Review of State Transportation Funding Initiatives

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in cooperation with
Kentucky Transportation Cabinet
Commonwealth of Kentucky

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Review of State Transportation Funding Initiatives

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Chapter 1 Introduction

Despite significant cutbacks to the funding allocated to state departments of transportation (DOTs), demand for accessible and reliable transportation has increased even as existing transportation infrastructure has continued to age. Falling gasoline tax revenues resulting from increasing fuel efficiency and technological advancements have prevented state DOTs, including the Kentucky Transportation Cabinet (KYTC), from funding and financing much-needed transportation projects. Meanwhile, the Federal Highway Trust Fund, which provides funding to states and is tied to the federal gas tax, routinely receives cash infusions from the Federal General Fund to remain solvent — the federal gas tax has not been increased since 1993. Needing to invest in urgent transportation projects while facing stagnant revenue streams has led many state DOTs and researchers to begin exploring alternative funding sources as well as strategies to modify current revenue sources (e.g., gasoline tax, registration and licensing fees) to improve their sustainability. Ensuring the public understands that adequate funding is required to meet our infrastructure needs is critical as well — especially when transitioning to alternative funding mechanisms.

An often-cited alternative funding strategy is road usage charges (RUCs) (also termed mileage-based user fees)[1]. With RUCs drivers pay a set amount for each mile they drive on public roadways rather than a consumption-based gasoline tax. A variety of methods and technologies can assist in the calculation of mileage fees, ranging from GPS-based devices installed in vehicles to manual odometer readings. Potential obstacles to implementing road usage charges are privacy concerns and administration costs (see Chapter 2). Kentucky has begun to address alternative funding, with the House of Representatives proposing House Concurrent Resolution 18[2], which establishes a Mileage-Based Transportation Funding Task Force. Given the burgeoning interest in RUCs among policymaker and legislators, KYTC asked Kentucky Transportation Center (KTC) researchers to perform a detailed study of alternative funding mechanisms, their application, and their potential to generate a sustainable level of revenue over the long term. Specifically, the Cabinet directed KTC to:

- Examine state legislation and proposals related to transportation funding, with a focus on RUCs and interim funding solutions.
- Provide information and marketing materials to KYTC that can be used to inform legislators about potential funding options.

Chapter 2 discusses the funding issue within Kentucky in the context of historical funding sources. Chapter 3 presents background on road usage charges, their potential benefits, challenges that must be addressed before implementation, and the criteria state DOTs must consider prior to replacing or supplementing gas taxes with a RUC. Chapter 4 reviews several recent pilot studies in which state DOTs experimented with mileage fees as well as proposed legislation pertaining to road usage charges. Chapter 5 discusses interim funding options in several states, while Chapter 6 offers concluding remarks and directions for continued research in this area.

[1] States have increasingly embraced the term, *road usage charge* — while dispensing with *mileage-based user fee or vehicle miles traveled fee*. Although there is no clear indication of what prompted the discursive, one possibility is that road usage charge more succinctly communicates the benefit principle of taxation upon which a road charge is based, namely idea that drivers should pay for the maintenance and upgrade of the transportation system in direct proportion to their use of it — whereas the other framings foreground the idea of fees and taxes, which could diminish public acceptance. Also, *usage* is a depersonalized framing — it does not foreground the user-as-taxpayer, which in the original formulation could lead some individuals to think they are being unfairly penalized (i.e., the fees are targeting users rather than being what are used to build, repair, and maintain roadways, which require attention because they have been used). Following the latest conventions, this chapter adopts the *road usage charge* terminology exclusively.

[2] http://www.lrc.ky.gov/record/18RS/HCR18.htm

Chapter 2 Kentucky Background

2.1 Problem Statement

Monies used to plan, design, construct, operate, and maintain Kentucky's roadways are allocated primarily from the state's Road Fund. Motor vehicle usage fees and the motor fuels tax (gasoline and diesel) are the primary sources of revenue for the Road Fund. Revenues from fuel taxes vary based on multiple factors, including economic conditions, vehicle fuel efficiency, number of alternative fuel vehicles (e.g., electric, diesel) on the road, and oscillations in fuel prices. Volatility in gasoline tax revenues presents significant challenges to KYTC and state DOTs as they attempt to engage in long-range planning. State DOTs are obligated to adopt conservative revenue assumptions to avoid overcommitting to projects they may lack the necessary funding to undertake. Recognizing the capriciousness and variability of fuel tax revenues, many states, as noted in the introduction, have begun to explore alternative sources of revenue to ensure they have the necessary funding to build, operate, and maintain infrastructure. This chapter provides historical context for Kentucky's approach to taxing fuels and looks at recent trends in Road Fund revenue, which depends heavily on gasoline tax receipts.

2.2 History of Motor Fuels Tax in Kentucky

Kentucky was the fifth state to institute a tax on motor fuels and has relied on some form of fuel tax for almost 100 years to finance its transportation needs. Table 1 briefly summarizes the legislative history of the motor fuels tax in Kentucky. The first fuel tax was introduced in 1920 and set at $0.01 per gallon. By 1925, the tax was increased to $0.05 per gallon. And in 1945 legislation passed restricting the use of tax revenue to the state's public highways. The tax rate was nudged up to $0.07 in 1948 while a special fuels (diesel) tax was added in 1952.

Following the enactment of HB 973 in 1980, the state modified how it calculated its motor fuels tax, setting the minimum excise tax rate at 9 percent of the per-gallon average wholesale price (AWP) of gasoline. The bill also established an arrangement whereby the per-gallon tax rate could be adjusted based on changes in the AWP (LRC, 2016). Initially, the AWP floor was set at $1.00 per gallon. Further changes were made to the structure of Kentucky's fuel tax in 1986 with the passage of HB 126, which introduced a supplemental highway user motor fuel tax. Originally based on a complex formula, a ceiling for this tax was initially established at $0.05 per gallon on gasoline and $0.02 per gallon for special fuels. Rates were later fixed at $0.05 per gallon and $0.03 per gallon for gasoline and diesel, respectively (LRC, 2016). In 1995, a petroleum storage tank environmental assessment fee was enacted; it is currently set at $0.014 per gallon. Accordingly, Kentucky's current motor fuels tax has three components — the motor fuels excise tax, supplemental highway user motor fuel tax, and the storage tank assessment fee. The latter two taxes are set at a fixed rate. While indexing a part of the gasoline tax has helped stabilize income, revenues remain volatile and somewhat unpredictable due to variations in fuel prices and the amount of fuel purchased by consumers.

Recent legislation passed in Kentucky has attempted to dampen the effects of variability in gasoline tax revenues. With the number of vehicle miles flattening out, one method for effectively increasing revenue is raising the minimum value of the AWP through legislation, which occurred in 2005, 2006, and 2009. In 2015, HB 299 revised how the motor fuels tax rate is set. The bill increased the minimum AWP (i.e., price floor) from $1.786 to $2.177, implemented an annual adjustment for the AWP based on the previous four quarters, and limited annual changes in the AWP to 10 percent (LRC, 2016). This legislation has succeeded somewhat in reducing the impacts of fuel price volatility. However, it also limits potential revenue increases when gasoline prices increase significantly without artificially raising the index. On average, over 50 percent of the Cabinet's funding comes from the Road Fund. In FY 2017, 63 percent of the Road Fund's revenues were sourced from the motor fuels tax while 36 percent came from the motor vehicle usage tax.

Table 1 A Brief History of the Gasoline Tax in Kentucky

Kentucky Legislative History:	
o 1920	Established Fuel Tax at $.01/gal
o 1926	Increased to $.05/gal
o 1945	Restricted use of funds to public highways
o 1948	**HB195** Increased to $.07/gal
o 1952	**HB271** Added special Fuels (Diesel)
o 1972	**HB336** Increased to $.09/gal
o 1980	**HB973**
	• Introduced Variable Rate - 9% of AWP
	• AWP determined each quarter
	• Min AWP set at $1.00
	• AWP can only increase 10% annually
o 1982	**HB478**
	• Min raised to $1.11 ($.10/gal)
	• Min AWP can only change thru legislation
o 1986	**HB126**
	• Established User Tax at $.05/gal for motor fuels and $.02/gal for diesel fuel
o 2005	**HB267** Raised Min AWP to $1.22 ($0.11/gal)
o 2006	**HB380** Raised Min AWP to $1.342 ($0.121/gal)
o 2009	**HB374** Raised Min AWP to $1.786 ($0.161/gal)
o 2015	**HB299 Attempt to stabilize the Road Fund**
	• Raised Min AWP to $2.177 ($0.196/gal)
	• AWP adjusted annually using previous year average
	• Max decrease/increase in AWP set at 10% of previous year average

The effects of declining fuel tax revenues at the state level have been compounded by a stagnant federal gasoline tax, which has remained unchanged since 1993 at 18.4 cents per gallon. As a point of reference, a gallon of milk cost $1.93 in 1993 — today the same gallon costs $3.22. As such, planners at KYTC and state DOTs around the United States are forced to assume no significant increase in revenues as they plan for the future, despite mounting highway needs. Unquestionably, state DOTs must find new sources of revenue if they are to adequately preserve their transportation systems.

2.3 Road Fund Revenues

Kentucky's Budget in Brief reviews the Road Fund's sources of revenue. Table 2 lists revenues from sales and gross receipts taxes and the amounts collected in FY 2017, which amounted to just under $1.26 billion.

Table 2 Kentucky Road Fund Revenues from Sales and Gross Receipts Taxes 2017 by Source

	2017
Sales and Gross Receipts Taxes	
Motor Fuels Normal and Normal Use	$759,572,447
Motor Vehicle Usage	$454,442,501
Motor Vehicle Rental Usage	$45,284,256
Truck Trip Permits	$942,520
Sales and Use	$107,134
Total	***$1,260,348,858***

Source: Kentucky Budget in Brief, 2018-20 Proposed

Road Fund revenue varies based on the AWP of gasoline, amount of fuel purchased, usage taxes, and other non-tax receipts. Figure 1 summarizes annual Road Fund revenues from 2008 to 2017, in both nominal and inflation-adjusted 2008 dollars. Revenues increased steadily from $1,207 million in 2010 to a high of $1,527 million in 2015. Since 2015, they have leveled off. Critically, even when Road Fund revenues increased over this period they failed to keep pace with inflation, which reduces the purchasing power of each dollar of revenue.

Figure 1 Kentucky Road Fund Revenue from 2008 to 2017

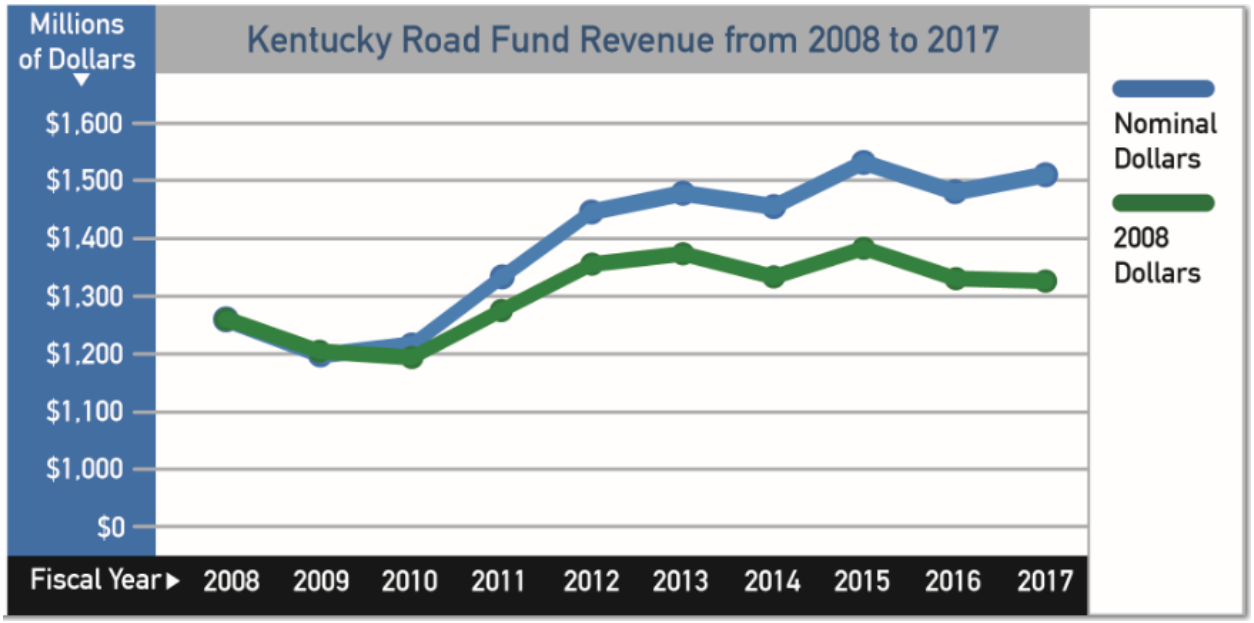


Figure 2 portrays trends in motor fuels tax receipts from FY 2008 to FY 2017. From 2009 through 2014, tax receipts climbed steadily, but this growth was followed by a precipitous decline beginning in 2014. Had no corrective legislative actions been taken (i.e., HB 299), the drop in annual motor fuels tax receipts could have approached $300 million per year — reducing total revenues to $600 million. Losses of this magnitude would have severely crippled KYTC's ability to effectively manage and maintain the state's roads.

Figure 2 Kentucky Motor Fuel Tax Receipts FY 2008 – FY 2017

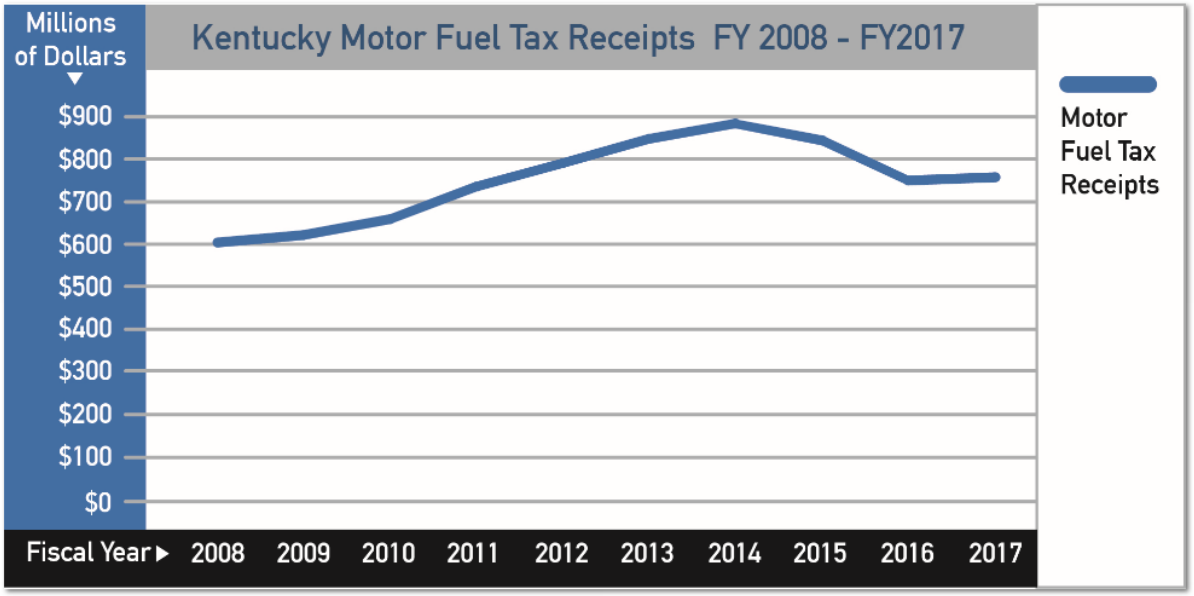
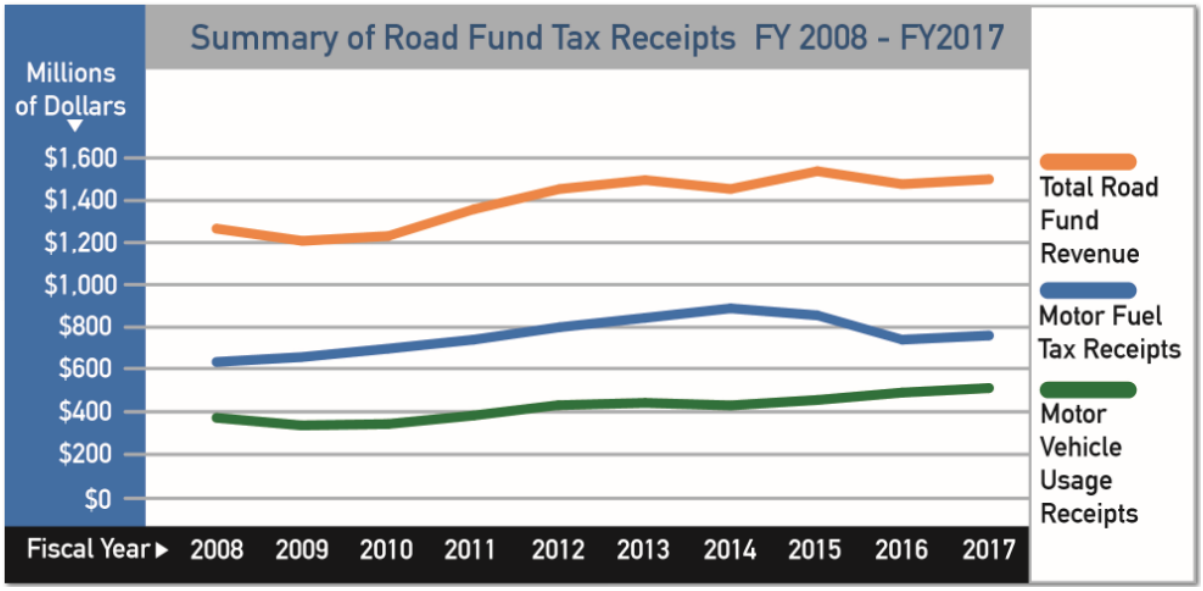


Figure 3 presents the total Road Fund revenue, motor fuels tax receipts, and motor vehicle usage tax receipts from FY 2008 to FY 2017. During this period, the motor fuels tax and motor vehicle usage tax accounted for 84 percent of the Road Fund's revenues, with the remaining income derived from various usage fees and non-tax receipts. The motor vehicle usage tax is a 6 percent tax levied when drivers purchase a new vehicle or register their vehicle for the first time in Kentucky. While the aggregate Road Fund revenue comes from many different sources, it is imperative to bear in mind that the motor fuels tax is the major funding source, generally accounting for upwards of half of all revenues. Thus, variability in motor fuels tax receipts translates fluctuating Road Fund revenues.

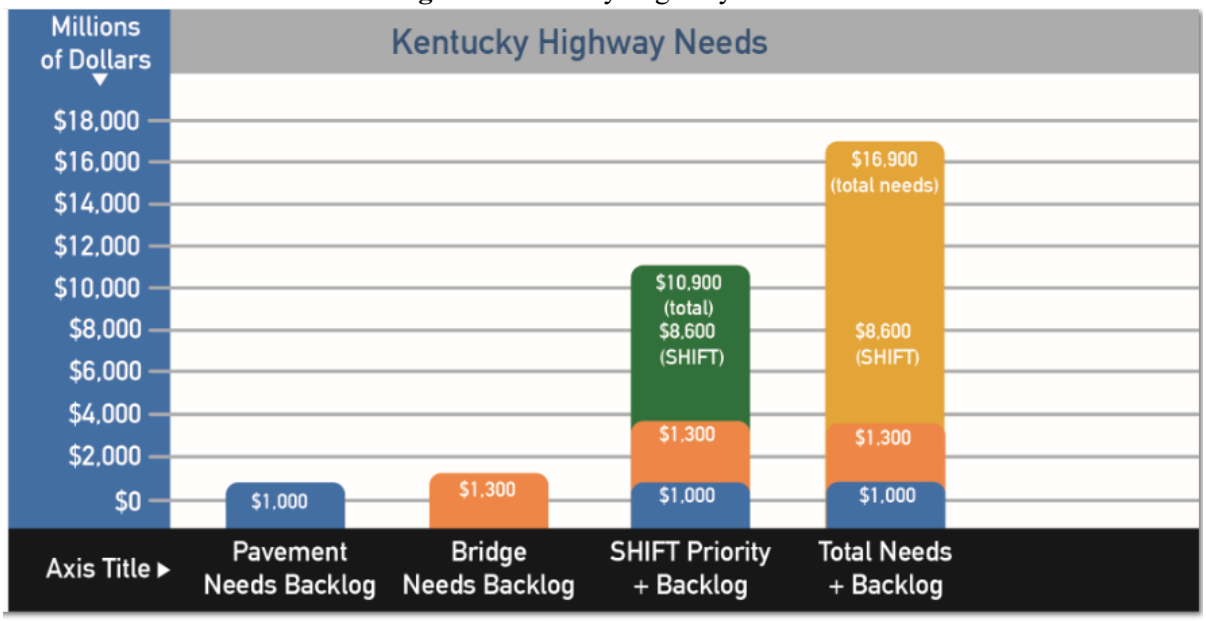
Figure 3 Summary of Road Fund Receipts FY 2008 – FY 2017



2.4 Kentucky Highway Needs and Projected Revenues

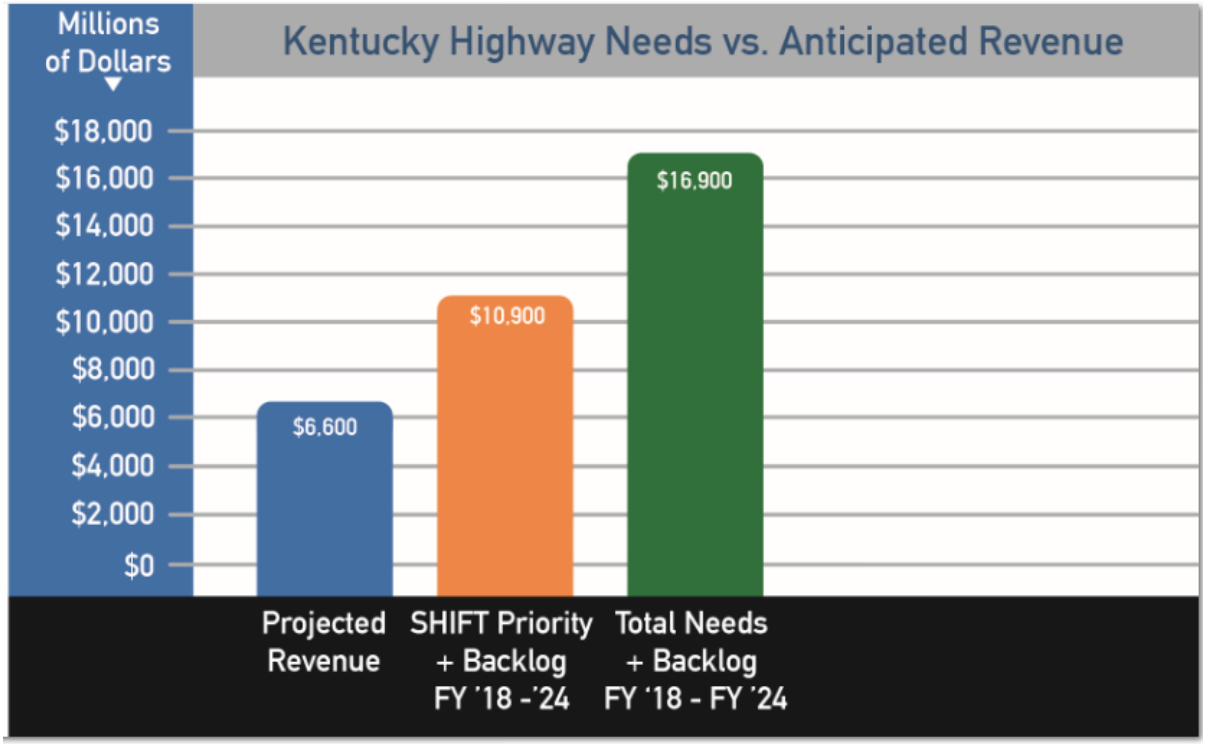
Kentucky has the eighth largest state road system and the seventh largest inventory of state-maintained bridges in the United States, with the Cabinet being responsible for over 27,500 miles of roadway and more than 14,000 bridges. To maintain and improve this system demands that KYTC have a reliable source of sufficient revenue. When preparing the *FY 2018 – FY 2024 Recommended Highway Plan*, KYTC determined current and future needs to help ensure that available funding is used to address critical highway needs and extend the useful life of existing highway infrastructure. Currently, there is a backlog of more than 1,000 deficient bridges and 3,700 miles of roadway with deteriorated pavement that are in need of repair or replacement. Addressing these issues will be costly. Correcting bridge deficiencies will cost $1.3 billion while addressing pavement issues is estimated to cost $1 billion. Thus, KYTC requires approximately $2.3 billion to bring existing bridges and pavements up to an acceptable condition. These backlogs do not account for additional transportation needs identified by the Cabinet's *Strategic Investment Formula for Tomorrow* (*SHIFT*). Tackling all outstanding project needs will cost the state $14.8 billion. However, leveraging the *SHIFT* process, KYTC narrowed down the list of needed projects to encompass those with the highest priority. Completing these projects will cost an estimated $8.6 billion. Figure 4 summarizes the costs associated with addressing highway needs.

Figure 4 Kentucky Highway Needs



Attending to all listed highway needs would be a daunting task for KYTC, even with the availability of a reliable and sufficient revenue source. Unfortunately, projected total revenue from FY 2018 to FY 2024 is $6.6 billion. Figure 5 compares the anticipated revenue to identified highway needs.

Figure 5 Kentucky Highway Needs vs. Anticipated Revenue



There is a projected revenue shortfall of $4.3 billion for addressing just the current bridge and pavement backlogs and priority projects. Including all highway needs — as determined through *SHIFT* — widens the funding shortfall over this same period to $10.3 billion. These estimates do not account for the escalating costs of continued deterioration on the existing highway system when funding is not available to perform timely, preventative maintenance.

Given anticipated revenue shortfalls, it is evident that Kentucky needs an additional or alternative source of revenue to maintain and improve the state's highway infrastructure. Under a best-case scenario, the motor fuels tax — alone — could only be expected to maintain current revenue levels. However, a significant amount of additional revenue is needed. While the General Assembly has the power to increase the motor fuels tax, and therefore revenue, historically this has been a highly unpopular maneuver, and at best only provides nominal and temporary relief.

Chapter 3 Alternative Funding Sources for Transportation

3.1 Alternative Funding Criteria

Currently, the federal government and state governments rely on gasoline taxes to fund transportation infrastructure projects and maintenance. Because gasoline taxes are tied to consumption, motorists pay on a per-gallon basis and not in direct proportion to their use of roadway systems. Although this method of revenue collection was at one point sufficient to fund the country's transportation needs, federal gasoline tax receipts have been too meager to fund congressionally authorized transportation programs since FY 2008 (Kirk and Levinson, 2016). At the state level, fuel taxes have become increasingly unable to fund transportation needs. To address this problem, 26 states have passed gasoline tax increases since 2013 (NCSL, 2017). Nudging fuel taxes upward by a few cents may offer some immediate relief, but this will not offset the anticipated long-term decline in gasoline tax revenues. With more fuel efficient cars on the road than ever before, along with a steady uptick in alternative fuel vehicles, a decline in personal vehicle ownership, the growing popularity of public transit, and the insidious effects of inflation gradually undermining the dollar's purchasing power, it is increasingly unlikely that fuel taxes alone will be able to provide a sustainable source of revenue to fund the country's transportation needs (Sorensen et al., 2011).

Many states have considered alternative revenue sources to replace or supplement traditional sources of transportation funding, however, it is often challenging — frequently insurmountably so — to design a revenue mechanism that meets infrastructure needs while being acceptable to citizens and legislators. Regardless of the methods used to analyze alternative funding strategies, individual states have unique characteristics and funding needs, which are likely to be overriding factors as they contemplate different options. When deciding on potential funding options, states must also account for privacy concerns as well as administrative costs and technology needs; the latter can siphon off revenue and leave governments and agencies in a financially precarious position.

Several researchers have detailed considerations for revenue sources such as RUCs. Penner et al. (2006, p. 4) described an optimal alternative revenue structure for transportation as follows: "Ultimately, in the fee system that would provide the greatest public benefit, charges would depend on mileage, road and vehicle characteristics, and traffic conditions, and they would be set to reflect the cost of each trip to the highway agency and the public." Based on an examination of Oregon's Road User Fee Task Force, Whitty (2007, p. 2) identified criteria that any new revenue source should meet, including:

- Users pay
- Local government control of local revenue sources
- Sufficient revenues to replace the current revenue structure
- Revenue sufficiency
- Transparent to the public
- Nongovernmental burden
- Enforceability
- Support entire highway and road system
- Public acceptability

Once a state DOT identifies options that meet some of these criteria as well as its particular needs, they should pursue additional evaluation of funding alternatives. When analyzing funding alternatives, it is critical for agencies to address the following questions and issues (Rufolo et al. 2001):

- Should the gasoline/diesel taxes be continued or eliminated?
- Can the alternative funding strategy tax mileage that out-of-state vehicles drive?
- Should the alternative funding strategy account for social costs (e.g., pollution)?
- The timeframe over which the proposed alternative funding strategy will be implemented

- The appropriateness of instituting congestion/dynamic pricing
- The level of administrative costs that can be tolerated with the alternative funding strategy
- What technologies are needed, and can they be deployed in a manner the safeguards the privacy of motorists?

Analyzing various alternative funding options (e.g., increasing gasoline taxes or sales taxes, introducing RUCs), Pulipati and Mattingly concluded that: "Due to their stronger performance with respect to ease of implementation, equity and public acceptance, the authors recommend increasing the fuel tax steadily and tolling all new freeway capacity; while gradually moving towards congestion based tolls on all toll roads as the set of future funding options requiring further investigation" (2014, p.2). Over the past five years, several states have conducted pilot studies and surveyed public opinion to determine whether implementing RUCs is feasible and could provide a sufficient revenue to continue funding transportation projects in the coming years as receipts from consumption-based gasoline tax continue falling because of declining vehicle ownership and the proliferation of more fuel efficient and electric vehicles.

3.2 Alternative Funding and the Promises and Perils of Road Usage Charges

Acknowledging that revenue collected from gasoline taxes will no longer suffice, many states have begun to explore alternative funding options. Some methods used by states to collect revenue include tolls, weight-and-distance taxes, registration fees, and other miscellaneous fees. One option to bolster transportation funding that has been investigated aggressively in recent years is RUCs.

The basic premise underlying RUCs is intuitive and straightforward. Drivers pay a fixed rate for each mile they drive. However, the picture quickly becomes more complex because vehicles impact roadways differently based on factors such as size, weight, and number of axles. For example, commercial vehicles account for less than 10 percent of all vehicle miles traveled in the United Sates, but they are responsible for more costs than passenger vehicles — which are responsible for the other 90 percent of vehicle miles traveled — because they are the source of the most roadway damage (Beider, 2011). More precisely, less that 4 percent of the nation's vehicle fleet consists of heavy commercial vehicles, but they account for 25 percent of all highway costs users impose on others, including almost all costs attributable to pavement damage (Beider, 2011). While charging vehicles a flat fee for each mile traveled is thus an ostensibly simple procedure, in order to be consistent with the benefit principle of taxation upon which RUCs are founded, per-mile rates would need to be varied in direct proportion to the amount of stress or damage a vehicle class inflicts upon roadways (Sorensen et al., 2011). In addition to modifying per-mile rates based on vehicle characteristics, RUCs also open up the possibility of introducing congestion pricing — varying mileage fees based on route type, time of travel, or level of vehicle emissions. Arguably, a thoughtful RUC scheme would produce more equitable outcomes by charging drivers based on road usage rather than their fuel consumption (GAO, 2012). But there are challenges to overcome in establishing an operational RUC system.

Aside from dilemmas associated with setting mileage fees, another quandary RUC system administrators must confront is deciding on an appropriate mechanism to collect mileage data. As the case studies presented in Chapter 3 illustrate, a number of options are available, but each come with benefits and drawbacks. The most common methods of gathering mileage data are 1) periodic odometer readings, 2) devices installed in vehicles' OBD-II ports which record the number of miles driven (both GPS and non-GPS devices have been used in pilot studies), and 3) GPS-enabled smartphones, which also track the number of miles driven. States have also experimented with letting drivers purchase blocks of mileage to cover their anticipated driving, while California during its pilot study gave drivers the option of buying time permits, which let them drive an unlimited number of miles over a specified period of time. Nevada and Oregon have also investigated pay-at-the-pump technologies, which would let drivers pay for mileage when they purchase fuel, while California is poised to explore these further in the coming years. However, pay-at-the-pump technologies have been relatively uncommon. Pay-at-the-pump technologies are appealing since they would potentially alleviate the burdens drivers would have to negotiate in collecting mileage

data via manual readings and remitting payment to state DOTs after receiving an invoice for mileage traveled. But as Kirk and Levinson (2016) observed, while pay-at-the-pump technologies are feasible, they are more administratively complex than the system currently in use, which entail collecting fuel taxes from fuel dealers. While automated means of collecting mileage data (e.g., GPS-enabled devices) are convenient, many people have expressed concerns over privacy and are disinclined to let governments track their movements (e.g., Duncan et al. 2014). As the case studies in Chapter 3 demonstrate, there are viable methods of implementing privacy safeguards to conceal trip patterns and ensure that trip information does not get into the hands of state governments. Similarly, while opposition to RUCs based on privacy concerns is high among the general public, among the volunteers who have participated in pilot studies, worries over privacy have been relatively minor. A number of technical challenges could hamper RUCs, most notably ensuring that mileage data accurately reflect the number of miles driven. While the devices used in pilot studies have generally proven reliable, if a state pins its future transportation funding to mileage fees, it is imperative to ensure onboard devices or odometer readings accurately capture miles driven. There are still hurdles to contend with in handling miles driven out of state, on private roads, or off road.

Beyond the technical challenges of collecting and processing data, the various costs of managing a RUC system and collecting revenue are immense compared to current methods of tax collection. In most states, less than 1 percent of revenue from fuel taxes goes toward administration expenses — and in many cases administrative costs are just approximately 0.5 percent of total revenue. Administration costs for pilot RUC studies have been on the order of 5 to 10 percent of revenue, although most authors of the case studies in Chapter 3 suggest this percentage would diminish once a system achieves economies of scale. But according to Kirk and Levinson (2016) in their study of the federal gasoline tax, RUC administration and enforcement fees likely would range between 5 and 13 percent of all revenue collected; in comparison, between 7 and 12 percent of toll revenues go toward administration costs. Another factor to consider is credit card and banking fees. A 2007 study focused on the Washington State DOT found that 3.45 percent of adjusted gross revenue was lost on revenues collected at toll facilities due to credit card and banking fees. A 2015 study of the New Hampshire turnpike system revealed that 2.7 percent of its electronic E-ZPass revenues went to bank and credit card fees[3]. As Kirk and Levinson pointed out, at the federal level the cost of any RUC system which lets drivers use credit and bank cards to pay fees electronically would be more than double of what is currently paid to collect the federal gasoline tax — before factoring administration and enforcement. Given that their assumptions are based on revenue collection efforts at the state level, arguably an RUC system introduced by a state would incur similar banking and credit fees. On the administrative side of the equation, a final issue Kirk and Levinson scrutinize is so-called leakage rates. In the context of tolling, leakage rate refers to the proportion of transactions for which payment is never received. Generally, it is safe to assume a leakage rate of 5 to 10 percent for tolling facilities. Arguably, if drivers are expected to pay monthly or quarterly invoices for their mileage, there will be a significant leakage rate, with drivers either being delinquent on payments or refusing payment outright. There have been no studies on what level of leakage rate could be expected for RUC systems. Because pilot studies have mostly relied on simulation (i.e., participants were not required to pay their own money) and self-selecting volunteers interested in the concept of road charging, they are perhaps not the best barometer of the enforcement issues that would be encountered following large-scale implementation.

None of the challenges enumerated in this section need prove disqualifying for RUCs. But they must be confronted head on before any mileage fee-based system is introduced.

[3] Kirk and Levinson (2016) also discussed the problem of handling payments from unbanked and underbanked consumers, who may be unable to easily participate in a system which relies on electronic fee collection. Over 30 percent of consumers do not have a credit card, while 20 percent lack a debit card. Although it may be possible to sanction cash payments, doing so will drive up administrative costs, to say nothing of the potential time and financial costs that consumers would potentially incur if they had to pay mileage fees at an in-person location.

Chapter 4 Road Usage Charges

4.1 State Pilot Programs

A number of states have recently undertaken projects to evaluate whether RUCs are a viable replacement for gasoline taxes. This chapter reports on these pilot studies, which have occurred almost exclusively in the western United States. The following summaries outline each state's activities and describe the organization and scope of their RUC systems, study results (if available), and the attitudes and perceptions of project participants as well as the wider public. Most studies have been very small, with the number of participants ranging from 100 (Colorado) to over 5,000 (California). Their principal goal has been to determine the technical feasibility of RUCs and assess whether motorists are ready to embrace an entirely new approach to revenue collection. State programs covered in this chapter include:

- California
- Colorado
- Minnesota
- Hawaii
- Oregon
- Washington

Only pilot projects in California, Colorado, and Minnesota have been completed. The remaining studies are ongoing or still in their planning stages.

California

Following the passage and enactment of Senate Bill 1077, the California State Transportation Agency (CalSTA) oversaw implementation of the state's Road Charge Pilot Program, which evaluated the feasibility of adopting a RUC to fund transportation project. The study recruited volunteers who paid simulated road charges for each mile driven — 1.8 cents per mile for passenger and commercial vehicles, as this was deemed a revenue neutral rate. In designing the pilot study, CalSTA sought to capture a geographically and socioeconomically diverse cross section of motorists to discern the impacts RUCs on different segments of the populace. Ultimately, 5,129 vehicles participated in the study, most of which were private vehicles (4,471). A smaller number of government fleet vehicles (333), light commercial vehicles (261), and heavy commercial vehicles (55) were included as well. Eighty-nine percent of the vehicles hailed from urban locations, with just 11 percent coming from rural areas.

To facilitate system development that would not be hamstrung by proprietary technologies, Caltrans and CalSTA committed to building an open system administered by multiple account managers. As CalSTA noted (2017), similar programs in New Zealand and Oregon established that the private sector can operate RUC programs more efficiently state governments. Another justification for using private firms was that motorists may feel more comfortable if their data were handled by an outside third party rather than a state agency. During the pilot study, account managers oversaw project delivery and were responsible for offering mileage reporting and account management services to participants and staffing a customer service center. Account managers came from seven third-party vendors, which bid competitively to participate in the program — two firms served as commercial account managers (CAM), one firm acted as the state account manager (CalSAM), one firm was a heavy vehicle account manager, and three firms were dedicated to recording mileage and delivering reporting technologies. The pilot study did not mandate the use of a single method or technology for collecting data on vehicle miles traveled; rather, participants could choose from several manual and automated reporting methods (Table 3).

Table 3 Mileage Reporting Methods Available to California's Road Charge Participants

Method	Description of Methods and Procedures
Time Permit	• Motorist prepaid for an unlimited amount of driving over a defined time period • Permits available in 10-, 30, or 90-day increments • Permit prices set based on the 95th percentile of driving
Mileage Permit	• Motorist prepaid for a fixed number of miles • Permits available for 1,000-; 5,000-; and 10,000-mile increments • Required periodic odometer readings to verify the motorist did not exceed their permitted limits
Odometer Charge	• Motorist reported the number of miles driven every three months, compensating the state for the miles driven since the last reporting • Official odometer readings done at the beginning and end of pilot to verify the mileage was reported accurately • Odometer performed in-person or using a smartphone app that captures and validates a picture of the odometer • Motorists could ask for refunds for miles driven out-of-state, off road, or on private roads
Automated Reporting (No Location)	• Reported mileage without divulging where a vehicle had traveled • Plug-in devices, smartphone applications, and in-vehicle telematics facilitated reporting • Motorists could ask for refunds for miles driven out-of-state, off road, or on private roads
Automated Reporting (General Location)	• Coupled location-based technologies with a process termed *map matching* to track mileage • Plug-in devices, smartphone applications, and commercial vehicle electronic logging devices facilitated reporting • Motorists could elect to retain locational information for commercial services, however, no locational information was communicated to the state • Locational tracking prevented motorists from being charged for travel on out-of-state and private roads as well as off-road excursions

The pilot study also included numerous privacy safeguards to forestall outside entities from accessing data without authorization. Before launching the pilot, the technical advisory committee articulated a set of 12 privacy protection principles for the study to abide by. These are listed in Table 4. For information on the data security principles used for the pilot study, consult Table 4-2 in CalSTA (2017, p. 34).

Table 4 Privacy Protection Principles Guiding the Design of California's Road Charge Pilot Study

The Road Charge Program must…
1. At all times recognize and respect an individual's interests in privacy and information use pursuant to Section 1 or Article I of the California Constitution.
2. Offer motorists a time-based system of paying for road use as an alternative payment method for individuals concerned about disclosing their mileage driven.
3. Allow motorists choice in how mileage will be reported.
4. Be designed, implemented, and administered in a manner transparent to the public and to individual motorists.
5. Comply with applicable federal and state laws governing privacy and information security.
6. Not disclose personal information to any persons or entities without motorists' consent, specific statutory authority authorizing disclosure, appropriate legal process, or emergency circumstances as defined in law.
7. Not collect information beyond what is needed to properly calculate, report, and collect the road charge, unless the motorist provides his or her consent.
8. Remove all personal information from data retained beyond the period of time necessary to ensure proper mileage account payment and be used for public purposes (i.e., improving the safety and efficiency of the traveling public).
9. Require motorist consent to release personal information in a clear, unambiguous, written manner
10. Not require use of specific locational information, including specific origins or destinations, travel patterns, or times of travel.
11. Allow motorists an opportunity to view all personal data being collected and stored to ensure only data required for proper accounting and payment of road charges is being collected and retained.
12. Investigate all potential errors identified by motorists and make all corrections to ensure road charge records remain accurate.

Source: CalSTA (2017)

The program launched in July 2016 and continued through March 2017, with participants driving over 37 million miles during the study. Volunteers reported mileage automatically or manually, depending on the reporting option chosen. Every month, participants were emailed invoices; if they owed money, payment was made using simulated credit card numbers and vouchers. Because there was no actual exchange of money, CalSTA (2017) commented that discerning whether the payment and invoicing methods used on the study would be accepted by the general public if enacted as part of a live RUC program is challenging. Although the study's per-mile charge was anticipated to be revenue neutral, the sample fleet had better fuel economy than the statewide average the pilot, yielding net revenue of approximately $100,000. While interoperability with other state RUC systems was not a major focus of the pilot study, vehicles with GPS-enabled reporting devices took part in a simulated interoperability test with OReGO for one quarter. This evaluation demonstrated that interoperability is feasible if two states have an agreement with an account manager and there is compatibility among their respective systems.

Surveys and focus groups indicated that study participants largely endorsed the use of road charges. Overall, 73 percent of volunteers said they felt a RUC was a more equitable means of funding transportation projects than gasoline taxes. Whether this is representative of the feelings of the public more generally is unclear given the pilot study's reliance on volunteers, who may be more favorably disposed toward road charges to begin with. Irrespective of reporting method they selected, a majority of participants felt that their mileage had been accurately captured. Conversations with focus groups also revealed that participants were charged approximately one-third of what they had anticipated (i.e., they paid less than they had expected to under the system). Combining this information with supporting analysis, CalSTA demonstrated that RUCs appear to produce relatively equitable outcomes, and that rural drivers are not asked to pay a larger relative share than urban motorists. Participants were mostly untroubled by privacy concerns, with just 4 percent mentioning feeling worried about privacy during the Road Charge Program. Post-study interviews with

account managers also indicated there were no instances of personally identifiable information being compromised.

Despite their positive experiences a number of focus group members expressed skepticism over whether the program — as configured — could be rolled out on a much larger scale, citing possible tax evasion as a key reason. CalSTA also acknowledged that a number of challenges would need to be resolved before implementing a statewide Road Charge Program. Although outsourcing administrative duties largely to private sector vendors can reduce the operational and tax collection burdens faced by the state's government, implementing a large-scale RUC program is an enormously complex task as it would involve dealing with millions of motorists. Another challenge is making sure that mileage collection and reporting systems are compatible with other states' RUC systems. Identifying an accurate method to invoice out-of-state drivers, as well as in-state motorists who drive off road or on private roads, must also be done. Other potential challenges related to RUCs that must be addressed are social equity, administration costs, and ensuring compliance among drivers. The administration fees could pose very consequential hurdles. Under the current system, just 0.54 percent of revenue from the gasoline tax goes toward administrative costs. CalSTA anticipates this would increase to between 5 and 10 percent with the Road Charge Program, with higher costs upfront as the state works to get the system off the ground. Caltrans plans to use federal funding and leverage lessons learned from the Road Charge Program to explore pay-at-the-pump revenue collection, which would reduce the burden on drivers and presumably lower administrative fees by using a system design comparable to what motorists are accustomed to.

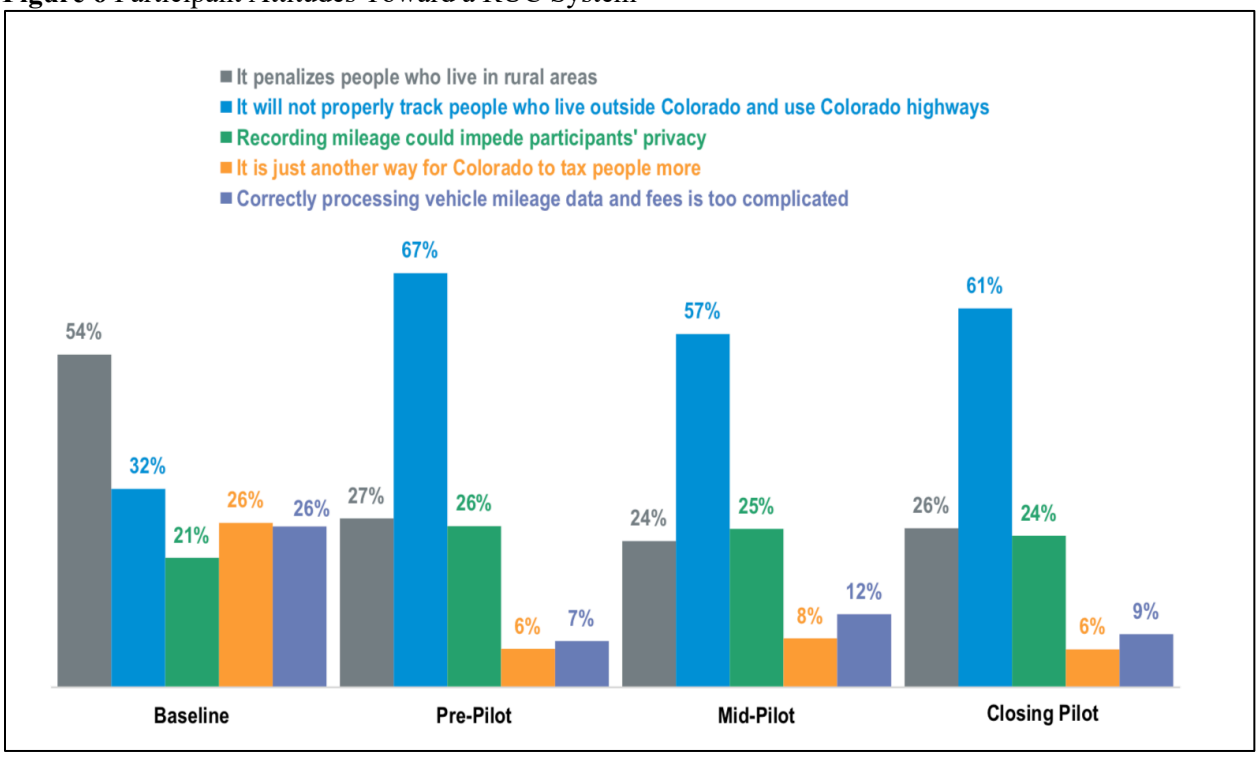
Colorado

Following a study on road charges and implementation methods (Ungemah et al. 2013), the Colorado Department of Transportation (CDOT) funded the Road Usage Charge Pilot Program (RUCPP) to evaluate the feasibility of RUCs (Cambridge Systematics 2017). Although funded by CDOT, the project was managed by a team of external consultants. Launched in December 2016, the study lasted until April 2017, with 100 participants taking part in the program. Similar to California's Road Charge Program, the RUCPP relied on simulation, meaning that no real money exchanged hands. Based on historical data and characteristics of the state's vehicle fleet, the pilot team set the per-mile rate at $0.012, reasoning this would be revenue neutral. In designing the program, CDOT and its consultants sought geographic parity to ensure all regions of Colorado were represented in the study as well as all vehicle types. However, no commercial vehicles were included in the study. Participants were able to choose from three reporting options — odometer reporting; a non-GPS-enabled mileage reporting device, which connected to a vehicle's onboard OBD-II port and collected data on distance traveled and fuel consumed; and a GPS-enabled reporting device, which measured distance traveled and fuel consumption while harnessing GPS data to calculate chargeable miles (e.g., miles driven in Colorado) and non-chargeable miles (e.g., miles driven in another state). Overall, 13 percent of participants opted for odometer readings while 17 percent and 70 percent, respectively, selected the non-GPS-enabled device and GPS-enabled reporting device. Maintaining the privacy of volunteers was a key concern for the project team, and GPS locational traces and route information were not made available to state agencies. All data were anonymized and reported as either in-state or out-of-state mileage.

The consultant team used a variety of data to analyze the pilot and the receptivity of participants and the broader public to RUCs, including social media metrics and comments, media summaries, help desk logs and common issues confronted by participants during the study, mileage reporting data, invoicing data, labor data from the project team, and surveys and interviews of the participants and the public. A common misperception held among the general public was that the RUC supplemented rather than replaced the current gasoline tax, although educational outreach explaining the purpose and operations of RUCs proved a useful corrective. Public acceptance of road charges increased as the RUCPP progressed, with stakeholders unanimously agreeing once the study had been completed that greater transportation funding is warranted in order keep up with growing demand. The most pressing concerns to the public were regional equity (e.g., not harming residents who live in rural areas), impact of out-of-state visitors, performance of data collection technologies, privacy, fairness, trust issues, and the belief that a RUC is really just a way to

ratchet up taxes on state residents (Figure 6 illustrates how the attitudes of participants regarding the potential drawbacks of a RUC system changed during the study).

Figure 6 Participant Attitudes Toward a RUC System



Source: Cambridge Systematics (2017)

During the five-month study, participants drove a total of 541,013 miles. Among vehicles equipped with GPS devices, 93 percent of these miles were driven in Colorado. The pilot was not beleaguered by fatal reporting errors, significant issues with technology, or customer service problems. Although intended to be revenue neutral, surplus revenue was collected. In the future, per-mile rates could be lowered to achieve revenue neutrality or ramped up to increase revenue. Cambridge Systematics (2017) commented that while the demonstration study confirmed that a road usage charge program is both technologically and technically practicable, expanding the program to a much broader scale would require developing innovative ways to report mileage driven or the adoption of innovative technological solutions to verify mileage, since it would not be feasible to perform manual mileage reporting or invoicing statewide. Additionally, an expansion of the program would require the state and its private vendors to formulate data security and retention policies to safeguard the privacy of motorists. Costs associated with program administration and hardware acquisition would require closer scrutiny before attempting a more ambitious rollout because RUCs are more expensive to manage than a system based on gasoline taxes, which are generally collected from fuel distributors.

Unlike trends observed in some other states, concerns over privacy among RUCPP participants did not abate significantly by the end of the pilot study, although some participants mentioned being enticed by the value-added features of GPS devices (e.g., vehicle diagnostics, push notifications for low battery or check engine codes). Volunteers preferred the ease of automatic reporting devices to monthly odometer readings, suggesting that convenience outweighs — to some extent — privacy issues. Indeed, in the first month of the program, just 18 percent of the participants who had opted for odometer readings failed to submit their required mileage tallies; by the final month, this figure increased to 55 percent. If manual reporting were allowed on a statewide program, ensuring driver compliance would prove challenging. Before the program began, 30 percent of participants said they believed a RUC produced equitable outcomes for all motorists.

This number climbed to 60 percent by the study's conclusion. But interestingly, the proportion of participants who agreed that all drivers pay a fair share for road use under a RUC system declined 15 percent from the beginning to end of the program. However, the number of participants saying that a RUC offers a more sustainable model for funding transportation crept up from 53 percent to 61 percent by the end of the pilot.

Minnesota

In 2007 the Minnesota Legislature appropriated $5 million to study RUCs. This resulted in the Minnesota Road Fee Test (MRFT), which ran from September 2011 to October 2012. The state worked with three prime contractors to conduct the study. A primary goal of the test was to evaluate the technical feasibility of using readily available technologies to record vehicle miles traveled, collect road usage fees, issue travel alerts, and generate time travel data. At the outset of the study, participants were given a smartphone with custom software that was able to collect second-by-second trip data and event-based log data, generate unique trip identification numbers, and record the number of miles driven in each fee category (see below). The MRFT was carried out in the Twin Cities Metro Area, with a particular focus on Wright County. In designing the study, the Minnesota Department of Transportation (MnDOT) sought a mixture of urban and rural residents as well as people whose socioeconomic and demographic profiles fell across the spectrum. No commercial vehicles were included in the study, however. While 500 people began the study, 478 completed it. To make the study as realistic as possible, MnDOT asked participants to pay invoices for mileage fees. Fees were calculable even without the study team having access to data that would identify travelers. Like the California and Colorado studies, participants were not required to pay out of pocket for mileage fees; rather, the study was simulated insofar as participants received money that could be used to pay the charges that appeared on their invoices. The fee structure incorporated elements of congestion pricing. Motorists driving within the Twin Cities Metro Zone during peak hours were charged $0.03 per mile, while all other trips cost $0.01 per mile. For miles driven without the smartphone, participants were charged $0.03 per mile. Participants also had the option of providing MnDOT with anonymized trip data. If they agreed, they were charged a flat $0.01 per mile fee. Along with information generated from the smartphone application, the MRFT was appraised using a combination of interview and survey data.

The study captured approximately 4 million miles worth of data, which were distributed across 500,000 trips. Approximately 660 million trip data points were captured as well. Over 2,700 invoices were generated during the study, yielding $38,000 in revenue. Most participants ended up paying around $20 per month, an amount comparable to what they would have paid under Minnesota's then-current gasoline tax. Rephlo (2013) commented that the study demonstrated the technical feasibility of using off-the-shelf technology to administer a RUC system. Smartphones were able to separate miles into fee categories based on location, roadway type, day of week, and time of day. Odometer checks revealed that roughly 77 percent of the total miles driven by participants were logged by the MRFT application. However, the system's performance was by no means flawless. A number of issues arose during the study. Common problems included the smartphone failing to collect data, which in a real-world setting could significantly affect the amount of revenue collected; hardware failures; and inconsistent GPS performance. Following in-depth analysis, researchers deemed 52 percent of the total trips collected by the system invalid due to unrealistic or questionable characteristics. In some cases, the system recorded more miles than had been registered by vehicle odometers. Thus, while the study demonstrated the approach used to collect RUCs is feasible, it also underscored numerous issues with reliability and accuracy that would need to be addressed before a large-scale rollout. Readers, however, should bear in mind that the study was began nearly seven years ago. Numerous advancements in smartphone technology have been made in the intervening period, which could render many of the problems observed during the MRFT irrelevant. At that time, no commercially viable plug-in devices were available. This gap has since been filled in, with all the other studies discussed in this chapter at least giving participants the option of using an onboard device. In all likelihood, future efforts to implement RUC systems will rely on either plug-in devices or pay-at-the-pump options.

Throughout the study, participants gained a better understanding of how revenue shortfalls impact transportation budgets and why RUCs are being considered as a way to generate a sustainable cash flows.

Overall, 17 percent of the participants — at the end of the study — said the rates they paid were higher than they had expected to, while 53 percent replied there were on par with expectations and 31 percent responded that rates were lower than expected. When asked about the appropriateness of congestion pricing and whether it is acceptable to adjust usage fees based on time of day or route, 51 percent of participants said both are appropriate, 23 percent said neither are acceptable, and the remainder expressed mixed attitudes (e.g., one appropriate while the other is not — in varying combinations). More importantly, a finding that speaks to the level of public acceptance for RUCs, is that 37 percent of participants said they would prefer a RUC over a gasoline tax while 48 percent endorsed preserving the gasoline tax; the other 15 percent were unsure or did not have a strong opinion. The primary reason given for supporting the gasoline tax over a RUC was simplicity. Participants wanted a straightforward system for collecting taxes. They also preferred the tax to be hidden in the price of fuel — paying a mileage fee, conversely brings to the forefront the amount they are paying. Interestingly, while 81 percent of participants by the end of the study claimed it would be easy to pay invoices for mileage fees, a main reason cited for preferring the gasoline tax was the hassle of paying a monthly invoice. With respect to equity, 56 percent of study participants said RUCs accord fair treatment to all drivers, while 33 percent said they favor some drivers over others. Privacy was not a significant concern for most participants, with only 32 percent saying they felt the system introduced privacy issues. Mostly, participants wanted assurances that their data could not be accessed by unauthorized third parties or hackers. Some participants mentioned being comfortable with personal trip data being used if it would lead to targeted infrastructure improvements, but participants agreed on the importance of never having personal data shared with private companies.

Rephlo (2013) concluded that while the demonstration study verified the technical feasibility of administering a RUCs program using smartphones, any full-scale rollout of a road charge program should be preceded by further research on the logistical, administrative, and operational hurdles that would need to be overcome. Among these are determining appropriate methods for collecting mileage data; handling mileage driven by out-of-state motorists; and establishing an appropriate and equitable fee structure that accounts for routes, congestion pricing, and vehicle size and weight. Developing messaging for the public that clearly justifies the fee system chosen is also imperative, as is public outreach focused on why new and more sustainable forms of funding are necessary to preserve the transportation system.

Hawaii

The Federal Highway Administration awarded the Hawaii Department of Transportation (HDOT) $4 million in 2016 to implement a large-scale demonstration project that would examine the potential of funding transportation system construction and maintenance with RUCs. Hawaii's proposal calls for a study grounded in simulation — therefore, no actual revenue would be collected. Expected to involve over 1 million motorists, the RUC Demonstration Test will be the most ambitious study to date on road user fees. Because the study is ongoing, there is little information available on its performance to date, however, HDOT's proposal contains insights that could potentially be leveraged in designing future RUC studies.

Hawaii's demonstration study will evaluate whether a RUC can serve as a potential replacement for gasoline taxes, foster a system flexible enough to collect mileage-based successors to federal and county gasoline taxes, and provide a way to collect county user-based fees such as registration and weight fees. Three objectives are guiding HDOT's design of the RUC system. They agency wants to establish a method of transportation funding that 1) sustainably generates enough revenue to maintain the state's transportation system; 2) is transparent and treats stakeholders equitably; and 3) supports the state's long-term goals and policies related to environmental protection and energy efficiency. In many ways, Hawaii is ideally suited for a large-scale demonstration project on RUCs as it does not share any border with other states. However, HDOT plans to investigate issues pertaining to interoperability. Each of the state's counties has a unique fuel tax rate, and the agency will need to devise strategies on handling tax collection for cross-registered vehicles (i.e., a vehicle is registered in one county but located in another). And while the study will not experiment with congestion pricing, the variability in per-mile rates among counties will ostensibly give HDOT valuable information on the effects different rate levels have on driving choices and travel behaviors.

HDOT plans to implement the demonstration study in two phases. During the first phase, vehicles will undergo manual odometer inspections. Hawaii already has a requirement in place which mandates annual odometer readings to renew vehicle registration. As such, HDOT can take advantage of its existing contracts with a private firm that electronically stores all mileage data collected during motor vehicle safety inspections as well as the agreements it has forged with 600 inspectors located throughout the state. During the RUC study, mileage data from odometer readings will be input into a billing engine that will generate billing data and invoices which will be sent to vehicle owners. At safety inspections, HDOT will communicate directly with motorists about how roads are funded in the state, problems created by the ongoing reduction in gasoline tax revenues, and methods (e.g., RUCs) that have the potential to alleviate funding concerns. The state's goal is to have invoices in the hands of motorists within several weeks of the inspection. Enclosed with the invoices will be surveys asking recipients to share their feedback and suggestions related to the program. Information on public attitudes will also be collected though online surveys. Throughout the demonstration study, HDOT will continuously analyze survey results to identify improvements that could be incorporated into the mileage reporting process. The study's second phase will explore the feasibility of automated mileage reporting. The collection, management, storage, and transmission of data will be outsourced to private firms. This phase of the study will have a much more limited reach, with HDOT wanting 2,000 volunteers in four counties to participate. Rigorous privacy standards will be adhered to throughout this portion of the study, with HDOT integrating best practices from other states that have experimented with automated reporting. In addition to determining the optimal method for collecting mileage data and assessing fees, HDOT also plans to investigate the viability of flexible payment options, including: 1) paying the RUC once per year; 2) paying the RUC quarterly or monthly; and 3) paying the RUC quarterly or monthly and bundling it with other user-based revenue mechanisms (e.g., state registration fee; other federal, state, and county taxes and fees). Data collection on will continue throughout 2018, with a final report expected in 2019.

Oregon

Arguably, the State of Oregon has the richest and deepest history of exploring alternatives to conventional gasoline taxes. Anticipating that more fuel-efficient vehicles would imperil gasoline tax revenues, in 2001 the state established a Road User Fee Task Force to address this problem. Eventually the task force decided on a road user fee as the most equitable solution to generate sufficient revenue to fund transportation projects. Two pilot studies on RUCs followed, the first in 2006-07 and a second in 2012-13. Building off a 2004 joint venture between the Oregon Department of Transportation (ODOT) and Oregon State University, which investigated the feasibility of using in-vehicle equipment to collect mileage data and pay-at-the-pump technologies, a 2006 pilot study included 300 volunteers who installed this equipment on their vehicles. GPS devices were installed on vehicles; participants incurred a road user fee for miles driven and received a gasoline tax credit. When drivers fueled their vehicles, the onboard equipment communicated the mileage driven to a centralized reader, which then transmitted it to the point of sale system. The study also investigated congestion pricing. Drivers were assessed a fee based on the number of miles traveled and where they were driven at. The 2006-07 study demonstrated the viability of a RUC system, validated pay-at-the-pump technologies, indicated that a mileage fee could be phased in gradually, and verified the feasibility of congestion pricing. Ninety-one percent of the volunteers who took part in the pilot said they would opt for a mileage fee over the gasoline tax if the program were expanded throughout Oregon.

A follow-up study in 2012-13 included 88 volunteers and lasted approximately four months. It investigated four RUC concepts — 1) collecting mileage with a GPS device (i.e., enabled locational tracking); 2) collecting mileage with a basic, non-GPS device; 3) payment of a flat fee; and 4) collecting mileage data with a smartphone app. In designing the follow-up study, concepts and designs initially tested in 2006-07 were significantly reworked. As a result, the study abided by the following principles. First, this study required that any mileage reporting system must have an open architecture. Motorists, it was reasoned, should have the option to decide how mileage data are collected. Furthermore, an open system architecture supports interoperability among states. Second, the government should not mandate the installation of GPS technologies in vehicles. Third, drivers must have a range of options for mileage reporting and the ability to choose where they obtain reporting technologies from. Lastly, private firms retained to administer a RUC

program should be able to offer drivers mileage supporting devises as well as assistance with tax processing, account management services, all while providing value-added benefits. Participants in the 2012-13 study gave the road user fee system high marks, finding it easy to use, the mileage reporting devices generally accurate, and that effective privacy safeguards were put into place. Based on the strength of the 2012-13 pilot study, Oregon became the first state to enact a mileage-based revenue program for passenger vehicles into law. This law was the catalyst for OReGO Project, an ongoing large-scale RUC demonstration study.

ODOT launched the OReGO Project in July 2015. Pursuant to the enacting legislation, the project can support up to 5,000 vehicles. Unlike initiatives elsewhere, OReGO is not simulation-based — it collects actual revenue. As such, it is a fully authorized tax program, with payments being collected in accordance Oregon State Treasury regulations. While the 2006-07 pilot study concluded that pay-at-the-pump technologies offered a workable solution, ODOT and other stakeholders decided — because OReGO is a statewide demonstration project — that installing the necessary technology at gasoline stations around Oregon would prove financially onerous and politically infeasible. All funds collected by the OReGO Project are remitted to the State Highway Fund. Mileage rates are designed to be revenue neutral for vehicles that get 20 MPG. Among vehicles enrolled in the study, no more than 1,500 may have fuel efficiency ratings below 17 MPG and no more than 1,500 vehicles may have fuel efficiency ratings between 17 and 22 MPG. There is no cap on the number of vehicles with fuel efficiency ratings greater than 22 MPG. The study only includes vehicles with a gross vehicle weight rating less than or equal to 10,000 pounds. Accordingly, it is not testing the concept on commercial vehicles. At the project's outset, drivers were charged $0.015 per mile, however, the rate increased to $0.017 per mile beginning on January 1, 2018, when the state's fuel tax increased from $0.30 to $0.34 per gallon. ODOT administers the program through private sector account managers, of which there are two types: 1) ODOT Account Managers, who oversee mileage tracking systems that do not use location technologies to track mileage or driver behavior; and 2) Commercial Account Managers who are responsible for overseeing systems use GPS-based technologies to track mileage. The terminology is somewhat confusing — while the individuals who work with the non-locational tracking systems are referred to as *ODOT Account Managers*, they are not employed by ODOT directly, they work for emovis (a private firm specializing in electronic tolling and mobility services) on behalf of the agency. To date, OReGO has enrolled 1,455 vehicles and brought on 1,148 volunteers. As of February 2018, there are 697 vehicles currently participating in the project.

OReGO works similarly to the other programs with respect to how it charges fees and reconciles the difference between the amount paid for miles traveled and gasoline taxes paid at the pump. After imposing the per-mile road charge, OReGO estimates fuel tax credits based on 1) the amount of gasoline a vehicle has consumed, or 2) applying a vehicle's combined EPA mileage rating to the miles driven. Using this information, account managers credit the state gasoline tax to a participant's account, the bill is reconciled, and an invoice is mailed out. Volunteers in the program can also submit reimbursement requests for miles driven on private roads or outside the state. There is no automated method of differentiating taxable miles from non-taxable miles (a point discussed below).

ODOT has administered several public surveys to current and former OReGO volunteers to document and evaluate its performance. The two most recent surveys were conducted in December 2015 and January 2017. Over 90 percent of respondents to the December 2015 survey said that signing up for the program was simple and intuitive. A similar number were able to their install mileage reporting without assistance. Sixty-seven percent of respondents felt the mileage invoices were clear and accurate, however, just 33 percent of them knew the what to do after receiving their invoice. A more expansive follow-up survey in January 2017 focused more on attitudes toward RUC programs. Of those enrolled in the program, 69 percent supported the concept of a RUC; conversely just 31 percent of respondents in a statewide public survey were favorably disposed toward a mileage fee system. Approximately 50 percent of the volunteers were more supportive of a RUC after participating in OReGO, even though 96 percent claimed they were satisfied with their experience in the program. Over half of the volunteers described a RUC as fair, with 69 percent saying they favored it over other sources of transportation funding. Volunteers also voiced fewer concerns regarding privacy than respondents to a statewide survey, which suggests greater exposure to or

participation in a RUC program mitigates anxieties over privacy. During interviews and focus groups, volunteers made other recommendations to improve OReGO, including adding greater detail to invoices, increasing the amount of data that are available on the program's online dashboard and smartphone app, providing an option to pay the RUC automatically, and devising ways to integrate data collection with insurance companies that also use in-vehicle devices.

Despite the OReGO Project still being active, ODOT (Jones and Bock, 2017) has published a number of lessons learned so far as well as various factors other state transportation agencies may want to consider when designing a RUC program. From ODOT's perspective, it is imperative to forge strong working relationships with private sector vendors that will administer an RUC system. Working with private firms confers three key benefits — 1) the availability of value-added services offered by account managers, such as geo-fencing, partnerships with car insurance companies, and engine and vehicle diagnostics available through either in-vehicle devices or linked smartphone apps; 2) letting volunteers make their own decisions about account managers, data collection devices, value-added services, and billing options, among others; and 3) encouraging motivation and competition, which can improve the performance of any RUC program. Indeed, during focus groups held in the lead-up to OReGO, participants strongly endorsed the creation of an open market. If road charge fees eventually become mandatory, offering motorists a range of choices may foster public acceptance. ODOT strongly recommends devising a technology-agnostic backend system to receive and store mileage and gasoline consumption data from account managers. In doing so, account managers enjoy the flexibility to innovate with a range of mileage collection and reporting technologies as long as they supply data in an ODOT-approved format. Based on early performance of the system, ODOT is confident that a RUC could be a sustainable replacement for a state gasoline tax (and not function merely as a supplement). Most state transportation agencies experimenting with RUCs have expressed apprehension over the administrative costs. Most of these agencies claim that administrative costs will fall once such programs achieve economies of scale. While this may be the case, ODOT has pinpointed several other strategies to reduce administrative costs, including the elimination of subsidies for account managers (compensating account managers has been the most expensive part of Oregon's program); giving drivers the option of paying a flat annual usage fee; reducing duplicative processes and relationships between the government and taxpayers; replicating tax and administration policies used in other portions of an agency (e.g., gasoline tax, DMV, Division of Motor Carriers); and working with national organizations to institute common reporting standards and billing platforms, which can facilitate interoperability among states.

Moving forward, state transportation agencies will also need to identify more reliable technologies for collecting mileage data. Embedded telematics, flat annual fees, and manual mileage reporting (like HDOT is using in Phase I of its RUC program) are examples. While the in-vehicle devices used in demonstration studies have proven mostly up to the task of collecting accurate data, sometimes they malfunction, leading to reporting gaps. Most devices plug into OBD-II ports, which are increasingly being used for other purposes (e.g., insurance). Reading data from the ports on electric vehicles has also proven troublesome. Addressing this shortcoming will be critical given that it is imperative to capture the mileage driven by electric vehicles, with there being no other way to tax their road use. Another challenge noted previously is that current technologies cannot differentiate between taxable road use and tax-exempt road use. Tax-exempt road use includes miles drive on non-public roads, in another state, and the use of vehicles on tribal lands by tribal members. States will need to establish binding regulations on what constitutes a non-public road, develop continuously updated maps which help account managers distinguish between taxable and non-taxable mileage, and ensure data collection methods are in place to verify miles driven on tax-exempt roads. Currently, ODOT asks volunteers to submit documentation if they want reimbursement for non-taxable mileage — but the agency essentially has to trust drivers, which as a solution is not tenable long-term, especially if the program goes statewide. Another issue ODOT has confronted is missing mileage (i.e., miles not recorded by in-vehicle devices). Initially, OReGO sanctioned up to 10 days of missed driving data. However, beginning on the 11th day, the agency would charge drivers based on the average number of miles logged each day, according to their driving record. Many drivers found this confusing, and some even left the program because of it. While ODOT is creating new policies to handle missing mileage, it is clear that other states considering RUCs will need to judicious and well-crafted approach to assessing fees

for miles missed by data collection devices. Similarly, unresolved questions remain over the enforcement of a RUC program and dealing with people who attempt tax evasion. This has not been an issue during the OReGO project, but any program that enrolls all motorists in a state will inevitably encounter this problem.

Washington

In 2012, the Washington State Legislature requested that the Washington State Transportation Commission (WSTC) collaborate with a steering committee to explore whether a RUC could replace the state's gasoline tax. After devoting years of study to the problem, WSTC and the steering committee determined that a RUC is feasible and could potentially generate enough revenue to fund the state's long-range transportation needs. After several years of planning, the Washington Road Usage Charge Pilot Project completed its recruitment in early February 2018 and is ready to begin, with a goal of having 2,000 drivers enroll. The project is expected to stretch into the first part of 2019, with findings presented to the legislature in 2020. Replicating the approaches of most other states which have conducted similar studies, the Washington pilot project does not entail the collection of fees or the exchange of actual money — it is simulated. Participants who volunteer for the project will be able to select among four options for mileage reporting: 1) mileage permit; 2) odometer reading; 3) automated mileage meters which are plugged into vehicle OBD-II ports (GPS and non-GPS devices are available); and 4) a smartphone app[4]. Participants who select the mileage permit option will purchase blocks of miles in three-month increments to cover their driving. They will be required to either take a photo of their odometer using a smartphone or submit to in-person odometer inspections at Department of Licensing offices. Volunteers who choose the odometer reading option will report their mileage each quarter, electronically or in person. Like the mileage permit option, volunteers will either submit a photo of their odometer using their smartphone or have an in-person odometer reading performed at Department of Licensing offices. Mileage data collected with in-vehicle devices (GPS and non-GPS options) are automatically submitted. WSTC plans to evaluate the interoperability of its system, and is currently working on a RUC Hub, which will help reconcile payments between Oregon and Washington. Throughout the project, volunteers will receive invoices and be asked to fill out quarterly surveys, which will be focused on their experiences and attitudes toward RUCs.

In preparation for rollout of the RUC program, the project team commissioned a telephone survey to understand perceptions and attitudes regarding Washington's transportation system and their feeling toward road charges. The snapshot provided by this survey will thus serve as a baseline against which to measure future changes in public attitudes. When asked to identify the most important challenges for elected officials to address, 17 percent said transportation — ranking it as the top priority for state residents. Respondents expressed particular concern with roads, traffic, and the condition of infrastructure. However, 64 percent of respondents felt state highways are currently in excellent or good shape. As the authors of the report noted, the high percentage of residents who feel roads are well-maintained could make it challenging to convince the public that a new source of funding is needed. Indeed, 61 percent said that introducing a RUC is merely another way for the government to levy a tax on citizens, with 52 percent remarking that the current gasoline tax — which recently increased to $0.49 per gallon — is too high. A majority (53 percent) of survey respondents claimed they were familiar with the concept of road charging. Respondents were evenly split on the question of whether a RUC is more or less fair than a conventional gasoline tax; 41 percent believed RUCs are less fair than a gasoline tax, while 44 percent stated they are fairer or equally fair. And yet, 58 percent of respondents voiced opposition to road charging, with 40 percent saying they were strongly opposed. Thus, a mixed picture emerges from the survey results, not unlike other states where comparable studies have been done. Most respondents suggested transportation issues are a high priority and that issues must be addressed, however, there was skepticism directed toward road charging, with most respondents unwilling to consider it as an alternative funding method. The project also commissioned focus group studies, however, the results of those have not yet been published.

[4] The project team worked with an outside company to hold a Smartphone Innovation Challenge. Four teams of student researchers from the University of Washington interested in RUC design, software, and technology submitted designs for a smartphone app. Concepts and features devised by teams were given to the RUC service providers so they could potentially be tested during the pilot.

Key Takeaways

- Completed and ongoing studies discussed in this chapter appear to demonstrate the technical and administrative feasibility of RUC systems. As noted, volunteer pools in these studies ranged from approximately 100 to 5,000. Thus, it remains unclear how quickly the systems could be expanded to the regional or statewide levels. Hawaii's demonstration study will provide some indication of whether a statewide program can work, however, it benefits from having pre-existing infrastructure in place to conduct odometer inspections, which most states lack.

- States have generally settled on the following four mileage reporting options: 1) mileage permits, 2) manual odometer readings, 3) automatic mileage reportage devices that can be plugged into vehicles' OBD-II ports (with or without GPS capabilities), and 4) smartphone apps. In the mid 2000s, Oregon found that pay-at-the-pump technologies are workable, but they were not incorporated into the state's current program due to the high cost of installing equipment at fuel stations statewide and associated political difficulties. Caltrans, with funding supplied by the FAST Act, has plans to explore pay-at-the-pump technologies. Two benefits of pay-at-the-pump systems are their lower administrative costs and higher likelihood of gaining widespread public acceptance, because they differ little from the revenue collection systems that are currently used (not requiring effort from drivers).

- With the exception of Oregon, all of the pilot studies in this chapter are simulated, which means that no money exchanges hands between study participants and the states (note: the Minnesota study involved the exchange of money, but it was furnished by the state). Although relying on simulated payments and invoices is completely understandable, especially for initial testing, it raises questions over whether the attitudinal data collected with surveys will accurately represent the experiences of drivers once they are obligated to pay real money once a RUC is instituted. Drivers who participate in these studies could overestimate or underestimate their willingness to accept RUCs as replacements for gasoline taxes.

- Volunteers involved in RUC pilot studies expressed increased support for road charging after experiencing a RUC system firsthand. Many — especially after acquiring new knowledge of how RUCs work — came to view road charging as producing fairer outcomes for all drivers. Remarkably, privacy concerns were not a significant issue in most states. This is not to say volunteers were entirely unconcerned with automatic mileage reporting devices infringing on their privacy; but they were adamant that states should take all precautions necessary to ensure that no unauthorized third parties could access their data. Study participants generally said that they paid an amount less than or equal to what they had expected. Even though volunteers have tended to be more favorably disposed toward RUC systems at the end of studies, widespread skepticism has remained over whether states could easily scale up these programs — and many people find the convenience of the current gasoline tax system appealing since it requires no work on their part. Surveys of the broader public conducted alongside pilot studies have found greater opposition to RUCs, with many respondents arguing they produce inequitable outcomes and are merely another way for state governments to levy taxes.

4.2 Legislation

To gauge efforts by other states related to mileage-based user fees, legislation from 2016-2018 was compiled from the National Conference of State Legislator's (NCSL)Transportation Funding and Finance Legislation Database. Table 5 lists the state, bill number, a brief summary, and the bill status. Hyperlinks from the bill numbers in the table provide a link to the text of the bill. Most of the proposals are to develop task forces or committees to study the feasibility of RUCs, although several expressly prohibit the usage of such fees or propose to develop pilot programs.

Table 5: State Legislation on Mileage-Based User Fees (2016-2018)

State	Bill	Brief Summary	Status
Colorado	HB 1304 (2016)	• Requires Colorado Department of Transportation to assist each transportation planning region in holding public meetings to discuss funding options for the state. Includes guidance for public meetings and mandates a report that ranks transportation priorities and the preferred approach to raising necessary revenues.	Failed
Illinois	SB 3267 (2016)	• Creates the Road Improvement and Driver Enhancement Act, which requires vehicles registered in Illinois to pay a "distance-based road user fee" with payment plan options and credits for estimated gas taxes beginning on July 1, 2017.	In Senate Committee on Assignments (re-referred)
Illinois	SB 3279 (2016)	• See SB 3267 above for summary — implementation date for user fee is July 1, 2025	In Senate Committee on Assignments (re-referred)
Kentucky	HCR 18 (2018)	• Creates a task force to study the potential implementation of a mileage-based user fee to fund transportation infrastructure. Task force will meet monthly and report findings to the Legislative Research Commission for further referral and action by December 1, 2018.	Referred to House Transportation Committee
Kentucky	HCR 27 (2017)	• See HCR 18 above for summary	Failed
Kentucky	HCR 27 (2016)	• See HCR 18 above for summary	Failed
Maine	HP 813 (2017)	• Establish a task force to study road usage charge alternatives, make recommendations for the design and evaluation of a pilot program on mileage-based user fees. Guiding criteria include: security and ease of recording and reporting usage, cost of administration, and potential compliance. Mandated to submit a report with recommendations to the Joint Standing Committee on Transportation by February 5, 2018.	Failed
Maine	HP 771 (2016)	• Review funding levels needed to reach highway and bridge capital goals; method to help address falling traditional revenues "such as registration fee surcharges on electric or hybrid cars or the establishment of a voluntary vehicle miles traveled program that allows a user to self-report the miles traveled and pay a tax based on those miles." Finding ways to ensure out of state visitors pay a fair share such as adding a seasonal gas tax or electronic tolling. Potentially dedicate portion of sales tax receipts from transportation-related products for transportation needs.	Failed
Maine	HP 1110 (2016)	• See HP 711 above for summary	Failed
Maryland	SB 284	• Prohibits the state and local governments from imposing a vehicle miles travelled tax and	Failed

	(2017)	any requirement to install a device to be used for tracking mileage.	
Maryland	SB 196 (2016)	• See SB 284 above for summary	Failed
Massachusetts	SB 1851 (2016)	• Establish a mileage user fee task force to help develop and evaluate the feasibility of a mileage-based user fee as a funding alternative or supplement to the gas tax. The one-year pilot program should include 1,000 volunteers with a representative sample of vehicles. Evaluation should consider "reliability, ease of use, cost and public acceptance of technology" and evaluate technologies to safeguard data and privacy.	Accompanied a study order (SB 2364)
Minnesota	HF 389 (2016)	• Public universities in Minnesota cannot use state funds or resources to study, test, or evaluate mileage-based user fees or provide funds/dues to any organization advocating for such fees.	Failed
Minnesota	SF 582 (2016)	• See HF 389 above for summary	Failed
New Hampshire	HB 621 (2017)	• Establish a road usage fee for New Hampshire-registered vehicles paid at the time of annual registration. Proceeds are deposited in a restricted road usage account in the Highway Fund. Department of Safety tasked with implementing the fee. Fee is based on 12,500 miles per year and MPG of 22.5 consuming 675 gallons and paying $123.33 in road toll. "The road usage fee for such base vehicles is $0. The road usage fee for all other vehicles shall be $123.33 minus the New Hampshire road toll paid per year based on 12,500 miles of travel."	Laid on the table
New Hampshire	HB 1763 (2018)	• Establish a road usage fee for New Hampshire-registered vehicles with greater than 20 MPG paid at the time of annual registration. Fee is based on 10,000 miles per year at 20 MPG consuming 500 gallons of fuel and paying $111 per year in road toll. "The road usage fee for such base vehicles is $0. The road usage fee for all other vehicles shall be $111 minus the New Hampshire road toll paid per year based on 10,000 miles of travel."	In House Ways and Means Committee
New Hampshire	HB 1602 (2016)	• Establish a road usage fee for New Hampshire registered vehicles with greater than 20 MPG paid at the time of annual registration. Fee is based on 13,500 miles per year at 20 MPG consuming 675 gallons of fuel and paying $149.85 per year in road toll. "The road usage fee for such base vehicles is $0. The road usage fee for all other vehicles shall be $149.85 minus the New Hampshire road toll paid per year based on 10,000 miles of travel."	Failed
New York	A 670 (2017)	• Creates a Road Usage Charge Advisory Committee to study alternatives and develop recommendations using criteria (e.g., privacy, ease and cost of administration, data access) to guide a pilot program assessing potential of a mileage-based user fee for New York. Program to be established by January 1, 2020; data collection methods and processes for data transmission and handling to be analyzed.	Referred to Assembly Committee on Transportation
New York	A 9848 (2016)	• See A 670 above for summary	In Assembly Committee on Transportation

Oregon	HB 2464 (2017)	• Eliminates caps on the number of vehicles that can participate in the Road Usage Charge Program. Requires new vehicles purchased after 2026 with greater than 20 MPG to be enrolled in the program and for gas tax refunds to be granted to program participants as a credit against road usage charges.	Failed
South Carolina	H 3316 (2017)	• Establishes a Mileage-Based User Fee Study Committee to gauge the potential of implementing a mileage-based user fee to replace the gas tax. Report to be made to General Assembly by December 31, 2018.	Referred to House Ways and Means Committee
Washington	HB 2956 (2016)	• Forms a legislative task force on information technology in transportation to study a number of transportation issues. Task force is not permitted to consider a road usage charge or mileage-based user fee.	Failed

Chapter 5 Interim Funding Options

States moving to an alternative system of revenue collection (e.g., RUC) would require a transition period to achieve full implementation. Given that traditional sources of revenue, such as the gasoline tax, would be inadequate to fund transportation construction and maintenance during a transition, states will likely need interim funding options. Several states have enacted legislation to generate modest revenue increases in an attempt to prolong the ability of traditional revenue sources to meet needs.

One of the most popular options has been to increase gasoline taxes. According to the National Conference of State Legislature (NCSL), 26 states passed legislation to increase their gasoline taxes from 2013 to 2017.[5] The increasing fuel efficiency of vehicles coupled with inflation has reduced the amount of revenue produced by gasoline taxes. As such, a common response of states has been to index gasoline taxes (or maintain an already-existing indexing structure) to a measure of inflation. NCSL notes that 14 of the 26 states which enacted legislation either kept already-existing indexing features of their gasoline tax or implemented new indexing features. Relevant information about each bill is included in Table 6 including the state, bill number, and a brief summary, which are gathered from the NCSL.[6] Hyperlinks from the bill numbers in the table provide a link to the text of the bill.

[5] http://www.ncsl.org/research/transportation/2013-and-2014-legislative-actions-likely-to-change-gas-taxes.aspx#Map
[6] http://www.ncsl.org/research/transportation/2013-and-2014-legislative-actions-likely-to-change-gas-taxes.aspx#Map

Table 6 State Legislation Raising Gas Taxes 2013-2017

State	Bill	Brief Summary
California	SB 1 (2017)	• Increases gas tax by 12 cents per gallon and diesel tax by 20 cents per gallon • Gas tax is indexed to inflation via the California Consumer Price Index. • Institutes $100 electric vehicle fee also tied to inflation (vehicle model years 2020 and later).
Georgia	HB 170 (2015)	• Increases state gas tax to 26 cents (from 7.5 cents plus 4% sales tax, gas is now exempt from state sales tax; local governments also have sales tax of generally 3-4%) • Increases diesel tax to 20 cents. • Annual adjustments to gas tax based on the Consumer Price Index. • Allows local governments to levy 1% use tax on gas. Establishes a $200 registration fee for alternative fuel vehicles (indexed) and eliminates $5,000 tax credit for purchase of such vehicles. Also imposes a $5 per night hotel tax.
Idaho	HB 312 (2015)	• Increases gas tax from 25 cents to 32 cents per gallon. • Levies a registration fee on electric vehicles of $140 and hybrid vehicles of $75.
Indiana	HB 1002 (2017)	• Increases gas tax by 10 cents per gallon • Indexes gas tax for inflation using the Consumer Price Index for Urban Consumers and Indiana Personal Income. • Increases registration fees $15. • Introduces a $150 fee for electric vehicles and a $50 fee for hybrid vehicles.
Iowa	SB 257 (2015)	• Increases gas tax by 10 cents to 30 cents per gallon. • Increases diesel tax by 10 cents to 32.5 cents per gallon. • Increases fees for oversize/overweight permits.
Kentucky	HB 299 (2015)	• Sets floor for calculating the wholesale price of gas; new floor results in minimum gas tax of 26 cents per gallon.
Maryland	HB 1515 (2013)	• Indexes all motor fuel taxes to the Consumer Price Index beginning in FY 2014; increase is limited to no more than 8% of the prior year's rate. • Levies a 1% sales and use tax on all motor fuels (increased to 2% on January 1, 2015 and 3% in FY 2016). If federal legislation on sales tax collection is not enacted then it increases to 4% on January 1, 2016, and 5% in FY 2017.
Massachusetts	HB 3535 (2013)	• Increases gas tax by 3 cents per gallon to 24 cents • Indexes gas tax to the Consumer Price Index beginning in 2015 and sets floor at 21 cents per gallon.
Michigan	HB 5477 (2014)	• Replaces current 19 cent gas tax and 14 cent diesel tax with variable rate of 14.9% on the wholesale price, tax increases limited to 5%. • Part of a larger transportation funding package that was voted down (more below) that also included increased fees and repeal of sales tax on motor fuels and increase in general sales tax.

Michigan	HB 4738 (2015)	• Increases gas and diesel tax by 7.3 cents per gallon; both taxes are now 26.3 cents per gallon. • Starting in 2022, both taxes are tied to the Consumer Price Index (annual adjustments). • Part of a larger transportation funding package (HB 4614, HB 4616, HB 4370, HB 4736, HB 4737, HB 4738, SB 414) that also includes a 20% increase in vehicle registration fees and annual fees for hybrid and electric vehicles
Montana	HB 473 (2017)	• Increases gas tax by 6 cents per gallon through FY2023 (rising from 27 cents to 31.5 cents in 2018-19, 32 cents in 2020-21, 32.5 cents in 2022, and 33 cents in 2023). • Increases diesel tax by 2 cents per gallon through FY 2023.
Nebraska	LB 610 (2015)	• Increases fixed component of gas tax by 6 cents (1.5 cents per year for four years starting January 1, 2016) to 16.3 cents (other components of the tax include a wholesale tax and variable tax).
New Hampshire	SB 367 (2014)	• One-time adjustment to gas tax (current rate of 18 cents per gallon) on July 1, 2014 based on the change in the Consumer Price Index from 2004-2013; resulting change increases tax to 22.2 cents per gallon
New Jersey	AB 12 (2016)	• Increases gas tax to 37.5 cents (from 14.5 cents) • Increases diesel tax to 43.6 cents (from 16.6 cents) • Ties tax to quarterly adjustments based on gas prices. • Rate set to guarantee the level of revenue generated in FY2016 (approximately $1.16 billion) using 23 cents per gallon (floor).
North Carolina	SB 20 (2015)	• Replaces current gas tax (fixed rate of 17.5 cents per gallon and variable rate of 7% on the wholesale price) with fixed rate of 34 cents per gallon (rising to 36 cents per gallon by December 31, 2015). • Indexes gas taxes to the Consumer Price Index (25%) and population growth (75%) in 2017.
Oregon	HB 2017 (2017)	• Increases gas tax by 10 cents per gallon through 2024 (4 cents in 2018, 2 cents in 2020, 2022, and 2024). • Institutes new registration fees schedule based on fuel efficiency ($18 for 0-19 mpg, $23 for 20-39 mpg, $33 for 40+ mpg, and $110 for plug-in electric vehicles not enrolled in OReGO program; these increase in 2022). • Levies new privilege tax on sale of vehicles of 0.5% and a sales tax on bicycles, • Increases payroll taxes by 0.1% with funds dedicated to transit
Pennsylvania	HB 1060 (2013)	• Gradually eliminates the cap on the average wholesale price of gas and diesel subject to the Oil Company Franchise Tax and sets a price floor of $2.99. • Eliminates fixed gas tax (12 cents per gallon). • Registration and licensing fees are tied to the Consumer Price Index for Urban Consumers beginning on July 1, 2015, with two-year adjustments; most are allowed to increase to the rate of inflation.
Rhode Island	HB 7133 (2014)	• Indexes gas tax to the Consumer Price Index for Urban Consumers beginning July 1, 2015, with annual adjustments. Total gas tax floor is its current rate of 32 cents per gallon.
South Carolina	HB 3516 (2017)	• Increases gas tax by 2 cents per gallon annually from 2017-2022 (total 12 cent increase). • Increases road tax on motor carriers (equivalent to gas tax) and registration fees as well as introduces a biennial electric vehicle fee of $120.

South Dakota	SB 1 (2015)	• Increases gas tax 6 cents per gallon to 28 cents. • Levies excise tax of 4% on purchase of motor vehicles.
Tennessee	HB 534 (2017)	• Increases gas tax by 6 cents per gallon over 3 years (4 cents in 2017, then 1 cent in 2018 and 2019) • Increases diesel tax by 10 cents per gallon over 4 years (4 cents in 2017, then 3 cents in 2018, 2019, and 2020). • Increases registration fees by $5 and levies new electric vehicle fee of $100.
Utah	HB 362 (2015)	• Replaces current gas tax (24.5 cents per gallon) with 12% tax on the statewide average rack price per gallon starting January 1, 2016. Floor of the average rack price is $2.45 per gallon (after 2019) and is adjusted annually based on the Consumer Price Index.
Utah	SB 276 (2017)	• Gas tax imposed at 16.5% of statewide average rack price per gallon. • Minimum average rack price of gas cannot be less than $1.78; adjustments made each January 1 by using the minimum statewide price from the prior year and adding an amount equal to the greater of the rack price multiplied by the percentage change in the Consumer Price Index. Statewide average rack price cannot exceed $2.43 per gallon. (Modifies HB 362)
Vermont	HB 510 (2013)	• Levies a 4% tax on average retail price of gas over two years. • Decreases the fixed gas tax by 6.9 cents per gallon. Total impact expected to be an increase of 6.9 cents per gallon. • Increases diesel tax by 3 cents per gallon (over 2 years).
Virginia	HB 2313 (2013)	• Replaces current 17.5 cent per gallon gas tax with 3.5% wholesale tax (rises to 5.1% if Congress does not pass internet sales tax legislation). • Levies a $64 fee for hybrid vehicles (repealed in 2014). • Raises dedicated state sales tax for transportation from 0.5% to 0.675% over 5 years. • Sales tax also increases from 5% to 5.3% and is dedicated to transportation. • Increases the vehicle sales tax from 3% to 4.15% over 3 years.
Washington	SB 5987 (2015)	• Increases gas tax (37.5 cents) by a total of 11.9 cents per gallon (7 cents August 1, 2015, and 4.9 cents July 1, 2016).
West Virginia	SB 1006 (2017)	• Increases price floor on variable rate portion of gas tax from $2.34 to $3.04 (5% wholesale tax). • Increases sales tax on vehicles (from 5% to 6%) and other fees.
Wyoming	HB 69 (2013)	• Increases gas and diesel tax by 10 cents per gallon to 24 cents beginning July 1, 2013.

Several states, including Tennessee, Georgia, Virginia, Michigan, and Indiana passed more comprehensive transportation funding packages. Although these included gasoline tax increases, they were accompanied by some of the following: registration fee increases, fees on electric vehicles, sales tax increases dedicated to transportation (or vehicle sales tax increases), and even a hotel tax ($5 per night in Georgia). In addition to these legislative efforts, several states have put forth ballot measures to increase gasoline taxes. NCSL reports that Massachusetts and Michigan voters have weighed in on fuel taxes. In 2014, Massachusetts voters approved a measure that repealed indexing requirements established by a prior bill (HB 3535), which increased the gas tax and indexed it to inflation beginning in 2015. In 2015 Michigan voters rejected Ballot Proposal 1, a transportation funding package that included a gasoline tax increase in HB 5477. The Michigan legislature later passed a bill (HB 4738) to increase the gasoline tax, which was part of a larger transportation funding package that also increased fees (see Table 6).

Several of the bills which increased gasoline taxes included new funding measures, such as levying additional registration fees on electric/hybrid vehicles and increasing sales taxes or other fees. These fees are typically in the range of a few hundred dollars. No research has been conducted to date on methods for collecting equitable taxes on electric/hybrid vehicles (Boske et al., 2013). Boske et al. (2013, p.43) noted some considerations states need to account for when determining whether and how to impose fees on owners of electric/hybrid vehicles. Fees should be able to:

- Completely recover lost gasoline tax revenues from purely electric vehicles
- Recover lost gasoline tax revenue from electric vehicles and other hybrids and alternative fuel vehicles
- Recover the full annual cost of road usage for an electric vehicle

While Table 6 focuses primarily on gasoline tax increases, it includes other changes in revenue collection enacted as part of those bills. Several states have also addressed other funding measures, such as sales taxes and registration fees, apart from gasoline tax increases. Table 7 summarizes the contents of these bills.

Table 7 State Legislation on Other Revenue Sources

State	Bill	Brief Summary
Delaware	HB 140 (2015)	• Increases various licensing fees, including motor vehicle document fee, late driver's license renewal fee, fee for reinstatement of revoked or suspended license, and title lien.
Florida	HB 7175 (2014)	• Permits commercial sponsorships on multiuse trails and facilities to raise revenue for their maintenance. • Also permits leasing right-of-way for cell phone towers, with revenues used to boost capital funding for transportation.
Texas	SJR 5 (2015)	• Proposes constitutional amendment (approved by voters). • Dedicates portion of future sales tax revenue to transportation ($2.5 billion if tax receipts are at least $28 billion). • Dedicates 35% of revenue growth from vehicle sales and rental car taxes to transportation starting in 2020.

Several other revenue sources could be considered to supplement current revenues or serve as an interim funding source. Dierkers (2009, p. 1) lists some of these: inspection fees; driver's license fees; advertising; rental car tax[7]; state lottery/gaming funds; oil company taxes; vehicle excise taxes; vehicle weight fees; investment income; and other licenses, permits, and fees revenues. One revenue source that is currently in use or being considered by several states is leveraging advertising rights to generate income. (Slone, 2010). While this option has been most popular with transit agencies, opportunities also exist for state DOTs to engage in this practice (e.g., as selling space on exit information signs and message boards).[8] Georgia uses advertising revenue to cover the cost of an Atlanta-based motorist-assist program, while Pennsylvania sells advertising space on tollbooths along the Pennsylvania Turnpike. Some states have also experimented with rest area sponsorships[9], although the effect of these sponsorships is not entirely clear.[10] Between changes to gasoline taxes and other fees, many states have endeavored to secure and boost transportation revenue in the short term. Generally, the legislative efforts pursued thus far suggest that increasing already-existing fees is likely to a more acceptable solution, politically, than instituting new fees.

[7] See http://www.ncsl.org/research/fiscal-policy/rental-car-taxes.aspx for more information.
[8] https://www.fhwa.dot.gov/ipd/value_capture/sources_tools/local.aspx
[9] See: http://www.state.nj.us/transportation/about/rules/documents/16-42-Current.pdf, http://www.documentcloud.org/documents/787430-iowa-dot-rest-area-sponsorship-program.html, https://www.nevadadot.com/home/showdocument?id=24, and http://www.virginiadot.org/business/sponsorships/sponsorships_main.asp for examples.
[10] http://www.courant.com/opinion/editorials/hc-ed-adopt-rest-area-1115-20161114-story.html

Chapter 6 Conclusion and Future Research

Adopting new models of revenue collection to fund transportation construction and maintenance projects will likely require, if not public support, at least public acceptance. Gaining public acceptance is a critical part of changing how revenue is collected for transportation. Agencies which have successfully implemented revenue changes have routinely reached out to the public and asked for community input (Mahendra et al. 2011). The introduction of RUCs is one possible solution, albeit one that would carry with it significantly more administrative complexities (and expenses) than the current gasoline tax. Likewise, a RUC would require testing and implementation of new technologies, identifying enforcement strategies, and likely hiring private sector firms to manage revenue collection. While volunteers from RUC pilot studies have typically viewed road charges favorably, these positive views are far from unanimous. And polling of the general public tends to indicate there is strong resistance to RUCs. Future research could examine the work that has been done on public receptivity to road charging and alternative funding strategies. Considerations for using road pricing options are dictated by the current economic and political environments, availability of alternatives, and policy conditions. Having a champion who will advocate for and support a change in revenue collection will likely positively impact any effort to modify revenue structures.

Interim funding options warrant further examination, as do other funding alternatives such as tolling, sales taxes, and other options. Tolling could be considered both an interim and longer-term alternative funding option. Tolls are currently used in Kentucky to finance the Louisville-Southern Indiana Ohio River Bridges Project (LSIORB) through the River Link all-electronic tolling system. LSIORB is a mega-project that was designed to increase mobility across the Ohio River, improve safety, reduce congestion, and enhance connectivity. Kentucky was responsible for the Downtown Crossing, which included building a new I-65 bridge (I-65 northbound), reconfiguring Spaghetti Junction (I-64, I-65, and I-71) reconfiguring Indiana's bridge approach, and rehabbing the Kennedy Bridge (I-65 southbound). Burwell and Puentes (2009) noted that a growing number of states have incorporated tolling; they explained the increased reliance on tolling thusly: "Since the 1990s, several factors have led to resurgent interest in tolling. These include (1) revenues from fuel taxes rising more slowly than program costs, (2) widespread adoption of technological advances in electronic toll collection systems, and (3) the interest in pricing schemes to reduce demand and improve system performance by efficiently allocating scarce road space" (p. 17). Increasingly, electronic tolls have simplified pricing options (variable versus fixed) and have relatively low evasion rates (Crabtree et al. 2008; Forkenbrock, 2000). Tolling is an option that deserves further research to determine if it is feasible in certain situations.

Another research topic which merits further attention is the performance of RUCs in international contexts. While not addressed in this report, countries throughout Europe, as well as New Zealand, have implemented road-charging schemes, especially for commercial vehicles. Taking a closer look at the structure of programs adopted in other countries might offer beneficial insights which could prove instructive when evaluating potential strategies for Kentucky.

Understanding the potential revenue that can be realized from interim or long-term alternative funding strategies is critical for guiding policy formulation. As current revenues are insufficient to meet existing infrastructure needs, much less future demand, it is imperative to ensure that interim and long-term alternative options generate sufficient revenue. Mapping out future revenue scenarios by developing revenue projections under different funding strategies would provide valuable information to policymakers. First, analyzing the composition of current revenues and projecting future revenues will help evaluate how future revenues will need to be structured to meet infrastructure needs. Second, examining several alternative revenue scenarios in conjunction with shorter-term interim options will provide insight into the feasibility of different revenue collection strategies and their implications for sustainably funding transportation infrastructure.

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