones, television, internet access). For the latter group, competition serves to prevent excessive prices. For investor-owned monopoly utilities, there is external regulation via public utility commissions, which is admittedly

imperfect.²⁶ Government monopoly utility providers are presumed to be operating in the public interest, even though that is not always the case. And today's taxpayers generally oppose fuel tax increases and other forms of transportation revenue increases on the grounds that state and local transportation agencies do not spend their money wisely.

Hence, if roadway funding is to be depoliticized via the transition to per-mile charging, there must be some form of external oversight of how well the state DOT and county transportation agencies are managing their roadways. Many states have nonpartisan transportation commissions that oversee the operations and planning of the state DOT. In this proposed roadway utility model, the role and responsibilities of these bodies would need to be strengthened. The legislature would still be able to set general transportation policy, but without direct control of roadway budgets, legislators would no longer be micromanaging the DOT or substituting political decisions about projects for engineering/economic decisions made by the DOT and vetted by the transportation commission. A similar process would need to be implemented at the county level.

#2 If MBUF revenues are used solely for the capital and operating costs of roadways, how would other modes of transportation be funded?

The concept of roadway utilities, supported by dedicated MBUF revenues, would reverse the practice of nearly 50 years in which fuel taxes were changed from a pure users-pay/users-benefit concept to become an open-ended funding source for all modes of surface transportation. If the MBUF becomes a pure roadway user fee, how would transit and other modes (bikeways, sidewalks, recreational trails, etc.) be paid for? The principle of subsidiarity holds that each level of government should be responsible for services that serve the relevant constituents: local services paid for by local governments, state services by state governments, and national functions by the national government. Under this model, local/regional governments would be responsible for transit and other forms of local mobility.

While some may fear that without federal funding derived from federal motor fuels taxes, transit systems would be devastated, the experience of California suggests a more positive outcome. Over the past 40 years, every urban county in that state has enacted one or more dedicated transportation sales taxes. The counties with such taxes in place are called,

²⁶ Erickson, Ralph and R. Richard Geddes. "Public Policies within a Fully Priced Transportation Network: Lessons from Utility Regulation." Cornell Program in Infrastructure Policy working paper. September 2013.

appropriately, “self-help counties.” In the early years (the 1980s), the ballot measures creating these sales taxes needed only a simple majority vote. A later court decision changed that to a two-thirds majority, but despite that change, transportation sales tax measures continued to be enacted. Many of these measures fund an array of projects, but with transit usually garnering the majority of the revenue. Los Angeles County provides an example of how political coalitions have been assembled over the years to craft and gain approval for an array of transportation sales taxes.²⁷

In his study of L.A.’s Measure M, UCLA’s Michael Manville notes that this dedicated transportation sales tax model has spread nationwide over the past two decades. And to the surprise of many observers, close to two-thirds of these transportation ballot measures receive voter approval each year. If the new MBUF system fully supported state and local roadways, local transportation sales taxes could devote all their revenues to transit and other non-highway modes.

#3 What would happen to annual vehicle registration fees and local property taxes currently being used for streets and roads?

This question appears to have received little attention from the MBUF research community. The answer would likely vary from state to state, depending on how those revenues are used today. On registration fees, if most or all of the revenues from those fees now go into the highway budget, those fees could be reduced or eliminated. On the other hand, if they pay for non-DOT functions such as the state highway patrol, registration fee revenues to support those functions should be continued.

Local property taxes have historically been an important source of funding for local public works, including streets and roads. But since a per-mile charge would apply to all miles driven, the simplest approach would be to use the county’s per-mile charge for all its streets and roads, reserving property taxes for all the other local functions they have long supported. This would enable either a reduction in property taxes or freeing up some of that tax revenue for other needed public works.

²⁷ Manville, Michael. “Measure M: Lessons from a Successful Transportation Ballot Campaign.” Eno Center for Transportation. July 2019.

#4 How would drivers from Canada and Mexico pay for driving on U.S. roads during and after the transition to per-mile charging?

This question has also received little attention. The good news is that when individuals or truck operators drive vehicles into the United States, they do so via official ports of entry. As part of the clearance process, their odometer reading could be recorded and compared with the odometer reading when they subsequently depart the country, with the fee levied on departure. Alternatively, a per-day fee could be charged, with a deposit required upon entry and the balance due on exit.

#5 If the states take the lead on transitioning to per-mile charges, what should the federal role be?

One of the most important roles for the federal government, in a state-led transition, is to develop performance-based national standards to ensure interoperability among the state MBUF programs. Interoperability requires more than just compatible systems for reporting miles driven. It also requires the ability to enforce payment by out-of-state roadway users to the state whose roadways they are using.

The federal government's most logical role is to support research and development of a national framework for state MBUF programs, including technology standards and account systems. Many states have significant travel on their roadways from out-of-state vehicles. A national framework would make it easier to ensure that out-of-state users pay their fair share for using the roadways of other states. In mid-2019, the Senate Environment & Public Works Committee approved a five-year surface transportation reauthorization bill that included \$50 million over that period for research and development on nationwide per-mile charging.

Congress attempted to provide for electronic tolling interoperability simply by setting a 2016 deadline for this to be done, but that date passed without the goal being achieved. First, no agreement was reached among toll agencies on which tolling protocol to adopt (which would produce winners and losers among the agencies, unless all had to replace their existing tolling equipment). Second, the harder problem of negotiating reciprocal enforcement agreements among states has been solved only among some groups of states. The first problem is likely to be resolved by technology. Instead of replacing equipment at many thousands of toll gantries across the country, a wiser approach would be to adopt universal transponders, compatible with all the existing tolling protocols, and/or to allow

innovative companies such as PayTollo to enable smartphones to serve as universal transponders. Once the second problem—reciprocal enforcement—is resolved for toll agencies, that will enable much the same provisions to be used to enforce MBUF payments by out-of-state highway users.

As states become largely or entirely self-sufficient in funding and managing their highways, Congress will likely wish to continue collecting funds from roadway users and using the proceeds to make grants for transportation. So as gasoline and diesel use declines in coming decades, and states succeed in implementing MBUFs to replace their fuel taxes, Congress may decide to add a federal tax or fee on top of each state's MBUF. Those who have championed MBUFs as a true users-pay/users-benefit method of paying for highways (only) may be offended if Congress calls its federal levy a user fee rather than what it would actually be: a transportation tax.

