

The following document is supplemental to *NCHRP WebResource 2: Road Usage Charge Guide* (NCHRP Project 19-18, “Transitioning Fuel Tax Assessments to a Road Usage Charge”). The full WebResource can be found at <https://crp.trb.org/nchrpwebresource2/>.

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1. Introduction

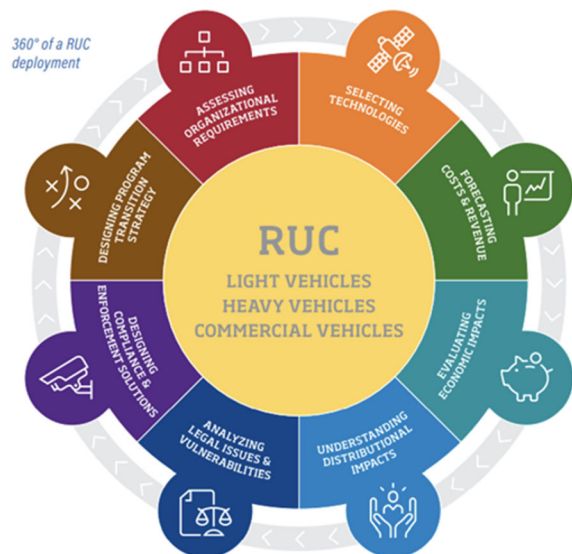
The objective of Task 1 is to document existing results from road usage charge (RUC) and road pricing research, pilots, and systems from government agencies, academia, and from experience with user charging systems in related industries. This memorandum contains the three deliverables from this task:

- Summary of existing relevant literature
- Identification of Best Practices
- Three RUC program case studies

2. Literature Review and Best Practices

This memorandum summarizes the literature and best practices on RUC. The review covered hundreds of technical papers and articles on RUC from online resources such as the Mineta Transportation Institute’s Mileage Fee Research and Information Directory (MFRID), obscure data sources, and interviews with knowledgeable subject matter experts. The project team has organized all existing information in a manner accessible to those interested in learning more about RUC by topic.

- Selecting Mileage Reporting Methods/Technologies
- Forecasting Costs and Revenue
- Evaluating Economic Impacts
- Understanding Distributional Impacts
- Analyzing Legal Issues and Vulnerabilities
- Designing Compliance and Enforcement Solutions
- Assessing Organizational Requirements
- Light, Heavy and Commercial Vehicles
- Designing Program Transition Strategy
- Communications



Each section below begins with an introduction and description of the topic area, followed by a broad industry scan, and concludes with best practices. Each section includes a list of top references for the topic. The list of references is not meant to be exhaustive, but serves as guide to the reader who would like to read more about the topic.

2.1 Selecting Mileage Reporting Methods/Technologies

Introduction and Description

The selection of suitable mileage reporting methods is a key issue critical to the success of RUC for a variety of reasons. First, the use of the mileage reporting method provides the most direct contact between the RUC payer and the RUC system, so it constitutes a significant portion of the RUC payer's user experience. Second, the performance of the reporting method determines what percentage of the miles driven are reported to the state. Finally, the selected mileage reporting methods is a primary driver of the capital and operating costs of the RUC system.

Lower tech mileage reporting methods include flat fee, self-reporting, submitting mileage during a vehicle safety inspection, or purchasing a distance permit. Higher tech mileage reporting methods include OBDII plug-in devices, native automaker telematics, heavy vehicle fleet management systems, and odometer image capture.

Two of the most important topics that states consider when selecting mileage reporting technologies are the use of location data, and the use of private commercial account managers (CAMs) to support the use of the technology (Jacobs 2019). The ability for RUC payers not to share location data with the state has been central to growth of RUC—without that ability, RUC programs would likely not be operating today, as sharing location data generates strong political opposition. CAMs have proven important for states to process data from automated technologies.

Broad Industry Scan

OBDII plug-in devices plug into cars' OBD-II ports (present on all light vehicles in the US built since 1996, except the Tesla 3 and Y) and are widely used in the usage-based insurance and fleet management industries. They are also the most widely studied technology for RUC recording and reporting (Jacobs 2019). These devices contain a means of communication such as a cellular modem and typically report miles driven at least once per day. These devices often include GPS chips, though devices without GPS chips are also in use. The devices with GPS chips provide the most accurate miles by state/region available for light vehicle RUC collection now. The primary challenge with these devices is cost in that devices with cellular modems are expected to cost at least \$50 at scale and incur monthly cellular connection fees.

Odometer image capture refers to the use of mobile devices to capture odometer images, typically by RUC payers themselves. Odometer image capture software typically contains many security measures to ensure that fraudulent images are not accepted (D'Artagnan 2017). Odometer image capture generally works well, but the primary challenge is that some RUC payers do not submit their odometer images, even when given frequent reminders.

Smartphone apps that use location data have also been studied by California, Washington, and the Eastern Transportation Coalition. No app has yet proven suitable for use in revenue operations, due to an unsatisfactory user experience and the inability to consistently identify the subject vehicle (CH2M Hill 2019). A suitable smartphone app may yet be developed. The primary challenges are developing a smartphone app that is user friendly and captures miles in a satisfactory way when the phone is not in the vehicle.

Heavy vehicle technologies include electronic logging devices and fleet management systems, both of which are equipment already used in medium and heavy trucks to measure data on the usage of the truck (Jacobs and EROAD 2020). These devices have no real challenges, although it should be noted that low end electronic logging devices do not have sufficient security, accuracy, or reporting frequency for RUC collection.

Native automaker telematics uses data generated and communicated by the vehicle itself to measure and report RUC and many view this telematics as the best long-term solution for RUC recording and reporting (Caltrans 2017). By some estimates, 95 percent of vehicles sold in 2021 have telematics capabilities, and 100 percent are expected to have such capabilities by 2025. To date, automakers have not made vehicular data available directly to support RUC. Doing so would enable software to report RUC to reside on vehicles, and by most accounts this is the ideal solution for RUC recording and reporting. Instead, today native automaker telematics is used for RUC via an API provided by third parties such as Smartcar and Otonomo. This third-party solution has the drawback of limiting the frequency of the collection of location data, meaning that precise location-based charging is not possible. The biggest challenge with native automaker telematics is getting automakers to support RUC directly.

Self-reporting means users reporting their own odometer values with some frequency. Such reports are subject to unintentional and intentional errors, so some percentage of self-reported mileage should be checked, either by in-person validation or looking up on a VIN lookup service such as CARFAX.

Vehicle inspection-based reporting uses data collected in periodic vehicle safety or emissions inspections for RUC recording and reporting. This has proven to work well in states that still have annual safety inspections, specifically Hawaii.

Flat fees are annual fees that do not vary with roadway usage, so do not in fact measure RUC. They may be useful to offer to RUC payers who do not wish to report mileage for RUC, but must be set high enough, so significant revenue is not lost from high mileage drivers.

Considerations in Selecting Technologies

- In RUC systems procured thus far, CAMs typically provide the mileage reporting technologies as well as the account services. States typically compensate CAMs through a per-device fee and an annual flat fee to cover the cost of operations. A state may select multiple CAM vendors, with limited duration contracts, to avoid monopolies. A state may choose one CAM when a system is small, and add additional CAMs as the system grows.
- A state may find it useful to encourage private sector technology vendors to innovate and combine RUC services with other service offerings such as fleet management services (particularly important for heavy vehicles) or usage-based insurance.
- Some states have found it useful for RUC data to be standardized. RUC data generated can be specified to include all miles (no location information) and miles by state, on and off-road. Standardized data facilitates interoperability.

- It's very useful to functionally specify RUC technology prior to procurement and have specifications be open (available to all) and vendor-agnostic (favoring no particular vendor) in order to obtain the best and lowest-cost technology.
- Certifying (passing bench and field tests) RUC technology to perform according to industry standards reduces costs and supports interoperability.
- Offering at least one technology that supports all vehicles and imposes no additional cost on the RUC payer supports systems equity.

Best Practices

The following best practices for states selecting mileage reporting technologies have been identified in many pilots and studies:

- **Offer user choice.** Not every user will want the same mileage reporting technology. The best offerings vary from state-to-state.
- **Consider offering, but do not mandate, a location-based technology.** If a non-location-based reporting option is not offered, significant political opposition will likely arise. Even so, many people who do not want to be charged for out-of-state, off-road, and private road miles prefer a location-based option. For now, the only viable light vehicle location-based method is the OBDII plug-in device. Those who choose a location-based technology can use it to pay for other services.
- **A good User Experience (UX) with a technology is vital for success.** When the user experience is not polished, users may oppose or not participate in RUC programs. Online interfaces should be smooth, and there should not be too many steps to set up a RUC technology.
- **A RUC program can function without states receiving location data.** Even for those individuals who choose a location-based method, a private company can process the location data, and share with the state only aggregated data to ensure that RUC payers do not feel that the state is intruding on their privacy.
- **CAMs can be empowered to offer high-tech options.** Especially for location-based options, instead of the state directly.
- **Use Commercial Off the Shelf (COTS) technology.** Custom technology for RUC collection is neither cost-effective nor reliable.

Selecting Mileage Reporting Methods / Technologies Top References

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2.2 Forecasting Costs and Revenue

Introduction and Description

Practices for forecasting future state transportation revenue vary widely from state to state. The Federal Highway Administration employs a spreadsheet-based tool, the Highway Revenue Forecasting Model (HRFM), to evaluate existing and prospective federal funding alternatives (FHWA 2021). However, among the states, there is no standard approach.

All states provide short-term revenue outlooks aligned with legislative budgeting cycles of up to five years, and many take a longer outlook, with a few projecting revenues up to 30 years in the future. Methodologies and degrees of sophistication range from extrapolation to expert judgment to econometric modeling. But, as the vehicle fleet becomes more fuel efficient and increasingly electric, agencies will experience challenges predicting future revenue from fuel taxes given the scarcity of “good, continuous data for state fleet fuel economy” (NASEM 2015). As legislatures explore and enact policy proposals including RUC, it will be crucial for states to update their forecasting tools to respond to changing policy circumstances.

On the cost side, numerous studies have attempted to estimate the future cost of RUC, but with few experience-based benchmarks to date in the U.S., much of this research is conjectural. Active RUC

programs range from administration costs of less than 5 percent of revenue (New Zealand) to 40 percent (Oregon's small-scale program), with estimates of future costs ranging from about 3 percent to 20 percent.

Broad Industry Scan

According to a recent synthesis of state transportation revenue forecasting practices (NASEM 2015), there is no standard process or methodology for states to forecast revenue from existing sources let alone new policies. Over half of states surveyed indicated conducting one-off analysis of policy proposals for new revenue sources, which include changes to existing taxes and creation of new mechanisms like sales taxes, general fund transfer, electric vehicle fees, and RUC. However, modeling new sources of revenue is difficult because agencies are often constrained to analyzing current policy, and selecting the most important variables to consider under new policies is difficult.

For RUC specifically, several states have undertaken financial analysis of revenues. Below are examples from Oregon, Washington, and Utah.

In advance of the launch of its second RUC pilot program in 2012, the Oregon Department of Transportation (ODOT) developed a revenue and cost modeling tool to inform decisions of the Road User Fee Task Force. The tool reflected gross and net revenues (net of collection costs) for fuels taxes (gasoline and diesel) and RUC. It allowed ODOT to explore the transition for the imposition of RUC on vehicles by motive power source (electric, hybrid, internal combustion) and year of introduction (ODOT 2012). ODOT updated the model several years later to add flexibility to build more scenarios describing economic circumstances affecting vehicle miles traveled (VMT) and fuel economy, policy scenarios for RUC rate setting, and technology scenarios affecting RUC cost of collection (ODOT 2016).

The Washington State Transportation Commission (WSTC) also explored revenue forecasting for RUC through its Steering Committee process. Like Oregon, the modeling tool focused on detailing the net revenue potential of fuel taxes and road usage charges. The modeling tool underpinned a business case analysis that illustrated revenues and costs of a RUC system under a variety of potential transition scenarios, all relying on a "revenue neutral" per-mile RUC rate equivalent to what the average vehicle paid per mile in Washington state fuel taxes (WSTC 2014). More recently, WSTC began an effort to evaluate the impacts of alternative mobility trends on future transportation revenue, incorporating the analysis into an upgraded version of the existing modeling tool (WSTC 2020).

Following the enactment of a road usage charge in 2018, the Utah Department of Transportation (UDOT) implemented a system allowing drivers of electric, hybrid, and plug-in hybrid vehicles to choose between paying a flat annual registration surcharge and a per-mile charge. To support analysis of the program's finances and future planning, UDOT constructed a financial model based on the legislation and program. The model estimates enrollment by vehicle type, revenue from flat fees and road usage charges, and other revenue from fuel taxes and state vehicle registration fees (Milestone Solutions 2020).

The active RUC program in New Zealand, which covers both heavy vehicles and light-duty diesel cars, costs the government less than 2 percent of revenue to administer and enforce (NZTA 2020),

while Oregon's heavy-vehicle weight-mile tax costs less than 8 percent of revenue to administer and enforce (ODOT 2021).¹ Oregon's operational light-vehicle RUC program provides 40 percent of revenue to third-party vendors, but at a scale of fewer than 1,000 vehicles. ODOT has indicated that figure would be renegotiated to a lower level before the program becomes mandatory and expands to other vehicles (ODOT 2017). Research done in Washington estimated ranges from 4 percent for large-scale RUC systems reliant on automation and third-party service provision to as high as 18 percent, on par with tolling (WSTC 2016).

Best Practices

Best practices for financial analysis and modeling of RUC include:

- **Recognize the relationship between fuel economy and fuel consumption.** Fuel economy is a major factor impacting future fuel tax revenue. The other major factor is vehicle miles traveled. Incorporating estimates of future on-road fuel economy directly into revenue forecasting is the simplest way to ensure a logically consistent relationship between VMT, fuel economy, and revenue.
- **Utilize scenarios to explain the range of possible future trends.** Revenue forecasting is part art, part science. When the audience is lawmakers attempting to create sustainable revenue policy, scenarios serve as stories that can help explain the uncertainty inherent in attempting to predict the future.
- **Include an array of revenue sources.** Although RUC originated as a policy concept to replace the indirect usage-based fuel tax with a more direct charge, states increasingly pair RUC with other mechanisms like vehicle fees. Comprehensive transportation revenue forecasting in a single tool can make decisions easier for lawmakers.
- **Consider a horizon of 20+ years, while harmonizing with existing state forecasts for the near term.** Most state transportation revenue forecasts have a track record of accurate performance in the near term (five years). To avoid inconsistency and maximize credibility, forecasting tools developed to support RUC explorations and program evaluations can harmonize with existing forecasts over the near term, and extend to at least 20 years in the long term. A longer-term forecast aligns with the time it would likely take to transition a state to RUC.
- **Focus on net revenue.** Analysis of RUC and other revenue sources is not complete without subtracting losses due to evasion and collection costs. This analysis can grow more robust with time and data, but it's important to subtract at least nominal costs for these factors, using the ranges indicated above for varying scenarios, and updating them as new information about experience-based RUC program costs becomes available.

¹ ODOT's Commerce and Compliance Division does not report the cost to collect the weight-mile tax distinct from other functions like licensing and safety enforcement. The 8 percent figure includes weight-mile tax collection and enforcement and all other functions of the division.

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2.3 Evaluating Economic Impacts

Introduction and Description

Introducing RUC payments would have notable economic impacts for individual drivers. Individuals and commercial interests would be faced with a new system of user fees that may or may not replace existing fuel taxes. The specific impacts would depend on how exactly a RUC program functions and could vary for different groups. This section will review relevant literature on how individuals may evaluate the economic impacts of RUC.

Broad Industry Scan

Literature on this topic largely focuses on how individuals would perceive the economic impact of a RUC system. This is conducted through public opinion surveys as there are no mandatory RUC programs for individuals. As mileage user fees have become more well known, public support for the concept has increased. Research published in 2017 presented drivers in the United States with a hypothetical approach to replace fuel taxes with a general mileage user fee; opponents of this scheme outnumbered supporters by four to one (Denvil et al., 2017). A similar study in the United Kingdom in 2016 found more favorable results, with between 59 and 69 percent of participants supporting some form of road charging that would address declining revenue for roads. (ITC, 2016).

The most recent data in the United States shows a growing familiarity with RUC concepts as well as a more favorable public perception. The June 2021 version of the Mineta Transportation Institute's survey of Americans on Federal tax options to support transportation found that about half of respondents support some form of a mileage fee. Specifically, forty-seven percent supported replacing the gas tax with a flat-rate mileage fee of three cents per mile, and fifty-three percent supported a version that charge a rate in line with how much the vehicle polluted (Agrawal and Nixon, 2021). Three quarters of respondents preferred to pay a mileage fee in small installments rather than paying one annual bill (Agrawal and Nixon, 2021). These results indicate that individuals could see a mileage fee in similar economic terms to their current road user fees if they can pay the fee similar to how they pay fuel taxes or for their utilities.

Research suggests that a RUC that is targeted to do no more than replace declining revenue from fuel taxes will not have a significant impact on most drivers. The Hawaii Road Usage Charge Demonstration project has found that under a revenue neutral mileage rate of \$0.008 per mile, more than 92 percent of vehicles studied would have an annual increase or decrease of no more than \$35 as compared to fuel tax payments (HiRUC, 2021). This means that under these conditions, most drivers likely would not experience a significant change in their vehicle-level costs.

Best Practices

- **Orient users towards mileage reporting methods and reporting frequencies that are suitable to their needs.**
- **Set up a payment plan that allows for to small and frequent installments.** If RUC payment is comparable to paying fuel taxes at the pump or monthly utility billing, then drivers will find a change to be less jarring. This would reduce the perceived economic impact.
- **Give users the choice on how they would like to pay for RUC.** Consider different payment modes (pre-pay and post-pay options) and various payment means including cash options.
- **Leverage existing programs** created by DMVs, transit agencies, or tolling agencies within the state to build payment options and payment plans users are accustomed to.

Evaluating Economic Impacts Top References

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2.4 Understanding Distributional or Equity Impacts

Introduction and Description

Transportation contributes to positive as well as negative societal outcomes that can impact different communities to varying degrees. Those who benefit from a transportation initiative may be different from those who bear costs related to the initiative. Thus, when implementing a new policy, disparities and inequities in transportation systems and services should be considered to ensure benefits do not concentrate in specific communities and underrepresented or underserved communities do not disproportionately bear the direct and indirect costs of policy.

The assessment of distributional or equity effects for road usage charging involves defining the relevant dimensions of equity and identifying distributional assessment methodologies relevant for RUC policy

Broad Industry Scan

Definitions: Equity Framework and Equity Dimensions

A clear definition of equity is needed to evaluate impacts of RUC policy and to determine with the appropriate mitigation measures. To evaluate impacts of RUC policy, a useful framework assesses equity across the following dimensions (McDermott et al. 2013):

- **Distributive Equity** mainly relates to the economic dimension of equity and addresses the fair distribution of benefits, costs, risks and responsibilities. Common questions that arise for transportation funding include which populations should pay, how much they should pay, and how and where the revenue collected should be spent.
- **Procedural Equity** relates to the political processes in place (governance, regulations and policies) that allows representation, active inclusion and acknowledgement of stakeholders in the decision-making process.
- **Contextual Equity** relates to the pre-existing political, economic, and social conditions that enable or limit the ability to include certain groups or persons in the decision-making process

In addition to those high-level dimensions, more granular definitions of types of equity can be used to evaluate taxation and transportation funding initiatives (Raux and Souche, 2004):

- **Horizontal equity** relates to the “fairness” or “equality” principle where everyone is taxed the same for the same usage.
- **Vertical equity** considers the ability to pay of different population segments and the relative burden imposed on them. It considers social inequities and recommends spending more

3 dimensions of social equity

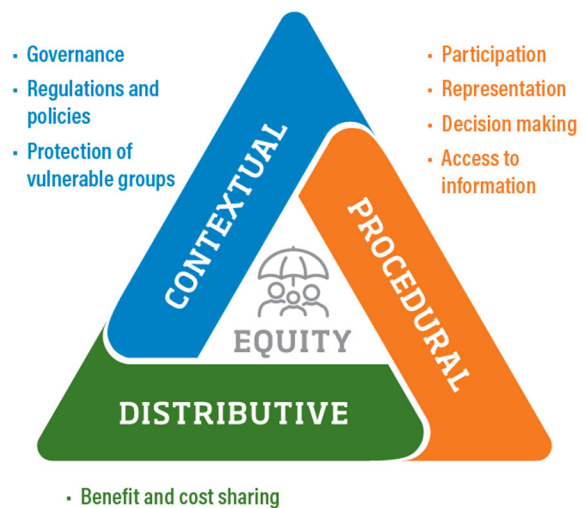


Figure 1- The Three Dimensions of Social Equity

revenue on the most disadvantaged groups. It specifically focuses on the impact of the costs of a new initiative on low-income or minority populations. (Thoebald, 2001).

- **Vehicle weight equity** considers impacts of different vehicles on the road based on their weight. It follows the “polluter pays” principle where each road user pays according to the amount of wear and tear their vehicle imposes on the road.
- **Geographic equity** considers impacts based on where people live or work. It factors in the driving patterns, distance driven by people who live in different geographic areas and ensures that rural populations are not disproportionately impacted compared to urban populations.
- **Cross-generational equity** considers impacts on future generations and identifies impacts on different age groups – in particular youth, adults and seniors – depending on the type of vehicles they drive or driving patterns.
- **Systems equity/operational equity** considers the ability to interact or comply with system and operational requirements. It considers accessibility and affordability of technology required to comply with reporting requirements, flexibility of payment systems for different user profiles, and the level of time and effort needed to comply with overall system and operational requirements.
- **Process equity** concerns the ability to participate in or shape policy. It includes the procedural and contextual equity dimension and relates to the representation, inclusion and recognition of diverse stakeholders in the decision-making process.

Distributional Assessment Methodologies and Frameworks

Two comprehensive frameworks for a distributional impact assessment are:

- The Australian Transport Assessment and Planning (ATAP) Guidelines Steering Committee has published useful guidelines to assess distributional or equity impacts in a five-step process that involves community engagement and participation. The process includes identifying populations impacted by road usage charge initiatives (Scoping), establishing profiles of these populations in socio-demographic terms by defining population segments (Profiling), characterizing the impact (Impact Characterization) and measuring the extent to which the impacts to these population segments are positive or negative (Analysis). These steps culminate into the preparation of mitigation strategies to address equity impacts or concerns (Preparation of mitigation strategies). Each of the five steps focus on deep community engagement and participation.
- NCHRP provides a complete Guidebook and Toolbox for assessing environmental justice and implications of toll implementation and rate changes. It outlines a comprehensive 8-step process framework used for typical transportation planning that includes framing the project, identifying applicable requirements governing decisions, recognizing relevant decision-makers and stakeholders, scoping the approach to measure and address impacts, conducting impact analysis and measurement, identifying and assessing mitigation strategies, and conducting post-implementation monitoring.

Quantitative and Qualitative Techniques to Estimate Distributional Impacts

- Both the ATAP Guidelines and NCHRP Guidebook cover various quantitative and qualitative techniques to estimate distributional impacts. The relevant techniques include equity weights to incorporate the notion of fairness into economic analysis, social impact assessment of transportation initiatives, equity impact analysis, evaluation of cumulative impacts, stated preference surveys, spatial analysis techniques and microsimulations.

Frameworks and Methodologies Used in RUC Pilots

RUC pilot projects conducted in Washington, California and Hawaii have built on these frameworks, using quantitative and qualitative techniques to develop comprehensive approaches to distributional impact assessments. Approaches for RUC have included:

- Baseline conditions assessments conducted at the beginning of RUC projects to paint a quantitative picture of the current situation before introduction or testing of a policy. It includes analyzing data from sources such as the Census database, vehicle registry database and other state revenue collection systems, and uses of current state transportation revenue, demographic analysis of the state population, and customer preferences.
- Identification of key stakeholders and populations impacted through outreach efforts to key stakeholders and members of the general public. Stakeholder groups have typically included legislators, industry experts across the transport industry including automakers and technology companies, public facing organizations that represent community group, advocacy groups, consumer associations representing drivers (e.g., AAA). Part of the identification step is about reaching out to stakeholders to understand the communities they represent and obtain recommendations on other relevant stakeholders or community groups that should be included in the conversation.
- Developing socio-economic profiles to capture characteristics of the communities impacted by RUC policy. Characteristics for consideration typically include socioeconomic status (e.g., income, level of education, employment status, mobility characteristics), demographic factors (e.g., age, gender, race/ethnicity) and household characteristics (e.g., size, composition, number of vehicles)
- Characterizing and measuring the impact on different communities by conducting baseline attitude surveys to gauge public sentiment and understanding of policy impacts. This process consists of conducting public opinion research through targeted online surveys of populations of interest.
- Engaging communities to collect public feedback through community meetings or townhalls to allow local officials to share ideas with community members and build awareness on RUC research initiatives; conducting focus groups for collecting feedback from smaller groups of stakeholders, and workshop activities to drill into specific aspects of the policy, operations or systems. Community engagement culminates with a pilot participation phase to engage deeply with members of the public and stakeholders. Pilot participants get exposure to policy, systems and operations, which allows them to gauge time investment needed to comply with the policy, explore mileage reporting options and provide feedback on improvements for an operational RUC system.

- Conducting stated preference surveys to inform equity evaluations that can assess participant preferences on mileage reporting options, payment frequency options and alternatives to RUC policies that might be considered.

Best Practices

The following best practices for evaluating equity impacts have been identified in pilots and programs:

- **Leverage both quantitative and qualitative methods** for evaluating impacts of new policies on underserved and underrepresented populations.
- **Constitute a project advisory group with diverse stakeholders** including equity stakeholder groups that represent underserved and underrepresented communities.
- **Design community engagement processes that facilitate community leadership and the inclusive participation of traditionally underserved and underrepresented communities.**
- **Seek to actively include and empower community members in their environments** using focus groups and interactive workshops to understand how they would interact with a new policy and seek meaningful input on possible RUC implementation strategies and their impacts.
- **Engage diverse user groups in pilot testing efforts** to give them more exposure to RUC policy and gauge their understanding on impacts.
- **Develop a transparent communications process** leveraging public facing media outlets, websites, social media and newsletters to inform stakeholders and user groups on pilot test findings research outcomes.

Understanding Distributional or Equity Impacts Top References

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2.5 Analyzing Legal Issues and Vulnerabilities

Introduction and Description

As states study RUC, they uncover a range of legal obstacles and vulnerabilities associated with these new methods of revenue-raising. Thus, for a new funding policy to have longevity, these legal obstacles must be identified and evaluated in order to overcome them.

Broad Industry Scan

The discovery of new legal issues is common with the implementation of new policies, particularly transformational policy, such the wholesale reform of the way states fund transportation projects. Some of these legal issues are relatively minor; however, some are more significant. Generally though, the issues fall into several broad categories.

- **Privacy and data sharing.** Arguably, privacy and data sharing constitute the most significant legal, policy and public relations challenge in a RUC system. Because a road usage charge is premised on charging a user by his or her usage of the road system, it inherently relies upon knowing where a user is when he or she is on the road. Thus, significant privacy concerns are implicated in the tracking and sharing of this information. While no state has been able to resolve all the privacy issues, several states have taken steps towards resolving some by proposing enhanced security measures for data protection, exempting certain data from disclosure, and providing remedies for those persons aggrieved by disclosure of information.
- **Rate-setting.** In order to implement a RUC system, it's likely that a state legislature will need to statutorily authorize agencies to begin the process of setting rates for the use of roads. As such, the agency charged with rate-setting and collection oftentimes must go through rulemaking in order to fully implement the legislature's directive. Setting the actual rates for the usage of a road facility, what agency is tasked with collection of the taxes or fees, and how that agency will collect those fees are all rate-setting challenges.
- **Interoperability and multi-state collection.** Another significant challenge with the implementation of a RUC system is its interplay with other states. Roads frequently cross borders, as do the users of those roads. Having a system that can determine when a user is using one state's road versus another state's road is critical to ensuring that state is receiving the revenue for the use of its road. This has forced neighboring states, and even coalitions of states, to work together to resolve inter-state issues around the collection and distribution of revenue from a RUC system.
- **Characterization of revenue as taxes or fees.** Whether a charge is characterized as a tax or fee has statutory and constitutional implications. The power to tax is vested in the legislature, which has broad authority to do so. The authority to impose a fee is narrower in scope and invokes the police power that the government has in order to regulate certain activities. While a fee oftentimes is more politically palatable because it does not involve the word, 'tax,' it may not always be sufficient to implement a policy involving such a financial levy that applies to nearly every person. Thus, given the nature of the road charge and to whom it applies, classifying a road charge as a tax may vest agencies with authority to implement the charge more effectively and efficiently.

- **Role of Federal Government and constitutional concerns.** As states are contemplating a RUC system, constitutional questions and questions about what role the federal government will play in a RUC system have arisen. First, some states have raised concerns that a RUC program would violate the Commerce Clause of the U.S. Constitution. The United States Constitution grants to Congress the authority to regulate interstate commerce and this power places a dormant restraint on the ability of any state to regulate or tax interstate commerce. Nevertheless, when Congress is silent regarding an area of commerce, the states have certain abilities to place impositions on interstate commerce, especially regarding taxation. Most literature is in agreement that a RUC system would operate similar to that of current fees and taxes that are in place and be upheld as not violative of the Commerce Clause.

The second issue that has been briefly mentioned in literature is the possibility of the federal government instituting a RUC system. This could operate similar to the current fuel tax regime—there is a federal fuel tax and a state fuel tax with the federal government collecting the federal fuel tax and distributing it to states. Each individual state decides how and where to spend its fuel tax revenue. Nonetheless, questions have been raised about how to implement both a statewide and federal RUC system.

- **Limitations on the use of revenues.** In some states, revenue from the collection of the fuel tax is constitutionally dedicated to transportation projects. In other states, the legislature is free to direct that revenue elsewhere. Some states have used the constitutional amendment to dedicate certain fuel tax revenue to transportation projects as a way to demonstrate to the public that transportation dollars are being used effectively and efficiently. This is particularly true when there is action towards an increase in transportation funding. Similarly, with the implementation of a RUC system, the legislature must decide where revenue from this system is directed. If there is already a constitutional amendment directing fuel tax revenue to transportation projects, changes may need to be made to ensure that RUC revenue is included in that constitutional guarantee. Generally, limitations on the use of revenue are not an obstacle to implementing a RUC program, and there is tends to be broad support for transportation revenues to go to transportation projects.
- **Program implementation, administration, and enforcement.** Currently, the issues surrounding the implementation, administration and enforcement are some of largest and most significant barriers to implementing a RUC program. Most of these challenges are logistical in nature but legal obstacles can be embedded within. For example, once a state decides on a rate, how does a state government go about charging a user? Does the state require monthly, quarterly or yearly payments? If a user does not pay the fee, what kind of enforcement mechanism does the collecting agency have? The legislature will likely need to put these mechanisms into law, and the agency overseeing the program will likely need to undertake a significant amount of rulemaking. There are numerous other questions like these that will need exploration and examination.

Best Practices

Most of the legal issues inherent in implementing a RUC system have been identified, and states are actively exploring solutions to them.

- **Customized problem solving.** For some legal challenges, a universal approach is not appropriate. Instead, a state-by-state strategy that recognizes the uniqueness of each state

can be more helpful. For example, privacy and data-sharing challenges are complex. A rural state *may* be more resistant to location and data collection whereas a more urban state *may* be more open to certain data being collected. These are broad generalizations that are not necessarily universally applicable but represent the fact that every state may have different political, geographical and social factors to take into consideration.

- **Repurpose policies that have worked.** It is likely that a state has considered an issue and drafted model legislation. If legislation has not been drafted, the agency that has considered the particular legal issue may be able to offer guidance on dealing with the legal issue. Using policies from states that have come before can be helpful.

Analyzing Legal Issues and Vulnerabilities Top References

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2.6 Designing Compliance and Enforcement Solutions

Introduction and Description

Having effective compliance and enforcement solutions is vital to the success of large RUC programs (Binder 2019). As a more transparent tax than the fuel tax, and as a tax collected directly from the taxpayer instead of at the distribution rack, RUC may be subject to more fraud attempts than the fuel tax. It's worth noting that the fuel tax is difficult to evade, though it does occur. RUC compliance and enforcement solutions have not been widely studied, as RUC programs in the United States have largely been voluntary (Milestone 2021).

Compliance refers to efforts to encourage RUC payers comply with the system. Enforcement refers to efforts to detect and penalize evasion. Compliance and enforcement efforts should prevent both general evasion, which could be attempted by all RUC payers regardless of mileage reporting method, and mileage reporting method-specific evasion.

Broad Industry Scan

There is almost no literature on RUC compliance and enforcement. Literature from adjacent industries—tolling, DMV fees, registration enforcement—can act as a supplement (such as tolling, see Kalauskas 2019). The most comprehensive study of RUC enforcement was Milestone's 2021 report for RUC West, which is discussed below.

General evasion methods and their primary prevention methods are illustrated in Table 1:

Table 1 Evasion Methods and their Primary Prevention Methods

Evasion Method	Primary Prevention Method
Failure to register vehicle with DMV	Registration enforcement, including for out of state vehicles domiciled in state
Failure to enroll vehicle in the RUC	DMV checks that required vehicles enrolled
Failure to make payments	CAM sends late notices, penalties
Moving out-of-state without making a final report / payment	Require prepayment/require deposit for post-payment); Don't issue registration refunds till final payment made
Vehicle scrapped/abandoned without making final report/payment	Require prepayment/require deposit for post-payment; Require scrapyards check RUC status; Add RUC owed to vehicle abandonment fines

Mileage reporting evasion methods and their primary prevention methods are illustrated in the Table 2:

Table 2 Mileage Reporting Evasion Methods and their Primary Prevention Methods

Mileage Reporting Method	Main type(s) of evasion	Primary Prevention
Distance Permit	Overrun permit	Spot enforcement, Annual checks
Odometer Image	Manipulate image, Fail to submit image	Image manipulation detection, reminders, penalties
Safety Inspection	Bribery	Random audits
Plug-in device	Leave device unplugged	Reminders, penalties
Native telematics	Not update login credentials	Reminders, penalties

When evasion is detected, enforcement activities begin. For initial minor infractions, a warning letter may be sufficient. For continued infractions, penalty fines may be appropriate. Only in severe cases should harsher penalties be used, such as vehicle registration holds or sending outstanding RUC owed to a collections agency. Such penalties may have disproportionate impact on low-income individuals, who may need their vehicle to work and earn money. For that reason, driver's license suspensions may not be considered appropriate penalty

Best Practices

The following are best practices for compliance and enforcement.

- **Begin compliance and enforcement efforts with a plan.** The plan can describe how to develop RUC-enabling law, regulation, and operations to include compliance and enforcement measures.
- **Design the RUC system making compliance easy** and enforcement unthreatening to compliant RUC payers. For example, begin enforcement notification with warning letters. For minor offenses, issue only warning letters on the first violation. For minor offenses, consider waiving the penalty for the first evasion instance.
- **Monitor regularly and perform audits as necessary.** For example, validate a limited percentage of odometer readings through a VIN lookup service in order to prevent and detect odometer rollback.
- **Consider a pre-pay or wallet-based payment system** with a required deposit for post-pay.
- **Transitioning with the gas tax in place** allows for sufficient time to improve and refine RUC compliance and enforcement measures as the system matures.

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2.7 Assessing Organizational Requirements

Introduction and Description

When transitioning a new policy from concept to implementation, the administering agency of government faces many organizational needs to stand up and operate the program, including setting up fee collection systems, enforcement programs, and contracting with vendors; integrating technologies into existing related programs; establishing customer support and general communication tools; and hiring and training staff. Given the wide range in competencies, capacities, and fitness within and across state governments, many alternatives exist for designing the organizational aspects to support RUC implementation.

Any government evaluating the establishment of a new RUC program must review core organizational needs to help analyze which agency is best suited for program oversight and management, then design an organizational structure that meets said agency's needs. Some state DOTs have been responsible for RUC program management, while other states have placed the responsibility with their Department of Motor Vehicles. Different models for program governance structures can be tapped based on the needs and existing strengths of a given agency. Any opportunities to cost-share with other programs with respect to cost of collection should be evaluated, such as by developing back-end systems that can be shared with other states or leveraging shared technologies (e.g., AASHTOWare model). Collection of other transportation fees like parking, tolling, and congestion pricing, either by said or partner agencies, should also be evaluated for cost share opportunities.

Broad Industry Scan

The few enacted RUC programs as of 2021 offer a range of approaches to organizational design. Different agencies are responsible for light or heavy-duty vehicle charging across existing programs, with different approaches to procurement.

- **Light Vehicle RUC Organizational Models.** In Oregon and Utah, the state legislatures entrusted RUC programming to the state DOTs, and in both cases the groups operating the RUC programs coordinate closely with their respective state vehicle registries. In Oregon, the DMV is part of Oregon DOT.

Oregon organized the RUC program under the agency's Office of Innovation, a division with independent procurement authority to maximize flexibility in pursuing innovative delivery approaches. The Office of Innovation maintains a small staff devoted to the RUC program but enjoys the flexibility to pursue a variety of contracting approaches to make the most of market offerings. Utah DOT similarly organized its road usage charge program within its group responsible for innovation and technology, though procurement of vendors followed Utah's standard process.

In Virginia in 2020, the legislature enacted RUC alongside a new vehicle fee graduated by fuel economy and directed the DMV to implement both fees. In Oklahoma, which does not yet have an operational program, legislation passed in 2021 charged the DOT with the study of a RUC program, while the Department of Taxation was authorized to be the agency responsible for administering any potential future operational RUC program.

- **Heavy Vehicle RUC Organizational Models.** Among operational heavy vehicle RUC programs in Kentucky, New Mexico, New York, and Oregon, all four are organized within the heavy vehicle regulating division of each state DOT. Connecticut, which enacted a weight-mile tax in 2021, directed the state Department of Revenue Services to operate the program.
- **Light and Heavy Vehicle RUC Organizational Model.** New Zealand's RUC program, which covers both light and heavy vehicles, is operated by the same division of the New Zealand Transport Agency, in collaboration with New Zealand Police for enforcement matters.

Regardless of whether the administering agency is a state DOT, DMV or related agency, common themes and challenges emerge related to organizational considerations:

- Balance between private sector and institutional staff resources. Most all agencies rely on some form of private sector assistance to establish and operate RUC programs, from working with technology vendors to actual programmatic oversight. Over-reliance on the private sector can lead to a dearth of institutional knowledge and skillsets needed for program oversight. Knowledge transfer can be a challenge for most public agencies, which is exacerbated when only a small subset of agency staff oversees a broad team of consultants and vendors running a program.
- Required DMV coordination, reliance on antiquated systems. In cases where an agency other than the DMV oversees a RUC program, close coordination is required to access the state's vehicle registry. DMVs (and state DOTs) often are using older systems for management of vehicle registries and lack financial resources for system modernization, which can be a challenge when setting up a new system.
- Enabling legislation considerations. RUC programs and the ability to collect a RUC will always require legislative action of some kind. This can have major impacts on the amount of authority delegated to the executive branch for program oversight, which has the opportunity to be very open ended or highly prescriptive. Allocation of sufficient (or insufficient) financial

and staff resources to establish and maintain a new RUC program can also ease or slow the startup phase, especially if existing systems needed to support the program are antiquated. Any RUC program will also need enforcement provisions, which may or may not be included in the legislation.

Best Practices

Best practices for organizational assessment of RUC stand out.

- **Engage early with potentially impacted agencies to understand systems, possibilities, constraints, opportunities.** Many agencies are likely to be involved in establishment, operations, and oversight of a RUC program. Proactive engagement will strongly support effective organization design in the startup phase, with clear lines of communication and coordination in place for implementation.
- **DMV will be essential everywhere and their capabilities can be leveraged, even if not responsible for RUC program oversight.** As keepers of motor vehicle registries, DMVs will have an important role to play in RUC programs. While some state DOTs have oversight of these functions, others do not, which will require additional coordination. Constraints or dependencies on antiquated systems should be avoided for optimal functionality and service provision.
- **Leverage existing public sector knowledge (with caution).** Explore involvement of state agencies with experience or operations with broad-based customer tax accounts to find efficiencies in startup and operational phases. While tolling agencies can be viable partners due to their experience with customer accounts, toll operations are not an ideal starting point. RUC is closer to DMV-related vehicle fees than tolling.
- **Private sector innovations should be harnessed without overpowering public oversight.** The private sector can often be tapped for technology innovation and outsourcing of programmatic support, allowing a RUC program to be nimble and scalable. However, strong public sector procurement and oversight is needed for management.
- **Align incentives.** As the cost of collections decrease, the revenue potential of RUC systems will grow substantially over time. Agencies with revenue to gain will be incentivized to organize effectively and efficiently for RUC program delivery.

Assessing Organizational Requirements Top References

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2.8 Light, Heavy and Commercial Vehicles

Introduction and Description

There are a host of technical, policy and communications challenges that vary considerably between different groups of vehicles and their users. Most experience in the United States in

implementing and piloting RUC in recent years has focused on privately owned light vehicles, particularly alternatively fueled vehicles such as electric and hybrid vehicles. This is understandable given most developments in new engine technology have been on such vehicles, and most of the vehicle fleet consists of light private vehicles. However, any technical and policy solution for such vehicles will not be suitable for heavy vehicles and may not necessarily be applicable for light to medium duty commercial vehicles either.

The key issues being:

- Choice of technology to report distance, as heavy vehicle RUC requires reporting of changes in configuration, as well as mileage data.
- Policy design, because the range of vehicle weight and road damage impact between differently sized heavy vehicles requires a more complex rate structure than for light vehicles.
- The effect of higher mileage fees (for heavier vehicles) and commercial incentives to save costs, requires system design to be more robust in preventing and detecting fraud
- Communication and engagement of policy for commercial vehicle owners is predominantly with businesses rather than private citizens, with a different set of concerns and issues.
- The operations of heavy and commercial vehicles tend to involve much higher regular mileage per vehicle than private vehicles, but also a more diverse range of operating patterns, meaning impacts will likely to vary considerably. Understanding of these impacts may be difficult without adequate data about trip patterns.
- For larger heavy vehicles, interstate travel can be routine, and some commercial vehicles travel considerable distances off public roads. This indicates that charging by location is likely more important for heavy and commercial vehicles than private light vehicles.
- Effects of engine technology on fuel efficiency and choice of energy source are slower for heavy vehicles, but the impacts will be much higher on revenues because they pay proportionately much more per mile than light vehicles.

Broad Industry Scan

Application of RUC to heavy and commercials can be seen in a small number of jurisdictions, and only two pilots in the United States have tested the application of RUC to heavy vehicles, albeit in a very limited context.

Key experience is seen in:

- Four states have revenue-collected weight-mileage taxes for heavy vehicles. Kentucky, Oregon, New Mexico, New York. They operate at varying degrees of complexity, and only Oregon's system is used to replace revenue from state fuel tax and offers a choice to use GPS-based telematics technology to automate measurement and collection of the weight mile tax.
- Eleven countries in Europe and New Zealand all have RUC systems that apply to heavy vehicles, although eight of the systems in Europe only measure road use on major highways. Most of these systems use some form of GPS telematics devices to measure and report road

use, some with open markets of competitive account managers, with interoperability of technology and accounts across multiple national borders. All, but New Zealand, have used RUC on heavy vehicles to replace time based prepaid permit systems of paying for road use.

- Two small scale RUC pilots in the United States have included heavy vehicles: California and the Eastern Transportation Coalition. In both cases fewer than 60 vehicles were included, and only a very basic fee structure was tested, with a single type of technology. Australia has also recently run a small-scale pilot with 259 heavy vehicles using commercial telematics equipment with invoices issued comparing fuel tax and registration fees to RUC and is now developing a larger pilot with 1000 heavy vehicles. (Wilson 2019)

Except for Oregon, the US weight mileage tax systems are in many ways legacy tax programs with low levels of technical or policy sophistication. Non-compliance in New York is estimated at 33-50 percent, but in Oregon it is estimated at 3-7 percent (Congress of the United States 2019) which is similar to the range seen in New Zealand.

Europe has a mature market and experience in delivering heavy vehicle charging systems, but with only Switzerland, Iceland and Belgium charging vehicles on all public roads (and Belgium charging a zero tariff on many of them), and none using it to replace fuel tax, the experience has more limited application for the conditions in the United States. Although a small country, akin to the population of Alabama, New Zealand implemented RUC on all heavy vehicles, but also light vehicles including commercial vehicles that use diesel, and abolished excise duty on diesel. It operates in parallel to gas tax on vehicles that use gasoline (but do not pay RUC), so has some useful lessons that may be applied in the US context.

Best Practices

Both policy and system design for RUC for heavy and commercial vehicle users' needs to consider the different interests and incentives around commercial vehicle use compared to private vehicle use and ownership. Commercial vehicle users' livelihoods depend on using the roads, and how much they pay can affect their competitiveness in whatever industry they operate in. As road users, they are likely to travel greater miles on average per vehicle than private vehicle owners.

Best practices in developing RUC for heavy and commercial vehicle owners include:

- Engage with the sector and propose a policy package that considers the sector's ability to adjust to changes in how they pay and how much they pay. Some jurisdictions that have introduced RUC for heavy vehicles have spent years transitioning to avoid sudden financial impacts on some users.
- Consider using RUC to reform and replace other taxes applying to heavy vehicles, like tire, weight, and high registration fees. It is an opportunity to simplify taxation of commercial vehicles, and shift from fixed fees that don't reflect usage to targeting usage, which better reflects ability to pay and impacts on infrastructure.
- Existing telematics technologies can be adapted to deliver solutions, although they need to be able to reliably collect all of the necessary data, such as configuration changes.
- Offer a location-based method for charging, as commercial vehicle owners with extensive off-road and out-of-jurisdiction road use will want to avoid paying for mileage they don't need to.
- Develop a rates table that reflects infrastructure cost recovery and rewards configurations that lower wear and tear. There is some evidence that having sophisticated, but not complex rates tables that reward using more axles for the same weight can reduce road damage costs. (Zhao 2015)
- Inform rates tables by an economics-based cost recovery approach, that is regularly updated, to reduce arguments about how much should be paid. Oregon, New Zealand and most European countries with RUC conduct regular cost-recovery studies, or update models to inform rate setting, to reduce the risks of politics undermining revenues or favoring some segments of the commercial vehicle fleet.
- Make vehicles that rarely use public roads exempt from paying RUC, because the costs of applying and enforcing RUC on such vehicles are prohibitive and there is little economic benefit in applying RUC to such vehicles.
- User choice in account management can lower costs to government and to users, and encourage innovation

Light, Heavy, and Commercial Vehicles Top References

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2.9 Designing Program Transition Strategy

Introduction to and Description of the Issue

A well-planned, well-executed RUC system can be a sustainable source of funding to supplement and eventually replace the current motor fuel taxation model. State departments of transportation (DOTs) and commissions, along with other state and local agencies and special task forces, have been actively exploring alternative funding mechanisms like RUC for over two decades. Of the over 38 states exploring RUC, most are in research or pilot and demonstration stages. As of 2021, only three states, Oregon, Utah, and Virginia, have implemented legislatively enacted RUC programs that are collecting tax revenue from RUC in lieu of gas taxes and/or special registration fees (Figure 2).

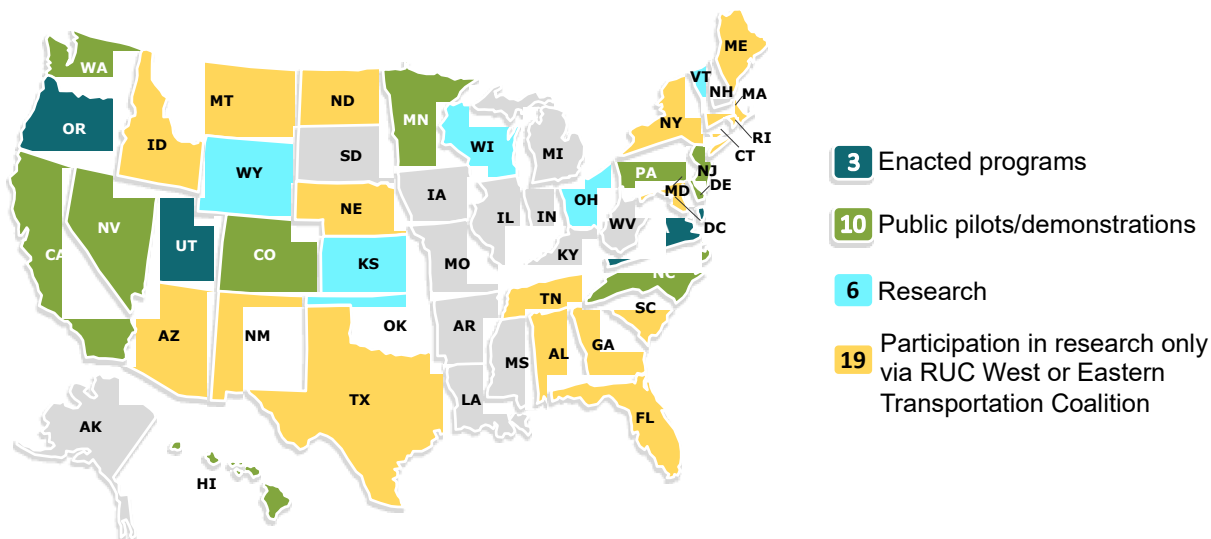


Figure 2- RUC Initiatives Across the United States

Internationally, New Zealand has operated a large-scale RUC system for heavy vehicles and diesel cars since the 1970s, while Australia is actively exploring a distance, weight, and configuration-based heavy vehicle charge to replace its existing system of diesel taxes and registration fees.

To successfully advance RUC from concept through pilot testing to implementation, states must overcome several impediments. To do this, policymakers will need to craft implementation and transition strategies.

Broad Industry Scan

Key Impediments

The key impediments to a widespread transition from motor fuels taxes to RUC tend to fall into the following categories:

- 1. Lack of public acceptance.** Challenges building a convincing case for RUC to a skeptical public, especially related to privacy and equity concerns.
- 2. Lack of political support.** Insufficient political support to change policy due to perceived political risk.

3. **Complexity and Costs.** Technical complexity to collect mileage data, complexity and high costs involved with administering the program.
4. **Debt-repayment or bonding constraints.** Some states, like the state of Washington, have legal obligations to repay outstanding bonds from gas tax revenue. This constrains options to transition completely out of the state's gas tax until all outstanding bonds that pledged the gas tax revenues have been paid off or restructured (WSTC Vol. 1).

Four Stages of Maturity

RUC programs can be generally categorized into four stages of maturity – research/planning, setup, transition/ growth, and ongoing operations.

- **Research/planning** encompasses all the activities prior to the enactment of a law creating an operational RUC program. These include foundational exploration and analysis, background research needed to understand the local political context and the meetings and discussions that create the conditions for passing a RUC bill. This stage sometimes includes public demonstration or pilot testing.
- **Setup** starts after enabling legislation is enacted and encompasses the effort of government and private sector partners to go through design, development, testing, public communication, and finally launch of a RUC program into existence. Oregon, for example, set up its OReGO program from 2013 to 2015, while Utah set up its program from 2018 to January 1, 2020. Virginia is setting up its program now.
- **Transition/growth** covers the period from initial launch until a program reaches a critical mass of hundreds of thousands or millions of vehicles, with operational features, costs, and systems largely settled into place. Given the modest scale of most RUC programs in existence today, we expect the transition to critical mass will take at least a decade for most states.
- **Ongoing operations** describes the “steady state” phase once critical mass has been reached.

RUC Transitions

RUC transitions across the four states of maturity have mostly been slow:

- In Oregon, the state legislature created the Road User Fee Task Force (RUFTF) in 2001 to examine alternatives for replacing Oregon's fuel tax as the primary source of revenues for maintaining, repairing, and building Oregon's roads. In the research and planning stage, the state conducted stakeholder and public engagement, revenue analysis, technology evaluations, organizational structure studies and policy analysis, before conducting a series of small-scale pilots in 2006 and 2012 (299 and 50 volunteer vehicles respectively) (ODOT 2017). The second pilot addressed issues raised in the first pilot, and leveraged lessons learned from other studies. In 2015, the OReGO became the first fully functional RUC program in the country (ODOT 2017). In 2020, RUFTF introduced a bill for the 2021 Oregon state legislative session that requires all model year 2027 and newer passenger vehicles with a combined city/highway fuel economy of over 30 miles per gallon model to enroll in RUC (ODOT 2021, HB 2342). This bill ultimately did not make it to a vote.
- In Washington, the Washington State Legislature gave authority to the Washington State Transportation Commission (WSTC) to explore the feasibility of transitioning from a gas tax

to a road user assessment system of paying for transportation. From 2012 to 2016, the WSTC conducted pre-pilot analysis and design activities. In 2017, WSTC recruited pilot participants for a live pilot test which was conducted from 2018 to 2019, followed by pilot evaluation and final reporting activities from 2019 to 2020. WSTC research efforts continue and will lead to more pilot efforts that are estimated to start in 2022.

- In Utah, the transition to a small-scale RUC program has been comparatively rapid. In 2018, the Utah State Legislature directed the Utah Department of Transportation (UDOT) to establish a Road Usage Charge Advisory Committee and establish an opt-in RUC in lieu of a statutory flat fee imposed on EVs, plug-in electric hybrids, and gas hybrids (UDOT). Policymakers and politicians leveraged research from other states to develop policy, enable legislation, and set-up systems to have the relatively small-scale (< 5,000 drivers) RUC program implemented by January 1st, 2020 (UDOT).

Best Practices

- Starting small and transitioning gradually affords the Legislature and state agencies time to make policy adjustments and refine the specifics of a RUC system in a controlled manner. By remaining open to evolution in transportation technologies and emerging business models, states benefit from the ability to apply emerging innovations to the RUC program as it slowly transitions away from the gas tax (WSTC Vol. 1).
- Begin a gradual transition to RUC. Implementation options should allow RUC to gradually scale up over time, offering drivers an opportunity to try the system and recommend further improvements while it is still in an early implementation stage.
- A start-up phase of RUC should include a limited number of vehicles to facilitate testing and system improvements.
- State agency vehicles should be included in an initial RUC start-up phase to allow continued testing, especially for privacy measures. State agency vehicles make ideal test vehicles, as they represent a diverse vehicle fleet owned, managed and used by public employees to conduct official state business.
- Consider the fully realized RUC program during transition phases. The optimal transition pathway for expansion of a small initial RUC program to a full road usage charge program depends on the preferred final RUC system delivery configuration.
- A transition strategy should lay out, in advance, the final end state to which the program aspires in order to assure that the steps taken lead to the aspiration rather than to a dead end (D'Artagnan A-13). The optimal transition pathway for expansion of a small RUC program to a fully implemented one over time depends on the preferred final RUC system delivery configuration (D'Artagnan A-13).
- Coordinate with other jurisdictions on how to collect RUC revenue from out-of-state drivers once gas taxes are completely phased out.

Designing Program Transition Strategy Top References

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2.10 Communication and Engagement

Introduction and Description

As with the various technological elements, transition strategies, policy developments, and logistical and organizational considerations, effective communications and engagement strategies are critical for the successful implementation of RUC programs.

Successful communications and engagement are essential as part of each element of RUC implementation. While developing communications strategies as a stand-alone element is important, these strategies are often most successful when integrated into the technical and policy development element of a RUC program.

Broad Industry Scan

As with any major policy and funding shift, communications are an important element of any successful RUC program. RUC programs with proactive and comprehensive communications strategies were most successful, overall, while programs that were less resourced and more reactive were less successful in meeting their goals and/or experienced more negative perceptions of RUC.

The RUC-related communications challenges that are most often noted include a lack of understanding by the general public of how transportation projects and programs are funded,

skepticism of government-led initiatives, especially related to funding and financing, and concerns around personal privacy and data security.

Best Practices

Communications and engagement strategies and practices are deeply rooted in local and regional social, political, economic and cultural climates where RUC programs are under consideration. As such, best practices and lessons learned from existing RUC programs must be taken into local and regional contexts – any agency or jurisdiction considering a transition from fuel taxes to RUC must have a good understanding of these local and regional themes, and how to apply them in their locations.

The following best practices for communications and engagement for RUC programs are rooted in baseline communications best practices for major policy and infrastructure projects, and tailored with an understanding of the unique communications needs for RUC:

- **Set clear, concise and consistent communications-specific goals.** RUC-specific communications strategies should be anchored by clear, concise and consistent goals that directly relate to the overall RUC program goals. These goals should remain constant throughout the RUC program’s timeframe, while specific communications plans and strategies will constantly be adjusted and adapted for various phases within the program. For example, the Washington Road Usage Charge Pilot Program developed the following core communications goals in late 2016, which anchored the communications strategies throughout the pilot, which wrapped up in early 2019: (1) Inform and educate the public, (2) Recruit participants into the pilot project from across the state that represent diverse populations, (3) Generate broad understanding for the pilot project among stakeholders, (4) Cultivate balanced and accurate media coverage about RUC and the WA RUC Pilot Project, (5) Assess public opinion before and throughout the course of the pilot.
- **Understand audiences and stakeholders, and the best ways to engage them.** Identifying core audiences and stakeholders, and understanding their communications needs and concerns are critical steps prior to development of tactics or strategies. Methods for understanding and engaging audiences can often start with stakeholder interviews, particularly aiming for early conversations with policy makers, advocacy organizations, and organizations and communities from historically marginalized communities. Additional methods could also include leverage existing relationships RUC program sponsors and advocates may have with existing stakeholders and organizations. It is also essential to conduct a stakeholder gap analysis so that critical stakeholders aren’t missed – such as marginalized groups that have often been left out of early transportation policy questions. Early and frequent conversations with stakeholders and consistent connection points with audiences often lead to a deeper understanding of initial baseline questions and needs, an understanding of other audiences that should be engaged, and a development of trust.
- **Develop, implement and be willing to continually refine a comprehensive communications strategy and tactics.** States and agencies that have utilized comprehensive communications strategies in support of RUC programs (either via pilots or implemented programs) report a higher degree of participation and public acceptance, in contrast with RUC communications programs that are more reactive to negative input and

news. As a RUC program develops, new information and questions will come up, and new audiences will become aware of the program. Successful communications strategies will be to seek new information and be ready to adjust strategies as needed. These strategies should also be directly supportive of the goals, and to seek authentic, engaged relationships with audiences and stakeholders. Through these strategies, RUC project leaders must also be aware of barriers to participation from marginalized groups, and work to minimize and eliminate these barriers and access to participation. While all strategies and tactics employed must be contextual to each area RUC is being considered, several strategies and tactics that have been successful in other RUC programs include: formation and maintenance of a RUC steering committee, or similar body; leveraging traditional, earned media to reach broad audiences with clear, consistent messaging; leveraging paid media, including social media, targeting to specific audiences and groups; developing and maintaining a core interest group, and keeping this group informed at regular intervals.

- **Equity is essential to communications strategies, not an add on.** Equitable communications and engagement are an essential part of any communication strategy and must be embedded into the comprehensive communications plan. As defined in Section 2.4, Understanding Distributional or Equity Impacts, it is important to understand that procedural equity (and the lack of it) is an important component of how inequities can arise in implementing RUC communications plans. To ensure procedural equity, project sponsors and their communications teams must understand and ensure access, representation, active inclusion and acknowledgement of stakeholders that are often marginalized in important transportation policy conversations.
- **Invest in communications and engagement.** The most successful RUC programs have adequately resourced their communications and engagement strategies, ensuring a comprehensive communications and engagement beginning early in a RUC program's development, and continuing through transition and implementation. It is easy to overlook the necessity of comprehensive communications, but to do so can often mean a RUC program's development can go sideways or need to be resourced in a reactive way, which often results in higher costs and potential delays.

These best practices are a sound foundation for developing strong, comprehensive RUC communications strategies, although they are not exhaustive. When adopted, these best practices can help lay the groundwork for a successful transition to RUC.

Communication and Engagement Top References

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3. Three RUC Program Case Studies

Case studies offer real-world approaches, considerations, and lessons learned. Three RUC program case studies are presented in this section that will be used throughout the project to help illustrate the application of frameworks, pathways, strategies, and tools. These case studies have played an important role in advancing road usage charge and by studying them, much can be learned and even improved upon by other jurisdictions looking to transition to RUC.

3.1 Oregon

Introduction to RUC in Oregon

Oregon has advanced RUC the farthest within the United States. Since studies began in 2001, Oregon has operated two RUC pilot programs. In 2015, the state launched OReGO, the state's operational RUC program for light vehicles. OReGO currently has 750 vehicles enrolled. Oregon also has a weight-mile tax for heavy vehicles that has been in operation since 1933. The weight-mile tax collects revenue based on the weight and distance travelled by commercial vehicles weighing more than 26,000 pounds, making it effectively a RUC. This case study will review the history, current operations and lessons learned from RUC and the weight-mile tax in Oregon.

How the RUC Program was Developed

The roots of the OReGO program trace to 2001 when the Oregon House of Representative's transportation committee created the Road User Fee Task Force (RUFTF) to study alternatives to fuel taxes. The genesis of this was similar to the current rationales for studying RUC, though based on the conditions at the time. The Toyota Prius had just entered the US market as had some very early alternative fuel vehicles. Legislators on the transportation committee were expecting more of these vehicles to come to market and knew that this would reduce fuel tax revenues. As such, the RUFTF was charged with evaluating all potential revenue generating concepts and making a recommendation for a path forward.

The resulting recommendation was for the Oregon Department of Transportation (ODOT) to operate a RUC pilot program with 299 participants, which started in June 2006 and ended in March 2007. Mileage was collected by technology installed within participant vehicles. The technology had a GPS chip that could identify whether recorded mileage was driven in or out of

state boundaries. When drivers visited one of two designated fueling stations in Portland, the mileage data would be inputted to a DOT-managed database, which would check the data against reports filed later in order to determine what charge would be added to fuel payments. This procedure functioned correctly about 75 percent of the time. State fuel taxes would be deducted for pilot participants. This program was the first of its kind and was composed of new electronic systems that were being tested in public for the first time.

After several years of reflection and further study, a second RUC pilot ran for four months in the winter of 2012 and 2013. This pilot operated jointly with Washington and Nevada; Oregon had 50 vehicles participating and the other two states had 25 vehicles each. This program trialed many of the processes that OReGO currently utilizes. Participants could choose between a commercial account manager and a state account manager to record, register and pay their RUC. The agency developed open system standards to create competition among vendors to provide attractive services, as well as develop better technologies. Mileage data was collected by OBDII plug-in devices, with options for GPS and without GPS, and participants had the option to not have their locational data collected via GPS. This pilot was successful and proved the concept of operating a RUC program. It led to a bill that established OReGO. Senate Bill 810 passed in 2013 legislative session that officially created the framework that was embedded in the program when it launched on July 1, 2015.

OReGO Today

OReGO seeks to address the same issues first outlined by the RUFTF in the early 2000s, which have since come to pass. In 2019, hybrid and electric vehicles accounted for almost 4.4 percent of all vehicles sales in Oregon, second only to California.

The main goal of OReGO is for these vehicles to pay their fair share of road usage. Ultimately, the vision is for the program to become mandatory for all light vehicles in the state except for passenger vehicles rated as less than 30 MPG, which would remain on the fuel tax. OReGO directly ties RUC to the fuel tax revenue lost due to electric vehicles and increasing fuel efficiency. On OReGO's "Why does road funding matter?" webpage, this is explained as follows:

"Oregonians pay 36 cents per gallon of fuel to fund road projects. But, as more cars run on electricity or use less gas, Oregon gets less funding to maintain roads and bridges. OReGO preserves our roads by creating a fair and sustainable funding model that is based on actual use – miles driven – instead of gallons consumed."

OReGO program managers want the public to understand the rationale behind RUC and to understand the role that they play in the maintenance of roadway infrastructure. The importance of driver participation is a pillar of the program's customer-facing messaging.

Fuel Taxes

Oregon was the first state in the US to institute a gas tax, starting in 1919. The current fuel tax rate is 38 cents per gallon. In 2009, the fuel tax was raised six cents. A 2017 law instituted a 10-cent increase in four phases through 2024, which will ultimately bring the state fuel tax to 40 cents per gallon.

How Does It Work?

Many of the 750 vehicles currently enrolled in OReGO are electric vehicles, and in fact are the fastest growing group of enrolled vehicles. OReGO is available only for light vehicles, defined as less than 10,000 pounds. Drivers pay multiple years' worth of registration fees when purchasing a car or renewing their registration. For new cars, the registration period is 4 years; for previously registered vehicles, the registration period is 2 years. Electric and vehicles with a high mile per gallon rate have higher registration fee requirements because of a registration surcharge. If these vehicles enroll in OReGO, the surcharge fees are waived, and they only pay the base registration fee of \$43 per year. As of January 1, 2022, all vehicles enrolled in OReGO are charged 1.9 cents per mile. By law, this rate is adjusted to be five percent of the state gas tax. Participants with fuel-powered vehicles are eligible to receive non-refundable credits for their fuel taxes paid that corresponds to their mileage driven.

Mileage reporting is conducted through devices that plug-in to the OBD port, which most vehicles that were made after 1996 have. This port is only used for diagnosing vehicle repairs, so the device does not burden the driver. The devices automatically record a vehicle's mileage, which is reported to the account manager using the cellular technology embedded in the device. If the vehicle is fuel-powered, the devices can generally record how many gallons of fuel are used and automatically credit fuel tax payments back to the driver. If the actual fuel usage is not recorded, then the account manager uses the combined fuel efficiency rating for the vehicle to determine the amount of the credit. Participants have the choice as to whether they want a device to have GPS capabilities or not. The advantage of enabling GPS is that the device can discern when the vehicle has left Oregon and appropriately adjust the RUC payment.

OReGO uses two private account managers (Azuga and emovis). Both operate as commercial account managers. The state option is also run by a third-party (emovis). These account managers operate slightly different programs, which provides participants with options that can better fit their preferences. Table 3 compares the account managers.

Table 3 OReGO Account Managers

Service	Azuga	emovis	ODOT
Payment Frequency	Pay as you go	Post-pay quarterly	Post-pay quarterly
Payment Method	Credit or debit card	Credit or debit card	Credit or debit card
GPS	Yes or no	Yes	No (by law)
Out of State	Mileage is credited	Mileage is credited	Mileage is not credited
Electric Vehicles	EV compatible	EV compatible	Not EV compatible

This model of account management was designed to encourage innovation in the RUC field, maximize user choice, and reduce state costs. In order to entice participants, account managers strive to make their product simple and easy to use. In addition, both Azuga and emovis provide their users with additional features such as trip logging, vehicle issue diagnostics and parked vehicle locating. Providing multiple options through different account managers makes it easier to entice drivers to enroll in the program. As an example, the ability to set up an account without GPS and to have the ability to choose an account manager could allay the privacy concerns of some drivers.

The enabling legislation included privacy protections like the requirement that personally identifiable information, like trip location data, be destroyed within 30 days after account settlement. Law enforcement personnel must have a warrant to access any such information. The state receives aggregated and anonymized data to support the tax filings by the account managers. In addition to these statutory protections, the OReGO program also requires its account managers to be compliant with payment card industry data security standards and to have an audit done to show it complies with SSAE 18 standards.

OReGO is managed by ODOT and was created through designated legislation. Oregon Driver & Motor Vehicle Services, which administers traditional DMV operations, is a division of ODOT. This makes coordination easier, such as aligning the financial incentives on registration fees for electric vehicles and highly efficient vehicles that enroll in OReGO. Because the waiver may be revoked if the vehicle is withdrawn from OReGO before the end of the registration period without good cause, the DMV also provides enforcement because it then collects the amount of the waived surcharge.

Future Plans

A major next step is to convert OReGO into a mandated system, in which enrollment is compulsory. A recent bill in the state legislature sought to begin this process by requiring all efficient new vehicles sold in 2027 to be automatically enrolled in the program. The efficiency rating that would have resulted in mandatory enrollment was a combined efficiency rating of at least 30 mpg. Another aspect of this legislation would have been to eliminate the non-refundable credits for fuel tax payments for non-electric vehicles. This bill did not make it out of the most recent legislative session.

One notable gap in pushing towards full implementation is related to vehicle weight. As stated earlier, only vehicles less than 10,000 pounds can enroll in OReGO, and the weight-mile tax (see below) applies to vehicles heavier than 26,000 pounds. There has been discussion in recent RUFTF meetings to fill in this gap and open OReGO up to all efficient vehicles below 26,000 pounds or to require them to be part of the weight-mile tax program.

Weight-Mile Tax

The Oregon weight-mile tax was first introduced in 1933. Originally called the ton-mile tax, this tax was implemented because heavier vehicles did more damage to roadways. Since then, rules and tax rates have been regularly updated to fit with contemporary conditions. The most recent major change was in 2014 with the introduction of an electronic reporting option.

The weight-mile tax applies only to vehicles that are heavier than 26,000 pounds, which are typically commercial trucks. Vehicles that cross this threshold do not pay a diesel fuel tax, so the weight-mile tax functions in place of this. The exact rate varies by weight, which is determined by two rate tables. Table A is for vehicles that weigh between 26,001 and 80,000 pounds. Weight rates are divided into bands of 2,000 pounds; the 26,001 – 28,000-pound band is charged 6.54 cents per mile and the 78,001 – 80,000 band is charged 21.5 cents per mile. Table B is for vehicles greater than 80,000 pounds, which charges rates that vary by 2,000-pound weight bands and the number of axles. The lowest rate is 17.01 cents per mile for a nine-axle vehicle that weighs between 80,001 and 82,000 pounds. The highest rate is 30.25 cents per mile for a five-axle vehicle that weighs between 96,001 and 98,000 pounds. A vehicle with more axles will pay a lower rate. ODOT

conducts biennial cost allocation studies on all vehicle classes; one of the outputs of the data collected is used to assess the rate table and make adjustments.

In the first year of enrolling to pay the weight-mile tax, vehicles must report and pay mileage on a monthly basis. After 12 consecutive months of filing without any issues, a carrier can file reports quarterly. Motor carriers with established accounts can file reports and make payments on a dedicated online portal via credit card, charge account or direct payment from a checking account. Motor carriers can also use the EROAD Oregon WMT product to report and pay their taxes. This product is an in-vehicle device that records all relevant information for a trip, including distance traveled, weight/axle configuration and any exempt mileage. The product calculates this data to determine the tax owed and allows for direct payment to ODOT. It was introduced at no cost to the state.

While not explicitly stated, the weight-mile tax functions as a RUC equivalent for heavy vehicles. It charges trucks for roadway usage while also being reflective of the higher levels of roadway damage that heavy vehicles cause. Despite being implemented decades ago, the rationale behind it is the same as one of the core tenets of RUC. The user pays principle has been the bedrock upon which all of Oregon's highway user fees rests.

Policy and Implementation Lessons

Thanks to the tenacity of its program managers and state legislators, Oregon is furthest along on the path to fully implementing a RUC system in the United States. There are several lessons that can be employed by other states.

- **Don't solve everything at once** - The first two RUC pilots in Oregon were very different from each other with the first one focusing on testing the concept and the second focusing on the technical elements. Even now, OReGO is not a mandated system, but it has successfully proven the concept. Proponents of RUC pilot programs could emphasize that studies can proceed without answering every question surrounding RUC, both about policy and implementation.
- **Engage the legislature** - RUC program managers in ODOT met regularly with legislators, both when pilot programs were in operation and not. Eight legislators were participants during the second pilot study, which gave them firsthand experience of how users would engage with the system. This equipped them with the comprehension of how straightforward it was, making them more likely to champion future efforts.
- **Encourage private sector participation** - The account management system and technology that was tested in the second pilot was the result of private sector innovation. Private companies competed over providing better products and services, which benefitted ODOT in that the vendors did a lot of heavy lifting. Meanwhile, users benefitted by having more options to fit their needs. This structure was carried over into OReGO where the account managers have helped with system development and bore the cost of migrating to next generation mileage reporting devices.
- **Update messaging** - ODOT program managers met regularly with constituents and media to explain the rationale for RUC and proactively allay concerns. This did not stop when pilot

programs ended and to this day OReGO regularly refreshes its messaging to keep in line with how the program is functioning and what next steps are.

- **Recognize the impact of the familiarity effect** - As people participate in the program, most of them gain a greater understanding and become more comfortable with the concepts and operations. Regular outreach is helpful in this arena because it increases peoples' understanding. It is particularly effective to meet people in their communities so the messages can be tailored to the audience.
- **Keep an eye on the end game** – as technology evolves, it disrupts funding as evidenced by the increasing fuel efficiency of light duty vehicles. In order to raise revenues from these vehicles, a mileage-based fee will need to be a requirement. Incremental steps can be used to position a jurisdiction for that. For example, Oregon is engaging automobile dealers to educate them on the registration surcharge waiver that is available if a vehicle is enrolled in OReGO so they can accurately calculate and collect fees. This work will be foundational if there is legislation making the OReGO program mandatory starting with a specific model year and type of vehicle.

3.2 Utah

Introduction to RUC in Utah

Although Utah legislators observed the need to replace the gas tax in 2003, and although Utah joined RUC West in 2013, it was nonetheless surprising when the Utah Legislature passed a bill creating the nation's second RUC program in 2018. The Legislature bypassed holding a pilot, instead requiring the launch of a permanently operational RUC program 20 months after enactment of the bill. Utah joined Oregon as the first states to offer RUC in place of additional flat registration fees on alternative fuel vehicles, and innovated several related features of the RUC program, including an annual cap on RUC fees, not charging early enrollees to the program, and an annual reconciliation process to capture miles driven when a vehicle was not equipped with a mileage reporting device. Utah now has the largest light vehicle RUC program outside of New Zealand with approximately 4,000 vehicles enrolled. The legislature has indicated it plans to grow the RUC program to cover all vehicles in the state by 2031.

How the RUC Program was Developed in Utah

Utah's earliest statement on exploring long-term transportation revenue needs occurred in a 2003 Utah Transportation Planning Task Force. Legislators on the task force concluded "... the clear reality that fuel taxes alone cannot support an ever-burgeoning demand for transportation funding..." and so the state should pursue "...more creative means for raising needed funds". Utah's pursuit of such creative means eventually led the Utah Department of Transportation (UDOT) to join the Western Road Usage Charge Coalition (now known as RUC West) in 2013, intending to explore RUC as a potential future replacement of the fuel tax.

In the 2015 general session, the Utah Legislature explicitly endorsed UDOT's exploration of a RUC system. In a major transportation funding bill, House Bill 362, the legislature directed UDOT to research RUC systems and recommend further steps on the potential implementation of RUC in Utah.

In 2017, Utah's Transportation Governance and Funding Task Force recommended that UDOT begin piloting RUC to study its potential as an alternative funding source. In 2018, that recommendation led to Senate Bill (SB) 136, which created a RUC program.

SB 136 (2018) introduced a new alternative fuel vehicle fee, which owners of hybrids, Plug-in hybrids (PHEVs), and electric vehicles (EVs) would pay in addition to their standard registration fee, the fee varying by propulsion technology (hybrid, PHEV, EV). SB 136 also directed UDOT to:

- Design and introduce a RUC that would be paid in lieu of the alternative fuel vehicle fee starting in January 2020
- Form a RUC Advisory Committee, which would provide UDOT guidance on RUC program and policy development
- Compose annual RUC program reports for the legislature

SB 72 (2019) provided further legislative guidance on the RUC system, specifically including:

- Privacy and security provisions
- Guidelines for developing the per-mile RUC rate
- Authorizing RUC rulemaking by UDOT and other agencies
- Guidance on information sharing between UDOT and the Utah Department of Motor Vehicles (DMV)

Following the passage of SB 136, UDOT staff visited Oregon to learn the lessons from the implementation of the OReGO program and hired consultants to help design the Utah RUC system. UDOT and the consultants developed system specifications based on OReGO's, but with features to support RUC being charged in place of the alternative vehicle fee as well as other unique features. UDOT procured a RUC system based on these specifications, awarding the contract to emovis. UDOT supported the testing of emovis' system in late 2019 and oversaw the operational launch of the system on January 1, 2020.

The Utah legislature continued updating the RUC program after its launch. SB 150 (2020) showed the Utah legislature's commitment to the future of RUC, by adding a requirement for UDOT to submit a written plan to enroll all vehicles registered in the state in the RUC program by December 31, 2031. It also requires UDOT to submit annual reports about the status of the RUC program to a legislative committee. SB 82 (2021) creates the Road Usage Charge Program Special Revenue Fund, a new revenue source that is distinct from the motor fuel tax fund and defines its revenue sources and allowed uses.

UDOT RUC Today

Today, Utah's RUC system has the vision of replacing motor fuel taxes as the sustainable revenue source for all vehicles by 2031. Goals of the system include providing a fair and user-friendly system to vehicle owners and providing a competitive market for account managers to ensure the lowest-cost, highest-quality provision of the RUC system.

Potential RUC program participants are notified that their vehicles are eligible for the RUC program when they renew their vehicle registrations on the Utah DMV's Renewal Express website. If they

choose to enroll, they are taken to the Utah RUC program's website (<https://roadusagecharge.utah.gov/>) where they can enroll, and thus avoid paying the alternative fuel vehicle fee. When vehicles enroll, emovis uses an electronic interface to Utah's DMV to verify their eligibility and confirm that they are enrolled in the RUC program, so they do not have to pay the alternative fuel vehicle fee.

Nearly all vehicle types are provided OBD-II plug-in devices to record miles driven. Users insert these devices into their vehicle's OBD-II data port and take an odometer image using the Utah RUC app to ensure that their vehicles are actively reporting mileage. Vehicle owners are asked to submit an odometer image each year thereafter to capture any miles driven when the device was not plugged in.

Tesla models 3 and Y do not have OBD-II ports, so their owners must connect their vehicle's telematics systems with emovis. Tesla automatically reports these vehicle models' miles traveled, directly to emovis. These vehicles are not asked to submit odometer photos, as there is no opportunity for mileage to go uncaptured, as with an unplugged OBD-II device.

When the RUC program is sufficiently large, UDOT intends to create an open market for multiple account managers, as OReGO has. However, UDOT decided that currently, while the system was small, one account manager was sufficient. Emovis collects data from OBD-II devices provided by IMS / Trak Global and from Tesla telematics and posts that data to user accounts. Emovis issues monthly statements to users and accepts payments into an electronic wallet, adding \$10 of credit every time the user's account drops below \$5 in value.

Vehicles pay RUC in sync with the vehicle's registration year, which starts when the registration renews, and ends 12 months later. When vehicles enroll in the program, they are considered 'early enrollees' until their registration year restarts, and do not pay for their miles driven until that happens. Currently, UDOT charges 1.52 cents per mile for all miles driven. Mileage is charged for each vehicle in a given registration year until the vehicle hits its RUC cap for the given year, which in 2021 is \$123 for EVs, \$53.25 for PHEVs, and \$20.50 for hybrids. The per mile rate and alternative fuel vehicle fees increase each year based on an inflation index.

Utah's legislature has indicated that the state intends to cover the whole fleet with RUC by the end of the year 2031. However, UDOT's current focus is on light vehicles and there are no plans to cover heavy vehicles. Any program expansion beyond its current structure of allowing hybrids, PHEVs, and EVs to opt in to paying RUC instead of the alternative fuel vehicle fee will require legislative action.

Summary of Policy and Implementation Lessons for Other States

Utah's RUC program demonstrates the following lessons:

- **Successful RUC system launch in 20 months is possible.** The Utah governor signed the bill creating the RUC program near the end of April 2018, and the RUC program launched on January 1, 2020.
- **Charging RUC in lieu of flat fees is an effective way to introduce RUC.** But doing so requires syncing RUC payments with the registration fee.

- To encourage participation, it is important that people be able to enroll in RUC at all times. **So, if RUC is synced with the registration fee, people should be considered early enrollees, and not be charged for RUC until their registration year renews.**
- **When RUC is paid in lieu of a flat fee, having a RUC cap encourages more participation.** Users know that they will not pay more by choosing RUC as opposed to paying the flat fee.
- **It is possible to start with one account management vendor and plan to open the market to other vendors later.**
- **An odometer image-based reconciliation process can capture miles driven when a plug-in device is unplugged.**
- **An account manager can create a real-time application programming interface with a state DMV - but it requires effort on both sides.**
- **It is possible to access in-vehicle telematics for mileage reporting for a system vendor for processing a RUC invoice.**

3.3 New Zealand

Introduction to RUC in New Zealand

Background

New Zealand introduced weight and distance-based road user charging for heavy-duty vehicles and light-duty diesel vehicles in 1978 as part of a comprehensive set of reforms applying to the transportation sector. Along with the introduction of RUC was the abolition of an annual heavy-duty vehicle fee, a quarterly tax on heavy-duty vehicle mileage, significant reductions in vehicle sales taxes and streamlined regulation and licensing of the truck and bus sectors.

RUC was introduced with the goal to more equitably and efficiently recover the costs of road infrastructure, as compared to other forms of taxation for motor vehicle use or ownership. The focus has been on heavy-duty vehicles that generate most marginal road wear costs, but also on other vehicles not powered by gasoline. Although there is a gas tax, there is no excise tax on diesel because a high proportion of diesel is not used by motor vehicles on public roads, but rather for industrial or marine purposes. It would be inequitable and administratively burdensome to require those users to apply for refunds for a diesel tax.

New Zealand requires revenue from the gas tax and RUC to be placed in its National Land Transport Fund (NLTF) which must be used to fund roads, public transportation and active transportation infrastructure. RUC was phased-in over several years to apply to all vehicles with a maximum allowable weight of 3.5 metric tons (7716 pounds), but also all vehicles not using gasoline or natural gas as fuels (as both of those are taxed).

Development of RUC since 1978

RUC has evolved over many years and was subject to a major review in 2009, which resulted in the Government implementing several key changes:

- Enabling the certification of telematics service providers, in an open market, that could record trip data and collect RUC revenue on behalf of the government.

- Simplification and streamlining of the structure of rates and abolition of time-based permits, to reduce complexity and increase compliance.
- A temporary exemption for pure-electric vehicles, to encourage their growth in the fleet. This exemption is due to expire in 2024.

How does it Work?

RUC has different rates based on vehicle weight bands and axle configuration, to reflect variations in costs imposed on the road network and to encourage heavy-duty vehicle operators to choose vehicles that generate less wear-and-tear on the road network.

Users have two main options to pay RUC:

- Purchase prepaid distance permits, in blocks of 1,000 kilometers (although any multiple of 1,000 can be purchased), available online or by contracted over-the-counter retail outlets (such as Postshops, some gas stations and vehicle inspection stations). These are displayed in the vehicle's windshield; or
- Contract with a private certified telematics service provider (there are four competing entities) to have vehicles equipped with a GNSS-enabled device to record trip data, and to be invoiced regularly for RUC.

Owners of vehicles subject to RUC can choose to use either the mandatory manual measurement device (hubodometer or odometer) to reference against prepaid distance permits, or to contract with a telematics service provider.

At every regular safety inspection, the frequency of which depends on vehicle age and size, readings of either hubodometers or odometers are taken as a check. If a mismatch is identified between a reading and a RUC permit, the vehicle owner is advised of how much they owe to correct this.

Status of RUC Today

RUC collects around NZ\$2 billion (US\$1.4 billion) per year, which is 45 percent of revenue collected for the NLTF from road users. Around 75 percent of vehicles subject to RUC are light-duty diesel vehicles, including automobiles, SUVs, pick-ups, and vans, but around 75 percent of revenue is collected from heavy-duty vehicles. Over half of revenue collected is through the four GPS telematics service providers, all of which almost exclusively service commercial vehicle owners. Of the vehicles subject to RUC, around 250,000 vehicles are heavy-duty vehicles or trailers and around 850,000 are light-duty vehicles.

How Have Major Challenges Been Addressed?

Public Acceptability

RUC was designed and implemented primarily for heavy-duty vehicles as part of a package of reforms intended to replace existing taxes and reduce the overall regulatory burden for those that would have to pay RUC. This was acceptable to users at the time, and as the principles of the reform have remained, and the system has evolved to meet changing needs and technology, it has been accepted as a relatively simple, but effective means of paying for road use. It is also transparent that diesel is cheaper as it is not subject to an excise tax, unlike gasoline.

The number of private vehicle owners paying RUC has increased exponentially over 40 years as consumer preferences have moved towards diesel-powered SUVs and cars, due to the removal of import restrictions and tariffs in the 1990s. Today there are around 20 times as many light-duty vehicles paying RUC as there were 40 years ago. As it is easy to buy new distance permits online, or over the counter, and such permits only reflect vehicle type and distance, there are no concerns over privacy or costs of collection.

Other elements of the system that have enhanced public acceptability include:

- All revenue placed in the National Land Transport Fund (NLTF)
- Very low costs of collection (around 2 percent of revenue collected)
- Rate setting based on an objective process that also informs the setting of the gas tax rate
- Sufficient high levels of compliance (little sense of unfairness)
- No excise tax on diesel (nobody considers they are paying “twice”).

Rate Setting

As there are over 70 individual rates based on different weights and axle configurations, it has been important to have a process that enables rate setting to be done fairly and equitably. A cost-allocation model was developed to apply economic and engineering principles to recommend rates based on forecast spending (by different categories of spending) and allocating the costs of that spending to different types of vehicles. For example, although weight-generated road wear and tear is more attributable to heavy-duty vehicles, weather-related road wear and tear is equally attributable to all vehicles.

Although final decisions on rates are done by Cabinet, the use of the cost-allocation model has significantly reduced lobbying and political pressure to give preferences to operators of specific vehicle types, as there is an objective assessment about how to set rates that fairly raise the revenue required to fund transportation infrastructure.

Enforcement

The key issues around enforcement have been ensuring that distance measurement equipment is not tampered with or removed, and that road users do not travel significant distances beyond the validity of their prepaid distance permits. Enforcement has been focused on heavy-duty vehicles for many years, because a significant proportion of revenue is collected from them. This activity has been split functionally between the NZ Police Commercial Vehicle Safety Team (CVST), for on-road enforcement, and the Economic Compliance Unit undertaking regular audits and investigations of commercial vehicle owners. The Police enforce all safety, licensing, and weight limit laws, so RUC enforcement is under its purview, including checking that hubodometers have not been tampered with, and that prepaid distance permits are valid. Having a specialist unit dedicated to commercial vehicles has enabled it to build up intelligence as to how commercial vehicle owners might evade RUC, and to strategically work with the Economic Compliance Unit to target locations and operators that may have higher levels of non-compliance. There is a strong correlation between breaking safety related regulations and RUC, so it is cost-efficient and effective to include RUC enforcement with that activity. With the majority of heavy-duty vehicle RUC revenue now collected through GPS

telematics systems, which have very low levels of non-compliance, enforcement can be focused on users of the manual option.

For light-duty vehicles, compulsory odometer reading and reporting for safety inspections (which occur annually after a vehicle is three years old) was introduced after 2009. This has significantly reduced non-compliance by light-duty vehicle owners. Linking RUC to annual vehicle re-licensing has helped to minimize unintentional non-compliance. When owners of gasoline powered vehicles switch to a diesel-powered vehicle, many are unaware of RUC, so the change of ownership process supplies information about the program to any new owner of a RUC -liable vehicle. Overall non-compliance is estimated at around three to four percent of total revenue.

Cost of Collection

Waka Kotahi, the government agency responsible for operating the RUC system, is also the funding agency that allocates funds collected from RUC, along with gas tax and motor vehicle registration fees. The agency is legally required to meet performance targets to control the costs of collection. Government directed administration costs per annum for RUC alone are around NZ\$18 million (US\$12.6 million). Of these costs, around two-thirds are recovered from user fees, such as fees for over-the-counter payments or credit card payments, as there are options that do not carry such fees. However, there are some additional costs shared with other activities. For example, the database of the RUC system is shared with the motor vehicle registry and the driver licensing system. Enforcement of RUC for heavy-duty vehicles is shared with enforcement of safety regulations. Including some proportion of those costs, it is estimated total costs of collection (including costs recovered from users directly) are around NZ\$40 million per annum (US\$28 million).

These costs have been effectively managed by:

- Promotion of online options for payment
- Competitively contracting for over-the-counter services rather than providing them directly
- Requiring collection of distance data at the time of vehicle safety inspections, registration renewals and change of ownership
- Provision of an open-market for higher-technology options
- Streamlining and reform of the policy over time (e.g., exempting vehicles that by design travel little distance on public roads, such as agricultural machinery)