Surface Transportation System Funding Alternatives Phase I Evaluation

Regional Road Usage Charge System Definition and Pilot Planning Project by RUC West

FHWA-HOP-19-047

January 2022

U.S. Department of Transportation
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16. Abstract

This report presents the independent evaluation results of the Regional Road Usage Charge (RUC) System Definition and Pilot Planning Project by the Western Road Usage Charge Consortium (RUC West), which received fiscal year (FY) 2016 funding from the U.S. Department of Transportation's Surface Transportation System Funding Alternatives Program. RUC West is a voluntary coalition of 17 western State departments of transportation (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Utah, Washington and Wyoming) that are committed to collaborative research and development of a new funding method for transportation infrastructure based on drivers' actual road usage. It is one of eight entities to engage in pilots or pre-pilot planning and development activities to explore a variety of options to demonstrate user-based alternative revenue mechanisms. The United States Congress and the Federal Highway Administration (FHWA) seek to understand whether a user-based alternative revenue mechanism that utilizes a user fee structure can help maintain the long-term solvency of the Highway Trust Fund and can be implemented nationally at some time in the future. As part of this endeavor, FHWA is evaluating seven of the eight grantee sites that received funding in Federal fiscal year 2016. The evaluation reports resulting from this process will allow the Secretary of Transportation and Congress to be aware of progress that has been made, lessons learned from initial pilot and planning efforts, the role of education and outreach, and the potential for any negative impacts on constituents and initial findings on administrative fees, among others.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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LIST OF ABBREVIATIONS

CCO	concept of common operations
ConOps	concept of operations
DOT	department of transportation
FAST	Fixing America's Surface Transportation
FFY	Federal fiscal year
FHWA	Federal Highway Administration
FY	fiscal year
GPS	global positioning system
OEM	original equipment manufacturer
PII	personally identifiable information
RUC	road usage charge
RUC West	Western Road Usage Charge Consortium
STSFA	Surface Transportation System Funding Alternatives
USDOT	U.S. Department of Transportation
VMT	vehicle mile traveled

EXECUTIVE SUMMARY

This report represents the independent evaluation results of the Western Road Usage Charge Consortium's (RUC West) fiscal year (FY) 2016 Regional RUC System Definition and Pilot Planning project. RUC West is a voluntary coalition of 17 western State departments of transportation (DOT) (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, Texas, Utah, Washington and Wyoming) that are committed to collaborative research and development of a new funding method for transportation infrastructure based on drivers' actual road usage.[1] Oregon DOT serves as the lead agency for grant administration purposes on behalf of the participating States. RUC West received $1.5 million in Surface Transportation System Funding Alternatives (STSFA) grant funding from the U.S. Department of Transportation (USDOT). The FY 2016 funding and associated grantee programs constitute Phase I of the STSFA Program and are referred to throughout the document as such. RUC West is one of eight entities to engage in pilots or pre-pilot planning and development activities to explore a variety of options to demonstrate user-based alternative revenue mechanisms.

BACKGROUND

As vehicles are becoming more fuel efficient, the reliability and adequacy of the motor fuel tax (fuel tax) as a primary source for transportation infrastructure funding continues to decline. Recognizing this trend, the Fixing America's Surface Transportation (FAST) Act[2] established the STSFA Program to provide grants to States or groups of States to demonstrate user-based alternative revenue mechanisms that employ a user-fee structure to maintain the long-term solvency of the Highway Trust Fund. The objectives of the STSFA program are to:

- Test the design, acceptance, and implementation of two or more future user-based alternative mechanisms.
- Improve the functionality of the user-based alternative revenue mechanisms.
- Conduct outreach to increase public awareness regarding the need for alternative funding sources for surface transportation programs and to provide information on possible approaches.
- Provide recommendations regarding adoption and implementation of user-based alternative revenue mechanisms.
- Minimize the administrative cost of any potential user-based alternative revenue mechanisms.

Staff from the Federal Highway Administration (FHWA) Headquarters in the Office of Operations have the overall responsibility for administering the program. FHWA Division office staff provide direct support by overseeing the program in participating States.

The U.S. Congress and FHWA seek to understand whether a user-based alternative revenue mechanisms that utilizes a user fee structure could help maintain the long-term solvency of the

[1] This composition of RUC West (11 States) is at the time of completion of the evaluation that this report documents in March of 2020. More States have since joined the consortium.

[2] Public Law 114–94, H.R. 22, § 6020, H.R. 22, 114th Congress (2015).

Highway Trust Fund, and be implemented nationally at some time in the future. As part of this endeavor, FHWA evaluated seven of the eight grantee sites that received funding in Federal FY 2016.[3] The evaluation reports resulting from this process will allow the Secretary of Transportation and U.S. Congress to be aware of progress that has been made, lessons learned from initial pilot and planning efforts, the role of education and outreach, and the potential for any negative impacts on constituents and initial findings on administrative fees, among others.

RUC WEST PHASE I SYSTEM DEFINITION AND PILOT PLANNING

Founded in 2013, the Western Road Usage Charge Consortium, formerly called the WRUCC and currently known as RUC West, has tackled many of the policy, organizational, technological, and operational challenges for finding a new way to generate and collect revenue to fund transportation infrastructure. At the time the organization submitted a grant application to USDOT's STSFA Program, the coalition included 14 States. As part of the STSFA Phase I Program, RUC West planned to define a regional system to promote and establish RUC consistency, interoperability, and compatibility throughout the western United States. At the time of the grant application, four of the RUC West member States had legislative approval to conduct RUC pilot tests (Oregon, California, Utah, and Washington). The project cost was $1.9 million, of which $1.5 million was funded by STSFA.

The two main project accomplishments for RUC West's Phase I efforts included:

- Creating a high-level concept of operations (ConOps) that outlined the basic principles of how a regional RUC system will function for future pilots and upon which all 11 participating States agreed.
- Creating detailed system and business requirements based on California and Oregon pilots.

The final RUC West STSFA Report states:

> The most valuable lesson learned from this project is that a regional RUC system is possible. Each state has its own requirements—different RUC rates, public funds laws, methods of fuels tax collection and disbursements, and overall politics—but this project demonstrated that a regional system can be built to be agile enough to accommodate each states' needs, but yet also prescriptive enough to seamlessly function for drivers.[4]

MAJOR FINDINGS

The evaluation assessed the impacts of the STSFA-funded activities in a systematic manner across all sites. The objective was to document the applicability of the system, and impediments to implementing user-based fee mechanisms as future alternatives to a gas tax on a nationwide level.

RUC West's Phase I efforts have demonstrated that regional coalitions can work to create consensus and efficiencies around the technical and logistical aspects of a mileage-based fee system. Further, a regional body can support the exchange of knowledge and critical information that may be applicable across geographic boundaries, apart from directly addressing issues of how an RUC system can be interoperable across those boundaries.

[3] The Phase I evaluation for the eighth pilot site, Hawaii, is delayed due to delays in pilot start.

[4] RUC West. (2018). *Regional RUC System Definition and Pilot Planning Project, Final Report*. October.

Key Findings of RUC West's Approach

RUC West's Phase I efforts have demonstrated that regional coalitions can work to create consensus and efficiencies around the technical and logistical aspects of a mileage-based fee system. Further, a regional body can support the exchange of knowledge and critical information that may be applicable across geographic boundaries, apart from directly addressing issues of how a road usage charge (RUC) system can be interoperable across those boundaries. In the case of RUC West, specifically, the consortium has brought together States that have been conducting RUC pilots for several years, such as Oregon, Washington, and California, and have been building a significant body of knowledge with States like Hawaii, Nevada, and Utah that are relatively recent entrants in this field.

The key findings from RUC West's Phase I activities are summarized below. Given that Phase I did not involve a pilot execution, the evaluation focuses on the key aspects of the consortium's efforts:

- **Interoperability:** RUC West's proposed approach would streamline and clarify the process that would enable interoperability of RUC data and fees between States, while allowing States flexibility in operating the RUC system that best fits their needs. The broad definition of interoperability—encompassing user friendliness, transparency, consistency, scalability, and equity—would address several of the STSFA criteria while ensuring that these considerations are addressed.
- **Compatibility with low-technology options:** Recording and charging for out-of-State mileage requires technology capable of recording and correlating locational data to mileage. However, RUC West member States may still use low-technology options, such as manual reporting of mileage through odometer readings, and could potentially use available travel data averages to estimate out-of-State mileage and fee reconciliation.
- **Enforcement:** Enforcing user compliance with RUC is more complex than collecting a fuel tax, and the public is not likely to support a funding system with enforcement that is perceived to be weak (i.e., where individuals can easily avoid paying RUC). Agencies may also address enforcement issues by increasing the role of the private sector.
- **Costs:** System administrative costs can be kept low by exploring economies of scale through mechanisms such as regional RUC systems and the use of a limited number of account managers.
- **User privacy:** In order to encourage public acceptance of RUC, agencies would want to offer choices to drivers on mileage reporting options and maintain a high level of transparency on data collection, retention, and usage. This would be in addition to following best practices in data security and protection.
- **Equity and public perception:** The public may already have several equity concerns regarding an RUC system. It is important for States engaged in pilots to analyze any adverse equity impacts and develop strategies to mitigate these concerns. States should also develop appropriate communication and outreach material to reassure the public when adverse impacts do not exist.
- **Ease of use and public acceptance:** While ease of use is a stated goal for the RUC mileage data collection method, it is not currently met by several technologies that have been explored among the RUC West pilots. Further exploration, particularly in getting in-

vehicle telematics data directly from original equipment manufacturers, appears to be a promising way forward; however, concerns with data sharing would need to be resolved in future efforts in this direction.

CHAPTER 1. INTRODUCTION

As vehicles become more fuel efficient, the reliability and adequacy of the motor fuel tax as a primary source for transportation infrastructure funding has come into question. Recognizing this trend, the Fixing America's Surface Transportation (FAST) Act[5] of 2015 established the Surface Transportation System Funding Alternatives (STSFA) Program. The purpose of this program is to provide grants to States or groups of States to demonstrate user-based alternative revenue mechanisms that employ a user-fee structure to maintain the long-term solvency of the Highway Trust Fund.

> *"As states struggle to keep pace with increasing funding shortfalls and maintenance backlogs, lawmakers are exploring innovative approaches to increase revenues for transportation…A [road usage charge] goes one step further, potentially eliminating the need for a gas tax altogether, by charging drivers on a per-mile-driven basis. Proponents see this as a way to increase transportation revenues even as fuel purchases decrease and vehicle miles traveled increases, due to improved vehicle efficiency."*
>
> Source: National Conference of State Legislatures, "Road Use Charges (RUC)" webpage. Last accessed April 5, 2019.

By funding road usage charge (RUC) pilots, the U.S. Congress and the FHWA seek to understand whether a user-fee structure, such as an RUC, could be implemented nationally in the future. As part of this endeavor, FHWA evaluated seven of the eight grantee sites that received funding in Federal fiscal year (FY) 2016, also referred to as Phase I of the STSFA grant program.[6] The evaluation reports will inform the Secretary of Transportation and U.S. Congress of the progress that has been made, lessons learned from initial pilot and planning efforts, the role of education and outreach, the potential for any negative impacts on constituents, and initial findings on administrative fees, among others.

Staff from Federal Highway Administration (FHWA) Headquarters in the Office of Operations have the overall responsibility for administering the program. The FHWA Division office staff provide direct support by overseeing the program in participating States. The evaluation team adopted the terminology used by the specific grantee sites in planning and executing their proposed programs. As such, same or similar concepts in different geographies may variably be referred to as mileage-based user fee, distance-based user fee, RUC, or vehicle miles traveled (VMT) fee. Given the lack of a standard definition, these terms will be defined within the context of each grantee's program vision and activities.

RUC WEST'S PHASE I PROGRAM

Founded in 2013 and previously known as the Western RUC Consortium (WRUCC), now RUC West, the multi-State coalition has tackled many policy, organizational, technological, and operational challenges as it searches for a new way to generate and collect revenue to fund transportation infrastructure. When RUC West submitted its STSFA grant application, the coalition included 14 States. As part of the STSFA Phase I Program, RUC West planned to define a regional system to promote and establish RUC consistency, interoperability, and

[5] Public Law 114–94, H.R. 22, § 6020, H.R. 22, 114th Congress (2015).

[6] The Phase I evaluation for the eighth pilot site, Hawaii, is delayed due to delays in pilot start.

compatibility throughout the western United States. At the time of the grant application, four of the RUC West member States had gained legislative approval to conduct RUC pilot tests (Oregon, California, Utah, and Washington). The project cost was $1.9 million, of which $1.5 million was funded by STSFA.

> *"The most valuable lesson learned from this project is that a regional RUC system is possible. Each state has its own requirements-- different RUC rates, public funds laws, methods of fuels tax collection and disbursements, and overall politics— but this project demonstrated that a regional system can be built to be agile enough to accommodate each states' needs, but yet also prescriptive enough to seamlessly function for drivers."*
>
> *~Final RUC West STSFA Report*

RUC West member States are organized into three tiers based on their current level of involvement in advancing RUC in their jurisdiction:

- Tier 1: Enacted policy to implement RUC programs—Oregon and Utah.
- Tier 2: Testing RUC through pilot programs—California, Colorado, Hawaii, and Washington.
- Tier 3: Research RUC Concepts—Alaska, Arizona, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Texas, Wyoming.

RUC West's vision at the beginning of Phase I was to define a regional system that embraces the following attributes, which would provide the flexibility needed to accommodate each State's institutional and operational environment. The ideal system would:

- Employ per-mile charging, variable by State of vehicle registration, for passenger vehicles.
- Use an open system architecture model to foster competition in the market for providing RUC services.
- Offer choices for participants regarding how an RUC would be assessed and paid, including, but not limited to: mileage reporting technology, mileage reporting detail (e.g., Global Positioning System [GPS] and non-GPS) and account managers (both private and public sector).
- Be interoperable, supporting the seamless transfer of information between disparate State systems.
- Be able to accommodate both illustrative and actual billing.
- Support and foster administrative cost efficiencies and economies of scale for all parties.
- Incorporate a system design that would not preclude congestion pricing.
- Use industry standards and best practices for system reliability and security, including compatibility with readily available and affordable consumer products and technologies, such as smartphones, in-vehicle navigation systems, and other data-dependent vehicle technologies.

The two main project accomplishments of RUC West's Phase I program included creating:

- A high-level concept of operations (ConOps) that outlined the basic principles of how a regional RUC system will function for future pilots and that all 11 participating States agreed on.
- A detailed system and business requirements based on the California and Oregon pilots.

Further details about the Phase I program are provided in chapter 3.

ORGANIZATION OF THIS REPORT

Chapter 1 of this report introduces the user-fee concept, and the background and purpose of the pilot.

Chapter 2 details the activities RUC West planned and accomplished under Phase 1 of the STSFA grant program or the FY 2016 grant cycle.

Chapter 3 presents the evaluation framework as proposed under the 2016 Notice of Funding Opportunity and the key USDOT questions that the evaluation seeks to address, and the evaluation team's approach.

Chapter 4 provides the major findings from evaluation of Phase I activities, including lessons learned, findings and outcomes as observed by the evaluation team, and suggestions for further exploration through the course of future efforts towards an alternative revenue program.

Chapter 5 summarizes the key takeaways from Phase I activities and lessons learned that would be relevant for a national implementation of a mileage-based fee program.

CHAPTER 2. SYSTEM DEFINITION AND PILOT PLANNING PROCESS

This chapter describes the Phase 1 efforts of the RUC West with the system definition and pilot planning project, including the program objectives and a summary of activities conducted under Phase I of the STSFA grant program during the FY 2016 grant cycle.

BACKGROUND

As noted in chapter 1, RUC West is a voluntary coalition of 17 western State DOTs that are committed to collaborative research and development of a new method for funding transportation infrastructure based on drivers' actual road usage. The fundamental vision behind RUC West recognizes that States that individually implement RUC programs have variability in how the program operates. However, there is also a need for some consistency and commonality among such factors as the basic technologies used and their associated standards, the ability to leverage economies of scale for the private sector, and policies regarding travel in other States.

The goal of this coalition has been to build public sector organizational capacity for and expertise in RUC systems and their associated policy, administrative, and technology issues. RUC West provides a collaborative forum to share information and best practices, discuss issues, observe and learn from other public agencies that are at different stages of testing and implementation, and facilitate joint research, thereby achieving economies of scale.

At the time RUC West submitted its STSFA grant application, it had 13 projects planned or ongoing that addressed varying policy considerations for RUC. Table 1 summarizes these projects and the 2016 Notice of Funding Opportunity requirements of the STSFA that the projects do or did address.

Table 1. Projects funded by the Western Road Usage Charge Consortium prior to the 2016 Surface Transportation System Funding Alternative initiative.

Scope	Notice of Funding Opportunity: Statutory Areas Addressed
Cross-Examination of Oregon Road Usage Charge (RUC) Program	
Peer review of the Oregon RUC and forward compatibility with other western States.	• Implementation, interoperability, public acceptance, and potential hurdles to adoption of the demonstrated user-based alternative revenue mechanism. • Privacy protection. • Use of independent and private third-party vendors. • Equity concerns. • Ease of user compliance. • Reliability and security on the use of technology. • Flexibility and user choice. • Cost of administering the system. • Auditing and compliance/enforcement.

Table 1. Projects funded by the Western Road Usage Charge Consortium prior to the 2016 Surface Transportation System Funding Alternative initiative. (continuation)

Scope	Notice of Funding Opportunity: Statutory Areas Addressed
Roadmap for State Consideration of a RUC System	
Compiling best practices for RUC policy development and creating a roadmap for State consideration of RUC, including common issues raised and frequently asked questions.	• Implementation, interoperability, public acceptance, and potential hurdles to adoption of the demonstrated user-based alternative revenue mechanism.
Key Elements for a RUC Vendor Certification Program Available to Multiple States	
Establishing the approach, objectives, and plans for deploying a standard multi-State RUC vendor certification program for a RUC system across multiple States, including processes and mechanisms for certifying account managers at the regional level.	• Interoperability. • Use of independent and private third-party vendors. • Flexibility and user choice. • Cost of administering the system. • Auditing and compliance/enforcement.
Addressing Out-of-State Drivers in a RUC System	
Analysis and development of options for collecting a RUC from out-of-State drivers; identification of possible approaches, as well as the costs and revenues associated with alternatives, including international concepts.	• Interoperability. • Potential hurdles to adoption of the demonstrated user-based revenue mechanism.
Effects of RUC on Rural Residents	
Examines urban/rural fiscal impact issues.	• Equity concerns.
Impacts of Changing Vehicle Fleet Fuel Economy on State Transportation Funding	
Framework for forecasting the impact of alternative fuel and fuel-efficient vehicles on State funding.	• Flexibility and user choice.

Table 1. Projects funded by the Western Road Usage Charge Consortium prior to the 2016 Surface Transportation System Funding Alternative initiative. (continuation)

Scope	Notice of Funding Opportunity: Statutory Areas Addressed
RUC Communications Task Force	
Establishes a communications task force and a phased communications program that includes creation of a Western RUC Consortium website and development of a communications tool kit on RUC.	• Privacy protection. • Public acceptance and potential hurdles to adoption of the demonstrated user-based alternative revenue mechanism. • Ease of user compliance.
Protection of Privacy in a RUC System	
Established foundation and future policy considerations for protecting driver privacy throughout the western region; identified standards and comparing those against current best practices (ride hailing companies, tolling, and account managers currently using).	• Privacy protection. • Reliability and security on the use of technology.
Evasion and Potential Enforcement Policy Options[1]	
A literature review of methods to minimize RUC payment evasion and enforcement policy options.	• Auditing and compliance/enforcement.
Web-Based Cost of Transportation Calculator	
Online calculator lets consumers compare RUC versus gas tax.	• Ease of user compliance.
RUC Payment Options at the Gas Pump (Point of Retail Sales)[1]	
Examination of options to collect RUC at point-of-retail sale for purchase of fuel or electricity.	• Ease of user compliance.

Table 1. Projects funded by the Western Road Usage Charge Consortium prior to the 2016 Surface Transportation System Funding Alternative initiative. (continuation)

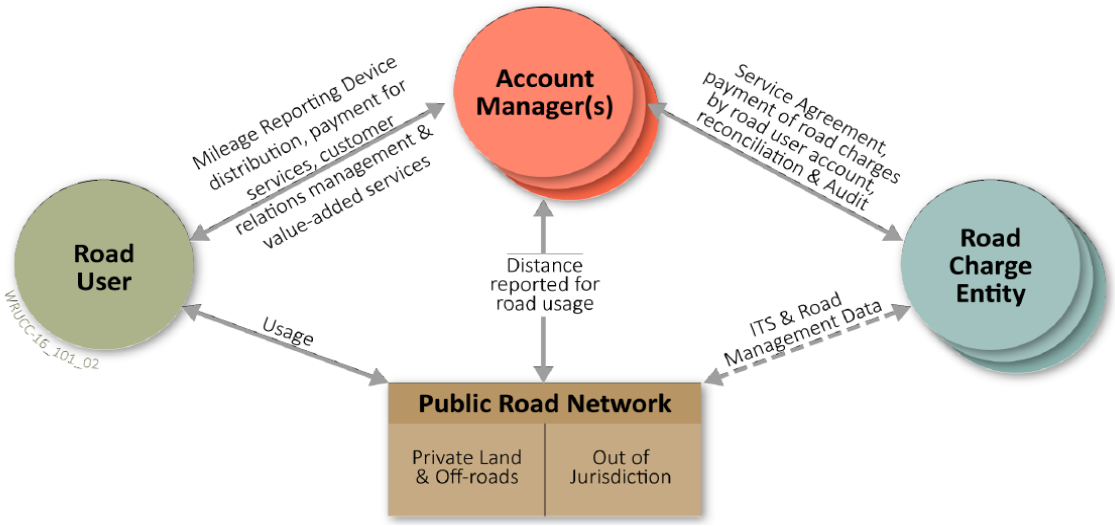
Scope	Notice of Funding Opportunity: Statutory Areas Addressed
Procedures for Distribution of County/City Portions of Taxes/ Indexing for Local Jurisdictions with a Local Gas Tax[1]	
Examination of procedures for distributing RUC revenues to local entities that now receive dedicated fuel tax revenues, inflation indexing revenues from indexed fuel tax.	• Potential hurdles to adoption of the demonstrated user-based revenue mechanism. • Auditing and compliance/enforcement.
Parameters for RUC Rate[1]	
Examination of congestion pricing and the parameters for the basis of a RUC.	• Congestion mitigation. • Equity concerns.

Source: Western Road Usage Charge Consortium. (2016). STSFA Grant Application, "Regional Road Usage Charge System Definition and Pilot Planning Project."
[1] Project currently under development.

SURFACE TRANSPORTATION SYSTEM FUNDING ALTERNATIVES PHASE I PROGRAM SUMMARY

RUC West contends that RUC policies, strategies, and administrative and technical solutions must take the variability in how each State operates into consideration. At the same time, certain consistencies and commonalities are necessary (e.g., basic technologies and associated standards, providing economies of scale for the private sector, policies regarding travel in other States) to most effectively enable a multi-State approach. As defined in chapter 1, the coalition's vision is to define a regional system that embraces a series of attributes that would provide the flexibility needed to accommodate each State's institutional and operational environment.

Figure 1 shows the conceptual model for an open-system, multi-State RUC program as envisioned by RUC West at the start of the Phase I program.



Source: Western Road Usage Charge Consortium.

Figure 1. Diagram. Conceptual open system model for a multi-State road usage charge program.

Table 2 shows the involvement of the various RUC West States in the STSFA-funded efforts. These funds supported a two-phase effort involving system definition of a multi-State pilot (Phase 1A) and the development of essential regional pilot project plans (Phase 1B). As shown in table 2, 11 RUC West States are participating in one or both of these phases, which will help ensure that most concerns and interests will be addressed. After these initial system definition and pilot planning activities, the coalition will conduct a multi-State pilot (Phase 2) using 2017 STSFA grant funding, awarded in fall 2017.

The two main project accomplishments of RUC West's Phase I program were creating:

- A high-level concept of operations (ConOps) that outlined the basic principles of how a regional RUC system will function for future pilots, and on which all 11 participating States agreed.
- Detailed system and business requirements based on California and Oregon pilots.

Table 2. Member State involvement in regional pilot project phases.

Participating States	Phase 1 Pre-development Work		Phase 2 Pilot Demonstration[1]
	Phase 1A System Definition	Phase 1B Project Planning	
Arizona	✓	–	–
California	✓	✓	✓
Colorado	✓	✓	–
Hawaii	✓	–	–
Idaho	✓	–	–
Montana	✓	–	–
Nevada	✓	–	–
Oklahoma	✓	–	–
Oregon	✓	✓	✓
Utah	✓	–	–
Washington	✓	✓	–

Source: Western Road Usage Charge Consortium. (2016). STSFA Grant Application, "Regional Road Usage Charge System Definition and Pilot Planning Project."
Note: New Mexico, North Dakota, and Texas are not currently designated as having roles in any of the phases; however, their input may still be sought as part of capturing requirements in Phase 1A activities.
[1] California and Oregon are pursuing State policy approval during Phase 1 that would allow for participation in the Phase 2 regional pilot demonstration to begin in fiscal year 2018. Other States may use the Phase 1 activities to educate legislators, building the necessary policy and legislative backing for participation in the regional pilot demonstration.
– = not participating.

The common concept of operations addressed the following topics:

- Identification of the system stakeholders and their roles, including the following primary stakeholders: RUC West, participating States, drivers/users, business partners and a regional clearinghouse, and the following secondary stakeholders: legislators/policy makers, Federal agencies, general public, and professional organizations.
- Overarching system needs and goals, including State needs and user needs.
- Functional architecture, including mileage and data collection and processing, regional consideration, and approaches and system functions.
- Operational scenarios defining, at a high level, the roles and responsibilities of all the primary stakeholders for program aspects such as enrollment and account access, user driving scenarios, invoicing and account management scenarios, data aggregation and reporting, and enforcement and compliance.
- Organizational composition defining the proposed organizational structure, roles of participating States, and other related activities.

- Failure scenarios, including user-oriented, business partner, and regional clearinghouse failure scenarios.

The key RUC West Phase I activities included:

- Research: conduct of workshops and interviews
- Planning: development of Concept of Operations and Pilot Evaluation, Oversight and Management report
- Design: development of contract documents and administrative systems assessment
- Communications: development of communications plan, media and folios and website.
- Procurement: support for vendors and future considerations.

Communications

Member States were engaged in developing and refining the communications resources created for this effort, including subject matter folios, a communications plan, media kits, and a website. The work products included:

- Information folios (briefing on key issues) on topics such as data privacy, rural drivers and communities, fuel-efficient/electric vehicles, future of transportation funding, and measuring miles traveled beyond jurisdictional borders.
- RUC West produced three media kits that can be modified and issued as press releases by member States prior to, during, and following the multi-State pilot.
- A communications plan that serves the goal of building awareness, participation, key messages, messaging strategies, and understanding of the Regional RUC Pilot Project and road usage charging leading up to and during the 1-year multi-State pilot.

Procurement and Future Policy Considerations

RUC West prepared and issued a request for information that was advertised by Oregon DOT. Private-sector vendors who may one day serve as RUC business partners were invited to answer a set of questions to gauge their interest in a regional RUC pilot, provide comment on the contract documents, and identify any key considerations RUC West should address prior to releasing a request for proposal. The request for information responses led to RUC West conducting in-depth interviews with four vendors, with a summary of the interview results provided in a technical memorandum. The interviews provided the following topics for future policy consideration:

- The size of the participant pool.
- Participant recruitment and enrollment efforts.
- Policy considerations (e.g., how to compensate and incentivize private-sector vendors).
- Standardization of certification of vendors across States.
- Interaction of clearinghouse with other State agencies, such as departments of motor vehicles.

Needs Gathering and Research

Workshops

RUC West conducted a total of nine workshops with RUC West member States. Three workshops were convened for the initial development, refinement, and review of the concept of common operations (CCO). Two workshops each were conducted for the Pilot Evaluation Plan and Pilot Oversight and Management Plan. Five workshops were convened for the development of the communications plan and other outreach and messaging materials.

State Interviews

RUC West started the Phase I activities by conducting interviews with the 11 member States, which involved discussions around each State's experience with and understanding of RUC and their individual perspectives of the regional RUC considerations, business partners and authorities, or limitations around sharing information and funds across multiple States through a potential RUC clearinghouse.

Planning Activities

RUC West's project team developed several planning documents for the multi-State RUC pilot and a potential future system. These materials were initially developed through workshops with RUC West member State representatives, subsequently refined, reviewed by all participating States, and finalized in a concluding workshop:

- The CCO describes how an open architecture, regional RUC program will function to include roles, responsibilities, and interactions of each key system stakeholder. It is structured to allow the independent operation of multiple State RUC programs while supporting the collection and transfer of RUC revenues and data across multiple State jurisdictions.
- The Pilot Evaluation Plan will be used to gauge the success of the multi-State pilot against evaluation criteria. The evaluation plan will use data provided by business partners, pilot participants, participating State agencies, and the regional clearinghouse to provide quantifiable results on how well the multi-State pilot performed.
- The Oversight and Management Plan provides an organizational structure and the roles and responsibilities for administering a future program. The program manager will oversee pilot activities, evaluate and manage program risk, and provide governance from the Steering Committee to business partners, a regional clearinghouse, and States.

Technical Design

RUC West developed technical documents and assessments to complement the concept planning activities and to support subsequent pilot operations and administration for a regional RUC system. In addition to the CCO described above, RUC West also developed the following technical documentation:

- **Business requirements document:** Provides non-technical rules for conducting business, such as payment remittance, data transfers, audit support, and financial reporting.

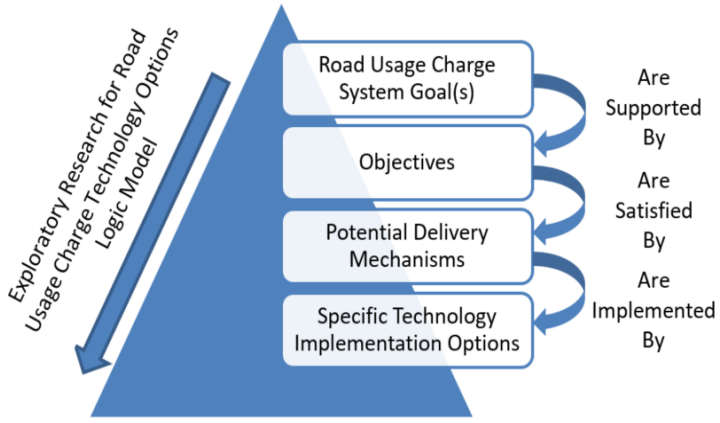
- **Interface control document:** Provides technical specifications for all system and subsystem interfaces.
- **System requirements specifications:** Outlines the technical and functional requirements for the regional RUC pilot system and the specific subsystem requirements for the data collection, data processing, administration, and clearinghouse subsystems.
- **Service-level agreement:** Serves as an agreement between business partners and RUC West that defines the expected levels of required services, such as customer service, hardware provisioning, reporting, and data protection to be provided over the course of the pilot.
- **Verification cross-reference index:** Cross-references requirements from the business requirements document, interface control document, and system requirements specifications, providing details on how systems and processes will be certified.
- **Administration collaboration:** RUC West convened a full-day workshop with technical staff from Oregon DOT, the California Department of Transportation, Colorado DOT, and Washington DOT to assess the Oregon DOT's RUC accounting system as a potential administrative support system for the upcoming multi-State pilot. Attendees discussed technical issues associated with Oregon DOT's RUC accounting system interaction with other State systems, resulting in consensus of key operational aspects and refinements to the technical documents.

CHAPTER 3. INDEPENDENT EVALUATION METHODOLOGY

This chapter summarizes the independent evaluation approach and methodology. The study team completed this work in coordination with FHWA staff from the Headquarters Office of Operations and Division offices, as well as representatives of the respective grantee sites. This chapter defines the evaluation framework and includes responses to key questions that the U.S. Department of Transportation (USDOT) expressed about RUC approaches and their viability and characteristics if implemented on a national scale.

EVALUATION APPROACH

As its name suggests, the fundamental concept of an RUC is that users pay a direct charge for the use of a roadway. However, it is important to understand that both "use" and "user" can be defined in several different ways, and the mechanism by which a charge is levied can also vary significantly. This is evident among the Phase 1 participants, all of which are using different combinations of technologies and various paradigms and mechanisms to levy charges. Often, the fundamental objective of the RUC system is a significant factor in identifying the technology options, data collection, and methods for levying fees. Previous research has characterized this phenomenon through an RUC logic model, as illustrated in figure 2.



Source: HDR Inc.

Figure 2. Diagram. Exploratory research for road usage charge technology options logic model.

One essential component of this evaluation was trying to understand the fundamental objectives of the RUC systems as deployed by the grantee sites. The objectives provided overarching insight into more detailed assessments and the evaluation of the efficacy, costs, and scalability of the systems at a regional or national level. Please see the discussion in the Evaluation Process section for a summary of how the study team conducted this evaluation.

EVALUATION FRAMEWORK – U.S. DEPARTMENT OF TRANSPORTATION QUESTIONS

Table 1 presents the key questions that USDOT intends to examine as part of this evaluation. The evaluation team elaborated on the questions and defined the relevant metrics for conducting the evaluation for the specific grant site. While the evaluation team found some questions to be highly applicable to RUC West's Phase I activities, others were marginally applicable. Table 3 provides the assessment framework, and table 4 provides the system attributes relevant to the evaluation.

Table 3. Assessment framework.

No.	U.S. Department of Transportation Evaluation Question	Relevant Site Question/Metrics	Applicability to RUC West's Phase I Activities
Q1	What is the viability of RUC on a nationwide scale?	What are the lessons learned from collaborating with multiple States on RUC implementation?	Moderate
Q2	Would the fee assessment and collection mechanisms be scalable?	What are the results of technology and manual reporting options?	Moderate
Q3	What is the efficiency of the fee assessment and collection relative to the fuel tax?	What are the costs of RUC collection?	Low
Q4	What are the system attributes and characteristics of the RUC systems with respect to: privacy, security, user acceptance, ease of use, ability to audit, charging accuracy, reliability, equity, ability for a user to circumvent the charge, and other factors?	See Table 4 for detailed metrics.	Moderate
Q5	What is the user and stakeholder perception of RUC in general and of pilot activities?	What are some of the key inputs received from public outreach, and stakeholder engagement?	High
Q6	What changes in institutional and financial setting, frameworks, models, and elements are required?	What are the potential organizational structures and institutional considerations for implementing a regional RUC?	Moderate
Q7	What is the financial sustainability of each pilot deployment?	Have you evaluated the financial sustainability of the pilot deployment?	Low

Table 4. System attributes.

Functional Parameter	Description
User-Orientated Parameters	
Privacy	The nature of the information being collected as opposed to the integrity of the information.
Equity	How user costs and other outcomes will impact people in different income brackets and people of different races/ethnicities, gender, English proficiency level, and travel mode.
Potential for value-added services	The ability to add other transportation-related applications or software to the system to enhance system performance, reduce congestion, and improve mobility.
Ability to audit	Extent to which an individual can contest their charges and have visibility into how those charges were accrued and assessed.
Ease of use/public acceptance	The degree to which the system use is straightforward and time that a participant needs to spend interacting with the installed system is minimized; the level of acceptance by the traveling public.
Transparency	User awareness, specifically in real-time, of what users are being charged.
Cost to user	Cost of equipment or installation to the end-user and cost of the per-mile (or other) charge.
System-Orientated Parameters	
Data/communications security	Data source integrity and storage, transmission, and access.
Charging accuracy	The system's ability to assess the expected charge for each use of the roadway.
Charging precision/repeatability	The system's ability to produce a consistent assessment of fees repeatedly for identical travel.
System reliability	System up-time.
Flexibility to adapt	Ability of the technologies and systems to be upgraded or updated.
Flexibility to expand	Ability of the system to respond to increased demand/system capacity and add technological capabilities.
Interoperability	Ability for the system to interact and exchange information across multiple jurisdictions.
Compatibility with low technology	Assessment based on the system's ability to accommodate users that cannot utilize the technology.
Evasion	Evaluation of how easily the system can be circumvented.

Table 4. System attributes. (continuation)

Functional Parameter	Description
System-Orientated Parameters	
System costs	Understanding of the full spectrum of investment costs, including initial capital, operating, and maintenance costs.
Ease of enforcement	Ability of law enforcement to identify travelers that have evaded the system.
Cybersecurity	Extent to which the system is vulnerable to a cyberattack or release of private information.
Ability to reallocate revenue	Extent to which the system collects information that can be used to inform allocation of revenue.

EVALUATION PROCESS

The evaluation team devised an approach centered on periodic interfaces with the grantee agencies, including a site visit with a subset of grantees conducting pilot deployments, to better understand the rationale and outcomes for Phase I activities.

Kickoff Meeting

At the start of the evaluation, the team conducted 90-min kickoff meetings with each of the grantee sites. The primary purpose of this call was to introduce the goal and scope of the evaluation to the grantees and obtain information about the grantees' Phase I goals, scope, and timeline. The evaluation team requested program documents compiled up to that point and updated project management plans.

Development of Evaluation Reports

The information collected during the interviews and workshops and through review of RUC West's project reports comprise the key inputs for developing this evaluation report. Note that as with the other grantee sites, RUC West's Phase I tasks did not directly address all the Federal evaluation criteria.

Chapter 4 includes the major findings related to aspects that Phase I directly addressed.

CHAPTER 4. MAJOR FINDINGS

This chapter presents an overview of the RUC West's proposed RUC system and a summary of key findings and lessons learned resulting from its Phase I efforts. The findings are presented in accordance with the evaluation framework provided in chapter 4 that is based on the STSFA grant evaluation criteria as provided in the notice of funding opportunity.[7] RUC West's Phase I scope included pilot planning and set up activities, but a pilot was not launched. As such, several evaluation criteria were not directly addressed within the scope of grant-funded activities. RUC West may be addressing additional aspects of an RUC system with non-Federal funds and/or may anticipate addressing some aspects in the future as it advances towards executing a pilot. Given the limitations of scope of this effort, this chapter includes detailed discussion only on the attributes of the proposed system that were explored, examined, or tested during Phase I.

OVERVIEW OF RUC WEST'S MILEAGE-BASED FEE SYSTEM

The functional architecture proposed in RUC West's concept of common operations (CCO) is derived from various RUC pilots conducted in Oregon, California, and Colorado.

The CCO also explores the various manual and automated methods of reporting mileage and other data, such as vehicle identification number and fuel usage. With automated approaches, this information is transmitted to a business partner via secure wireless communications.

For some automated methods, location and routing data may also be collected—as selected by the vehicle owner/lessee—to differentiate between mileage driven out-of-State and on private roads, and also in support of in-vehicle and driver-oriented services. Manual methods include recurring odometer readings, pre-paying for mileage blocks, and time-based flat-rate fees involving no mileage reporting. These manual methods involve drivers providing some vehicle information (e.g., vehicle identification number and odometer readings) to a business partner, but very little or no personally identifiable information (PII). They can also be offered to those vehicle owners and lessees who either chose not to or could not use a technology base.

The CCO further identifies the various tasks associated with mileage data collection and processing, including transaction processing, account management and reconciliation, administration, and data transfer. However, it also acknowledges that while this RUC architecture has worked well for individual State pilots, the required information and data flows can be very high for a regional pilot involving multiple States. As such, the CCO proposes two scenarios: the same business partners being used by all participating States.

Different business partners being used by each participating State. Further, the CCO proposes setting up a regional clearinghouse to perform the following functions:

- Receiving funds from each business partner, with supporting documentation, including differentiation of miles by State and the associated fuel taxes credits.
- Processing the received documentation to determine the amount of RUC funds allocated to each State based on number of miles driven within each State, less the fuel taxes credit based on each respective State's fuel taxes value.

[7] USDOT Notice of Funding Opportunity Number DTFH6116RA00013, issued on March 22, 2016.

- Transferring the funds to each State. (Note: The duration for which the regional clearinghouse can hold funds before depositing them to the States' designated accounts is dependent on the relationship between each participating State and the regional clearinghouse, as well as any laws within each participating State related to funds withholding.)
- Supporting reciprocity agreements between each participating State, including collecting and transferring RUC program revenues.
- Performing audit functions for the business partners and participating in State audits of the regional clearinghouse.
- Supporting compliance and enforcement efforts across States.
- Conducting participant vehicle validation, including interfacing with State departments of motor vehicles.
- Certifying business partners and their methods and technologies for the region.

SYSTEM-ORIENTED PARAMETERS

This section summarizes the system-oriented parameters addressed directly by RUC West's STSFA Phase I activities. The primary STSFA evaluation parameters RUC West addressed in this phase include interoperability, compatibility with low-technology options, and system costs. Because RUC West is a multi-State coalition and does not recommend specific technologies, several aspects of the pilot related to specific technologies—such as data and communications security, flexibility to adapt and expand, charging accuracy, user payment evasion, and enforcement—have not been detailed at this stage. However, RUC West's CCO document does outline these as key considerations for a multi-State pilot.

Interoperability—The Ability of the System to Interact and Exchange Information across Multiple Jurisdictions

The ability to expand RUC West's approach would greatly depend on the RUC framework that States eventually adopt. One of the key goals of RUC West's approach is that it promotes the aggregation and sharing of data and fees between member States to allow in-State and out-of-State mileage to be allocated appropriately. This approach requires States to adopt a base set of requirements addressing data collection, reciprocity between States, and the ability to access and work with a regional clearinghouse to distribute data and fees.

RUC West envisions the RUC approach to be technology agnostic; therefore, as long as the data produced and submitted to the regional clearinghouse are collected and formatted to the requirements, the system could expand to other States that are operating or starting to operate their own RUC system.

Interoperability among the different RUC systems used by the participating States presents several challenges and will likely become more complicated as the scale, complexity, and number of systems being tested increases. RUC West has created a framework for identifying many of the questions that will need to be resolved and provides an overall architecture for how such a system would function regionally.

The stated mission of RUC West is to: "…collaborate and coordinate between various member states and their elected, public, and private stakeholders to develop a regionally coordinated RUC system. RUC West will enable interoperability of RUC systems between its member states by setting the basic standards and practices for RUC implementation without dictating specific mechanisms to individual states for meeting those standards and practices."[8]

RUC West is essentially designed to allow and promote interoperability among States, with each State having the ability to implement its own variety of RUC system. The ConOps states this approach succinctly: "…a structure sufficient to allow independent operation of multiple state programs while providing the foundational elements needed to collect and transfer RUC revenues and data across multiple state jurisdictions needs to be developed."[9]

RUC West's ConOps outlines the data that would need to be accurately collected for the system to function, as follows:

- Vehicle identification number.
- The number of miles traveled.
- The per-mile rate(s) to be applied.
- The amount of fuel purchased (for the purpose of providing a credit for the amount of fuel taxes paid).
- The per-gallon fuel tax rate(s) to credit (where applicable).
- Accurate delineation between miles traveled within different States (Note: this is ONLY required for regional RUC programs that do not have a single per-mile rate and fuel-tax rate).
- The location of miles driven.
- Time of day the miles were driven.
- Specific driving incidents (e.g., lengthy idle times, hard braking incidents, and other congestion-related measures).
- Ways to incorporate multiple, variable RUC rates and the considerations of how those rates should be calculated and assessed between multiple States.

Through the process of engagement with its member States, RUC West has created a recommended architecture for how data and fees can be submitted and allocated among those member States for mileage driven within the Western RUC region. RUC West studied a number of approaches for structuring a regional RUC system. The recommended approach uses a regional clearinghouse that would coordinate among the business partners, account managers (if used), and the States. All data and fees would be transferred from the business partner or account manager to the clearinghouse, where the fees and data would be reconciled and distributed to member States based on the location of mileage driven:

> The Data Clearinghouse capability supports the collection, aggregation, and dissemination of all RUC data collected from each Business Partner, to each participating state, and potentially, monitoring states, and RUC West.[10]

RUC West conducted two workshops during 2018 with the participating States. The workshops resulted in the articulation of a broad vision of interoperability encompassing the following system attributes:

[8] RUC West. (2018). RUC West Pilot Project, Common Concept of Operations. February.

[9] Ibid.

[10] RUC West. (2018). *RUC West Pilot Project, Common Concept of Operations*. February.

- **User-oriented:** Users should not have different devices, accounts, or reporting or billing systems when traveling across State borders. Driving miles across multiple States should be seamless to the user.
- **Feasible:** System complexities are minimized and practical to administer.
- **Transparent:** Users should clearly understand which RUCs are being assessed and paid. Furthermore, States should be able to easily verify and audit both assessed and paid revenues without the need for administrative complexities.
- **Consistent:** Systems, messages, and themes should be consistent across platforms to alleviate confusion from the users. This implies consistency in terms of messaging and communications (including outreach and education) to States, vendors, and system users (i.e., RUC payers). For example, communications explaining the business case for transitioning to an RUC program or the overall objectives of RUC implementation should incorporate consistent messages, themes, and resources across State lines.
- **Equitable:** Although the concept of equity does not necessarily have technical implications for this effort, it is an important concept from a policy perspective and has significant implications for future governance. The regional RUC program should perform at the same level for each participating State regardless of the contractual arrangements between an individual State and the business partners.

Two variations of the overall approach were offered. One approach that was developed through State interviews with RUC West members is for the participating States to procure their own business partners (in accordance with the system requirement), with the regional clearinghouse providing testing and certification activities of these business partners across States. The ConOps recommends that this architecture may be most appropriate for a regional RUC system involving several States. It would involve a regionwide set of business partners (rather than unique business partners for each State) with a regional clearinghouse.

Compatibility with the Low-Technology Option

RUC West's framework does not preclude States from adopting low-technology options. However, the ability to accurately record and reallocate fees for out-of-State driving requires technology capable of recording and flagging out-of-State mileage. Current versions of these technologies include Global Positioning System (GPS)-enabled devices that record the time and place of mileage driven and are able to determine the number of miles driven in each State, allowing a straightforward reconciliation of fees between States.

Key Finding: **RUC West's proposed approach would streamline and clarify the process to enable interoperability of RUC data and fees between States while allowing each State the flexibility in operating the RUC system that best fits its own needs. The broad definition of interoperability—encompassing user friendliness, transparency, consistency, scalability, and equity—would address several of the STSFA criteria while ensuring that these considerations are an integral part of the concept for the proposed interoperable system.**

Several RUC West member States are testing or have tested different approaches to low-technology options. The ConOps gives some consideration to these approaches and how the issue may be addressed:

> An important consideration is whether data collection and analyses – and the associated costs – are necessary to estimate out-of-state travel, beyond what location-based approaches can provide…The amount of work-related cross-state travel is relatively small for the western states. The possible exceptions might be travel between the Portland, Oregon and Vancouver, Washington metro areas, and between Southern California and Las Vegas, Nevada. In these circumstances, origin-destination studies might be useful to allocate mileage between states for vehicles that don't have location technology.[11]

In terms of manual mileage data collection options, RUC West's ConOps explored the flat-rate time permit where participants purchase unlimited road use for a specific time period and odometer reading, where the usage fee is based on actual mileage collected from odometer readings. While not specifically outlined in the ConOps, what this means is that member States would potentially have the option to estimate the number of miles driven and allocate funds based on these estimates. The issue that may arise with this approach would be between States with different mileage rates. It would be difficult to determine and charge drivers for higher-fee out-of-State miles if location data are not available. Additionally, if a State were to pay an estimated fee on out-of-State mileage that was higher than its own, while only collecting its lower mileage fee from other States, then there will be a net loss in revenue for the State with the lower fee.

Key Finding: **Recording and charging for out-of-State mileage requires technology capable of recording and correlating locational data to mileage. However, RUC West member States may still use low-technology options, and could potentially use available travel data averages to estimate out-of-State mileage and fee reconciliation.**

Enforcement and Compliance

In addition to being low cost, fuel taxes are also relatively easy to enforce, because they are generally paid by distributors; therefore, any vehicle requiring fuel is simply reimbursing the station owner by paying the tax at the pump. However, enforcement of RUC is more complex, and the public is not likely to support a funding system with perceived weak enforcement where individuals can easily avoid paying their fee. Different RUC approaches and supporting technologies will likely have different compliance rates and enforcement costs, with automated methods (e.g., in-vehicle telematics and plug-in mileage reporting devices) having the highest compliance and relative ease of enforcement as compared to methods that require drivers to voluntarily report mileage (e.g., taking a picture of the vehicle's odometer on a recurring basis). Agencies may also address enforcement issues by increasing the role of the private sector for administration and operation of mileage reporting options and linking RUC to value-added services.

[11] RUC West. (2018). RUC West Pilot Project, Common Concept of Operations. February.

Key Finding: **Enforcement of RUC is more complex than a fuel tax, and the public is not likely to support a funding system with perceived weak enforcement where individuals can avoid paying their fee. Agencies may also address enforcement issues by increasing the role of the private sector for administering and operating mileage reporting options.**

System Costs

RUC West's final ConOps made some observations on addressing the issue of system administrative costs.

First, the ConOps acknowledged that gas tax collection is efficient to collect, as it is generally assessed and collected from licensed fuel distributors, which are companies receiving fuel from a manufacturer and then distributing it to local fueling stations where drivers pay the tax. Thus, the key to the success is a relatively small number of collection points and generally high compliance. The key factors contributing to relatively higher costs of an RUC include:

- An exponentially higher number of data collection points if the fee is assessed for each individual vehicle.
- Hardware, wireless communications, and data processing costs associated with using in-vehicle and aftermarket mileage reporting technologies, upon which an RUC often relies.

To mimic the advantages of gas tax collection, the ConOps proposes using a limited number of account managers in combination with or in addition to a regional clearinghouse. The clearinghouse would mimic the current fuel distribution system by helping reduce the number of collection points.

Further, the ConOps considers exploring potential economies of scale with a large (i.e., regional) RUC system. The RUC account manager business would be based on millions of vehicles included in a road charge system, with the road charge component becoming a value-added to the other services they provide to customers.

Key Finding: **System administrative costs can be kept low by exploring economies of scale, such as designing regional RUC systems and using a limited number of account managers.**

USER-ORIENTED PARAMETERS

User Privacy

Perceived and Real

RUC West's ConOps contends that one of the biggest challenges facing RUC implementation will be convincing the public that any data collected on road usage will be protected, and that drivers are not being actively monitored or tracked by the government when they travel. These key issues and considerations include:

- Providing motorists choices for mileage reporting, including at least one approach that does not involve any sort of mileage reporting (e.g., a time-based system).
- Not requiring a location-based approach (i.e., not including specific origins or destinations or travel patterns).
- Stipulating how long the collected data are retained by the account management entity or State government.
- Protecting personally identifiable information (PII) and identifying the scenarios under which it may be disclosed.
- Considering the extent to which private-sector providers and account managers are allowed to share (i.e., sell) collected data to other entities.
- Considering the extent to which data should be anonymized (i.e., removing PII) and aggregated before providing the information to others.
- Offering drivers the ability to opt-in or opt-out of approaches that involve data sharing with other entities or long-term retention of the data, particularly when these individuals are using other services offered by a private-sector provider.
- Allowing individuals access to all personal data collected on them (i.e., to review it for accuracy and to ensure only data required for proper accounting and payment of RUC, and other services if selected, are being collected).
- Providing protections and notifications should a government entity request detailed data (e.g., routes by time of day) from private-sector RUC providers.

Key Finding: **In order to encourage public acceptance of RUC, agencies would want to offer choices to drivers on mileage reporting options and maintain a high level of transparency on data collection, retention, and usage. This would be in addition to following best practices in data security and protection.**

Equity and Public Perception

Disparate Impacts across Populations—Perceived and Real

RUC West's ConOps explores the following chief concerns with equity related to RUC, regardless of specific State programs:

- RUC systems are likely to increase the cost of driving for the owners of electric vehicles and hybrid electric vehicles, which may be viewed as unfair to those who have made conscious decisions to reduce fuel consumption and emissions.
- RUC systems are publicly perceived as being unfair to drivers who travel further on a trip-by-trip basis, because they are based on actual use, and these individuals are, therefore, charged more per trip.

The ConOps also draws from the prior experiences of member States and the coalition to highlight the results of studies related to equity impacts, particularly the following conclusions:

- While rural drivers tend to drive slightly more miles per day than urban residents, they are generally driving older and less fuel-efficient vehicles than their urban counterparts.

Assuming an RUC program will credit any paid fuel taxes back to the motorist, most rural drivers may see a positive impact from participating in an RUC program. In fact, RUC West's prior report on this issue indicates, on average, rural households will pay between 1.9 and 6.3 percent less, while urban households will pay 0.3 to 1.4 percent more State tax in an RUC system than they currently pay in State gas tax.[12] Ranges reflect the differences from State to State.

- Using different rates based on income, average mileage per gallon, and classification of the driver's residence (e.g., urban, rural, mixed, commercial) may be a future consideration.
- As RUC expands, States may encounter international drivers. One example of this is Canadian drivers who also travel on United States roadways. Further studies and demonstrations encompassing Canadian and Mexican national borders should be considered to capture equity along States with international borders.

Key Finding: **The public may already have several equity concerns regarding an RUC system. It is important for States engaged in pilots to analyze any adverse equity impacts and develop strategies to mitigate them, as well as develop appropriate communication material where adverse impacts do not exist.**

Ease of Use and Public Acceptance

The Degree to Which a System Is Straightforward and Accepted by the Public

RUC West's ConOps states that "a long-term goal for RUC may be that the driver will not be required to do much of anything, be it plugging in a device, taking a picture of the odometer, etc."[13] The ConOps also notes that the California road charge pilot program included approximately 60 vehicles where in-vehicle telematics was used to collect RUC information.

> Currently, there are challenges with in-vehicle telematics data as automobile [original equipment manufacturers, or OEMs] are considering that data proprietary and have not been willing to share that data for RUC collection. However, as the public becomes more comfortable with—and often demanding of—enhanced technology on their persons and in their vehicles, it may be that in the future, vehicle owners and lessees will not choose a "RUC technology," per se, but rather they will choose from alternative amenity packages incorporating a variety of services they desire, with RUC being offered as a value-added option to these other driver services. This may support better collaboration with the OEMs and the public sector for the sharing of in-vehicle telematics data to support RUC programs. Another technology area to be addressed is the potential role of Connected and Automated Vehicles in RUC. As research is being conducted on these technologies, specifically the types of data that can be collected and disseminated, the use of that data for processing RUC should also be considered.[14]

[12] *Financial Impacts of Road User Charges on Urban and Rural Households*.

[13] RUC West. (2018). RUC West Pilot Project, Common Concept of Operations. February.

[14] Ibid.

Key Finding: **While ease of use of the RUC mileage data collection method is a stated goal, it is not currently met by the several technologies that have been explored in the RUC West State pilots. Obtaining in-vehicle telematics data directly from OEMs appears to be a promising way forward; however, concerns with data sharing would need to be resolved in future efforts in this direction.**

CHAPTER 5. SUMMARY AND IMPLICATIONS FOR NATIONAL IMPLEMENTATION

The RUC West's Phase I efforts have demonstrated that regional coalitions can work to create consensus and efficiencies around the technical and logistical aspects of a mileage-based fee system. Further, a regional body can support the exchange of knowledge and critical information that may be applicable across geographic boundaries, apart from directly addressing issues of how an RUC system can be interoperable across those boundaries. In the case of RUC West, specifically, the consortium has brought together States that have been conducting RUC pilots for several years (i.e., Oregon, Washington, and California) and have been building a significant body of knowledge with States that are relatively recent entrants in this field (i.e., Hawaii, Nevada, and Utah).

KEY FINDINGS

The key findings of RUC West's Phase I activities are summarized below. Given that Phase I did not involve a pilot execution, the evaluation focuses on the key aspects of RUC West's efforts:

- **Interoperability:** RUC West's proposed approach would streamline and clarify the process to enable interoperability of RUC data and fees among States while allowing them flexibility in operating the RUC system that best fits their needs. The broad definition of interoperability—encompassing user friendliness, transparency, consistency, scalability, and equity—would address several of the STSFA criteria while ensuring that these considerations are an integral part of the concept for the proposed interoperable system.
- **Compatibility with low-technology options:** Recording and charging for out-of-State mileage requires technology capable of recording and correlating locational data to mileage. However, RUC West member States may still use low-technology options and could potentially use available travel data averages to estimate out-of-State mileage and fee reconciliation.
- **Enforcement:** Enforcing user compliance with RUC is more complex than with a fuel tax, and the public is not likely to support a funding system with perceived weak enforcement where individuals seem to easily avoid paying their RUC. Agencies may also address enforcement issues by increasing the role of the private sector for administering and operating mileage reporting options.
- **Costs:** System administrative costs can be kept low by exploring economies of scale (e.g., designing regional RUC systems and using a limited number of account managers).
- **User privacy:** In order to encourage public acceptance of RUC, agencies would want to offer choices to drivers on mileage reporting options and maintain a high level of transparency on data collection, retention, and usage. This would be in addition to following best practices in data security and protection.
- **Equity and public perception:** The public may already have several equity concerns regarding an RUC system. It is important for States engaged in pilots to analyze any adverse equity impacts and develop strategies to mitigate them, as well as develop appropriate communication material where adverse impacts do not exist.

- **Ease of use and public acceptance:** While one of the stated goals of an RUC is to adopt a mileage data collection method that is easy to use, this goal is not currently met by several of the technologies that have been explored in the RUC West State pilots. Obtaining in-vehicle telematics data directly from OEMs appears to be a promising way forward; however, concerns with data sharing would need to be resolved in future efforts in this direction.

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