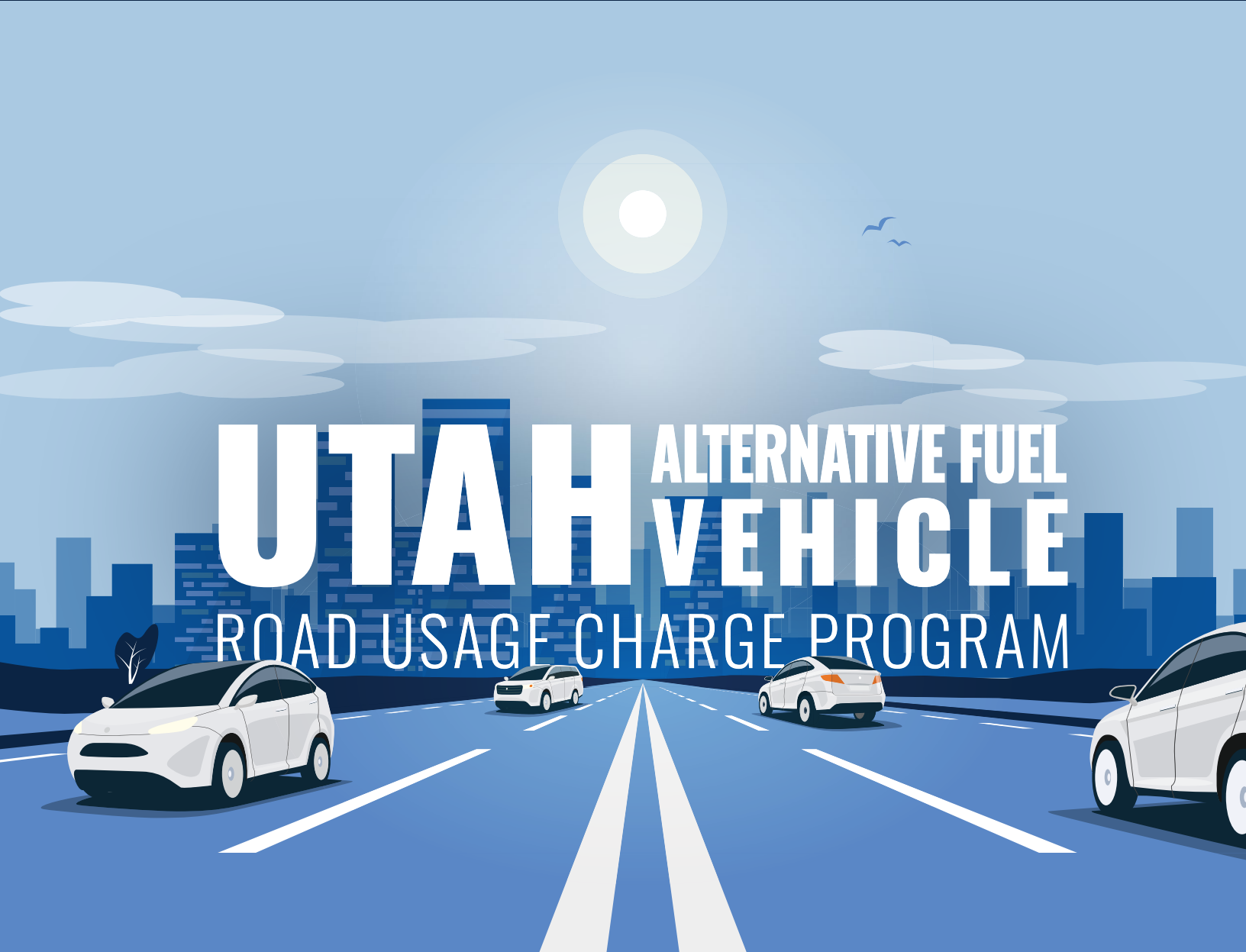




UTAH ALTERNATIVE FUEL VEHICLE ROAD USAGE CHARGE PROGRAM

FINAL REPORT

MARCH 2025

SUBMITTED TO:
USDOT/FHWA STSFA Program

SUBMITTED BY:
Utah Department of Transportation

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LIST OF ACRONYMS

AFV	Alternative Fuel Vehicle
API	Application Programming Interface
BLE	Bluetooth Low Energy
BRD	Business Requirements Document
CAM	Commercial Account Manager
CI	Confidence Interval
DMV	Division of Motor Vehicles
DTS	Department of Technology Services
EV	Electric Vehicle
FHWA	Federal Highway Administration
FOT	Field Operational Testing
GRAMA	Government Records Access and Management Act
HOT	High Occupancy Toll
ICD	Interface Control Document
KPI	Key Performance Indicators
MOE	Margin of Error
MPG	Miles Per Gallon
MRO	Mileage Reporting Option
OBD	On-board Diagnostic
ODOT	Oregon Department of Transportation
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicle
PII	Personally Identifiable Information

RFI	Request for Information
RFP	Request for Proposals
RUC	Road Usage Charge
SB	Senate Bill
SLA	Service Level Agreement
SRS	System Requirements Specification
STSFA	Surface Transportation System Funding Alternatives
UDOT	Utah Department of Transportation
USDOT	United States Department of Transportation

EXECUTIVE SUMMARY

Utah is a pioneer of innovative approaches to transportation infrastructure and its legislature created a task force to explore mileage-based transportation funding methods back in 2003. The use of Surface Transportation System Funding Alternatives (STSFA) funding to implement an operational road usage charge (RUC) program was the culmination of many years of work by the Utah Legislature and Utah Department of Transportation (UDOT) staff tasked with carrying out the legislative direction. Utah's program launched on January 1, 2020 in alignment with parameters set forth in several House and Senate bills enacted between 2015 and 2019.

Utah's RUC efforts are largely a response to the reality of a changing vehicle fleet and its effects on fuel tax revenue. The alternative fuel vehicle (AFV) category—composed of electric vehicles (EV), plug-in hybrids (PHEV), and gasoline hybrids—accounted for fewer than 5% of total vehicle registrations but represented nearly 35% of net fleet growth from 2023 to 2024. By contrast, gasoline vehicles made up 86% of Utah's vehicle fleet but accounted for only 52% of the fleet growth from 2023 to 2024. Figure ES-1 illustrates these vehicle registration trends.

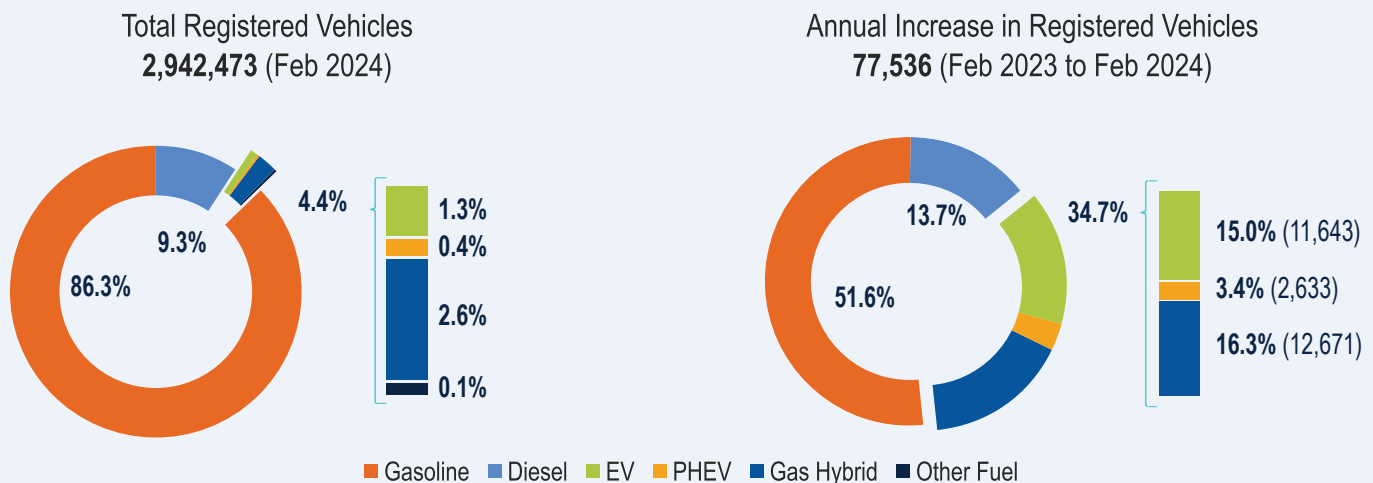


Figure ES-1 Utah Vehicle Fleet Composition

Increases in gasoline and diesel vehicle efficiency are also a significant factor impacting fuel tax revenue. This factor, combined with the increase in EVs, has resulted in Utah's light duty vehicle fleet increasing from 19.1 miles per gallon (MPG) in 2015 to 21.2 MPG in 2023. This increase equates to a 11% decline in fuel purchased for each mile driven.

UDOT is the lead agency for Utah's RUC efforts and administered this STSFA grant. The Department of Motor Vehicles (DMV) was a critical partner for reasons that will be detailed in this report. The Utah Department of Technology Services (DTS) was another important partner. DTS provides for the technology needs of all other State agencies. Together these three departments composed the RUC implementing agencies that worked closely together to meet the legislative mandates and carry out STSFA grant activities. UDOT had the support of other State agencies, key legislators, and some groups outside of Utah's governmental structure throughout the process. This support proved invaluable during an extremely short implementation timeline.

Utah developed the RUC program in response to the following legislative requirements:

- A schedule for the flat fee charged to AFV owners in addition to their annual base registration fee beginning in January 2019
- A requirement for UDOT to work with the other implementing agencies to offer a RUC payment method in lieu of the flat fee beginning in January 2020
- Creation of an Advisory Committee to give recommendations to the implementing agencies about how Utah should structure its RUC program
- Submittal of annual reports presenting results of the RUC program to the legislature and other committees

All AFV types were eligible to join the RUC program for the first three years. Beginning in January 2023, only EVs were eligible to enroll. Existing PHEV and gasoline hybrid RUC customers could remain in the program. This report documents how project objectives were addressed initially and how attitudes toward them evolved over time during the system implementation and operation phases. Specific project objectives included:

- Engage a broad-based Advisory Committee composed of important stakeholders
- Define roles of the various implementing agencies
- Design a RUC program that minimizes administrative costs, provides a seamless user experience, and protects individual privacy
- Define technology requirements for mileage collection and billing, and leverage private sector competition to find the best ways to meet those requirements
- Explore potential interoperability with existing tolling operations

Utah hired a commercial account manager (CAM) to collect mileage data, perform back-end processing functions, collect fees, and remit payments. Utah chose to approach technology procurement from a specification-based standpoint, meaning that specifications were written to obtain desired end outcomes and potential CAMs were invited to propose solutions that met those requirements.



The program’s initial RUC rate was 1.50 cents per mile because it represented what the driver of an average gasoline vehicle was paying through the State’s fuel tax in 2020. RUC customer billing was set up to include monthly account statements and prepaid wallets that included an initial \$15 balance and subsequent \$20 replenishments whenever the wallet balance fell below \$5. Credit and debit cards were the only payment methods offered. Notable unique features of Utah’s program included:

- Enrollment limitation to AFVs only
- Launch of an operational program without first conducting temporary pilot projects
- Flat fee payment alternative for AFV owners not wanting to participate in RUC
- Annual RUC cap tied to the flat fee amount
- Agency structure where UDOT and the DMV exist in separate divisions of the State government
- Integration with annual DMV registration cycle

Utah’s RUC program deployed three mileage collection technologies for operational use. On-board diagnostic (OBD) plug-in devices and embedded vehicle telematics were the primary methods for collecting mileage. Odometer photos established an initial mileage benchmark as well as an annual mileage “true up” for customers who chose OBD as their primary mileage reporting option. Odometer photos were unnecessary for telematics customers because that reporting method involved automatic wireless submission of odometer readings.

Program enrollment occurred much faster than initially expected. More than 1,000 vehicles enrolled in the first month and 5,668 vehicles were enrolled as of March 2024. Figure ES-2 shows enrollment and attrition from program inception through March 2024.

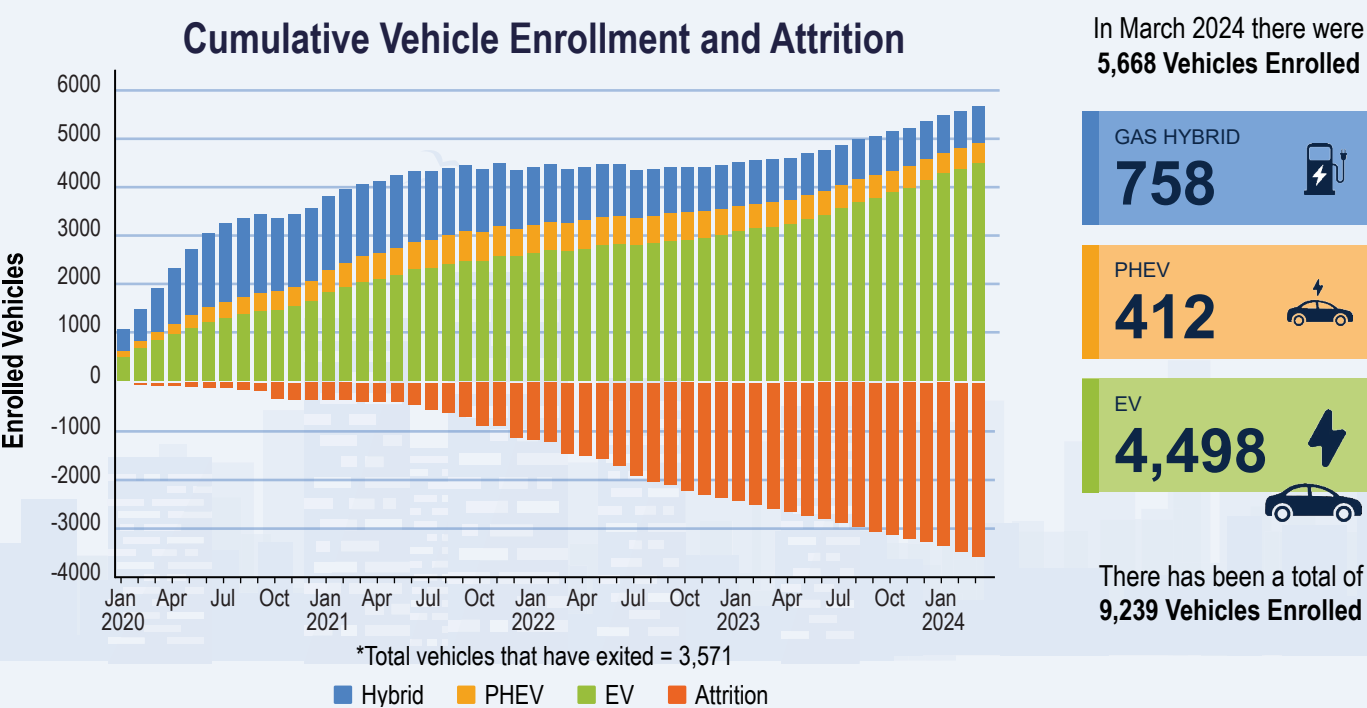


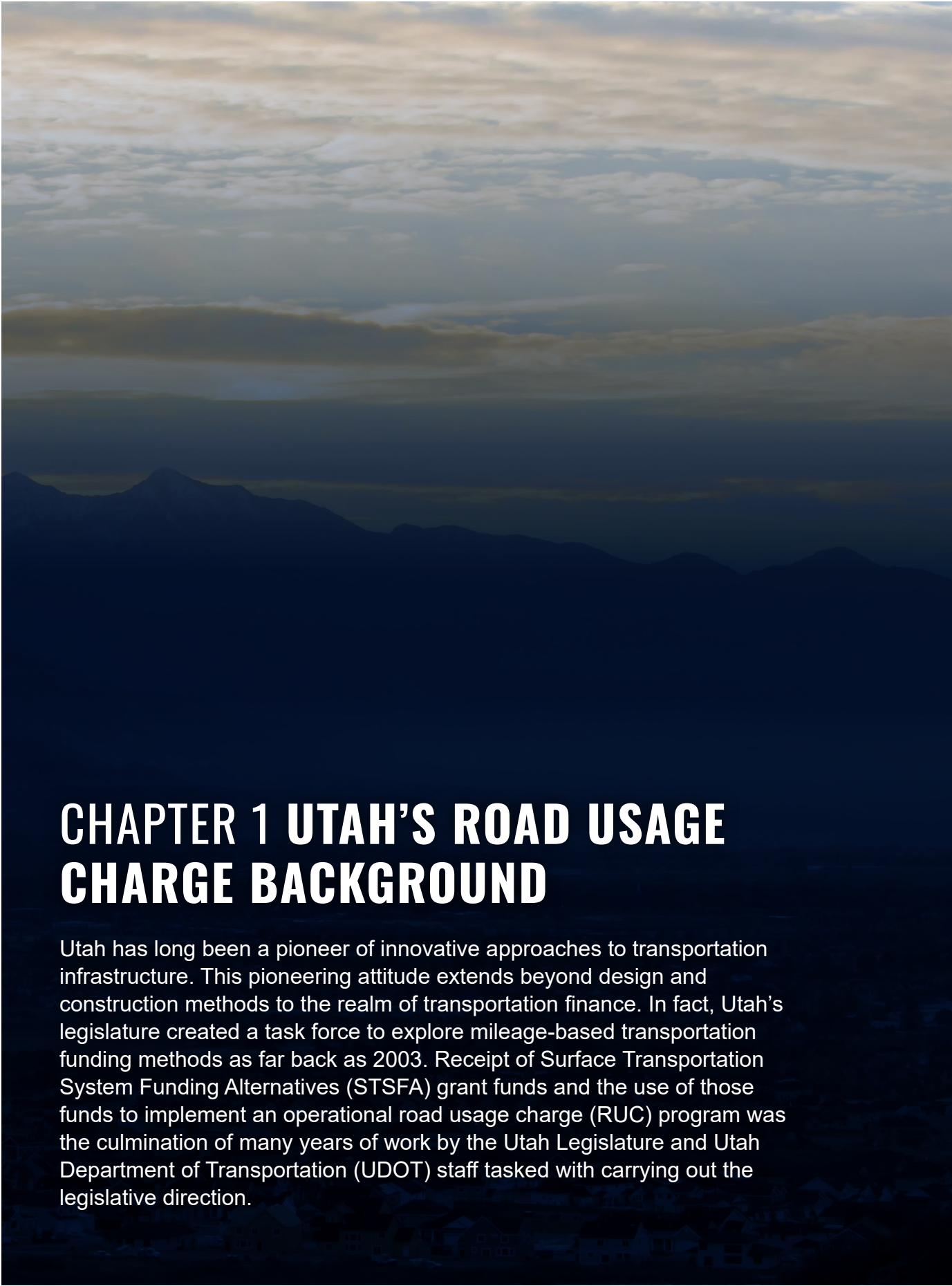
Figure ES-2 Utah RUC Enrollment History

The initial enrollment wave was accelerated by UDOT's letter-based information outreach campaign aimed at owners of eligible vehicles. The Utah legislature decided to restrict program eligibility to EVs beginning in 2023, largely due to an influx of PHEV and gasoline hybrid vehicles that cost the program more to administer than the revenue they contribute.

At the time of this STSFA grant final report, Utah's RUC program costs more to operate than the revenue it generates. This result is not entirely unexpected given that RUC program enrollment currently represents less than 0.2% of all registered vehicles and operating at such a small scale makes profitability difficult. However, Utah is currently implementing a second generation RUC program with a new CAM and expects that new program to generate 63% more revenue than the cost of administering the program. There is reason for optimism regarding long-term administrative cost given the expected growth in operational scale and improvements between UDOT's first and second generation programs.

Utah learned many valuable lessons as a result of its STSFA-funded operational program for AFVs. Chapter 7 provides details about the following key lessons:

- It is very important to allow sufficient time to thoroughly plan a RUC program, procure a CAM to operate it, test the system prior to launch, implement corrections based on test results prior to program launch, and audit the system after full program implementation to ensure the CAM is operating as expected
- States considering a RUC program need to carefully consider which vehicle types to include
- The use of OBD plug-in devices for mileage collection is challenging from both an administrative and design cost and customer experience standpoint
- Accuracy and completeness of customer statements and account portal information is important for a good customer experience
- Protection of customer privacy is crucial and it is advisable to employ robust technological and procedural measures if location-based information is used in the implementation of a RUC program
- Many important details need to be closely coordinated and explored with the DMV, whether the DOT and DMV are located in separate branches of government or not, to ensure the successful implementation of a RUC program
- States using CAMs to operate their programs need to carefully consider CAM technical proficiency against their associated price quotes in order to strike the proper balance between limiting administrative costs and providing a quality customer experience



CHAPTER 1 UTAH'S ROAD USAGE CHARGE BACKGROUND

Utah has long been a pioneer of innovative approaches to transportation infrastructure. This pioneering attitude extends beyond design and construction methods to the realm of transportation finance. In fact, Utah's legislature created a task force to explore mileage-based transportation funding methods as far back as 2003. Receipt of Surface Transportation System Funding Alternatives (STSFA) grant funds and the use of those funds to implement an operational road usage charge (RUC) program was the culmination of many years of work by the Utah Legislature and Utah Department of Transportation (UDOT) staff tasked with carrying out the legislative direction.

1.1 LEGISLATIVE HISTORY

With Utah’s ongoing status as one of the fastest-growing states in the nation, state policymakers continue to discuss how state transportation funding mechanisms can adapt and evolve to meet long-term needs. That commitment to explore long-term needs and funding solutions can be traced back to a 2003 Transportation Planning Task Force in which legislators formally stated “...the clear reality that fuel taxes alone cannot support an ever-burgeoning demand for transportation funding...” and that the state must pursue “...more creative means for raising needed funds.” That support for “creative means” became the basis for UDOT to join the Western Road Usage Charge Coalition (RUC West, and later RUC America) in 2013 for the purpose of advancing exploration of RUC as a potential future replacement of the fuel tax.

The Utah Legislature formally expressed support for UDOT’s ongoing exploration of a RUC program by adopting language in a major transportation funding bill, House Bill 362, *Transportation Infrastructure Funding*, which was adopted in the 2015 General Session. This bill directed UDOT to continue studying a RUC program and make recommendations on the potential use and future implementation of a RUC program.

A 2017 Transportation Governance and Funding Task Force, comprised of state and local policymakers and prominent business leaders, included a provision in the final report recommending that UDOT begin a RUC demonstration and pilot program as a potential future alternative to motor fuel taxes. That recommendation was incorporated into Senate Bill (SB) 136, *Transportation Governance Amendments*, adopted by the legislature in the 2018 General Session. This bill created a flat fee schedule that owners of alternative fuel vehicles (AFV) must pay in addition to their annual base registration fee. The legislation defined AFVs as electric vehicles (EV), plug-in hybrid electric vehicles (PHEV), and gasoline or diesel hybrids. SB 136 also directed UDOT to:

- Work with other State agencies to offer a RUC payment method in lieu of the flat fee, beginning in January 2020

1
- Create an Advisory Committee to give recommendations about how Utah should structure its RUC program

2
- Submit annual reports presenting results of the RUC program to the legislature and other committees

3

The legislature passed SB 72, *Transportation Governance and Funding Revisions* during the 2019 General Session. This bill provided more detailed direction to UDOT about how to initially implement RUC in Utah. It addressed issues such as:

States typically perform temporary RUC pilots prior to implementing a live system involving collection of real tax payments. Utah’s legislation, however, directed UDOT to implement a live system in a time frame that did not feasibly allow for a temporary pilot to precede it. For this reason, UDOT focused on implementing the live system for AFVs immediately and applied for STSFA grant funds to assist with that implementation.

- Privacy and security protections

■ Information sharing between UDOT and the Division of Motor Vehicles (DMV)

■ Process for setting the RUC mileage rate
- Rulemaking authority for UDOT to set parameters for enrollment, enforcement, and contracting of a commercial account manager (CAM) to operate the RUC program

Figure 1-1 shows Utah’s comprehensive RUC legislative history from 2003 to 2023. RUC-related legislation continues to pass regularly as Utah expands and adapts its program to meet the needs of the State.

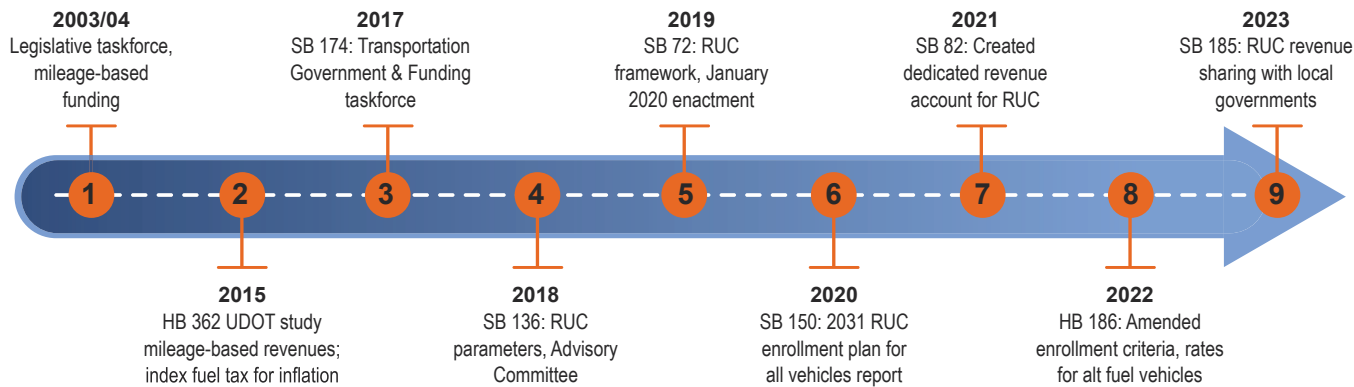


Figure 1-1 Utah RUC Legislative History

1.2 VEHICLE FLEET & FUEL TAX CONTEXT

Utah’s legislative efforts described in the previous section are largely a response to the reality of a changing vehicle fleet and its effects on fuel tax revenue collection. Figure 1-2 shows the composition of Utah’s vehicle fleet and how registrations of each vehicle type are trending. This figure shows that AFVs together account for fewer than 5% of total light duty vehicle registrations but are growing substantially more quickly than conventional gas and diesel vehicles. For example, gasoline vehicles currently made up about 86% of Utah’s light duty vehicle fleet but only accounted for about 52% of the year-over-year growth from 2023 to 2024. By contrast, EVs only made up 1.3% of the vehicle fleet but accounted for 15% of fleet growth from 2023 to 2024.

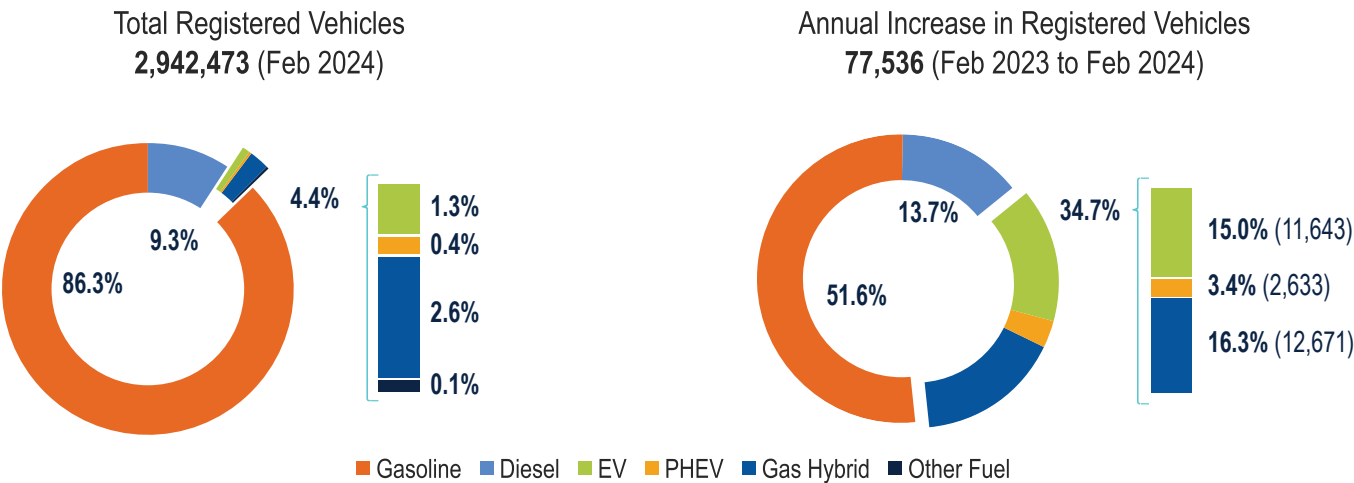


Figure 1-2 Utah Vehicle Fleet Composition

The fleet characteristics shown in Figure 1-2 largely explain why Utah’s vehicle fleet average fuel efficiency is steadily trending upward. However, another significant factor is that gasoline and diesel vehicles are also becoming more fuel efficient each year. These two factors combined have resulted in Utah’s light duty vehicle fleet increasing from an average of 19.1 miles per gallon (MPG) in 2015 to 21.2 MPG in 2023. This increase in average MPG equates to a 11% decline in the amount of fuel purchased for each mile driven by light duty vehicles in Utah over only an eight-year period. Figure 1-3 illustrates Utah’s fuel efficiency trends.

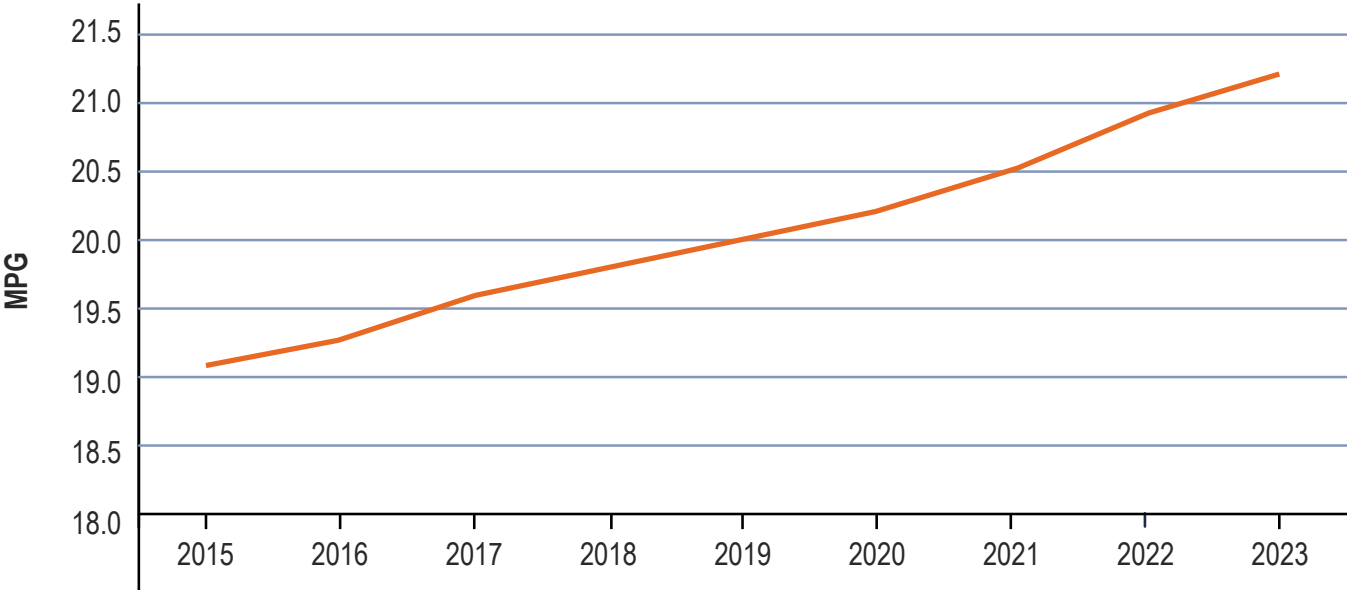


Figure 1-3 Utah Fuel Efficiency Trends

1.3 PARTICIPATION IN RUC WEST

UDOT research and policy experts attended a RUC summit hosted by the Oregon Department of Transportation (ODOT) in Fall 2013. This summit served as an introduction to the concept of RUC and was an opportunity for other states to learn about its technical and legislative aspects. That same year the Federal Highway Administration (FHWA) approved the formation of RUC West as a transportation pooled fund study. This allowed use of State Planning and Research funds from member states for collaborative research and development of RUC as a potential new transportation funding method based on actual road usage. UDOT joined RUC West along with 13 other state transportation organizations. This group is now known as RUC America and has grown to 20 states. UDOT is still an active member.

1.4 PRE-STSFA GRANT PREPARATORY ACTIVITIES

Utah's effort to meet the SB 136 AFV mandate began in earnest in April 2018 following the legislative session. Utah accomplished much in the period between then and Utah's notification of its STSFA grant award in March 2019. The following sections describe activities during that period that laid a solid foundation for success implementing the AFV RUC Program funded through the STSFA grant.

1.4.1 Interagency Coordination

UDOT is the lead agency for Utah's RUC efforts and administered this STSFA grant. Utah structures the DMV inside the Tax Commission rather than inside UDOT. The DMV was a critical partner in Utah's RUC implementation for reasons described later in this report. Utah also has a Department of Technology Services (DTS) that provides for the technology needs of all other State agencies. Together these three groups compose the RUC implementing agencies that worked closely together to meet the SB 136 mandate and carry out STSFA grant activities. UDOT worked closely with DMV and DTS to hit the ground running after the STSFA grant award announcement. Examples of inter-agency preparatory activities included:



Investigation into preferred methods for procuring a CAM to operate the program



Development of protocols for DMV sharing driver information data with UDOT and its selected CAM



Research into how best to integrate RUC program enrollment with DMV vehicle registration processes



Consideration of how best to implement enforcement mechanisms to mitigate potential fee evasion and fraud

UDOT had the support of other implementing agencies, key legislators, and some groups outside of Utah's governmental structure throughout the process. This support proved invaluable during an extremely short implementation timeline that began with signature of a CAM contract in June 2019 and culminated with a "go live" date of January 1, 2020.

1.4.2 Advisory Committee & Technical Groups

SB 136 directed UDOT to form a RUC Advisory Committee composed of people from RUC implementing agencies, the legislature, and other stakeholders with experience in telecommunications, privacy protection, data system security, and national RUC research. The Committee's first meeting was on May 3, 2018. Subsequent meetings were held quarterly for the rest of 2018, ending in November with a list of agreed-upon program parameters. Table 1-1 lists each participatory agency (or organization) and the staff positions from each group represented by committee members.

Table 1-1 Utah RUC Advisory Committee Membership	
Agency/Organization	Staff Position
UDOT	Executive Director
	Deputy Director
	Director of Technology & Innovation
	Director of Policy & Legislative Services
	Director of Finance
	Director of Communications
	Technology & Innovation Engineer
	Director of Research
Utah Governor's Office	Budget & Financial Operations Specialist
Utah Tax Commission	Deputy Director
Utah DMV	Director
Utah DTS	Chief Operations Officer
Utah Insurance Office	Property & Casualty Insurance Director
Utah Transportation Commission	Commissioner
Utah Legislature	State Senators (2)
	State Representatives (2)
Utah Legislature Staff	Policy Analyst
Mountainland Association of Governments	Executive Director
Utah Taxpayers Association	Vice President
Utah Trucking Association	Executive Director
FHWA Utah Division	Division Administrator
Uber	Desert & Mountain Regions Public Policy
RUC West	Administrator
Utah Farm Bureau	Vice President, Public Policy

Table 1-1 Utah RUC Advisory Committee Membership	
Agency/Organization	Staff Position
ACLU of Utah	Legislative & Policy Counsel
Salt Lake Chamber of Commerce	Business Representative
Layton City	Mayor
Utah Clean Energy	Government & Corporate Relations Manager

The Advisory Committee included five technical subgroups, structured to focus on specific elements important to a RUC program. Each subgroup met monthly between the quarterly Advisory Committee meetings. Groups included Committee members who elected to join. This structure allowed for small groups of engaged people to look deeper into specific issues in ways that would have been impractical with the entire Committee.

Groups provided preliminary recommendations to the full Advisory Committee on issues related to their specific topics. The Committee processed the subgroups' preliminary recommendations and ratified them to UDOT and the other implementing agencies if they were in agreement. This process allowed for parallel evaluations of separate RUC program elements rather than relying on the full Committee to directly consider all elements in sequence. It was a unique approach designed to balance the need for reasonable consensus with the need for timely decisions.

Figure 1-4 shows how Utah's implementing agencies, Advisory Committee, and technical subgroups were organized.

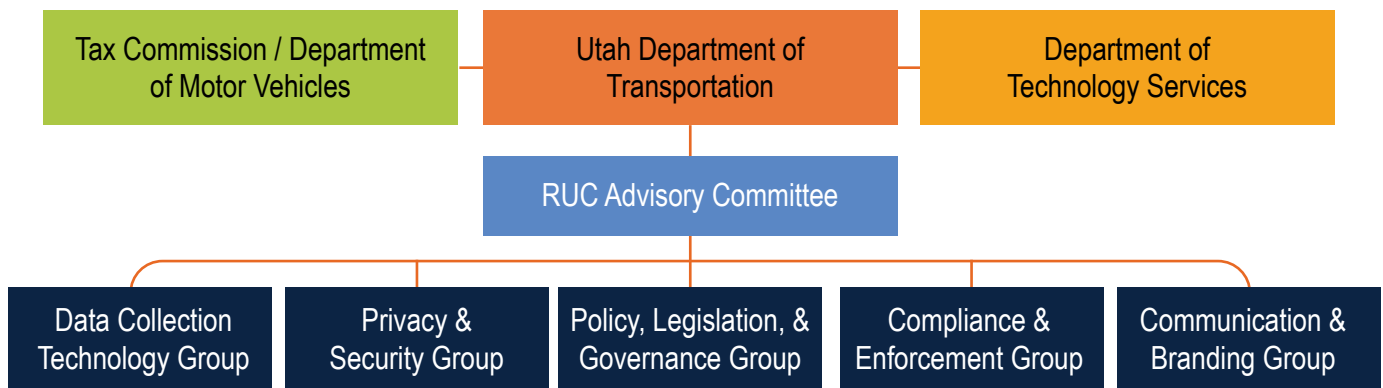


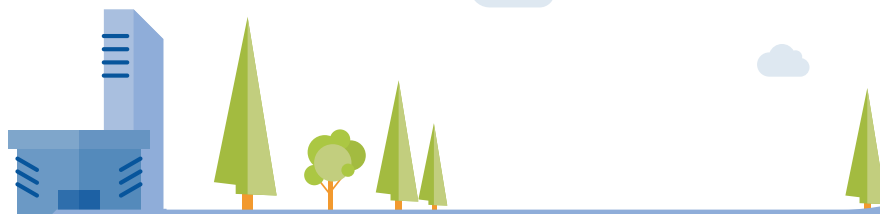
Figure 1-4 Utah RUC Leadership Structure

1.4.3 Oregon Peer Exchange

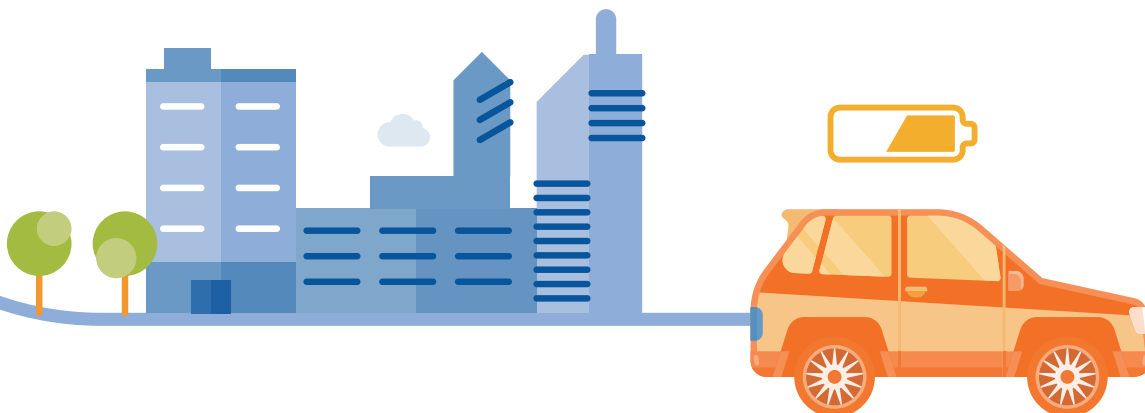
Nine individuals from Utah's RUC implementing agencies participated in a two-day peer exchange in June 2018 hosted by ODOT staff members that operate their OReGO RUC program. This exchange gave key senior staff in Utah the opportunity to talk directly with peers about their experience setting up a RUC program.

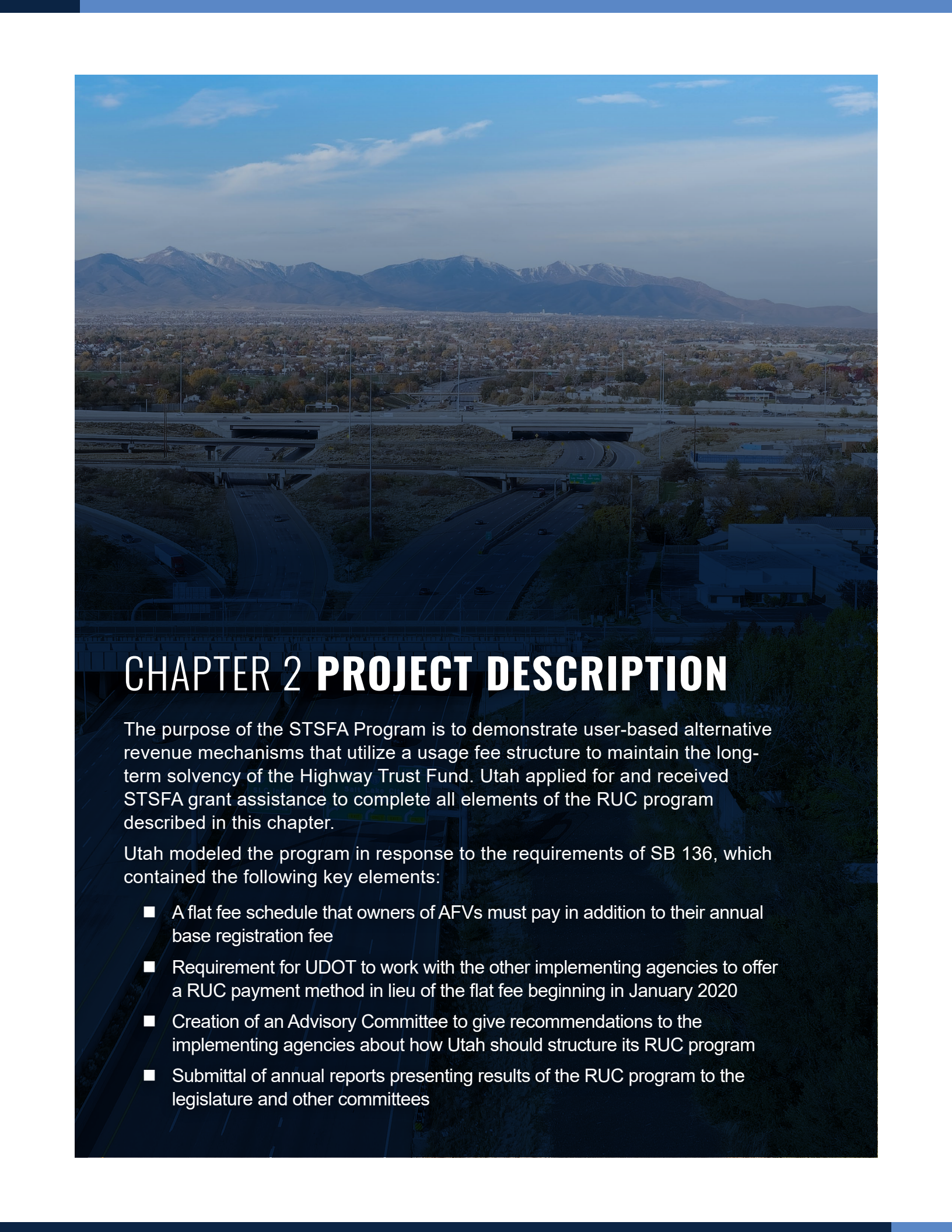


Attendees learned about important aspects of OReGO such as technology choices, CAM procurement, and communications directly from the people involved at the operational level.



This crash course provided important lessons learned and helped guide UDOT's discussions about how best to design a system to meet the SB 136 AFV RUC mandate. It also resulted in collection of many different forms of communication and procurement documentation that proved valuable as UDOT created its plan in a compressed time frame.



An aerial photograph of a multi-level highway interchange in a valley. In the background, a range of mountains with patches of snow is visible under a blue sky with light clouds. The foreground shows the complex road structure with multiple lanes and overpasses.

CHAPTER 2 PROJECT DESCRIPTION

The purpose of the STSFA Program is to demonstrate user-based alternative revenue mechanisms that utilize a usage fee structure to maintain the long-term solvency of the Highway Trust Fund. Utah applied for and received STSFA grant assistance to complete all elements of the RUC program described in this chapter.

Utah modeled the program in response to the requirements of SB 136, which contained the following key elements:

- A flat fee schedule that owners of AFVs must pay in addition to their annual base registration fee
- Requirement for UDOT to work with the other implementing agencies to offer a RUC payment method in lieu of the flat fee beginning in January 2020
- Creation of an Advisory Committee to give recommendations to the implementing agencies about how Utah should structure its RUC program
- Submittal of annual reports presenting results of the RUC program to the legislature and other committees

Table 2-1 shows the flat fee schedule set in SB 136 for different classes of AFVs from 2019-2021. It also shows the adjustments to these fees in the years since 2021. Utah’s legislation indexed these fees to the Consumer Price Index beyond 2021. Fees are due at the time of vehicle registration, which is conducted in a rolling fashion throughout the year. Future sections of this report explain how owners of AFVs were able to enroll in the RUC program in lieu of paying these fees.

Table 2-1 Utah AFV Fee Structure			
Year	EV	PHEV	Gasoline Hybrids
2019	\$60.00	\$26.00	\$10.00
2020	\$90.00	\$39.00	\$15.00
2021	\$120.00	\$52.00	\$20.00
2022	\$123.00	\$53.25	\$20.50
2023	\$130.25	\$56.50	\$21.75
2024	\$138.50	\$60.25	\$23.25

2.1 VISION & OBJECTIVES

At the outset of its STSFA grant implementation, Utah envisioned RUC as a usage-based transportation revenue source with the potential to be a long-term replacement of the fuel tax. Specific project objectives included:

- Engage a broad-based Advisory Committee composed of important stakeholders
- Define roles of the various implementing agencies
- Design a RUC program that minimizes administrative costs, provides a seamless user experience, and protects individual privacy
- Define technology requirements for mileage collection and billing, and leverage private sector competition to find the best ways to meet those requirements
- Explore potential interoperability with existing High Occupancy Toll (HOT) lane tolling operations

This report documents how these goals were addressed initially and how attitudes toward them evolved over time during the system implementation and operation phases.

2.2 PROJECT SCHEDULE

Figure 2-1 displays the project schedule including the preparatory activities that preceded UDOT's STSFA grant award. Grant funds were spent over a four-year period after the award announcement.

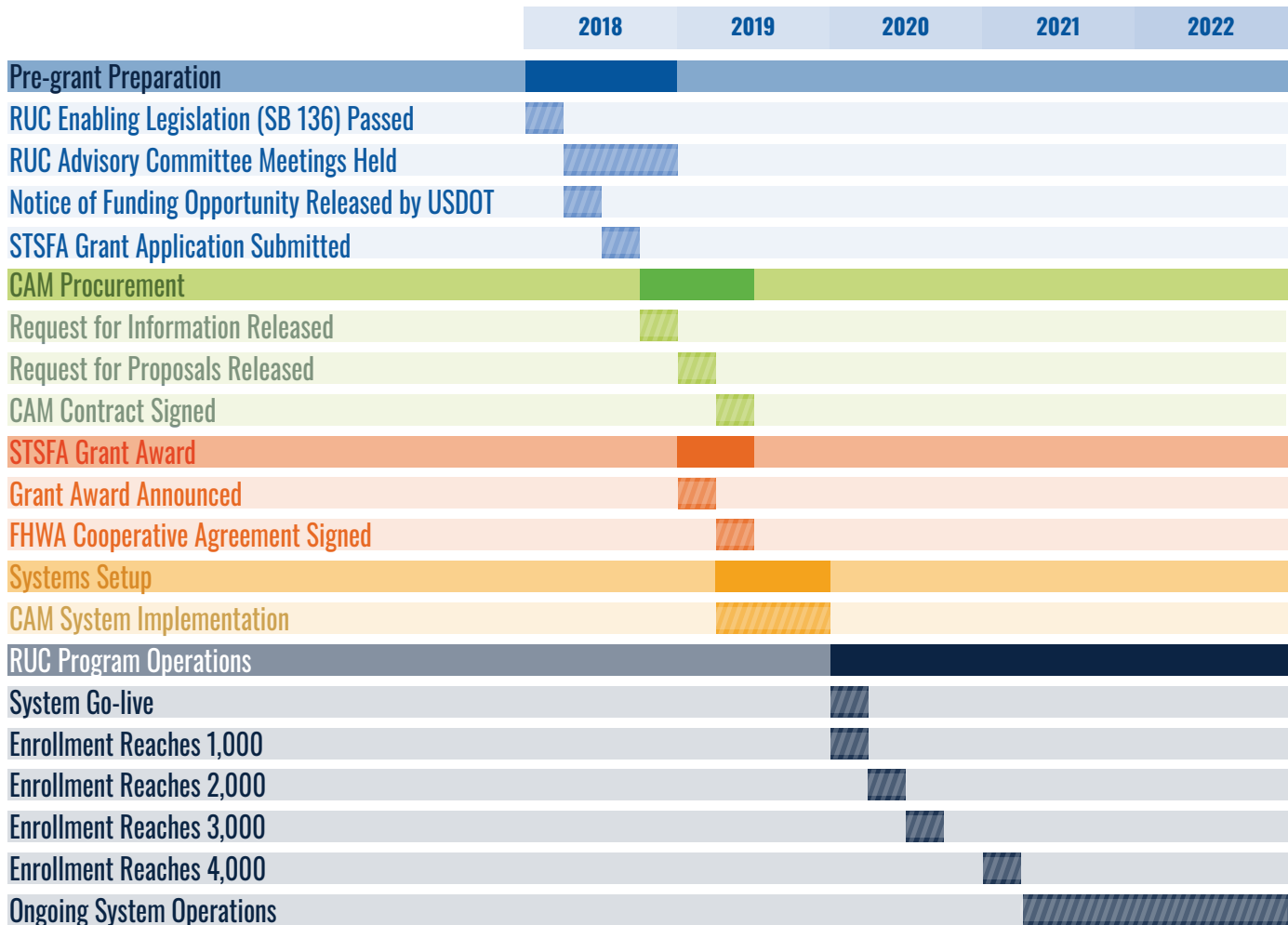


Figure 2-1 Utah RUC Implementation Schedule

2.3 SYSTEM DESIGN

Utah's RUC program implementation prioritized meeting STSFA program goals in addition to Utah's internal needs. Sections 2.3.1 through 2.3.8 provide detailed descriptions of notable system design components. Section 2.6 summarizes how the system meets specific STSFA program goals and criteria.

2.3.1 Enrollment

UDOT sought from the outset of this project to make its RUC program a seamless user experience to the extent possible. One way in which this desire manifested was through the use of existing governmental touchpoints such as the vehicle registration process. Beginning in 2019, the annual registration process for AFV owners added a flat fee intended to capture some of the

impact those vehicles have on the road network. In 2020, the option to enroll in a location-based RUC program in lieu of the flat fee was added to this existing vehicle registration workflow.

Information provided in registration notices helped vehicle owners understand the RUC program and make informed choices about whether they should join. Owners that were not comfortable sharing mileage data with a CAM could remain with the default option of paying the AFV flat fee at registration and could choose to join RUC in a future year registration cycle. Owners choosing the RUC option were directed to enrollment details. Mileage collection began for RUC customers in the month when their new 12-month registration cycle began in order to sync RUC enrollment and registration.

Approximately 8,000 EVs, 4,400 PHEVs, and 43,000 gasoline or diesel hybrids were registered in Utah in January 2020 when the RUC program began. By February 2024, these numbers grew to approximately 37,000, 12,000, and 76,000, respectively. The owners of these vehicle types made up the pool of potential RUC customers. It was difficult prior to initial RUC program implementation to estimate how many eligible vehicle owners would choose to enroll in RUC even though some outreach was conducted with AFV owners in late 2018 to gauge likely enrollment volumes. Estimates, although imperfect, were necessary in order to give potential CAMs an idea of the magnitude of customer load they would be servicing.

2.3.2 Data Collection & Back-end Processing

Utah hired a CAM to collect mileage data, perform back-end processing functions, collect fees, and remit tax payments due to the State. More companies are developing products to serve the nascent RUC market each year. For this reason, Utah chose to approach technology procurement from a specification-based standpoint, meaning that requirement documents specified the end outcomes that the State wanted, inviting vendors to propose solutions that met those requirements. Specification-based procurement methods have several benefits:

1

Allow the private sector to innovate without unnecessary constraints

2

Allow new technologies to enter RUC programs when they become viable

3

Allow RUC programs to scale up organically in the future when technological advances make it reasonable to extend RUC payment options to additional vehicle types

Members of the RUC implementing agencies and Advisory Committee hosted meetings with several vendors offering CAM services to learn more about their products’ potential applicability to Utah’s program. These meetings helped decision makers refine expectations and gain a better understanding of how UDOT could best structure a procurement process to accomplish the State’s goals.

UDOT then released a formal Request for Information (RFI) in late 2018 to begin the process of soliciting interest from the CAM community. This RFI process resulted in valuable insights into what the marketplace could offer. CAMs benefited by gaining a deeper understanding of Utah’s specific needs and how they could best meet them. An additional benefit to both groups was that knowledge gained during the RFI process helped to better define the ensuing Request for Proposals (RFP) process, which began in February 2019 and culminated in the hiring of a CAM in June 2019.

2.3.3 RUC Rate Setting

It was necessary prior to system launch to determine the per-mile RUC rate that would be charged to program customers. The Advisory Committee considered two approaches for setting the rate, as illustrated by Figure 2-2.

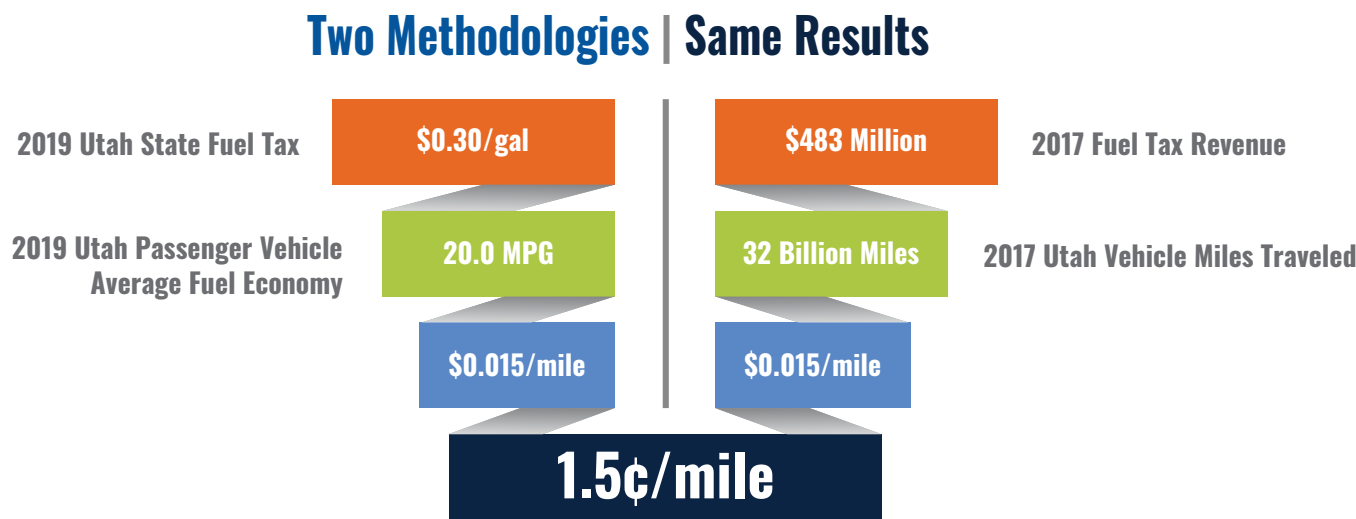


Figure 2-2 Utah RUC Rate Calculation Approaches

The first approach was to divide the State’s per-gallon fuel tax rate by the estimated average light-duty passenger vehicle fuel economy. The second approach involved dividing total annual statewide fuel tax revenue by UDOT’s estimate for statewide annual vehicle-miles traveled. Both approaches were in service of the same goal, which was to assess a per-mile rate that would result in owners of AFVs paying the same as the average Utah driver of an internal combustion vehicle. Interestingly, both approaches produced the exact same result of 1.5 cents per mile. The Advisory Committee ratified this result and the program began in January 2020 with RUC program customers paying 1.5 cents per mile.

2.3.4 Payment Process

RUC program customer billing occurs monthly, structured with a prepaid electronic wallet. Credit and debit cards were the only payment methods accepted for wallet replenishments. Anyone unable or unwilling to provide a credit or debit card paid the AFV vehicle flat fee at the time of registration and was not able to complete the RUC enrollment process. The required initial wallet balance was \$15, with \$20 replenishments charged automatically to the card on file whenever the wallet balance dipped below \$5. This payment structure is similar to that of UDOT’s HOT lanes program and the similarities benefited customers enrolled in both programs.

Customers received monthly statements via email summarizing wallet balances, payment card debits, and mileage accrued. An actual customer statement example is included in Appendix A.

2.3.5 Exiting the RUC Program

The intent of Utah’s AFV RUC program is to keep people enrolled through the full 12 months of their registration cycle when they choose the RUC option in lieu of the AFV flat fee. Ideally, the yearly registration process would be the only touchpoint where vehicle owners could switch

between paying the flat fee and enrolling in RUC. However, various events create demand for a way to leave the RUC program in the middle of a registration period. Such events include selling a car, relocating to a different state, refusal to comply with program rules and procedures, or simply not liking the program.

The Advisory Committee considered the various benefits and drawbacks associated with different ways of handling mid-year RUC exits. Ultimately, the Committee decided to require customers exiting mid-year to be assessed an amount equal to the AFV fee associated with their vehicle type minus the amount of RUC mileage fees they had already paid to date during their registration cycle. For example, the owner of an EV in 2021 would be assessed \$30 (\$120 minus \$90) at the time of a mid-year account closure if they had already driven 6,000 miles during their registration period before exiting the RUC program.

Two major considerations underpinned the rationale behind this exit process. First, it mitigated against customers that might otherwise game the system by enrolling in RUC to avoid the flat fee at registration and then immediately exit the RUC program before paying any mileage fees. Second, it was analogous to the current situation experienced by vehicle owners that register their vehicle and then sell it or relocate to another state fewer than 12 months from that registration event. The Utah DMV does not offer any prorated rebates for situations of that nature and therefore deemed it acceptable for the RUC program to handle customer exits in like manner since the RUC program is an alternative to paying the AFV flat fee at registration.

2.3.6 Interoperability with HOT Lane Tolling

UDOT currently operates 144 lane-miles of HOT lanes on I-15 with an active customer base of approximately 35,000 people that own transponders. Plans are also underway to consider electronic tolling on popular canyon routes leading to recreational areas. UDOT, DMV, and DTS staff held several meetings internally and with vendors that operate both RUC and tolling operations to investigate potential options for system interoperability between tolling and RUC. The complexity of merging these operations became evident and UDOT chose to table the conversation until a future time. Ultimately, UDOT chose to apply for (and was awarded) a separate STSFA grant to focus specifically on the topic of RUC and tolling interoperability. Another final report for that grant will present the findings.



2.3.7 Privacy & Data Handling

Many other states' RUC pilot projects have successfully tested the concept of protecting drivers' privacy by using private CAMs to collect location-based mileage data and transmit only aggregated mileage totals to State entities. UDOT followed best practice examples from these other pilots and from Oregon's operational RUC program to similarly protect the privacy of Utah drivers through industry-standard collection, management, storage, transmission, and purge protocols. Additionally, Utah has robust statutes governing data privacy and the RUC program was structured to comply with those statutes.

2.3.8 Potential for Future Phasing

While legislation to date limits Utah's initial RUC program to AFVs, the annual legislative reporting requirements and other elements suggest an appetite for considering system expansion to include other types of vehicles in the future. Discussions continue to occur about future pilot projects and potential long-term changes to the live program. Examples of future RUC elements that Utah may consider testing or taking operational include:

- New mileage collection technologies
- System interoperability with other states
- Exemption of miles driven on private roads
- Ability to separate miles driven on paved and unpaved roads
- Time-of-day and congestion charging

Examples of RUC elements that Utah has already received other STSFA grants for (and is actively working on) include:

- Integration of RUC and HOT lane tolling
- RUC overlays that would give local governments a mechanism to add their own mileage fees to the State mileage rate, similar to how Utah allows local government sales tax overlays
- Optimization of the customer experience

2.4 UNIQUE FEATURES

Several key elements of Utah's proposed system described in Section 2.3 are unique in the United States and add substantially to the national RUC conversation. This section highlights those elements and explains their potential value to other states and the United States Department of Transportation (USDOT).

2.4.1 Limitation to AFVs

Other states' pilot projects experiment with a variety of vehicle types. Utah intentionally limited its initial system to AFVs because they don't pay transportation taxes in an amount proportional to the miles they drive, as is typically the case with internal combustion vehicles. Utah's legislature believed that it was logical to gear the State's initial RUC program toward the vehicle types that were contributing less fuel tax per mile driven.

2.4.2 Ongoing Operational Program

Utah's RUC program design aligned with real-world pragmatism out of necessity because it was not merely an ephemeral pilot project with simulated RUC payments. In January 2020, Utah became the second ongoing operational RUC program in the nation. The lessons learned from several years of live operations are enumerated later in this report. These lessons will be inherently useful for moving the state of RUC practice forward in the US.

2.4.3 Flat Fee Payment Alternative

It is important for RUC programs to offer a tax payment alternative that does not require opting into location-based tracking. Utah chose to address this by offering a flat fee alternative payable at the time of vehicle registration. While not a RUC method itself, the flat fee option provides a very practical counterbalance to a location-based RUC program and helps the RUC program function more smoothly by giving AFV owners choices.



2.4.4 Annual RUC Fee Caps

Utah chose to implement annual RUC fee caps pegged to the registration flat fee amounts applicable to each AFV type. These caps ensure that those enrolling in RUC will not pay more in RUC fees during their 12-month registration cycle than they would have paid if they'd chosen the flat fee at registration. For example, a person driving an EV in 2021 and choosing to enroll in the RUC program would know at enrollment that yearly RUC fees would not total more than \$120.

Annual RUC fee caps have several implications. First, they remove the need for a vehicle owner to determine whether enrolling in RUC or paying the flat fee is better from an economic perspective. The owner is left to make the enrollment decision based on other factors such as inclination to allow third-party mileage collection, preference for paying fees up front or gradually, and willingness to spend additional time completing a RUC enrollment process. The cap also likely resulted in far more people enrolling in Utah's program than otherwise would have.

Another implication of annual fee caps is that they put the onus on the legislature to determine the annual maximum payment amounts through manipulation of the flat fee targets. The initial flat fees (even at their highest values in 2021) were set lower than the amount that equated to the average Utah miles driven multiplied by the revenue-neutral RUC rate of 1.5 cents per mile. Legislators will continually need to determine whether, as a matter of policy, registration flat fees should be set in line with average miles driven or at other amounts that further specific legislative policy goals. Results from Utah's implementation of payment caps will be useful for other states contemplating future RUC system designs.

2.4.5 Agency Structure

Oregon was the only other state with an ongoing operational RUC program when Utah launched its program in January 2020. Oregon's governmental structure places its DMV within ODOT. Utah, on the other hand, places the DMV inside the Tax Commission. This structure means that UDOT and the DMV/Tax Commission worked together to define roles and integrate systems. Utah's experience can be a useful operational model for other states similarly structured with DMVs and DOTs located in separate branches of state government, should those states choose to seriously consider implementing RUC programs in the future.



2.4.6 Integration with DMV Registration

A benefit of real-world RUC implementation vis-a-vis temporary pilot projects is that it forces a state to figure out how to accommodate RUC within existing systems in agencies such as the DMV and DOT. Utah's goal was (and still is) to make the user experience as seamless as possible by minimizing the need to create new customer touchpoints. Integrating RUC enrollment and exiting processes into the annual registration cycle was a logical idea to implement in pursuit of that goal.

RUC program enrollment aligned with the annual registration cycle by presenting owners of AFVs with the option to join RUC as part of their registration workflow. Enforcement mechanisms also aligned with DMV registration by allowing the CAM to request that the DMV place a registration hold on customers that were noncompliant with program rules such as activation of mileage reporting devices and maintaining a valid payment card on the customer account. This type of RUC-DMV integration can provide a useful model for other states to follow at a future time when they are ready to implement ongoing RUC programs that use real money and must be tied into established processes. Additionally, Utah's RUC program was the first to utilize an online application performance interface (API).

2.5 COMMUNICATION

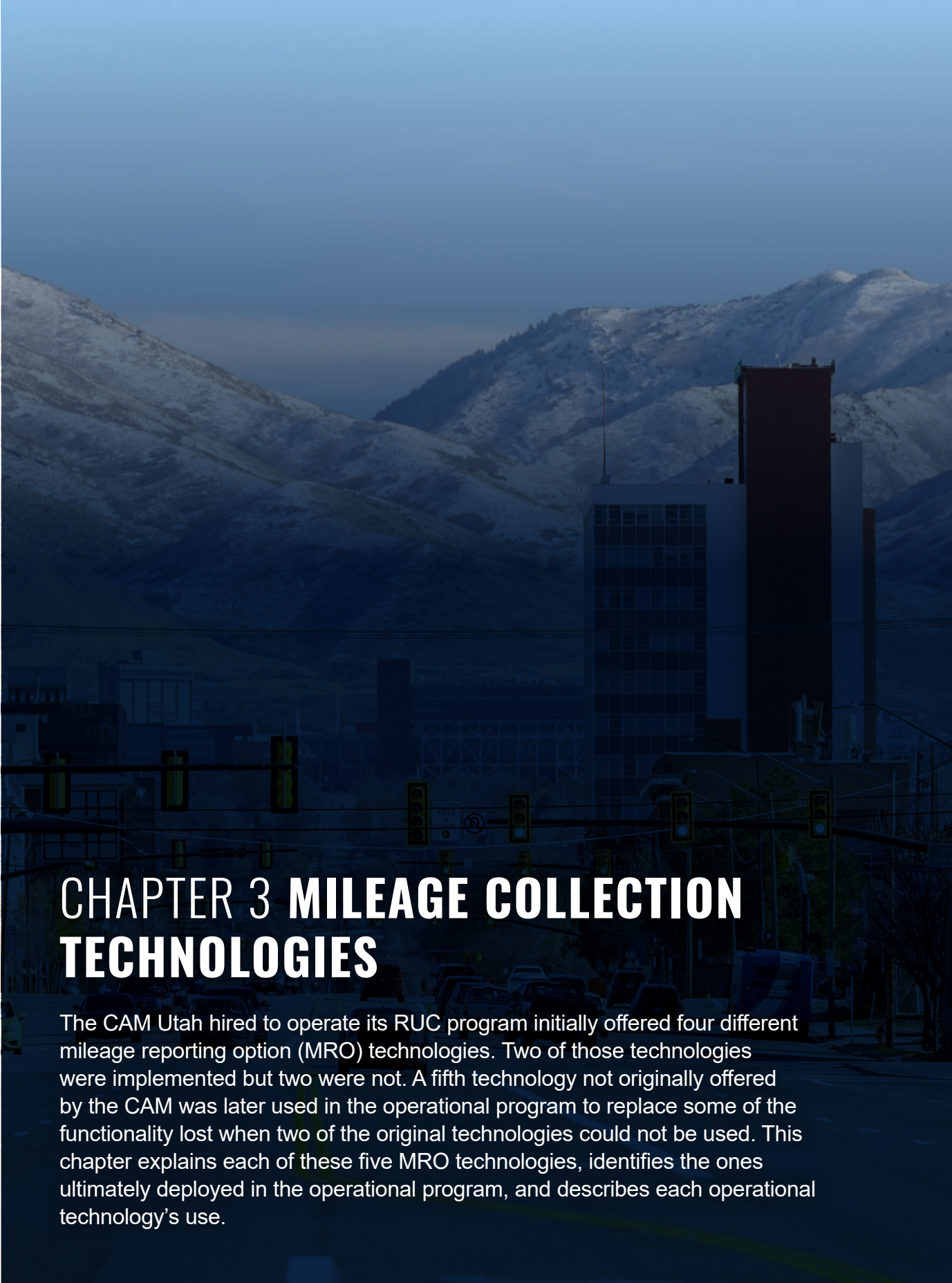
Members of UDOT's communication staff participated in the Advisory Committee and in other internal UDOT work groups in preparation for the program launch. A Strategic Communication Plan was created specifically to prepare for this launch. The effort included a mass mailing to all owners of AFVs in January 2020. Feedback from customers indicated that this mailing was highly influential in motivating potential customers to enroll.

2.6 FULFILLMENT OF STSFA PROGRAM GOALS

The STSFA grant program had the following goals:

- Test RUC design, acceptance, and implementation (see Chapters 4, 5, and 6)
- Improve functionality of RUC mechanisms (see section 5.3)
- Conduct outreach to increase public awareness of the need for alternative funding sources (see section 6.6)
- Provide recommendations about RUC adoption and implementation (see Chapter 7)
- Minimize RUC administrative cost (see section 6.2)

This report demonstrates how Utah's AFV RUC program implementation fulfilled all of these STSFA program goals. Much remains to be tested with respect to widespread implementation of RUC programs but Utah's experience adds valuable real-world operational data to the conversation.



CHAPTER 3 MILEAGE COLLECTION TECHNOLOGIES

The CAM Utah hired to operate its RUC program initially offered four different mileage reporting option (MRO) technologies. Two of those technologies were implemented but two were not. A fifth technology not originally offered by the CAM was later used in the operational program to replace some of the functionality lost when two of the original technologies could not be used. This chapter explains each of these five MRO technologies, identifies the ones ultimately deployed in the operational program, and describes each operational technology's use.

3.1 UNUSED TECHNOLOGIES

Two of the MRO technologies originally proposed by the selected CAM could not be implemented in the program because they were not sufficiently developed for live deployment. In fact, at the time this report is being prepared, these technologies have never been utilized in any RUC program or pilot. These MROs both involved pairing a Bluetooth-enabled device with a smartphone and are described below.

3.1.1 Bluetooth Low Energy OBD-II & Smartphone Application

This MRO combined a Bluetooth low energy (BLE) on-board diagnostic (OBD)-II device with a smartphone app. The smartphone app was intended to run in the background on the phone and only activate when connected to the BLE OBD-II device while driving, thereby minimizing phone battery drain. The BLE OBD-II plug-in device would have been powered by the vehicle's OBD port in the same manner as traditional OBD-II devices used for RUC purposes. The app and BLE OBD-II device would have been paired such that the app would recognize the vehicle and activate when the vehicle was driven. This MRO would have been an option for drivers of all EV, PHEV, and gas hybrid vehicles eligible to enroll in Utah's RUC program, other than Tesla's Model Y and Model 3, which do not have OBD-II ports.

This MRO would have recorded mileage data in two ways. First, the smartphone would record GPS location data while the vehicle moves and calculate mileage from those GPS coordinates. Second, the BLE OBD-II device would transmit beginning and ending vehicle odometer readings from each trip to the smartphone app. The smartphone would then transmit both forms of mileage to the CAM either through the cellular communication connection or WiFi. Multiple drivers could download the app and pair it with the BLE OBD-II device. To preserve privacy, the app would delete trip data after confirmation of transmission receipt from the CAM's data collection system.



3.1.2 Bluetooth Beacon & Smartphone Application

This MRO worked similarly to the BLE OBD-II and smartphone app option described in the previous section. The key difference is that the Bluetooth beacon would not communicate with the vehicle itself through the OBD-II port. Instead, the Bluetooth beacon would have been mounted in the vehicle and merely serve as an identifier for the smartphone app to recognize the vehicle. All mileage calculations would depend on the phone GPS coordinate tracking. This MRO would have provided a RUC enrollment option for drivers of vehicles that did not have an OBD port or original equipment manufacturer (OEM) telematics capability.

3.2 OPERATIONAL TECHNOLOGIES

Utah's AFV RUC program deployed two MRO technologies for live operations. The OBD-II plug-in device and OEM telematics MROs were used for primary mileage collection, with odometer photo MRO usage limited to an initial benchmark odometer value and periodic "true up" readings for participants that chose OBD-II as their primary MRO. **Figure 3-1** shows the relative percentages of RUC participants enrolled in OBD-II plug-in device and OEM telematics as their primary MRO at the end of 2022 when the STSFA grant funds were fully expended. The sections below describe the two operational MROs in more detail.

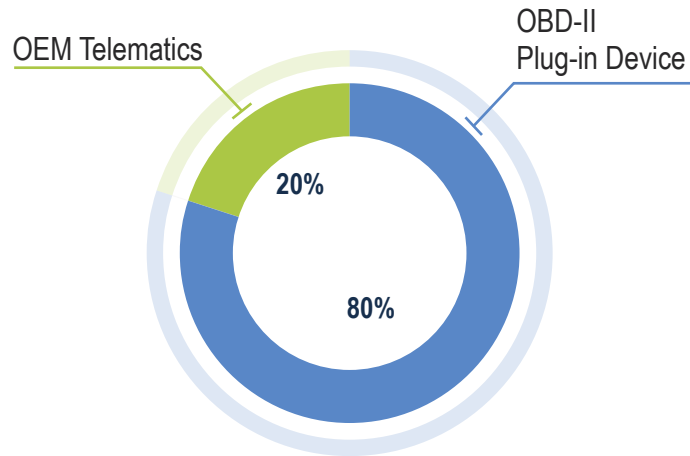


Figure 3-1 RUC Participant MRO Selection

3.2.1 OBD-II Plug-in Devices

An OBD-II device is aftermarket electronic hardware that plugs into a vehicle's OBD-II port to obtain power and vehicle data. It is the same port used by auto mechanics to diagnose a car when it is brought in for maintenance. The OBD-II data standard was originally developed to support emissions monitoring. All vehicles manufactured after 1996 were required to have OBD-II ports until very recently when exemptions began to be made for some electric vehicles that do not emit tailpipe emissions. **Figure 3-2** shows an example of an OBD-II device.



Figure 3-2 OBD-II Device

OBD-II devices can request many different types of vehicle data to assist in monitoring vehicle health and performance, and they can also include technology (e.g. a GPS receiver) to determine location and speed. Odometer reading values can also be obtained through communication with the vehicle's on-board computer. The location and mileage data can then determine the exact jurisdictions (e.g. states, counties, cities) in which a vehicle travels to then apply different charge rates for driving in different areas. Operational RUC programs and pilot projects use OBD-II devices extensively because they are sources of mileage data. However, there are several potentially significant drawbacks to using OBD-II devices for RUC purposes, the most noteworthy of which are:

- Expense
- Device delivery and return logistics
- Ability of customers to easily remove devices
- Perception from some customers that installing devices is a complex task

Utah's AFV RUC program used OBD-II devices for all enrolled vehicles other than Tesla models Y and 3 that did not have OBD-II ports, but they were not part of the MRO offerings originally planned by the CAM. These devices came into the program as a replacement for the functionality that the CAM originally intended to provide through the two unused Bluetooth-based MROs described in section 3.1.

Odometer photos can be effective means for gathering periodic odometer readings. In Utah's AFV RUC program, participants who enrolled with an OBD-II plug-in device as their primary MRO had to download a smartphone app capable of taking photos of their vehicle odometer and submitting them wirelessly to the CAM. Odometer photo capture enabled capturing miles driven when devices were unplugged. Submitted photos were compared against a database of most common vehicle make and model dashboards to confirm that the photo matched the correct dashboard setup for that vehicle. Image recognition software then extracted the odometer value and checked for signs of attempted fraud. Figure 3-3 shows the odometer photo submission workflow experienced by Utah's AFV RUC participants.

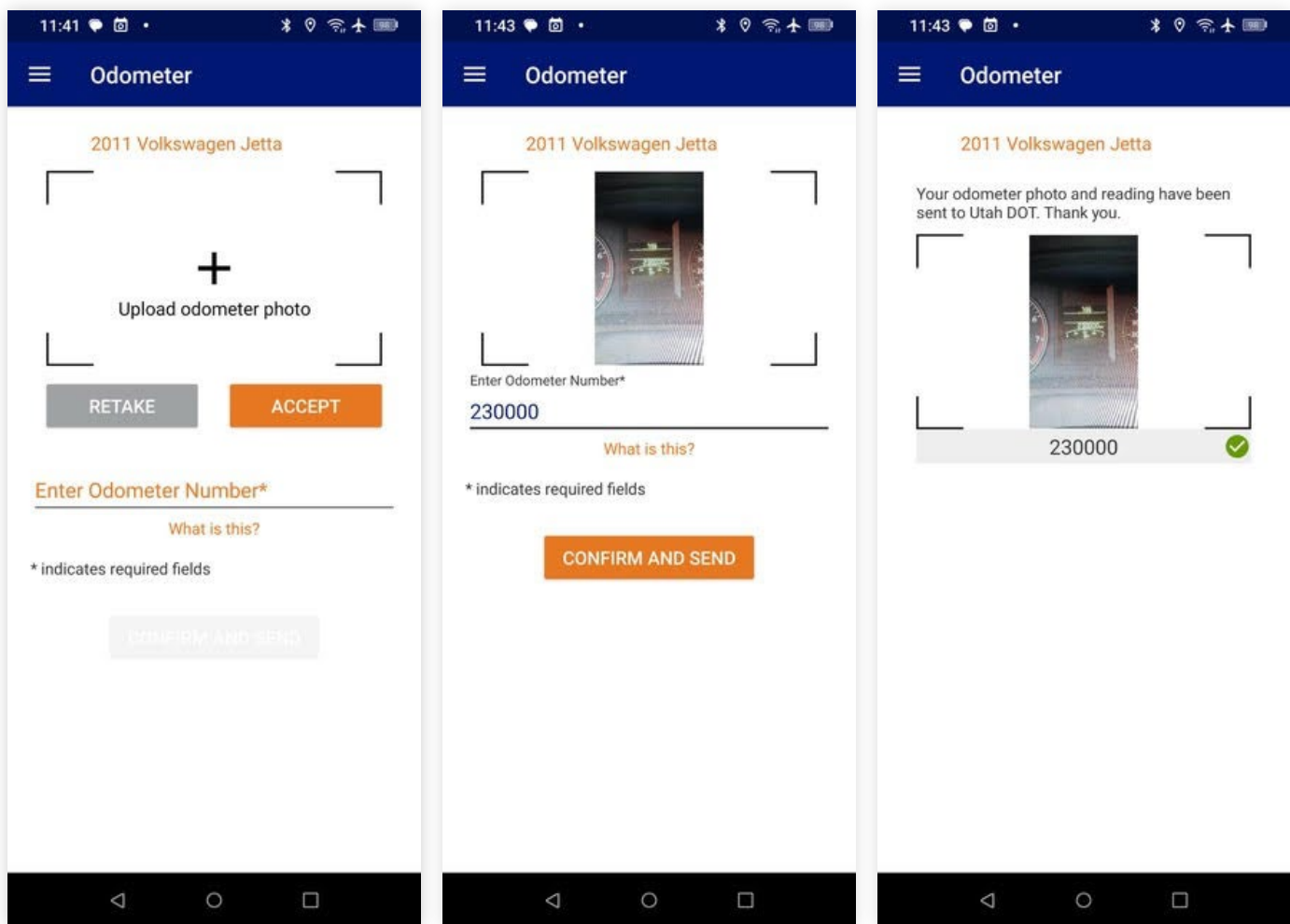


Figure 3-3 Odometer Photo Submission Workflow

Participants enrolled with an OBD-II plug-in device as their primary MRO used odometer photo capture at the following stages of participation:

As part of the initial enrollment process in order to set an odometer benchmark

1

Annually thereafter at the end of the participant's registration year in order to "true up" accrued mileage collected through the OBD-II device MRO

2

On an ad hoc basis to assist with resolution of participant mileage data disputes

3

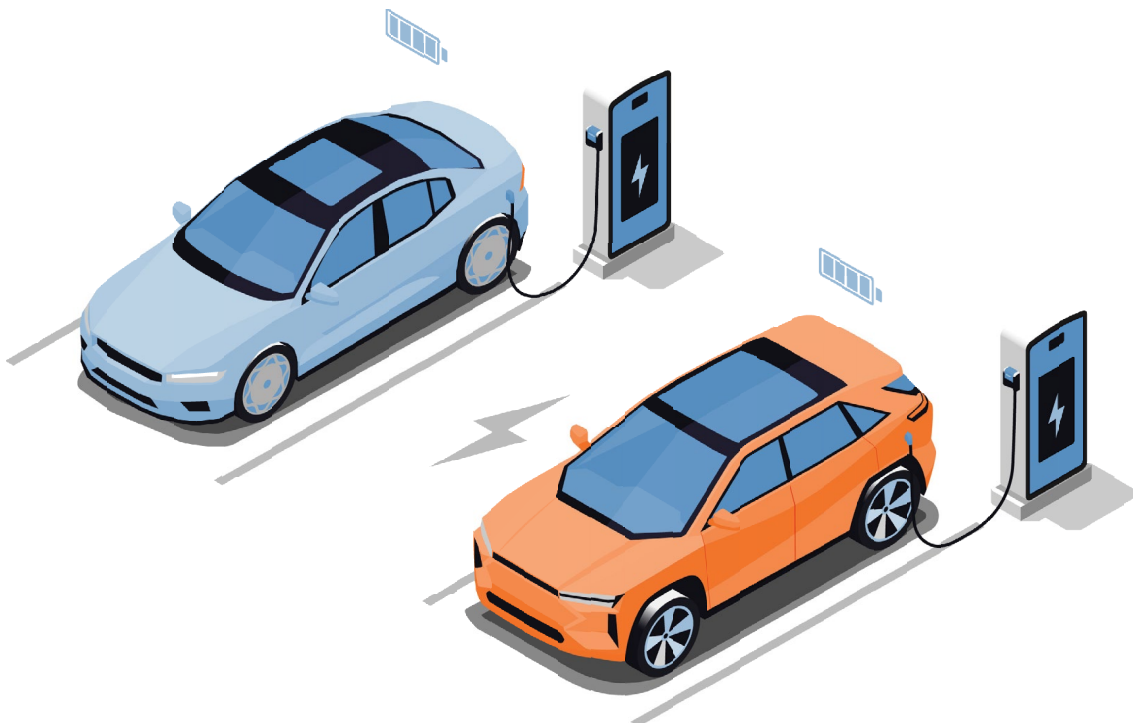
3.2.2 OEM Telematics

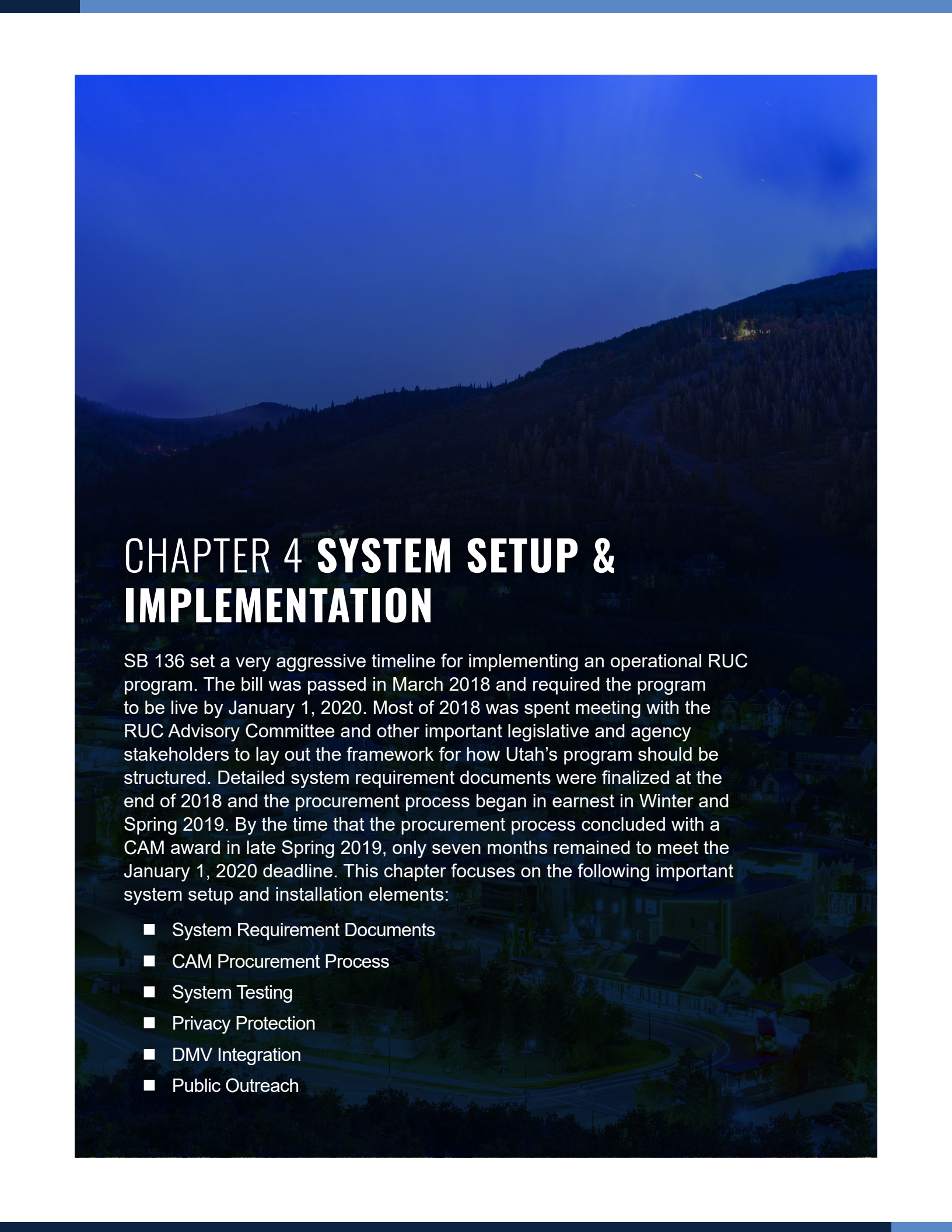
The OEM telematics MRO uses technology embedded in the vehicle by the manufacturer to send location and mileage information over a network to the CAM. Most newer vehicles have OEM telematics and this method can be a reliable way to obtain RUC data from such vehicles. However, at the time when Utah's program began (and still to a large extent today), it wasn't possible to share OEM telematics data directly from a RUC participant's vehicle to the CAM. A further challenge of using OEM telematics to obtain RUC information is that many vehicle manufacturers require a

monthly subscription to their telematics services and most vehicle owners do not want to pay for subscriptions merely so that they can participate in a RUC program.

Telematics data is currently only available through third-party data aggregators that are able to access vehicle data by having the participant grant them authorization to pull data from the telematics account. The third party aggregators then share the location and/or mileage information with the CAM. Communications between the third-party aggregator and both the vehicle and CAM occur through application programming interfaces (APIs). The primary function of OEM telematics in Utah's AFV RUC program was to provide an enrollment option for drivers of Tesla models Y and 3 that do not have OBD-II ports.

From the participant perspective, OEM telematics holds a lot of promise for the future because this method requires very little interaction or intervention on the part of the participant after the initial RUC enrollment process. Data from the on-board GPS can also be aggregated by jurisdiction if agencies wish to assess different mileage fees for separate geographic locations, and this feature can be appealing to government agencies looking at long-term RUC implementations. RUC programs can either pull simple odometer readings from the vehicle with no associated location data or they can obtain location data and post-process it to calculate miles traveled. This gives agencies the ability to offer multiple alternatives to prospective customers depending on their individual tolerance for location tracking and privacy protection. Finally, program participants cannot remove telematics features like they can with OBD-II devices and this trait helps to minimize potential fraud.





CHAPTER 4 **SYSTEM SETUP & IMPLEMENTATION**

SB 136 set a very aggressive timeline for implementing an operational RUC program. The bill was passed in March 2018 and required the program to be live by January 1, 2020. Most of 2018 was spent meeting with the RUC Advisory Committee and other important legislative and agency stakeholders to lay out the framework for how Utah's program should be structured. Detailed system requirement documents were finalized at the end of 2018 and the procurement process began in earnest in Winter and Spring 2019. By the time that the procurement process concluded with a CAM award in late Spring 2019, only seven months remained to meet the January 1, 2020 deadline. This chapter focuses on the following important system setup and installation elements:

- System Requirement Documents
- CAM Procurement Process
- System Testing
- Privacy Protection
- DMV Integration
- Public Outreach

4.1 SYSTEM REQUIREMENT DOCUMENTS

UDOT developed a set of system requirement documents to define the RUC program and comply with the statutory framework provided by the Utah legislature in SB 136 and SB 72. The CAM procurement included these documents so that all potential CAMs would know the requirements if selected. The requirement documents were written in such a way that a single CAM could provide all RUC functionality, including MRO technology, account management, and customer service operations. However, the documents were flexible enough to also allow for a future open system where multiple CAMs could support the system at the same time. UDOT anticipated having fewer than 10,000 participants in this initial AFV RUC program, and so decided to procure a single CAM initially to eliminate the higher up-front costs necessary to help multiple CAMs implement programs.

The system requirement documents included the assumption of OBD-II plug-in devices as the primary MRO because they were the most prevalent technology used in the Oregon RUC program (the only operational program at the time) and because they were considered the only reliable, widely available MRO that would work for most vehicle makes and models. However, the documents also required the vehicles that lacked an OBD-II port to support OEM telematics.

UDOT used Oregon's system requirement documents as the starting point from which to create documents specific to Utah's AFV RUC program. Many parts did not require significant change, but there were some key parts that required modification to comply with Utah's unique program elements. One key difference is that Utah's RUC program enabling statutes limited eligible vehicles to EVs, PHEVs, and gas hybrids whereas Oregon's program was open to all passenger vehicles. Another key difference was that the statutes called for Utah's AFV RUC to be a program that owners of eligible vehicles could opt into in lieu of the AFV flat fee assessed on these vehicles at annual registration renewal. These differences necessitated updates to the requirements. For example, Utah's requirements required modification to sync RUC payments with vehicle registration annual cycles and cap the amount of RUC paid in one registration year to the AFV fee amount applicable to each vehicle type. Other differences with Utah's program that necessitated requirement document changes include:

- RUC mileage fee rate
- Charging for all miles driven regardless of location
- Charging participants the difference between the AFV flat fee and RUC paid to date in the annual registration cycle if they exit the RUC program before completing the full 12-month registration cycle
- Adding OEM telematics as an MRO
- Allowing owners of eligible vehicles to enroll any time during the year instead of limiting enrollment to when a person registers their vehicle
- Using odometer photo capture for establishing an initial odometer benchmark and performing annual mileage true-ups

The following subsections describe each of the requirement documents and their roles in Utah's program.

4.1.1 System Requirements Specification

The System Requirements Specification (SRS) includes all software and hardware technical system requirements. These requirements specify what the system must do but do not specify exactly how the system must do it. Requirements fall into categories including basic IT capabilities (system security, availability, etc.), mileage reporting functionality, and account management functionality.

4.1.2 Interface Control Document

The Interface Control Document (ICD) defines the interface messages between subsystems comprising the overall RUC system. The primary elements of Utah's program ICD are:

- Mileage messages that define mileage data captured for a given period of time
- Summary data reports of miles driven and money charged that the CAM provides to UDOT and DMV each month for program monitoring and evaluation
- Definition of the real-time API that the CAM uses to access DMV's vehicle registration database to verify eligibility of vehicles attempting to enroll in the program, as well as exchange other information with the DMV for important program functions

The DMV-CAM API portion of the ICD was developed by the DMV in coordination with the CAM and had the following primary goals:

- Allow the CAM to securely verify RUC program eligibility of a given vehicle in real time
- Allow the CAM to affirm to DMV that a given vehicle is enrolled in RUC so that DMV will not charge the AFV fee for that vehicle when the owner renews registration
- Allow the CAM to inform DMV that a given vehicle is noncompliant with RUC program rules, and thus merits a registration hold
- Allow the CAM to check the status of a given vehicle to confirm that DMV believes it is still enrolled in the RUC program, and to get the correct annual RUC fee cap value for the vehicle
- Allow the CAM to inform DMV that a given vehicle has left the RUC program and should thereafter be subject to the AFV fee at registration

4.1.3 Business Requirements Document

The Business Requirements Document (BRD) defines how to use the system outlined by the SRS to implement desired business behavior. The BRD defines payment rules, customer service operations, account management operations, data retention, and many other rules necessary to specify desired business behaviors.

4.1.4 Service Level Agreement

The Service Level Agreement (SLA) specifies how well the system and operational functions should perform by providing key performance indicators (KPI) and their target ranges that the CAM should measure and report to UDOT each month. It also specifies the points at which the CAM will be noncompliant and incur consequences for negative performance. KPIs cover areas such as:

1

Customer service
(e.g. wait time on
phone calls)

2

Timely and accurate
mileage reporting

3

System uptime

4.2 CAM PROCUREMENT PROCESS

The CAM procurement process utilized a Best Value selection method, which includes a combination of pass/fail criteria, technical proposal submission, and a cost proposal. UDOT wanted cost to be a factor considered in the selection but did not want it to be the sole consideration. The overall selection criteria was as follows:

- **Pass/fail screening:** past experience that demonstrates minimum capability
- **Technical proposal score weighting:**
 - Proposal narrative – 60%
 - Company/team/individuals – 20%
 - Cost proposal – 20%

Four proposals were submitted. All met the pass/fail criteria and moved on to the full scored evaluation. The schedule gave consideration to providing proposers enough time to put together quality proposals but also achieve a relatively fast contract execution.

- **RFP compilation:** Fall 2018 through Winter 2019
- **RFP posting:** Mid-February 2019
- **Proposal responses due:** Early April 2019
- **Presentations:** Late April 2019
- **Award announcement:** Early May 2019
- **Notice to proceed:** Early June 2019

Overall, the schedule provided enough time for the selection process. However, additional time between the award announcement and contract compilation would have been helpful to allow for negotiation discussions. This would have given additional time to more fully understand the selected CAM's approach and ask clarifying questions that could inform the contract.

4.3 PRIVACY PROTECTION

Utah's RUC enabling legislation required protection of participant privacy in compliance with state laws. Privacy protections in Utah's program are summarized by category and compliance method in the following subsections.

4.3.1 Raw Location Data

Both of the primary MROs offered in Utah's program required the collection of location data and sharing of that data with the CAM so that miles driven could be calculated and charged to participant accounts. Owners of RUC-eligible vehicles that were uncomfortable sharing location data with the CAM were able to pay their AFV fee during annual registration and were not required to join the RUC program. Those who opted into RUC signed a user agreement authorizing the CAM to collect and use their location information to calculate mileage but acknowledging that the CAM would only share total miles driven per vehicle with the State. The system requirement documents prohibited the CAM from sharing raw location data or other personally identifiable information (PII) with the State. Furthermore, the CAM had to destroy all raw location data 30 days following the close of the monthly statement period to which the data applied. The only exceptions to this data destruction requirement were for:

- Cases where ongoing customer mileage disputes required the CAM to retain specific customers' location data until the disputes were fully adjudicated
- Limited program audits performed by UDOT to ensure CAM compliance with requirement documents

4.3.2 Aggregated & Anonymized Data

The CAM performed specific steps to aggregate and anonymize location data across the entire customer base, and then provide that data to UDOT periodically. UDOT wanted to analyze these anonymized datasets to see if they might be useful for other agency goals. Steps the CAM had to take in order to aggregate and anonymize the data before sharing it with UDOT included:

- Removing all personal information from GPS location trace data before aggregating it
- Truncating a randomized distance between 0.25-0.50 mi from the beginning and ending of each trip so that trips could not be followed to specific driveways or parking lots
- Only sharing aggregated data from major urban areas where there were enough RUC customers in the same geographic space to make aggregation meaningful and ensure that specific individual trips could not be traced

4.3.3 Participant Access to Data

RUC participants received monthly statements (see Appendix A for a sample statement) summarizing their miles driven, fees, and electronic wallet balances. They also could view their detailed driving data stored by the CAM and dispute charges. The program defined a dispute resolution process for such situations.

4.3.4 Admissibility in Legal Proceedings

Utah has a statute called the Government Records Access and Management Act (GRAMA) that governs the types of information that State agencies can be compelled to share with the public and the conditions for such information sharing. For purposes of Utah's RUC program, location data could only be compelled from the CAM through a GRAMA request associated with a valid search warrant and criminal proceeding. Even then, only the most recent 1-2 months of location data would be available from the CAM because of the program's data destruction requirements.

4.4 DMV INTEGRATION

A benefit of real-world RUC implementation relative to temporary pilot projects is that it forces a state to figure out how to accommodate RUC within existing systems in agencies such as the DMV and DOT. Utah's goal was (and still is) to make the user experience as seamless as possible by minimizing the need to create new customer touchpoints. Integrating various aspects of RUC with existing DMV processes was a logical idea to implement in pursuit of that goal. The following subsections describe different RUC elements that were integrated with Utah DMV processes. The API described in Section 4.1.2 is instrumental in facilitating CAM-DMV communications that support the necessary integration. Utah's experience can provide a useful model for other states to follow when they are ready to implement ongoing RUC programs that use real money and must be implemented alongside established processes.

4.4.1 RUC Enrollment

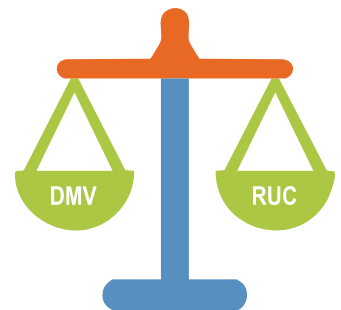
In Utah's program, RUC enrollment aligned with the annual registration cycle by presenting AFV owners with the option to join RUC as part of their registration workflow. The Utah legislature enacted additional registration fees for AFVs beginning in 2019. Owners of AFVs are notified in the online registration workflow that they will be exempted from those additional fees if they enroll in RUC. Information about how to enroll in RUC is then presented. If a vehicle owner elects to join the program before completing their registration process, the registration fee amount is reduced by the amount of the additional fee pertaining to their vehicle type. Table 2-1 showed the additional fee amounts applicable to each AFV type from 2019 through 2024. These fee amounts also serve as annual RUC payment caps for those who choose to enroll in the RUC program in lieu of paying the fee at registration. Thus, RUC customers are guaranteed that they will never pay more in annual RUC fees than they would have paid if they'd chosen to pay the additional registration fee.

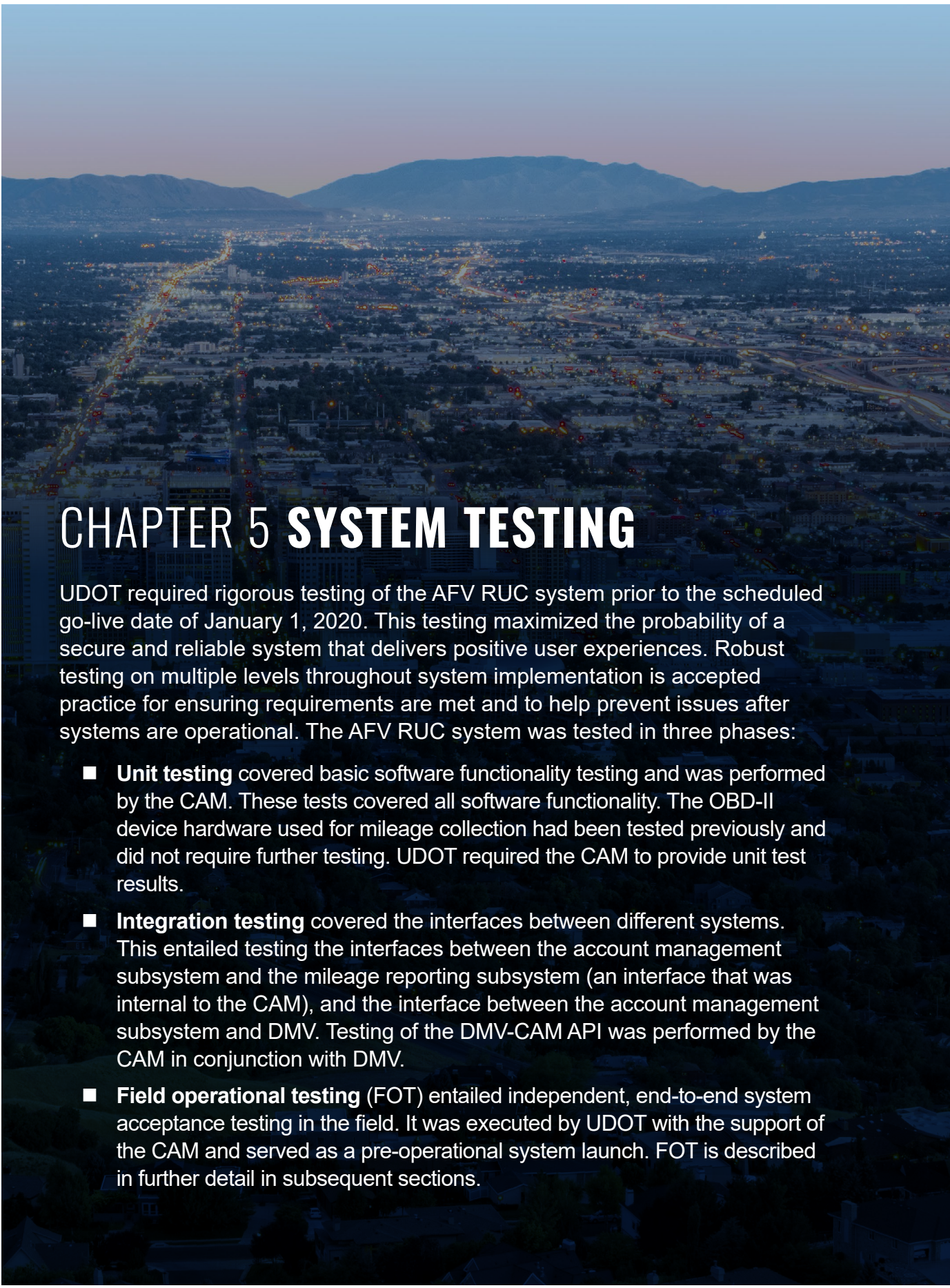
The RUC enrollment process was incorporated into the online registration renewal process for all AFVs. AFV owners renewing the registrations for vehicles not already enrolled in RUC were presented with an informational pop-up window providing information about the RUC program. Owners were then given the option to either skip past the pop-up and continue with their normal registration renewal or go to the CAM's website to enroll in RUC. Those electing to enroll in RUC were returned to the DMV website to complete their registration renewal after RUC enrollment was complete. Total registration fees for these newly-enrolled RUC customers were reduced by the amount of the AFV fee.

4.4.2 RUC Compliance & Enforcement

Enforcement mechanisms were also tied to DMV registration by allowing the CAM to request that the DMV place a registration hold on customers that were noncompliant with program rules such as activation of mileage reporting devices and maintaining a valid payment card on the customer account. Noncompliant RUC customers were unable to register their vehicles with the DMV until they worked with the CAM to rectify the reason for the hold being placed. Registration holds can motivate compliant behavior but they also generate customer service calls and complaints, so actions should be taken to minimize the need to place holds in the first place.

It was important in Utah's system to structure the CAM-DMV relationship in such a way that every vehicle was clearly either a "RUC customer" or a "DMV customer" at any given moment. A vehicle defined as a RUC customer is one that is exempt from the additional registration fee but is subject to mileage fees up to (but not exceeding) the additional registration fee amount. A vehicle defined as a DMV customer is one that is not enrolled in RUC and is subject to paying the additional registration fee. Unclear distinctions between these two statuses could open the door to unintentional double-charging of people enrolled in RUC or attempts at fraud by people trying to momentarily register for RUC to evade the additional registration fee.



An aerial photograph of a city at dusk, with a digital overlay of a road network and data points. The overlay consists of a series of yellow and orange dots connected by lines, forming a path through the city. The background shows the city's lights and the silhouettes of mountains in the distance.

CHAPTER 5 SYSTEM TESTING

UDOT required rigorous testing of the AFV RUC system prior to the scheduled go-live date of January 1, 2020. This testing maximized the probability of a secure and reliable system that delivers positive user experiences. Robust testing on multiple levels throughout system implementation is accepted practice for ensuring requirements are met and to help prevent issues after systems are operational. The AFV RUC system was tested in three phases:

- **Unit testing** covered basic software functionality testing and was performed by the CAM. These tests covered all software functionality. The OBD-II device hardware used for mileage collection had been tested previously and did not require further testing. UDOT required the CAM to provide unit test results.
- **Integration testing** covered the interfaces between different systems. This entailed testing the interfaces between the account management subsystem and the mileage reporting subsystem (an interface that was internal to the CAM), and the interface between the account management subsystem and DMV. Testing of the DMV-CAM API was performed by the CAM in conjunction with DMV.
- **Field operational testing (FOT)** entailed independent, end-to-end system acceptance testing in the field. It was executed by UDOT with the support of the CAM and served as a pre-operational system launch. FOT is described in further detail in subsequent sections.

5.1 INITIAL FIELD OPERATIONAL TESTING

The original round of FOT (FOT-1) was held in November and December 2019, primarily in the Salt Lake City area. The purpose of FOT-1 was to review, in a live environment, the AFV RUC system and equipment in order to discover technical errors, glitches, or user experience issues that needed to be addressed before launching the live system.

Due to incomplete system functionality at the time of FOT-1, two additional rounds of FOT (FOT-2 and FOT-3) were held. FOT-2 aimed to test payments via credit and debit card and was scheduled for late December 2019. However, the CAM eventually implemented payments only on the live operational system, where it was then tested. FOT-3 was performed June-August 2020 to test the remaining functionality. FOT-2 and FOT-3 are described in more detail in Sections 5.3 and 5.4.

5.1.1 Participants & Roles

FOT-1 involved 30 driving participants that included UDOT employees, UDOT consultants, and a few State government representatives outside of UDOT. Those participants collectively included the following vehicles:

- 2 Tesla Model 3 vehicles
- 5 other EVs in addition to the Teslas
- 1 PHEV
- 8 gas hybrids
- 14 internal combustion engine vehicles, which the DMV manually coded as one of the above eligible vehicle types on their test system so that they could participate in testing

UDOT employees, UDOT consultant staff, CAM staff, and DMV staff worked cooperatively to execute FOT-1. The CAM's customer service team was operational during testing and driving participants were able to call them as they would during live operations.



5.1.2 Mileage Reporting Options

The following MROs were tested during FOT-1:

- Location-based OBD-II device for all vehicles except for the Tesla Model 3 vehicles
- OEM telematics for the Tesla Model 3 vehicles only

5.1.3 Testing Modules

The following testing modules were executed in FOT-1:

- The **On-boarding Module** involved participant enrollment steps such as signing participant agreements, account setup, and device activation instructions
- The **Driving Module** involved daily driving by participants with no special requirements
- The **Invoicing and Payment Reminders Module** included the distribution of monthly customer statements only, as payments were not ready for testing and payment reminders were not ready to be sent
- The **Change Account Details Module** involved selected participants changing phone numbers and addresses on their web portal accounts, as well as one participant changing vehicles



5.1.4 Functionality Not Tested in FOT-1

Several system functionalities originally intended for testing in FOT-1 could not be tested, as follows:

- **Account closeout and system unenrollment** were not tested because of the desire to use the full testing period for participants to drive as many miles as possible, and because account closeout was a manual process (users needed to call customer support or use an online form, which was not yet functional at the time of FOT-1).
- All system **operations under failure conditions** require automated user notifications, which were not functional at the time of testing, so this functionality could not be tested.
- Required **data reporting** between the CAM and DMV was not ready. This meant that the DMV-CAM API could not be checked as planned prior to launch, and also that aspects of system performance could not be validated through data. For example, it could not be validated that the CAM's mileage summary reports were the sum of individual miles reported.
- The **annual mileage true-up process** that utilizes odometer photos submitted by participants to adjust account mileage tracking to actual odometer values was not ready for testing.
- **Payment** functionality could not be tested because it was not ready.
- **Automatic user notifications** for the following types of situations were not ready for testing.
 - Unplugged OBD-II device
 - OBD-II device plugged into wrong vehicle
 - Invalid telematics credentials
 - Delinquent payment status
 - Invalid credit or debit card
- **Automatic presentation of DMV data through the API** could not be tested because the FOT-1 process required DMV to manually set annual registration date expirations for all FOT-1 participants to either the end of October or end of November on their test server, rather than use real registration dates (and annual RUC cap values) provided by the API to the CAM. Manual setting of the registration expiration dates was required because RUC program enrollment was tied to the annual registration workflow, and that meant that FOT-1 participants needed to have the test server recognize their vehicle as needing to be renewed in the Nov-Dec 2019 timeframe when testing occurred.

5.2 FOT-2

A second round of FOT was planned to test payments before the Jan 1, 2020 go-live date. After investigating options for payments testing, the CAM determined that putting payments on a test server before deploying it on the live server was not feasible. Thus, FOT-2 payment testing took place on the live operating system server by UDOT staff enrolled in the live RUC program. Data reporting, automatic user notifications, and the odometer photo true-up processes were still not ready, and were planned for testing after go-live.

5.3 SYSTEM IMPROVEMENTS AFTER FOT-1 & FOT-2

UDOT and the CAM accomplished the following major system improvements following FOT-1 and FOT-2:

Planned improvements to live system	Debugging of live system due to issues discovered in May 2020
Payments (credit and debit card) activated January 3, 2020 Addition of data reporting (first reports sent in March 2020, and continually improved in Apr–May 2020) User interface and web portal improvements (executed Summer 2020)	Early enrollees (i.e. those enrolling in the RUC program in advance of their next registration renewal cycle) not being subject to initial charges at right time Miles towards annual RUC caps not being counted correctly, allowing some users to exceed caps because miles were undercounted Annual RUC cap values set to incorrect year (many set to higher 2021 values that should have been set to the lower 2020 values)

5.4 FOT-3

A third round of FOT was conducted in order to test the following functionality that had not already been tested in FOT-1 and FOT-2:

- End-of-year odometer photo true-up
- Account closeout
- Monthly customer statement review (especially for accounts with multiple enrolled vehicles)

Automated user notifications were also planned for testing but the CAM had not implemented them at the time of FOT-3. It should be noted that the CAM never did implement automated user notifications during their contract period and thus these notifications were never tested.

FOT 3 occurred Jun-Sep 2020 and involved four participants that received three monthly statements (Jun, Jul, and Aug). FOT-3 included the following test modules:

Enrollment: all participants enrolled in Jun, with vehicles set to have registrations expire at the end of Jun and become real participants in Jul.

Participants were asked to **drive** normally as follows:

- Record trips for two weeks using a driving log
- One participant drove out of state to test ability for the system to differentiate between miles driven in Utah and in other states
- Received monthly customer statements with early enrollee miles (i.e. unbilled) for Jun differentiated from regular enrollee miles for Jul and Aug

Odometer photo true-up: participants performed the true-up in Aug by submitting an odometer image.

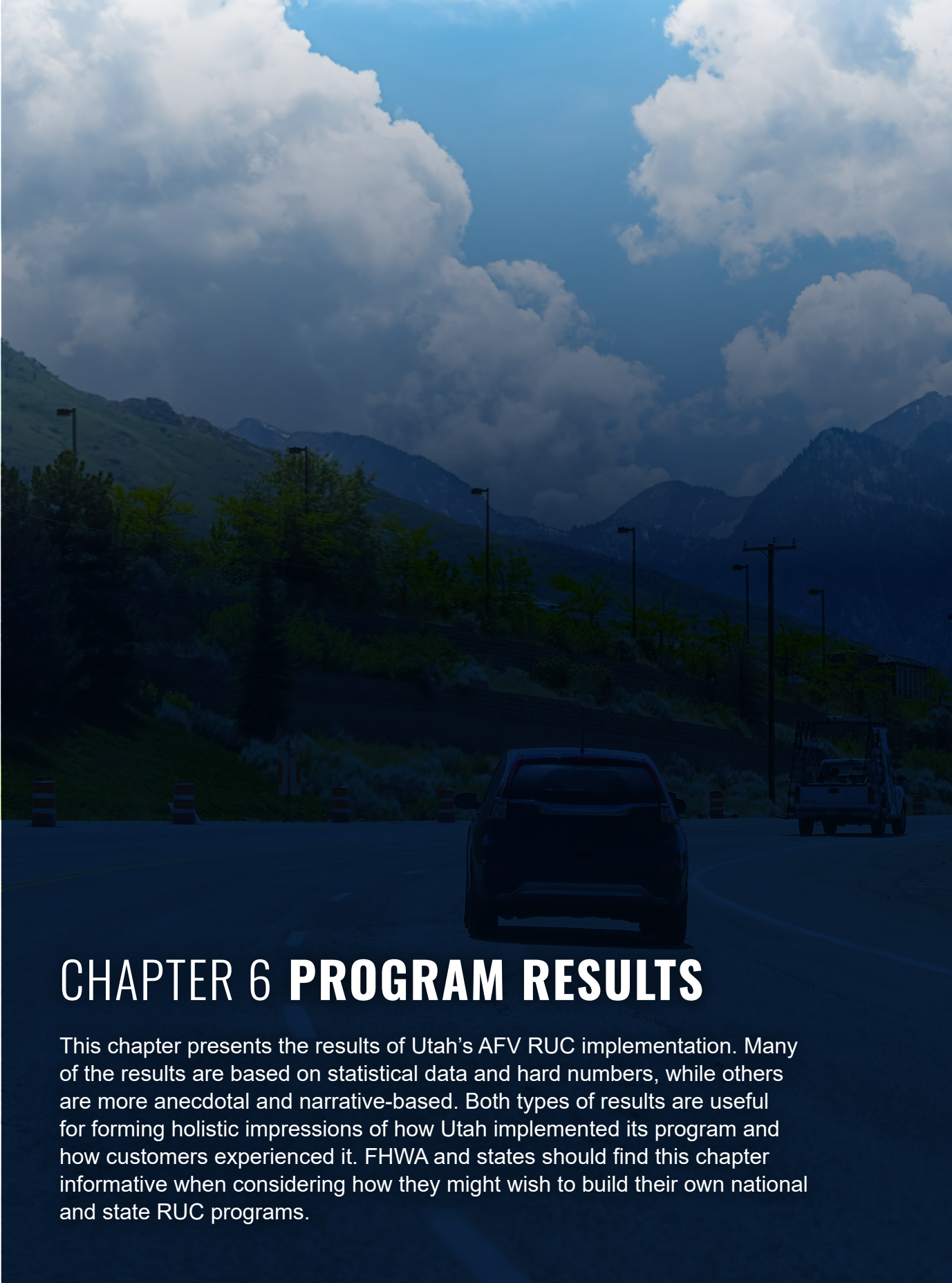
Change of vehicle: one participant completed a change of vehicle on their account.

Failure notifications: testing of the following two failure notifications was planned but could not be completed because the following automated notifications were never implemented:

- Unplugged OBD-II device
- OBD-II device plugged into the wrong vehicle

Account closure: one participant closed his account after conclusion of FOT-3 in Sep.

FOT-3 conclusion: CAM made improvements to the odometer photo true-up, monthly customer statement, and account closeout processes.



CHAPTER 6 **PROGRAM RESULTS**

This chapter presents the results of Utah's AFV RUC implementation. Many of the results are based on statistical data and hard numbers, while others are more anecdotal and narrative-based. Both types of results are useful for forming holistic impressions of how Utah implemented its program and how customers experienced it. FHWA and states should find this chapter informative when considering how they might wish to build their own national and state RUC programs.

6.1 ENROLLMENT

Enrollment was open to all AFVs from January 1, 2020 through December 31, 2022. Only EVs were eligible to join beginning in January 2023 although PHEVs and gas hybrids enrolled before 2023 were able to remain in the program and many are still in the program to this day. Figure 6-1 shows the enrollment history from program inception through March 2024. Several noteworthy aspects of Figure 6-1 are elaborated upon in the following subsections.

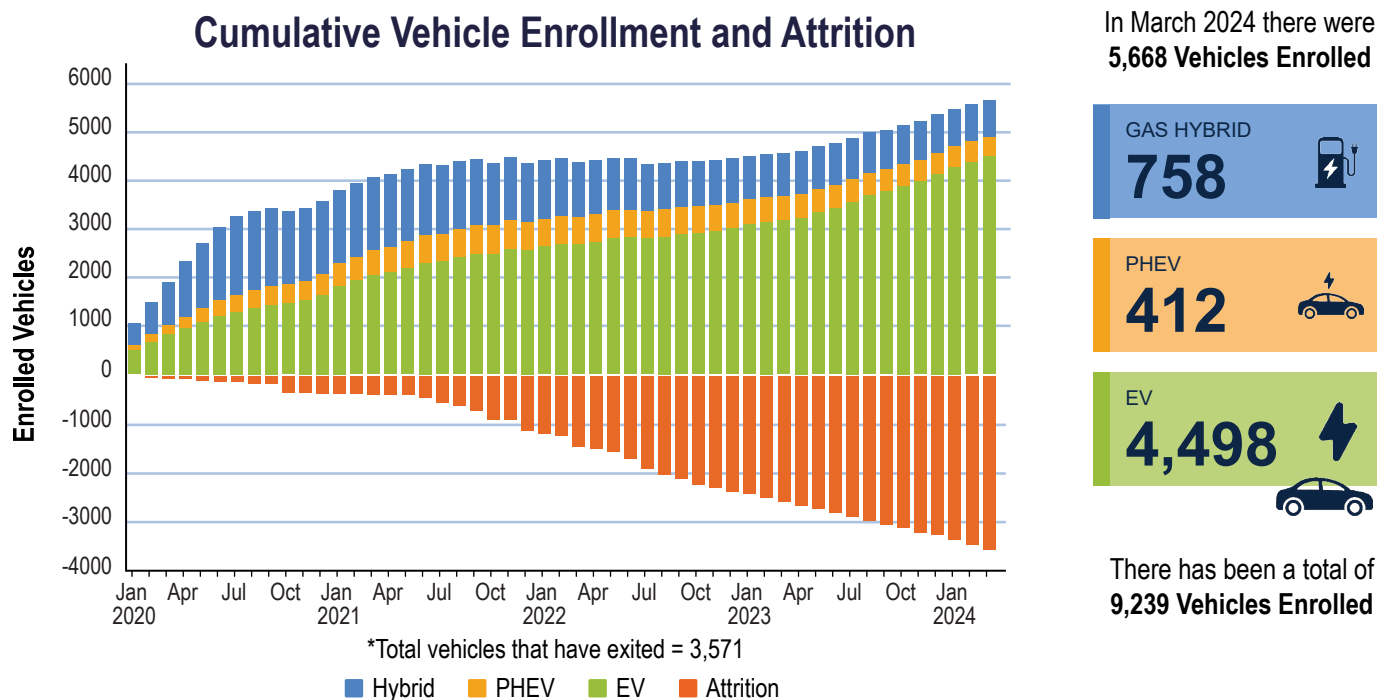


Figure 6-1 Utah RUC Enrollment History

6.1.1 Initial Enrollment Wave

Enrollment spiked steeply out of the gate when the program opened in January 2020. The number of enrollees far outpaced expectations, likely because UDOT conducted an aggressive outreach campaign to all AFV owners in the months prior to program launch. Each AFV owner received a letter in the mail from UDOT in the two months prior to January 2020 alerting them to the program and the possibility of saving money by enrolling during their registration cycle in 2020. For a few months into 2020, each AFV owner received another similar letter a month or two prior to when their registration renewal would occur in 2020. UDOT discontinued these follow up letters after a few months because the enrollment response was so strong that they deemed it better to slow down the enrollment pace. Utah believes that enrollments during the first year of program operations would have been much lower had these two letters not been sent.

As shown previously in Figure 3-1, approximately 80% of enrollees used an OBD-II device for their MRO and the other 20% enrolled under the telematics option. It is important to note that this does not imply that 80% of customers preferred OBD-II devices over telematics. Telematics was only offered as an option for owners of Tesla models 3 and Y because those vehicles do not have OBD-II ports. Owners of other vehicle types were not offered the option of using telematics,

so nothing about MRO customer preferences can be deduced from the percentage of people enrolling in either MRO.

6.1.2 Enrollment Stabilization

Enrollment intensity leveled off after the initial six-month surge and remained steady and gradual from the middle of 2020 onward. The following factors likely explain this leveling off:

- The people most excited about joining the RUC program probably joined at their first opportunity in 2020 and this “low hanging fruit” was picked by the end of 2020
- Many AFV owners, particularly owners of PHEVs and gas hybrids, figured out fairly quickly that they were unlikely to save money because they hit their annual payment caps in relatively few months of driving
- Growth in AFV registrations increased the pool of eligible drivers each year, which made program enrollment growth certain even if the percentage of eligible drivers choosing to enroll wasn’t increasing

6.1.3 Exiting Customers

A total of 9,239 vehicles were in Utah’s RUC program at some point in the program’s history through March 2024, of which 3,571 were no longer enrolled. At first glance, this would seem to point to widespread dissatisfaction with the program but there are likely several factors at play in addition to potential dissatisfied customers, including:

- Vehicles that leave the program because their owners have moved out of state and no longer have the vehicle registered in Utah
- Vehicles that have been sold and are now registered with a new owner
- Vehicles that are unenrolled from the program because their owners have figured out that they are not likely to save money and would rather pay the AFV fee during registration instead of paying mileage fees throughout the year

6.2 REVENUE & ADMINISTRATIVE COSTS

Fuel taxes are a very efficient method of collecting transportation revenue at a minimal administrative cost. Replacing the fuel tax system as vehicles increasingly use less fuel in the future is a tall order, especially when it comes to limiting the administrative cost of potential fuel tax replacements such as RUC. Utah’s RUC program is currently operating at a very small scale (approximately 0.2% of light duty vehicles in the state) and thus is unable to take advantage of the typical cost savings associated with operating at mass scale. This is one of the principal reasons why Utah’s RUC program has not yet begun operating at a net profit. Figure 6-2 shows the revenue and associated administrative cost of running Utah’s program for each month from the January 2020 launch through March 2024.

Monthly Revenue & Administrative Cost

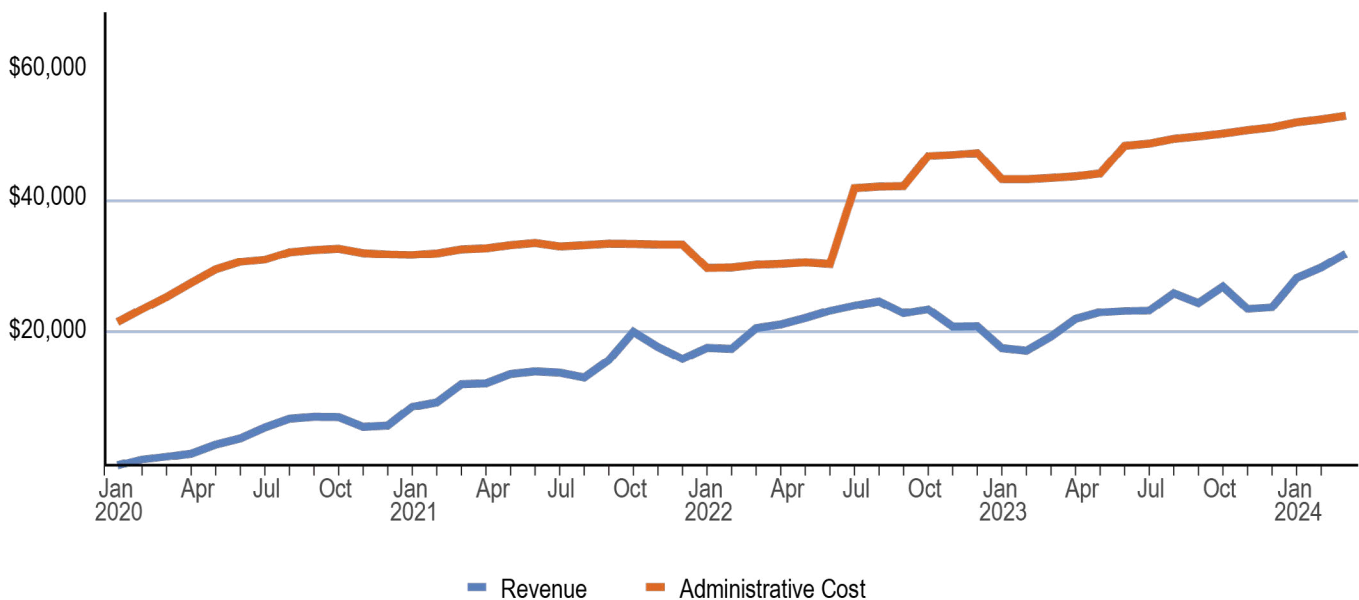


Figure 6-2 Utah RUC Revenue & Administrative Costs

The small program scale is one of many factors that contribute to the Utah program not operating at a profit prior to March 2024. Other significant factors include:

- A decision made by the Utah legislature to decrease the per-mile RUC rate to 1.0 cents per mile (from 1.52 cents per mile) beginning in 2023 in order to incentivize more EVs to enroll in the RUC program
- Annual payment caps that limit the amount of RUC a given AFV owner will pay to approximately 50% of what the driver of an average gasoline or diesel vehicle will pay in fuel taxes each year (also for the purpose of incentivizing RUC enrollment)
- Limited competition and lack of system maturity offered by potential CAMs
- Underdeveloped technology options for collecting miles driven

Legislation already in place in Utah will slowly reduce the effects of the first two factors in the bulleted list above. Both the RUC rate and annual payment cap amounts are set to increase by about 25% in 2026, with another 25% increase set for 2032. These two increases will bring RUC payments more in line with what drivers of gasoline and diesel vehicles pay per mile in fuel tax. Removing the annual payment caps entirely would require new legislation.

The effects of the last two factors in the bulleted list above are expected to slowly wane over time as more competition comes into the CAM space, existing CAMs refine their processes, and technology options are able to collect mileage more efficiently. In fact, Utah is already seeing this happen during the implementation of its second generation RUC program. Although this STSFA grant final report is focused on Utah's first generation RUC program, it is worth noting that UDOT expects the second generation RUC program to operate at a profit immediately. The second generation program is expected to collect 63% more revenue than it will pay for administrative costs in its first year of operation, and become even more cost competitive with each successive

year. By comparison, revenue during the last year of the first generation program was 48% less than the administrative cost. This large improvement in limiting administrative costs relative to revenue is mostly attributable to more cost effective MRO technologies and better CAM marketplace competition. Utah has a long way to go before its RUC system is cost competitive with fuel taxation but the significant improvement in the second generation system, as well as the fact that only 0.2% of the state’s light duty vehicle fleet is currently enrolled in RUC, are cause for optimism.

6.3 MILES DRIVEN

Figure 6-3 shows the total miles driven by customers from program inception through March 2024. Figure 6-4 shows how those miles are distributed across Utah and surrounding states.

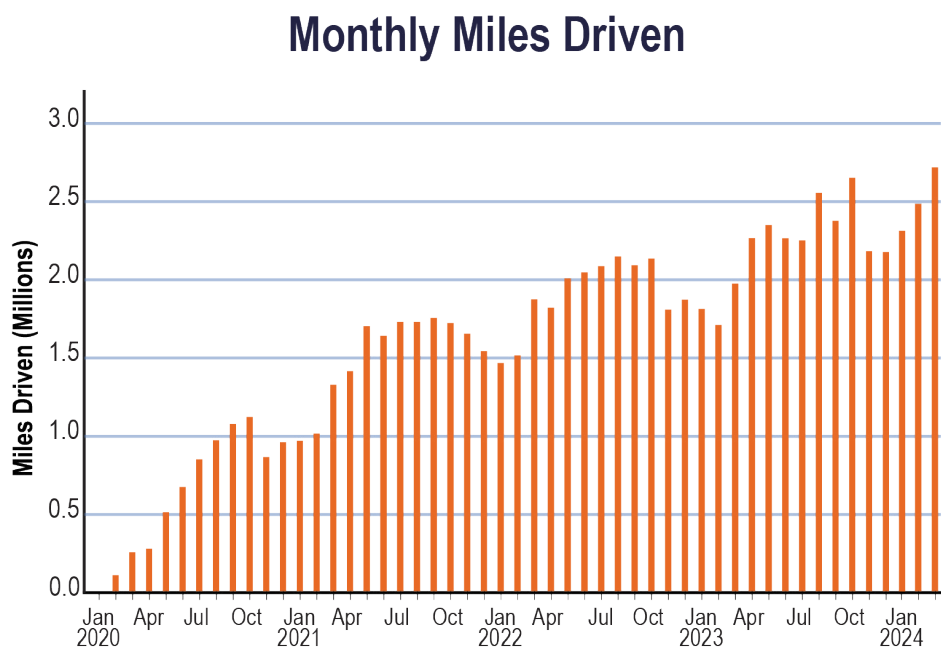


Figure 6-3 Total Miles Driven by RUC Customers

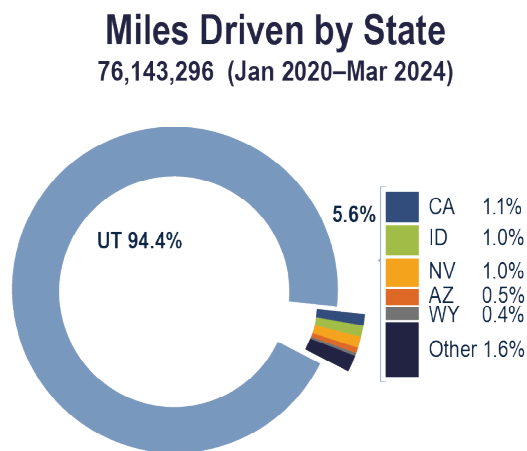


Figure 6-4 Miles Driven by State

The following trends can be gleaned from these figures:

- Miles peak each year from late spring to early fall and decline in winter
- Approximately 94% of miles are driven in Utah
- California, Idaho, and Nevada each account for approximately 1% of miles and no other state exceeds 0.5%

6.4 CUSTOMER EXPERIENCE

Starting an entirely new public-facing revenue collection program is inevitably going to be difficult and fraught with unanticipated challenges. UDOT recognized early on after the program launch that many aspects of the customer experience needed improvement to adequately serve the growing number of people enrolling. The subsections below describe noteworthy aspects of the customer experience and, where applicable, UDOT's efforts to identify and improve specific aspects that needed improvement.

6.4.1 SLA Compliance

The CAM operating Utah's RUC program was required to comply with an SLA that provided specific customer service targets. The main SLA compliance challenges the CAM had were with on-time submission of required reports and verification of OBD-II device "heartbeat" statuses. The challenges with on-time reporting mainly occurred during the first few months of the live program launch. This became less of an issue as the program grew and matured. The CAM also performed well with customer service response times and no significant issues were ever experienced in that area.

With respect to OBD-II device heartbeats, the SLA required the CAM to verify that at least 99% of all devices were sending a healthy heartbeat signal. Penalties were in place to provide motivation for the CAM to meet this requirement. However, UDOT made a collective decision to not enforce the noncompliance penalties for this metric because the CAM lacked the practical ability to enforce compliant behavior on the part of program participants. Device heartbeats could fail for reasons such as a participant unplugging the device, and ten or more participants per thousand would be enough to violate the requirement.

6.4.2 Registration Holds

Registration holds were the main enforcement mechanism for individuals that didn't maintain a valid credit card on file with the CAM. The hold was levied through an API connection between the CAM and the DMV. In many cases, customers weren't aware that they had a registration hold until they tried to renew their vehicle registration. When this happened, the customer would often contact UDOT directly instead of contacting the CAM since the DMV's messaging reflected that the hold had been established by UDOT.



The CAM's messaging consisted of a couple emails letting someone know that their credit card was expired and notifying them of the hold. No additional communication was sent after establishing the hold. As a result, many holds were never resolved because the customer had sold their vehicle or moved out of state. No actions were triggered to resolve these holds because the customer didn't attempt to renew the registration. This issue with unresolved holds was not discovered until a few years into program operations.

Issues associated with registration holds became very negative experiences for many customers that experienced them. In some cases, customers were physically at a DMV office trying to renew their registration when they discovered the hold. These individuals tended to be less technologically savvy and preferred to complete their annual registration in person. Customers in this situation were told by DMV staff that they needed to contact the CAM to resolve the hold before they could proceed with registration. If their account had been closed because of long-standing non-responsiveness to the CAM, which was generally the case, the CAM would then have to reopen the account to allow for the new credit card number to be entered. This generally took a couple of days. Only after the new credit card was entered and authenticated could a customer's outstanding charges be assessed and the hold removed.

6.4.3 MRO Satisfaction

Two MROs were offered in Utah's RUC program: OBD-II devices and in-vehicle telematics. Telematics was only offered to customers with Tesla models 3 and Y because those vehicles do not have OBD-II ports. All other customers were offered OBD-II devices. Telematics customers were generally satisfied and relatively few issues occurred. OBD-II users, on the other hand, experienced numerous challenges with installing, using, and returning the devices. Some OBD-II customers misplaced their device after receiving it in the mail and had to request that another device be mailed to them.

Other customers received the device but never installed it despite repeated reminders to do so. The CAM had to proactively remove these customers from the program after a period of non-



responsiveness and assessed them a \$95 device non-return fee. The most common reason for the CAM's proactive removal of customers was people enrolling and receiving an OBD-II device but never installing it. Some customers also found it challenging to locate the OBD-II port and the CAM's customer service personnel needed to explain on the phone how they could find the port on their specific vehicle. A significant number of people who were assessed \$95 device non-return fees cited complexity with installing the device as the reason why they did not install it and were non-responsive to repeated requests from the CAM.

General logistics with receiving and returning devices by mail proved very challenging and inefficient. Some customers lost their device before installing it and many others did not return their device when they exited the program, despite the terms and conditions requiring a \$95 non-return fee. UDOT estimates that 25-35% of all exiting OBD-II customers did not return their device and incurred the fee instead. A significant number of those customers were unhappy about being charged this fee and called the CAM customer service phone number. Customers that did not have a valid payment card on file at the time when the CAM attempted to assess the \$95 fee, and who did not provide a valid payment card after repeated requests from the CAM, had a registration hold placed on their vehicle. Some of the customer calls were escalated beyond the CAM to UDOT for resolution, particularly in situations where registration holds were involved.

6.4.4 Customer Statements & Account Portal

Customers received monthly statements summarizing miles driven in each individual month and mileage fees incurred by those miles, as well as cumulative miles and fees for the current 12-month registration period. The number of miles and fees remaining to the annual cap limit was also shown. Customers were able to see these same metrics in an online customer portal. Some customers noted that monthly and cumulative miles listed in the customer statements did not match what was shown in the online portal for the same periods. UDOT attempted to work with the CAM to identify the reasons for the discrepancies and rectify the issues but the discrepancies nonetheless persisted.

6.4.5 STSFA Round 5 Grant Application

UDOT submitted an application for the fifth and final round of STSFA grant funding. The focus of this application was optimizing the customer experience. All of the issues described in the last few subsections were the motivation for UDOT pursuing another grant. UDOT was awarded the grant and work continues today on completing that work. Another STSFA final report will be released in the future to describe the customer experience audit and UDOT's work to implement the recommendations that resulted from that audit.

6.5 PRIVACY REQUIREMENTS COMPLIANCE

Utah's RUC program required the CAM to protect all PII from sharing with UDOT or any other private or governmental entity. The CAM complied with this requirement and there were no known instances of accidental or intentional sharing of customers' PII.

The CAM was also initially required to provide anonymized and aggregated location data to UDOT. The anonymization process involved having the CAM delete a randomized distance

between 0.25 miles and 0.50 miles from the beginning and ending of each trip so that an individual trip could not be traced to a person's driveway. The aggregation involved overlaying all location data into a single layer for a given geographic area. UDOT conducted an internal audit to attempt to reverse engineer personal addresses from this anonymized and aggregated data. Although actual violations were not found, UDOT chose to stop receiving this data from the CAM because there was enough evidence that a skilled person might be able to determine the location of individual people in some instances. Ultimately, UDOT decided out of an abundance of caution that the need to protect privacy outweighed any benefits that UDOT hoped to receive from analyzing the anonymized RUC program driving location data.

6.6 PUBLIC OUTREACH

UDOT gathered thoughts and opinions regarding Utah's RUC program and related topics by commissioning a general public survey in Spring 2021 of 404 Utah residents with an additional oversampling of 202 EV owners. Survey methods included both telephone and online. The objectives were to:

- Identify respondents' vehicle types and weekly miles driven
- Identify how respondents think funds are generated for roads in Utah
- Determine RUC awareness, overall impressions, and reasons for their impressions
- Determine if respondents feel RUC should replace the fuel tax for all vehicles
- Discover if EV owners are enrolled in Utah's RUC Program and why (or why not)
- Determine respondents' comfortability with having a reporting device track mileage on their vehicle, and reasons for their opinions
- Gather respondents' demographic profile information

Survey results for the 404 members of the general public yielded a margin of error (MOE) of +/- 4.9% with a 95% confidence interval (CI). Results for the 202 EV owners produced an MOE of +/- 6.9% with that same 95% CI. Key findings are described and illustrated in the subsections below. The term "Owners" in the graphics presented in this section refer to AFV owners eligible to enroll in Utah's RUC program. "Non-owners" refers to survey respondents that do not own an AFV.

6.6.1 Respondent Demographics

Survey respondents were split nearly evenly between men and women. Figures 6-5 through 6-8 illustrate the following other demographic characteristics of the respondent pool:

- Non-owner ages were fairly well-distributed but owners skewed much older
- Most people did not have children under the age of 18 living in their household, especially in the owner group
- Most people had high levels of education, particularly in the owner group
- Average household income was moderately high, especially in the owner group

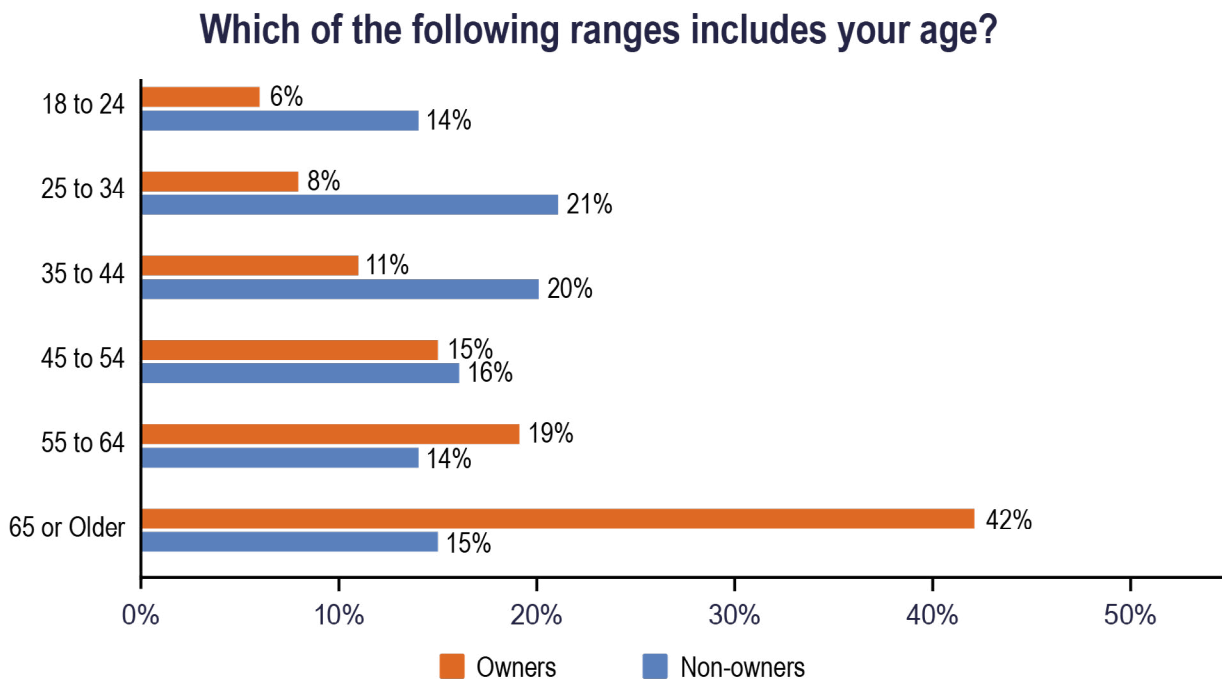


Figure 6-5 Survey Respondent Age Range

Do you have children under the age of 18 living in your household?

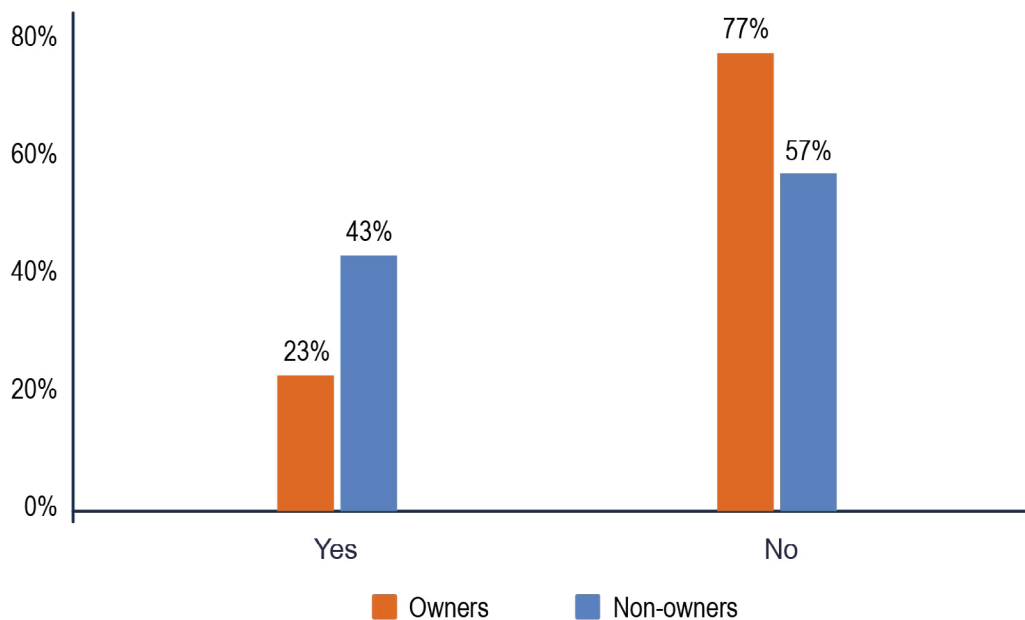


Figure 6-6 Children Living in the Household

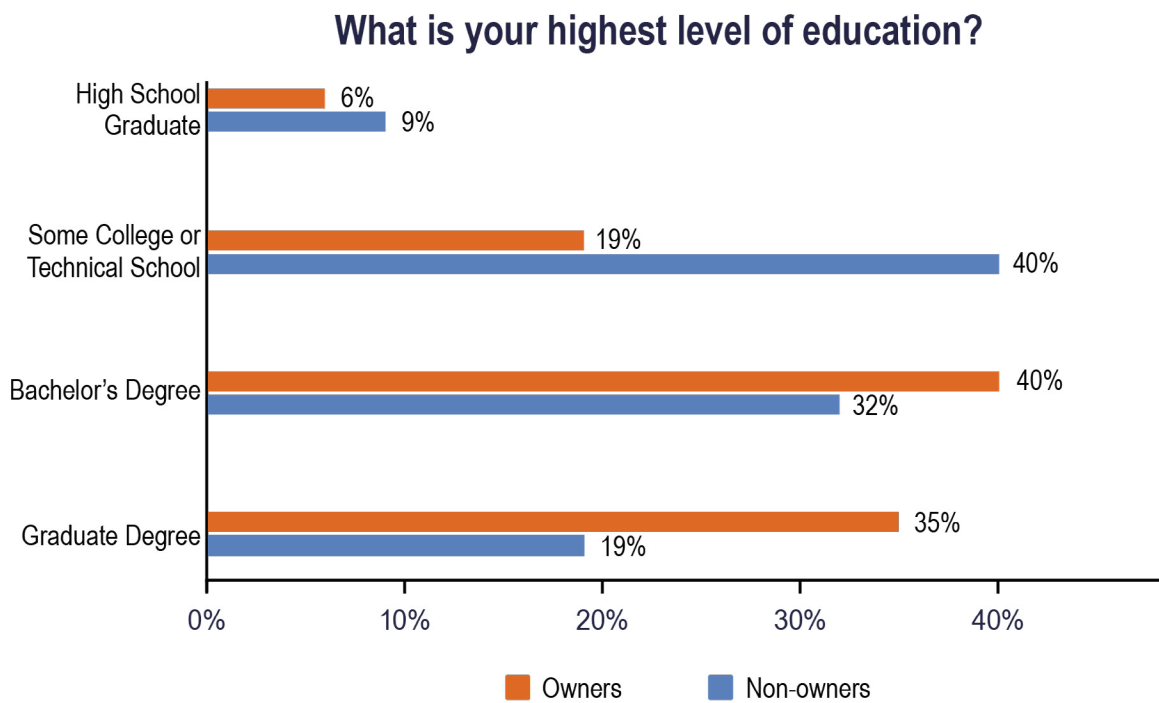


Figure 6-7 Education Level

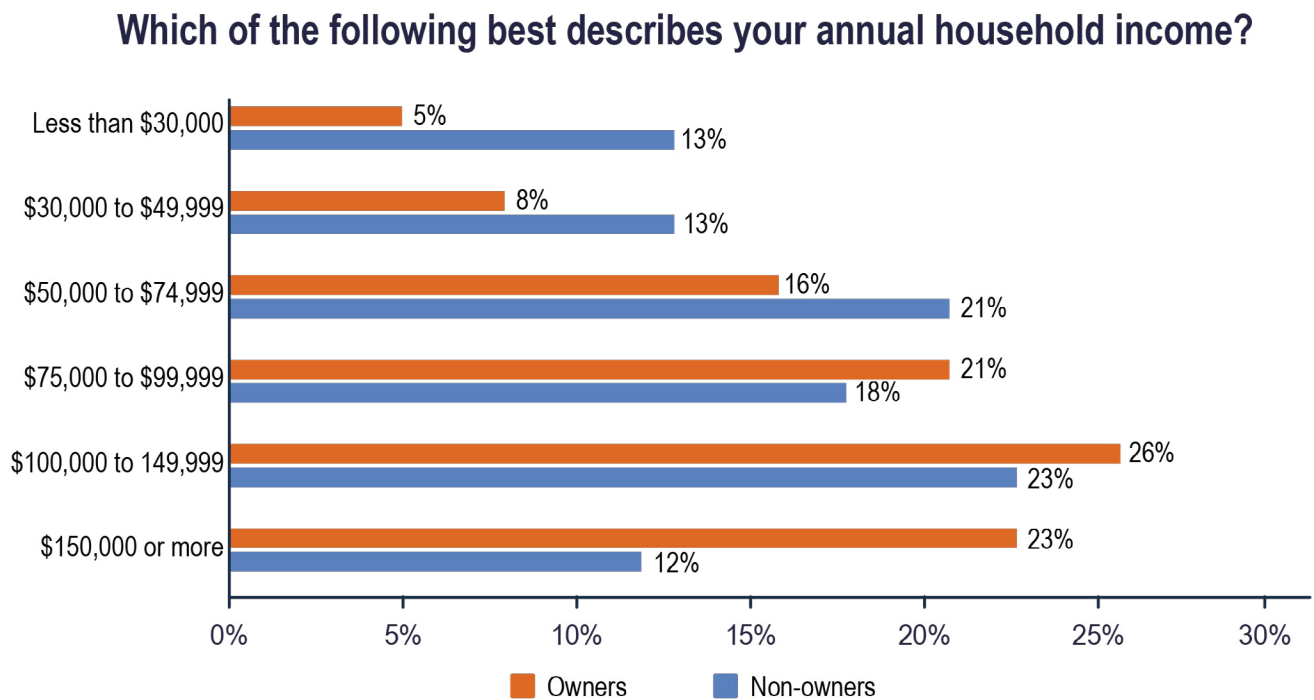


Figure 6-8 Household Income

6.6.2 RUC Awareness & General Perceptions

82% of owners said that they also own a gas-powered vehicle in addition to at least one AFV. Owners were more likely (68%) to say that fuel taxes generate funds for roads than non-owners (54%). Both respondent groups said that “taxes in general” fund roads. Figure 6-9 shows that owners were much more likely to be aware of the phrase “road usage charge” than non-owners. Figure 6-10 shows relative perceptions of owners and non-owners of the concept of RUC prior to being given a description of it. The main takeaway from this graphic is that owners have much more solid opinions (whether positive or negative) of RUC than do non-owners. This makes logical sense because owners are much more likely to have been exposed already to RUC by virtue of being asked if they want to enroll in the program during their annual registration process.

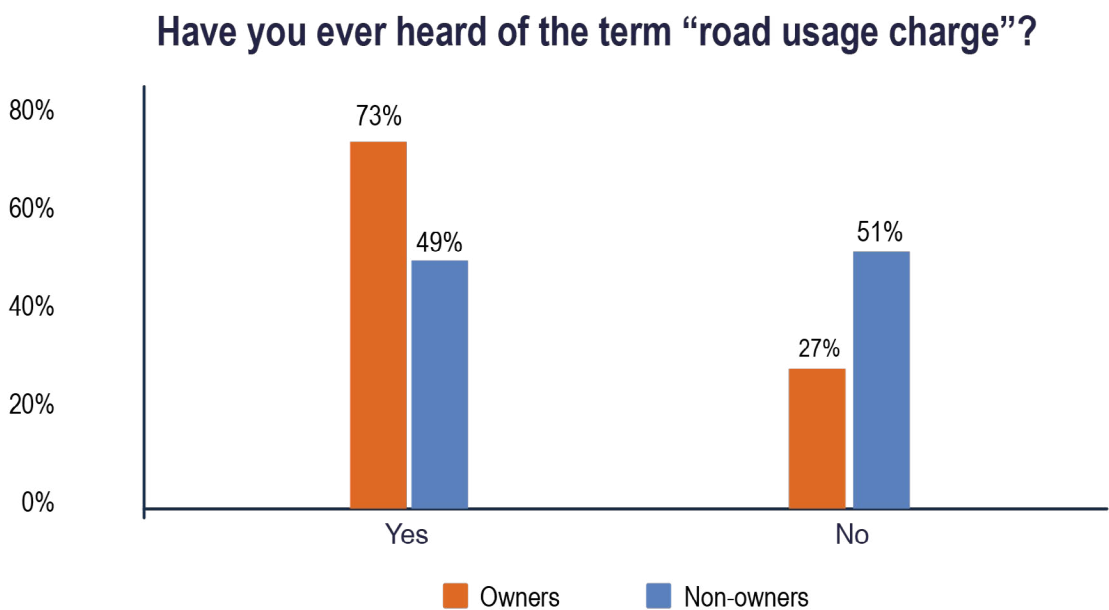


Figure 6-9 RUC Awareness



Based on what you know, please rate your perception of the road usage charge.

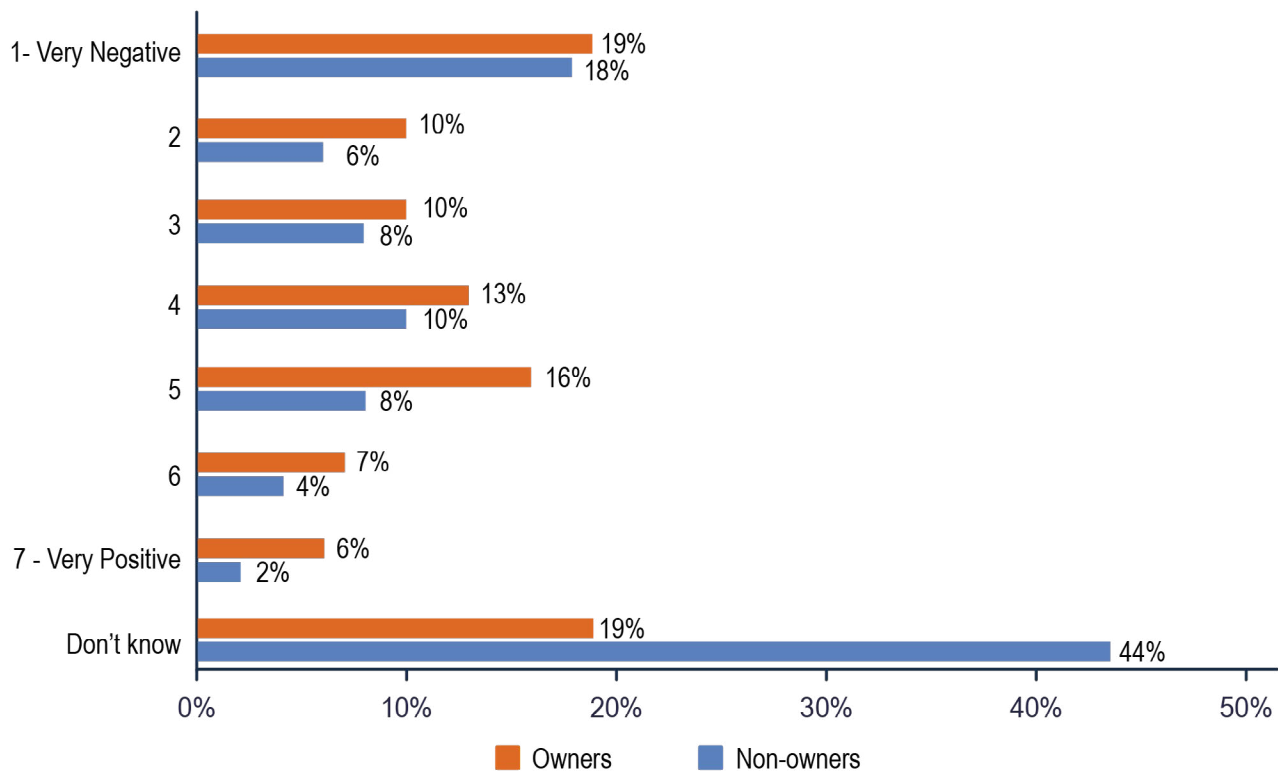


Figure 6-10 RUC Perceptions Prior to Description

Figure 6-11 shows how these perceptions changed after survey participants were read a description of RUC. For owners, rankings 1 through 5 changed very little from Figure 6-10 to Figure 6-11 but a measurable number of “Don’t Know” respondents in Figure 6-10 changed to rankings 6 and 7 in Figure 6-11. For non-owners, rankings 1-3 remained largely unchanged but a very large number of “Don’t Know” respondents from Figure 6-10 changed to rankings 4 through 7 in Figure 6-11. A comparison of these two figures shows that at a broad level:

- Educating the public about RUC can help them form opinions of it
- People largely have higher opinions of RUC after learning more about it
- Owners for the most part have a lower opinion of RUC than non-owners, likely because RUC is a way of taxing them for road use in lieu of the fuel taxes they are able to avoid

Having heard this description, please rate your perception of the road usage charge on the same one-to-seven scale.

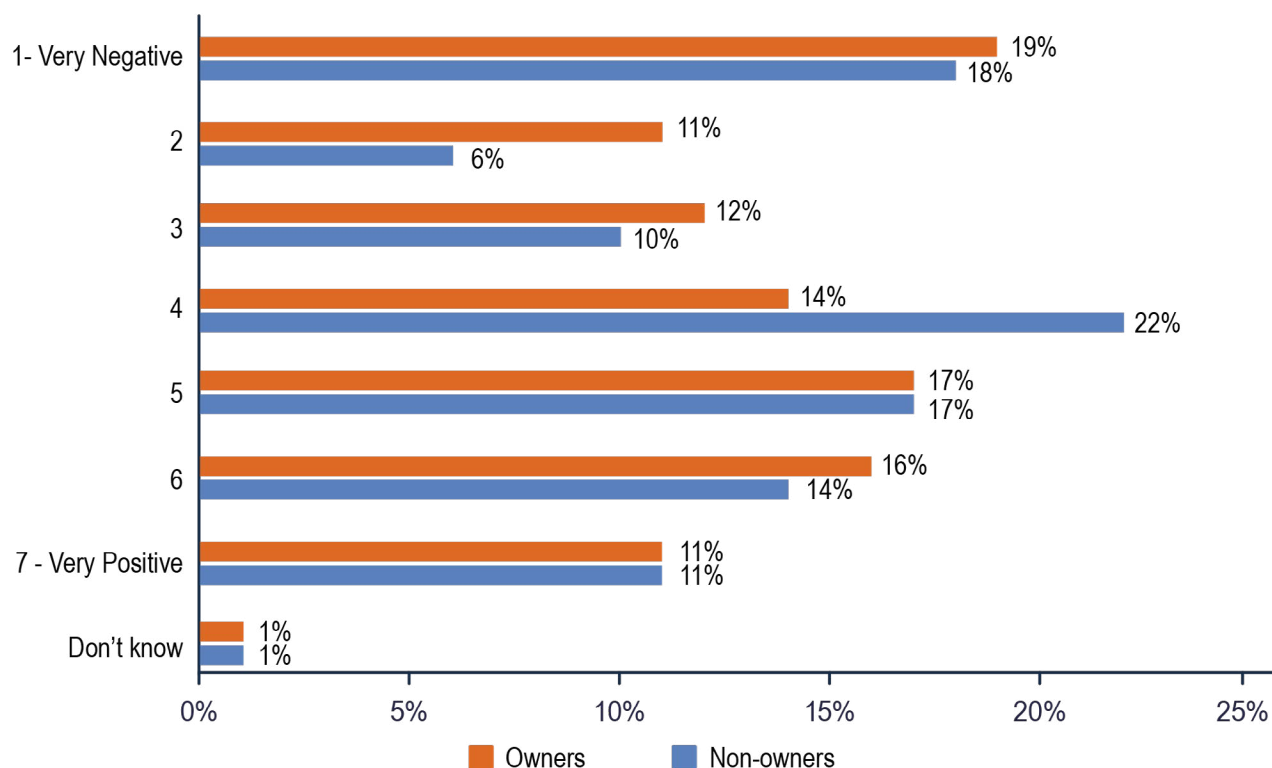


Figure 6-11 RUC Perceptions After Description

Figure 6-12 shows the respective views of owners and non-owners with regard to the perceived fairness of RUC. It is important to note that this question was asked after survey respondents had been given a description of RUC. Figure 6-13 shows the views of these two groups with regard to the question of whether RUC is an innovative and forward-thinking approach to transportation funding. Both of these figures show that opinions are mixed but that people in both groups skew towards positive views of RUC being fair, innovative, and forward-thinking.



**Please tell me whether you agree or disagree with the following statement:
The road usage charge is fair, as it ensures motorists pay for what they use**

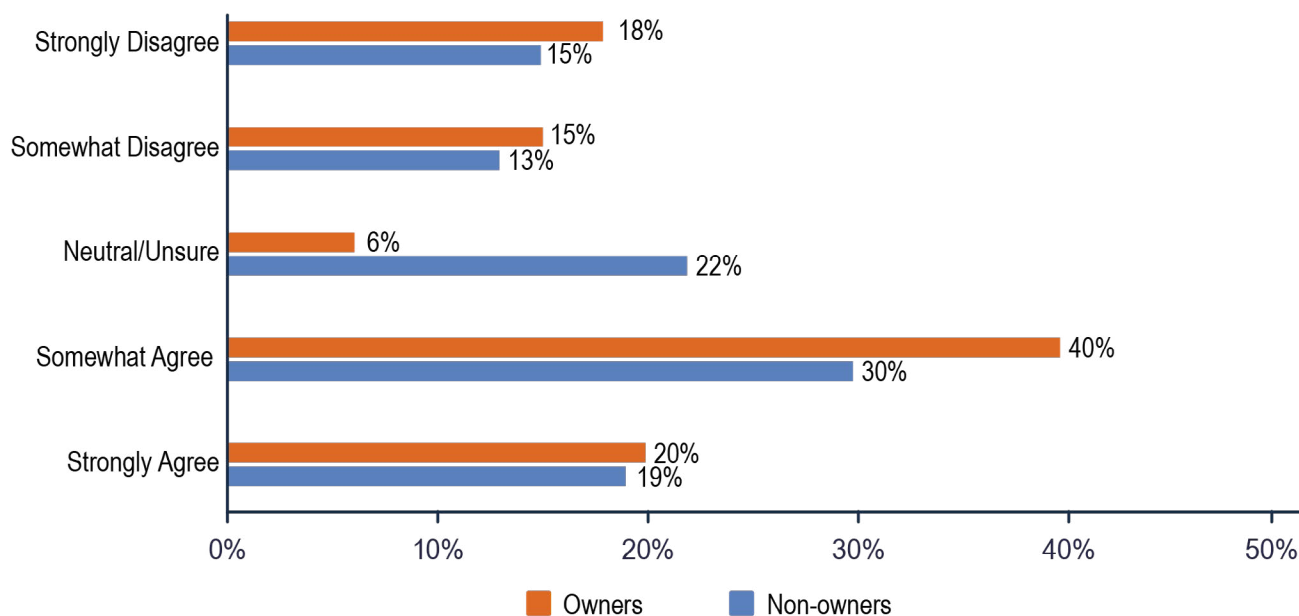


Figure 6-12 Perceptions of RUC Fairness

**Please tell me whether you agree or disagree with the following
statement: The road usage charge is an innovative and
forward-thinking approach to funding transportation**

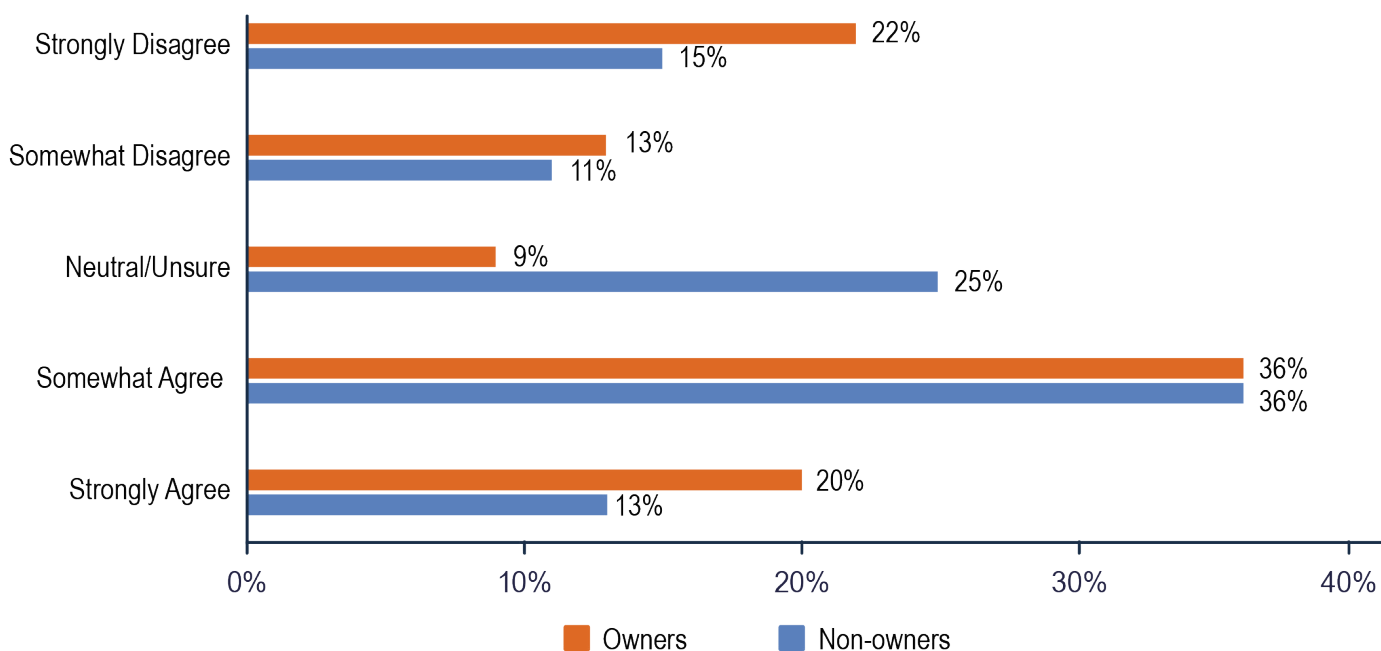


Figure 6-13 Perceptions of RUC as an Innovative Approach

Figure 6-14 shows the respective views of owners and non-owners about whether RUC will discourage people from buying AFVs. The noteworthy result here is that owners slightly skew toward the “Agree” side of the graph while non-owners slightly skew to the “Disagree” side. It is important to acknowledge, however, that perception does not necessary translate into reality and it is unclear whether or not paying \$100-\$200 in RUC fees per year will actually prevent significant numbers of people from buying a vehicle that costs tens of thousands of dollars.

Please tell me whether you agree or disagree with the following statement: The road usage charge will discourage consumers from purchasing alternative fuel vehicles.

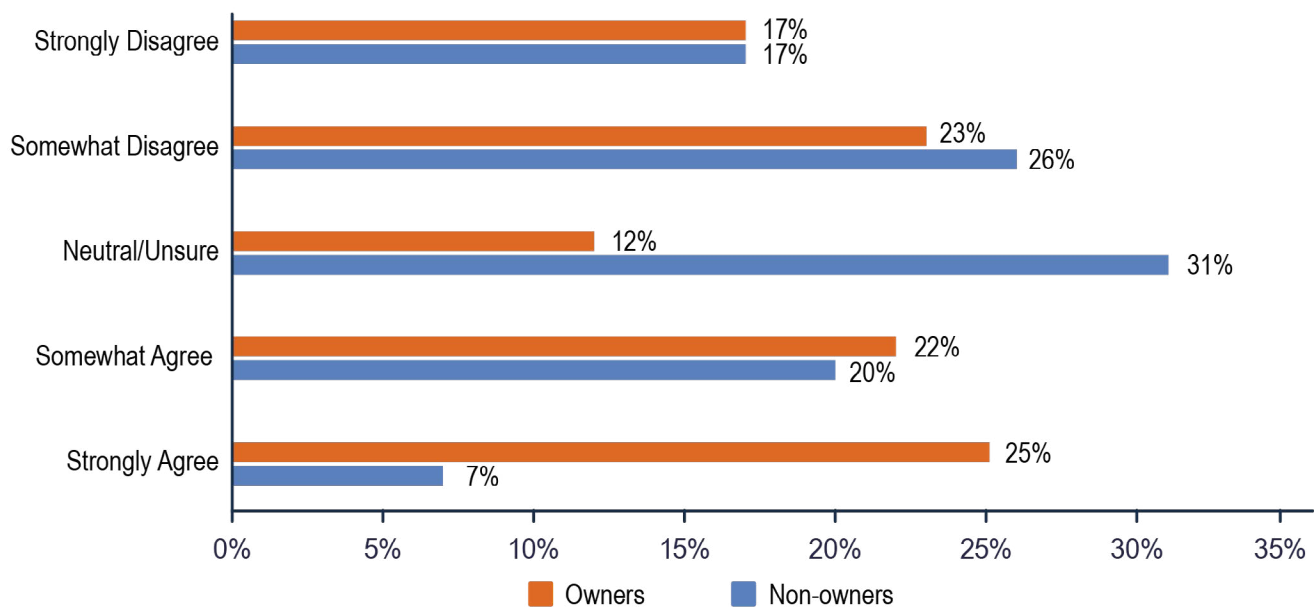


Figure 6-14 Perceptions of RUC’s Impact on AFV Sales

Figure 6-15 shows views about whether or not RUC should replace fuel taxes for all vehicle types. Results show that owners skew much more heavily to the “Yes” side than non-owners and that many more non-owners are unsure of their opinion on this subject. This makes logical sense because owners are much more likely than non-owners to have encountered RUC and formed opinions about it, and they also might believe that everyone should be subject to RUC instead of it only being applied to them.

Should the Road Usage Charge program replace the fuel tax for all vehicles, not just alternative fuel vehicles?

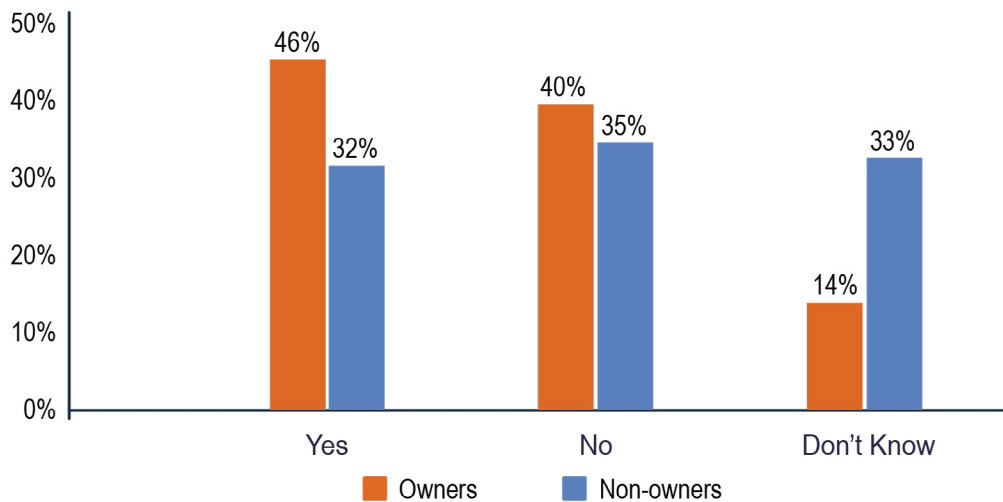


Figure 6-15 Opinions About RUC Replacing Fuel Taxes

6.6.3 Participation in Utah's RUC Program

Survey results revealed that at least 14% of owners were already enrolled in Utah's RUC program (16% responded that they weren't sure if they were enrolled or not). Figure 6-16 shows enrolled owners' stated motivations for joining. Potential to save money was by far the most important factor in decisions to join. Other motivations were many and varied. Figure 6-17 shows the stated reasons why non-enrolled owners chose not to enroll. Nearly half of those not enrolled in the program stated that lack of awareness was the primary reason for not joining.

Why are you enrolled in Utah's Road Usage Charge program?

Alternative Fuel Vehicle Owners Only

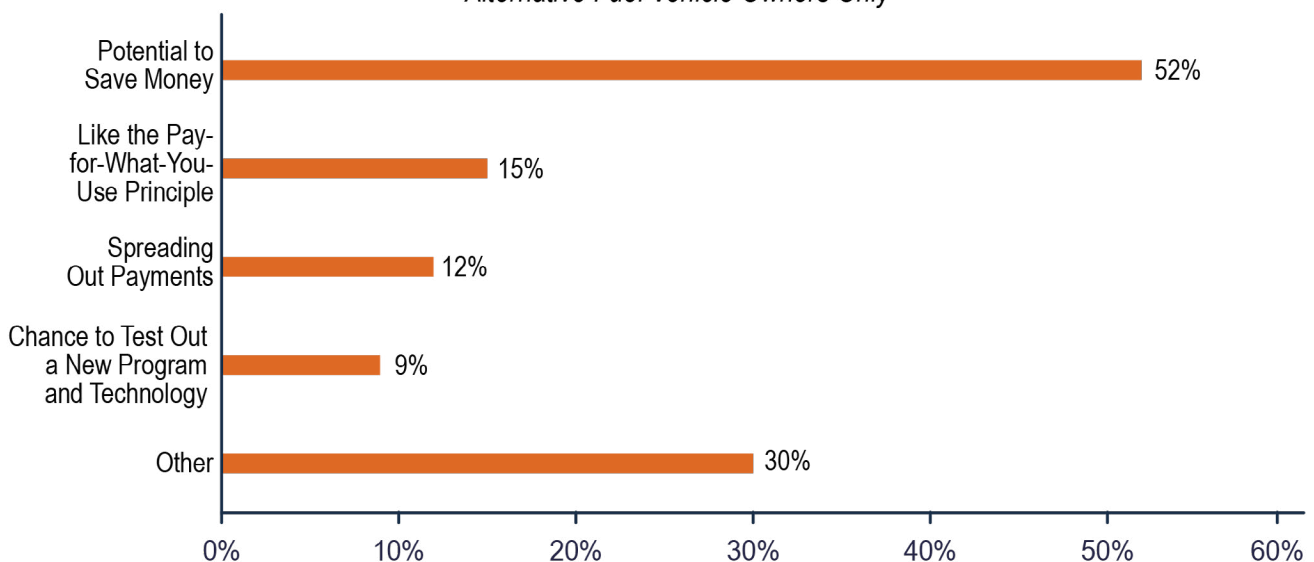


Figure 6-16 Reasons for Enrolling in RUC

Why aren't you enrolled in Utah's Road Usage Charge program?

Alternative Fuel Vehicle Owners Only

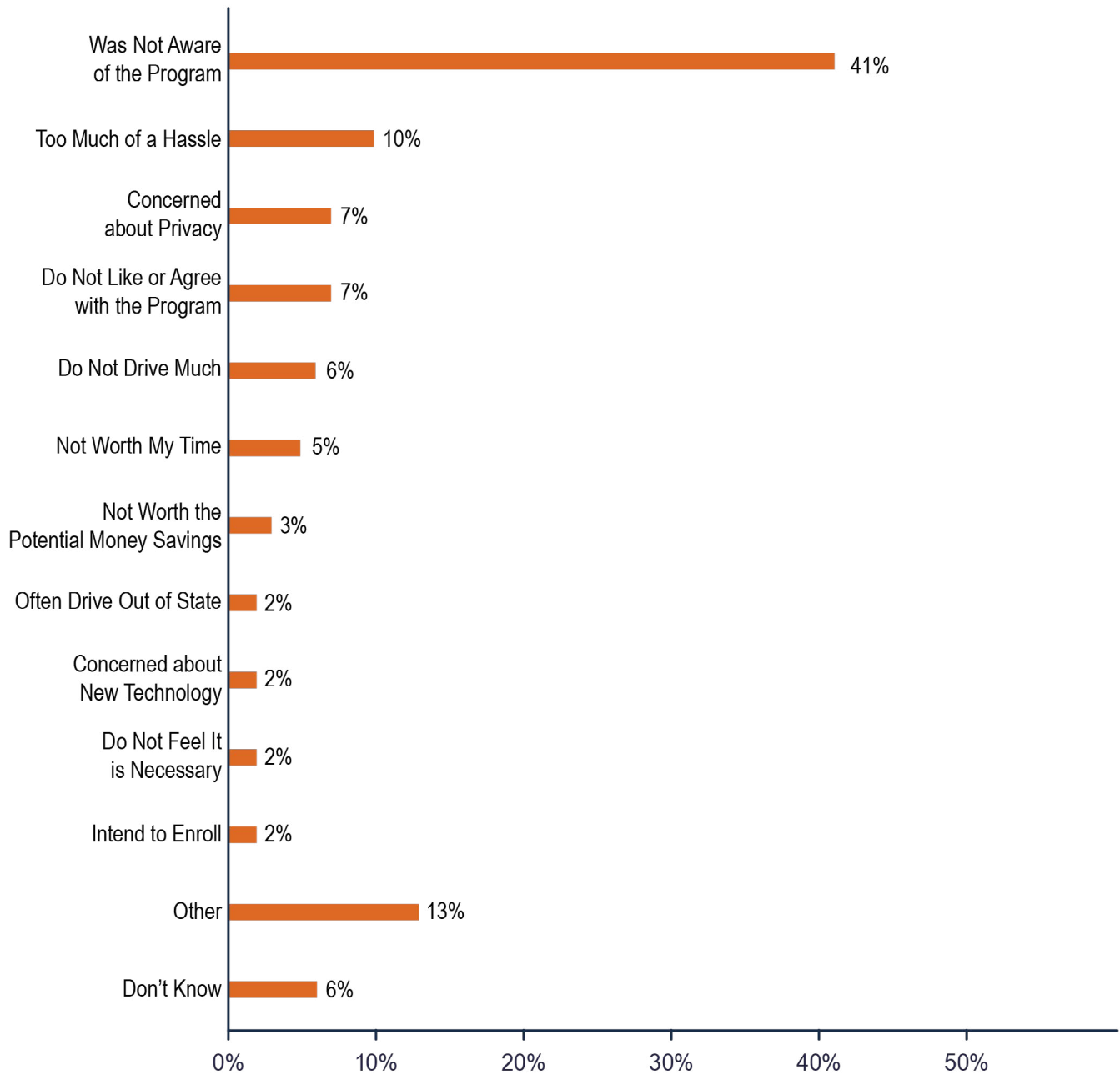


Figure 6-17 Reasons for Not Enrolling in RUC

Figure 6-18 shows respondents' level of comfortability with the concept of using an in-vehicle mileage tracking device. Three key takeaways are evident from this figure and a follow-up question about reasons why people responded the way they did:

- Most people, owners and non-owners alike, are uncomfortable with the idea of mileage tracking devices
- Owners are significantly more comfortable with mileage tracking devices than non-owners
- Privacy concerns are by far the most commonly-quoted reason for uncomfortability with mileage tracking devices, followed by the potential misuse of information

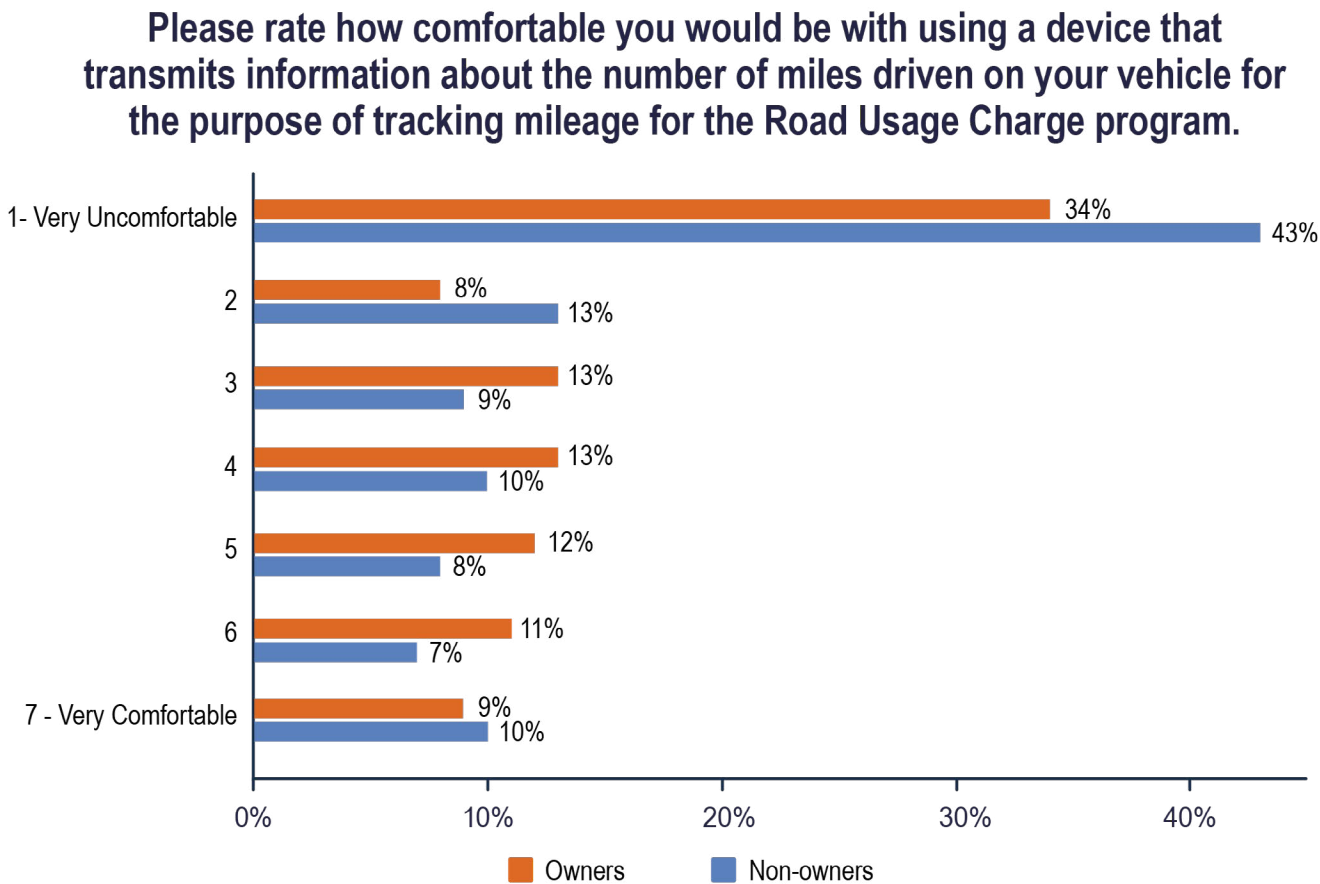
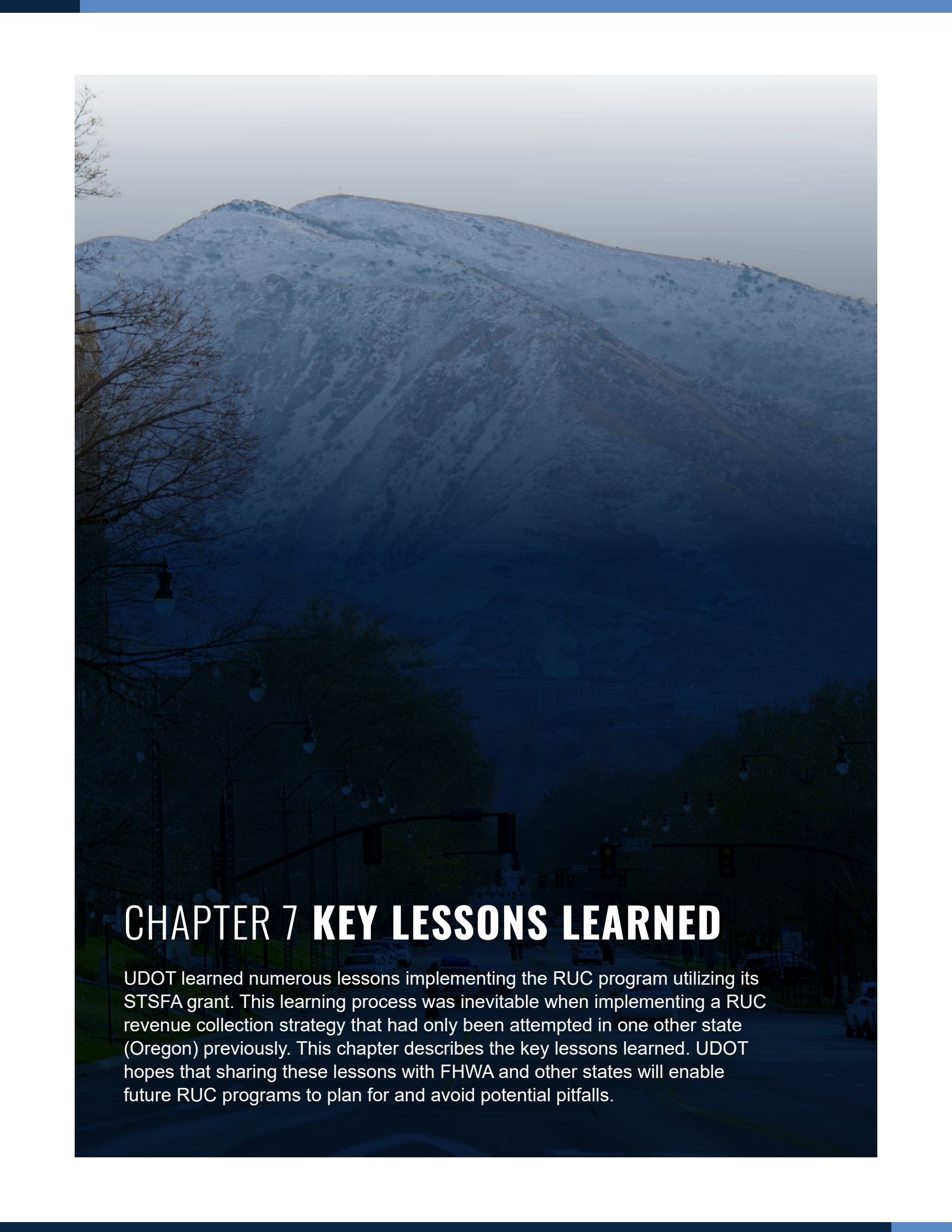


Figure 6-18 Comfortability with Mileage Tracking Devices



CHAPTER 7 KEY LESSONS LEARNED

UDOT learned numerous lessons implementing the RUC program utilizing its STSFA grant. This learning process was inevitable when implementing a RUC revenue collection strategy that had only been attempted in one other state (Oregon) previously. This chapter describes the key lessons learned. UDOT hopes that sharing these lessons with FHWA and other states will enable future RUC programs to plan for and avoid potential pitfalls.

7.1 IMPLEMENTATION & TESTING PROTOCOLS

One of the key lessons was the importance of allowing for ample time to plan a RUC program, procure a CAM to operate it, thoroughly test the CAM's system, implement corrections based on test results, and open the program to the public. In UDOT's case, state lawmakers passed legislation in Spring 2018 that required UDOT to have a RUC program operational by January 1, 2020. This timeline proved to be too short to accommodate ideal setup and testing protocols or allow for unanticipated challenges. The program did launch on January 1, 2020 but numerous issues needed to be addressed in the months following launch because there was not sufficient time to do so prior.

In UDOT's experience, it is easier to rectify RUC system problems prior to launch than to do so afterward when there are more competing priorities for attention and time. Allowing a CAM to launch the program without all of the desired functionalities in place from the start can set a precedent that is hard to overcome later. In fact, some system elements required at program launch were never implemented by the CAM despite UDOT's efforts to follow up.

Another lesson involving testing is that it is very helpful to have trusted users deeply familiar with the program embedded into the customer base after program launch to find errors and troubleshoot problems. Several UDOT employees and RUC program consultant staff enrolled vehicles and became actual customers. Feedback from these people was instrumental in finding problems, ideally before less-familiar customers noticed the problems.



7.2 ELIGIBLE VEHICLES

One of the first questions any state considering a RUC program will have to answer is which types of vehicles to include. In Utah's case, the RUC enabling legislation required UDOT to offer the program to EVs, PHEVs, and gas hybrids. These vehicle types were allowed to enroll until January 1, 2023. Only EVs could enroll after that date, although PHEVs and gas hybrids already in the program were allowed to remain. The main reason why state statute directed UDOT to withdraw eligibility from PHEVs and gas hybrids is that the annual payment cap for those vehicles (\$52 and \$20 in 2021, respectively) was lower than the CAM's cost to service them in the program. In other words, UDOT was losing money on each PHEV and gas hybrid that enrolled.

Enrollment initially occurred at a much faster rate than UDOT estimated. Instead of having an estimated 650 enrolled vehicles at the end of the first year, there were approximately 3,600 vehicles enrolled. This unanticipated high enrollment rate added to the compressed



implementation timeline and proved challenging from a customer service perspective. UDOT recommends that states considering implementing RUC strongly consider starting with a vehicle type like EVs, thus limiting the program eligibility pool to a relatively small part of the vehicle fleet. Starting small allows a state to work with the CAM(s) to rectify problems and solidify program operations while the number of enrollees is small and problems affect relatively few people. Starting with EVs also makes sense from a policy level because EVs are the vehicle type that does not already pay any fuel taxes.

7.3 MILEAGE REPORTING OPTIONS

OBD-II devices proved to be challenging from both a customer service and administrative cost standpoint. Specific challenges included:

- Logistics surrounding the mailing of devices from the CAM to customers and from customers back to the CAM when customers exited the program
- Level of complexity for customers to install the devices
- Device installation requiring another step in the enrollment process, which inevitably leads to some customers not fully completing enrollment
- Customers unplugging devices and disregarding requests from the CAM to reinstall them
- \$95 device cost, which makes it difficult to ever reduce administrative costs to acceptable levels
- Difficulty of collecting fees from customers who do not return devices when they exit the program

UDOT’s ultimate conclusion is that OBD-II devices may be suitable for temporary RUC pilot programs where users are fully cooperative and willing to accept drawbacks of a plug-in device, but are not suitable for ongoing revenue collection programs where administrative costs and customer experience are paramount. Other MRO-related lessons learned include:

Electronic submission of odometer photos (e.g. through cell phone apps) may be a cost-effective MRO; UDOT did not offer odometer photos as a stand-alone MRO but odometer photos were used as part of the enrollment process and each year as an annual mileage accrual true-up check

1

2

Telematics is a promising MRO to continue using and developing. While it is currently more expensive than odometer photos, its future potential is strong, justifying a bit more cost in order to realize the future benefits.

7.4 CUSTOMER STATEMENTS & ACCOUNT INFORMATION

It is important for public trust purposes to make sure that miles driven and cost accrual information shown on customer statements and online portals match. If a state operating a RUC program has difficulty with its CAM not being able to match this information on all public-facing

documents, it may be better to only provide a single information source to customers, whether that source be a customer statement or an online portal. Customers generally understand that mileage reporting may have a small tolerance (e.g. a few percentage points) for error between actual miles driven and what the CAM reports, but they are far less understanding of why the CAM would report different results in different places when there is only one source of mileage information being collected. It is also important that all information sources follow principles of readability, user friendliness, and good design.

7.5 PRIVACY PROTECTION

Privacy protection considerations are extremely important when starting a RUC program. It is advisable to err on the side of caution when starting a program and building public trust. UDOT's experience with attempting to aggregate and anonymize location data in a relatively small program is that it may be nearly impossible to meaningfully anonymize this data. This is because in areas of a state (e.g. rural areas) with relatively few people that own eligible vehicles, someone looking at location data on a map might be able to reasonably identify who is driving those miles if they happen to know that a given person is enrolled in RUC. Even if location data can be meaningfully anonymized, or if location data is only published for the more populous areas of a state where aggregation would obscure individuals' identity, the benefit of this data is minimal at a small program scale and likely not worth the risk of anyone perceiving privacy violations.



Telematics and odometer photo MROs offer the ability to collect mileage without collecting any location information. States may wish to use those instead of location-based MROs to steer clear of any potential privacy concerns. If location-based MROs are used, states should consider measures that provide strong protections against the state receiving any location information from the CAM. The downside of not having location-based MROs is that it does not allow for exclusion of RUC fees for miles driven outside of the state in which the program has been implemented. States considering a RUC program will need to decide whether exclusion of out-of-state miles and non-public road miles within state boundaries is important enough to justify the use of location-based MROs.

It is important to establish clear customer terms and conditions to govern how data is shared and privacy is protected. Terms and conditions should be transparent with regard to data collection, how data is used, what data the CAM provides to government agencies, and what (if anything) is shared beyond those agencies. Data sharing restrictions and data destruction requirements should also be clear.

7.6 DMV COORDINATION

In states such as Utah where RUC program enrollment is explicitly tied to the DMV registration process, it is important to have a clear understanding between the CAM and DMV as to whether a vehicle is a “RUC customer” or “DMV customer” at any given instant. Tight controls are necessary to prevent people from gaming the system by registering for RUC for a very short time to evade the additional registration fees applicable to AFVs, only to then exit the

RUC program and go back to being solely a DMV customer without paying anything to the RUC program. UDOT handles this issue by charging RUC customers the full value of the annual AFV fee (minus any RUC fees accrued to date in the 12-month registration cycle) as a condition of leaving the program.



It became apparent during the system implementation process that the messaging provided to potential RUC customers during the DMV registration process needed to be improved. In particular, it was not always clear to customers how much less their total registration fees would be if they opted into RUC, or how much money they were likely to pay in RUC fees given how many annual miles they typically drive. UDOT worked with the DMV to improve this messaging but it would have been better if more time was available prior to program launch to work with the DMV proactively rather than reactively. Similarly, the messaging provided to vehicle owners (either by physical mail or email) in advance of their annual registration could have been much better. UDOT also worked with the DMV to improve that language, but doing so took a significant amount of time because those messaging functions are outsourced by the DMV to a vendor and changes require a lot of lead time.

Registration holds can motivate compliant behavior but are annoying to people and generate customer complaints. The need for registration holds could have been reduced by implementing text message notifications in support of compliance enforcement. This could help reduce the need for placing a hold altogether or could expedite hold reversals. UDOT's initial program only had email notifications and reminders, and many people either did not see them at all or ignored them.

7.7 CAM PROCUREMENT PROCESS & REQUIREMENTS

States using a CAM to operate their RUC program must inevitably make decisions about how to balance technical competency and proven RUC program success with the price a given vendor proposes in competitive procurement processes. Lowering administrative costs is a widespread goal of all states currently operating RUC programs as well those that are seriously considering starting a program of their own. If running a RUC program as cheaply as possible is the overarching goal of a state, proposal evaluations will heavily weight price in the selection process. The likely result of this would be the least expensive CAM being hired, but in return the state might have less confidence in the program quality. If on the other hand a given state prioritizes technical proficiency and customer satisfaction over price, proposal evaluations will weight technical competency more highly than cost. The likely result of this would be higher confidence in program quality but at a higher price point.

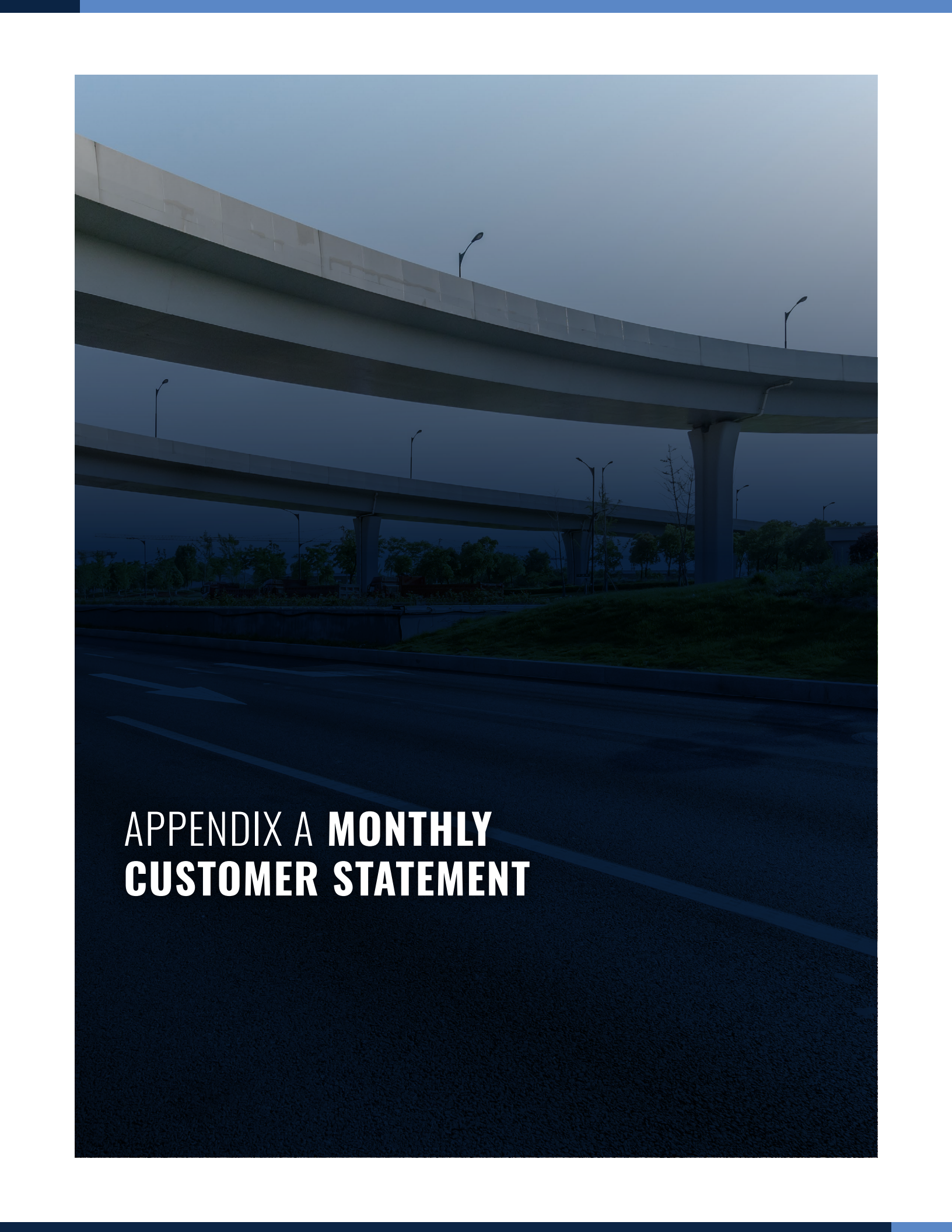
Each state will need to decide how to balance the competing needs of cost and quality. One risk of heavily weighting cost



at the expense of quality initially is that it may lead to customer complaints early on in the program. If those complaints are above a certain threshold of seriousness and frequency, they could compromise the legislative support that enacted the RUC program and thus threaten long-term program viability. On the other hand, incurring administrative costs that are too excessive for the legislative and cultural climate of the state might also threaten program viability. Regardless of how a given state decides to balance these competing needs, it is advisable for the RUC implementing agency to be open and transparent with legislative supporters regarding the choices being made in favor of quality or cost savings. Doing so will buttress the implementing agency against imperfect results by setting expectations properly.

Including an SLA in CAM contract language is a common practice to set expectations and performance metrics for customer service. It is important for SLAs to contain meaningful consequences for not meeting critical requirements. UDOT's experience is that it is important to only include SLA requirements that the implementing agency is committed to strictly enforcing. Including certain requirements and then choosing to not enforce them makes it more difficult to strictly enforce the things that an implementing agency does intend to strictly enforce. An example of this is UDOT writing in a requirement for its CAM to maintain at least a 99% OBD-II device heartbeat verification and then not actually enforcing it because UDOT realized later that the CAM didn't have enough control of that issue to realistically meet the requirement through its own efforts. In this case, the CAM never experienced SLA penalty actions even though they were in violation of the terms as written.





APPENDIX A **MONTHLY CUSTOMER STATEMENT**

Utah's Road Usage Charge Program

[REDACTED]
Park City, UT 84098
[REDACTED]

Account Number: [REDACTED]
Statement Number: 1001818391
Statement Date: 01/05/2024
Billing Period: 12/01/2023 to 12/31/2023

Statement Summary For All Vehicles

This statement provides a summary of your account activity.

 Total Miles Driven in December: 1972.3
 Total Road Usage Charge Accrued in December: \$19.72



Prepaid wallet

Beginning Balance: \$5.48
Refund/Fee Adj: \$0.00
Reverse/Fees/Adj: \$0.00
Total Charge Accrued: \$19.72
Funds Added: \$20.00
Ending Balance: \$5.76

2022 TESLA MOTORS MODEL Y enrolled JUL 2022 - [REDACTED] - Telematic Mileage Reporting Option

	Miles	Charge
Max Charge for Registration Period	----	\$130.25
Charges Accrued	1,972.3 mi	
Current Month Charged (DEC 2023)	1,972.3 mi	\$19.72
Current Month Uncharged (DEC 2023)	0.0 mi	----
Adjustment miles charged	0.0 mi	\$0.00
Previous Months Charged (JUL-NOV 2023)	9,952.6 mi	\$99.53
Previous Months Uncharged (JUL-NOV 2023)	1,046.1 mi	----
Total Road Usage Charged	11,924.9 mi	\$119.25
Total Road Usage Uncharged	1,046.1 mi	----
Amount Left to Max Annual Charge	----	\$11.00

Per program policy, the mileage rate will decrease effective January 1, 2023, from 1.52 cents per mile to 1.00 cents per mile. The maximum charge applicable to a 12-month vehicle registration cycle will increase in 2023. This increase will take effect at the beginning of the month that a vehicle registration renews. The increases will be as follows:

- Electric vehicles: from \$123.00 to \$130.25
- Plug-in hybrid electric vehicles: from \$53.25 to \$56.50
- Gasoline hybrid vehicles: from \$20.50 to \$21.75

Further, plug-in hybrid and gasoline hybrid vehicles are no longer eligible to enroll in the program. Currently enrolled plug-in hybrid and gasoline hybrid vehicles may remain in the program.

Road usage details and account balance can be accessed online by logging into your account at <https://www.roadusagecharge.utah.gov>

Contact Us

Contact us with any questions or concerns regarding your statement or account.

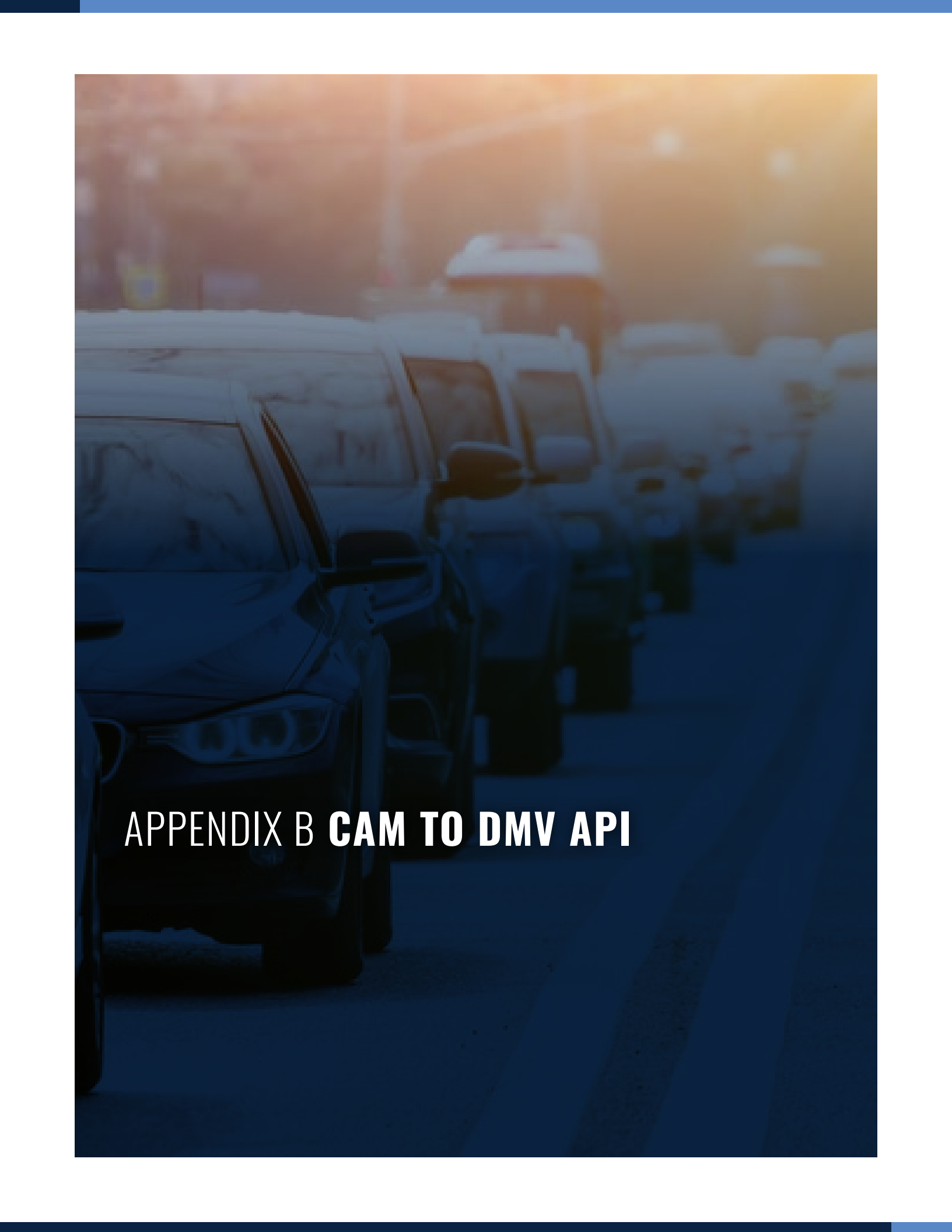


By Phone at: 855-782-8824
Mon-Fri, 8:00AM - 5:00PM MT



Online at:
[roadusagecharge.utah.gov](https://www.roadusagecharge.utah.gov)





APPENDIX B **CAM TO DMV API**

1 PURPOSE

The purpose of this document is to define the required elements of information required between UDOT, DMV, and any RUC CAM contracted by UDOT. Required elements facilitate lookup of registered vehicle and owner information to enroll participants into the RUC program as well as place and release vehicle registration holds for noncompliance with RUC system rules. The data elements defined below were used to create an ICD between the CAM(s) and DMV.

2 VEHICLE/OWNER LOOKUP

2.1 Description

Initial webservice call to determine if a vehicle is eligible for enrolling in the RUC program. The CAM collects the necessary information from the consumer and then validates that information against the DMV webservice.

The Utah DMV will apply business rules to determine RUC enrollment eligibility and return the appropriate Status Code and other data elements. Text data elements are variable length and the character lengths provided are the maximum possible length.

2.2 Data Elements—In

Data Element	Description	Data Type
VIN	Vehicle VIN	Text (30 characters)
Plate Number	License plate characters	Text (10 characters)
Owner Name	Last Name or Business Name	Text (255 characters)
Zip Code	Zip Code	Text (30 characters)

2.3 Data Elements—Out

Element	Description	Data Types
Status Code	0 - Success Vehicle was found and the vehicle information has been populated in the other data fields. 1 - Unable to Locate Vehicle Vehicle was not found. 2 - Unqualified Vehicle Vehicle is not qualified for the RUC program.	Int16
RUC-Key	Unique Identifier used for inquiries about this specific vehicle/owner combination.	Int64
Plate Number	The plate number which a look-up was performed on.	Text (10 characters)
Plate Country	USA	Text (3 characters)
Plate State	Utah	Text (4 characters)
Plate Type	200+ Plate Types	Text (255 characters)
Registration Commence	The last date the vehicle was registered.	Date
Registration Expiration	The date the vehicle's registration expires.	Date
VIN	The Vehicle Identification Number (VIN) for the vehicle.	Text (30 characters)
Vehicle Make	The make of the vehicle.	Text (255 characters)
Vehicle Model	The model of the vehicle.	Text (255 characters)
Vehicle Year	The year of the vehicle.	Int16
Vehicle Color	The primary color of the vehicle.	Text (255 characters)
Vehicle Fuel Type	Alcohol, Electric, Hybrid, Hydrogen, Other, Plug-in Hybrid, Steam	Text (30 characters)
Registered Weight	The registered weight of the vehicle	Int32

Element	Description	Data Types
Renewal Alternative Fuel Vehicle Flat Fee Amount	The full amount for the alternative fuel vehicle flat fee if they weren't registered in RUC at the time of renewal	Decimal
Owner Type	Individual, Business, Government	Text (10 characters)
First Name	First name of the lessee/owner.	Text (50 characters)
Middle Name	Middle name of the lessee/owner.	Text (50 characters)
Last Name	Last name of the lessee/owner.	Text (255 characters)
Business Name	Business name of the lessee/owner.	Text (255 characters)
Street	Mailing Street of the lessee/owner.	Text (255 characters)
Street 2	Street 2 of the lessee/owner.	Text (255 characters)
Unit	Unit of the lessee/owner.	Text (30 characters)
Unit Type	Unit Type of the lessee/owner.	Text (50 characters)
City	City of the lessee/owner.	Text (100 characters)
State	State of the lessee/owner.	Text (6 characters)
Zip	Zip code of the lessee/owner.	Text (30 characters)
Country	Country of the lessee/owner.	Text (6 characters)
First Name	First name of the lessor.	Text (50 characters)
Middle Name	Middle name of the lessor.	Text (50 characters)
Last Name	Last name of the lessor.	Text (50 characters)
Business Name	Business name of the lessor.	Text (255 characters)
Street	Street of the lessor.	Text (255 characters)
Street 2	Street 2 of the lessor.	Text (255 characters)
Unit	Unit of the lessor.	Text (30 characters)
Unit Type	Unit Type of the lessor.	Text (50 characters)

Element	Description	Data Types
City	City of the lessor.	Text (100 characters)
State	State of the lessor.	Text (6 characters)
Zip	Zip code of the lessor.	Text (30 characters)
Country	Country of the lessor.	Text (6 characters)

3 VEHICLE/OWNER ENROLLMENT

3.1 Description

Used by the CAM to notify the DMV of changes in the enrollment status.

3.2 Data Elements—In

Element	Description	Data Types
RUC-Key	Unique Identifier used for inquiries about this specific vehicle/owner combination.	Int64

Element	Description	Data Types
Enrollment Status	1 - Enrolled Vehicle/owner is newly enrolled in RUC. 2 - Delinquent Vehicle/owner is delinquent with the CAM and a renewal hold should be added. 3 - Settled Vehicle/owner is not delinquent with the CAM and a renewal hold should be removed. 4 - Cancelled Vehicle/owner is no longer enrolled in RUC.	Int16

3.3 Data Elements—Out

Element	Description	Data Types
Status Code	0 - Success Vehicle was found and the vehicle information was updated accordingly. 1 - Unable to Locate Vehicle Vehicle was not found (Invalid RUC-Key). 2 - Invalid Registration Vehicle is no longer registered to this owner.	Int64

4 VEHICLE/OWNER STATUS

4.1 Description

Used by the CAM to check the DMV status of a vehicle/owner.

4.2 Data Elements—In

Element	Description	Data Types
RUC-Key	Unique Identifier used for inquiries about this specific vehicle/owner combination.	Int64

4.3 Data Elements—Out

Element	Description	Data Types
Status Code	0 - Success Vehicle was found. 1 - Unable to Locate Vehicle Vehicle was not found (Invalid RUC-Key). 2 - Invalid Registration Vehicle is no longer registered to this owner.	Int16
RUC Status	1 - Enrolled Vehicle/owner is enrolled in RUC. 2 - Delinquent Vehicle/owner is delinquent with the CAM and a renewal hold is active. ** Note that Settled is not listed, since that would flag the account as active again ** Note that Cancelled isn't listed, since a Status Code of "1 - Unable to Locate Vehicle" would be returned instead	Int16
Registration Commence	The last date the vehicle was registered.	Date
Registration Expiration	The date the vehicle's registration expires.	Date

Element	Description	Data Types
Current Alternative Fuel Vehicle Flat Fee Amount	The full amount for the alternative fuel vehicle flat fee if they canceled the RUC program today.	Decimal
Renewal Alternative Fuel Vehicle Flat Fee Amount	The full amount for the alternative fuel vehicle flat fee if the vehicle wasn't registered in RUC at the time of renewal.	Decimal

5 SERVICE HEALTH

5.1 Description

Used by the CAM to check the status of the RUC Web Service hosted by the DMV.

5.2 Data Elements—In

None

5.3 Data Elements—Out

Element	Description	Data Types
Status Code	0 - Online Service is online. 1 - No Enrollment Changes Allowed Service is online for query purposes only, enrollment changes are not allowed. 2 - Offline Service is offline.	Int16