Road Usage Charge Pilot Project Final Evaluation Report for Washington State Participants

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This report provides a summary of evaluation results of Washington's participation in the Road Usage Charge Pilot Program (RUCPP). The RUCPP was a trial of various approaches and technologies for motorists in the States of Washington, Oregon, and Nevada to measure and report mileage as the basis for a per-mile road usage charge (RUC). Beginning in November 2012, selected participants signed agreements, selected plans, and adopted in-vehicle devices to measure their road usage for the succeeding months. Washington participants received monthly invoices indicating their road usage and associated charges, less taxes paid on fuel as estimated by the system; however, they did not actually make any payments. The pilot formally completed on January 31, 2013. This report represents the findings of the pilot test by the evaluation team under the direction of the Washington State Department of Transportation (WSDOT).

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Prepared by D'Artagnan Consulting LLP

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Table of Contents

Definitions and Abbreviations 6

1 Introduction 7

1.1 Road Usage Charging Program Background in Washington 7

1.2 Washington Participation in the RUCPP 8

1.3 Background, Implementation, and Execution of RUCPP 9

1.4 Purpose and organization of this report 14

2 Evaluating the Pilot Program 15

2.1 Evaluation Methodology 15

2.2 Summary of results 18

2.3 Explanation of results 19

3 Motorist Response 20

3.1 Getting started with the system 20

3.2 Ease of Use 21

3.3 Participant Perception of MRD Accuracy 21

3.4 Practical Issues 22

3.5 Policies 22

3.6 Overall 24

4 Conclusions 25

Appendix – Detailed Evaluation Results 29

Evaluation category 1: Policy and public acceptance 29

Evaluation category 2: Technology 34

Evaluation Category 3: Operations 42

Evaluation Category 4: Costs 48

List of Figures

Figure 1: Mileage Reporting Device for Basic (left) and Advanced (right) Road Usage Charge Plan 9
Figure 2: RUCPP Installation Guide 12
Figure 3: Typical Installation of Mileage Reporting Device 13
Figure 4: Typical Road Usage Charge Statement 14

List of Tables

Table 1: Road usage charge plans available in the RUCPP 11
Table 2: Overview of RUCPP Evaluation Strategy 15
Table 3: Summary of Evaluation Results 18
Table 4: Average time and ease of completing various RUC system setup tasks for participants 20
Table 5: Costs of RUC and Fuels tax under 10,000 vehicle and 3 million vehicle scenarios 51

Definitions and Abbreviations

In this document, the following definitions and abbreviations are employed.

Term / Abbreviation	Definition/Description	Remarks
COTS	commercial-off-the-shelf	
CSP	Certified Service Provider	
EV	Refers to Electric Vehicles	While EV and PHEV have some important distinctions, these two classes of vehicles are often bundled together, particularly within the latest Road Usage Charge legislation.
GPS	Global Positioning System	
ICD	interface control document	
JSON	JavaScript Object Notation	JSON is a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate. It is based on a subset of the JavaScript Programming Language, Standard ECMA-262 3rd Edition - December 1999.
MRD	Mileage reporting device	
OBE/U	On Board Equipment/Unit	
OIPP	Oregon Innovative Partnerships Program	Program administered by ODOT's Office of Innovative Partnerships and Alternative Funding
PCI compliant	Payment Card Industry compliant	
PHEV	Plug-in Hybrid Electric Vehicles	
RFI	Request for expressions of interest	Alternately RFEI (RFI is used in Oregon)
RFP	Request for proposal	
RP	Responsible Party	See RUC payer
RUC	Road Usage Charge is the name of the ODOT program to collect a tax on the miles traveled by a vehicle.	
RUCA	Road Usage Charge Accounting	Also referred to the "Taxing Authority"
RUC payer	RUC payer refers to any individual subject to and responsible for paying the Road Usage Charge, including the registered owner of a motor vehicle that is registered in Oregon, and any person who leases a motor vehicle that is registered in Oregon.	
RUCPP	Road Usage Charge pilot program	
SOAP message	Simple Object Access Protocol message	SOAP is an XML-based messaging protocol. It defines a set of rules for structuring messages that can be used for simple one-way messaging but is particularly useful for performing RPC-style (Remote Procedure Call) request-response dialogues.
TP	Transaction processor	
VIN	Vehicle Identification Number	

1 Introduction

This report provides a summary of evaluation results of Washington's participation in the Road Usage Charge Pilot Program (RUCPP). The RUCPP was a trial of various approaches and technologies for motorists in the States of Washington, Oregon, and Nevada to measure and report mileage as the basis for a per-mile road usage charge (RUC). Beginning in November 2012, selected participants signed agreements, selected plans, and adopted in-vehicle devices to measure their road usage for the succeeding months. Washington participants received monthly invoices indicating their road usage and associated charges, less taxes paid on fuel as estimated by the system; however, they did not actually make any payments. The pilot formally completed on January 31, 2013. This report represents the findings of the pilot test by the evaluation team under the direction of the Washington State Department of Transportation (WSDOT).

1.1 Road Usage Charging Program Background in Washington

A series of efforts over the past decade have aimed to address the challenge of sustainable transportation funding and other closely related transportation issues in Washington State.

- *Traffic Choices* pilot program, by Puget Sound Regional Council (PSRC) in 2005-2006. In this pilot program, PSRC studied the driving behavior and public acceptability of using GPS-enabled on-board devices to measure distance travelled by zones, with differential pricing by location and time of day. The program involved 275 vehicles and was hailed nationally as an example of both an innovative transportation funding source and a demand management tool for the future.
- *Long-Term Transportation Financing Study,* by the Legislature's Joint Transportation Committee (JTC) in 2007. Replacing the motor fuel tax with a per-mile road usage charge was among the long-term recommendations for the State.
- *Implementing Alternative Transportation Funding Methods*, also by the JTC in 2009, updated the long-term revenue shortfall and explored a variety of revenue options.
- *Connecting Washington*, a select panel of business and government officials convened by Governor Gregoire in 2011 was charged to develop a 10-year transportation funding strategy. One recommendation was to begin planning now for a transition to more sustainable funding sources for transportation. In support of this recommendation, the final report states "The Task Force recognizes that Federal action would be desirable before the state implements a revenue system based upon vehicle miles traveled. However, we believe Washington should begin to test alternative methods to implement such a system and prepare for the transition to an alternative of that kind."

- Most recently, in 2012, the legislature directed the Washington State Transportation Commission (WSTC) and WSDOT to convene a Steering Committee to explore road usage charging and make a determination as to the feasibility of such a policy in Washington. In December 2012, the Steering Committee unanimously concluded that road usage charging is feasible. The legislature is currently working with WSTC and WSDOT to determine next steps in formulating and analyzing road usage charging policy alternatives and operational concepts working through the Steering Committee.

The RUCPP originated in Oregon as part of that state's evaluation of alternative road usage charging policy and technology approaches. Washington and Nevada joined the pilot and contributed to its planning and development in summer 2012. The initiation of pilot testing coincided with the formation and early activities of the road usage charge Steering Committee, several of whose members participated in the RUCPP.

1.2 Washington Participation in the RUCPP

Washington State's participation in the RUCPP had the following objectives:

- Demonstrate cooperation among multiple states in the execution of pilot test of road usage charging policies.
- Address policy questions about road usage charge.
- Generate feedback from pilot participants, including policy makers, and communicate pilot outcomes to the public.
- Learn about technology issues and challenges related to road usage charging.

To achieve these objectives, WSDOT coordinated the participation of 21 participants in the RUCPP. Washington participants were allowed to choose their method of reporting mileage for purposes of the road usage charge from the following two alternatives:

- Sanef Basic plan. This plan featured an on-board device with no location capability that counts and reports all miles travelled for purposes of billing.
- Sanef Advanced plan. This plan featured an on-board device with location capability that counted and reported miles travelled on public roads in Washington for purposes of billing. Miles travelled outside of Washington and off public roads in Washington (on private roads or private property) were not billable.

Both plans were supported by the account management vendor, the firm Sanef.

All 21 Washington participants began the pilot on December 1, 2012 and concluded on January 31, 2013, allowing for two months of data collection and billing.

The Washington portion of the RUCPP did not include actual payment of road usage charges--no participants were asked to pay their road usage charge bills, but all received indicative invoices to illustrate how the system would work in practice.

At the conclusion of the pilot test, the evaluation team gathered and analyzed extensive data, including hard data and interview results collected from the operators of the test, including the hardware provider (IMS), account manager (Sanef), pilot coordinator (Oregon DOT), and help desk operator (CH2M Hill). In addition, the evaluation team collected results from three web-based surveys of participants (pre-, mid-, and post-pilot). The results of this data collection and analysis are included as part of this report which marks the conclusion of Washington's RUCPP participation.

1.3 Background, Implementation, and Execution of RUCPP

This section provides background of the operational concepts tested, implementation, and execution of the RUCPP.

RUCPP operational concept

The core of the operational concept for Washington state participants comprised two road usage charge plans: basic and advanced.

Figure 1: Mileage Reporting Device for Basic (left) and Advanced (right) Road Usage Charge Plan

The Basic Road Usage Charge Plan employed a mileage reporting device that does not measure vehicle location, but uses only information from the vehicle electronics to measure and wirelessly report distance traveled and fuel consumed. Fuel tax rebates or credits are computed based on all fuel consumed. Basic Road Usage Charge reporting does not support refunds for out-of-state or off-road travel.[1] A mileage Reporting Device for this plan is pictured in Figure 1 on the left.

The Advanced Road Usage Charge Plan employs a mileage reporting device that measures vehicle location so it can report miles traveled by zone or region. In the pilot, the state of Washington constituted one zone, and all other jurisdictions, including Washington, Nevada, and Canada, are other zones. The advanced plan supports refunds or credits for miles driven outside of Washington from the state's road usage charge. Fuel tax rebates or credits are computed based on fuel consumed on public

[1] Basic devices include some pay-as-you-drive insurance devices such as those provided by IMS (Intellimec).

roads in the state of Washington.[2] A mileage reporting device for this plan is pictured in Figure 1 on the right.

An additional mileage reporting device, called a Smartphone mileage reporting device, was used by some Oregon participants in the RUCPP. At a few points in the evaluation, results of Oregon use of this hardware will be mentioned.

In general, data flows from the mileage reporting device to an account management system (provided by Sanef in the pilot), and excerpts of that data are forwarded to the mileage tax accounting division for audit and reconciliation purposes (provided by ODOT in the pilot). The full details of these architectures are explained in the *ODOT Operational Oregon Vehicle Road Usage Charge System and Road Usage Charge Pilot Program Updated Concept of Operations* Version 1.1 March 15, 2012.

Implementation of the RUCPP

Pilot implementation maximized participation of private industry. Vendors bid through an RFI/RFP process run by ODOT to fill the roles of mileage reporting device vendor and account management system vendor. Awardees were Battelle, Brisa, GMV, Accenture, Raytheon, Sanef (teamed with IMS), and IBI. French toll systems integrator Sanef (teamed with Canadian pay-as-you-drive insurance hardware and data analytics provider IMS) provided the pilot hardware and systems used by Washington participants. Sanef provided three components of the system: the basic mileage reporting device, advanced aftermarket telematics mileage reporting device, and the account management system.

Sanef spent several months implementing the Interface Control Documents (ICD), including the "mileage message" which specifies how mileage data was to be transmitted to the account management system. After this development, Sanef's products and services were subjected to intense testing. First, the products went through bench testing to verify that they products worked correctly on their own. Next, the products went through integration testing to verify that the product interfaces including the mileage message were implemented correctly. Finally, the products went through system testing to verify that they worked correctly as a system.

During testing, a help desk was set up to support participants during their involvement in the pilot. ODOT set up two websites and Sanef set up one website as described below:

- http://www.oregon.gov/ODOT/HWY/RUFPP/Pages/rucppvolunteers.aspx: This is the road usage charge pilot program website for the participants.
- http://roadchargeoregon.org: This is the dedicated pilot website and is also for the public who are interested in the trial.

[2] Fuel tax credits were only provided for chargeable miles—miles driven on public roads in Washington. Non-chargeable miles include out-of-state miles and off public road. To ensure that fuel tax credits were only provided for travel on public roads, the fuel tax credit was computed by multiplying the ratio of chargeable miles (chargeable miles divided by total miles) times the estimated amount of fuel consumed times the fuel tax.

- https://www.sanef-oregon.com: This is where participants go to choose their plan and set-up and manage their accounts.

Execution of the RUCPP

WSDOT recruited a select group of volunteer participants to participate in the RUCPP. State and local elected officials, WSDOT management, WSTC members, Road Usage Charge Steering Committee members, Department of Licensing management, legislative staff, and others were invited. Requirements included having a vehicle equipped with an adequate on board diagnostic port (OBDII port), generally from model year 2004 or newer, and a willingness to participate in the pilot.

RUCPP participants were introduced to the pilot activities through an onboarding process, including regular communications about timelines, informational sheet explaining the pilot operations, and access to a help desk throughout the onboarding process.

Mileage Reporting Plan Selection. Once signed on, the RUCPP Participants chose their preferred road usage charge plan and set up their accounts. The following table explains the essential elements of the two plans available for the pilot.

Table 1: Road usage charge plans available in the RUCPP

RUCPP Plan	Miles Reported	Invoice	Online account management	Uses GPS?
Sanef Basic Plan	All	Emailed Monthly	Yes	No, does not report where miles are driven
Sanef Advanced Plan	Public roads in Washington only	Emailed Monthly	Yes	Yes

Installations. Participants received a mileage reporting device in the mail along with instructions on how to install it in their vehicles. These instructions appear in Figure 2 below. A photo of a mileage reporting device being installed appears in Figure 3 below.
Figure 2: RUCPP Installation Guide

Figure 2: RUCPP Installation Guide

ODOT Road Usage Charge Pilot Program (RUCPP)

Mileage Reporting Device - Installation Guide

Before You Begin:

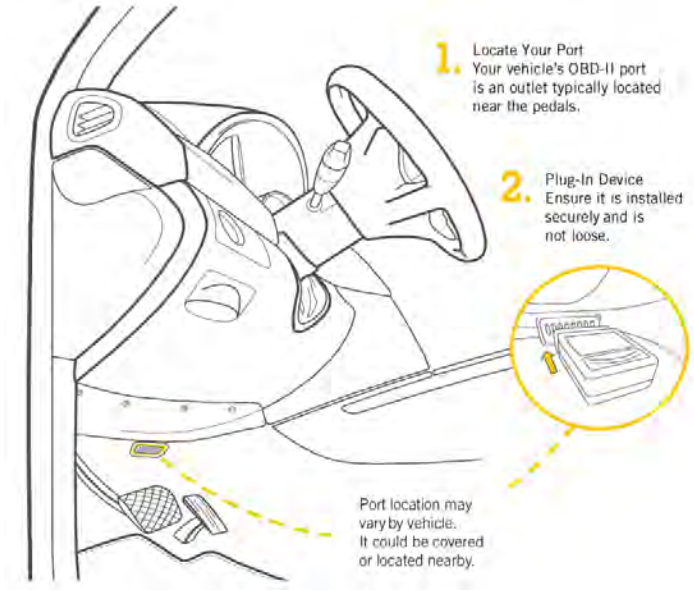
The Device needs to be installed in the same vehicle that was registered during account set up.	For a better connection, perform installation outdoors or in a well – lit place.	For your safety, ensure that your vehicle ignition is OFF during installation.

saner

If you have any queries, contact the RUCPP Help Desk at 855-797-1266

IMS

HOW TO INSTALL THE MILEAGE REPORTING DEVICE



Once installed, it is important you wait 1-2 minutes before starting your vehicle to allow the Device to configure.

Your mileage data will be automatically recorded and sent for processing.

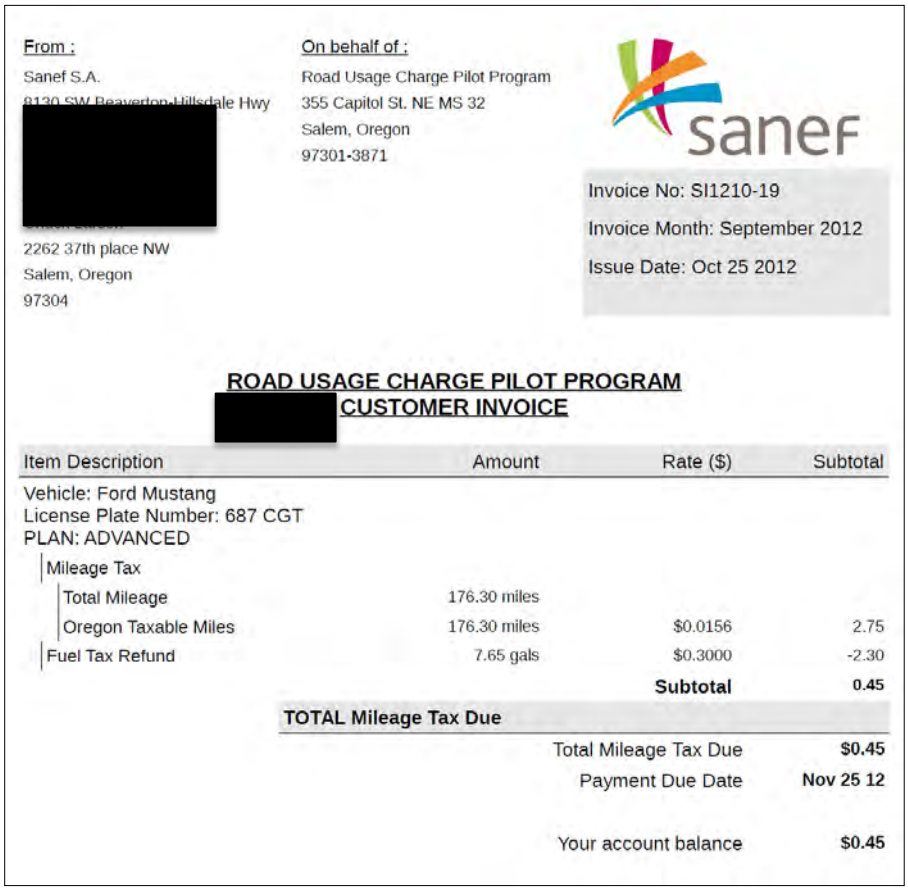
It is important to ensure that the Mileage Reporting Device does not interfere with your ability to safely enter, exit, or operate the vehicle. If so, contact the Help Desk.

If your OBU becomes disconnected for any reason, simply repeat these steps.

Figure 3: Typical Installation of Mileage Reporting Device

Invoicing. After the pilot participants installed their mileage reporting devices, they received a monthly statement indicating number of miles driven, road usage charges owed and fuel tax credit earned. A typical statement is presented in Figure 4.

Figure 4: Typical Road Usage Charge Statement



From :
Sanef S.A.
8130 SW Beaverton-Hillsdale Hwy
[redacted]
2262 37th place NW
Salem, Oregon
97304

On behalf of :
Road Usage Charge Pilot Program
355 Capitol St. NE MS 32
Salem, Oregon
97301-3871

sanef

Invoice No: SI1210-19
Invoice Month: September 2012
Issue Date: Oct 25 2012

ROAD USAGE CHARGE PILOT PROGRAM
[redacted] CUSTOMER INVOICE

Item Description	Amount	Rate ($)	Subtotal
Vehicle: Ford Mustang License Plate Number: 687 CGT PLAN: ADVANCED			
Mileage Tax			
Total Mileage	176.30 miles		
Oregon Taxable Miles	176.30 miles	$0.0156	2.75
Fuel Tax Refund	7.65 gals	$0.3000	-2.30
		Subtotal	**0.45**
TOTAL Mileage Tax Due			
		Total Mileage Tax Due	**$0.45**
		Payment Due Date	**Nov 25 12**
		Your account balance	**$0.45**

1.4 Purpose and organization of this report

This report provides a summary of evaluation results of the RUCPP as it related to Washington's participation.

This document presents the evaluation of the RUCPP on a range of criteria, which fall into four main categories: policy and public acceptance, technology, operations, and costs. Each of these categories includes several distinct metrics. Inputs used to measure the metrics are a combination of quantitative data collected from the mileage reporting devices and users as well as qualitative surveys of key stakeholders involved, such as participants and vendors.

The remainder of this report is organized as follows:

- Chapter 2 presents the evaluation methodology, results, and narrative of results.
- Chapter 3 provides a range of conclusions based on the evaluation results.
- The Appendix includes more detailed evaluation results for those interested.

2 Evaluating the Pilot Program

This chapter summarizes the evaluation methodology and the results of the evaluation.

2.1 Evaluation Methodology

Evaluation involves measurement of RUCPP performance relative to a set of pre-determined goals and metrics. In developing a methodology, the evaluation team was guided by four key categories of evaluation criteria: policy and public acceptance, technology, operations, and costs. For each category, the team articulated a corresponding goal and multiple metrics. Table 2 summarizes the four key evaluation criteria categories, goals, and detailed metrics.

Table 2: Overview of RUCPP Evaluation Strategy

Evaluation Criteria Category	Goal	Metrics[3]
1. Policy and public acceptance	**Determine the level of public acceptance of the RUC program**	a. Similar revenue contribution by RUC payers under RUC as under the motor fuel tax
		b. Acceptance by RUC payers and other system users concerning: • Costs to RUC payers • Ease and convenience to RUC payers • Privacy protection • Fairness • Aversion/attraction • Choice
2. Technology	**Demonstrate and measure the technical and operational viability of the proposed RUC concept through demonstrations**	a. Adaptability of the RUC system
		b. Ease of installation of mileage reporting devices
		c. Safety of mileage reporting devices, mileage reporting device installation, and system operations for motorists.
		d. Anti-tampering
		e. System performance

[3] In this evaluation, a **metric** is defined as the value to be measured to determine how well each program goal is fulfilled. For example, "Ease of Mileage Reporting Device Installation" is a metric that measures how easy it is to install the mileage reporting device, a key part of the first system goal—that the system is easy to use. The specific numerical value held by a metric is called an **indicator.** The indicator for the "Ease of Mileage Reporting Device installation" is the average (mean) of the responses to the following survey question: What was the level of difficulty to install the mileage reporting device? Response options: 1. Very high, 2. High, 3. About right, 4. Low, and 5. Very low

Evaluation Criteria Category	Goal	Metrics[3]
		f. Hardware, software and other system elements including • Feasibility • Accuracy • Reliability • Security/encryption • Open system • Energy consumption • Account management system experience
3. Operations	**Gain a preliminary understanding of the operational aspects of the RUC program**	a. Ease and cost efficiency of administering the RUC
		b. Ease of use and cost of compliance with the RUC system by RUC payers and other system users, including evasion potential
		c. Accuracy and perception of accuracy of data transmitted to the central database and used for assessing mileage taxes
		d. Privacy options for RUC payers in protecting personal, private data
		e. Ability to audit
		f. Usefulness for phasing and partial implementation
4. Costs	**Gain a preliminary understanding of the costs associated with implementing the RUC program**	a. Start-up costs (capital and retrofitting)
		b. Operations and maintenance

The team identified the following six key RUCPP stakeholder groups. Evaluation activities comprised surveys of and data collection from each of these groups:

1. **Participants or RUC payers**. Individuals who were responsible for paying the road usage charge, typically vehicle owners or lessors. For the purpose of the pilot, participants are defined as those individuals who signed up for the pilot, chose a mileage reporting plan, installed the mileage reporting device if applicable, and drove chargeable miles on the Washington roadway network.
2. **Mileage reporting device vendors**. Representatives of the companies who supplied the mileage reporting devices.
3. **Account management system vendors.** Representatives of the company who provided the private account management systems.
4. **Pilot participant coordinators.** Representatives from Oregon DOT who coordinated activities of the pilot participants.
5. **Road Usage Charge Accounting System Operator**. The contractor who operated the Road Usage Charge accounting system.
6. **System Integrators**. The contractors who integrated, tested, and provided ongoing support for all elements of the RUCPP.

One of the first steps in the evaluation was distribution of initial surveys to vendors and participants in order to determine their perspectives and opinions prior to initiation of RUCPP, as a baseline. Vendors were surveyed during the stakeholder information sessions before the start of the RUCPP, as described above, and were surveyed again at the end of the RUCPP. No midpoint survey was held. Participants were surveyed three times:

1. A pre-screening survey to determine RUC payers' opinions, thoughts, and behaviors at the outset of the program.
2. A mid-point survey to determine RUC payers' opinions, thoughts, and behaviors during the program following receipt of the first invoice.
3. A third and final survey was distributed at the conclusion of the pilot to determine RUC payers' opinions, thoughts, and behaviors after the program finished.

During and after the data and survey collection, the evaluation team compiled responses, analyzed indicators, and prepared this report.

In addition to the largely qualitative feedback from surveys, the evaluation team collected raw data from a range of pilot stakeholders at various points throughout the. The evaluation team asked each of the stakeholder groups to provide the data in the original formatting in which it was recorded (whatever spreadsheet or other formatting had been used to record the data). For illustrative purposes, below is a partial list of data collected:

- Number of mileage reporting devices that are reported broken, missing, etc.
- Whether any mileage reporting device, data collection, transactions processing, account management system options available to participants before RUCPP failed, and why.
- Compilation of Road Usage Charge Accounting reports.
- The capital and retrofitting costs that ODOT incurred starting up the Road Usage Charge pilot system.
- The operations and maintenance costs that ODOT incurred starting up the Road Usage Charge pilot system.
- The marginal costs of operating Road Usage Charge system in multiple states.
- Miles travelled (by zone) and taxes owed and paid for each RUCPP participant (may be provided as part of road usage charge accounting records)
- Customer service logs and issue logs (may be included in Help Desk Logs).
- Logs of road usage charging transactions.
- Error logs from mileage reporting devices.

2.2 Summary of results

The following table provides a snapshot summary of the evaluation results for the metrics within each evaluation category.

Table 3: Summary of Evaluation Results

Evaluation Category	Metric	Performance
Policy and public acceptance	Metric 1: Similar revenue contribution by RUC payers under RUC as under the gas tax	In aggregate, RUCPP participants had an average of 24.3 MPG and, had they would have contributed more in RUC than they paid in fuel tax.
	Metric 2: Acceptance by RUC payers and other system users concerning several criteria	Impacts to RUC payers: average of $0 cost and 44 minutes per participant. Ease and convenience to RUC payers: all participants responding to the survey lauded the ease of use of the RUCPP. Privacy protection: privacy was protected and adequately explained through user choice of GPS vs. non-GPS mileage reporting devices. Fairness: almost all participants agree that RUC is at least as fair as a gas tax. Aversion/attraction: overall, participants found the RUC methods acceptable. Choice: providing user choices alleviated many of the concerns about RUC beyond privacy.
Technology	Metric 1: Adaptability of the RUC system	The system demonstrates a high degree of adaptability including scalability and the ability to accept payments from many sources.
	Metric 2: Ease of installation of mileage reporting devices	All but two participants installed the devices themselves in a matter of minutes.
	Metric 3: Safety of mileage reporting devices, mileage reporting device installation, and system operations for motorists	There have been no reported incidents of mileage reporting devices compromising the safety of any aspect of the system, from driving to bill paying.
	Metric 4: Anti-tampering	Vendors have expressed confidence in device anti-tampering features and algorithms in their products.
	Metric 5: System Performance	Overall system performance has been high—it has exceeded expectations in terms of accuracy, efficiency, and ease of use.
	Metric 6: Hardware, software and other system elements	Feasibility: Yes. Accuracy: Yes. Reliability: Yes. Security/encryption: Yes. Open system: Yes. Energy consumption: Yes. Account management system experience: Yes.
Operations	Metric 1: Ease and cost efficiency of administering the MT	The system was easy to administer (required no unusual operations or training) and very cost-effective (required few person-hours once it was up and running).
	Metric 2: Ease of use and cost of compliance with the MT system by RPs and other system users, including evasion potential	Both the system vendors and the integrators believed it would be easy and free for participants to use the system, and participants confirmed this view with statements on their surveys.

Evaluation Category	Metric	Performance
	Metric 3: Accuracy and perception of accuracy of data transmitted to the central database and used for assessing mileage taxes	Distance measurement accuracy was measured to be 2-3%. Participants perceived the system to be very accurate—not to over-count or to miss miles.
	Metric 4: Privacy options for RPs in protecting personal, private data.	Vendors and participants felt that the system provided many privacy options and protected user privacy well.
	Metric 5: Ability to audit	The accountant who executed mileage tax accounting concluded that the system was simple and straightforward to audit using a new set of auditing tools.
Costs	Metric 1: Start-up costs (capital and retrofitting)	Startup costs for a CSP are estimated to be $200,000 if they have suitable account management software or $500,000 if they do not have suitable account management software.
	Metric 2: Operations and maintenance	O&M costs for a CSP are estimated to be about $18,000/month.

2.3 Explanation of results

Policy and public acceptance: The main policy result is that the system has a strong revenue potential and is sustainable relative to gas tax. The main public acceptance result is that the system tested in the RUCPP had a high acceptability among stakeholders including users, vendors, and DOT managers, particularly due to its "ease of use" and "simplicity."

Technology: The RUCPP successfully demonstrated multiple technology options and achieved high user satisfaction in an open system framework. The system was shown to be adaptable. The mileage reporting device technologies were shown to be easy to install. Mileage reporting devices were shown to be completely safe. The system was shown to perform with a high degree of accuracy. And it was shown to have pass a wide range of hardware and software criteria.

Operations: The RUCPP showed that RUC system supports smooth and effective operations. The system was easy and cost-effective to operate. Interfacing with the system was easy and cost effective for participants. The system was operationally accurate, and it was perceived to be accurate by participants. It provided effective privacy options for participants. Finally, the system operations supported easy and effective auditing.

Costs: The RUC system required relatively limited cost impacts. Startup costs for a CSP were estimated to be $200,000 if they have suitable account management software or $500,000 if they do not have suitable account management software. O&M costs for a CSP are estimated to be about $18,000/month at low vehicle volumes.

3 Motorist Response

This section presents the overall attitudes of the participants to the system as expressed on the surveys. For the most part, the conclusions reached in this section do not trace directly to the metrics described above in chapter 2. However, the analysis in this section includes data from the surveys not covered in the metrics.

In creating this section, the evaluation team attempted to summarize the overall views expressed by participants in the surveys. The team grouped these views into the following six subsections:

1. Getting started with the system
2. Ease of use
3. Participant perception of MRD accuracy
4. Practical issues
5. Policies
6. Overall system

RUCPP participants were not chosen specifically to be representative of the general Washington public, but the conclusions reached from the surveys are still highly relevant to future RUC program decisions. None of the participants had prior experience with the technology being tested for road usage charging, as the RUCPP represented a world-first technology trial. The participants were asked to provide objective feedback based on their experience, and their survey responses represent the first impressions of the live RUC system. For these reasons, the indications that can be taken from the data remain relevant to future RUC program decisions.

3.1 Getting started with the system

In general, participants found getting started with the RUC system to be a straightforward and quick process. Each of the four setup tasks had average time to complete under 10 minutes, and most participants found these tasks easy or very easy. The average total setup time per participant was less than 21.6 minutes as summarized in the table below.

Table 4: Average time and ease of completing various RUC system setup tasks for participants

Task	Average Time (min.)	Percent of participants who found task easy or very easy
Signing Participant Agreement	6.1	100%
Selecting Account Type and Features	3.1	n/a
Setting up account	4.9	93%
Installing Mileage Reporting Device	7.5	73%
Total	21.6	n/a

One free response comment by a Washington state survey respondent indicated that the various account choices were "somewhat confusing." Although participants appreciated having a choice, it is important to present the choices clearly, succinctly, and accurately to avoid confusion.

3.2 Ease of Use

A large number of free response comments by participants indicated that the system was simple and easy to use.

The hardest part was locating the OBDII port

A few comments both by Washington as well as Oregon participants indicate that the hardest part may have been locating the OBDII port on or under the vehicle dashboard. For some individuals, the port was difficult to find, due in part to obscure placement on some vehicle models. The Help Desk had access to a directory of the OBDII port locations for all vehicles manufactured in the last 20 years. When participants could not locate their OBDII ports, they could call the Help Desk to receive guidance. Since the location of OBDII ports is proprietary to the automakers, it cannot be published. Making information available through the Help Desk is probably the best interim solution. While locating the OBDII port may be difficult for owners of a small percentage of vehicle models, the solution used in the RUCPP makes it relatively simple for these individuals to install the MRD.

User Account Web Portal

The user account web portal was a key feature for many participants—all but one of 12 pre-RUCPP survey respondents said it was "important" or "very important." All mid-RUCPP participants found the user account web portal system easy or very easy to use.

Desire for feedback on MRD operation

Several respondents expressed a desire to know whether their MRDs were working correctly. This information was displayed via status lights on the MRDs, and participants were provided a sheet describing how the status lights worked. Still, some users felt the lights were confusing, and they couldn't be certain that their MRDs were properly installed. Users should be provided a straightforward way of knowing whether their MRD is properly installed. A simple status light is one solution. Another solution is to provide users feedback (e.g., email or text message) when the OBU is connected to a vehicle.

3.3 Participant Perception of MRD Accuracy

Some respondents stated in free response comments they could not determine accuracy of the MRDs. This corresponds to the high response rate of "Don't know" to the questions about whether the MRD was correctly computing off-road or out-of-state miles (of Advanced MRD holders, about half said that they didn't know). It would be desirable to provide some way for RUC payers to feel more confident of the accuracy of their devices.

One respondent stated a desire for feedback on device charges. Feedback can be provided by reading the measurement on the user account website, and it may be desirable to make this available by Smartphone App as well. It should also be explained to users that a direct comparison with the odometer is impossible (i.e., MRD readings may deviate), at least in cases where GPS may be used for distance measurement or to provide a correction to the odometer speed signal used to determine distance traveled.

3.4 Practical Issues

The help desk solved most practical issues that arose for participants during the RUCPP, and many respondents commented on the good support provided by the help desk.

There was only one issue impacting Washington State participants that could not be solved by the Help Desk: MRDs occasionally fell out of vehicles. This happened twice in Washington and once in Oregon. In the Oregon case, the MRD was stepped on and destroyed.

In the future, requirements could be strengthened to make OBUs more firmly connected to vehicles and/or more resistant to kicking.

3.5 Policies

Equity

Survey respondents generally perceived the road usage charge as fair and in fact being more equitable than gas tax. In the pre-RUCPP survey, in response to the question, "Compared to the gas tax, a mileage-based tax is:" there were 8 responses of "A lot more fair", 3 of "Somewhat more fair," and 1 "About the same". In response to the question, "What is your favorite part of the RUCPP system?" 7 of the 12 respondents identified some aspect of equity or fairness of the system. In response to the questions about the fairness of charging the RUC to a variety of classes of vehicles (electric, hybrid, gasoline, all) almost all responses were Fair or Very Fair.

The rate of 1.87 cents was largely acceptable. 3 respondents felt it was "Somewhat low", while 8 thought it "About Right," and 1 "Somewhat high".

These opinions from the pre-RUCPP survey were confirmed in the post-RUCPP survey, which had 15 respondents:

- In response to the question “How fair does the Road Usage Charge seem to you, in principle?” There was three “Neutral”, and the remainder were “Fair” or “Very Fair”.
- In response to the question: “Do you think the Road Usage Charge was fair for you personally?” all 15 respondents said yes.
- In response to the question “How does the Road Usage Charge compare to the fuel tax?” there were 4 “Much more fair than the Fuel Tax,” 6 “More fair than the Fuel tax,” 1 “Neutral,” and 1 “Less Fair than the Fuel Tax.”

One person did express a concern about fairness in a free response question. This respondent stated: “It is not clear to me how "fair" the mileage tax is compared with larger, heavier vehicles that create more wear and tear on the roads. Also, how does the state deal with folks traveling through Oregon? Will the gas tax remain in effect statewide to capture that revenue?”

The fact that heavy vehicles in Oregon already pay a RUC should be explained to RUC payers. The fact that road usage between a small EV such as a Leaf and a large SUV is nearly the same from a cost perspective should also be explained, although this is a subtle point and will be challenging to communicate in a way that the general public can accept.

Based on participant feedback, ODOT will need to consider making the RUC applicable to out-of-state residents in the long-term. In the short term, ODOT will need to consider how to respond to equity concerns raised by Oregonians who think that the RUC should apply to out-of-state vehicles.

Driver Feedback

One respondent asked for more feedback (total miles traveled and charges for a given month) from the system in a free response question. Future communications should emphasize to drivers that feedback is provided over Internet user accounts. In a revenue-generating system, CSPs should provide feedback via Smartphone and telematics app.

Future communications should also spend more time communicating the relationship of the miles charged to the odometer:

- One respondent specifically asked that all invoices contain beginning and ending mileage, instead of just ending mileage.
- Another typical comment was that the participant “didn't see an [odometer] reading on the invoices, so [it is] inconvenient to verify mileage driven during prior period.”

CSPs should be allowed to providing hypothetical odometer readings with customers as an option—the customer would have to opt into the system by sharing their odometer reading.

Understanding of Road Finance Policies

Knowledge of fuel tax and road finance was improved during the RUCPP, and ODOT should pay attention to this lesson on the importance of outreach on policy when the full system is implemented. In response to the question "How did the Road Usage Charge impact your understanding of the cost of road use?" 10 participants said it improved their understanding, while 5 said it had no impact. In response to the question "How valuable is it to you to know how much my highway taxes are," 5 participants responded with "It is highly valuable to me to know how much my highway taxes are" and 10 said "It is somewhat valuable to me to know how much my highway taxes are". No respondent said "It is not important to me to know how much my highway taxes are." When the full system is implemented, a clear explanation of the amounts and uses of fuel/highway tax should form a significant part of the outreach.

3.6 Overall

The overall attitude of the participants towards RUC improved, or in a few cases, was simply neutral. In response to the question "How has your overall attitude toward road user charges—specifically the mileage tax you are using as part of this pilot program—changed since before the pilot started?"

- 4 "Much More Positive"
- 7 "More Positive"
- 3 "No Change"

In response to the question "Based on your pilot program experience, do you see road user charges as a viable way to pay for road usage?"

- 7 "Definitely"
- 7 "Probably"
- 1 "Neutral"

4 Conclusions

Based on the analysis of pilot data, survey data, and interviews, the evaluation team offers the following conclusions related to Washington state's participation in the RUCPP.

1. **The RUCPP successfully met its objectives to demonstrate an easy-to-use mileage reporting and payment system replete with palatable choices administered in an interoperable fashion.** Based on review of the system implemented by the RUCPP suppliers and operators, participants had a clear choice between two technologies. Albeit similar in many ways, the technology choices included one device with no location detecting capabilities and another with GPS to allow motorists to "opt in" to location-based road usage charging with differentiation of in-state, out-of-state, and off-road miles. Based on participant feedback, the technology and billing system were widely regarded as easy-to-use and user friendly.

2. **Giving participants a choice of road usage charging plans is possible and supported success of the pilot based on participant feedback.** Although the choices tested for Washington participants spanned only two technology options (OBDII dongle with and without GPS), it successfully demonstrated the importance of allowing participant choice, as most participants indicated that choices were an important feature of the system. Sixteen (16) participants chose an advanced mileage reporting device, while 5 chose a basic device.

3. **1.87 cents per mile was generally acceptable as a price point.** The indicative rate for the RUCPP was computed by taking Washington's state gas tax of 37.5 cents per gallon and divided by 20 miles per gallon. This yielded a rate of 1.87 cents per mile, or approximately what a 20 MPG vehicle currently pays in gas taxes. Most of the pilot participants regarded this as an acceptable rate for a road usage charge, although it is important to recognize the caveat that pilot participants were from a carefully selected pool of policy makers and others familiar with transportation funding issues.

4. **Mileage Reporting Devices technology was quick to install and easy to use.** Based on participant feedback, the OBDII dongle technology used in the pilot was generally easy to install and easy to use. Minor issues included difficulty for some users finding the OBDII port, one vehicle from model year 1999 that predated the OBDII standard had an incompatible data port, and several instances of users accidentally dislodging the mileage reporting device. These issues were generally regarded as minor and did not affect the overall view by pilot participants the technology was "quick to install" and "easy to use."

5. **OBDII ports can be used as a data source for dongles, but not all vehicles follow standard OBDII port data specifications**. As mentioned previously, some older vehicles do not conform to the OBDII port data standard and, therefore, do not provide data in a format that is conducive to road usage charging. On the other end of the spectrum, some hybrid and electric vehicles do not conform to OBDII port data standards. Work-around solutions for these vehicles were created for the pilot program but would need to be addressed on a wider scale for any operational system.

6. **The cost of dongles is $50-$100 + $9/month to operate as of 2013; will be less in the future and can be offset by sales of data and 3rd party uses (PAYD).** The cost of dongles has declined precipitously in the past several years due to increasing demand in insurance telematics. Operating costs have declined as well. As penetration of in-vehicle services grows, costs will continue to decline, making use of aftermarket dongles more cost effective for road usage charging. It is doubtful that such technology is appropriate to support road usage charging as a standalone application today due to the relatively high costs associated with usage and relatively low revenues from road usage charging. However, this could change in the future as both costs decline and revenues for private providers increase through the provision of other driver services beyond road usage charging.

7. **The cost of operations is minor after setup of base system (just the cost of a call center, database maintenance). A base system setup can be completed for $200k if built on a pre-existing system.** The back-office system is a modest cost, and it scales favorably as the number of vehicles in a road usage charge system increases.

8. **Multi-state operation of RUC is technically feasible**. The RUCPP demonstrated that multiple states can operate technology and road usage charging collections with distinct policies across a common platform and across state lines. This includes providing distinct choices among road usage charging plans (e.g., Oregon offered 5 plans, while Washington offered 2) and different per-mile rates (e.g., Oregon charged 1.56 cents per mile, while Washington charged 1.87 cents per mile).

9. **A Road Usage Charge Accounting system is feasible.** The data and summary reports generated by the vendors in the RUCPP were submitted to a road usage charge accounting entity operated by ODOT contractors. The accounting entity provided functions consistent with accounting functions of other government transportation revenue systems such as fuel taxes and tolling. There were no issues performing this function with the data available from the road usage charging system tested in the RUCPP.

10. **User opinions of a RUC policy either improved or remained neutral as a result of their participation in RUCPP.** Again, an important caveat is that the participants in the RUCPP were selected based in part on their interest and familiarity with transportation revenue and funding policies in Washington. That said, even for these informed participants, the RUCPP was a "world first" test of OBDII dongles for a road usage charging application. The fact that favorability of road usage charging remained unchanged or improved among participants reflects the successful demonstration of this approach to road usage charging.

11. **Some dongles will fall out of the vehicle, and some may even be accidentally damaged or destroyed.** No tax system is perfect. One imperfection of the RUCPP was the reliance on users to install and maintain in-vehicle dongles. A real system, as in the pilot, will involve many instances of dongles becoming disconnected from the vehicle for a variety of reasons. Also, as occurred in the pilot, some of these dongles will even be damaged or destroyed. Future technologies for road usage charging, whether dongles, smartphones, telematics, or something else entirely, will face similar issues. The design of any system must include contingencies for managing these scenarios. In the RUCPP, the Help Desk resolved issues of dislodged, damaged, and destroyed dongles.

12. **EPA estimate fuel efficiency is a reasonable solution, but not the most desirable way to compute actual fuel consumption for purposes of providing fuel tax credits. The method of showing and providing fuel tax credits in the RUCPP, if offered in a real system, should be revisited.** Pilot participants received statements showing miles traveled, road usage charges associated with those miles, and the amount of gas tax they had already paid for those miles, based on an estimate of fuel consumption for those miles. There are several methods to estimate fuel consumption: measurement from the vehicle itself using one of several data feeds from the OBDII port or estimates based on EPA ratings or adjusted EPA ratings. The choice of fuel consumption estimation methodology in a real system should be studied carefully, as there are discrepancies among the methods available that could result in inaccurate refunds (including both overcompensation and under-compensation), leading to customer confusion and even complaints.

13. **While RUC policy is broadly viewed by RUCPP participants as either the same as or more fair than the gas tax, *all* participants viewed it as a fair policy for them personally.** All participants who responded to RUCPP surveys indicated that, for them personally, a road usage charge was fair. Interestingly, however, not all respondents felt that road usage charging was as fair for the public at large as it was for them personally. This could reflect beliefs about the amount of road usage charges that should be paid by individuals in certain stakeholder groups, including rural motorists, owners of high fuel efficiency vehicles, and owners of low fuel efficiency vehicles.

14. **While participants generally trusted that RUCPP provided privacy protection and account security and provided similar protections as mobile phones and credit cards, they had no means of verifying this.** Likewise, it is difficult for participants to truly measure the security and privacy protection of their mobile phones and credit cards. All of these systems require an implicit level of trust between the user and the service provider. In the case of road usage charging, initial results from participant surveys indicate a strong level of trust, but at the same time, an inability to verify that trust in a meaningful way.

15. **Despite the simplicity of the RUCPP from a user perspective, some participants worried about high administration and account management costs for government.** The concern over high costs of administration spanned the pre-pilot, mid-pilot, and post-pilot surveys. Although expressed by only a handful of survey respondents, the theme was repeated and not explicitly addressed through the RUCPP in a way that was communicated to the participants.

Appendix – Detailed Evaluation Results

Evaluation category 1: Policy and public acceptance

Policy and public acceptance metric #1: Similar revenue contribution by RUC payers under RUC as under the gas tax

The purpose of this metric is to assess the difference in revenue generated by road usage charges and fuel taxes in order to show whether the road usage charge generates a sustainable amount of revenue. The analysis of the RUCPP shows that the RUC does in fact generate as much or more revenue when compared with the fuel tax, so long as the fleet to which it applies has a fuel economy of at least 20 MPG.

The road usage charge used in the pilot was a per-mile fee of 1.87 cents that, unlike the fuel tax, did not vary based on the fuel efficiency of the vehicle. The amount of road usage charge revenue a group of vehicles generates stays the same, but the amount of gas tax they pay decreases as the efficiency of the group increases.

The table below summarizes the actual distances driven and road usage charges incurred by vehicles during the two full months of Washington's participation in the RUCPP.

Characteristics of RUCPP, December 2012 – January 2013

Number of Washington-registered vehicles	21
Total miles driven	34,676
Total chargeable miles driven	32,795
Total road usage charges incurred (at 1.87 cents per mile)	$613.12
Road usage charge revenue net of fuel tax refunds or offsets	$57.28

As shown in the table above, the 21 participating vehicles incurred $613.12 in road usage charges for December 2012 and January 2013. For the same mileage, the RUCPP recorded that these vehicles consumed 1,482 gallons of fuel. At the Washington tax rate of $0.375 per gallon, these vehicles already contributed about $555.84 in fuel taxes, so road usage charges would have generated an additional $57.28, or about 10 percent, more revenue than the fuel tax. This scenario appears in the second row of the table below. For comparison, we also show scenarios where the vehicles subject to road user charges have an average fuel efficiency of 20, 40, and 55 miles per gallon, as well as a final scenario in which only electric vehicles are subject to road usage charges.

RUC vs. fuel tax revenues for various MPG scenarios at 32,795 miles driven

Scenario[4]	Gallons of fuel consumed	Nominal fuel taxes	RUC Paid	RUC paid minus nominal fuel taxes	RUC vs. fuel tax percent difference
20 MPG	1,635	$613.27	$613.27	$0.00	0%
22 MPG (RUCPP actual)	1482	$555.84	$613.27	$57.28	+10%
40 MPG	820	$307.45	$613.27	$305.82	+100%
55 MPG	596	$223.60	$613.27	$389.67	+174%
All electric vehicles	0	0	$613.27	$613.27	N/A

This chart illustrates that about $57 more revenue would have generated in the pilot under a road usage charge than under a fuel tax. If the average fuel efficiency of the fleet in the RUCPP was higher (40 or 55 MPG), or if the fleet in the RUCPP was all-electric, even more revenue would be generated. Only if the fleet in the RUCPP were to have an average fuel efficiency of 20 MPG or lower would the expected revenue of the RUC be less than that of the fuels tax. These figures are based on the pilot test rate of 1.87 cents per mile.

The table provides a range of scenarios that fulfill this metric regarding the ability of road usage charges to generate revenues relative to the fuel tax in Washington. These figures are derived from actual distances driven in the RUCPP by participating vehicles as well as, in the case of the second scenario, the actual gallons of fuel consumed in the RUCPP.

Policy and public acceptance metric #2: Acceptance by RUC payers and other system users concerning several criteria

The RUCPP shows that the RUC system is very acceptable to participants. Evaluation of the RUCPP entailed two types of road usage charge acceptability measurements: data (objective) and survey (subjective). In this section we present results of both.

First, the table below summarizes objective data collected from users and vendors during first phase of the RUCPP.

[4] All scenarios are based on the 30,746.6 chargeable miles driven during the November 2012 billing cycle of the RUCPP.

RUCPP participation characteristics

Item	Value
Average participant cost in dollars	$0
Average time devoted to the RUCPP per participant, in minutes[5]	50[6]
How many participants started the pilot?	21
How many participants completed the pilot?	21
How many participants have dropped out of the pilot?	0

All Washington participants in the RUCPP who started the pilot completed it. They have devoted an average of about 50 minutes per person to the pilot test, with zero costs.

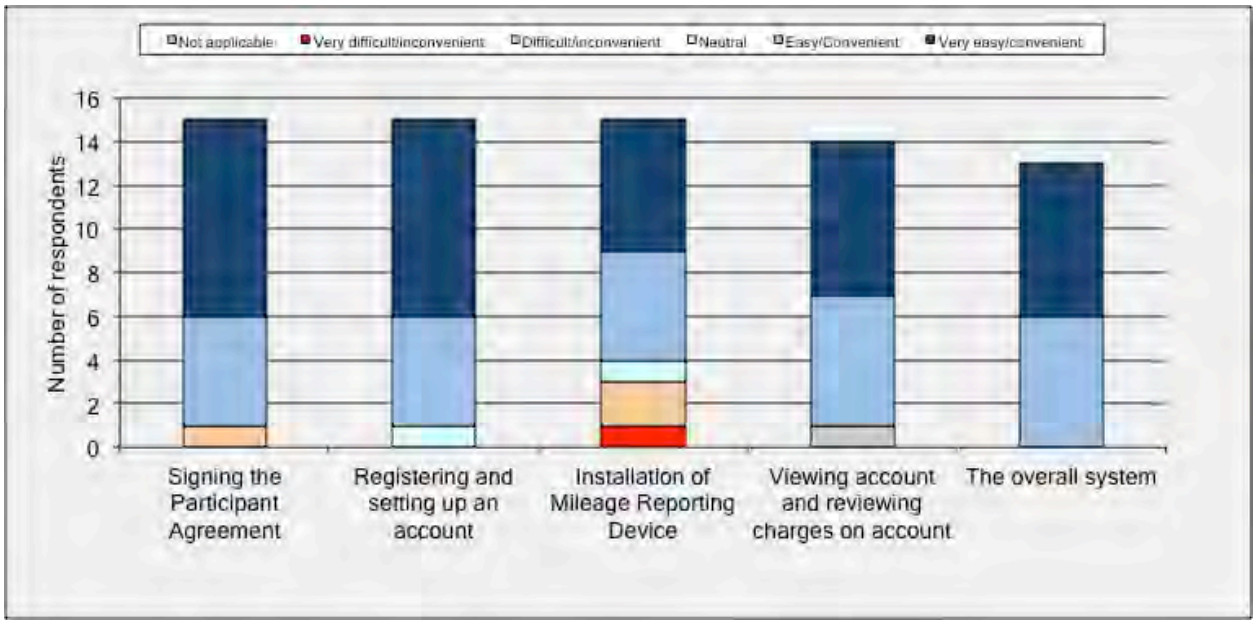
Next, the evaluation process considered responses to survey questions. All participants were asked to complete a survey before the start and at the midpoint of the RUCPP. Approximately 60 percent of those surveyed responded, and the responses form the basis of the metrics presented below.

Ease and convenience. RUCPP participants found the system to be very easy and convenient. The table below summarizes survey responses regarding ease and convenience of a variety of aspects of the RUCPP. In addition to the four categories, the far right column represents ease and convenience of the overall system. For each category, the majority of respondents viewed the RUCPP as "easy/convenient" or "very easy/convenient," as illustrated by the blue shading. There were three respondents who expressed difficulty with the installation of the mileage reporting device due to difficulty finding the data port on their vehicles and, in one case, an incompatible data port. Thirteen out of thirteen respondents rated the overall system as easy/convenient or very easy/convenient. Of the 10 survey respondents who answered the question "what aspects of the mileage tax system did you like best," six cited "ease" or "simplicity" of the system, while four cited fairness and/or transparency of road usage charges over fuel taxes.

[5] Includes time devoted during the two months of the pilot to the following activities: reading and signing the participant agreement; selecting a plan; setting up an account, installing the mileage reporting device; troubleshooting issues with the device; reading and understanding a billing statement; troubleshooting account problems; and completing evaluation surveys.

[6] Based on participant responses to surveys.

Respondents' opinions about the ease of various aspects of the RUCPP

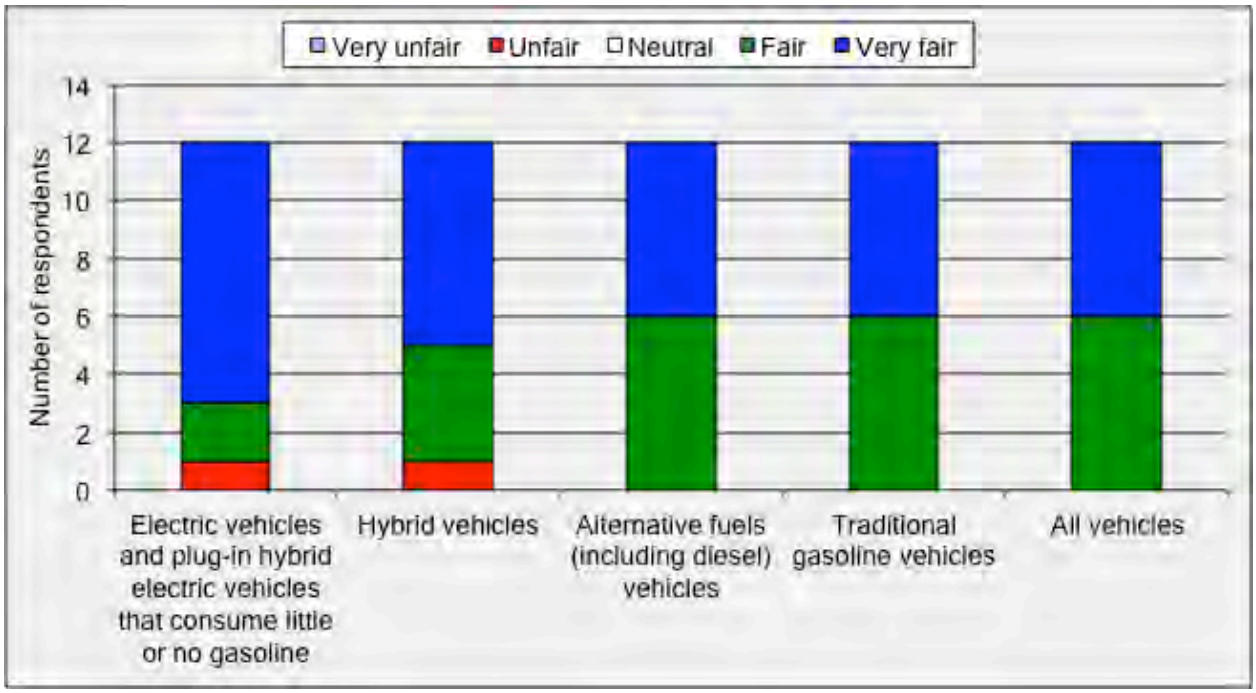


Privacy protection. RUCPP participants found that the system protects their privacy well. A variety of privacy issues were explored through the survey instrument both before and during the RUCPP.

- Interestingly, prior to the RUCPP, a minority of survey respondents indicated that personal location privacy is important: 42 percent rated personal location privacy as important or very important, while 17 percent were neutral and 42 percent rated it not important. On the other hand, 92 percent of respondents felt that account security is important.
- At the midpoint of the RUCPP, 47 percent of respondents believed both their personal location privacy and account security were being protected well or very well, while 53 percent were neutral. This reflects the fact that the majority of Washington RUCPP participants selected and "advanced" mileage reporting device equipped with GPS.

Fairness. RUCPP participants found the system to be fair. However, it must be noted that the participants in the pilot were selected due to their familiarity with transportation funding policy. Fully 83 percent of survey respondents thought the gas tax of 37.5 cents per gallon in Washington was "too little." Moreover, 92 percent of the same respondents found road usage charging to be "a lot more fair" or "somewhat more fair" than gas taxes, while 8 percent were neutral. When considering fairness by vehicle class, the responses vary as shown in the table below. Overall, though, a majority of respondents feel that road usage charges are fair or very fair for all vehicles.

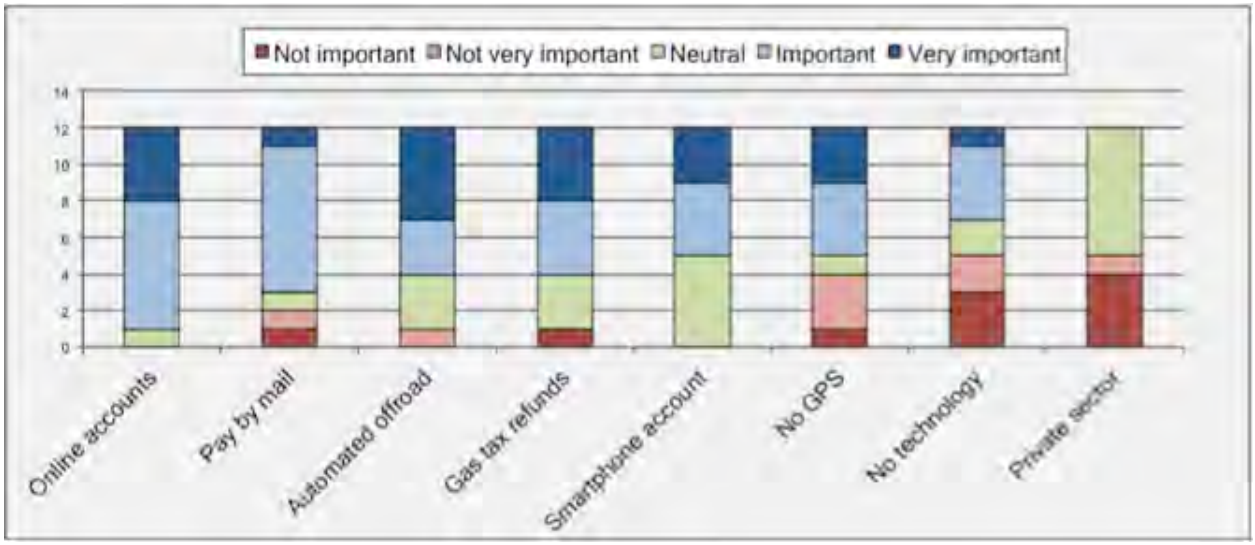
RUCPP survey respondents' views on fairness of RUC for various types of vehicles



At the midpoint, RUCPP participants were again surveyed about fairness. Of the 13 who responded to the question, “Do you believe the amount you paid (for your first RUC bill) was a fair price,” all responded affirmatively.

Choice. One of the principal objectives of the RUCPP is to demonstrate the concept of user choice. RUCPP participants were offered two different choices of mileage collecting and reporting plans in Washington. The level of satisfaction with the RUCPP shows that this has been well received by participants. However, there are many dimensions of choice. The following table summarizes the choices by level of importance to survey respondents.

RUCPP survey respondents' preferences regarding choices



Overall aversion/attraction. Prior to the RUCPP, 10 out of 12 survey respondents had a positive or very positive view of road usage charging, with 2 neutral. Although the concept had a favorable view from the start, 11 out of 15 survey respondents indicated that the pilot improved their overall attraction to road usage charging. The other four said the pilot did not change their views. Of those four respondents, one was neutral at the outset, one had a positive view, and the other two did not respond.

Overall, the survey responses and objective data indicated a high degree of acceptance of the system as demonstrated in the RUCPP. Measures of ease and convenience, privacy protection, fairness, choice, and overall attraction are very strong. The vast majority sees the system as easy to use, and fair, while sufficiently protecting location privacy and account security. These subjective responses are corroborated by objective data, which show a zero dropout rate, very few calls to the Help Desk, and no major technical issues with the mileage reporting devices.

Evaluation category 2: Technology

Technology metric #1: Adaptability of the RUC system

This metric was intended to measure the use of the RUC system for other services, the openness of the RUC system for changes in the RUC structure, and the scalability of the RUC system. It was measured by interviews with the system vendor Sanef and the system integrator CH2M Hill.

Sanef stated that their system was highly adaptable—it is capable of accepting both charges and payments from a variety of sources, and it is highly scalable. It can be easily configured to accept multiple types of charges, such as tolling, parking, and value added services. In order to accept other charges, all that would be needed is an

interface to the service from which the charge is to be accepted, and a modification of the invoice to customers to reflect charges from this new service. In fact, the RUC system was just such an adaptation of their tolling system—only the interface to devices was added, and the invoice specifications adjusted from that system. Their system is also capable of accepting payments from a wide variety of sources.

CH2M Hill, IMS, and Raytheon confirmed Sanef's estimation of the system's strong degree of adaptability, but stated that there is one area in which system adaptation may require significant effort: the ability to receive data from vehicles that are completely or partially noncompliant with OBDII standards. The MRD's interface/interfaces to such vehicles may need to be developed on a cast-by case basis for such vehicles. This applies especially to electric vehicles, to which OBDII regulations do not apply.

Technology metric #2: Ease of installation of mileage reporting devices

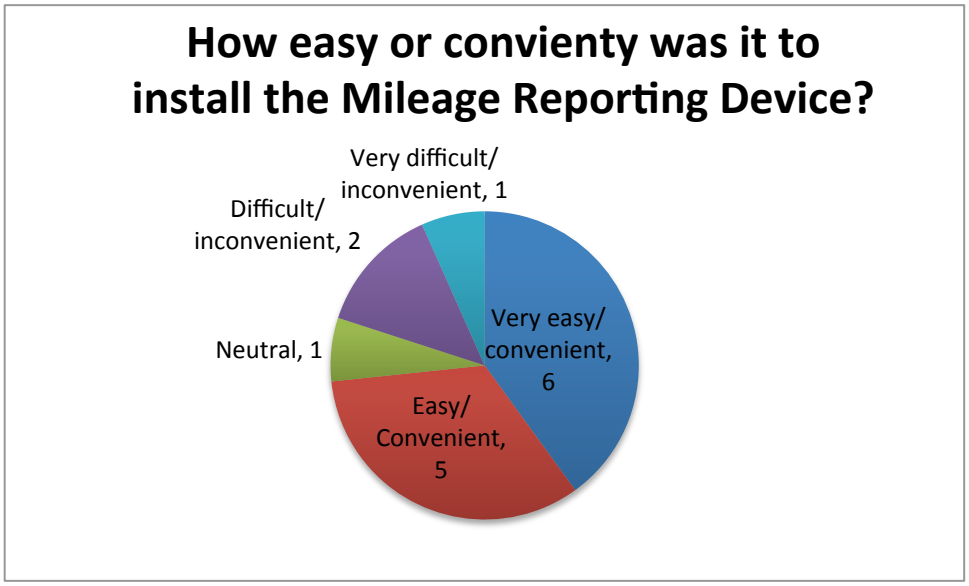
In general, RUCPP participants found the mileage reporting devices easy to install. The ease of installation of the mileage reporting devices is demonstrated by an analysis of combined vendor responses, surveys, and pilot participant coordinator records.

Vendor surveys. Both vendors indicated that the mileage reporting devices (hardware) are designed to plug into the OBDII port and should be self-installed by the users without additional assistance for most car models (if the car model has an OBDII port). The vendors stated that hardware installation process, including becoming familiar with the installation guidelines, should take an average of about five minutes. The only activity that may prolong the process is locating the OBDII port. To facilitate the installation and help desk support, IMS provided documentation to the help desk on where OBDII ports are on various car types.

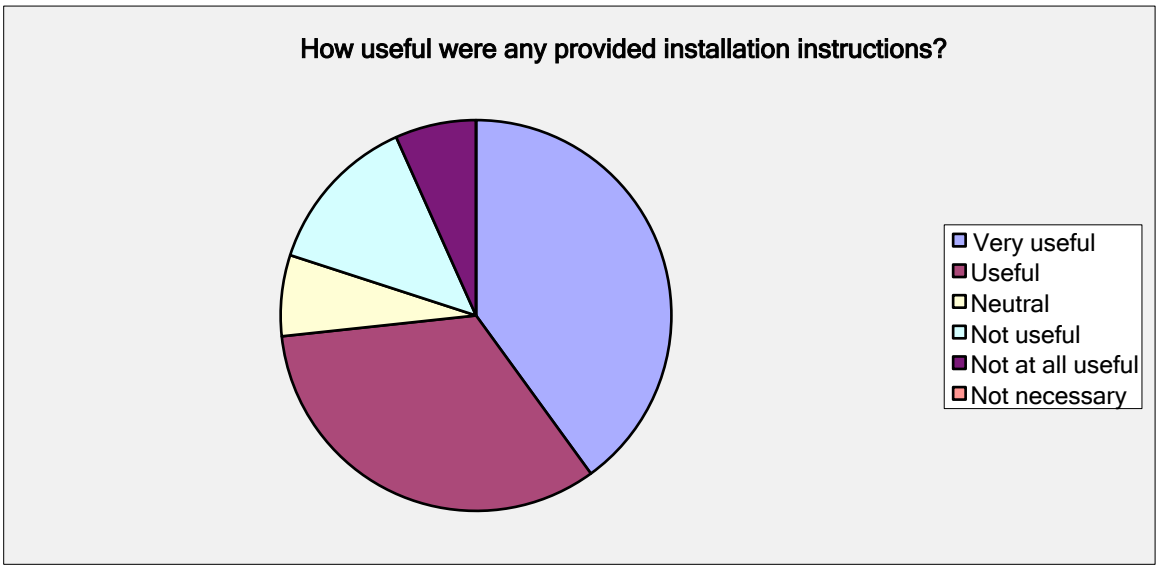
Participant surveys. The main results from the respondents are derived from the midpoint RUCPP survey that included responses to most questions from 15 respondents, out of 21 surveyed. A summary of the key reaction to each installation related question is as follows:

- Did you install it yourself or did you need help? If you needed help, who helped you?
  - All but two respondents indicated that they were able to install the device without assistance. This means that self-installation for such mileage reporting devices is possible and has been proven to be something that a wide majority of respondents are able to accomplish with little or no difficulty.
- Was there any cost to you for installation?
  - Of the 15 respondents, all indicated that they incurred no costs for installation. This clearly demonstrates that installation of RUCPP mileage reporting devices leads to no additional installation charges for RUC payers.

- How long did it take to install the OBU start to finish?
  - The time to install for all 15 respondents with mileage reporting devices ranged from a low of only 1-2 minutes for five respondents to a high of 30 minutes for one respondent. The average time to install was 7.5 minutes. One of the key determining factors of installation time is the ability to locate the OBDII port, which depends on the make and model of the vehicle.
- What was the level of difficulty to install the mileage reporting device?
  - Eleven respondents indicated that installation was "easy/convenient" or "very easy/convenient." For the remaining four, one person found it "neutral," two found it "difficult," and one found it "very difficult."



- How useful were any provided installation instructions?
  - Of 15 responses, three people indicated that instructions were not useful or not at all useful, one person indicated a neutral viewpoint, and 11 indicated they were useful or very useful. These results demonstrate that the installation instructions were for the most part reliable and self-explanatory, but that on some vehicles (with an unusually located OBDII port) the installation instructions did not help.



Technology metric #3: Safety of mileage reporting devices, mileage reporting device installation, and system operations for motorists

RUCPP participants have found the mileage reporting devices to be very safe without any significant issues related to installation of the mileage reporting device and systems operations. The safety, installation and system operations aspects of the mileage reporting devices are demonstrated by an analysis of the responses by participants to a set of questions.

Participant surveys. The results from the respondents are derived from the following four questions:

- Did the OBU ever physically impede your driving? If so, how? And how often?
- Did the OBU ever distract you during driving? If so, how? And how often?
- Have the Road Usage Charge system operations affected your vehicle or driving in any other way?
- Was the Mileage Reporting Device ever dislodged or removed from the OBDII port? Did the OBU ever fall out of the OBDII port? If so, how often?

For the first three questions, the response was Never for all 15 respondents. Four the fourth question, 12 answered Never, and 3 answered Yes, Once but the responses indicated that only for two vehicles did the MRD actually fall out of the port, and for the other one it was removed from the port intentionally. One respondent said that the MRD was located close to the parking brake, so it was easy to bump it when applying the parking brake.

The results of the survey for this metric related to safety, installation and system operations issues demonstrate that the RUC system implemented for the RUCPP is safe and easy to use for the mileage reporting devices. This safety issue means that none of the mileage reporting devices actually fell out of the OBDII port, and no incidents transpired leading to interference with driving. Furthermore, the results demonstrate that installation and on-going system operations have been without any major issues.

Technology metric #4: Anti-tampering

The anti-tampering metric is demonstrated by an analysis of combined vendor responses. The following table provides the indicators representing the combined vendor responses to two questions.

RUCPP Vendor responses to questions on anti-tampering measures

Question / Vendor response	How effective are your anti tampering means?	Could an unskilled individual learn to effectively tamper with the mileage reporting device, for example, by reading how to do so on the Internet?
Sanef/IMS	• Enclosure has tamper-evident tape (see if device is opened). • Sanity checks in firmware. • Compare distance OBU in GPS to distance from engine.	• Sanef did not answer this question directly but implied that if signals used to detect device removal from vehicle were monitored by the account management system it would be very hard to commit fraud.
Raytheon	• Device, detects and logs if it is removed from vehicle.	• Raytheon believe anti-tamper prevents user from removing device from vehicle without being noticed, the main means of tampering.

Technology metric #5: System performance

The system performance record indicates that the system is performing very well: there have been no identified lost transactions, no inaccurate billing, and no missed or mis-recorded mileage.

The system performance metric shows these results using the following four indicators:

1. Acceptance Testing. Acceptance testing demonstrated that the mileage reporting devices, and by extension the system, could accurately measure distance traveled, and in the case of advanced mileage reporting devices, could accurately measure distances traveled off-road and out-of-state. Full details of acceptance testing are recorded in the Acceptance testing reports; however, it is sufficient to state that mileage reporting devices correctly measured distances traveled. Thus, the acceptance testing indicator shows that the system performs very accurately.*2. System and Mileage reporting device Errors from System Logs.* The help desk monitors and logs all errors recorded by the

system. During the RUCPP, no mileage reporting device errors have been logged, indicating the system has performed very well.

3. Mileage Tax Accounting Auditing of Transactions. The RUCPP includes a detailed accounting analysis of all mileage tax transactions that is designed and implemented by an accountant experienced in large government-run transaction systems. This analysis was performed on the two months of data collection for Washington State Residents (December 2012 and January 2013), and resulted in finding no errors in billing Washington Residents, and complete consistency in results.

4. Participant Survey questions. To the survey question: "Do you believe any driving events or miles have been missed by the system?" All but one participant responded negatively, and that participant said that the Mileage Reporting Device had been removed during an oil change and that it had not been replace promptly.

To the question "Do you believe the system has over-counted your mileage?" All participants responded negatively.

Conclusion for System Performance. Taken together, these indicators demonstrate that the system is measuring all miles driven, and neither over-counting nor undercounting, and sending participants accurate bills on a monthly basis. This shows a very high level of system performance.

Technology metric #6: Hardware, software and other system elements

The RUCPP system is feasible, accurate, reliable, secure, open and has neutral or beneficial energy consumption impacts. The following sections address the evaluation results for all of these elements.

a) Feasibility

The system is feasible, as demonstrated by two indicators:

1. Acceptance Testing of devices used to support Service Plans. The rigorous acceptance testing process of devices used in phase one was successful and thus demonstrated that the system is feasible. All Advanced mileage reporting devices performed well. The Basic mileage reporting devices also performed well.

2. Vendor Surveys. In vendor interviews, Sanef/IMS indicated that their products were already in production (IMS mileage reporting devices support eight insurance companies' pay-as-you-drive insurance products; Sanef's account management systems support tens of thousands of tolling customers). Sanef stated that scaling up production and operation would be straightforward.

b) Reliability

The system is reliable, as measured by four indicators:

1. Mileage Reporting Device failures observed during RUCPP. Two mileage reporting devices have failed during the RUCPP so far, and only one in Washington State, but neither was caused by faulty hardware. One was kicked out of the OBDII port by a driver who was unaware of the mileage reporting device. This driver then stepped on mileage reporting device and damaged it. The other mileage reporting device (the one being used by a Washington State resident was plugged in a car that experienced an electrical system issue.[7] This electrical system issue damaged the mileage reporting device.

2. Mileage Reporting Device Vendor Survey. IMS stated that their devices have a minimum design lifetime of 5 years.

3. Availability of Account Management System. IMS did not specify a precise availability but stated that their system was very highly available.

4. Participant Survey Questions. The same survey questions as indicated accuracy (no missed miles, no over-counted miles) indicate that the system is reliable from the participant perspective.

d) Security

The system is secure. The indicator for system security is vendor survey responses.

The mileage message has no encryption by specification. This choice was made to ease the implementation of the RUCPP system; in full operation, encryption would be used on the mileage message

However, the choice was made during the RUCPP to use the WS-OASIS security standard for the mileage message. Online operations use AES 256-bit CVC encryption, an encryption standard equal to or better than most e-commerce websites.

Sanef's system also uses firewalls and other standard cybersecurity measures.

Using the cybersecurity measures included in the pilot (WS-OASIS and various firewalls) combined with additional measures such as message encryption to be implemented during revenue operations, the system is and will continue to be secure to cyber-attacks.

e) Open system

[7] The electrical system issue was not caused by the mileage reporting device; it was an unrelated automotive issue.

The RUCPP system is open, as demonstrated by three indicators:

1. Use of standard mileage message. All mileage reporting devices and the account Management system used a standard information format known as the **Mileage Message** to transmit mileage information. The Mileage Message is a completely open, public, standardized means of communication. Using such an open public standard means that any new vendor of either mileage reporting devices or Account Management System services can simply build a product that is compliant with the specification and be certain that it will work with the system.

2. Use of Mileage Reporting Devices by different manufacturers. Including the Oregon participants, the system used Mileage Reporting Devices provided by two manufacturers, IMS and Raytheon (Raytheon's devices were only available to Oregon participants). Sanef's Account Management system read messages from mileage reporting devices manufactured by IMS and from mileage reporting devices manufactured by Raytheon. Using multiple mileage reporting devices from different vendors demonstrates that the system is in fact open to as many vendors as wish to participate in the system.

3. Availability of choices to participants. Oregon participants had the choice of five different mileage plans, as explained in table 1 above: the ODOT Basic Plan, the ODOT Flat Rate Plan, the Sanef Basic Plan, the Sanef Advanced Plan, and the Sanef Smartphone Plan. Washington participants had two choices: the Sanef Basic Plan, and the Sanef Advanced Plan. These plans have worked seamlessly since the start of RUCPP, and participants have the option of switching plans if they so desire. The availability and coexistence of multiple supported by different CSPs demonstrates that the system is open to participation by as many vendors as wish to support it.

f) Energy consumption

This metric shows that mileage reporting devices do not impact energy consumption of vehicles in which they are used:

Indicator: Stated Energy Consumption of the Mileage Reporting Devices. Both the IMS and Raytheon mileage reporting devices use minimal electricity when the vehicle is operating, and almost no electricity when the vehicle is off, so it will not impact vehicle operations or cause the battery to discharge.[8] These small electricity consumptions are very minor and will not impact the fuel consumption of vehicles, demonstrating that use of the mileage reporting devices does not increase energy consumption.

[8] The IMS device uses about 100mA when operating (when the vehicle is on) and about 2 mA when the vehicle is off and the mileage reporting device is in sleep mode). The Raytheon device uses less than 1 mA when it is operating in sleep mode. Raytheon did not specify the operational electric consumption of their mileage reporting device, but it is likely to be 100 mA like the IMS device.

g) Account management system experience

RUCPP participants found that the system has an easy or convenient account management system as demonstrated by Participant Survey questions.

In response to the question "How easy or convenient have you found each of the following aspects of the road usage charge system so far? - Registering and setting up an account," there were 8 responses of Easy, 6 responses of Very easy, 1 Response of Neutral, and 1 response of difficult or inconvenient. These responses generally show that users feel that setting up an account is easy.

In response to the question "How easy or convenient have you found each of the following aspects of the road usage charge system so far? - Viewing account and reviewing charges on account," there were 6 responses of Easy and 7 responses of Very easy. The other two participants left the question blank or said Not applicable. These responses generally show that users feel that viewing an account is easy.

Finally, in response to the question "How easy has it been to use the account management system website and/or access your account by other means? There were 2 responses of Easy, 5 responses of Very easy, and 6 responses of Neutral. These responses show that users feel that viewing an account is easy, or at least typical of account management websites.

Conclusion

Metric 6 demonstrates that the Road Usage Charging system implemented for the RUCPP is feasible, reliable, secure, open, reduces energy consumption, and provides RUC payers an easy, convenient account management system experience.

Evaluation Category 3: Operations

Metric 1: Ease and cost efficiency of administering the MT

The purpose of this metric is to illustrate the relative ease and cost-efficiency of administering the mileage tax system.

The RUCPP system was relatively straightforward to administer. Ease of administration was measured through discussions with the private sector operator (Sanef) and the ODOT system integrator (CH2M Hill team). Sanef stated operating this system was "Business as Usual," because it was very similar to administering tolling systems that they usually operate. The only change that they made during system operation was a cosmetic update to the appearance of invoices. The only unexpected and ongoing problem is the difficulty of getting MRDs to communicate with electric vehicles. Sanef

stated that they had required a few person-months of development to achieve the correct system interface (with the mileage message), but that once the system was operating, maintaining the system required "much less" than one FTE per month. CH2M Hill said that operating the system was "Easy," because the kinks in the system had all been worked out during testing. CH2M confirmed this by stating that they received many fewer calls on the Help Desk than expected. In fact, operating this help desk was the only ongoing aspect of system operation, and because call volume was so light it required much less than one FTE per month to operate. Both Sanef and CH2M stated that some manual effort was used to send out and process invoices each month, but that much of this could be eliminated through automation in full system operation.

Administering pilot system was very cost-effective because it used hardware and software that was designed and operational for other purposes. IMS was able to provide a low-cost MRD, because these were the devices used for Pay as You Drive insurance. Sanef was able to provide a total system cost of $140,000 because the core system was developed as a tolling transactions processing and account management system. The average monthly cost of operation for Sanef was $18,000, and that this value would increase only slightly with a greater number of accounts. Sanef also stated that the marginal cost of operation in multiple states would be very small. Further cost metrics, including a comparison with the cost of collecting the gas tax, are included below.

Metric 2: Ease of use and cost of compliance with the MT system by RPs and other system users, including evasion potential

This metric was intended to gauge the ease of use of the system by drivers. It was measured both by interviews with vendors and by survey questions to RUCPP participants.

Vendor interviews indicated that the system would be easy to comply with, free or very inexpensive, and hard to evade for participants:

- Sanef, Raytheon, and IMS all felt that the system would be very easy to use for participants. Perhaps the only challenging portion could be installing the MRD, and then only for owners of a small percentage of vehicles. Installation of the MRD is straightforward on most vehicles, but on a small portion vehicles, the OBDII port can be hard to locate. Owners of such vehicles can simply call the help desk, where a directory of the locations of OBDII ports on all vehicles that have OBDII ports is stored.
- Sanef, Raytheon, and IMS all felt that it would not cost system users anything to comply with the system, except for those participants who use the Smartphone (Raytheon) MRD, who will have to provide for data communications using their smartphones. If this communications is already covered by the smartphones, then they have no additional cost.
- Sanef, Raytheon, and IMS felt that evasion potential was low. The most likely opportunity for evasion was simply removing the MRD and leaving it unplugged. However, OBU removal is detected both by the Raytheon MRD and the IMS

MRD. Other sources of evasion, such as using a GPS jamming signal, are very tricky and easy to detect unless perfectly executed.

On surveys most Washington participants said that they found all aspects of the system either to be easy or to be very easy to use. The only aspect of the system that more than one participant found difficult was the Installation of the Mileage Reporting Device, which was difficult to locate on some vehicles.

The only suggestions for making the system easier to use was to have more clear feedback from the MRD that it was in fact operating correctly, and to have more clear feedback about how many miles had already been driven in a given billing period (information that was available on online accounts).

All 16 Washington survey respondents agreed that the system has no cost to comply with.

Metric 3: Accuracy and perception of accuracy of data transmitted to the central database and used for assessing mileage taxes

This metric is intended to measure the accuracy of the system, both as perceived by the participants, and as measured from the data generated by the pilot.

Participants believed the mileage measurement and billing to be very accurate, although a few concluded that they didn't/couldn't know the accuracy of the system. Only one Washington participant believed that there was any inaccuracy in the billing. This participant had the MRD removed during an oil change, and the MRD was not tightly plugged in after the oil change. Thus, the MRD was not working and not counting miles. This issue was not related to mileage measurement accuracy, but with being certain that the device was properly installed.

No participants with advanced MRDs believed that there were inaccuracies with the refunds for out of state or offroad travel, although several responded "Don't Know" to the question.

Objective measurement of measurement accuracy of MRDs was conducted during acceptance testing, and shown to be 2-3% in all cases. Please refer to ODOT acceptance testing documents for details.

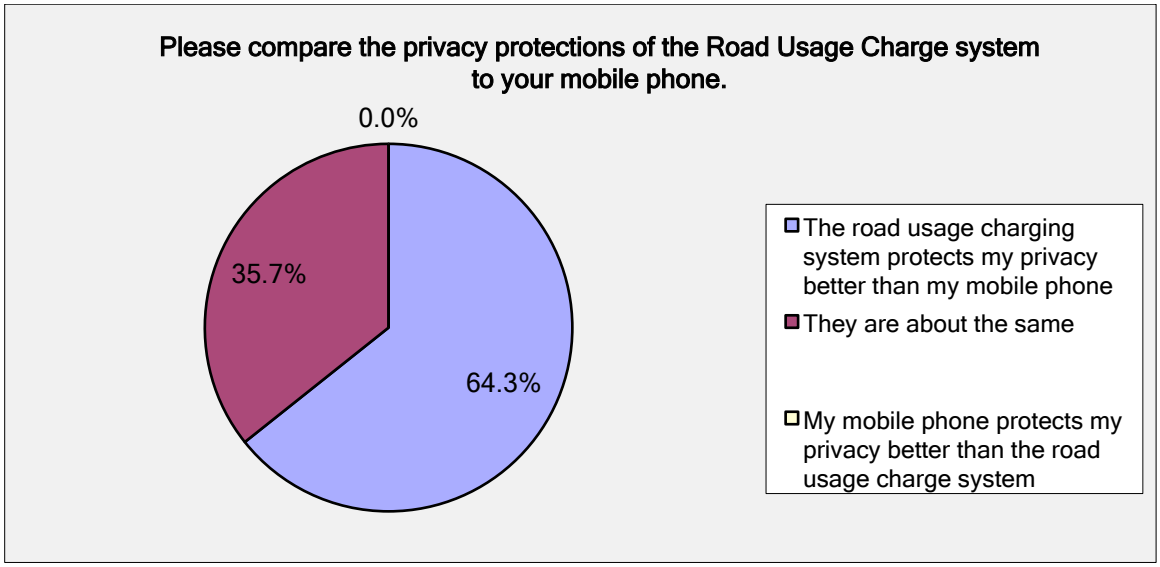
Metric 4: Privacy options for RPs in protecting personal, private data.

This metric is intended to measure the availability of privacy options provided by the system and the efficacy of those options at protecting individuals data, both as evaluated by the vendors and as perceived by the individuals.
The vendors (Sanef, Raytheon, and IMS) all felt that they way the system is structured, privacy is well-protected. Users had options not to use electronics at all; or to use

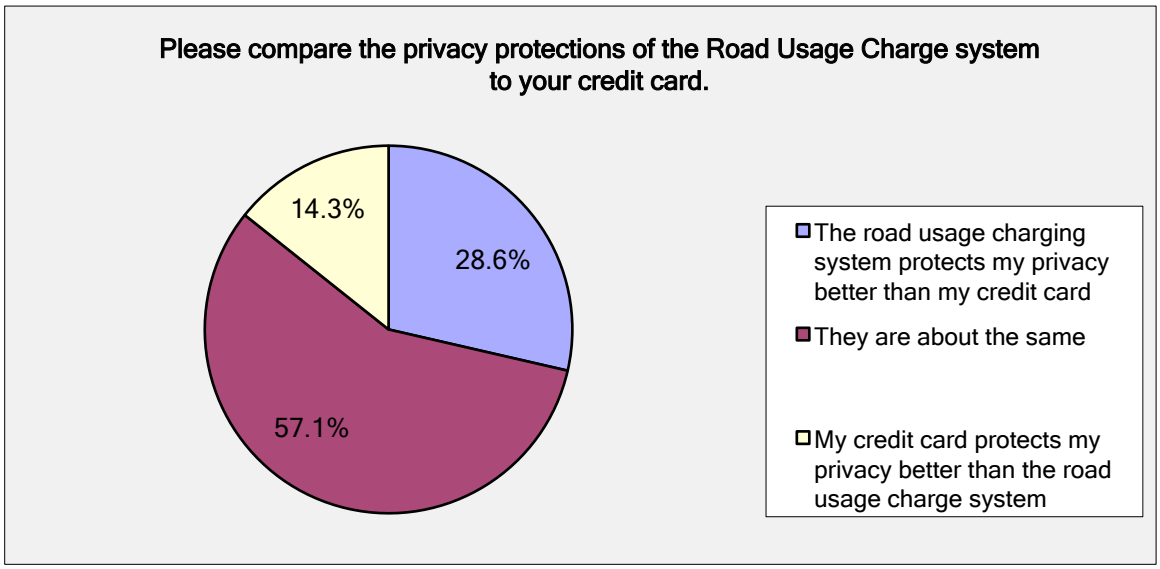
electronics that contained no GPS. For the smartphone plan, use of GPS data could be turned on and off. Also, users were asked to provide minimal data to support accounts. Sanef did point out that there were currently no requirements on maximum data retention, and that purging individual transaction data (though retaining aggregate data) could be another way to improve privacy protection. Data purging requirements have subsequently been added to the authorizing legislation in Oregon, and should be considered in Washington state as well, as this may be a major requirement of the ACLU, as it was in Oregon.

Most Washington participants believed that the system protected their privacy. About half of participants felt that the system protected their privacy Well or Very Well. The remaining participants were neutral in their response to the question.

Interestingly, about 2/3 of participants felt that the system protected their privacy better than mobile phone operators, indicating that even several of the participants who responded Neutral to the first question felt that the RUC system protected their privacy better than mobile phone companies do. The remaining third felt that the RUC system protects privacy about the same as mobile phone companies do.



In contrast, 57% of participants felt that the RUC system protected privacy about the same as credit card companies do. 29% felt that the RUC system protected privacy better than credit cards do, while just 14% felt that the RUC system did not provide as good privacy protection as credit card companies do.



In conclusion, both vendors and participants felt that the system protected privacy well—as good as or better than common systems such as credit cards and mobile phones. The only improvement suggested was to purge transaction data after a fixed cutoff time.

Metric 5: Ability to audit

This metric is designed to measure the auditability of the system. It will be vital for the account management system of CSPs to be audited, so the state can be certain that they are compliant with the requirements, interfaces, and business rules of the program. The state must ensure CSP compliance so that the public trusts the system. This metric was measured by interviews with the vendors, and an interview with the MTA representative who was a CPA who examined the data provided by the CSPs each month very closely and performed monthly accounting for all accounts using this data.

Sanef felt that their system was highly auditable, based on their experience having used a similar system for other operational tolling projects and having been audited on those projects, but deferred the final analysis of auditability to the MTA system representative.

The MTA system representative stated that the system was very auditable, although improvements could be made. Most of these improvements will be included in the updated requirements, ICD, and Business Rules documents. The improvements include formalizing/standardizing the monthly reporting from the CSPs, defining the precise nature of a transaction, requiring comprehensive numbering of transactions, and allowing no missing, purged, or deleted transactions. Full details of the MTA system are included in the MTA final report. The MTA system representative did point out that while during the pilot, all individual transactions were made available to the MTA, the MTA is

designed so that this will not be the case during revenue operation. Rather, CSPs will provide only summary information, and will provide individual transaction data only in cases where fraud is suspected or spot audits are needed to verify the proper function of the MTA.

Between the experience of Sanef and the statements of the MTA system representatives, the Evaluation team concluded that the system is very auditable.

Evaluation Category 4: Costs

Metric 1: Start-up costs (capital and retrofitting)

This metric is intended to measure the up-front costs of running the pilot program, and by extension, instituting a RUC. It was measured by interviews with the system vendor, Sanef, the OBU vendors IMS and Raytheon, and the system integrators, CH2M Hill.

This metric does not suggest how the costs should be covered. For CSPs in full system operation, much or all of their costs may be covered by selling additional services to customers, or selling customer access to other service providing companies such as Pay-As-You-Drive insurance companies (in fact, Pay-As-You-Drive insurance companies may even act as CSPs).

For the RUCPP, Sanef charged $212,431 for all their services, including integration and operations. Sanef stated that roughly 2/3 of the costs were incurred prior to system operation, so it is reasonable to conclude that up-front costs for a CSP would be about 2/3*212 = $140k, which includes development and customization of the account management system, but no MRDs, and no payment system. Sanef stated that they built the account management system on a piece of software that they already owned, which cost about $300,000. It also did not include Help Desk operations, which were provided by CH2M Hill.

IMS stated that MRDs are currently available near the $100 price point, and that this number would continue to drop. Independent research by the evaluation team found market research that forecast that the cost of MRDs will be in the $50-$75 price range by 2015, and continue to drop.

Raytheon declined to state what the price point of the Smartphone MRDs is or would be, but indicated that it would be higher than the price point of the MRDs that IMS is providing due to the fact that they are not in production for other uses (IMS's MRD's are widely used by insurance companies for Pay-As-You-Drive insurance products).

In summary, the evaluation team concludes that Capital and Retrofitting costs for an account management/transactions processing system from firm with a pre-existing account management system would be about $200,000 ($140k + ~$60k for the payment system, the help desk setup, and buffer funds), or if the firm didn't have a pre-existing system, would be about $500,000. Additional capital/retrofitting costs, such as acquiring MRDs and maintaining a storefront office, will cost extra.

Both Sanef and CH2M Hill stated that these costs will increase, but in a very gradual way, as the number of customers (individuals subject to RUC) increases, and that they would not increase dramatically in the case that the service is provided to a number of different states, so long as no state adds additional requirements that increase costs.

Metric 2: Operations and maintenance

This metric is intended to measure the ongoing, monthly costs of running the pilot program, and by extension, running a RUC. It was measured by interviews with the system vendor, Sanef, the OBU vendors IMS and Raytheon, and the system integrators, CH2M Hill.

As with the capital costs metric, this metric does not suggest how the costs should be covered. For CSPs in full system operation, much or all of their costs may be covered by selling additional services to customers, or selling customer access to other service providing companies such as Pay-As-You-Drive insurance companies (in fact, Pay-As-You-Drive insurance companies may even act as CSPs).

As stated above, for the RUCPP, Sanef charged $212,431 for all their services, including integration and operations. Sanef stated that roughly 1/3 of the costs were ongoing operations and maintenance (O&M) costs, so it is reasonable to conclude that O&M costs for a CSP would be about 1/3*212 = $71,000. Divided over a 4-month period, this comes to about $18,000/month. It is likely that this value could drop further as the system becomes fully automated.

CH2M Hill indicated that the only ongoing costs they incurred were the time of the employee who answered calls for the Help Desk, and sent out invoices and checked payments. Call volume was quite low, so this did not result in significant additional costs.

These values will increase with increasing numbers of participants, but invoicing and payment can be fully automated. It will be necessary to provide customer service online and via phone, but this can be outsourced or combined with other existing customer service provision, and after an initial outlay to set up the customer service, should be very affordable.

Metric 3: Costs of collection relative to gas tax and use fuel tax

The purpose of this metric is to compare the relative costs of collecting road usage charges and fuel taxes. However, information gathered from the RUCPP is insufficient to make a complete and accurate assessment of relative costs. As a result, the figures presented in this section draw on information obtained from additional research. In order to provide an "apples-to-apples" comparison of RUC and fuel taxes, we present the following computations:

- Forecast cost to collect RUC for 10,000 vehicles based on information provided from RUCPP vendors, using the collection methods tested in the RUCPP.
- Cost to collect fuels tax for 3+ million vehicles in Washington today based on information gathered from Washington Department of Licensing (DOL).
- Forecast cost to collect RUC for 3+ million vehicles.
- Forecast cost to collect fuels tax for 10,000 vehicles based on assumptions made about hypothetical program requirements

First, the cost of collection for the pilot program of fewer than 100 vehicles can be broken down as follows. The hardware (MRDs) cost approximately $100 per unit. In addition, there are costs of approximately $9 per month to operate each MRD, including the cost of telecommunications, data analytics, mapping, and data hosting. Moreover, there are fixed costs associated with setting up a transaction processor and billing system of about $200,000. The cost of ongoing operations of these systems is a further $18,000 per month, up to about 10,000 vehicles. Building these figures into a full operational cost estimate for a RUC system with 10,000 vehicles, we arrive at capital costs of about $1.2 million and annualized operational costs of about $1.3 million. Based on the pilot, participants drove average annualized mileage of 12,400, which would generate $231.88 per vehicle, or about $2.3 million in a small, 10,000-vehicle system. Exclusive of setup costs, the cost to operate RUC based on these sketch figures would be about 57% of revenues.

Secondly, the cost of collection for fuels tax in Washington today is about 0.6% of revenues, based on figures reported to FHWA for the 2011 *Highway Statistics*.[9] According to these figures, the cost to collect fuels tax in Washington is about $7.6 million per year, or 0.6% of the $1.26 billion in fuel tax revenues. According to the Department of Licensing, which is responsible for the motor fuel tax, there are approximately 75 state employees devoted to the fuel tax collections, account management, and auditing, which is in line with an estimate of about $7.6 million in annual costs.

Thirdly, the cost to collect RUC should decline as a proportion of revenue as the program grows larger due to economies of scale. Moreover, the methods of collection may evolve toward lower cost methods such as manual self-reporting and outsourced collection by private agents. As a private market for RUC collection develops, the cost

[9] See FHWA Highway Statistics, Table MF-3, November 2012. $7.6 million in collection costs out of 1,256.7 million in fuel tax revenues.

will decline substantially, because the private sector will offer it as a service to customers, but the vast majority of the costs will be built in to other service offerings covered by service provider revenues from other services (e.g., insurance, telecommunications, and vehicle concierge services through telematics). At a volume of 3 million vehicles, based on research and cost estimates built using a financial model for use in Oregon, RUC collection costs are expected to decline to approximately 5% of revenues. Similar costs are estimated for a manual system.

Finally, the cost to collect fuels tax from 10,000 vehicles would not decline in proportion to today's costs of collection. Assuming average statewide fuel economy of 21 MPG and 12,400 miles per year (as evidenced in the pilot), a 10,000-vehicle fuels tax program would generate about $2.2 million in revenues. To manage collections of such a small-scale program, DOL would need several staff devoted to the program, including a program manager, compliance officer(s), auditors, accounting technicians, and account managers. Although the number of staff would not be as large as it is today (75), it is safe to presume annual operating costs for salaries of DOL employees of between $500,00 - $1 million, or operating costs of 20-45% of revenues.

The table below summarizes the above sketch-level computations.

Table 5: Costs of RUC and Fuels tax under 10,000 vehicle and 3 million vehicle scenarios

Program	10,000 vehicles	3 million vehicles
RUC	• ~$2.3 million revenues • ~$1.3 million annual operating costs • costs of 57% of revenues	• ~$680 million revenues • <$35 million annual operating costs • costs of 0-5% of revenues
Fuels Tax	• ~$2.2 million revenues • ~$0.5 -1 million annual operating costs • costs of 20-45% of revenues	• ~$1,257 million revenues • ~$8 million annual operating costs • costs of 0.6% of revenues

It is clear that fuels taxes have a lower cost of collection than RUC at any volume, although the differences are not as sharp when comparing programs of similar size. It is also important to note that evasion and lost revenues are not captured in these estimates for either program. Neither is known, but fuel tax evasion was most recently by FHWA in 1992 at between 3-7% for gasoline and 15-25% for diesel. RUC evasion will be an issue as well, but there are no comparable figures available at this time. There was no evasion reported in the pilot program, but the small sample of knowledgeable participants is not representative of the larger population. Also important to note is that the costs for RUC in this metric are based on sketch-level estimates and assumptions that need to be further validated through more detailed cost modeling and program testing.