WA RUC

Appendix A-3: Road Usage Charge Innovation Research

December 2023

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PREFACE

Forward Drive was a research, development, demonstration, and public engagement effort of the Washington State Transportation Commission. The project sought to advance understanding of and implementation pathways for per-mile road usage charging (RUC) as an alternative to motor fuel taxes and alternative fuel vehicle registration surcharges. The project aimed to address several key issues for RUC including principally equity, user experience, and cost of collection. As reported in Volume 1, the project unfolded in several stages. A series of appendices contain more detailed results. These appendices are organized as explained and illustrated below.

Appendix A. Forward Drive began with research spanning several activities including financial analysis, equity outreach and analysis, user experience research, and cost of collection reduction workshops (Appendices A-1 through A-4, respectively). The purpose of the research was to explore the financial, equity, user experience, and cost impacts of RUC under a variety of deployment scenarios. This research informed the design of experience-based simulations and pilots of various elements of a RUC program.

Appendix B. The research stage led directly to the design and development of simulations and pilots of RUC program elements spanning several areas to reflect the multiple objectives and research findings. The centerpiece of the simulation and pilot testing stage was an interactive simulation of RUC enrollment, reporting, and payment. As described in Volume 1, the simulation offered over 1,100 Washingtonians an opportunity to experience RUC in as little as a few minutes, followed by a survey about their preferences and opinions. The detailed results of the simulation survey and the measurements of the simulation itself are presented as separate reports (B-1 and B-2, respectively).

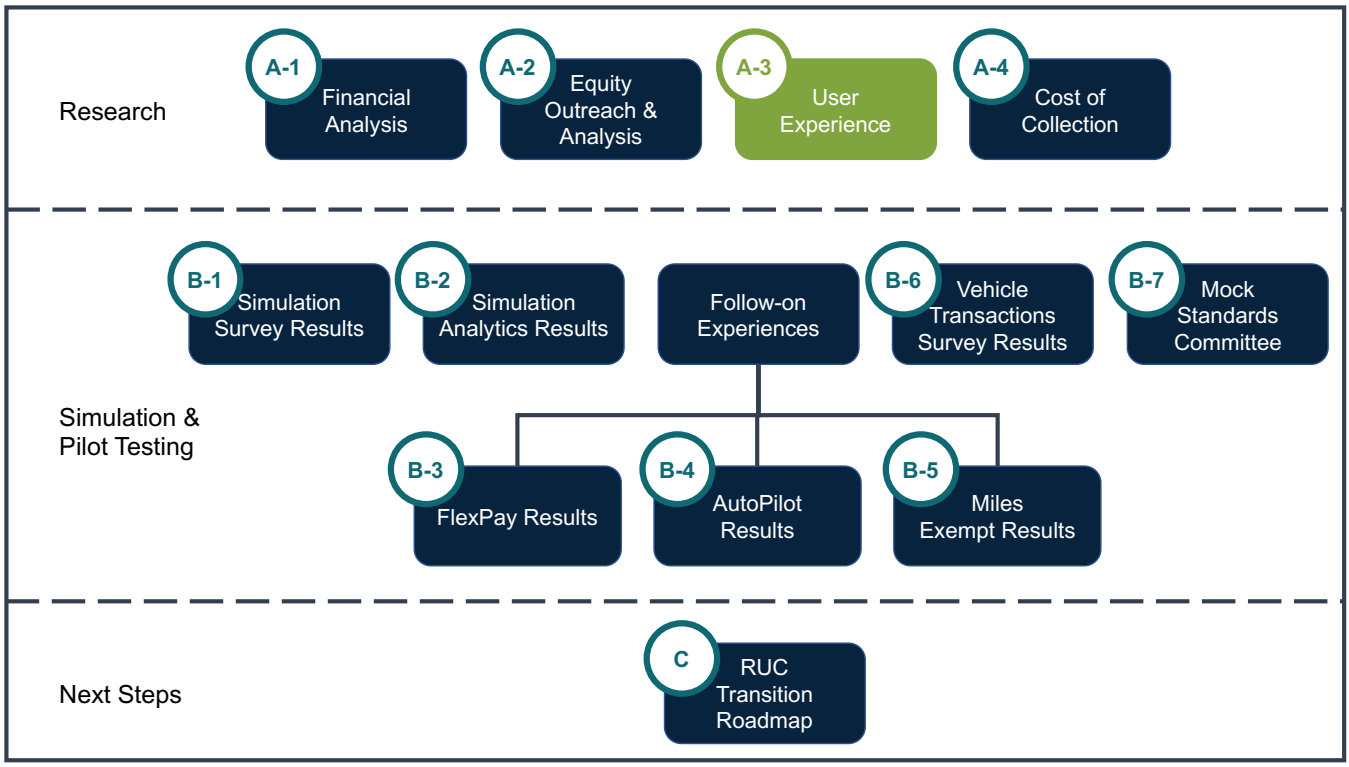
Within the simulation, participants could opt into one of three follow-on experiences, each designed to further test a specific feature of RUC of interest to Washington stakeholders and policymakers:

- FlexPay tested installment payments, allowing participants to pay their RUC over four payments instead of all at once (B-3).
- AutoPilot tested using native automaker telematics to report road usage as an alternative to self-reporting or other technology-based approaches to reporting (B-4).
- MilesExempt tested a self-reporting approach for claiming miles exempt from charges, such as off-road and out-of-state driving (B-5).

The simulation and pilot testing stage also included a statewide survey of Washingtonians' vehicle transactions designed to understand existing transactions and preferences and possibilities for how RUC reporting and payment could potentially be bundled with such transactions (B-6).

Lastly, the simulation and pilot testing stage included a mock standards committee of RUC experts from jurisdictions and industry. The committee simulated the process of creating standards for RUC to support cost reduction, enhanced user experiences, and multi-jurisdictional interoperability (B-7).

Appendix C. Appendix C details a transition roadmap for RUC in Washington drawing on the results of the research and simulation and pilot testing, as well as the updated recommendations regarding RUC implementation from the Commission to the Washington Legislature in 2022.



Appendix A-3 covers results from the RUC innovation research, with a focus on elements of the user experience.

1.0 INTRODUCTION

RUC innovation research was originally designed to support the Commission's request to "*incorporate emerging approaches to mileage reporting into Washington's RUC research, such as in-vehicle telematics, improved smartphone apps, use of private businesses to provide odometer verification and mileage reporting services, and more.*"

Based on this guidance, technologies and industry partners were identified that could support enhanced mileage reporting methods compared to the approaches taken in prior pilot testing in Washington and elsewhere. The research began with investigations of how mileage reporting methods tested in the first Washington pilot could be enhanced by adding new approaches and emerging technologies to provide more customer-friendly and equitable solutions for motorists and less costly solutions for the state. After initial conversations with technology providers of RUC solutions in the market, it became apparent that there were other opportunities besides mileage reporting to improve the overall RUC experience for motorists. As a result, the Commission agreed to broaden the research activities to cover all RUC functions that have an impact on a motorist's experience, not just mileage reporting. This new direction allowed for exploration of additional prospective private sector partners for delivery of RUC solutions.

With the broadened scope of research activities, RUC innovation research sought to inform the design of a pilot or series of pilots as part of *Forward Drive*. The research followed the objectives below:

- **Improve the user experience** by providing relevant choices to motorists, accessible mileage reporting and payment options, and smoother RUC processes to encourage natural compliance.
- **Deliver RUC services efficiently** by building on existing state capabilities, leveraging private sector services where needed, and defining how public and private entities can share roles and responsibilities efficiently to deliver quality services at the lowest administrative cost possible.
- **Open the RUC market** by involving new private sector partners with business models that can support RUC services cost-efficiently while providing a positive experience for motorists.

These research objectives aligned with the priority guiding principles of equity, user experience, and cost reduction for the project. For each priority, guidelines were created to guide and shape the innovation research. These priorities and guidelines are summarized in Table 1 below.

Table 1: Priorities and corresponding research guidelines

POLICY PRIORITIES	RESEARCH GUIDELINES
Support equity	**Offer relevant choices to drivers that:** • are simple, accessible, and convenient; • consider sensitivity to privacy, and typical situations drivers may encounter such as no or low vehicle connectivity, no or low access to technology or payment means; • are easy to understand and are accompanied by decision making tools when needed to guide users towards the most suitable choices; • are accompanied by user-friendly privacy policies and participant agreements that clearly explain rights and requirements especially when sensitive information is shared.

Provide positive user experience	The RUC system and supporting processes should be designed to be simple, convenient, and transparent to the user so that compliance is encouraged by design and does not create an undue administrative burden for the motorist.
Reduce the cost of administering RUC	The administration of a RUC system should be cost-efficient. It is important to define common terminology to compare cost efficiency for different public and private entities operating RUC systems and technologies.

These objectives and policy priorities laid the foundation for conducting broader research and outreach activities. The research approach, findings generated, and RUC scenarios selected for the ensuing pilot test are summarized in the remaining sections of this report.

2.0 RESEARCH APPROACH

This research was conducted concurrently and in coordination with the equity outreach and analysis (see Appendix A-2) and the cost reduction workshops (see Appendix A-4) to ensure the RUC solutions designed for the pilot tests aligned with equity and cost-efficiency recommendations.

The research began with the nine fundamental functions of RUC, which provide a broader perspective than just the two mileage reporting functions (generating road usage data and accessing road usage data, as illustrated in Figure 1). The research explored issues and opportunities to improve user experience, support equity objectives, and reduce cost of RUC collection.

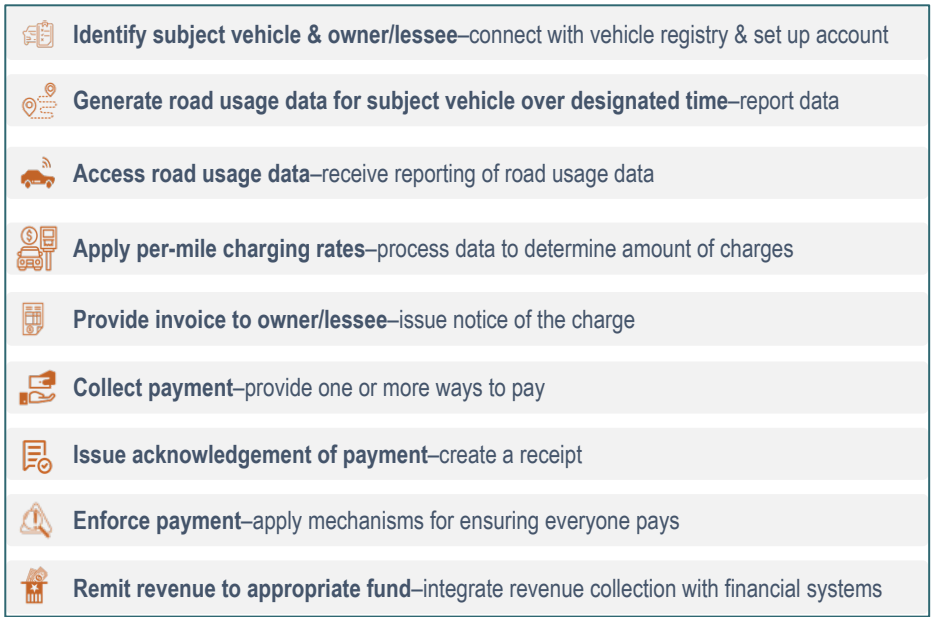


Figure 1: Fundamental functions of RUC

The nine fundamental functions listed above represent a combination of systems, processes, and services that need to be supported to provide a complete RUC service to vehicle owners. These functions are operated by administrative entities that can be public agencies, private firms, or sometimes a partnership between private and public entities. Some functions, such as “applying a per-mile charging rate” or “remitting revenue to appropriate funds,” are operated on the back end and are generally not visible to the end customer (the vehicle owner). Other functions, such as “generating road usage data”, “providing invoices,” or “collecting payment,” require interactions with customers and are usually the ones with the most opportunities to improve the user experience and incorporate equity considerations. The back-end functions mostly presented cost reduction opportunities, especially those related to data collection, processing, and enforcement of payments.

Based on research data from the 2018-19 Washington pilot and other pilots recently held in other states, four key areas were identified as having the most potential and need for improvement:

- ***Generating and accessing road usage data.*** In prior pilots, these two functions represented the greatest level of effort. Administering entities first had to set up a new mileage reporting function to complement their existing revenue collection systems. Next, motorists had to follow a series of steps to successfully report mileage. These steps included choosing a mileage reporting method (ranging from low- or no-technology options to advanced-technology options),

setting up the method, and reporting mileage either automatically or through periodic self-initiated reporting (manual reporting). These set-up steps were not always clear and seamless and sometimes led to non-compliance because customers either did not understand what was required or faced choices that did not match their preferred level of convenience**.** Figure 2 summarizes the level of effort required by customers to report mileage in the first Washington pilot (2018-2019). On the administrative side, a key challenge was how to offer convenient choices to customer at more sustainable costs. Automated systems, which were the most convenient options given their "set-it-and-forget-it" features were more onerous for the user to setup and to administer as they require third parties to operate the technologies and involve relatively higher setup costs. Though manual reporting systems had low set-up costs, they presented high indirect costs due to challenges with sustaining customer compliance through repeated reporting.

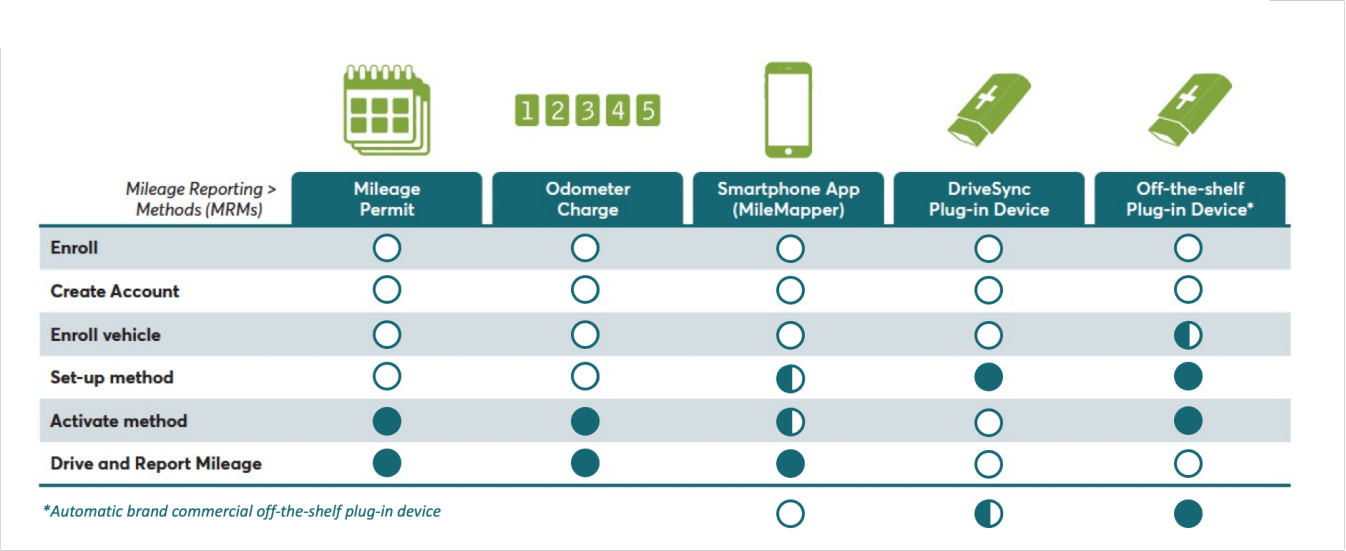


Figure 2: Relative level of effort to report data for various mileage reporting methods, 2018-19 WA RUC pilot

- ***Collecting payment***. The payment collection function is not new for public agencies or private entities, but it presents potential equity challenges for RUC. Revenue collection systems operated by public agencies are generally configured to collect yearly payments (e.g., vehicle tab renewal). Systems that offer more frequent payments (such as tolling or transit) are usually operated by private entities under contract to a public agency. An annual RUC payment could catch some vehicle owners by surprise, especially if the amount is relatively high. Therefore, to design an equitable RUC system, it is important to determine what level of flexibility payment systems should have. Such flexibility should reasonably address individual priorities and not put motorists in a situation of involuntary or inadvertent compliance due to lack of affordability or usability (i.e., the absence of convenient payment methods or plans).
- ***Providing invoices to the owner/lessee***. Invoicing is not a new function for public agencies and in prior pilots did not present technical or administrative challenges. However, as a companion to the more challenging payment collection function discussed above, the invoicing function presented opportunities to educate motorists and encourage compliance. Invoice design could be used as an educational tool, conveying key messages about RUC to promote understanding, demonstrate transparency, address misconceptions, and improve predictability.

- ***Integrating all nine functions***. Integrating all nine RUC functions into a cohesive user experience represented the biggest opportunity for improvement from prior pilots. Even though the first Washington pilot demonstrated that all nine RUC functions could be integrated from a technical perspective, there were challenges with the overall user experience especially as the functions were supported by different entities including two commercial RUC account managers, three technology providers, a help desk, and the Commission's oversight team. Pilot participants from the first Washington pilot had to go through a series of steps to comply with pilot requirements as illustrated in Figure 3. More than one in three invited participants did not make it past the account enrollment process and dropped out before creating their account. The technical set up of automated mileage reporting methods was another cause of participant attrition mainly because integrations with technical providers were not always smooth and sometimes required users to follow instructions that were not intuitive or simply too time consuming.

Based upon the preliminary analysis of improvements and opportunity areas, the following priorities were identified for the *Forward Drive* pilot:

1. Identify **relevant mileage reporting choices** that cover typical motorist situations and preferences along with business models that can support those choices cost-efficiently.
2. Identify **flexible payment choices** to align with individual priorities and needs, and accessible invoice layouts to help road users understand payment requirements.
3. Identity **compatible business models** to support user choices equitably and cost-efficiently while providing good user experience and addressing privacy.
4. Combine these choices into an **integrated service** to provide access to RUC options that align with driver's individual priorities.

2.1 Mileage Reporting Methods

To determine what additional mileage reporting methods choices could help bridge system accessibility gaps cost-efficiently in the *Forward Drive* pilot, analysis of typical customer connectivity circumstances was conducted. A two-dimensional framework was constructed that considered varying levels of vehicle connectivity and levels of assistance or automation that could be offered to improve accessibility of reporting systems (Figure 4):

- The "connectivity" dimension shows how varying levels of vehicle connectivity, which ranged from no connectivity (for older vehicles that cannot be retrofitted with plug-in technology) to native connectivity (for vehicles recently manufactured with built-in connectivity), could impact a vehicle owner's mileage reporting choices.
- The "reporting options" dimension shows what type of mileage reporting system could be offered depending on the level of assistance motorists need or prefer ranging from assisted manual reporting to self-reporting (without assistance) to fully automated reporting.

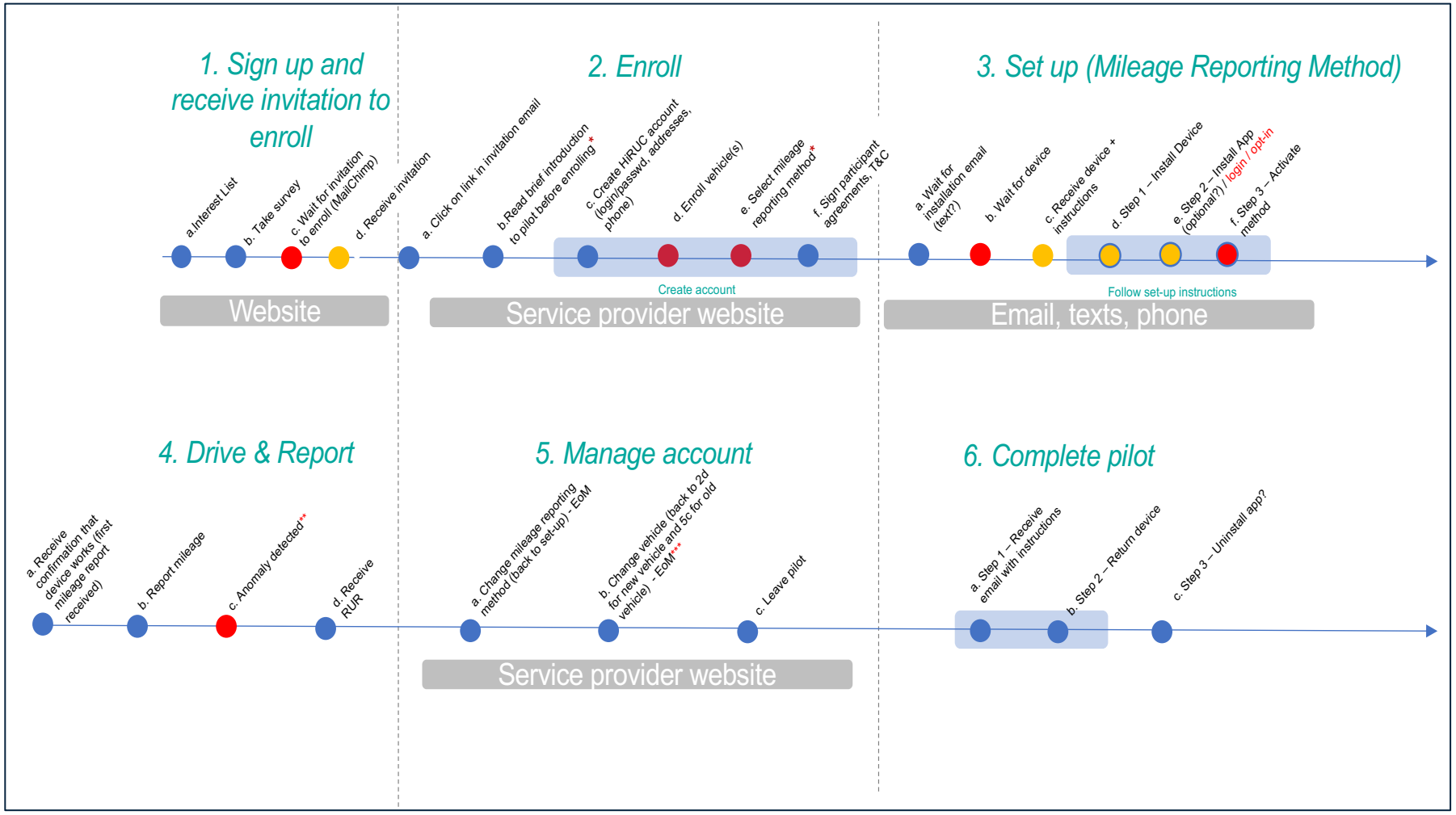


Figure 3: User experience in first Washington pilot

Reporting options \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted reporting (in-person assistance)			
Self-reporting (manual action required)			
Fully automated (no action or assistance required)			

Figure 4: Framework to determine relevant choices to address typical user situations

Together, these two dimensions create nine possible combinations of connectivity and reporting options. Mileage reporting methods that were deployed in the first Washington pilot were mapped to the framework to identify, revealing that only three of the nine combinations were covered, as illustrated in Figure 5:

- **Participating road users who had no connectivity** (through vehicles or devices) could access in-person odometer capture services through participating subagent offices. These services allowed customers to report mileage in person quarterly. While these in-person services improved accessibility for people with no connectivity, they presented additional costs as subagent offices would need to be compensated to support such services.
- **Participating road users who had third party connectivity** through iPhones could access the MileMapper[1] app specifically designed for the pilot to self-report their odometer reading by submitting a digital picture each month. Through this app, road users could also choose to deduct mileage driven out-of-state by activating a "GPS toggle" to automatically record mileage with location-detection enabled. While this app was popular in the first pilot and had promising features, its main shortcoming was that it could not be reliably paired with a vehicle. This meant mileage measured out-of-state could be overstated if the participant used the app while riding out of state in any another vehicle.
- **Road users with compatible vehicle telematics**, i.e., vehicles with an onboard diagnostic (OBD-II) port, could have third-party connectivity through plug-in devices that automatically capture miles traveled and transmit the data to RUC accounting systems using wireless technology. The main issue with plug-in devices were the high costs associated with device

[1] MileMapper was specifically designed for the first Washington pilot to propose an improved GPS-based smartphone solution to road users that addressed privacy concerns by giving the customer the flexibility to toggle location-based mileage counting on and off.

provisioning (e.g., manufacturing, distribution, customer support for installation) along with ongoing costs of data transmission and processing.

Reporting options \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted reporting (in-person assistance)	Vehicle Licensing Offices (using odometer image capture app)		
Self-reporting (manual action required)		Smartphone app • Odometer image capture • Optional GPS toggle	
Fully automated (no action or assistance required)		Plug-in device • With GPS • Without GPS	

Figure 5: Framework with choices offered in the first Washington pilot

Given the limited range of user situations covered and choices offered in the first pilot relative to the framework (three out of nine cells), industry partners were consulted to identify improved and emerging mileage reporting methods that could give more reliable and cost-efficient choices to users with varying levels of vehicle connectivity and desired reporting options. These options are summarized in Figure 6 and include the following:

- **Road users with no connectivity** could be offered an option to self-report their mileage through a web form or using camera phones to text odometer images. While self-reporting has the advantage of a lower cost of collection over in-person assisted reporting, it is less trustworthy than odometer readings collected by an accredited third party. To increase reliability of self-reported mileage, the possibility of leveraging odometer readings available through commercial vehicle lookup services was considered.[2] Such services could be used to spot check self-reported mileage and flag some customers for follow-up in the case of discrepancies or anomalies. Besides its use as a companion to self-reporting, VIN look-up services could eventually be used as a standalone fully automated reporting method for users with no connectivity. Efficient implementation of mileage reporting based solely on vehicle lookup is contingent upon agreements with the commercial providers of vehicle history data.
- **Increased options for third-party connectivity**, emerging smartphone mileage logging applications and third-party telematics interfaces were investigated. While there were notable improvements in the user interfaces of smartphone mileage logging apps and use of phone battery life, the key issue remained reliable pairing of the smartphone with the vehicle to unambiguously tie back road usage to the vehicle driven. Third-party telematics interfaces presented more reliable alternatives to both smartphone apps and plug-in devices in terms of

[2] Commercially available vehicle lookup services include companies like Carfax or Autocheck.

data continuity. However, the costs to access vehicular data were high and user permissions to access the vehicle interface were not always clearly defined and transparent to end customers.

- **Options for road users with native vehicle connectivity** had not been explored in the first Washington pilot as the technology was not mature at the time. Conversations with industry partners ranging from data aggregators to fleet managers to mobility-as-a-service (MaaS) platform providers indicated that two forms of in-vehicle telematics were mature enough to be tested: self-reporting through in-vehicle telematics and fully automated reporting through in-vehicle telematics. Both used the in-built vehicle capacity to report odometer readings with the main difference being that self-reporting would require manual approval of periodic data reports before they are sent from the vehicle to the account manager.
- **All users could be offered in-person assistance** through retail partner networks (including vehicle dealerships) to resolve typical installation issues encountered with mileage reporting set-up and thus increase accessibility of this automated reporting options for less tech-savvy customers.

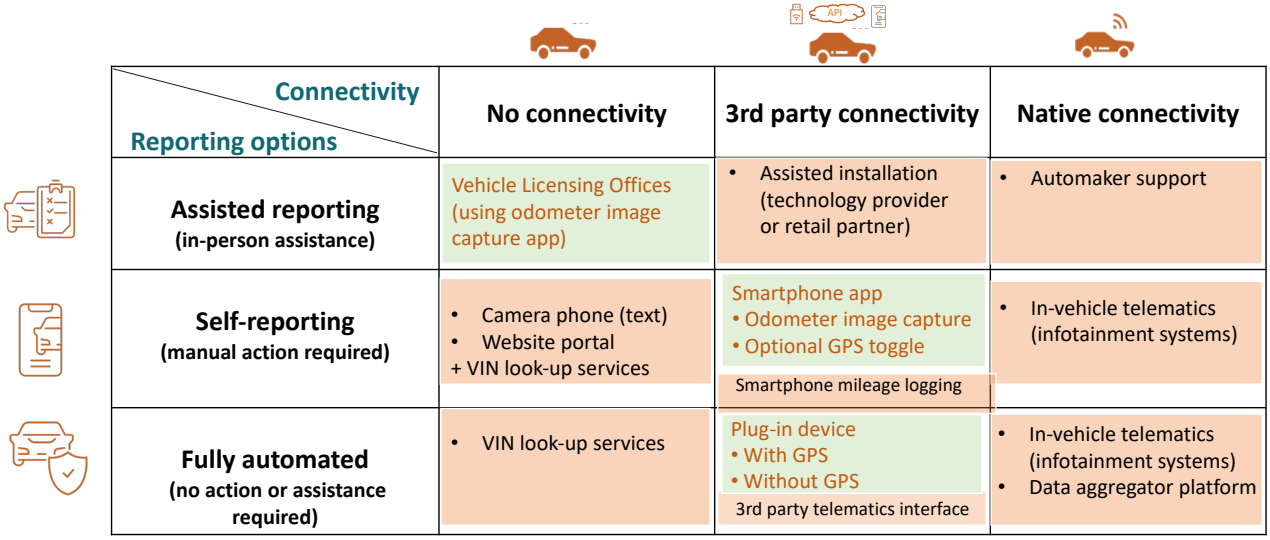


Figure 6: Framework with additional mileage reporting options

Mileage reporting and payment collection are two distinct but related functions. For administrative efficiency and usability, reporting and payment are generally coordinated such that automated mileage reporting follows monthly payment cycles. By contrast, manual mileage reporting methods follow either quarterly or annual payment cycles, primarily because reporting manually at a monthly frequency is burdensome for users.

Customers using automated mileage reporting methods thus have a payment system that more closely resembles the gas tax pay-at-the-pump system with smaller, incremental payments. However, quarterly and annual payments tied to manual reporting are larger and can be less predictable for road users who may need more flexible payment options. The next section lays out flexible payment options considered to support road users who would report mileage less frequently.

2.2 Payment Choices

In the equity outreach conducted as part of *Forward Drive*, yearly lump-sum payments under a RUC system raised equity concerns for low-income customers for whom payment of larger bills may be a challenge. These lump-sum payments apply to RUC but also to any fee vehicle owners must pay such as annual vehicle registration taxes and fees or sales taxes due upon vehicle purchase.

One of the questions the research on flexible payments could address was whether and how payment options offered under a RUC system could make it easier for vehicle owners or operators to comply with other periodic vehicle-related payments and reduce risks of missing payment. Lump-sum payments generally present the lowest revenue collection risk for the state, while flexible payments present the highest revenue collection risk (Figure 7). The first question was whether there was a need to offer flexible payment means, and if so, to identify what relevant alternative flexible payment systems could be offered that would not unreasonably increase revenue risks for states or financial risks for customers.

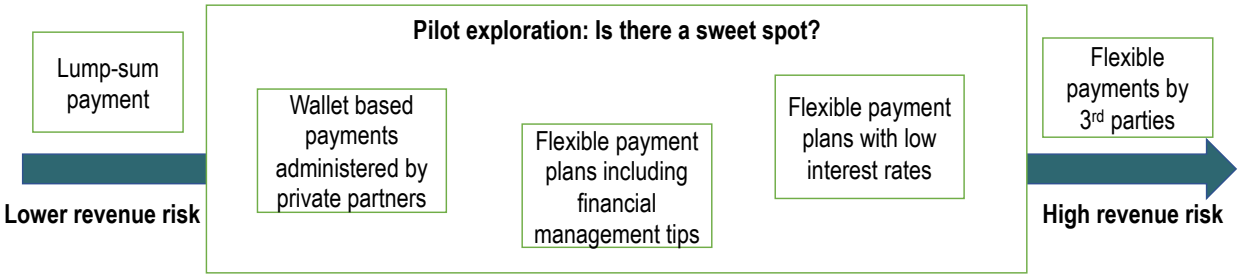


Figure 7: Flexible payment options for customers versus revenue risk for the state

The pros and cons of available vehicle-related payment systems were evaluated to hone in on the key research questions that a RUC pilot could address.

2.2.1 Lump-sum payments

Lump-sum payments, which is what most public entities are set up to support, are the simplest in terms of user experience and the least costly payment mechanism to administer. Under a RUC payment system tied to the yearly vehicle tab renewal process, the public entity would collect the RUC amount due once per year in most cases. There would be no need for additional reminders, follow-ups or enforcement as RUC payments could leverage the existing vehicle tab renewal process that is already integrated into customers' routines. While a yearly lumpsum system presented clear advantages in terms of administrative efficiency and simplicity of use, its financial impacts on road users could raise concerns, particularly for customers facing large road usage bills on top of other existing vehicle registration related taxes and fees.

A key research question to explore in the pilot is the following: Are lump-sum payments affordable for most road users, and would they increase cases of involuntary compliance for some population subgroups, especially considering that in this scenario RUC would be added to other vehicle tab renewal taxes and fees?

2.2.2 Flexible payment systems

Flexible payment systems, generally administered by third parties, could offer flexibility by accommodating smaller, incremental payments. However, flexible payments present a higher revenue

risk and administrative costs to states than lump-sum payments as each additional payment instance (albeit lower than one lump-sum payments) comes with a risk of payment default, thereby making it necessary to have robust reconciliation, payment collection, and potentially enforcement processes. Multiplying payment instances also means a more complex user experience with more administrative touchpoints that involve receiving invoices and reminders, making payments, and verifying accuracy of amounts invoiced.

A key research questions to explore in the pilot is the following: Given the financial risks and costs associated with flexible payment systems, is there a real need or demand that justifies offering this flexibility to vehicle owners, and if so, how does this demand vary according to the lump-sum payment amounts and population demographics? In other words, is there a cost tolerance threshold that depends on income level? What equitable and cost-efficient choices can be tested in a pilot?

2.2.3 Determining which choices to test in the pilot

To choose which flexible option to offer as an alternative to lumpsum payments, choices were narrowed to installment payments based on practices already implemented by tolling and transit agencies. These include pre-paid and post-paid systems with periodic or one-off top-up amounts set by customers according to their individual priorities.

Since lump-sum is simplest and least costly to administer, this would be presented as a default option, with flexible payments introduced as an alternative. This meant it would be important to provide a decision process to customers so that they could have the opportunity to first appreciate the amount due for a lump-sum RUC and determine whether the amount merits breaking into installments.

State agencies sometimes opt to contract with third party private-sector entities to administer the periodic payments for customers and bear some of the financial risk. Under this system, third parties remit the full amount due to states and then collect payment independently from customers. This financial risk is either absorbed by the state, which compensates third parties for bearing the financial risk, or passed down entirely to users who end up paying more overall than under a lump-sum payment because of the added interest rates.

The next step after identifying combinations of relevant mileage reporting technologies and flexible payment options was to identify which business models could support these options efficiently.

2.3 Compatible Business Models

Business models that could effectively support mileage reporting options, payment options and other core RUC functions were identified through analysis of similar revenue collection systems and a wide scan of technology providers. Business models tested in the 2018-19 Washington pilot included the following:

- Vehicle licensing offices that provided assisted reporting services
- Usage-based insurance account managers (IMS) and fleet telematics service providers (Azuga) which supported plug-in devices and operated back-office systems
- Tolling service providers (e.g., emovis), which integrated off-the-shelf plug-in devices, and operated back-office systems

Additional candidate business models were identified to include data aggregators, clearinghouse platform providers, rideshare service providers, MaaS platform providers, automakers, retail partners (e.g., auto repair and service stations, auto dealers), and vehicle history report providers (Figure 8).

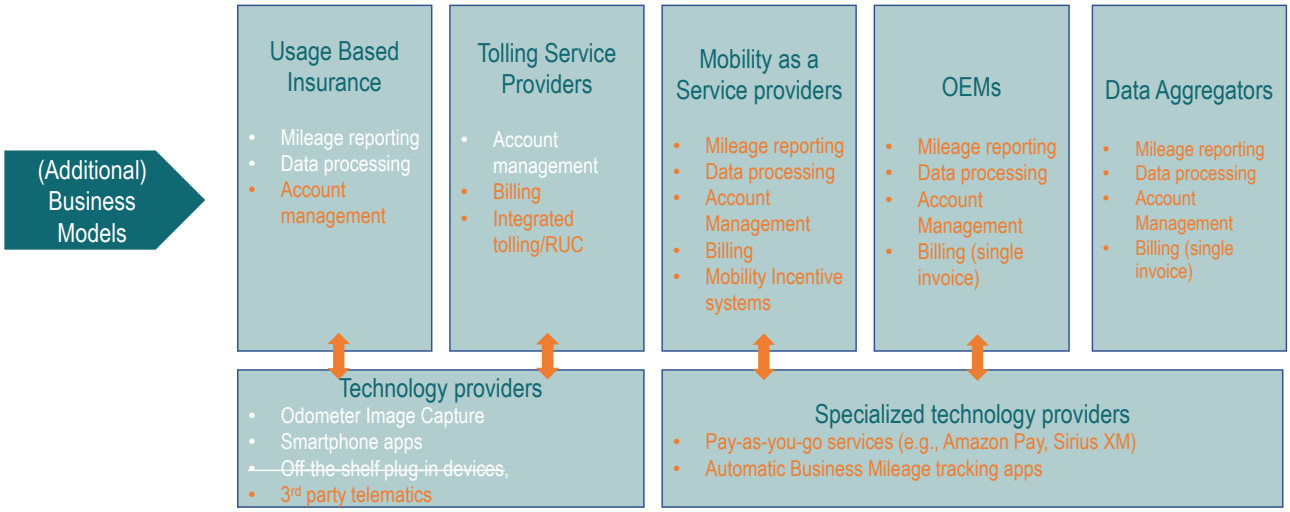


Figure 8: Additional business models evaluated for the *Forward Drive* pilot

After further assessing capabilities of these business models and determining which connectivity and accessibility situations they could cover, five were selected as the most promising to test in the *Forward Drive* pilot.

1. **Vehicle registry-based systems (**Figure 9**).** This model seemed promising as it was expected to support self-reporting manual reporting services in a cost-efficient manner by leveraging existing state agency capabilities.

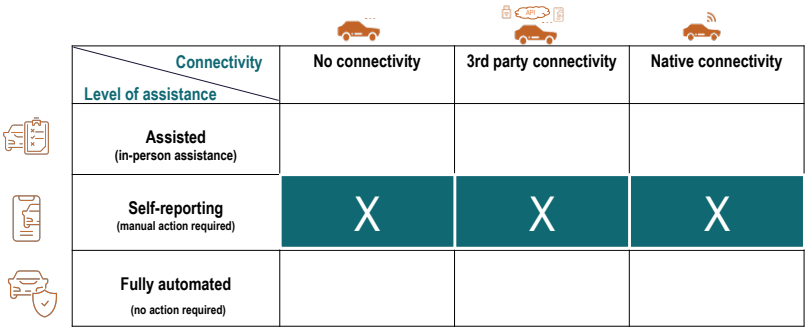
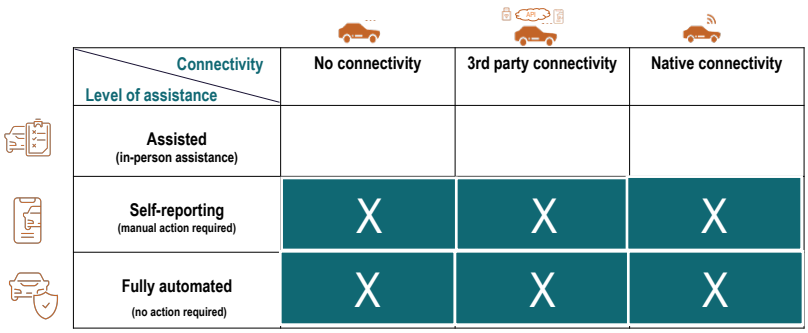


Figure 9: User situations covered by vehicle registry-based systems

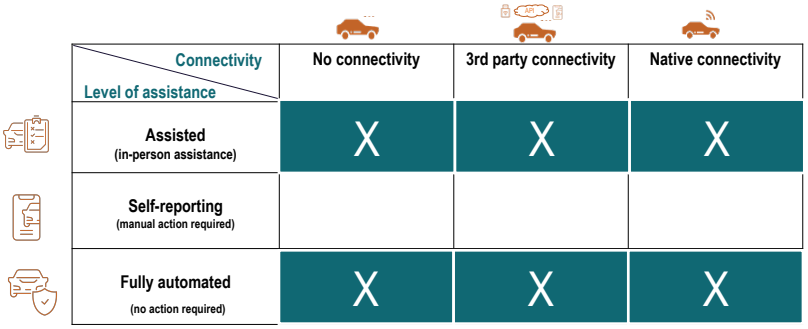
2. **Mobility-as-a-Service (MaaS) platform providers (Figure 10)**. These platforms are promising as they cover a wide range of situations and offer enhanced services to road users related to mobility including well-designed user experiences through mobile app interfaces.



Connectivity / Level of assistance	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			
Self-reporting (manual action required)	X	X	X
Fully automated (no action required)	X	X	X

Figure 10: User situations covered by MaaS platform providers

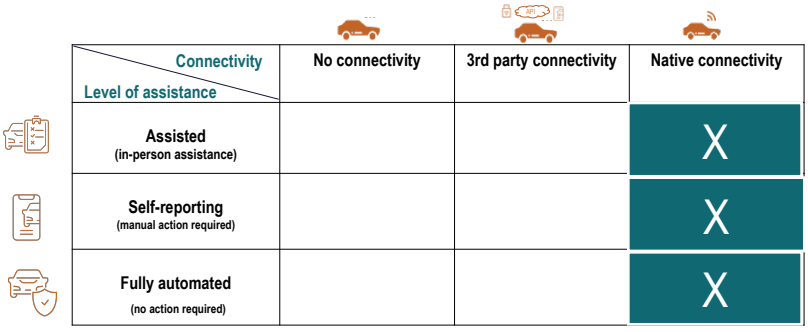
3. **Retail partners for reporting and payment (Figure 11).** This approach has a clear advantage for in-person services due to their local presence. They would be well positioned to help with both manual reporting as well as set-up and activation of automated mileage reporting.



Connectivity / Level of assistance	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)	X	X	X
Self-reporting (manual action required)			
Fully automated (no action required)	X	X	X

Figure 11: User situations covered by retail partners

4. **Automakers (Figure 12).** This approach was particularly interesting as automakers could enable in-vehicle telematics packages through opt-in reporting services that could range from assisted manual odometer reporting to highly automated reporting of full road usage data sets. Though they have the capability, the main issue anticipated with automakers is their willingness to participate in a revenue collection system.



Connectivity / Level of assistance	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			X
Self-reporting (manual action required)			X
Fully automated (no action required)			X

Figure 12: User situations covered by automakers

5. **Data aggregators (Figure 13).** Data aggregators are relevant as they already support a variety of use cases and collect data from a wide range of data sources including fleet management services and usage-based insurance. Given the number of use cases they support, they are expected to have the capacity to support RUC data collection at a relatively low marginal cost.

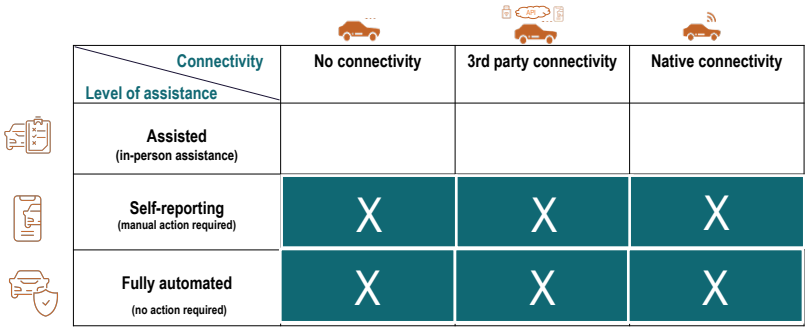


Figure 13: User situations covered by data aggregators

As illustrated in the figures above, each of these five business models covers many but not all nine customer situations (as illustrated in Figure 6). The challenge was to design a pilot that would offer participants a combination of business models so they could have the most complete and robust mileage reporting and payment choices to align with their individual priorities. It was, however, important to balance the full range of choices against complexity, and it was decided for the pilot, that offering too many choices would be confusing to many customers (Figure 14).

Retail networks for reporting and payment

Level of assistance \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)	X	X	X
Self-reporting (manual action required)			
Fully automated (no action required)	X	X	X

Vehicle Registry based system

Level of assistance \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			
Self-reporting (manual action required)	X	X	X
Fully automated (no action required)			

Mobility-as-a Service provider

Level of assistance \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			
Self-reporting (manual action required)	X	X	X
Fully automated (no action required)	X	X	X

Data aggregators services (insurance industry)

Level of assistance \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			
Self-reporting (manual action required)	X	X	X
Fully automated (no action required)	X	X	X

Automakers

Level of assistance \ Connectivity	No connectivity	3rd party connectivity	Native connectivity
Assisted (in-person assistance)			X
Self-reporting (manual action required)			X
Fully automated (no action required)			X

Figure 14: The challenge of simplifying choices for users

Based on this assessment, the pilot was designed in a manner that combined and simplified choices for participants focusing on keeping low costs of administration through a basic RUC service that would cover the essential RUC functions.

2.4 Combining Choices into an Integrated RUC Service Concept

A streamlined pilot approach emerged, with a single RUC service entry point that starts with the basic or simplest RUC service concept of vehicle registry-based reporting. Vehicle registry-based reporting relies on vehicle registration transactions such as original registrations and renewals, which tie to the state's official vehicle registry, as the point of integration for RUC. At the same time, registry-based RUC transactions serve as a platform for offering enhanced RUC service concepts as choices for the customer. Three principles were followed in developing the choice architecture for the pilot:

1. Leverage essential RUC functions to define a basic RUC service.
2. Refine the basic service so it covers the most relevant customer situations at the lowest cost possible.
3. Identify which additional service enhancements to the basic RUC service could be supported cost-efficiently through partnerships with private firms.

2.4.1 Defining a Basic RUC Service

After considering different options, the vehicle registry approach was determined to cover all RUC functions most cost-efficiently and support a basic RUC service.

The functional gap that would have to be filled for a vehicle registry-based approach to RUC is the generation and collection of miles driven required to calculate the RUC due. Adding a self-reporting feature would accomplish this function the most cost effectively while supporting a positive user experience. Thus, designing a simple and cost-efficient service flow that integrated the vehicle registry approach to delivering essential RUC functions based on an annual self-reporting of odometer readings and lump-sum payments became the foundation of the pilot design (Figure 15).

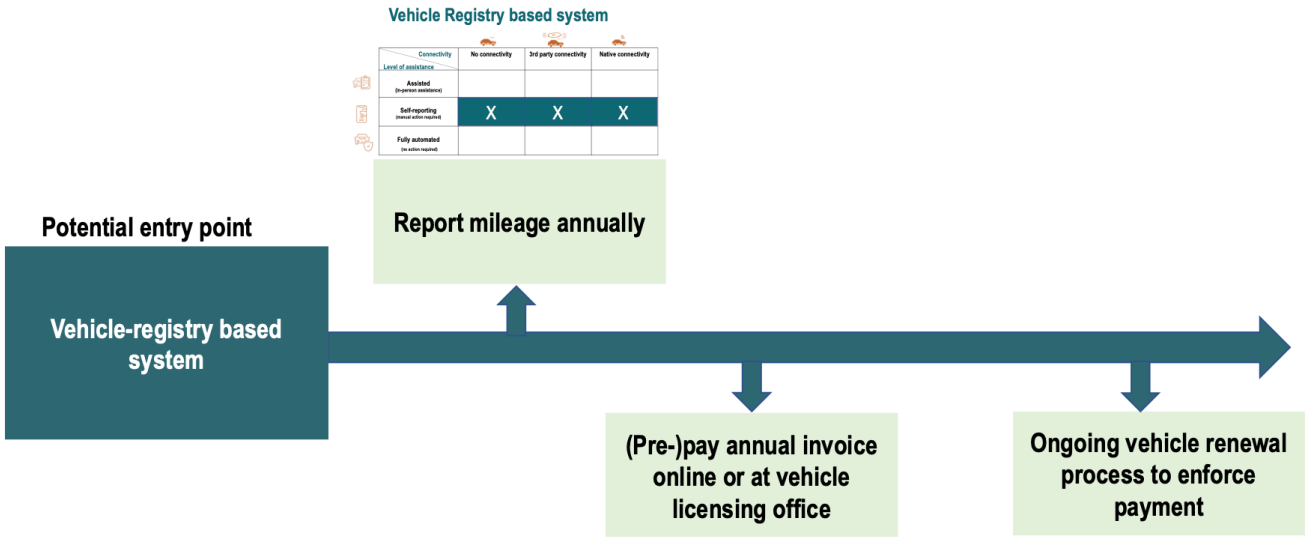


Figure 15: RUC service flow based on vehicle registry

2.4.2 *Enhanced RUC services (through private partnerships)*

To enhance the basic RUC service, additional enhanced mileage reporting and payment choices were offered to participants . The enhanced service flow (Figure 16) shows how the basic RUC service (a vehicle registry-based approach) branches out, supported by technology providers that can offer more mileage reporting options including plug-in devices, native automaker telematics and odometer-image capture; and private partners that can offer flexible payment plans that could be based on a pre-pay or post-pay systems.

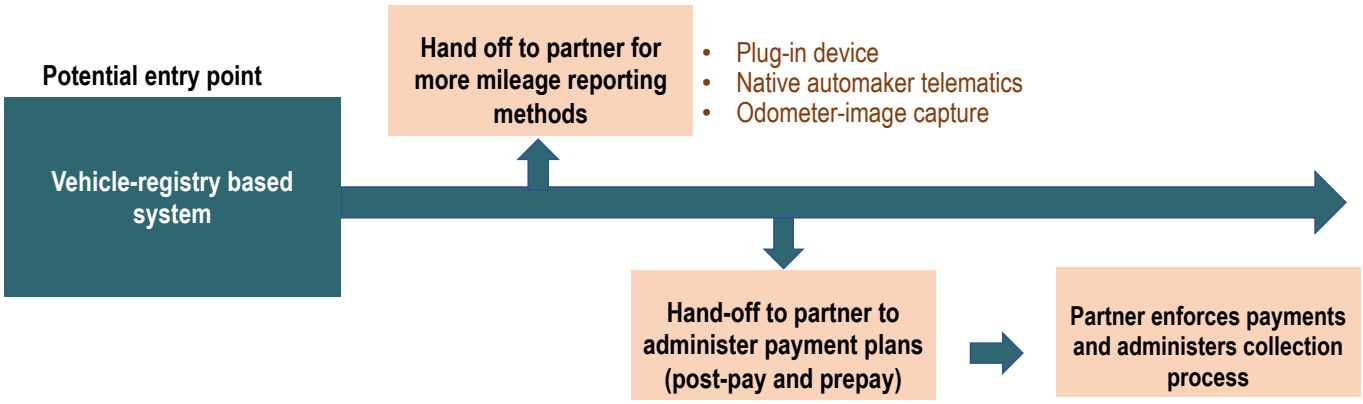
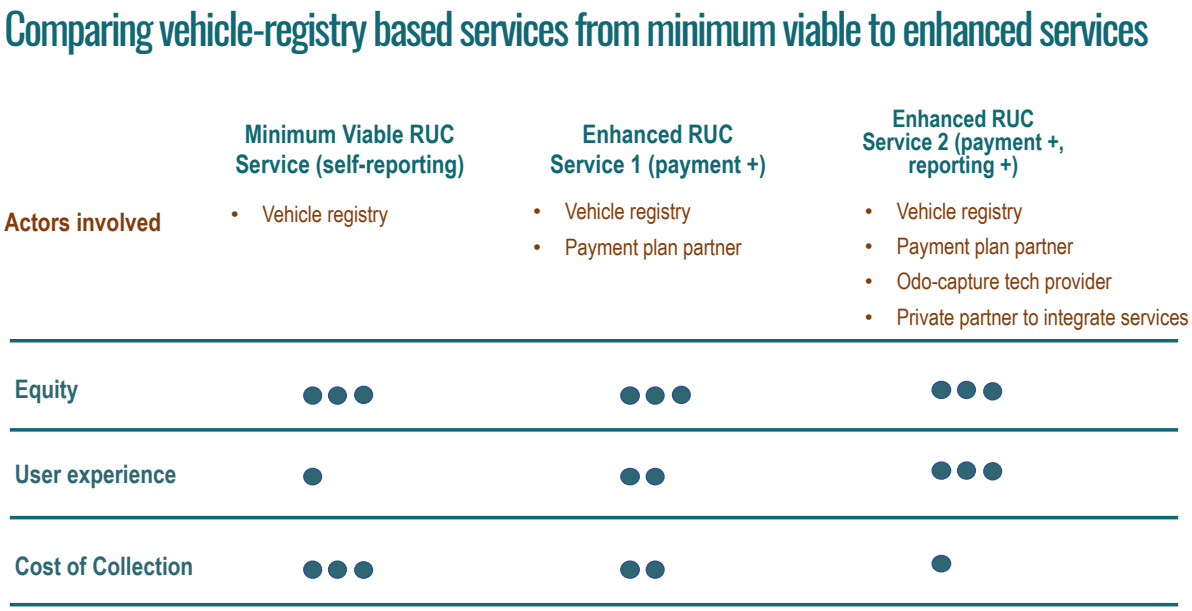


Figure 16: Enhanced RUC service flow

3.0 RUC SERVICE PILOT CONCEPT

The basic RUC service and enhanced RUC service flows served as the foundation of the RUC pilot concept that was ultimately designed and tested in the *Forward Drive*.

The goal of the pilot was to gauge how a basic RUC service inspired by the existing annual vehicle registration renewal process would be received by customers, and whether any of the enhanced services are relevant choices to offer in addition to the basic RUC service. The underlying principle of the pilot concept was to emulate how a basic and enhanced RUC services approach could be offered together. The RUC pilot concept was evaluated according to three key research metrics to inform how to balance equity, user experience, and cost-efficiency (Figure 17).



Note: “Minimum Viable RUC” is a technical term used to refer to the basic features and functions RUC must have when first introduced.

Figure 17: Evaluation of the basic and enhanced RUC service

3.1 RUC Service Workflows

Figure 18 illustrates the service workflow for a basic RUC service supported by the vehicle registry-based process as the default option.

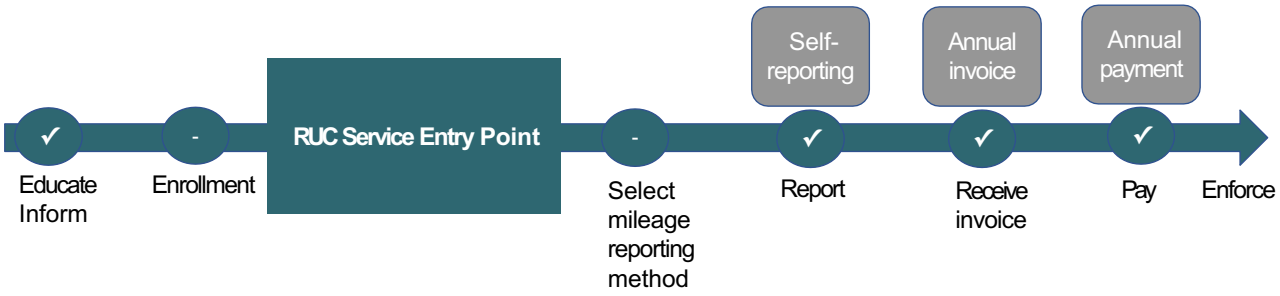


Figure 18: RUC service workflow based on vehicle registry

The same simple pilot workflow was enhanced by offering relevant choices to customers at key points of their decision-making process. Three categories of choices were considered to enhance the basic RUC service for the pilot (Figure 19):

- **Mileage reporting** including choice between no technology (based on self-reporting of odometer) and technology-based methods (based on in-vehicle telematics supported by a technology provider). The choice of mileage reporting comes with an inherent choice of reporting frequency that ranges from monthly (under high-tech options) to annually (under self-reporting).
- **Payment frequency** including choice between annual lump-sum payments or installment payments.
- **Payment type** including choices between cash, credit card, or direct bank transfers.

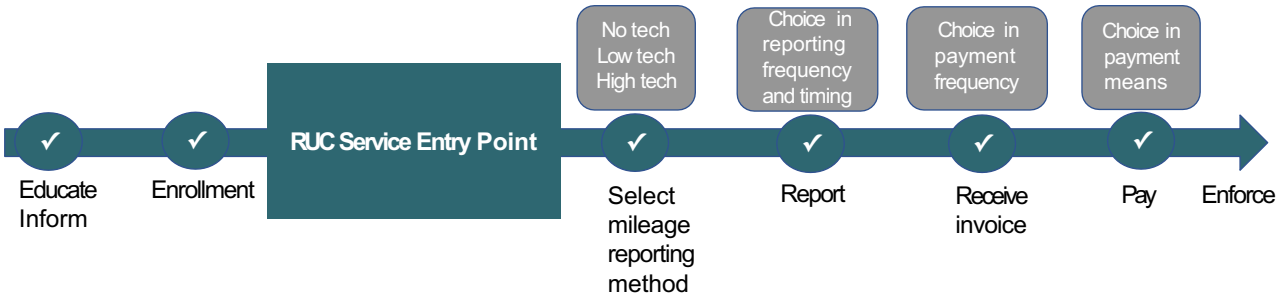


Figure 19: Enhanced RUC service flow based on private partnerships

To complete the RUC service offering with accessible choices for low-income participants and those who drive frequently out of state, the pilot concept built in additional options for customers to identify whether they qualify for targeted income-based discounts, and standard mileage exemptions (for miles driven other than on public roads in Washington) (Figure 20). The pilot concept also aimed to offer educational and accessible invoices that help make the RUC concept more accessible and understandable to participants.

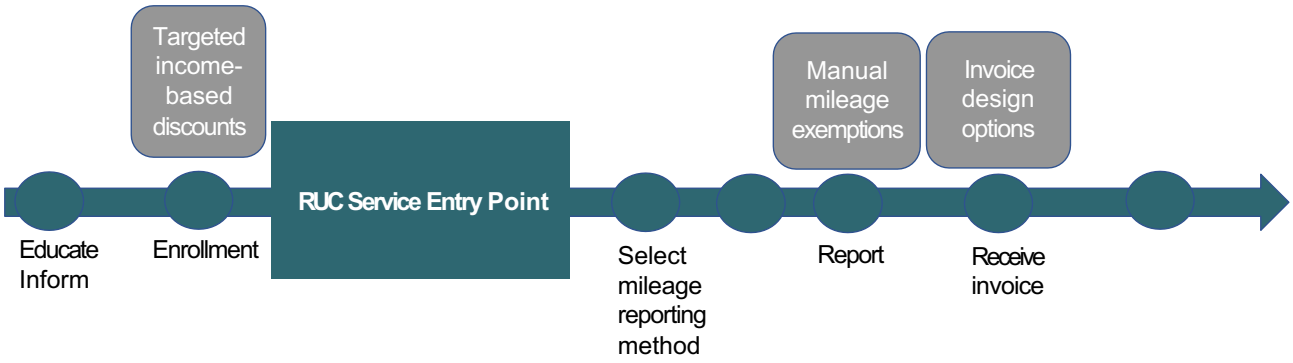


Figure 20: Additional services to address equity considerations

3.2 Combined Pilot Concept

The simple RUC service, enhanced RUC service, and additional equity service workflows outlined above were combined into a single cohesive pilot experience illustrated in Figure 21. In the pilot experience, participants first accessed the basic RUC service through a simulated process resembling vehicle tab renewal where they reported their odometer reading for their enrolled vehicle and were informed of the resulting annual RUC charges, demonstrated through an educational, interactive invoice builder. Participants were then invited to determine whether they qualify for discounts and exemptions. They could eventually decide to opt into enhanced RUC services such as payments plans that allow flexible payments in four installments, manual mileage exemptions, and, for those who have compatible vehicles, access to telematics-based mileage reporting services. The final design of the pilot experience took the form of a simulated basic RUC service with three follow-on experiences, with detailed results discussed in Appendix B.

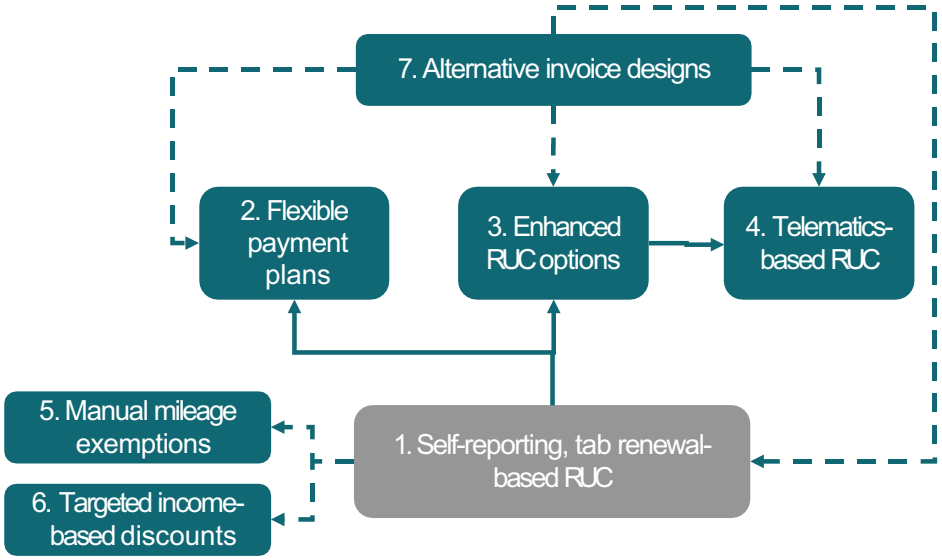


Figure 21: Combined pilot concept