



Applied Research and Innovation Branch

Colorado Road Usage Pilot Program Final Report

CH2M
WSP
PRR

Report No. CDOT-2017-11
December 2017

The contents of this report reflect the views of the author(s), who is(are) responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views of the Colorado Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

Technical Report Documentation Page

1. Report No. CDOT-2017-11	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Colorado Road Usage Charge Pilot Program Final Report		December 2017	
		6. Performing Organization Code	
7. Author(s) CH2M, WSP & PRR		8. Performing Organization Report No. CDOT-2017-11	
9. Performing Organization Name and Address CH2M 9189 South Jamaica Street Englewood, CO, 80112		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. 316-03	
12. Sponsoring Agency Name and Address Colorado Department of Transportation - Research 4201 E. Arkansas Ave. Denver, CO 80222		13. Type of Report and Period Covered	
		14. Sponsoring Agency Code	
15. Supplementary Notes Prepared in cooperation with the US Department of Transportation, Federal Highway Administration			
16. Abstract In late 2016/early 2017 the Colorado Department of Transportation (CDOT) conducted an operational pilot of the Road Usage Charge (RUC) concept as a possible transportation funding replacement to the state gas tax. The Colorado Road Usage Charge Pilot Program (RUCPP) involved a total of 147 participating vehicles that used one of three mileage-reporting mechanisms to record miles traveled and simulate fees based on that travel. Participants were drawn from transportation stakeholder groups as well as the general public with participation stratified to achieve geographic representation. Participation was also stratified based on vehicular fuel efficiency. Overall support for the operational pilot and the RUC concept itself remained high among pilot participants and there were no major technical issues encountered. A number of policy-related issues were identified throughout the course of the pilot. This report provides a summary of the RUCPP.			
17. Keywords Road Usage Charging, Funding		18. Distribution Statement This document is available on CDOT's website http://www.coloradodot.info/programs/research/pdfs	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 100	22. Price

Colorado Road Usage Charge Pilot Program FINAL REPORT

Prepared for



Colorado
Department of
Transportation

December 2017



Contents

Section	Page
Acronyms and Abbreviations	vii
1 Introduction	1
1.1 The Need for Alternative Funding Mechanisms	1
1.1.1 Existing Colorado Transportation Funding	1
1.1.2 RUC and Transportation Funding Sustainability	3
1.1.3 RUC and Transportation Funding Equity	7
1.2 RUC Initiatives and Research	9
1.2.1 Road Usage Charging efforts in other states	9
1.2.2 Truck Charging Systems	16
1.2.3 RUC Efforts in Colorado	17
1.3 RUC Evolution and Lessons Learned	18
2 Colorado Road Usage Charge Pilot Program	20
2.1 Pilot History	20
2.2 Pre-deployment Activities	21
2.2.1 Baseline Survey	21
2.2.2 Communications	23
2.2.3 Recruitment	30
2.2.4 Soft Launch	36
2.3 Pilot Deployment	39
2.3.1 Pilot Program Goals	39
2.3.2 Enrollment	40
2.3.3 Account Management	44
2.3.4 RUC Reporting	47
2.3.5 Mileage Reporting Device Installation	52
2.3.6 Invoicing and Payment	52
3 Pilot Results	54
3.1 Participant Totals	54
3.2 Mileage Reporting Option Selection	55
3.3 Geographic Stratification	56
3.4 Vehicular Stratification	57
3.5 Road Usage Charges Assessed for Participants	57
3.6 Participant Perceptions	59
3.6.1 Pre-Pilot Survey	60
3.6.2 Mid-Pilot Survey	61
3.6.3 Closing Survey	67
3.7 Summary of System Performance	80
3.8 Technical Issues	81
3.9 Administrative Issues	82
4 Outstanding Policy Considerations	83
4.1 User-Oriented Policy Considerations	84
4.1.1 Fiscal Impact Compared to the Gas Tax	84
4.1.2 Travel Behavior	85
4.1.3 Potential Impacts on Consumer Vehicle Preference	85
4.1.4 Out-of-State and Private Road Travel Characteristics	85

4.2	System-Oriented Policy Considerations.....	85
4.2.1	Rate Setting and Fee Structures	86
4.2.2	System Goals and Objectives.....	87
4.2.3	Vehicular Fuel Efficiency Trends	87
4.2.4	Elasticity of Travel.....	87
4.3	Technology Considerations.....	87
4.3.1	In-Vehicle Telematics.....	88
4.3.2	Transportation Networking Companies and Mobility as a Service (MaaS)	88
4.3.3	Automated and Connected Vehicles	88
4.3.4	In-vehicle Diagnostics-based Services	89
4.4	Administrative Considerations.....	89
4.4.1	Private Sector Administration and Operations.....	89
4.4.2	State-based Customer Service	89
4.4.3	Interagency Data Exchange and Coordination	90
4.4.4	Out-of-State Drivers.....	90
4.4.5	Compliance and Enforcement	90
5	Conclusions	91
5.1	Demonstration of an operational RUC	91
5.2	Identification and Evaluation of Issues	92
5.3	Feasibility of Mileage-reporting Options	93
5.3.1	Odometer Reading Findings	94
5.3.2	Non-GPS Enabled Mileage Reporting Device Findings	94
5.3.3	GPS-Enabled Mileage Reporting Device Findings.....	95
5.4	Feedback and Ideas	95

Appendixes

A	Enrollment FAQ
B	Program FAQ
C	CDOT RUCPP Newsletters
D	CDOT RUCPP Press Release
E	CDOT RUCPP Mileage Reporting Device Quick Start Installation Guide
F	Colorado Road Usage Charge Pilot – Account Management Monthly Summary Report – April 2017
G	Colorado RUCPP Policy, Technology and Administrative Issues Matrix

Tables

1	2016 STSFA Grant Recipients.....	10
2	Targeted Recruiting Composition	32
3	Urban/Rural Concentration of CDOT Regions	34
4	Stratification of Vehicles by Fuel Efficiency	34
5	Number of Participating Vehicles by Fuel Economy and CDOT Region.....	35
6	Description of Mileage Reporting Options as provided on the enrollment website.....	41
7	Pilot Account Summary.....	55
8	Summary of Mileage Reporting Device Utilization Among Participants	56
9	Participating Vehicles by Fuel Efficiency	57
10	Monthly RUC based on Mileage Reporting Option and Vehicle Type.....	58
11	Average Mileage by Vehicular Fuel Efficiency	58
12	Pre-Pilot Survey Respondent Characteristics.....	60
13	Mid-Pilot Survey Respondent Characteristics.....	62
14	Closing Survey Respondent Characteristics.....	67
15	Errors and Events Logged by MRD Systems.....	80
16	Pilot Help Desk Log	80
17	Number of Odometer Reading Participants Not Submitting Monthly Readings.....	81
18	Colorado RUCPP Advisory Committees	83
19	User-Oriented Policy Considerations.....	84
20	Estimated fees paid for 1,000 miles driven per month	84
21	System Oriented Policy Considerations	86
22	Additional Considerations for Rate Setting	86
23	Potential Goals and Objectives for RUC.....	87
24	Technical Considerations	88
25	Administrative Considerations.....	89
26	Account and VIN Summary	125
27	Odometer Reading Option Summary	125
28	Mileage and Road Charge Revenue Summary.....	126
29	Mileage and Road Usage Charge Revenue per Vehicle	127
30	Errors and Events Summary.....	127
31	Colorado RUCPP Policy, Technology and Administrative Issues Matrix	128

Figures

1	Decline in purchasing power of the state of Colorado gasoline tax (based on Consumer Price Index analysis).....	3
2	US gasoline consumption, 1960 to 2014 (Millions of Barrels)	4
3	State gas taxes paid per mile by fuel efficiency.....	4
4	Estimated US vehicle energy efficiency (MPG), 2015 - 2050	5
5	Estimated US vehicle fleet composition	6
6	Fuel taxes paid based on fuel economy.....	8
7	RUC paid based on fuel economy	9
8	Colorado RUC timeline.....	20
9	Perceptions of state and federal fuel tax rates.....	22
10	Respondent perceptions of RUC drawbacks.....	23
11	Graphic used on RUCPP website to illustrate decline in fuel tax purchasing power.....	25
12	Graphic illustrating processes and functional flows for the RUCPP	26
13	Graphic used to illustrate mileage reporting options.....	26
14	Screenshot of RUC calculator webpage showing estimated RUC	27
15	Colorado RUCPP Website Visits (provided by Google analytics)	28
16	11/6/2016 CDOT RUCPP Facebook post with view stats.....	29
17	2/28/2016 CDOT RUCPP Facebook post with view stats.....	30
18	RUC stakeholder strategy map	31
19	CDOT regional subdivision map	33
20	Number of participating vehicles by model year	35
21	Pilot workflow from user perspective	40
22	Considerations for mileage reporting options provided on the enrollment website	42
23	Participant perceptions of the enrollment process.....	43
24	Account management website dashboard	44
25	Account summary page	45
26	Account statements page	45
27	Account wallet page.....	46
28	Screenshots of Azuga Insight mobile app	47
29	Screenshots of Azuga Insight mobile app for odometer reading users.....	47
30	Percentage of mileage reporting options selected.....	48
31	Mileage reporting option by CDOT district.....	49
32	Example trip log	50
33	Example of a safe zone	50
34	Example of driving score	51
35	Example of driving badge.....	51
36	MRD installation to the OBD-II Port.....	52
37	Example RUCPP invoice	53
38	Geographic distribution of participants based on metering option.....	56
39	Geographic distribution of participants based on fuel efficiency.....	57
40	Pre-Pilot Survey – perceptions of the RUC concept	61
41	Pre-Pilot Survey – Participant perceptions of RUC benefits and drawbacks.....	61
42	Mid-pilot survey - perceptions of the RUC concept	63
43	Participant perceptions of the amounts assessed for RUC and Fuel Tax Credits	64
44	Mid-Pilot Survey - Participant perceptions of RUC benefits and drawbacks.....	64
45	Participant use of the Azuga Insight mobile phone app	65
46	Participant perceptions of mileage reporting devices.....	66
47	Participant awareness of RUC communications	66
48	Participant satisfaction with pilot elements	67

49	Participant satisfaction with various RUCPP elements.....	68
50	Change in participant satisfaction with RUCPP elements.....	68
51	Participant perceptions of RUCPP impact.....	69
52	Change in participant support for RUC over all three surveys	70
53	Participant perceptions of RUC fairness	71
54	Participant perceptions on future RUC work.....	71
55	Participant perceptions of amounts assessed	72
56	Participant perceptions of assessed RUC amounts	72
57	Participant perceptions of gas tax credit amounts.....	73
58	Participant perceptions of RUC benefits.....	74
59	Participant perceptions of RUC drawbacks	75
60	Participant perceptions on geographic equity of RUC.....	76
61	Participant perceptions of pilot invoicing.....	76
62	Participant perceptions of the Azuga web portal	77
63	Participant satisfaction with mileage reporting options	78
64	Participant privacy concerns.....	78
65	Participant satisfaction with privacy protections and data security	79
66	Participant perceptions of programmatic elements for future improvement	79

Acronyms and Abbreviations

AV	Automated Vehicle
CAFE	Corporate Average Fuel Economy
CalSTA	California State Transportation Agency
CCO	Concept of Common Operations
CDOT	Colorado Department of Transportation
CMAQ	Congestion Mitigation and Air Quality
CNG	Compressed Natural Gas
CPI	Consumer Price Index
CV	Connected Vehicle
DMV	Department of Motor Vehicles
DOT	Department of Transportation
EV	electric vehicle
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
GPS	Global Positioning System
GSM	Global System for Mobile communications
HUTF	Highway Users Tax Fund
IFTA	International Fuel Tax Association
IRP	International Registration Program
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MaaS	Mobility as a Service
MBUF	Mileage-based User Fees
MnDOT	Minnesota Department of Transportation
MPG	miles per gallon
MRD	Mileage Reporting Device
MRFT	Minnesota Road Fee Test
OBD-II	On-Board Diagnostics port
ODOT	Oregon Department of Transportation
OEM	Original Equipment Manufacturer
PIO	Public Information Office
PSRC	Puget Sound Regional Council
RUC	road usage charge

RUCPP	Road Usage Charge Pilot Program
RUC West	A western regional volunteer collaboration of state departments of transportation focused on pooled fund studies and knowledge transfer for RUC programs
SPR	State Planning and Research
STSFA	Surface Transportation System Funding Alternatives
TAC	Technical Oversight Committee
TNC	Transportation Networking Company
WSTC	Washington State Transportation Commission

1 Introduction

Road Usage Charges (RUC) are a relatively new type of fee for the funding of transportation infrastructure. They are typically assessed based on actual use of the roadway network, most often in terms of distance travelled. Road users thus pay per-mile travelled, but it is possible to incorporate other aspects of “use” such as vehicle weight, model year, fuel type, etc. There are numerous options for levying and collecting a RUC, from routine odometer readings to using various in-vehicle devices and technologies to automatically collect and transmit the relevant information.

This section provides a basic overview of the RUC concept with a focus on:

- **The Need for Alternative Funding Mechanisms:** This section begins with an overview of Colorado’s current transportation funding system, discusses challenges to the sustainability of that system, and discusses why RUC might be one possible option for meeting the states’ long-term transportation funding challenges in an equitable way.
- **RUC Initiatives and Research:** This section discusses RUC related efforts in other states as well as previous RUC efforts in the state of Colorado and provides lessons learned from these efforts that informed the design and operation of the Colorado Road Usage Charge Pilot Program (RUCPP).
- **RUC Evolution and Lessons Learned:** This section discusses the evolution of the RUC concept in recent years and how that evolution, coupled with insight gained from policy and planning studies in Colorado, led to the Colorado RUCPP.

1.1 The Need for Alternative Funding Mechanisms

Many states, including Colorado, are increasingly interested in the exploration of RUC as a long-term funding source for infrastructure investment. This is due to the fact that:

- **Gas Tax Model Sustainability:** The gas tax was last raised in the early 1990s. Since that time, vehicles have become much more fuel efficient which has led to declining revenues for transportation infrastructure investments. This is further exacerbated with the Corporate Average Fuel Economy (CAFÉ) standards, which require automakers to increase fuel economy to 54.5 miles per gallon for cars and light-duty trucks by model year 2025.
- **Population Increase:** Colorado has experienced dramatic population growth over the last 25 years and is expected to see a sustained population growth of 47% over the next 25 years.
- **Fuel Diversification:** In recent years, a number of alternative fuels have been introduced with little to no tax structures to support transportation infrastructure investments.
- **Purchasing Power:** Since the early 1990s, the last time the gas tax was raised, the purchasing power of the dollar has declined steadily. Due to projected inflation, this is a trend that is likely to continue.

The confluence of these factors means that the current gas tax model will continue to return declining revenues due to increased fuel economies and fuel diversification, there will be more demand on the transportation system due to population increase, and the limited revenue that is collected will continue to lose value due to the steady declination of overall purchasing power.

1.1.1 Existing Colorado Transportation Funding

The Colorado Department of Transportation (CDOT) is responsible for developing, operating and maintaining state roadways. This includes maintaining more than 23,000 lane miles of roads, 1480 rock fall hazard sites, over 3,400 bridges, 21 tunnels, 6,000 culverts, 2,350 intelligent transportation system devices, and 35 year-round mountain passes, in addition to supporting numerous transit systems

throughout the state. The major source of revenue for CDOT is the Highway Users Tax Fund; of which almost 75% is funded through fuel tax revenues, levied on a per-gallon basis on diesel, gasoline, and alternative fuels such as compressed natural gas (CNG), liquefied natural gas (LNG), liquefied petroleum gas (LPG), and ethanol. In addition to the \$0.22 per gallon tax on gasoline and the \$0.205 per gallon tax on diesel, Colorado also levies a \$0.03 per gallon tax on CNG, LNG and LPG fuels. The last time the state of Colorado raised its gasoline tax was 1991, and the current rate stands at \$0.22 per gallon. Colorado last raised its diesel tax in 1992 and the current rate is \$0.205 per gallon.

The State of Colorado will continue to grow for the foreseeable future, and this growth will place significant strain on transportation infrastructure. The Colorado 2040 Statewide Transportation Plan notes that the state population will increase by 47% to 7.8 million by 2040. The amount of travel per person (as expressed in miles travelled per capita) is expected to remain flat over that time. However, because of an increase in population total travel and associated transportation demand will increase. For example, total annual vehicles miles traveled (AVMT) on Colorado state highways and local roads is expected to increase from 48.1 billion AVMT to 69.7 billion AVMT between 2014 and 2040. This growth in AVMT given Colorado's existing roadways will cause severe increases in traffic congestion, resulting in traffic delays equating to two to three times the current levels.

Further exacerbating the problem, Colorado's long-term transportation plan estimates that approximately \$46 billion (in 2016 dollars) in funding will be required over the next 25-years to manage, maintain, expand, and operate Colorado's existing transportation system, of about \$19 billion in needs have been identified for the next ten years. However, sufficient funding might not be available to address these neither the short-term needs nor the projects needed to support Colorado's expected long term growth.

Also, while the long-term transportation plan notes that an estimated \$800 million in revenue might be available for transportation investments through 2020; more recent projections show that only approximately \$200 million might be available. After 2020, available transportation revenues are forecasted to grow by only 0.5%. Given this, Colorado's identified transportation revenues are expected to only cover about 40% of the state transportation needs over the next 25 years; resulting in a funding gap of just under \$25 billion total or \$1 billion annually. Furthermore, the near term 10-year transportation funding gap is estimated to be \$8.77 billion. CDOT estimates that it will only have enough funding to maintain the state's infrastructure in its current condition for another 10 years. As previously mentioned, much of these funding shortfalls can be attributed to increasing fuel economy of the Colorado vehicle fleet, coupled with the fact that Colorado has not raised its gas tax in nearly 25 years. Further exacerbating this revenue shortfall due to increased fuel economy, is the Corporate Average Fuel Economy (CAFE), which require automobile manufacturers to increase fuel economy to 54.5 miles per gallon for cars and light-duty trucks by [model year 2025](#).

Regardless of the time frame, Colorado will have a challenge meeting its long-term transportation investment challenges. The 2040 plan notes that CDOT could consider several more sustainable funding options to address these challenges, including ⁽¹⁾:

- Establishing a dedicated state sales tax for transportation;
- Increasing the state gas tax and indexing it to inflation;
- Other user charges, like tolling new roadway capacity;
- Using more public-private partnership financing mechanisms; and
- Exploring road usage charges, which are fees on a per-mile basis for driving.

¹ Colorado Department of Transportation, Transportation Matters: Statewide Transportation Plan 2040. 19 March 2015.

1.1.2 RUC and Transportation Funding Sustainability

In 2007, Colorado Governor Bill Ritter convened a blue-ribbon panel of experts, policy makers, community leaders and transportation system stakeholders to evaluate and recommend methods for addressing Colorado’s transportation needs. The 32-member Transportation Finance and Implementation Panel was officially convened on April 5, 2007 and in November of 2007, had completed its deliberations and issued its findings and recommendations. The Panel found that the state’s level of investment in transportation through 2030 would result in a \$51 billion deficit in terms of actual investment compared to what will be required to simply sustain the system at current operating levels. The 2007 Transportation Finance and Implementation Panel concluded that drivers “don’t realize that the primary means by which we pay for transportation has eroded to less than a third of its value over the last 10 years” and that “gas taxes are no longer a sufficient source of funding.”² There are several reasons for this erosion in fuel tax revenues and loss of sustainability.

As noted earlier, fuel taxes are excise taxes that, unlike sales taxes, are assessed on a unit basis (in this case per gallon) and not on the purchase price. This means that even though the average price of gasoline has doubled from \$1.14 in 1991 to \$2.45 in 2015 (³), the Colorado state fuel tax returns the same \$0.22 per gallon of revenue. Inflation further devalues this \$0.22 by almost 45% of its 1991 purchasing power (Figure 1).

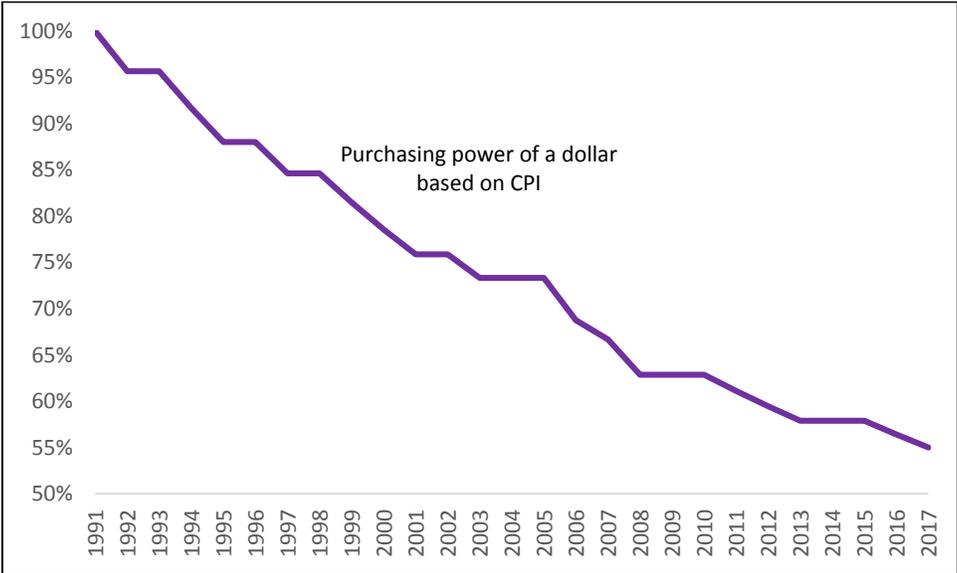


Figure 1: Decline in purchasing power of the state of Colorado gasoline tax (based on Consumer Price Index analysis)

This decline in purchasing power over time coupled with a significant decrease in fuel consumption (due to improved vehicle fuel economy), has created a declining revenue base needed to address Colorado’s transportation funding needs, which will continue to grow due to the increase in population and AVMT. As can be seen in Figure 2, gasoline consumption in the US peaked in 2007 and, while it has improved in recent years, mainly due to decreases in overall gas prices and the impacts the declining gas prices have had on personal travel behaviors, it is unclear as to how much consumption will recover and to what extent it will continue to grow over the next few years relative to historic patterns.

² Colorado Transportation Finance and Implementation Panel: A Report to Colorado, January 2008.

³ US Department of Energy. “Average Historical Annual Gasoline Pump Price, 1929-2015.” Fact#915, March 17, 2016. <http://energy.gov/eere/vehicles/fact-915-march-7-2016-average-historical-annual-gasoline-pump-price-1929-2015>, accessed 24 August 2016.

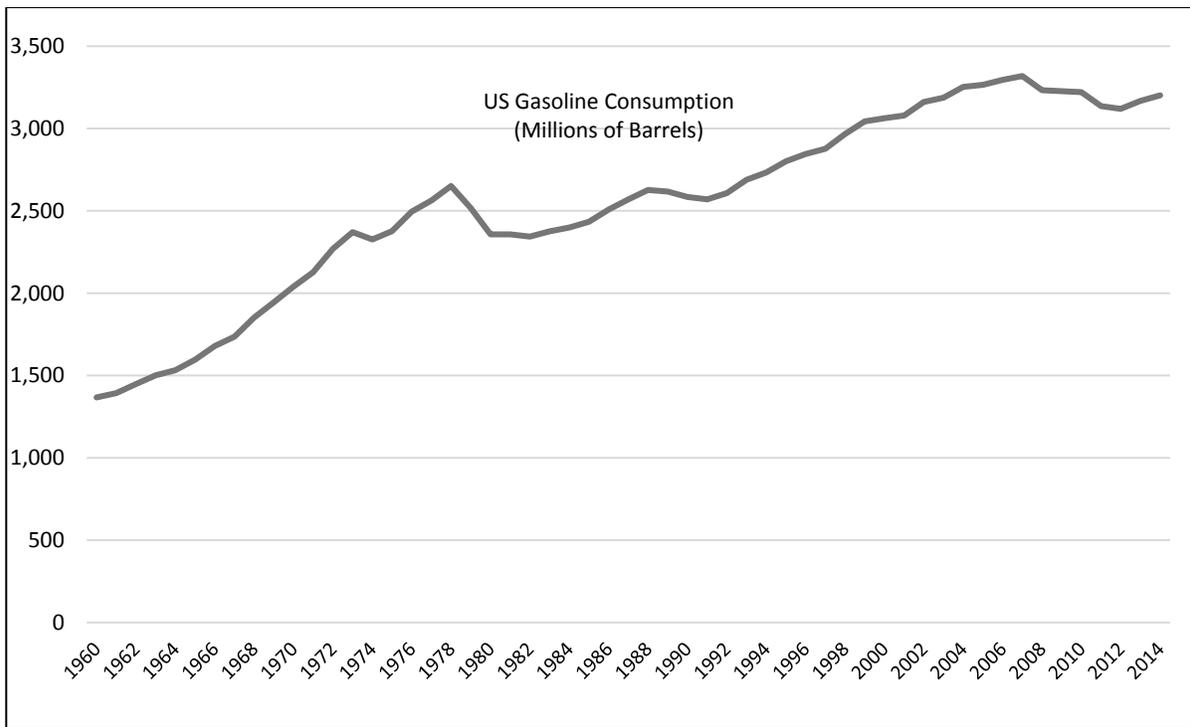


Figure 2: US gasoline consumption, 1960 to 2014 (Millions of Barrels) ⁴

Compounding the issue of fuel taxes being linked to fuel consumption (and not road use) is the fact that a vehicle's fuel efficiency will impact how much fuel tax is paid. A vehicle with a higher fuel efficiency will pay less per mile travelled than a vehicle with a lower fuel efficiency, as illustrated in (Figure 3) below. These revenues will further decline over time as automobile manufacturers continue releasing vehicles in accordance with the CAFE standards, which require an average fuel economy of 54.5 MPG by 2025.

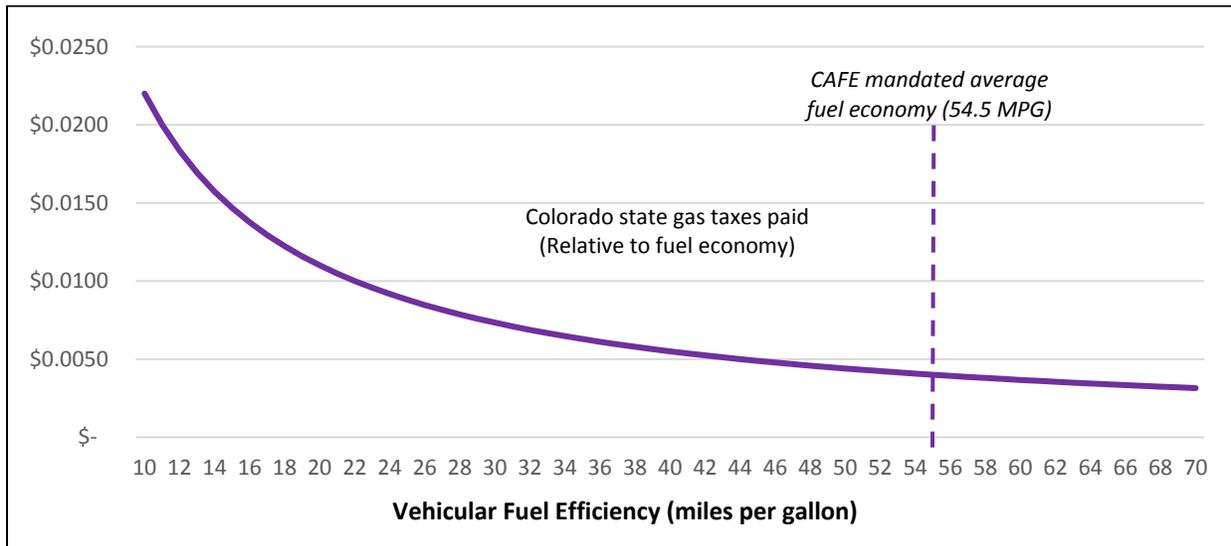


Figure 3: State gas taxes paid per mile by fuel efficiency

⁴ US Energy Information Administration, Table CT7. Transportation Energy Consumption Estimates, 1960 to 2014, United States, http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_use/tra/use_tra_US.html&sid=US, accessed on 26 August 2016.

The issue of fuel efficiency impacting fuel taxes paid per mile will continue to grow. As shown in Figure 4, the US Department of Energy’s Energy Information Administration (EIA) estimates that fuel efficiency will increase between 2017 and 2025 (5). The average fuel efficiency of a new light-duty passenger vehicle will increase by an estimated 50% between 2015 and 2025, while the average fuel efficiency of a new light-duty truck will increase by 41% over that time.

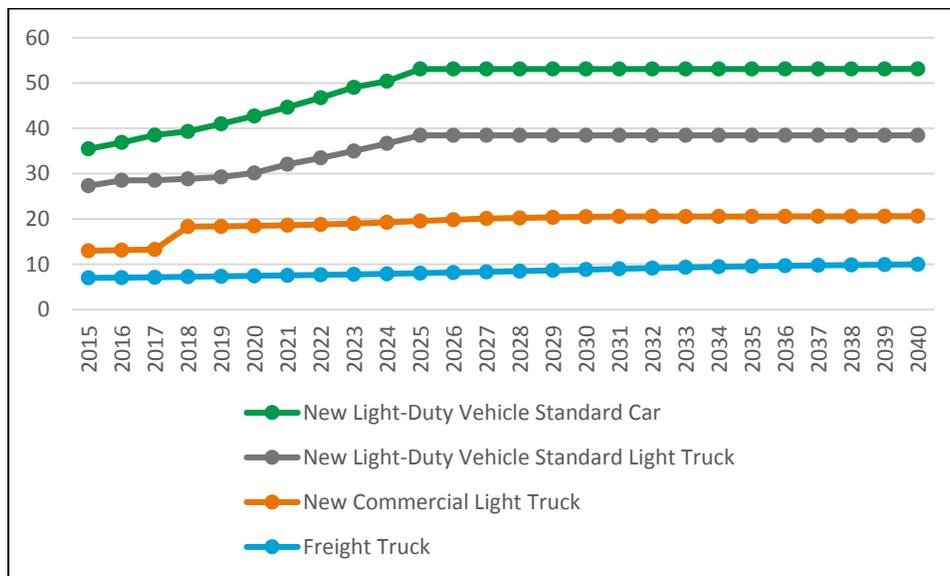


Figure 4: Estimated US vehicle energy efficiency (MPG), 2015 - 2050 ⁶

Further compounding these issues is the emergence and continued market penetration of alternative fuel vehicles including electric vehicles (EVs), who do not rely on conventional fossil fuels, and as such, pay little to no per-gallon fuel taxes. Currently, alternative fuel vehicles account for less than 10% of the US auto fleet, but that number could increase to over 20% by 2040, as shown in Figure 5 (7).

⁵ US Energy Information Administration. 2017 Energy Outlook. Transportation Sector Key Indicators and Delivered Energy Consumption. <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=7-AEO2017&cases=ref2017&sourcekey=0>. Accessed on 4 April 2017.

⁶ US Energy Information Administration. 2017 Energy Outlook. Transportation Sector Key Indicators and Delivered Energy Consumption. <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=7-AEO2017&cases=ref2017&sourcekey=0>. Accessed on 4 April 2017.

⁷ US Energy Information Administration. 2016 Energy Outlook. Light-Duty Vehicle Stock. <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=49-AEO2016&sourcekey=0>. Accessed on 19 April 2017.

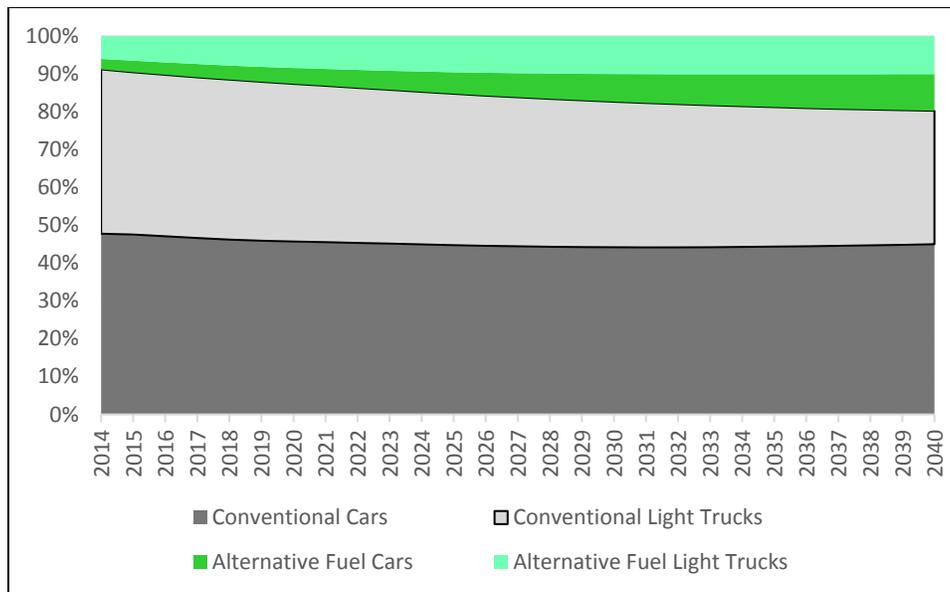


Figure 5: Estimated US vehicle fleet composition

Of particular concern is the increased market penetration of electric vehicles (EVs), which do not rely on any fossil fuels, and as such, do not pay any fuel taxes. All electric vehicles such as the Chevrolet Spark (purchase price \$26K), Chevy Volt (\$36K), Ford Focus Electric (\$29.2K), Kia Soul EV (\$34.5K), Nissan LEAF (\$29.9K), and Tesla Models S (\$71K) and X (\$80K)⁸ are among the already significant number of all electric vehicles currently available on the automotive market. Their purchase price tends to be higher than other popular makes and models, so there are not that many on the road relative to traditional internal combustion engine (ICE) based vehicles. However, the purchase price of these vehicles continues to decrease as battery costs, which are the most significant contributor to the overall cost of an electric vehicle, are expected to decline in the coming decades. Also, certain tax incentives and rebates, provided both at the federal and state levels (including Colorado) have reduced the overall purchase prices and made these vehicles more appealing to consumers. A 2016 analysis by Bloomberg New Energy Finance estimated that, by 2040, long range electric vehicles will cost less than \$22,000 in 2016 dollars and may account for up to 35% of new vehicle sales by that time.⁹

As previously noted, EVs are not powered by fossil fuels and as such, do not pay a per-gallon gas tax. This equates to EVs not paying an equitable share of their use on Colorado's roadway network. To help counter this concern, Colorado recently established an EV "royalty" program where Colorado EV owners pay an annual \$50 premium at time of registration. While this program has helped assuage concerns over EV owners paying their fair share of road use, it is still not in line with their ICE counterparts who are paying more through the current gas tax.

The long-term sustainability of the fuel tax as the primary mechanism for supporting infrastructure development is in doubt. Fuel excise taxes have already lost significant purchasing power over time due to inflation, and as vehicles become more fuel efficient they will return less and less revenue per mile travelled. Furthermore, vehicles that run on alternative fuels or on completely untaxed sources of power (such as electric vehicles) will make up an increasing share of the US auto fleet. Transitioning the transportation funding model to a usage-based system, such as RUC, can help to alleviate some of these challenges as revenues are tied to actual roadway use, not fuel consumption. Usage-based systems are

⁸ All vehicle purchase price estimates from plugincars.com, http://www.plugincars.com/cars?field_isphev_value_many_to_one=pure+electric, accessed 24 August 2016.

⁹ Randall, Tom. "Here's How Electric Cars Will Cause the Next Oil Crises." Bloomberg, February 25, 2016. <http://www.bloomberg.com/features/2016-ev-oil-crisis/>, Accessed 24 August 2016.

also agnostic to engine types, meaning that increased penetration of alternative fuel vehicles will not support a further decline in revenues.

1.1.3 RUC and Transportation Funding Equity

Fuel taxes are often considered a user fee, particularly with regard to paying for transportation investments as, historically, most vehicles on the roadway have required either gasoline or diesel to run. It was thus very difficult to use the nation's roadway network without also paying taxes for its upkeep and operations. The more someone drove, the more fuel they burned and the more they paid for use of the roadway network. Furthermore, differences in fuel efficiency were not as pronounced, meaning that drivers were generally paying about the same for use of the roadway.

As discussed earlier, vehicles are getting more and more fuel efficient, meaning that the average vehicle will return less and less revenue per mile driven over time. This is due in no small part to federal initiatives such as CAFE standards that set requirements for auto manufacturers to improve fuel efficiency to up to 54.5 MPG by 2025. There is also increasing consumer demand for more fuel-efficient vehicles. When fuel prices get very high, as they did several years ago, it creates an economic incentive for people to get more fuel-efficient vehicles. Therefore, the expectation that new vehicles will continue to get more fuel efficient for the foreseeable future is reasonable.

However, not all drivers will drive a newer, more fuel-efficient vehicle. Many in Colorado may have older, less fuel-efficient vehicles, and this presents an equity dilemma. According to AAA, the most popular vehicle currently purchased in Colorado is the Subaru Outback.¹⁰ A 2015 Subaru Outback gets 25 MPG in the city and 33 MPG on the highway. Using the Colorado state gas tax of \$0.22 per gallon, the driver of a 2015 Outback is paying less than 1 cent per mile in state gasoline taxes while driving (\$0.009 per mile in the city and \$0.007 per mile highway). However, a 2005 Subaru Outback, which is ten years older, gets 20 MPG in the city and 26 MPG on the highway, meaning that in many cases the driver is paying just over a cent per mile in fuel taxes (\$0.011 per mile in the city and \$0.008 highway). As such, among vehicles of the same make and model it is likely that the newer model will be paying less in vehicle taxes for every mile driven. The discrepancy in fuel taxes paid becomes more pronounced when looking across models and particularly with regard to the growing popularity of hybrid electric vehicles. For example, a 2015 Toyota Prius has a fuel efficiency of 51 MPG in the city and 48 MPG on the highway, resulting in fuel tax payments of a less than a half cent per mile (\$0.004 per mile in the city and \$0.005 per mile on the highway).¹¹ The relationship between fuel economy and fuel taxes paid per mile is shown in Figure 6.

¹⁰ AAA, "Top 10 Most Popular Vehicles in Colorado," <http://www.colorado.aaa.com/explorers-hub/top-10-most-popular-vehicles-in-colorado/>, accessed on 24 August 2016.

¹¹ All vehicle efficiency estimates from Edmunds.com

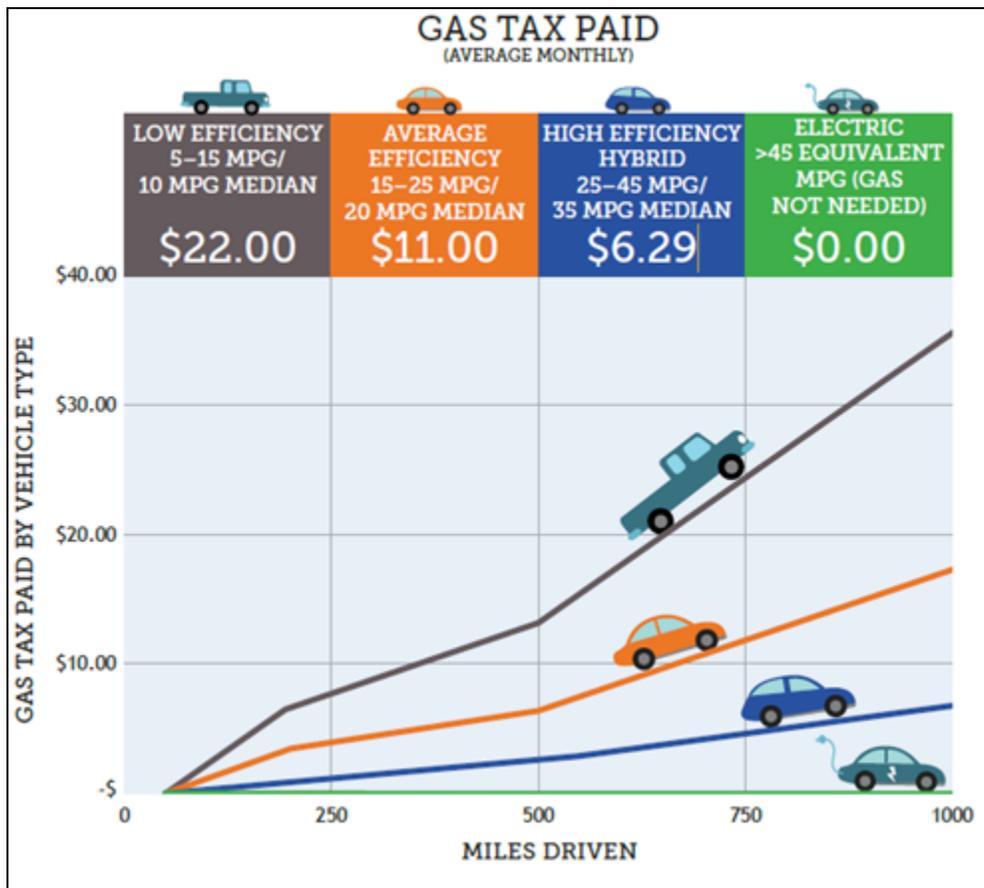


Figure 6: Fuel taxes paid based on fuel economy

As Figure 7 shows, RUC systems can create a more equitable funding system by levying fees based on actual travel and not fuel consumption. Drivers pay an equal amount for every mile they drive, regardless of the type of fuel used and the fuel efficiency of their vehicle.

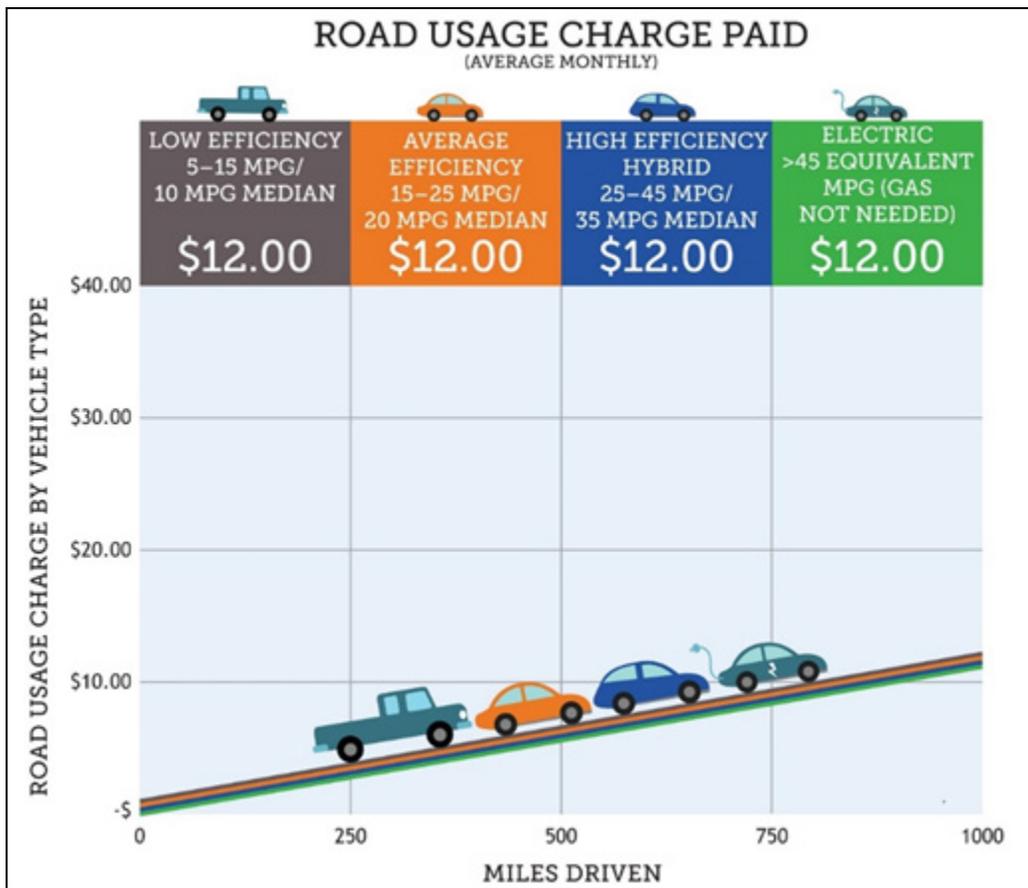


Figure 7: RUC paid based on fuel economy

1.2 RUC Initiatives and Research

Road usage charges have been studied in several states over the past ten years. This section provides a brief overview of RUC pilots conducted in other states, Oregon’s implementation of their current voluntary RUC program OReGO, discusses previous explorations of the RUC concept in the state of Colorado, and the efforts and findings of RUC West (a multi-state consortium, of which Colorado is a member, who collaboratively researches RUC and shares best practices. The section closes with a discussion on how the RUC concept has evolved from its initial pilot efforts and how that evolution, coupled with Colorado’s previous policy development efforts, informed the design of the current Colorado RUCPP.

1.2.1 Road Usage Charging efforts in other states

Pilot projects conducted in other states have generally fallen into one of two categories that generally correspond to when they were conducted and their associated level of sophistication. The “1st Generation” of pilot studies were those that initially explored the concept and assessed the feasibility of RUC as a replacement of the gas tax. These pilots typically tested only one type of metering technology, and all participants in those studies had to use that reporting technology. The “2nd Generation” of pilot studies took the findings of those initial pilots and tested more advanced systems that provided participants with a range of mileage reporting and account management options. These tests were less about testing the viability of the technology and more about developing and testing viable implementation models.

There are currently several pilots underway that will be covered in more detail within this section. Furthermore, additional state and multistate pilots can be expected to come online over the next few

years due to the availability of federal funding. The Fixing America's Surface Transportation Act (FAST Act) established the \$95 million Surface Transportation System Funding Alternatives (STSFA) Program that provides grants to states or groups of states for the demonstration of usage-based funding mechanisms as a means of maintaining the long-term solvency of the Federal Highway Trust Fund. Funding is authorized through 2020. Applicants are required to contribute a 50% match in funds that can be met in any number of ways (i.e. cash, staff time, facilities, toll credits, etc.). In September of 2016 the Federal Highway Administration (FHWA) announced the first round of STSFA awards, which totaled just over \$14 million in grants as summarized in Table 1.

Table 1: 2016 STSFA Grant Recipients

Recipient	Program Description	Award Amount
California Department of Transportation	Road User Charge (RUC) using pay-at-the-pump/charging stations.	\$750,000
Delaware Department of Transportation	User fees based with on-board mileage counters in collaboration with members of the I-95 Corridor Coalition.	\$1,490,000
Hawaii Department of Transportation	User fee collection based on manual and automated odometer readings at inspection stations.	\$3,998,000
Minnesota Department of Transportation	Use of Mobility-as-a-Service providers (MaaS) as the revenue collection mechanism.	\$300,000
Missouri Department of Transportation	Implementation of a new registration fee schedule based on estimated miles per gallon.	\$250,000
Oregon Department of Transportation	Improvements to Oregon's existing road usage charge program.	\$2,100,000
Oregon Department of Transportation	Establishing the consistency, compatibility and interoperability in road user charging for a regional system in collaboration with members of the Western Road User Charge Consortium.	\$1,500,000

Source: Federal Highway Administration (12)

1.2.1.1 "1st Generation" Pilots

The first generation of pilots established that the RUC concept is a feasible mechanism for collecting fees for road usage. These pilots were more focused on feasibility studies with a limited set of technology and account management options, generally only one choice for each pilot. They were deployed to allow transportation stakeholders, and in some instances the general public, an opportunity to understand the concept of RUC, and to begin identifying considerations for future pilot programs.

Puget Sound Regional Council Traffic Choices Study

In 2002, the Puget Sound Regional Council (PSRC) in the Seattle metropolitan region conducted the Traffic Choices Study to gauge driver response to congestion pricing on the region's road network. Congestion pricing involves applying fees that vary in amount throughout the day in response to traffic volumes such that fees are highest when there are more vehicles on the road. The study involved 275 participants who had Global Positioning System (GPS)-based devices installed in their vehicles that levied a simulated per-mile rate that varied based on the type of facility and the time of day. Fees were higher during periods of the day with higher traffic volumes. Information was transmitted through the cellular Global System for Mobile Communications (GSM) network to the central processing center.

¹² US Department of Transportation, Federal Highway Administration. "Federal Highway Administration Announces More than \$14 Million in Grants to Test New Ways of Funding Highways." Press Release, 1 September 2016.

Participants were able to view their travel patterns and adjust their behavior accordingly to reduce their incurred charges.

Lessons Learned: This study was focused on measuring changes in driver behavior and thus offered little privacy protection (in terms of the collection of location data) relative to what might be expected for a large-scale fee system. However, a very fine level of detail on driver behavior was captured. The study showed that congestion pricing provided an opportunity to significantly reduce traffic congestion as well as generate funds for transportation investments. The research team concluded that the technologies used were mature and reliable.¹³

University of Iowa National Evaluation of a Mileage-Based Road User Charge

In 2005, the Public Policy Center at the University of Iowa initiated a multi-state evaluation of a mileage based usage charge system as a potential funding replacement for the fuel tax. The test ran for a period of two years and relied on 2,650 participants from 12 areas across the US including Baltimore, MD; the Research Triangle area of North Carolina; Eastern Iowa; Austin, TX; Boise, ID; San Diego, CA; Portland, ME; Miami, FL; Chicago, IL; Wichita, KS; Billings, MT, and Albuquerque, NM. The system relied on in-vehicle devices that connected to on-board diagnostic ports for mileage estimation and data from GPS technologies to determine location. Information collected by these devices was transmitted via GSM cellular network to the study's network operations center (NOC) and then on to a processing/billing center. Fees were assigned to the jurisdiction (state) where mileage was accrued and bills were generated for pilot participants on a monthly basis. Participants could choose from three different billing options: a simplified bill with only the amount due by jurisdiction shown, a detailed statement with a complete record of travel, and a modified bill that showed only monthly travel.

Lessons Learned: The equipment used for collecting data and the systems used for calculating fees were robust and there was generally no difficulty in obtaining engine data through the diagnostic connections. The GPS components worked well and systems were in place for estimating location if GPS data was lost. The research team estimated that of the 23 million miles logged, only about 0.6% of that mileage could not be assigned to a location. Exit surveys of study participants showed that they generally had a favorable impression of the system with about 70% indicating acceptance. Participants did have privacy concerns but recognized that detailed data allowed for better transparency. As such, by the end of the study most participants preferred receiving the monthly bill that showed travel during the month but not a complete record of all travel.¹⁴

Oregon Mileage Fee Concept and Road User Fee Pilot Program

Oregon initiated the first state pilot test of the RUC concept over a 12-month period in 2006 with 299 volunteers. The devices used by study participants either plugged into vehicular onboard diagnostic ports, commonly referred to as OBD or as of 2004, OBD-II ports, or used GPS location to determine mileage. Devices had embedded GPS components to determine if mileage was being accrued in Oregon or if it was accruing out-of-state and therefore not subject to the Oregon charge. The system used a "pay-at-the-pump" model to mimic the fuel tax system as closely as possible such that when participating vehicles refueled at participating service stations, information was transmitted via wireless signal to specially installed equipment at the fuel pumps. This data was sent to a central processing center where a fee was calculated as well as fuel taxes paid, which were treated as a credit against the assessed road usage charge.

Lessons Learned: ODOT considered this initial pilot a success and concluded that the road usage charge concept was indeed viable. ODOT believed that the way the system was structured allowed for

¹³ Puget Sound Regional Council (PSRC) (2008). "Traffic Choices Study - Summary Report." Prepared for the Value Pricing Program under the Federal Highway Administration, Washington, DC.

¹⁴ Hanley, Paul and John Kuhl. (2010). "National Evaluation of a Mileage-based Road User Charge: Initial Results." Paper presented at the 2011 Annual Meeting of the Transportation Research Board. Washington, DC. Paper # 11-3972

protection of driver privacy, as location data was only used to determine if the vehicle was in Oregon or outside of the state and data uploads only occurred when the vehicle was being refueled. In spite of these protections privacy concerns remained paramount among participants and, in particular, the potential need for government mandated technology in their vehicles. However, study participants stated that they became more comfortable with the system the longer they used it and agreed that the “user pays” concept was fair and the fee itself was sufficiently transparent. Overall, participants had generally positive perceptions of the system. ODOT also concluded that by tying fee payment into fuel purchases, the system would be easier for travelers and would result in a built-in enforcement mechanism. Furthermore, the ODOT system accurately calculated fees, completed financial transactions, and had minimal technical issues.¹⁵

Minnesota Mileage-based User Fee Demonstration

In 2007 the Minnesota Legislature directed the Minnesota Department of Transportation (MnDOT) to conduct a pilot test of technologies that could support a usage-based replacement to the fuel tax. In 2011 the Minnesota Road Fee Test (MRFT) pilot project was initiated in the Minneapolis/St. Paul region with 500 participants. Participants in the study used specialized Android smartphones with a pre-installed mileage fee application specifically designed for the pilot. These smartphones had to be in the vehicle and communicated with a device plugged into the on-board diagnostic port to verify that the phone was in the correct vehicle. The phones used GPS to determine location and mileage and transmitted study information through the cellular network. The rates used in the study varied based on the time of day and location with travel outside of Minnesota being free and mileage within the Twin Cities region having a higher rate. Bills were issued on a monthly basis.

Lessons Learned: The MRFT was considered a success but there were some issues encountered with the smartphones. For example, the phones sometimes had trouble getting a GPS signal depending on where in the vehicle the phone was placed. Participants in the study generally found the fee rates reasonable and indicated that they understood the need for alternatives to the fuel tax after participating in the study. Some people did think that the system was too complicated, especially considering how easy the fuel tax system is for drivers.¹⁶

1.2.1.2 “2nd Generation” Pilots

The first generation of pilots established that the RUC concept is a feasible mechanism for collecting fees for road usage. However, they tended to offer minimal options for drivers. The 2nd Generation of pilots began with the assumption that the concept and underlying technologies were generally viable and set out to test different technology and account management options.

Oregon (2013) Road User Charge Pilot Program

Oregon’s 2006 Mileage Fee Concept and Road User Fee Pilot Program was successful in many respects, but certain issues persisted. For example, ODOT believed that the system tested would be complex and expensive to deploy and administer as a statewide replacement to the fuel tax. Officials were also uncomfortable with the idea of only using one type of device and wanted to explore system options that would allow for many different technologies that could evolve over time. Furthermore, the reliance on a single technology option could be perceived by the public as a government mandate for using in-vehicle technology in the vehicle. Finally, in spite of the first pilot’s focus on protecting driver privacy by limiting the amount of location data collected, privacy concerns among state residents persisted.

¹⁵ Oregon Department of Transportation (ODOT) (2005). Oregon's Mileage Fee Concept and Road User Fee Program. Report to the 73rd Oregon Legislative Assembly. Salem, OR.

¹⁶ Rephlo, Jennifer. “Connected Vehicles for Safety, Mobility and User Fees: Evaluation of the Minnesota Road Fee Test.” Prepared by SAIC for the Minnesota Department of Transportation, February 2013.

Given these concerns the state legislature directed ODOT to implement a second pilot test with a focus on addressing some of the lingering issues from the first pilot by testing a system oriented around user choice. Participants in the pilot were given several mileage reporting options to choose from, with some being administered by the state and others being administered by private sector vendors. Participants could therefore choose the mileage reporting plan they were most comfortable with in terms of what data would be collected and who would handle that data. A total of four different plans were offered:

- A Basic Plan relied on a plug in OBD-II device to record all miles driven but without any GPS location being collected. Participants who chose this option were assessed RUC for all miles driven regardless of where those miles were traveled
- An Advanced Plan used a plug in OBD-II device to record all miles and assign those miles on a state-by-state basis using GPS data. Participants who chose this option were assessed RUC for only those miles driven within their state of record and on public roads.
- A Switchable/Smartphone-based plan used GPS enabled plug in devices coupled with a participant's smartphone to collect mileage and location data but allowed participants to turn on and off the location data gathering feature. For this option, participants could choose whether RUC would be assessed for miles traveled outside their state of record while selecting when their vehicle location would be reported.
- A Simplified Flat Fee plan where participants would use no device and would simply write a check for mileage. This option was for participants who either chose to not have technology in their vehicle or their vehicle was not compatible with the other OBD-II plug in devices.

One major difference between the Oregon RUCPP and other pilots conducted to date is that the Oregon participants actually paid the \$0.0156 per mile road usage charge as opposed to using simulated payments. Fuel taxes paid during the course of the pilot were treated as credits against the assessed fee. Participants from Washington and Nevada were assessed their RUC and their payments were simulated.

In order to generate stronger support for future road usage charging efforts, ODOT included state legislators and representatives from transportation stakeholder groups in the new pilot. ODOT was also interested in seeing if the system could handle fees for several states, so participants were also recruited from Nevada and Washington. (One of the advantages of using the advanced or switchable/smartphone plans, which used location data, was that participants were only charged for mileage accrued within their state.)

Lessons Learned: ODOT considered the 2013 RUCPP, like its predecessor, a successful pilot. Participants logged over 121,371 miles in three months, and invoices for all 88 participants were properly calculated and distributed. The evaluation team estimated that the \$0.0156 per mile charge generated 28% more in revenue than the state fuel tax for participating vehicles. All of the participants who started the pilot completed it and 92% stated in surveys that the system was either "easy" or "very easy" to use and 58% indicated that their views of the system were either "more positive" or "much more positive" after having participated. The devices deployed were viewed as being easy to install, did not pose safety issues, and there were no attempts to tamper with the devices. Furthermore, participants stated that the system protected privacy either as well or better than common systems used for credit cards and mobile phones.¹⁷

Washington State Road Usage Charge Pilot Project

In 2012 the state legislature directed the Washington State Transportation Commission (WSTC) to assess the feasibility of transitioning from the fuel tax to road usage charges for funding transportation investments. The WSTC subsequently established a 20-member steering committee to conduct research

¹⁷ Oregon Department of Transportation. *Road Usage Charge Pilot Program 2013 & Per Mile Charge Policy in Oregon.* <https://www.oregon.gov/ODOT/HWY/RUFPP/docs/RUCPP%20Final%20Report%20-%20May%202014.pdf>

and make recommendations back to the WSTC and state legislature. Through these initial deliberations the steering committee concluded that the concept is indeed viable and developed a work plan to further refine the concept for Washington.

In 2013, following the steering committee's initial report, the state legislature allocated additional funding in order to develop the business case and operational concept for a road usage charge. At the conclusion of these efforts the steering committee presented a policy framework for several operational concepts. Additional funds were provided in 2014 to examine issues related to impacts on bonding, equity issues, transition issues and interstate issues. In 2016 the Washington Department of Transportation was awarded \$3.847 million in STFS funding to test "critical elements of interoperable, multi-jurisdictional alternative user based revenue collection systems." The Washington pilot should deploy in 2017 and will focus less on testing potential technologies and more on gauging participant reactions to the system and identifying public acceptance factors.¹⁸

California Road Charge Pilot Program

In 2014 the California legislature established the California Road Charge Technical Advisory Committee and charged it to "study road usage charge alternatives to the gas tax, gather public comment, and make recommendations" to the California State Transportation Agency (CalSTA) regarding a road charge pilot program.¹⁹ To accomplish this a 15-member committee composed of various transportation stakeholders from across the state was formed. This committee convened on a monthly basis to discuss policy and technical issues. In its final report, the committee recommended the following as components for the road charge pilot:²⁰

- Participants should have a choice in selecting mileage recording methods.
- Participants should have a choice in selecting account managers.
- The pilot should include out-of-state vehicles.
- The pilot should utilize an "open system" design.
- The pilot should test interoperability with that of other states road charging systems.
- The pilot should include individuals, households, businesses, and at least one government agency.
- The pilot should include a representative cross-section of at least 5,000 vehicles.
- The pilot should provide methods for exempting out-of-state mileage and mileage accrued on private property.

In arriving at these recommendations, the committee held 12 public meetings and received input from over 400 stakeholder groups and elected officials. The committee also obtained information from a public opinion survey and focus groups.

The California Road Charge operational pilot began in July of 2016 and completed in March 2017. A total of over 4,800 participants encompassing over 5,100 vehicles were included in the pilot test, where they were assessed a \$0.018 per mile charge. The pilot relied on a number of private account managers offering different value-added services in addition to different road use assessment plans. As such, participants were able to choose from several mileage-reporting options, including:

- **Time Permit** - Participants purchase unlimited road use over a specific period of time
- **Mileage Permit** - Participants pre-pay for a certain number of miles and a certified reading was required at the pilot's beginning and end

¹⁸ Washington State Transportation Commission. "Washington State Road Usage Charge Assessment – Phase 4 Report." 5 January 2016.

¹⁹ California Transportation Commission. "Road Charge Technical Advisory Committee." http://www.catc.ca.gov/meetings/Committees/Road_Charge/Road_Charge.html, Accessed on 30 September 2016.

²⁰ California Transportation Commission, California Road Charge Technical Advisory Committee. *Road Charge Pilot Design Recommendations*. December 2015.

- **Odometer Reading** - Participants pay based on periodic odometer readings which was verified at an official vehicle inspection station or via a smartphone app and photograph
- **Plug-in Device (Location-based)** - Participants use in-vehicle equipment that transmits travel information to the account manager for fee assessment with out-of-state mileage and travel on private roads being credited
- **Plug-in Device (Non-location-based)** - Participants use in-vehicle equipment that transmits road usage data but does not use (or transmit) location data)
- **Smartphone** - Participants use a smartphone app to record and report road usage.
- **Telematics** - Participants use factory installed, on-board systems within their vehicle to record and report road usage.

A total of 5,129 vehicles participated in the California Road Charge Pilot through March of 2017. Of these, most (87%) were privately owned vehicles registered in the state of California. About 5% of participating vehicles were light commercial vehicles and 1% were heavy commercial vehicles. The remaining 7% of participating vehicles were agency vehicles and out-of-state vehicles. The most popular make and model vehicle participating in the pilot was the Toyota Prius with 290 participating vehicles. The second most popular vehicle was the Ford F-150 accounting for 231 participating vehicles. About 79% of California’s participants chose an automated mileage-reporting option, and about 62% used location-based mileage reporting options. Participants did not incur any out of pocket expenses as the pilot, like others before it, does not collect any money from participants. At the conclusion of the pilot program, the state legislature will use the results of the pilot to decide whether to look at implementing a full-scale road charge system.²¹ At the time of this report, California is compiling their end of pilot legislative report which will provide key findings and lessons learned from the program.

Western Road Usage Charge Consortium (RUC West)

The Western Road Usage Charge Consortium (RUC West) is a voluntary coalition of 14 western states, including Colorado, that have pooled funding and other resources to explore RUC options that might be implemented on a multi-state basis. While the coalition has used its pooled funds to support various policy and planning studies related to the implementation of multi-state RUC systems, the group was recently awarded STSFA funding in the amount of \$1,500,000 (through the Oregon Department of Transportation) to develop a multi-state RUC pilot for the western US. These funds will support a two-phase effort involving definition of a multi-state pilot (Phase 1A) and the development of essential regional pilot project plans (Phase 1B). After these initial system definition and pilot planning activities the coalition will likely pursue additional funding to conduct a multi-state pilot. A critical component of the current effort will be the development of a Concept of Common Operations (CCO) document that outlines how the system will operate and be administered. The current effort will also produce a marketing and outreach plan with associated communications tools that can be used by RUC West member states in discussing the RUC concept with elected officials, stakeholders and the general public. The effort is anticipated to conclude in the summer of 2018.

Since its inception in 2014, RUC West has funded several research studies related to RUC throughout the western US. These projects include:

- Critical examination of the Oregon RUC program
- Addressing out-of-state drivers in a RUC system (Phase I)
- Impacts of a changing vehicle fleet fuel economy on state transportation funding
- Addressing out-of-state drivers in a RUC system (Phase II)

²¹ Caltrans. “California Road Charge Pilot Program – Frequently Asked Questions.” http://www.dot.ca.gov/road_charge/faq/index.html. Accessed on 30 September 2016.

- Web-based cost transportation calendar
- Effects of RUC on rural residents
- Public understanding of a RUC system
- Impacts of changing fleet fuel economy on state transportation funding
- Road map for state consideration of a RUC system
- Protection of privacy in a RUC system
- RUC vendor certification
- Plan for Regional RUC pilot (ongoing)
- Parameters for a RUC rate (ongoing)

1.2.1.3 Oregon “OReGO” Implementation

Based on the success of its previous two pilots and the legislative support those efforts engendered, Oregon implemented the nation’s first legislatively mandated road usage charge program for passenger vehicles in July 2015. The “OReGO” program is limited to 5,000 initial volunteer participants, that functions as a replacement to the state fuel tax. Participation in the program is limited based on fuel efficiency such that no more than 1,500 vehicles with a fuel efficiency of less than 17 mpg and no more than 1,500 vehicles with a fuel efficiency between 17 mpg and 22 mpg may participate. Participants in the OReGO program are assessed a rate of 0.015 per mile and credited any state fuel taxes paid.

The system was activated in July of 2015 and is still running. Those wishing to participate can sign-up online and provide their vehicle identification number, odometer reading and license plate number. From there they select an account manager and create an online account. Account managers are responsible for providing a mileage reporting device, assessing mileage, and collecting payment. OReGO offers both private and government account managers with options for participants. The Commercial Account Managers (CAMs) offer both a GPS enabled device that allows for the crediting of out-of-state miles and a “basic” non-GPS enabled plug-in device for participants that do not want their location collected. One of the OReGO CAMs, Azuga, was also the account manager for the Colorado RUCPP, and their role is further discussed in later sections of this report. Participants who enroll with a CAM are offered a menu of value added services including:

- visual trip logs
- “achievements” for good driving behavior
- safe Zones that notify when the vehicle has crossed a user defined zone
- engine health, diagnostic and other telematics based reports
- advanced navigation
- car finding service for use by smartphone
- remote vehicle use monitoring

The Oregon state account manager (OAM) offers only a “basic” device with no value-added services for participants. This option is for participants who prefer their RUC accounts to be administered by the state government as opposed to a commercial company.

OReGO will continue in its current form for the foreseeable future. ODOT was recently awarded \$2.1 million in STSFA funding in order to make improvements to the system to expand technology options, address policy considerations, expand their public outreach, and evaluate additional pricing alternatives.

1.2.2 Truck Charging Systems

Almost all of the road usage charging efforts conducted in the US and covered in this report deal with passenger vehicles. However, there are actually several road usage charging systems in the US for commercial vehicles like heavy trucks.

Long haul truckers in the US are also likely to participate in the International Fuel Tax Association (IFTA) and the International Registration Program (IRP). These systems are not true road usage fee systems in

the sense that fees are being collected from truckers, but they do function in a manner similar to what we might expect a multi-state road usage charge to look like. Both systems require truckers to keep logs of their travel that include information on location and distance travelled. Truckers are required to keep these if they are an interstate shipper and travel in states and Canadian territories that participate in IFTA and/or IRP. The information contained in these logs is periodically sent to the IFTA and IRP clearinghouses who use the information to determine how much interstate truck travel is occurring in the various participating states. Once this is determined, fuel tax revenues and commercial vehicle registration revenues get reallocated among the member states based on where travel is occurring. States and territories with the most commercial travel logged get the most.

Several states also levy weight-distance fees on heavy commercial vehicles including: Kentucky, New Mexico, New York and Oregon. All of these systems are paper-based in that they require drivers to maintain written travel logs that are used in the assessment of fees. Oregon recently tested an electronic reporting system meant to streamline the reporting process for commercial firms.

The IFTA and IRP data and financial clearinghouse capabilities are also being evaluated by states exploring RUC. The clearinghouse concept supporting IFTA and IRP contains many similar functional capabilities and data routing and interoperability protocols that could be used to collect and disseminate data and revenues in multi-state RUC programs.

1.2.3 RUC Efforts in Colorado

In 2016 CDOT launched a pilot test of the RUC concept through the Colorado Road Usage Charge Pilot Program (RUCPP). As will be discussed in subsequent sections of this report, the pilot included nearly 150 participants in a statewide test of three different road usage mileage reporting options and associated account management systems.

However, prior to this effort the state of Colorado had previous experience with the RUC concept. In 2008 the Colorado Transportation Finance and Implementation Panel issued its findings and recommendations. One of those recommendations was for CDOT to study “mileage-based user fees (MBUF),” another name for road usage charges. As a result, in 2011 CDOT initiated an effort to identify potential strategies for mileage fee implementation and engage the public in developing some potential fee options.

The team first conducted a review of other mileage fee efforts in Oregon, Puget Sound, and by the University of Iowa. Next, the team conducted 19 interviews with CDOT stakeholders regarding state transportation funding, their understanding of the MBUF concept, and their opinion of three different mileage fee implementation options. The first option was called the “Current System Model,” which would entail maintaining and indexing the current state motor fuel tax and adding a vehicle registration “gap” fee designed to address future gaps in transportation funding resulting from electric and hybrid vehicles. The next model, the “Infrastructure-based Model,” would place tolls on all facilities where tolling is feasible, tolling new capacity, and implementing a new “transportation utility fee.” This transportation utility fee would be similar to impact fees paid by property owners and would be based on the estimated number of trips generated by use of the property. This fee would provide funding for all non-toll viable statewide facilities. The final model was the “Mileage-based Model,” which would implement a per-mile fee using either bulk odometer mileage reporting (static fee per mile) or GPS-based reporting (variable fee based upon location and/or time of day), and implement a vehicle registration gap fee.

Interviewees were then asked for their opinions on Colorado’s transportation funding system and the three funding proposals. Most interviewees envisioned a future transportation system in Colorado that is well maintained, safe, offers choice, and is equitable. They noted that a sustainable and enhanced funding source should be a part of this vision and that insufficient transportation revenue will limit the achievement of this future vision. Most believed that the fuel tax is indeed unsustainable and insufficient and stated that they would like to see transportation needs met through a menu of funding options. Their support for the three alternative funding options depended on lots of specific details, but

mileage fees were seen as being an equitable and sustainable source of funding that could result in positive travel behavioral changes. The stakeholder interviewees agreed that privacy is likely to be one of the biggest issues for the people of Colorado when it comes to mileage fees. Overall, interviewees noted that the “Current System Model” was most likely to be embraced by the public, mostly because it is similar to the existing tax and registration funding system and would therefore require less education, public relations effort, and would be lower in cost to implement.

The research team also conducted three focus groups: two in Denver and one in the town of Brush in rural Northeast Colorado. Participants in these focus groups discussed Colorado’s transportation funding system, transportation needs in the state, and provided input on various transportation funding alternatives. Participants in all three sessions generally agreed that the state should continue to evaluate funding alternatives while also finding ways to increase efficient spending of existing sources and eliminate waste. As such, when talking about road usage charges, participants showed a clear preference for systems that are simple, low cost, and easy to understand from a driver’s perspective.

The research team also conducted outreach to CDOT stakeholders to solicit input on how the state of Colorado should pursue alternative funding mechanisms. Approximately 25 representatives from CDOT, other state agencies, Metropolitan Planning Organizations (MPOs), organizations representing transportation advocacy and stakeholder groups, and two elected county officials attended a half-day workshop in Denver and participated in these discussions. Attendees agreed that Colorado’s transportation funding situation is severe and requires immediate action. They noted that new funding sources like road usage charges will take years to test and implement and that interim measures, most likely involving existing funding sources, are needed to generate transportation revenue now. They also agreed that road usage charges are a sustainable option and should be evaluated. Participants also agreed that such charges will present significant public acceptance and political challenges, but that they are desirable because they generate new revenue and better connect users with their impact on the transportation system.

1.3 RUC Evolution and Lessons Learned

The first generation of RUC pilots established that the concept is feasible, but needs further exploration and refinement for implementation. The second generation of pilots have built upon this initial feasibility work by exploring different account management options to improve public acceptance and lower costs to the state. However, RUC systems are still generally immature and challenges remain to their implementation. National experience has found, and previous work in Colorado has confirmed, that public acceptance and associated political resistance are likely to be the most significant challenges facing the implementation of road usage charges. Demonstrations of the RUC concept in Oregon proved effective in addressing many of these concerns, which has enabled subsequent pilots and the current implementation. However, this success will need to be repeated to some degree in other states to gain wider acceptance, but it is not necessary for each state to test the concept from the perspective of a basic technology viability perspective. As such, the Colorado RUCPP was structured in order to leverage lessons learned from other states while still focusing on issues pertinent to Colorado motorists.

RUC experiences to date have illustrated three primary areas of public concern; areas which specifically informed Colorado RUCPP design and operation. These include:

1. **Privacy** – 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 when they travel. Research and experience has shown that one effective way to address privacy concerns is to allow users to select the mileage reporting option they are most comfortable with. Those with significant privacy concerns can select a low-technology mileage reporting option such as odometer reporting, while those that are more comfortable with technology can select the GPS enabled mileage option. All technology options generate a mileage measurement through the OBD-

II port, and not GPS. GPS functionality allows for greater detail in billing and the provision of value added services. The Colorado RUCPP thus allowed participants to select from low-tech and high-tech mileage reporting options. In either case, technology or non-technology, user privacy is protected.

2. **Cost of implementation, operations and administration** – Fuel taxes are a relatively low cost and efficient tax to collect as they are initially assessed and collected from licensed fuel distributors, those companies who receive fuel from a manufacturer, and then distribute it to local gas stations. This means that there are a relatively small number of collection points. Road usage charges would need to be collected for each vehicle, potentially increasing the cost of collection due to the exponential increase in collection points. Because they often rely on in-vehicle and aftermarket mileage reporting technologies, there are additional costs associated ranging from hardware to wireless communications and data processing costs. The public is aware of this added complexity and is hesitant to support a new transportation funding system that is more expensive to collect. As such, there is an increasing focus on finding ways to utilize the private sector for road usage charging system administration and operations. The Colorado RUCPP utilized private sector technology and an account management services provider.
3. **Enforcement** – In addition to being low cost, fuel taxes are also relatively easy to enforce. If someone drives a vehicle with an internal combustion engine, it is likely they have purchased taxed fuel. However, enforcement of road usage charging is more complex, and the public is not likely to support a funding system with perceived weak enforcement where individuals can easily avoid paying RUC. One way to address this is to levy the road usage charge as a replacement to the fuel tax and not as an added tax; whereby any fuel taxes paid by the participant when they purchase fuel, are credited back to the motorist as part of their RUC invoice. This creates a need to credit drivers for fuel taxes paid, which in turn creates an incentive to accurately report mileage and even adopt more accurate (high-tech) mileage reporting options. Agencies may also address enforcement issues by increasing the role of the private sector for administration and operation of technology-based mileage reporting options and linking road usage charges to value added services that might be provided by in-vehicle devices. The Colorado RUCPP was structured such that all drivers received a “credit” for fuel taxes paid during the course of the pilot. Furthermore, the users of high-technology mileage reporting option were given access to a number of added features that allowed them to monitor travel, vehicular diagnostics, safe driving behaviors, and other potentially valuable services.

Equity – In spite of recent RUC pilot success, issues of equity are likely to persist with the concept. 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. Furthermore, RUC systems represent a highly visible new charge from the perspective of the user, particularly since fuel taxes are embedded in the retail price of motor fuel and effectively hidden from the driver. Since road charging systems are based on actual use, they are perceived as being unfair to drivers who travel further on a trip-by-trip basis and therefore charged more per-trip. Such travel behaviors and vehicular characteristics are unique from state to state and from region to region within states. As such, regardless of how technically and administratively feasible RUC is in one state, equity concerns will nonetheless have to be evaluated and addressed in each state. The Colorado RUCPP was thus structured such that participation was stratified by geography and vehicle type. This, coupled with the collection of mileage data from reporting devices or odometer readings, will allow for an assessment of how a Colorado RUC system might disproportionately impact different drivers. Additionally, CDOT, through their membership in RUC West, has explored the rural and urban impacts of RUC. The conclusions to date are that while rural drivers may drive more miles, generally, they drive less fuel-efficient vehicles than their urban counterparts. Assuming that a RUC program will credit any paid fuel taxes back to the motorist, most rural drivers may see a positive impact from participating in a RUC program. Additional equity studies are planned to explore the impacts of RUC on other socioeconomic categories.

2 Colorado Road Usage Charge Pilot Program

2.1 Pilot History

The Colorado Road Usage Charge Pilot Program (RUCPP) represents the state of Colorado’s first effort to pilot test the RUC concept, where motorists would pay for their road use on a per-mile basis as opposed to through gas tax. Funds from CDOT’s State Planning and Research (SPR) program were used for the pilot. SPR funding is from federal sources and is dedicated to planning and research related activities. As such, no state funding and no funding that would otherwise be used to develop, maintain or preserve Colorado’s roadways were used for this pilot. CDOT was responsible for overall management of the pilot. As can be seen in the timeline shown in Figure 8, the RUC concept has been under consideration since 2007, but planning efforts for the RUCPP began in 2016.

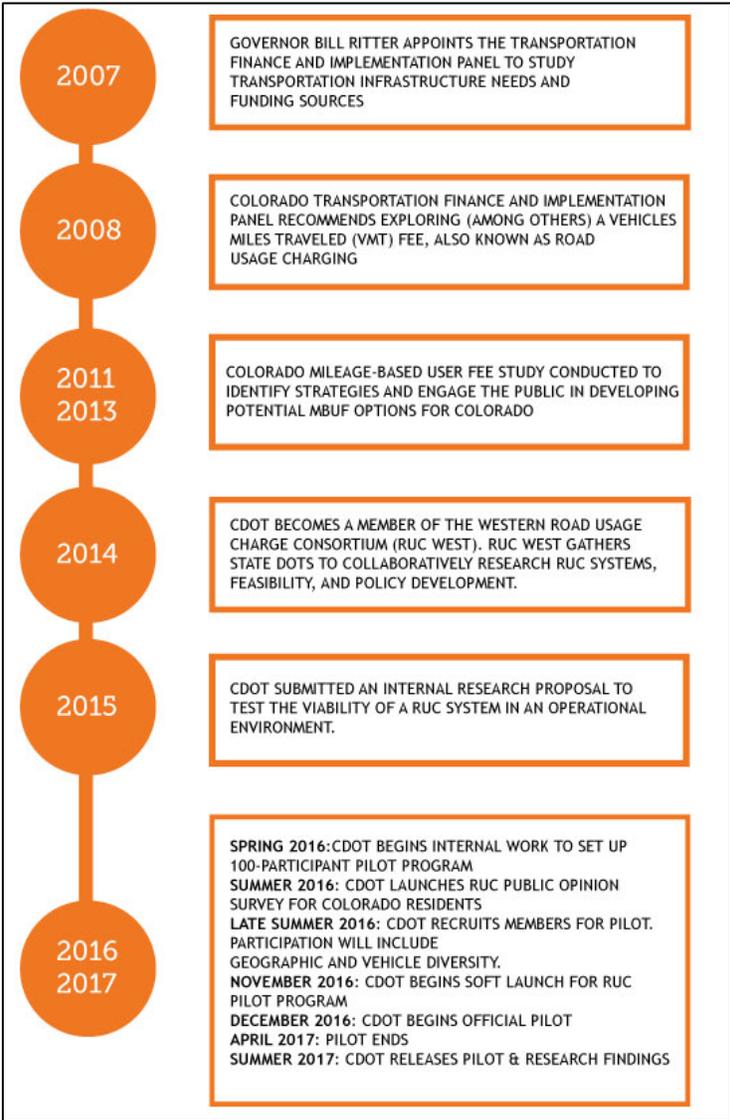


Figure 8: Colorado RUC timeline

2.2 Pre-deployment Activities

The Colorado RUCPP was operated and administered by CH2M with PRR providing communications support and WSP providing, research, reporting and other support services. Azuga served as the private sector account manager, providing mileage reporting devices (MRDs) and web-based account management services. Oversight was provided by CDOT executive leadership, a technical advisory committee (TAC) as well as steering committee composed of elected officials and transportation stakeholders.

Numerous activities were undertaken prior to the deployment of the RUCPP including the following:

1. Establishing a **project charter** and **high-level goals and objectives** with CDOT's Executive Management Team and the TAC;
2. The administration of a **statewide baseline survey** to establish public understanding and acceptance of the RUC concept and to initiate outreach and pilot recruitment activities;
3. The development of a **communications plan** for outreach and messaging on the RUC concept and specifically the RUCPP with the general public, stakeholders and elected officials;
4. The launch of a **pilot website** providing some of the key tenets of the RUCPP and monthly updates to the pilot;
5. The development and initiation of a **recruitment and enrollment program** to identify participants from the general public, transportation stakeholder groups and elected officials;
6. Establishing a **notional RUC rate of \$0.012** per mile based on the total Colorado state gas tax revenue, divided by the total vehicle miles traveled by Colorado passenger vehicles fueled by gasoline ²²; and
7. The implementation of a two-week "**soft launch**" with staff from CDOT to inform key participants and to test and correct any pilot system design issues prior to RUCPP launch.

2.2.1 Baseline Survey

In August of 2016, the pilot research team, with oversight from CDOT, conducted a demographically diverse baseline web-based survey to 500 people statewide. The purpose of this survey was to gauge knowledge and perceptions of Colorado's transportation funding system, the road usage charge concept, and to recruit participants for the pilot effort. The survey gauged the current understanding of Colorado residents on transportation funding, the understanding of RUC, perceptions about the equity of RUC, and some key concerns associated with RUC programs. Upon completion of the survey, respondents were asked if they would be interested in participating in the pilot. Those who indicated that they were interested were subsequently directed to the project website where they could provide their information.

The survey also asked respondents to provide some basic socioeconomic information, what types of vehicles they own, and where within the state they reside.

The opinion survey did not show significant differences in knowledge and perceptions of the RUC concept among Colorado's population. This survey captured the following information:

- Number of vehicles in households
- Driving (in regard to mileage) behavior

²² Note the purpose of the Colorado RUCPP was not to evaluate revenue impacts, rather to assess the technical and operational feasibility of the RUC concept. The RUC rate was calculated specifically for the pilot and is illustrative only; no money was exchanged as part of the Colorado RUCPP, and all payments and/or fuel tax credits were simulated. A per-mile rate for a road usage charge system would be determined by the Colorado State Legislature.

- Opinions about RUC
- Understanding of CDOT’s revenue shortfall
- Knowledge of the state gas tax.

Overall finding: The survey did not show significant differences in knowledge and perceptions of the RUC concept among Colorado’s population. Respondents were first asked a series of questions designed to gauge their knowledge of transportation funding in Colorado and RUC specifically. The survey revealed a wide gap in knowledge regarding how transportation is funded, showing 61% did not know the combined state and federal fuel tax rate is \$0.41 per gallon. When asked about their perceptions of the current tax rate (Figure 9), 45% indicated that rate was more than what they thought they were paying, while 39% the rate was about what they expected. About 10% of respondents were unaware they were paying a tax on fuels. In terms of general transportation funding knowledge, 64% were aware transportation in Colorado is underfunded, but 62% were unaware of the funding gap.

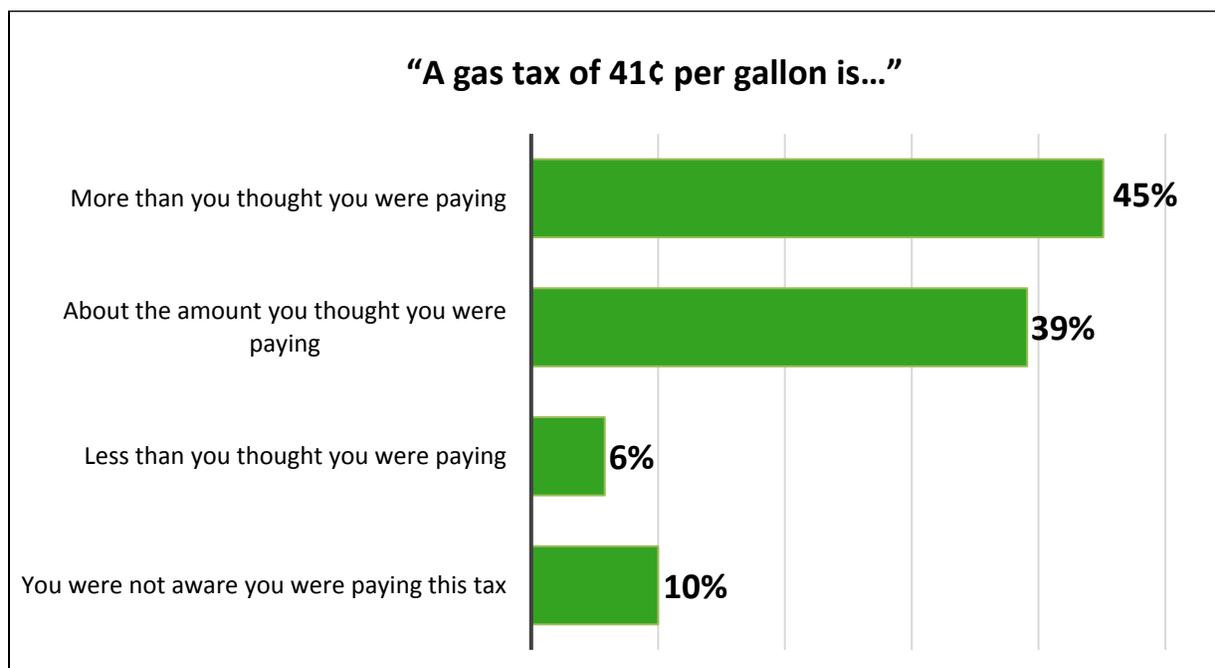


Figure 9: Perceptions of state and federal fuel tax rates

Respondents were also asked about different alternative funding approaches that might be deployed to address transportation funding challenges. The option receiving the highest support (32%) was the use of tolling on specific highways and bridges where improvements are being made. Implementing a sales tax received 17% support and increasing the vehicle registration fee received 13% support.

Awareness of the RUC concept was low, with 74% being either somewhat familiar or not at all familiar with it. A similar number, 71%, were unaware of RUC efforts in other states. Less than half of the respondents, 40%, somewhat or strongly agreed that a mileage-based system for transportation funding would be fair, while 43% were neutral to strongly supportive of implementing a road usage charge in Colorado. However, after providing RUC related information the survey provided a concluding question on potential support for RUC, which registered an increase with 58% of respondents indicating neutral to supportive perceptions.

The baseline survey also collected more detailed input on RUC perceptions and specifically respondent perceptions of the concept’s biggest drawbacks (Figure 10). Equity issues were the most predominant, as 54% perceived a RUC would unfairly penalize rural drivers and 32% said it would not properly calculate those who frequently cross state lines. About 27% believed RUC was simply too complicated, while 26% expressed a general aversion to taxes. About 22% indicated privacy was the biggest drawback, meaning respondents were concerned about their personal information being shared with a

government entity or third-party vendor. Nearly three quarters of respondents (71%) reported feeling very concerned or moderately concerned over the privacy and security of their data in a potential RUC program. In spite of these perceived drawbacks, about 40% of respondents agreed RUC is a fair way to pay for transportation.

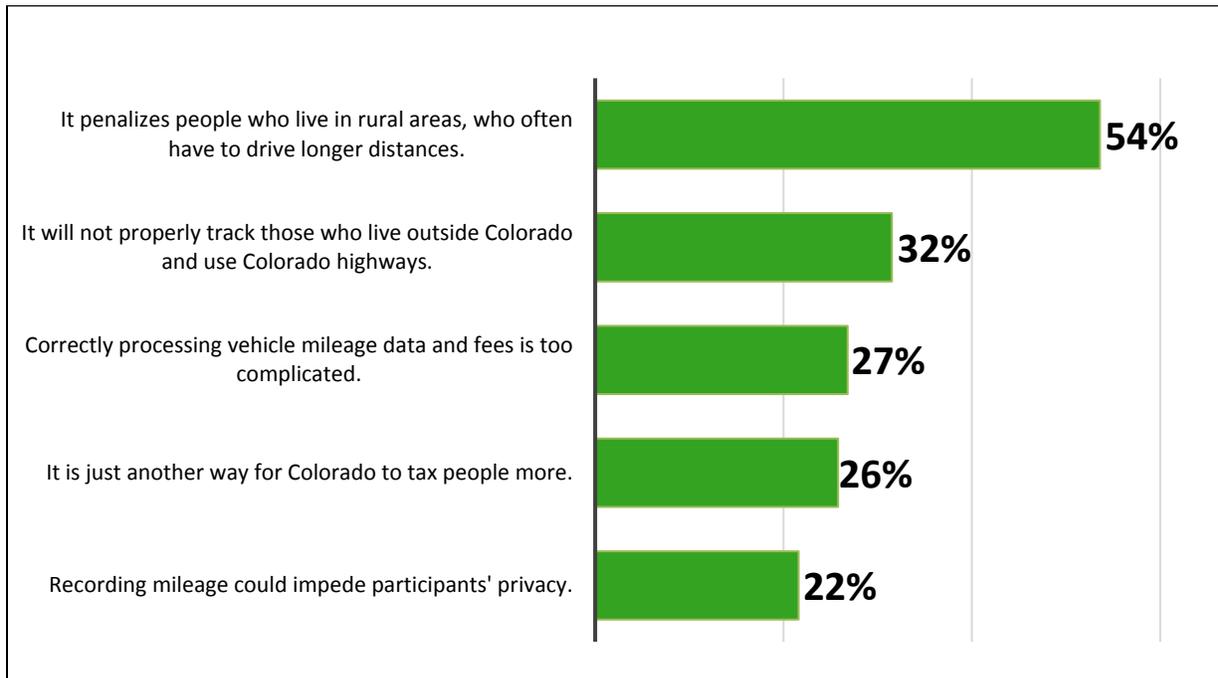


Figure 10: Respondent perceptions of RUC drawbacks

The main concern regarding a RUC was unfairness for rural drivers, but respondents also indicated an awareness of drawbacks to the gas tax that included concerns with fairness. For example, nearly half of respondents (46%) agreed the gas tax is unfair to people who have less fuel-efficient vehicles. Furthermore, 42% of participants agreed the gas tax might be unfair since more fuel-efficient vehicles put as much wear and tear on roadways as other cars, but pay less in fuel taxes. The most commonly cited drawbacks for fuel taxes were: increased gas prices (42%), unfairness to lower-income residents (38%), and unfairness to those who can't afford more fuel-efficient vehicles (37%).

Only about one in ten (11%) said they would volunteer for a pilot program, though a quarter (24%) expressed interest in receiving news and updates about the program. In terms of specific pilot program elements, respondents were interested in several Account Manager features including: being able to review detailed information about their vehicle diagnostics (53%), receiving alerts if their vehicle moves without their permission (48%), and the ability to monitor fuel usage costs relative to their driving habits (46%). The most appealing feature of a road usage charge program was that personal information would be kept secure and private (59%), followed by receiving credits for the gas tax to offset the road usage charge (48%).

The results of this baseline survey were used to craft key messages for the Colorado RUCPP as part of subsequent communications efforts. Furthermore, it provided a baseline assessment of the general public's perceptions of RUC for comparison to RUCPP participant perceptions prior to and after participating in the RUC pilot. This comparison is provided in Section 3: Pilot Results.

2.2.2 Communications

Communications for the pilot program were driven by a plan developed by key CDOT personnel in conjunction with the project team. The primary goal of this plan was to increase the awareness and understanding of Colorado residents and stakeholders of the RUC concept and Colorado RUCPP, as the

Baseline Survey Report indicated 61% of respondents did not know they were paying \$0.41 per gallon in gas tax (combined state and federal). To gain support for more sustainable transportation funding models, such as RUC, Coloradans first need to understand how roads are currently funded. Furthermore, they must understand that a significant \$25 billion transportation funding shortfall has been identified over the next 25 years, and that the current funding system will be insufficient to address those needs. To facilitate the distribution of these messages, the Colorado RUCPP project team and CDOT relied on several communications tools:

- A project [website](#)
- Newsletters
- General media interactions
- Social Media

A wider, more involved and more aggressive outreach effort was originally envisioned to support the Colorado RUCPP and achieve the public education goals noted above. However, upon further consideration and reassessment of overall CDOT priorities it was decided to deemphasize that effort. Communications efforts still covered a range of media and communications tools, but messaging was not as frequent as originally planned. However, in spite of this limited outreach the pilot still enjoyed fairly strong support among participants, as presented in Section 3.7: Participant Perceptions.

2.2.2.1 Website content

One of the first outreach and messaging activities undertaken as part of the project was the development of a website for pilot. The website (ruc.codot.gov) was added as part of CDOT's existing website and provided information on the pilot effort and directed potential participants to additional resources. The Colorado RUCPP website featured the following elements:

- Funding Information;
- RUCPP History
- Summary of the RUCPP;
- Road Usage Calculator;
- Enrollment Page for participants;
- Enrollment FAQs – Provided in Appendix A; and
- Program FAQ - Provided in Appendix B.

Each page on the RUCPP website provided links to additional resources, including:

- CDOT contact information;
- A link to news regarding the RUCPP;
- A link to a RUCPP fact sheet; and
- A link to a recruitment page for those interested in participating in the pilot.

Funding Information

The RUCPP website provided visitors with information regarding transportation funding in the state of Colorado. It started with a summary of challenges to the current transportation funding framework including increases in vehicular fuel efficiency, declining purchasing power of the fuel tax (Figure 11), and an increasing population. The page also provided population projections (increase of 47%) and vehicle miles travelled (47%) in the state through 2040 to underscore that transportation funding issues are likely to worsen, absent significant Change in the funding framework.

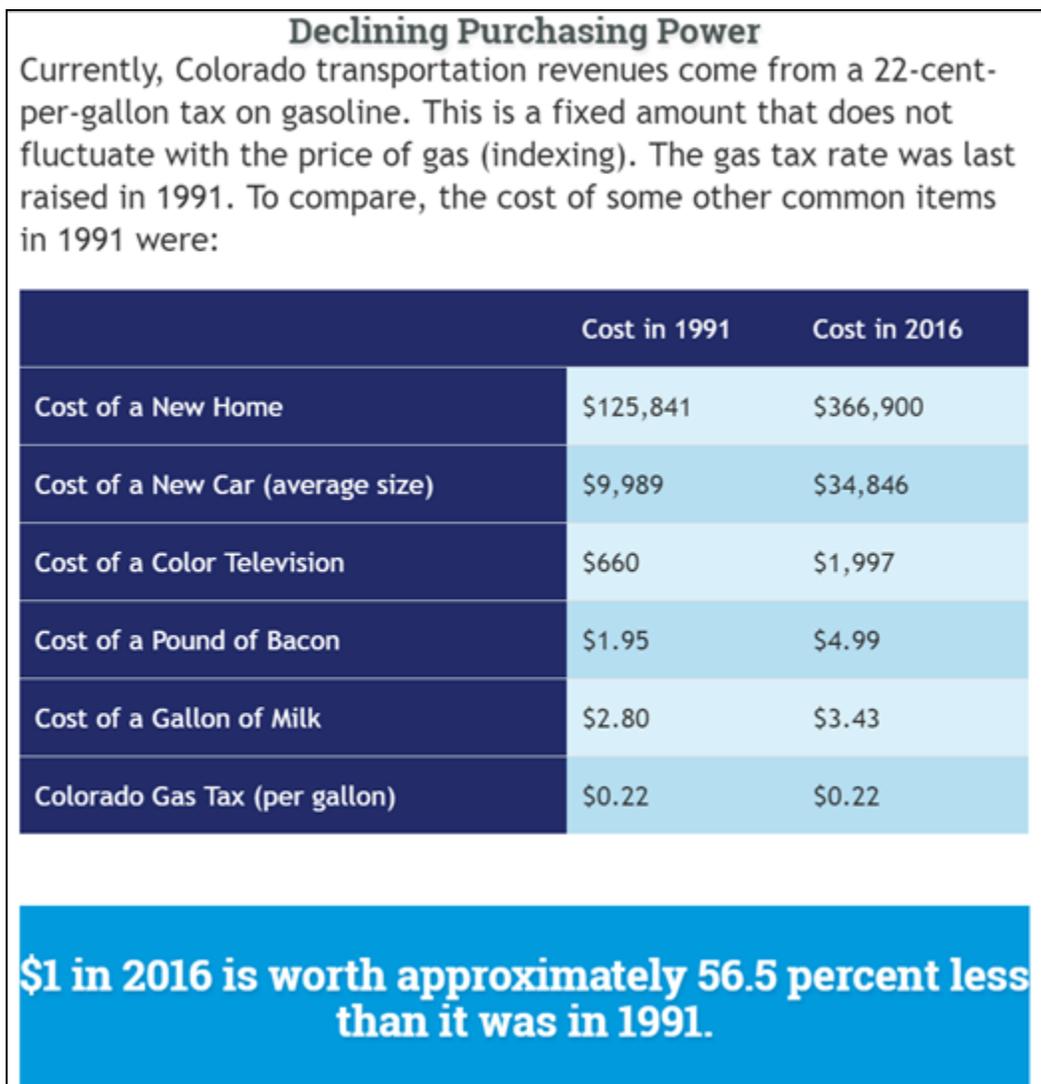


Figure 11: Graphic used on RUCPP website to illustrate decline in fuel tax purchasing power

This page also featured information on how RUC systems can address funding challenges, primarily by charging in proportion to actual road use and detaching funding from fuel consumption.

Operational Pilot Summary

This page provided an overview of how the pilot would work from the participant’s standpoint. It started by presenting the overall objective of the pilot and provided basic goals for achieving that objective:

- Demonstrate a RUC;
- Identify and evaluate issues;
- Test the feasibility of various mileage-reporting options; and
- Solicit feedback and ideas.

The page provided a graphic (Figure 12) illustrating the processes and functional flows of the pilot.

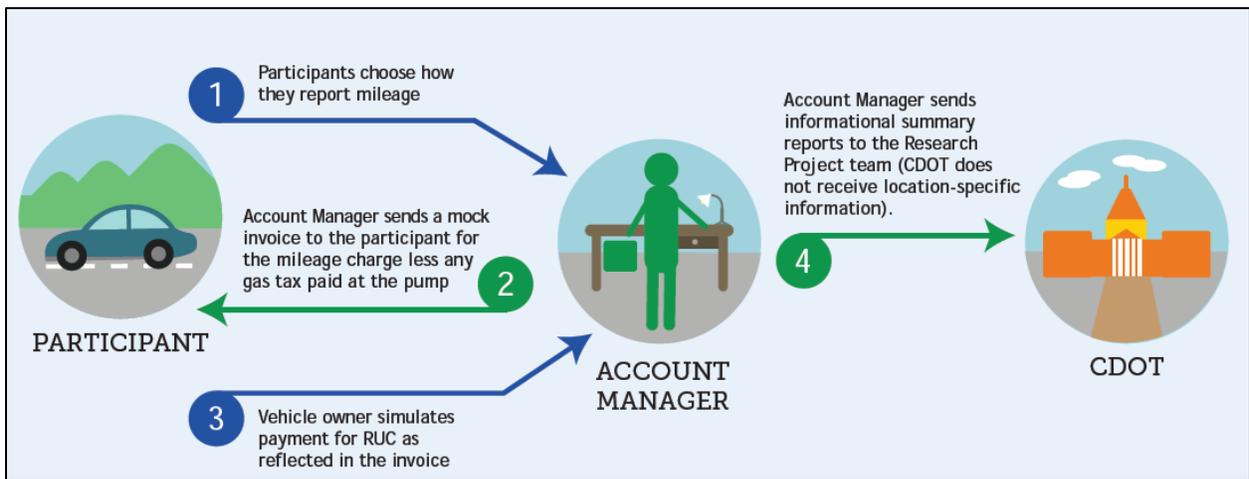


Figure 12: Graphic illustrating processes and functional flows for the RUCPP

The page also provided a brief project timeline and additional discussion on each of the different mileage reporting options (Figure 13).

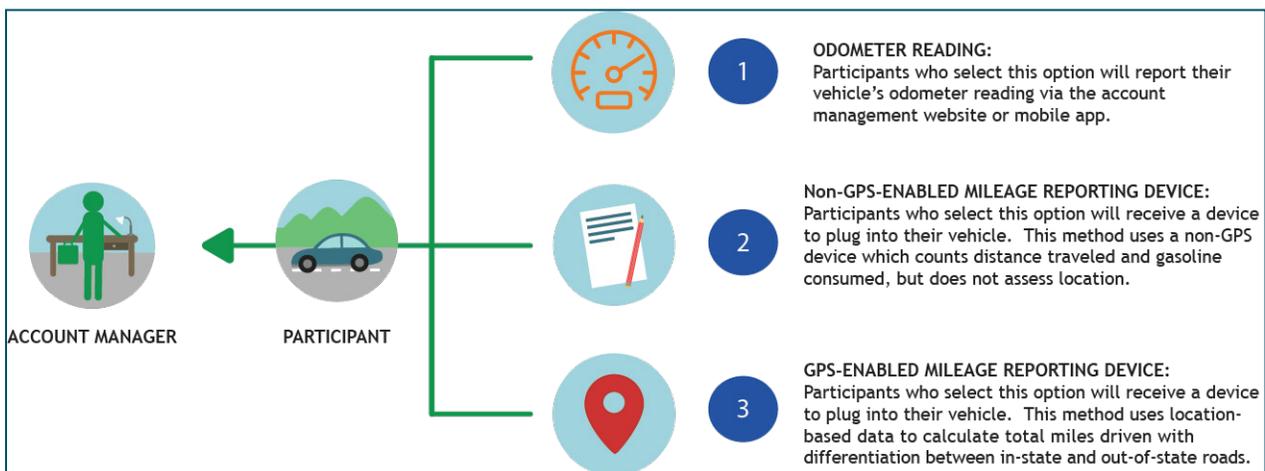


Figure 13: Graphic used to illustrate mileage reporting options

Road Usage Charge Calculator

The website also featured a “Road Usage Charge Calculator.” Users could enter their vehicular fuel efficiency manually or enter their vehicle make, model, and other specifications to have their vehicle’s EPA fuel economy looked up from an online database. They were then provided their estimated monthly fuel taxes paid and provided an estimate of what they might pay under a RUC program with \$0.012 per mile being assessed on their travel (Figure 14). The calculator also gave users the option of seeing what a fully electric vehicle pays in fuel taxes (which was always \$0.00) versus what they might be charged under a RUC system. This information was provided as a starting point for learning about RUC and how it might impact them personally.

2015 Subaru Outback AWD Regular Gasoline		
EPA Fuel Economy		
28 combined	MPG 25 city	32 hwy
How Much You Pay Per Month:		
	Gas Tax	RUC Rate
State	\$3.93	\$6.00
Federal	\$3.29	\$3.29
Total	\$7.21	\$9.29
Under a State RUC of \$0.0120 per mile, your monthly State RUC would be \$2.07 more than the current State Gas Tax structure.		
Compare to a Fully-electric vehicle		

Figure 14: Screenshot of RUC calculator webpage showing estimated RUC

2.2.2.2 Newsletters

As the RUCPP planning and deployment evolved, interested parties received updates including emailed newsletters. Four newsletters covering different topics were sent to over 500 people including pilot participants throughout the pilot’s operational phase. A copy of these newsletters is provided in Appendix C.

The first newsletter introduced people to the Colorado RUCPP and shared some quick history about how it came to be. It provided a high-level overview of the Pilot timeline and CDOT’s next steps.

The second newsletter provided readers with background information on the pilot, beginning with a brief introduction on the state of Colorado’s current transportation funding situation. It next presented brief overview of how the operational pilot would function in terms of mileage reporting options. The first newsletter closed with information on the next stages of the pilot and providing information on resources related to the pilot.

The third newsletter provided additional information about the pilot account manager, Azuga, and their role in the pilot. The newsletter also provided basic information about the invoicing process and directed readers to a page where they could view a mock invoice showing how information would be presented. The newsletter closed directing readers to a RUC calculator that allowed for a comparison of fuel taxes paid versus RUC based on the type of vehicle and miles travelled.

The final newsletter provided summary information on those participating in the pilot, some general pilot results, and initial participant perceptions. It closed with a discussion on the next steps in the pilot process.

2.2.2.3 Other Media interactions

CDOT and the pilot team were aware media would play a key role in disseminating RUC messages to multiple demographic groups. As such, the team leveraged CDOT’s existing relationships with media markets throughout the state to provide information and outreach on the RUC concept and the RUCPP. Furthermore, three people from the media were actively recruited to participate in the Colorado RUCPP to provide a firsthand experience.

A formal press release on the pilot was issued on November 12, 2017 and was picked up and circulated by numerous media outlets throughout the state including the Denver Post, the state’s most well-read

newspaper. The press release generated RUC interest. The press release notified the public of the pilot program and directed them to the Colorado RUCPP website where they could obtain more information and indicate their interest in participating in the pilot. A significant number of general public participants were identified as a result of this initial media release, which is provided in Appendix D. Also, as a result of the press release, a significant increase in the number of visits to the RUCPP website was also noticed. On the day of the press release, the number of website visits spiked to 908. Figure 15 below shows the number of RUCPP website visits over the duration of the project, with emphasis on how the number of visits increased after the CDOT press release.

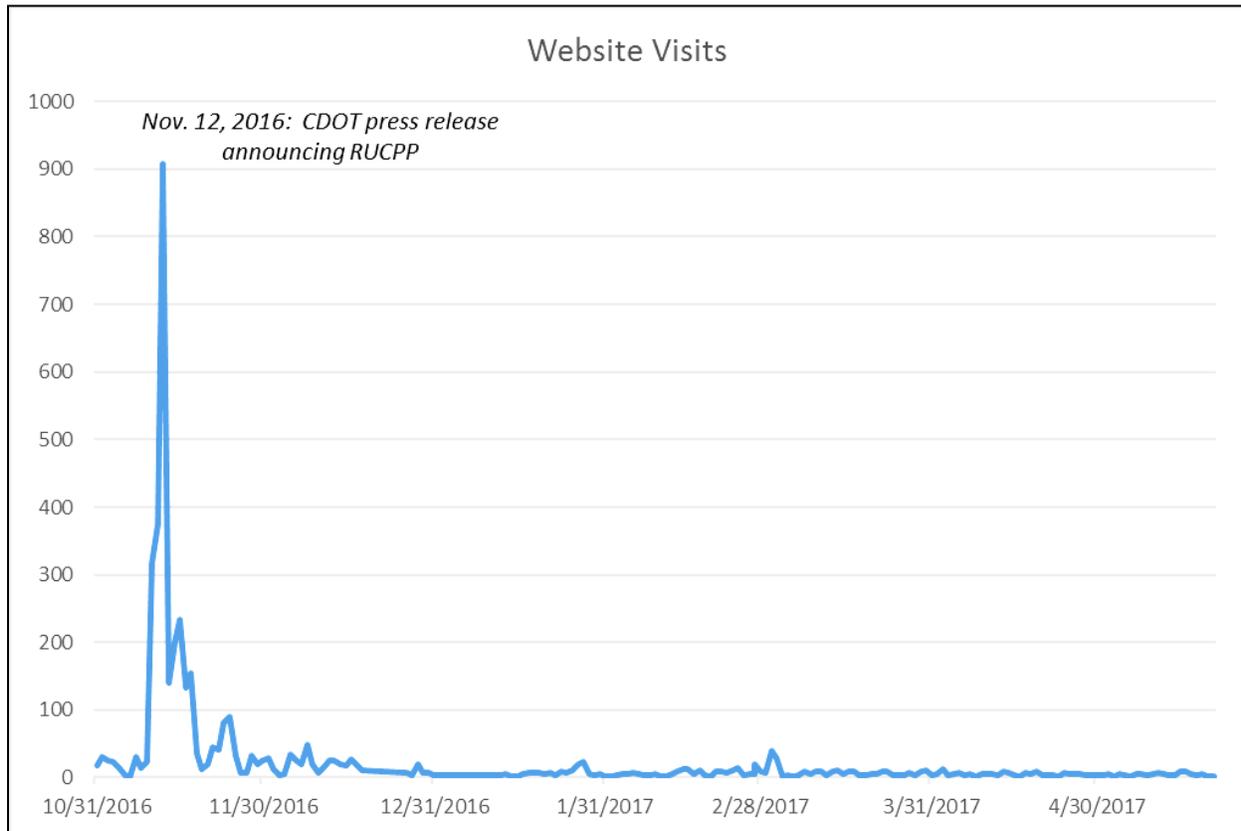


Figure 15: Colorado RUCPP Website Visits (provided by Google analytics)

2.2.2.4 Social Media

CDOT also uses social media to provide source conduit for two-way communication, welcoming comments, questions and ideas from the public. CDOT and the project team originally planned to initiate a social media campaign to share information on possible funding alternatives including the RUC concept and the RUCPP beginning in September 2016 with existing CDOT social media channels (i.e., Facebook and Twitter). Since the overall communications strategy shifted, CDOT made two postings to the department’s Facebook page regarding the RUCPP. The first, shown in Figure 16 below, was posted on November 10 and encouraged enrollment in the RUCPP program and directed followers to the main RUCPP webpage to obtain more information.

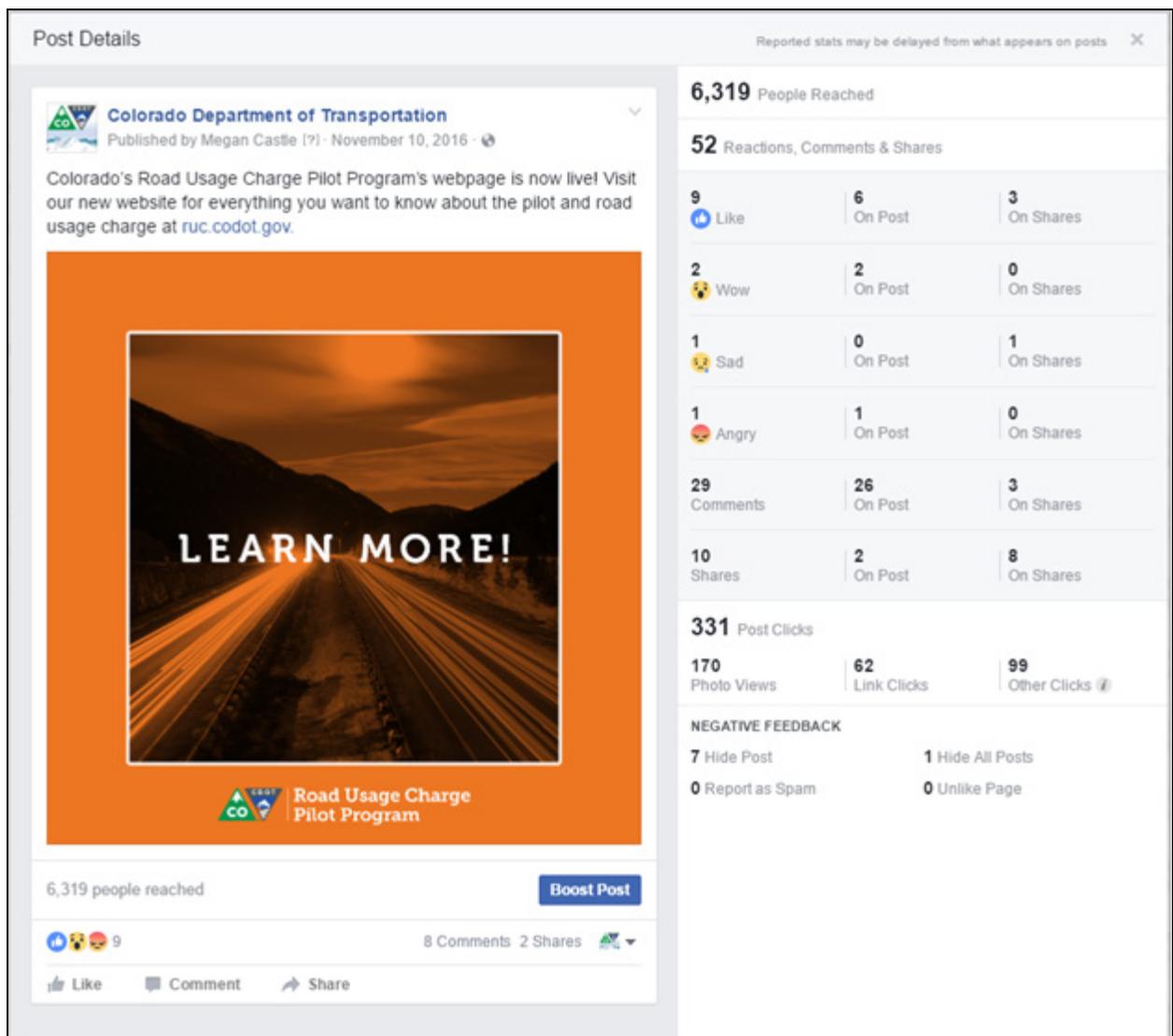


Figure 16: 11/6/2016 CDOT RUCPP Facebook post with view stats

The second Facebook post regarding the RUCPP provided information on how the cost of goods and services has increased since the time of the last increase in the state's motor fuel tax. That post is shown in Figure 17.

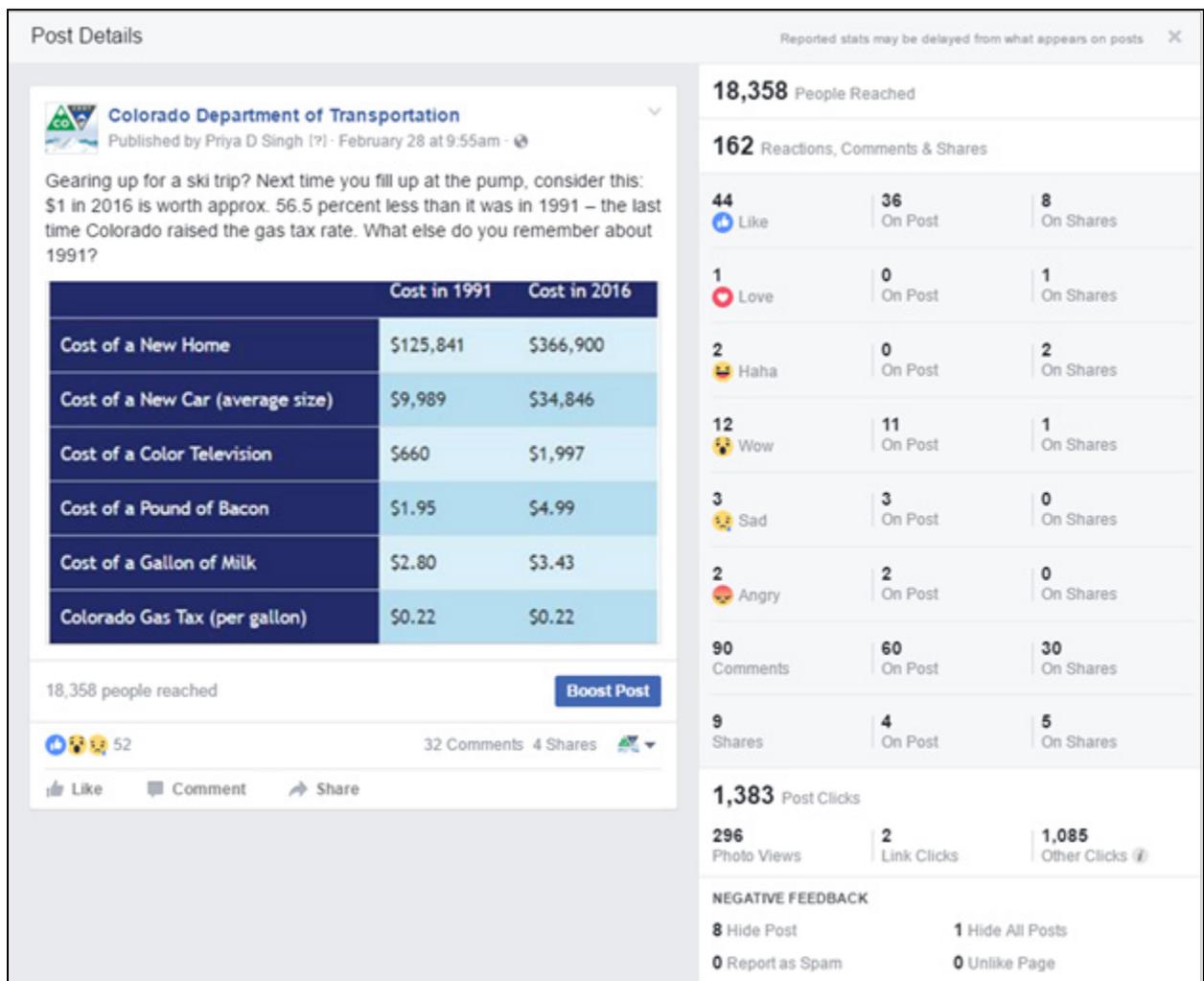


Figure 17: 2/28/2016 CDOT RUCPP Facebook post with view stats

As can be seen in the view stats, the February post reached almost three times as many people and generated over three times as many comments as the first November post.

2.2.3 Recruitment

Recruiting activities were oriented around achieving two primary objectives:

- **Geographic Stratification:** delineation across multiple regions to show technical feasibility regardless of where participants live.
- **Vehicle Stratification:** delineation across multiple vehicle types, with emphasis on fuel economy, to demonstrate the feasibility of RUC regardless of vehicle type.

2.2.3.1 Stakeholder Recruitment

One of the first recruitment activities was to identify a potential pool of stakeholders and decision makers to recruit for participation in the pilot. The image shown in Figure 18 below was developed by RUC West, a voluntary coalition of 14 state departments of transportation from the western US that are committed to collaborative research and development of RUC systems. It depicts a composite stakeholder map meant to provide guidance on targeted recruitment for RUC pilots. It was developed to identify stakeholders that both influence RUC, and are directly impacted by RUC. The graphic identifies quadrants where CDOT, and other states, should focus their efforts based on the extent to which

stakeholders might be impacted by a RUC system and their potential power/influence over RUC system design and implementation.

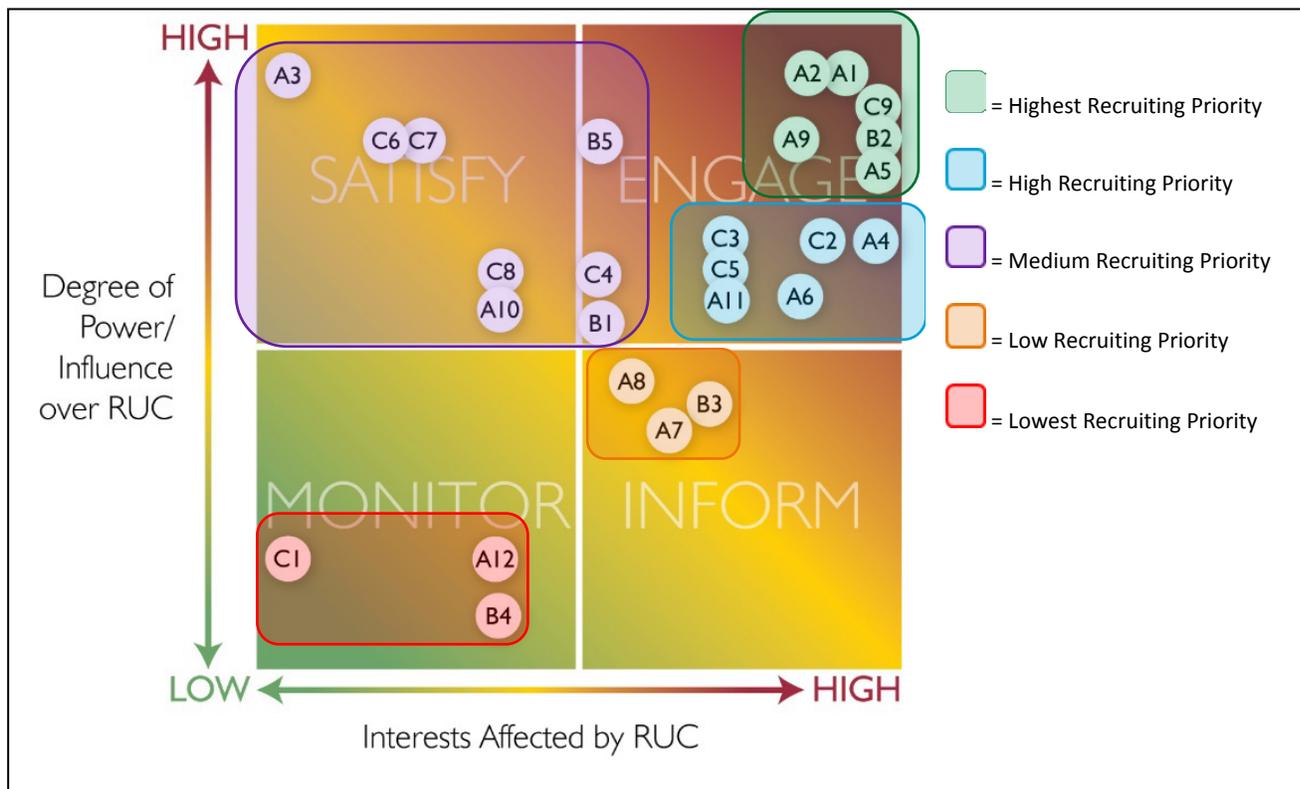


Figure 18: RUC stakeholder strategy map

Occupants in the “Engage” quadrant have both a high interest in RUC and a high degree of influence over the continuation of RUC activities. They therefore require the highest level of engagement and their interest and influence in RUC will play a key role in long-term acceptance of RUC. As such, pilot participation was sought from as many of these groups and entities as possible. The next highest level of priority was those with a high degree of affected interests, but with lower degrees of influence, as their affected interests may affect other more influential stakeholders. Third level priority was given to those with higher degrees of influence, but lower degrees of affected interests. Fourth level priority was given to those with lower degrees of influence, but still high degrees of affected interests. The lowest priority is given to those stakeholders with both low influence and low degrees of affected interests.

Table 2 shows a breakdown of the organizations that were targeted for stakeholder participation for the RUCPP, correlated against the matrix shown in Figure 18. This table shows the specific agencies or organizations, the target number of recruits from each organization, and the stakeholder category and blended recruiting priority for each agency/organization.

Table 2: Targeted Recruiting Composition

Agencies/Organizations	Number of Participants	Stakeholder Categories	Recruiting Priority
Technical Advisory Committee	5	A7, A8, A10, B2, C5	High to Medium
Steering Committee	10	A2, A6, A9, A10, A11, C2, C3	Very High
CDOT	16		
Headquarters & Region 1	8	A4, A5, A7	Very High
Regions (2-5)	8	A4, A11	High
Other VIPS	37		
Legislators	8	A2, A12	Very High
City/County Officials	5	A3, A11	Medium
Governor's Office	2	A1	Very High
Transportation Commission Members	6	A4	High
University Representatives	4	C1, C2	Medium to Low
Other Transportation Organizations	6	B5, C2, C4	High
Chambers of Commerce	6	A11, B5	High to Medium
Media	2	C7, C8, C9	High to Medium
TOTAL	70		

Targeted stakeholder recruitment was led by CDOT pilot team members. Ultimately, only 30 targeted stakeholder participants participated in the pilot, indicating that significant outreach and education to stakeholders and elected officials is still required in order to gain wider acceptance of the RUC concept. Any subsequent RUC evaluation efforts should also look to expand stakeholder participation by including additional stakeholder groups such as the tourism industry and farming and ranching organizations. The 30 stakeholders who did participate in the Colorado RUCPP represented the following groups and organizations:

- Transportation Commissioners
- Denver Chamber of Commerce
- Local governments/municipalities
- CDOT Executives
- FHWA
- News/Print Media
- State Legislators

2.2.3.2 Public Recruitment Methodology

The pilot team recruited members of the public from four outreach methods:

- Interest after participating in the baseline survey
- Social media posts
- Earned media
- RUC webpage on the CDOT website

The general public were directed to the project website to sign up as either an interested party or complete a survey to become a potential participant. The survey provided demographic and vehicle information to help meet recruitment objectives based on vehicle type, vehicle mpg, geographic region, mountainous terrain, etc. As such, a list of people interested in participating in the pilot was developed and maintained from which participants were ultimately selected based on the RUCPP’s recruiting objectives. Once the final stakeholder participants were recruited the pilot team determined what geographic and vehicle stratification requirements had not been met. The pilot team filled those gaps with members of the public.

2.2.3.3 Geographic Stratification

One of the key objectives for communications and education is the need to show that, much like the gas tax, RUC could be feasible across multiple geographic areas and topographies. As such, one of the key requirements for the Colorado RUCPP was geographic stratification across the State of Colorado, with an emphasis on rural mountain geographies to show how well per-mile information could be reported in areas with limited cellular communications coverage. To support this objective and assist with the recruiting, the pilot team used CDOT’s Regional subdivisions as a basis for geographic stratification. These subdivisions are shown below in Figure 19.

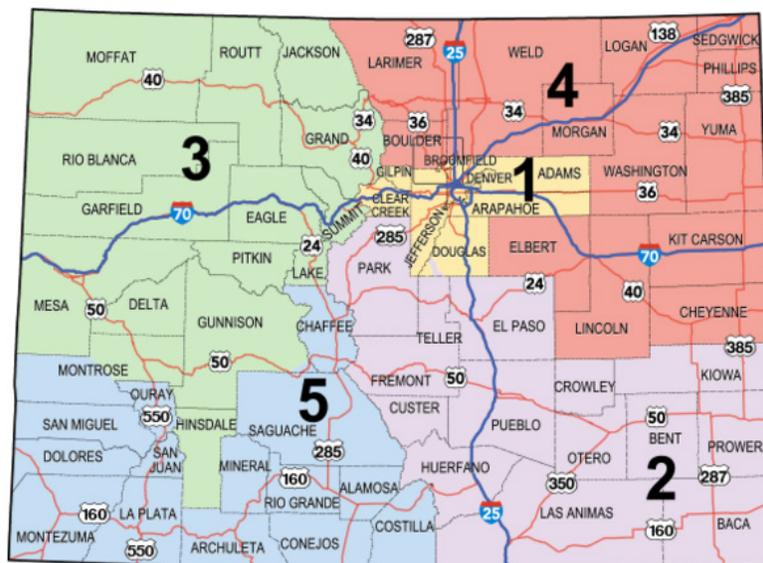


Figure 19: CDOT regional subdivision map

By using the CDOT districts as potential geographic delineators, the RUCPP could capture participants from urban, rural, and more specifically, mountainous rural communities, and leverage CDOT staff in each district to support recruiting efforts. Table 3 provides a correlation between each CDOT district, the urban/rural concentrations for each district, and number of participating vehicles in the RUCPP.

Table 3: Urban/Rural Concentration of CDOT Regions

CDOT Region	Rural	Urban	Number of Participating Vehicles*
1	○	●	48
2	●	◐	17
3 (Mountain)	●	◑	10
4	◐	◑	21
5 (Mountain)	●	○	5
*These numbers do not include soft launch participants or pilot project team participants. It only includes recruited stakeholders and general public participants who volunteered for the RUCPP.			

○ = Very Low; ◐ = Moderately Low; ◑ = Moderate; ◒ = Moderately High; ● = Very High

2.2.3.4 Vehicle Stratification

Vehicle stratification was another key delineator in determining a balance in RUCPP participants. As previously mentioned, the RUCPP requires vehicular stratification across four main vehicle categories, to identify compatibility across a wide range of vehicles. These categories and the final vehicle stratification for the pilot are shown in Table 4 below. As the table shows, participation targets were met in terms of mix of fuel efficiency and the participation of electric and highly fuel-efficient vehicles.

Table 4: Stratification of Vehicles by Fuel Efficiency

Requirement	Number of Participating Vehicles*	Results
Minimum 2 vehicles with fuel economy between 10-25 miles per gallon (MPG)	61	Average fuel economy for these vehicles was 19 mpg
Minimum 2 vehicles with fuel economy between 25-45 MPG	34	Average fuel economy for these vehicles was 29 mpg
Minimum 2 vehicles with fuel economy 45 MPG and above	3	All of these vehicles were hybrids with an average fuel economy of 48 mpg. One was located in Jefferson County (District 1), another in Arapahoe County (District 1), and the third was located in Pueblo County (District 2)
1 electric vehicle (EV)	3	Two of these vehicles were located in Douglas County (District 1), and the third was located in Weld Count (District 4)
*These numbers do not include soft launch participants or pilot project team participants. It only includes recruited stakeholders and general public participants who volunteered for the RUCPP.		

Figure 20 shows the breakdown of participating vehicles by model year. The pilot included vehicles both old and new from 1993 to 2017. The average model year for a participating vehicle was 2010, with the largest number of participating vehicles being model year 2015.

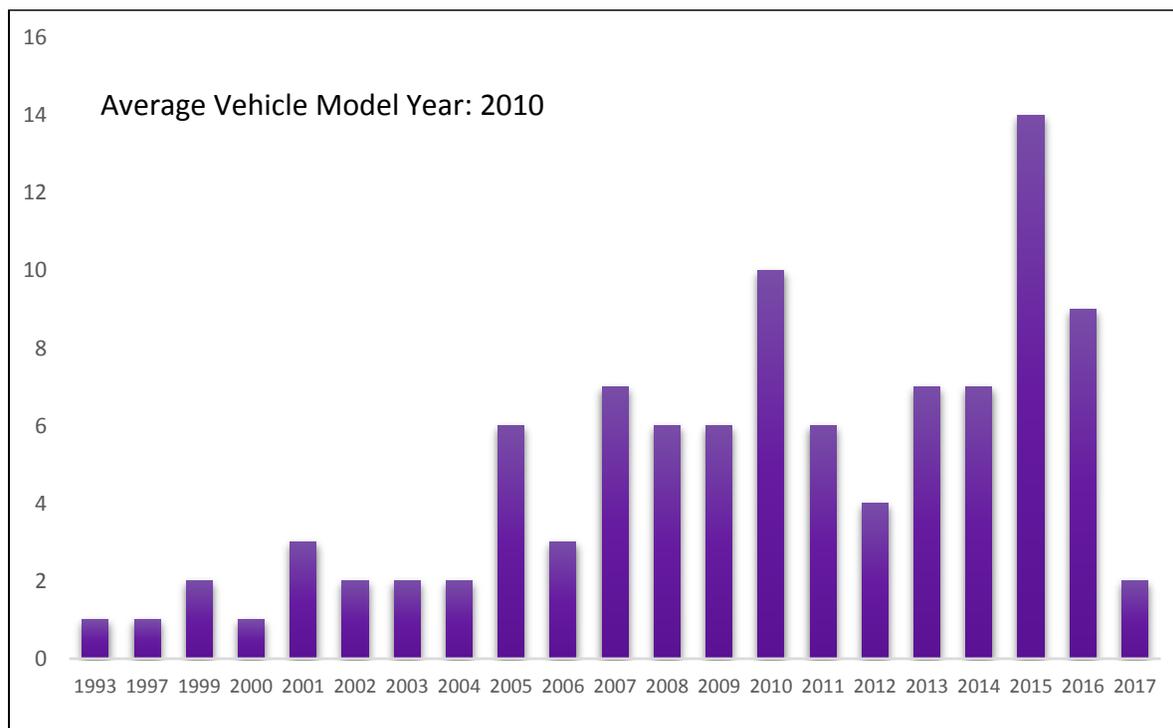


Figure 20: Number of participating vehicles by model year

Table 5 provides additional detail on vehicle stratification based on geography. As the table shows, rural CDOT districts tended to have older, less fuel efficient participating vehicles. There were no vehicles with a fuel efficiency of 45 mpg or electric vehicles participating from the rural Region 3 or Region 5.

Table 5: Number of Participating Vehicles by Fuel Economy and CDOT Region

Vehicle Categories	CDOT Regions					Total*
	Region 1 Urban (Denver / Metro)	Region 2 Urban / Rural (Southeast)	Region 3 Rural (West)	Region 4 Urban / Rural (Northeast)	Region 5 Rural (Southwest)	
10 - 24.99 mpg	23	13	8	12	5	61
25 to 44.99 mpg	21	3	2	8		34
45 mpg and above	2	1				3
Electric	2			1		3
TOTAL VEHICLES*	48	17	10	21	5	101
Average Vehicular Fuel Efficiency	28.3 mpg	21.4 mpg	21.7 mpg	25.2 mpg	17.6 mpg	
Average Vehicle Model Year	2011	2010	2012	2009	2005	

**These numbers do not include soft launch participants or pilot project team participants. It only includes recruited stakeholders and general public participants who volunteered for the RUCPP.*

2.2.4 Soft Launch

To vet the Colorado RUCPP's systems for recruitment, enrollment, account management, mileage reporting, fee assessment and invoicing prior to full pilot launch the pilot team initiated a "Soft Launch" of the system in November 2016.

The Colorado RUCPP Soft Launch was conducted in two phases. Phase 1 of the Soft Launch (referred to as the User Acceptance Test) was conducted from November 2 through November 9 and included participants from CDOT including select regional offices, as well as members of the pilot development team. Phase 1 Soft Launch participants were selected to meet similar geographic and vehicular stratification goals as the operational pilot. This pool included participants throughout Colorado as well as participants near the state border. This allowed the testing of location-based reporting devices that would discount out-of-state mileage. The Phase 1 Soft Launch participant mix also included electric, hybrid and gas vehicles with low, mid and high fuel efficiencies. Mileage reporting options were assigned to each participant to test the three mileage reporting options for the operational Colorado RUCPP. Thus, each mileage reporting option was tested by multiple Phase 1 Soft Launch participants. In addition to testing mileage reporting options, Phase 1 Soft Launch participants also tested other system components such as specific enrollment processes, invoicing procedures, mileage logs, and help desk procedures. Any and all issues identified with any of the RUCPP systems by soft launch participants were catalogued in an issues log, which was used to make refinements and adjustments in preparation of the full operational deployment. Issues and lessons learned from Phase 1 Soft Launch were resolved (if possible) prior to Phase 2.

Phase 2 of the Colorado RUCPP Soft Launch was conducted from November 18 through November 30 and included participants from the CDOT Executive Management Team and the Regional Transportation Directors. Phase 2 of the soft launch allowed these individuals to experience the RUCPP prior to the full operational pilot. It also allowed the pilot team to receive additional feedback and make final system refinements prior to the operational pilot.

The issues log developed during the soft launch included the type of issue encountered, a detailed description of the issue, identified the responsible pilot team member for addressing the issue, the priority of each issue relative to others, whether the issue could be incorporated by the operational pilot launch date, and whether it was completed or required no action with notes to support the resolution. The prioritization category allowed the team to focus efforts on high priority issues. Medium and low priority issues were less critical to the success of the pilot. Some low priority issues were logged as lessons learned for future pilots but required no further action for this pilot. High priority (and some low to medium priority) issues resulted in subsequent adjustments to Colorado RUCPP operations and administration prior to the full operational launch.

In general, issues identified in the soft launch and documented in the issues log fell into the following categories:

- **Recruitment and Enrollment Process** - These issues generally fell into one of four categories:
 - Formatting for emphasis- the information on project and enrollment websites, recruiting materials, device installation instructions, and mock invoices was formatted to clearly identify pertinent links and information
 - Simple content errors; - the information provided was accurate
 - Requests for additional information- there was a need for additional direction and information than what was provided on the project and enrollment websites, recruiting materials, device installation instructions, and mock invoices; and
 - General navigation issues – there were issues associated with website navigation, including app installation.

For example, some participants found the number of steps for enrollment to be confusing or had trouble finding the link for the recruitment questionnaire. The pilot team subsequently updated the project website by removing other information and links to make the page clearer and help the questionnaire stand out. Some participants were confused by the recruitment questionnaire and believed that it alone was sufficient to complete enrollment. The team stopped sending soft launch participants the recruitment questionnaire but modified language in the instructions for the operational pilot to ensure enrollment. Finally, the recruiting and enrollment websites were modified in terms of the layout and appearance to address other various issues including: adding an “enroll now” button to the enrollment page; adding new enrollment FAQs; updating participant agreements and terms and conditions for this pilot; and adding emphasis that all monies for this pilot are simulated.

- **Odometer Reading Option** - Issues with the Odometer Reading Option generally related to confusion about how the option worked, odometer reading submission requirements, and issues with the odometer reading submission process. Some were confused about how to report mileage, when to report mileage, how often to report mileage, when picture verification was required, and what the mobile app is used for. As a result, the project team added more detailed instructions to the project website enrollment page addressing the requirements for this option and how to submit odometer readings. Additional FAQs related to installing the mobile app were also added. Furthermore, some soft launch participants did not remember to submit monthly odometer readings so a reminder e-mail was developed for the operational pilot. The team also adjusted Odometer Reading Option requirements to allow odometer readings to be submitted at any time during the month and as many times as the participants want (with the last submission being used for invoicing.) Finally, there were concerns that a lack of photo verification of odometer readings could result in perceptions of vulnerability to fraud, which could also negatively impact perceptions of the pilot. Therefore, the requirements for the Odometer Reading Option were modified to require participants to take a picture of their odometer upon enrollment as well as at pilot close out. Further market research identified methods to verify odometer photo authenticity using technology; however, it was unavailable at the time of the pilot launch.
- **Mileage Reporting Device and Data Collection** - The most significant issues related to installation of the MRD for the two technology options (GPS enabled and non-GPS enabled MRDs) and specifically finding the location of the vehicle’s OBD-II port. OBD-II port locations can vary from vehicle to vehicle, making the development of a comprehensive guidance guide for all vehicles problematic. The pilot team thus developed a Quick Start Guide, provided in Appendix E, for inclusion with each MRD shipment to provide assistance. There were also a few issues in terms of mileage data being collected and reported correctly. Some of these issues included out-of-state trips not being reported correctly in the account summary, and statements including non-chargeable miles even though all miles were driven in-state. The pilot team identified and corrected the out-of-state issue in the reporting system and verified out-of-state travel was indeed being recorded correctly. Finally, the pilot team determined that the non-chargeable mileage displayed on the participant’s accounts that had only driven in state was mileage accrued on private roadways, which was still displayed on the account even though accounting for such mileage is not a component of the current pilot. The pilot team therefore removed that functionality from the Colorado RUCPP account management system.
- **Mobile Application** - The mobile application was not available in the App Stores during the soft launch, so participants had to use a series of steps to install the app on their phones which presented a challenge to many. However, these issues were largely addressed upon final refinement of the app and its placement online. Additionally, some participants reported issues with the feature on the mobile app that allowed them to report odometer readings by taking a picture of their odometer through their smartphone camera. For some, the camera option never made itself available for reporting, while others received an error message when attempting to take a picture. The issue causing these malfunctions was subsequently identified by the development team and corrected.

- **Help Desk** - Participants noted a few issues with the help desk including contact information not being clearly available and the voicemail box not working for after-hours calls. Resolution of these issues included help desk information being included in the Quick Start Guide sent with the MRDs, helpline information being made available on project-related websites and in email communications to participants, and adjusting the voicemail system and adding hours of operation to the message.

The soft launch resulted in several higher-level findings, observations and lessons learned. These include:

- **Strive for Visual Intuitiveness** – Enrollment procedures and user interfaces should be structured and presented so that critical information, in terms of both information required from the participant and information the participant requires, is apparent. This includes applying formatting to emphasize important data elements and removing unnecessary information to reduce the chance of confusion by enrollees. Many of the changes made in the Colorado RUCPP systems may appear cosmetic in nature, but changes were made out of the recognition that participants in any future RUC system will want to access information they need quickly and easily. If the enrollment process is viewed as complex and difficult, and information is not readily available to assist, it imparts an immediate negative connotation to the pilot project.
- **Anticipate Information Needs** - The soft launch highlighted the need to ensure that participants have all the information they need in order to be comfortable participating in the pilot. In some cases, this means providing additional information that can be accessed by participants as needed, such as additional guidance on OBD-II port location and device installation. This also includes information on expectations and conditions for participation, such as participant agreements and formal terms and conditions with a specific focus on privacy protections. In other cases, it means ensuring that participants receive, and are aware of, pertinent information as part of the required enrollment process. This includes requirements and expectations for odometer reporting. However, the provision of additional information must be balanced with the need to provide information in a concise and efficient manner, without cluttering website and app interfaces.
- **Minimize User Time** – The soft launch also highlighted that enrollment processes should be structured so as to minimize participant, as well as operations team, time and effort. This means streamlining processes or consolidating potentially duplicative steps. For example, some participants during the soft launch found the recruitment process to be confusing, perhaps because the steps appeared redundant or the need to complete both steps was not clearly articulated. For subsequent efforts, it may be worthwhile to more clearly delineate the purpose and need for separate recruiting and enrolling processes. Subsequent efforts should minimize the level of effort required by participants to complete both by reducing the collection of duplicative information.

Processes with reporting of mileage, regardless of the mileage reporting option selected, must be thoroughly checked in terms of their ability to accurately record data and generate an invoice. Inaccurate mileage readings are likely to generate negative perceptions of the systems deployed and reduce acceptance by participants. Isolated issues of inaccurate data were identified with the MRDs, but the technical issues behind these inaccuracies were identified and corrected. Furthermore, technical issues with regard to collecting odometer readings with smartphone cameras through the mobile app were identified and corrected.

In the longer term, CDOT will need to consider how to address installation issues with regard to MRDs used for subsequent pilots. Most soft launch participants did not encounter difficulty with device installation, but recognized there is a potential for confusion among many in the general public. The pilot team will provide a number of resources to aid in MRD installation including instructions to be sent with the device, online resources, and assistance through the help desk. However, for larger RUC efforts the state might consider contracting or partnering with entities or agencies that can assist with professional, in-person installation.

2.3 Pilot Deployment

When establishing the vision for the Colorado RUCPP, CDOT identified several key goals of the pilot. This section provides the results of the pilot and shows how each of the goals were met.

2.3.1 Pilot Program Goals

The goals of the pilot identified by CDOT were to:

1. Demonstrate an operational RUC;
2. Identify and evaluate issues;
3. Test the feasibility of various mileage-reporting options; and
4. Solicit feedback and ideas.

Additionally, several key requirements were identified that helped shape the overall pilot concept:

1. The pilot should consist of 100 participants;
2. The pilot should show vehicular stratification including:
 - a. A minimum of two vehicles with fuel efficiency between 10-25 MPG;
 - b. A minimum of two vehicles with fuel efficiency between 25-45 MPG;
 - c. A minimum of two vehicles with fuel efficiency 45 MPG and above; and
 - d. At least one electric vehicle;
3. The pilot should show geographic stratification of volunteers to ensure inclusion of urban and rural participants;
4. The pilot should ensure inclusion of GPS-selectees who regularly drive in mountainous terrain;
5. The pilot should use a notional rate for the per-mile RUC using the most recent available data on VMT and state gas tax revenues²³;
6. The pilot should capture baseline understanding of transportation funding to shape key messages; and
7. The pilot should conduct public outreach, further educating participants as well as the general public on the current transportation funding model and the RUC concept.

The Colorado RUCPP enrollment began on December 5 continued through December 31, 2016.

Operations began at that time and ran for four months ending in April 2017. A total of 106 participants enrolled in the pilot. Pilot participants experienced the full range of activities (Figure 21) that might be undertaken as part of a future RUC deployment, including:

- Enrolling in the program;
- Creating an account and registering a vehicle with an account manager;
- Selecting a mileage reporting option;
- Installing a mileage reporting device or MRD (if that reporting option was selected);
- Reporting mileage;
- Receiving invoices; and
- Submitting mock payments.

²³ Note the purpose of the Colorado RUCPP was not to evaluate revenue impacts, rather to assess the technical and operational feasibility of the RUC concept. The RUC rate was calculated specifically for the pilot and is illustrative only; no money was exchanged as part of the Colorado RUCPP, and all payments and/or fuel tax credits were simulated. A per-mile rate for a road usage charge system would be determined by the Colorado State Legislature.

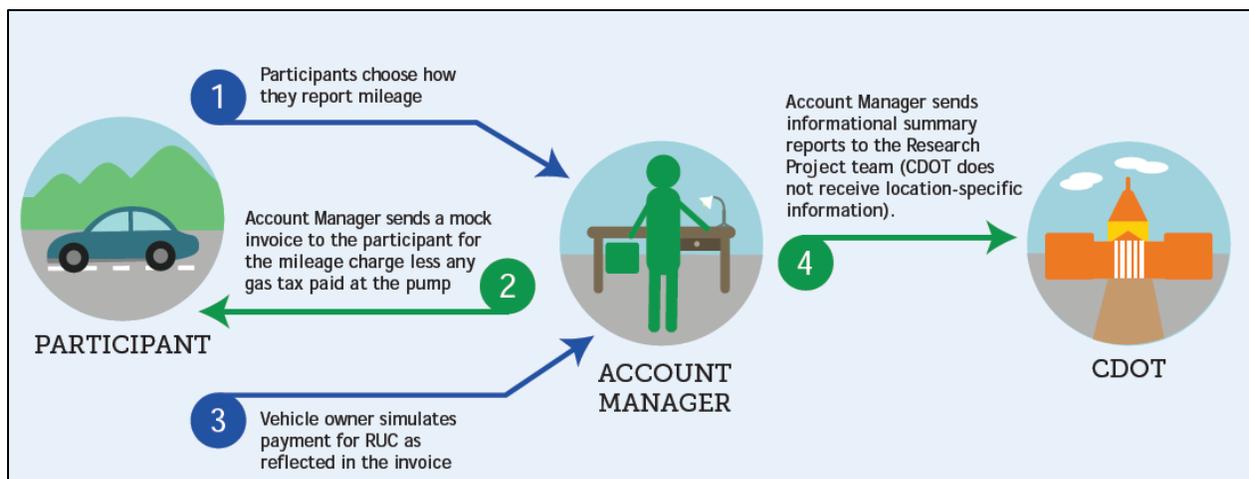


Figure 21: Pilot workflow from user perspective

2.3.2 Enrollment

The pilot team identified a series of methodical steps to support ease of enrollment for pilot participants. Upon selection into the Colorado RUCPP, participants were sent an e-mail notifying them of their selection with a weblink and unique ID directing them to the enrollment website. Participants were notified both in their selection email as well as on the enrollment page what information they would need to complete the enrollment process, which included:

- E-mail address;
- Vehicle Identification Number(s) (VIN) for participating vehicle(s);
- Current mileage on the participating vehicle(s)
- License plate(s) for participating vehicle(s);
- Vehicle year/make/model/trim for participating vehicle(s); and
- An activation code that was provided in the notification e-mail.

The enrollment page also provided information on the account manager and the various mileage reporting mechanisms provided by the pilot. The mileage reporting options as presented to the participants are shown in Table 6 below.

Table 6: Description of Mileage Reporting Options as provided on the enrollment website

Mileage Reporting Option	Plug-in Device	Description	Features
Odometer Reading	No	Participants who select this option will report their vehicle's odometer reading via the account management website or mobile app.	No mileage reporting device installed
			Submit an electronic picture of your odometer at the beginning and end of the pilot; and submit odometer updates monthly (via website or mobile app)
			Road usage charge based on all miles driven
			Credit included on statement for estimated amount of state gas tax paid (for gasoline vehicles), based on EPA average mpg estimate (not actual fuel consumption)
			Online account setup and access through Azuga website and mobile app
Non-GPS-Enabled Mileage-Reporting Device	Yes	Participants who select this option received a device to plug into their vehicle's OBD-II port; this method uses a non-GPS device which reports distance traveled and gasoline consumed, but does not assess location	Mileage-reporting device installed in car that reports all miles driven regardless of location
			Road usage charge based on all miles driven
			Credit included on statement for amount of state gas tax paid (for gasoline vehicles)
			Online account setup and access through Azuga website and mobile app
GPS-Enabled Mileage Reporting Device	Yes	Participants who select this option will receive a device to plug into their vehicle's OBD-II port; this method uses location-based data to report only those miles driven within Colorado.	Mileage-reporting device installed in car that reports miles driven miles differentiated by location
			Road usage charge based only on miles driven in Colorado
			Credit included on statement for estimated amount of state gas tax paid (for gasoline vehicles)
			Online account setup and access through Azuga website and mobile app

Furthermore, the website provided some tips for considering which mileage reporting option to use. The recommendations are shown in Figure 22 below.

Odometer Read Option	Non-GPS-Enabled Mileage Reporting Device	GPS-Enabled Mileage Reporting Device
<ul style="list-style-type: none"> • Have a vehicle made before 1996? These vehicles may not have the necessary technology to plug into you On-Board Diagnostic (OBD-II) port, the vehicle's data port used for emissions and vehicle maintenance • Prefer to report your miles manually • Drive most/all of your miles in Colorado, since this option will charge based on all miles driven 	<ul style="list-style-type: none"> • Like a "plug it in and forget about it" option • Drive most/all of your miles in Colorado, since this option will charge for all miles driven • Want some of Azuga's special features: vehicle health, battery voltage, and more 	<ul style="list-style-type: none"> • Like a "plug it in and forget about it" option • Drive out of state frequently • Enjoy seeing per-trip data • Want all of Azuga's special features: visual trip logs, vehicle location, vehicle health, battery voltage, and more

Figure 22: Considerations for mileage reporting options provided on the enrollment website

The enrollment website also provided an e-mail and phone number for the RUCPP Help Desk and the hours of operation. CH2M provided Customer Support for pilot participants through answering phones, email requests, and elevating issues to the Azuga project team when necessary.

After choosing a mileage reporting option, participants were directed to Azuga's enrollment website. Upon accessing the enrollment website, participants created their account, selected a mileage reporting option, added any new vehicles (Azuga accounts supported multiple vehicles under one account as long as they used the same mileage reporting option), accepted the terms and conditions, and explicitly signed the RUCPP and Azuga participant agreements which established the terms and conditions related to liability, data protection, and equipment care and damage.

Following enrollment participants were asked to take an initial survey in order to gauge perceptions of the RUC concept and the RUCPP. A total of 80 surveys were completed. Pre-pilot survey respondents generally indicated that they were interested in participating in the pilot so as to be "at the forefront of this project" and were generally more accepting of the RUC concept than the general public respondents to the baseline survey. More detailed discussion on participant perceptions of the RUC concept can be found in Section 3.7 Participant Perceptions section of this report.

Respondents to the pre-pilot survey were also asked to provide input on the enrollment experience, which was generally positive. For example, 45% indicated there was nothing difficult about enrolling. Overall, the resources provided to assist participants with enrollment were sufficient (Figure 23) with 91% of respondents indicating that the website provided all the information needed. Over half (55%) said they spent less than 10 minutes enrolling in the pilot while 29% spent 10-20 minutes. Gathering the required information (VIN, mileage, etc.) proved to be the biggest challenge, with 33% indicating this step was the hardest part.

Participants were asked when they enrolled in the RUCPP and their experience with that process. About 29% enrolled immediately after reading the email invitation to RUCPP, while 41% enrolled in 1-3 days. 45% of respondents said there was nothing difficult about the enrollment process.

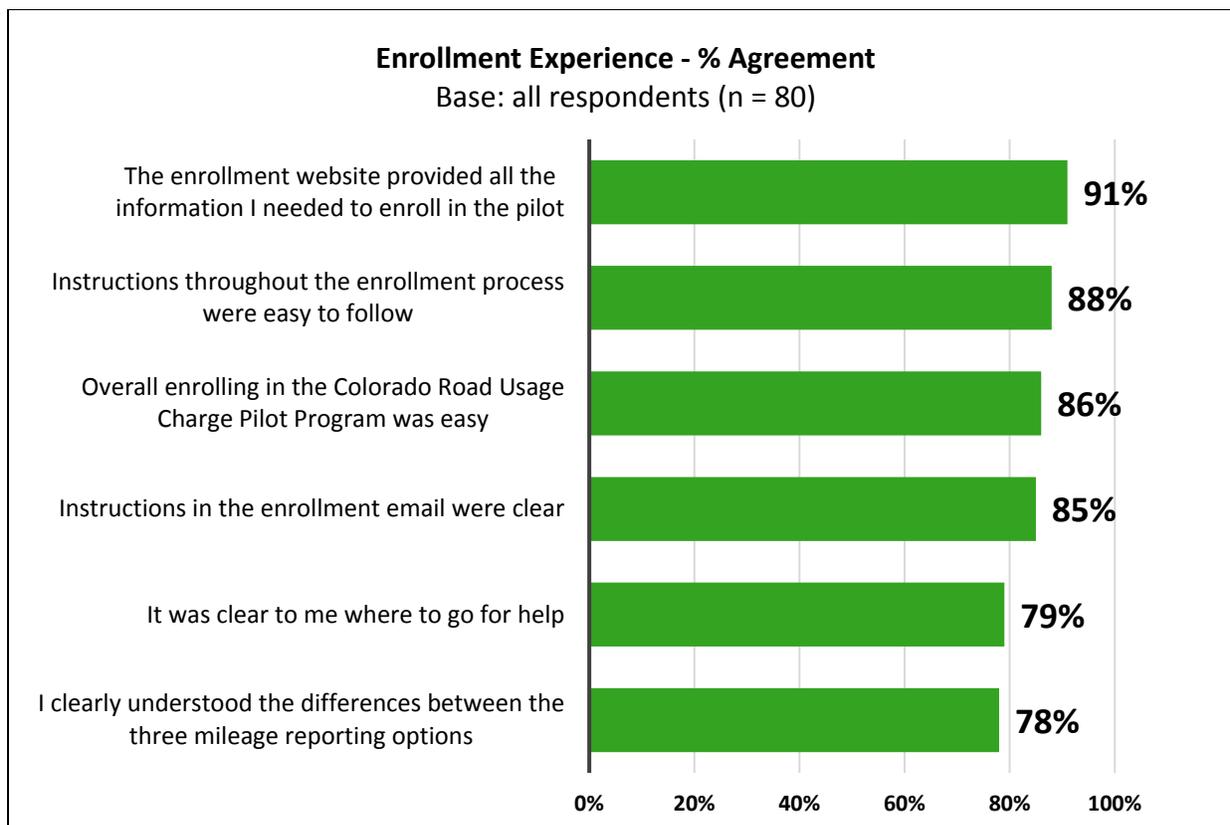


Figure 23: Participant perceptions of the enrollment process

Participants adopting a reporting plan that relied on an in-vehicle device were asked to provide input on the installation experience. About 34% of mileage reporting device users said there was nothing difficult about activating their device with 32% stating the most difficult aspect was finding their OBD-II port. Regarding device activation times, 66% spent less than 10 minutes activating their device while 21% spent 10-30 minutes. Most (75%) received their MRD in the mail within 2-7 days.

Similarly, participants selecting the odometer reading reporting option were asked about their experience. Among those respondents, most (67%) used the Azuga Mobile Insight app to submit odometer readings. Almost all (92%) indicated that the project website provided all of the information they needed for submitting their initial odometer reading, and almost all (92%) believed that the instructions provided prepared them for future reporting.

Respondents were also asked about their use of the Azuga Insight smartphone application). 47% had installed the Azuga Insight mobile app, 43% had not, and 10% did not know about the app. 86% of people who had used the app spent less than 10 minutes installing it. The most common reason given for using the app were reviewing RUC statements (51%) and reviewing their trip information (51%). Evaluating vehicular issues (30%), looking at driving badges (24%), and verifying mileage (22%) were other, less popular uses for the mobile app.

Respondents were also asked about their use of the Azuga account management website with the vast majority (95%) indicating that it was easy to navigate and 93% stating that RUC information was clear and easy to understand. 71% of respondents indicated that they visited the web portal, and the most common reason for not visiting the web portal was limited time. Among those who had visited the web portal, 98% had been able to see their road usage charge account activity. Several reported that they did not need the website because they were using the Azuga Insight app, and 4% said they did not realize they had an account.

Finally, respondents were asked about their experiences with the help desk and customer service functions provided by the RUCPP. 100% who sought help had their questions answered. Only a few (30%) asked for or sought help with 9% calling the help desk, 13% emailing the help desk, and 14% visiting the FAQ or web page. When participants sought help it usually took less than 10 minutes.

2.3.3 Account Management

As previously mentioned, the Colorado RUCPP utilized a third-party service provider, Azuga, to manage participant accounts for the pilot. Azuga, developed an account management website as well as a smartphone application (app), both of which could be used to view travel history, road usage charges and fuel tax credits, and report their periodic odometer readings (for participants who selected the odometer reading option).

Note that the information provided in this section shows data that a RUCPP participant could access through the Azuga account management platform. CDOT was not privy to any driver specific information and did not have access to participant accounts. Furthermore, all information provided to CDOT in monthly reports was sanitized (all personally identifiable information was removed) and aggregated (daily road use from participant was combined into monthly aggregate form).

2.3.3.1 Account Management Website

Pilot participants were able to manage their accounts and monitor their travel through the Azuga account management website. The website included a number of features including:

- **Dashboard** – The dashboard is the first screen the user sees in account management and provides an overall view of the account (Figure 24). The menu is on the left and panels representing RUC, vehicle location (if applicable to mileage reporting option), safe zone activities, driving scores, engine health, and battery voltage are immediately accessible. The user can see vehicle and personal details by clicking on their name in the top right corner. In addition, if multiple vehicles exist on the account, the user can select the vehicle to view using the drop-down menu next to their name.

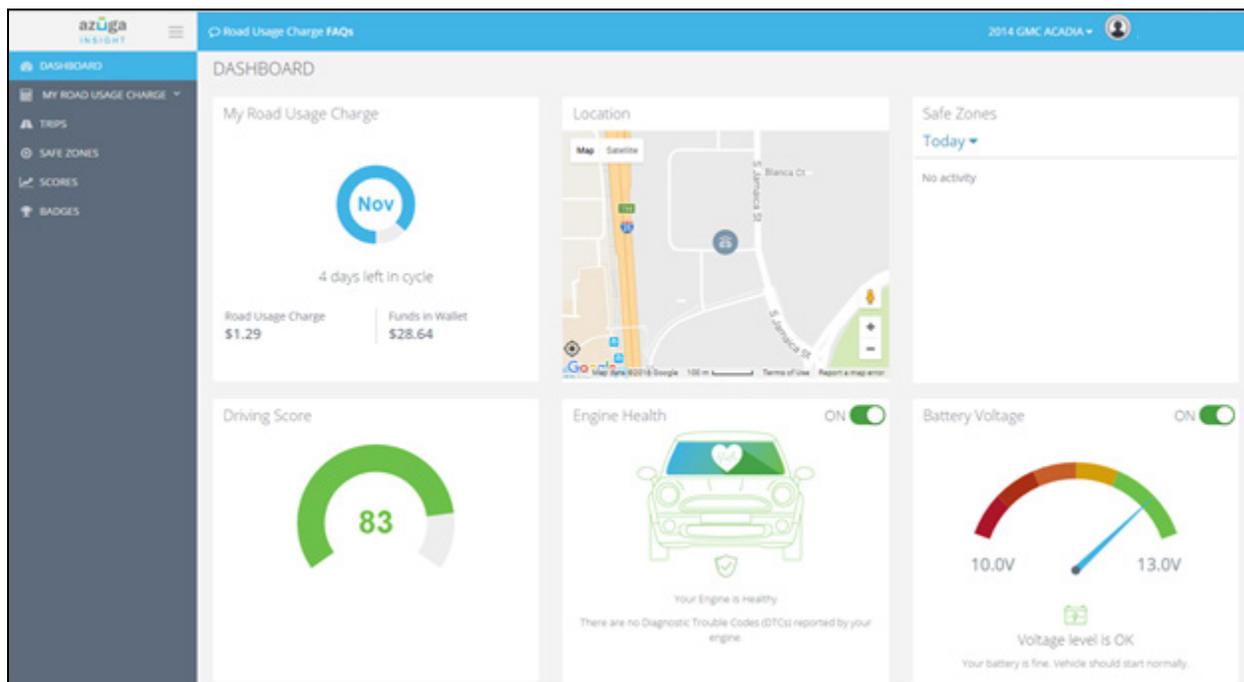


Figure 24: Account management website dashboard

- **Account Summary** – This page (Figure 25) allowed users to view their RUC account details, statements, wallet balances, vehicle information, and trips. Participants in the “manual odometer entry” reporting plan could view the previous month’s beginning and ending odometer reading, fees assessed, estimated fuel consumption, fuel tax credit and assessed RUC. Participants who selected the GPS-Enabled Mileage Reporting Device Option were able to view the actual trips overlaid on a Google map.

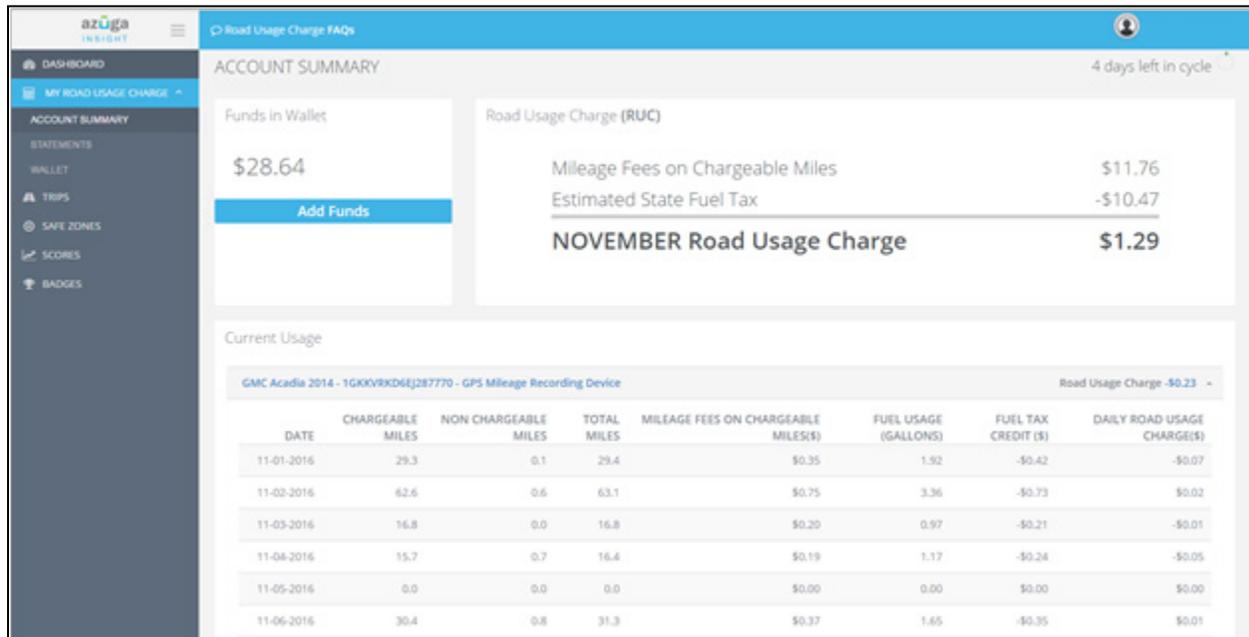


Figure 25: Account summary page

- **Statements** – This page allowed participants to view statements for previous months of road usage and their associated RUC. Statements were emailed to participants between the third and fifth of every month. The user received an email informing them that the statement was available. The email text included all the information provided in the statement as well as an attached copy for that month. At any time during the month, the user can see their statement details to date for the month online (Figure 26). RUC statements included RUC payer information and vehicle information, mileage reporting option chosen, chargeable miles traveled, non-chargeable miles traveled, total miles traveled, fuel usage and appropriate fuel tax credits, and RUC amount owed.

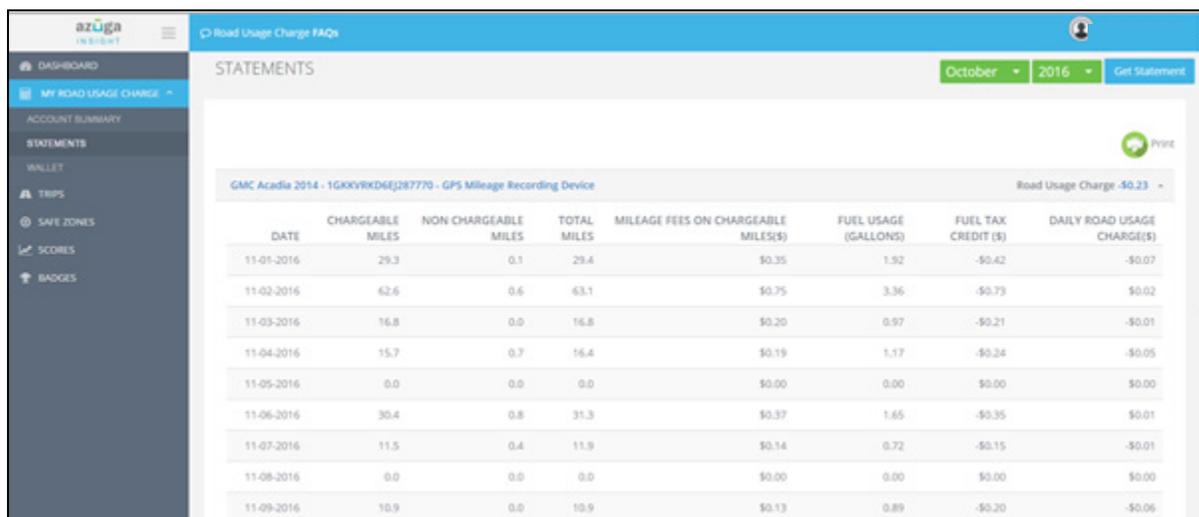


Figure 26: Account statements page

- **Wallet** – Payments for the pilot were simulated in that each participant received a certain amount of prepaid funding in their account “wallet” at the beginning of the pilot from which RUC payments would be deducted. The wallet page (Figure 27) showed funds available in the pilot account and provided participants the opportunity to “replenish” their wallet (also using simulated funds). From this page, participants could also select an “auto recharge” option that would automatically replenish their account wallet with \$20 when the balance fell below \$5.00.

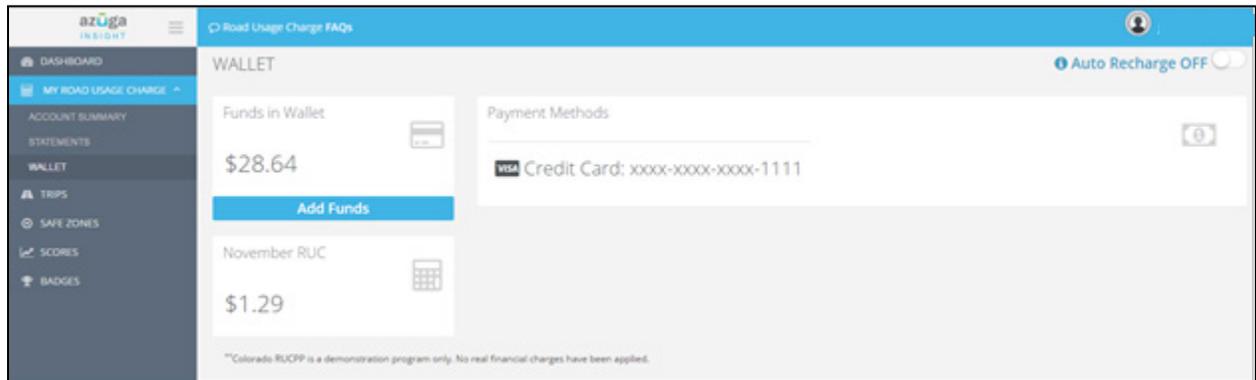


Figure 27: Account wallet page

2.3.3.2 Smartphone Application

Pilot participants, regardless of their mileage reporting option, were able to utilize a smartphone application (app) provided by Azuga. The Azuga Insight app (Figure 28) supported both Android and iPhone systems. The app provided most of the same features as the website, including:

- A display of the previous month’s assessed RUC;
- Summary information on the participating vehicle;
- A summary of chargeable miles and fuel usage;
- Account information including contact information and date of enrollment;
- Detailed trips (for those who selected the GPS-Enabled Mileage Reporting Option);
- Resources for contacting the help desk.

Participants using one of the high-tech mileage reporting options were able to access a number of additional services through the app. The additional services provided through the high-tech mileage reporting options are discussed in more detail in the RUC Reporting section of this report.

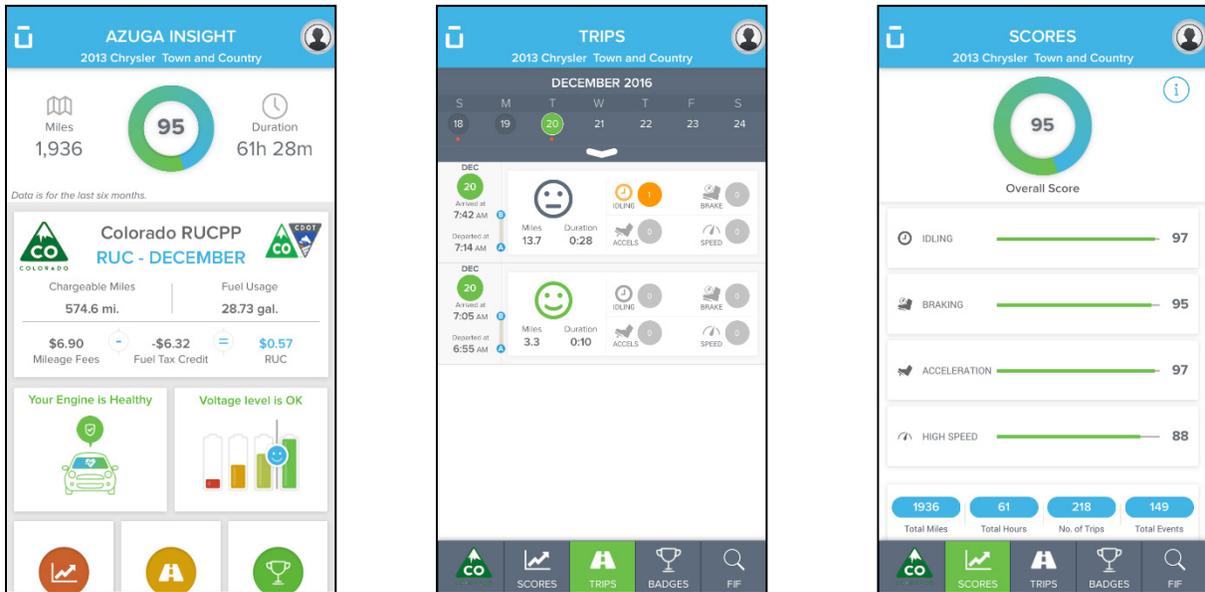


Figure 28: Screenshots of Azuga Insight mobile app

Participants who selected the odometer reading mileage reporting option had a different app that allowed them to report their odometer readings. The app provided users with a reminder notification to enter their odometer reading at the end of each month. Participants could enter their mileage through the app along with a picture of the odometer reading for verification (Figure 29). Participants were required to take a picture of their odometer for the initial and final readings.

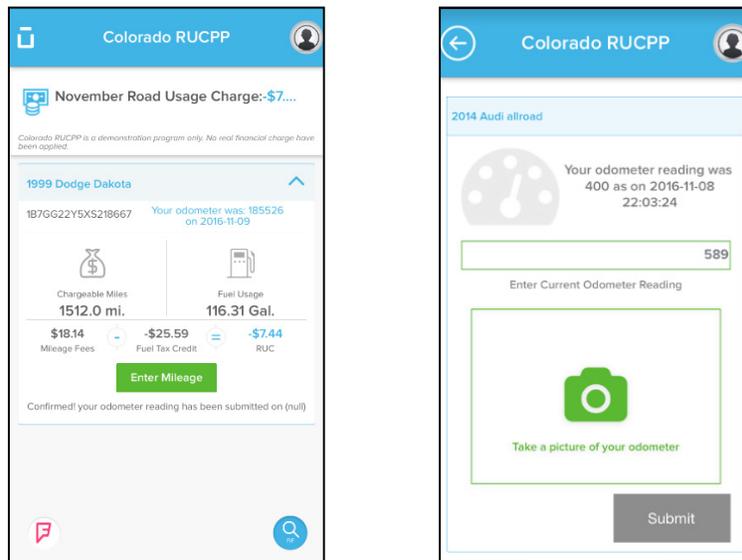


Figure 29: Screenshots of Azuga Insight mobile app for odometer reading users

2.3.4 RUC Reporting

Participants in the RUCPP were able to choose from one of three mileage reporting options:

- **Odometer Reading** – For this option, participants reported their vehicle’s odometer reading either through their account management website or the mobile app. Participants reported mileage on a monthly basis and paid for all mileage accrued over the time.
- **Non-GPS Enabled Mileage Reporting Device** – For this option, participants received an in-vehicle device that was plugged into the vehicular on-board diagnostic (OBD-II) port. This device does not

use GPS location data to determine miles driven, instead it relies on information provided to the device by the engine such as fuel consumption and fuel efficiency to determine distance travelled. Information was reported automatically by the device and participants with this reporting option were charged for all travel, regardless of whether it was in Colorado.

- **GPS Enabled Mileage Reporting Device** – For this option, participants received an in-vehicle device from the service provider that was plugged into the vehicular on-board diagnostic (OBD-II) port. These particular devices were GPS enabled and used location-based data to calculate total miles driven. Data was reported automatically by the device. Participants who used this option were able to discount any mileage accrued outside of Colorado.

The GPS-based mileage reporting device option was the most popular option selected by RUCPP participants with almost 70% selecting it (Figure 30).

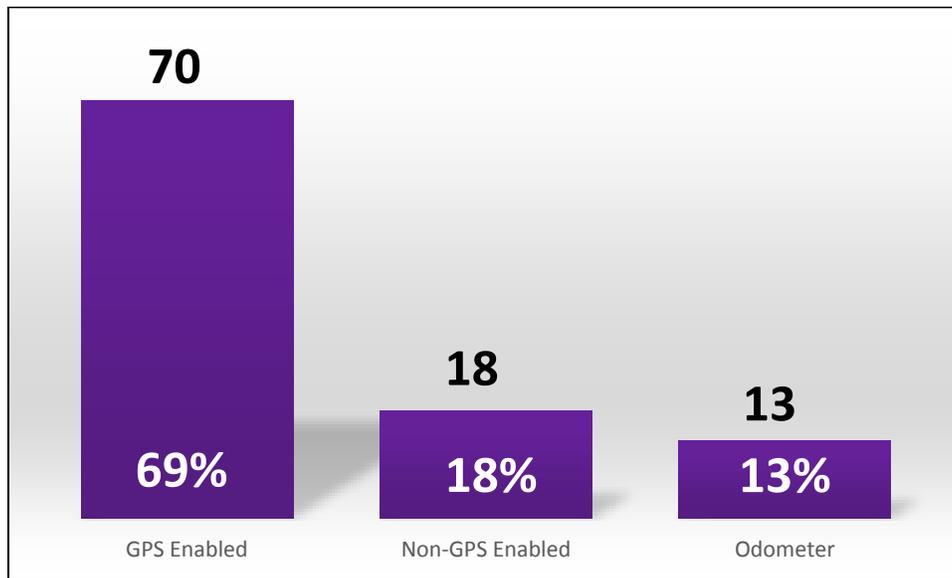


Figure 30: Percentage of mileage reporting options selected

As can be seen in Figure 31, the GPS enabled MRD was the most popular mileage reporting option in all of the CDOT districts. The odometer reading-based reporting option was most popular in rural Regions 4 and 2. However, it is possible that, absent some vehicular technology issues, the odometer option might have been utilized even less. For example, vehicles without the requisite OBD-II components (such as many pre-1993 models) could not support either of the MRD reporting options. These participants would have to select the odometer reading option by default. Furthermore, participants who were already using an OBD-II-based in-vehicle service would not be able to continue using those services and use one of the MRD reporting options. These participants would have to select the odometer reading option by default. Furthermore, participants who were already using an OBD-II-based in-vehicle service would not be able to continue using those services to use one of the MRD reporting options.

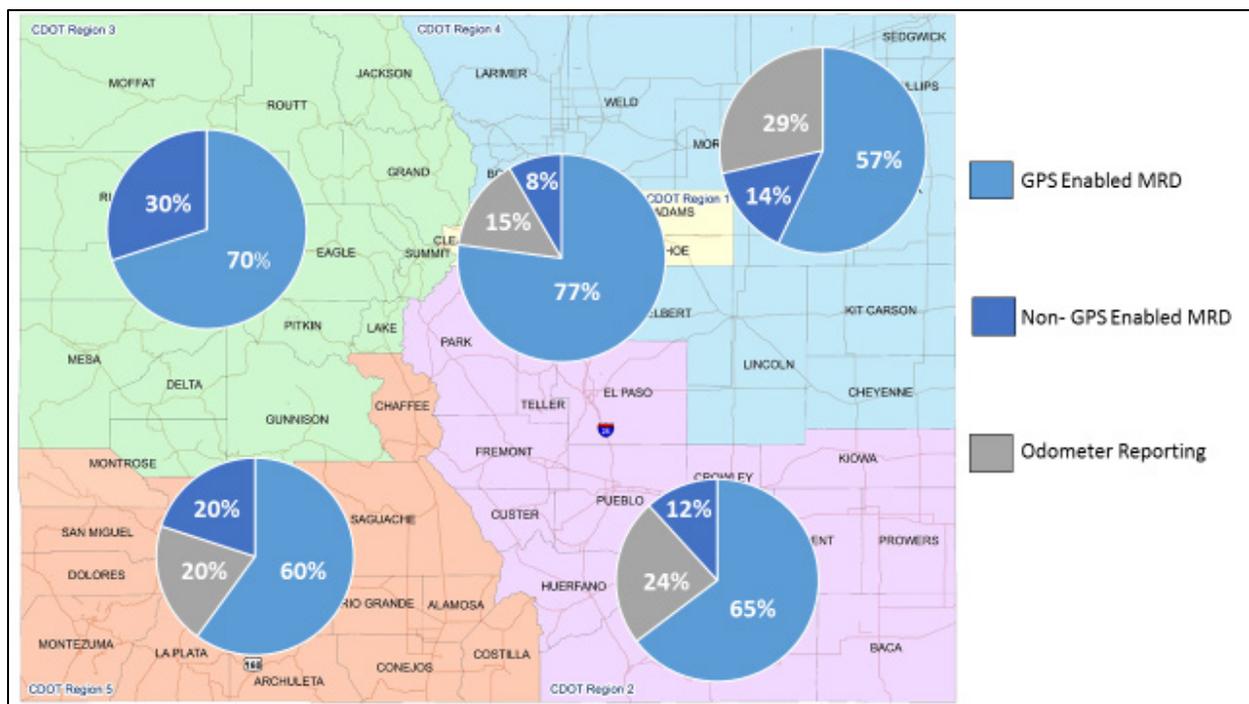


Figure 31: Mileage reporting option by CDOT district

Participants who selected either the Non-GPS Enabled or GPS-Enabled mileage reporting device options, benefited from the provision of additional value-added services from Azuga. These included providing information on vehicle diagnostics (such as battery voltage) as well as the following:

- Trip Logs (GPS device only)** – Participants in the mileage reporting device option that utilized GPS benefited from being able to monitor their travel on a trip by trip basis. Through the web portal and app, participants were able to view maps of trips that were taken on the current day, Last 7 Days and Last 30 days. Participants could select their trip viewing timeframe from a drop-down menu. Additional detail was provided in terms of the average speed on the trip, maximum speed, trip duration, time spent idling, carbon footprint and trip cost. An example of a trip log is provided in Figure 32.

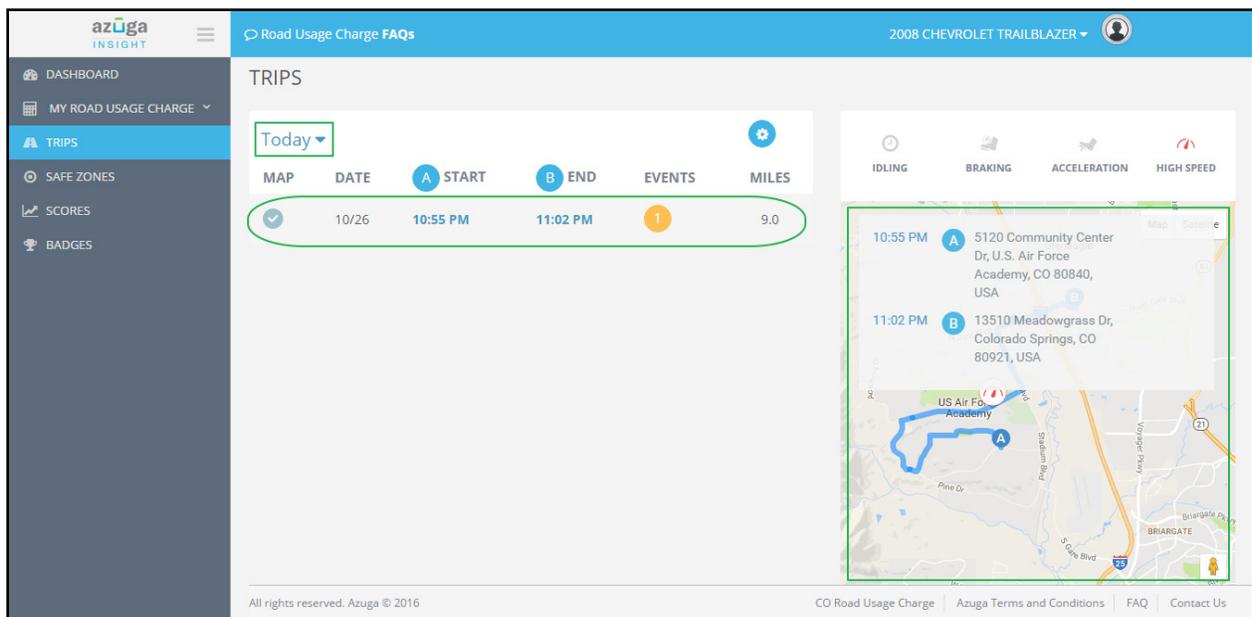


Figure 32: Example trip log

- Safe Zones (GPS device only)**– This service allowed users to establish the virtual boundaries around particular locations on a map (Figure 33). Any ‘Entry’ or ‘Exit’ of a participating vehicle into or out of a zone would result in an e-mail notification to the participant.

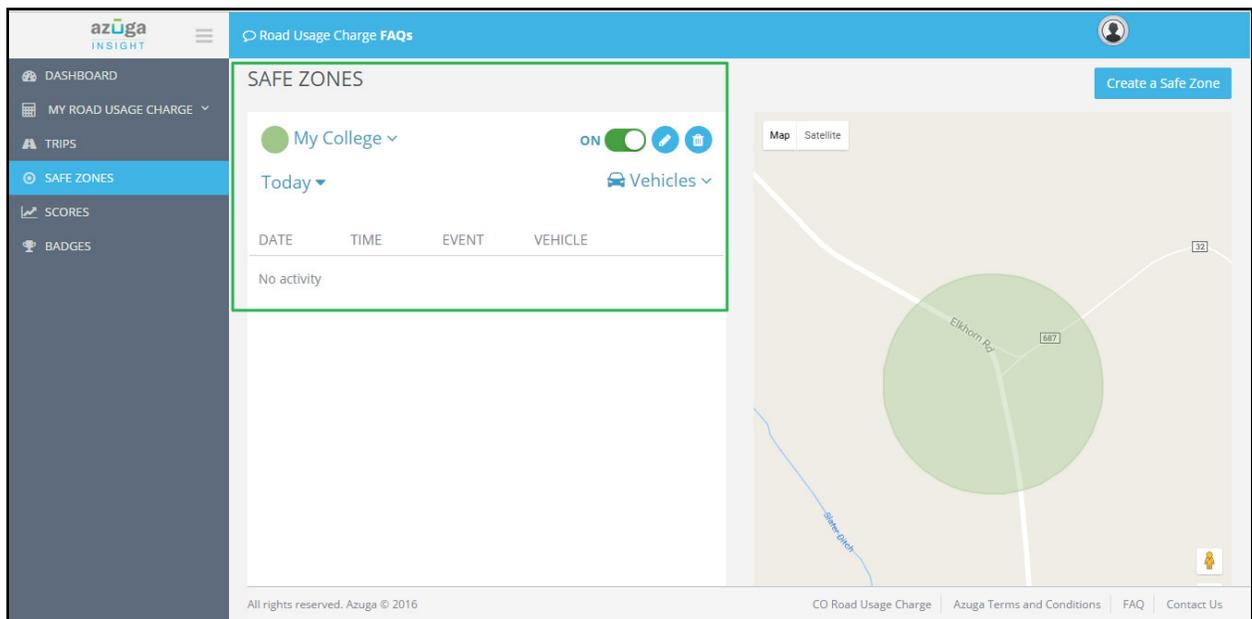


Figure 33: Example of a safe zone

- Driving Scores:** The Azuga devices (both GPS and Non-GPS enabled) collected various travel information and provided “scores” to participants based on certain travel behaviors (Figure 34). Scores were calculated on a daily basis and were calculated based on: idling time, braking events (hard and extreme), acceleration profiles, and high-speed events.

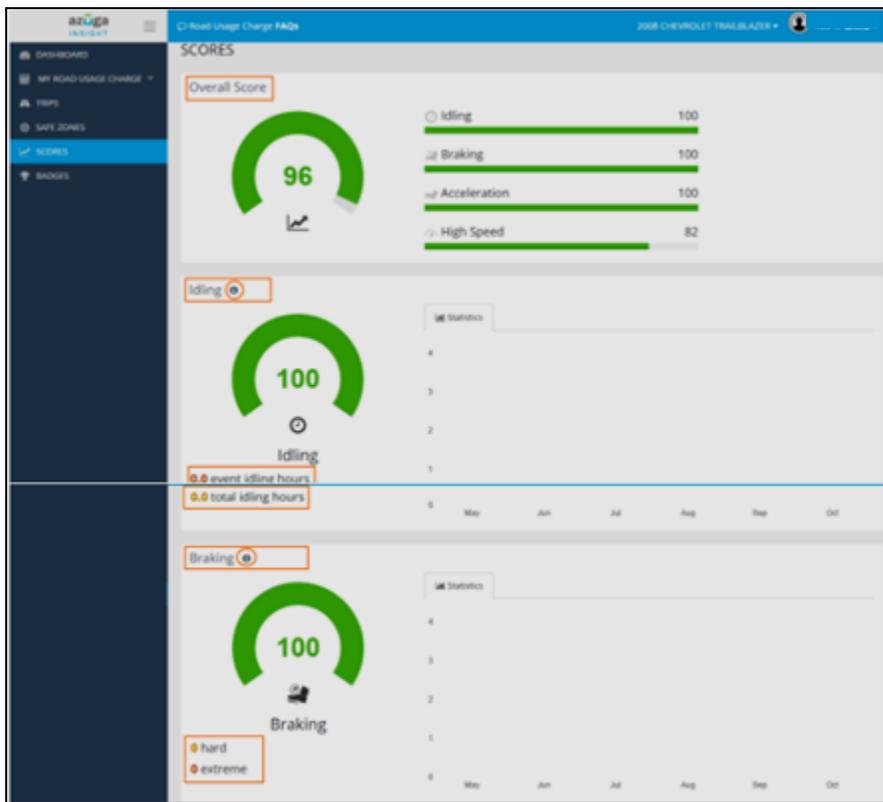


Figure 34: Example of driving score

- Badges:** These represented achievements given to users for efficient driving behavior. Badges were locked (but displayed on the web site or app) but unlocked based on the meeting of certain requirements (Figure 35). Participants could earn Participation Badges for achievements as part of pilot participation and Driving Badges related to driving behavior. Medals, such as Bronze, Silver, Gold and Platinum, were awarded as the collective result of specific individual badges earned by the user's vehicle.

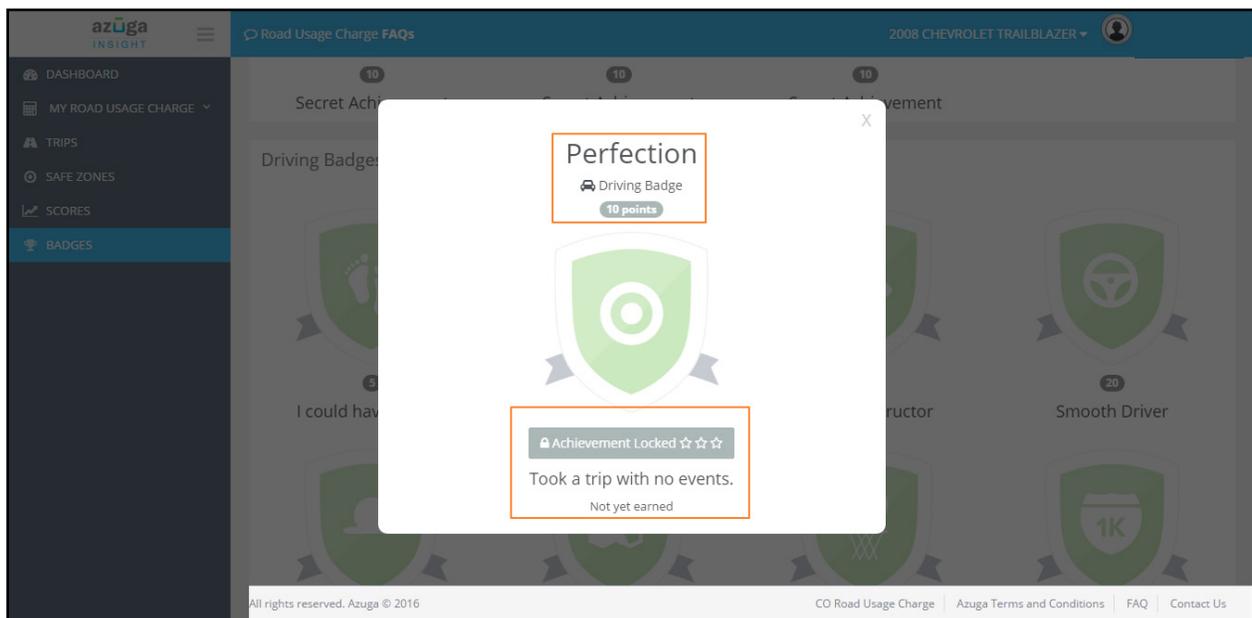


Figure 35: Example of driving badge

2.3.5 Mileage Reporting Device Installation

Mileage reporting devices were shipped to pilot participants upon their selection of an MRD mileage reporting option. The devices plug in to the vehicular on-board diagnostic port (OBD-II, Figure 36) and collected information from various in-vehicle systems to calculate road usage. Participants were provided with Quick Start Guide (see Appendix E) that provided instructions on how to locate their OBD-II port and install the device and could contact the RUCPP help desk if they encountered difficulty with the installation.



Figure 36: MRD installation to the OBD-II Port

2.3.6 Invoicing and Payment

Invoices were issued to pilot participants on a monthly basis. They provided basic account information, the number of miles driven for the billing period, the amount of fuel taxes credited, and the associated RUC amount due. An example invoice is shown in Figure 37.



INSIGHT

NOT A BILL - SIMULATED PAYMENT COMPLETE



MONTHLY STATEMENT ROAD USAGE CHARGE

Statement Period: Jan 1 2017 - Jan 31 2017

Statement At a Glance

Account Holder	
Number of Vehicles	2
Account Type	GPS Mileage Reporting Device
Azuga Customer Number	Azuga-1

Road Usage Charge Details For January

Mileage Fees for January	\$10.26
Fuel Tax Credit for January	-\$9.30
Net January Road Usage Charge (Mileage Fees - State Fuel tax)	\$0.96

Wallet Activity

No Payments made to wallet for the reported period

Figure 37: Example RUCPP invoice

3 Pilot Results

The Colorado RUCPP demonstration concluded on April 26, 2017 with participant accounts being officially closed on May 1. This section summarizes pilot results in terms of the following evaluation areas:

- Participant Totals
- Geographic Stratification
- Vehicular Stratification
- Mileage Reporting Option Selected
- Mileage and Simulated Revenue Totals
- Road Usage Charges for Participants
- System Performance
- Technical Issues
- Administrative Issues.

Much of this information was reported to CDOT, project oversight and advisory committees on a periodic basis through Account Management Monthly Summary Reports. A copy of the April 2017 report, the final monthly report for the pilot, is provided as Appendix F to this final report.

3.1 Participant Totals

Table 7 below shows the total number of vehicles that were added and dropped on a monthly basis throughout the course of the RUCPP. Participants in the soft launch were given the opportunity to continue through the operational pilot if desired. **The data provided in the table below includes all soft launch participants and pilot project team members that opted to continue through the operational pilot, including stakeholders and general public, that were invited to enroll in the operational pilot.** At the end of the pilot, a total of 140 vehicles were still participating, only slightly down from the 147 that were initially enrolled in November and December of 2016. Excluding the soft launch and pilot project team participants, there were 101 vehicles still enrolled at the end of the pilot, which met the target goal of 100 participants.

Of the 140 vehicles enrolled at the end of the pilot, 128 were reporting mileage in April. All of the vehicles not reporting mileage were odometer reading option participants that did not provide their odometer reading in the month of April.

Table 7: Pilot Account Summary

Reporting Period	Added Vehicles	Dropped Vehicles	Change in total Enrolled Vehicles	Vehicles Reporting Mileage
November (Soft Launch/ Pilot Team)	41	0	+41	39
December 2016	105	3	+102	125
January 2017	1	1	0	136
February 2017	0	2	-2	134
March 2017	0	1	-1	131
April	0	0	0	128
Pilot Total	147	7	140	

As can be seen in Table 7, a total of 7 vehicles withdrew from the pilot over its five-month operation. Vehicles withdrew for the following reasons:

- The three vehicles that dropped in December had been involved with the testing phase of the soft launch but did not continue participation through the operational pilot;
- The January vehicle drop was due to the participant owning a vehicle that was not compatible with the MRD and not having any interest in using the odometer reading reporting option;
- The first February vehicle drop was a participant who had not yet installed their device and, upon being contacted by the help desk regarding this issue, chose to opt out of the pilot;
- The second February vehicle drop was due to the participant having technical concerns with the MRD and opting to no longer participate;
- The March vehicle drop was due to the participant leaving on a vacation that would extend beyond the end of the pilot program.

3.2 Mileage Reporting Option Selection

Three mileage reporting options were available to participants. These mileage reporting options and the number of participants who selected that option are shown in Table 8. As can be seen in the table, the GPS enabled MRD option was the most popular option selected.

Table 8: Summary of Mileage Reporting Device Utilization Among Participants

Reporting Option	Description	Number of Participants*	Percentage of Participant Pool
Mileage Reporting Device (MRD) with GPS	Participating vehicle is equipped with a device that collects travel data from vehicular systems and uses GPS to discount out-of-state travel	70	69%
Mileage Reporting Device without location determining technology	Participating vehicle is equipped with a device that uses vehicle diagnostic data to determine and transmit travel data	18	18%
Self-reporting Odometer Input	Participating vehicle has its odometer read on a monthly basis by the participating driver with that information being entered into a smartphone application or website	13	13%

**These numbers do not include soft launch participants or pilot project team participants. It only includes recruited stakeholders and general public participants who volunteered for the RUCPP.*

3.3 Geographic Stratification

Figure 38 below provides the geographic location of the RUCPP participants based on the mileage reporting option selected. As the figure shows, participation was primarily concentrated in urban areas but rural and mountainous regions of the state were represented as well.

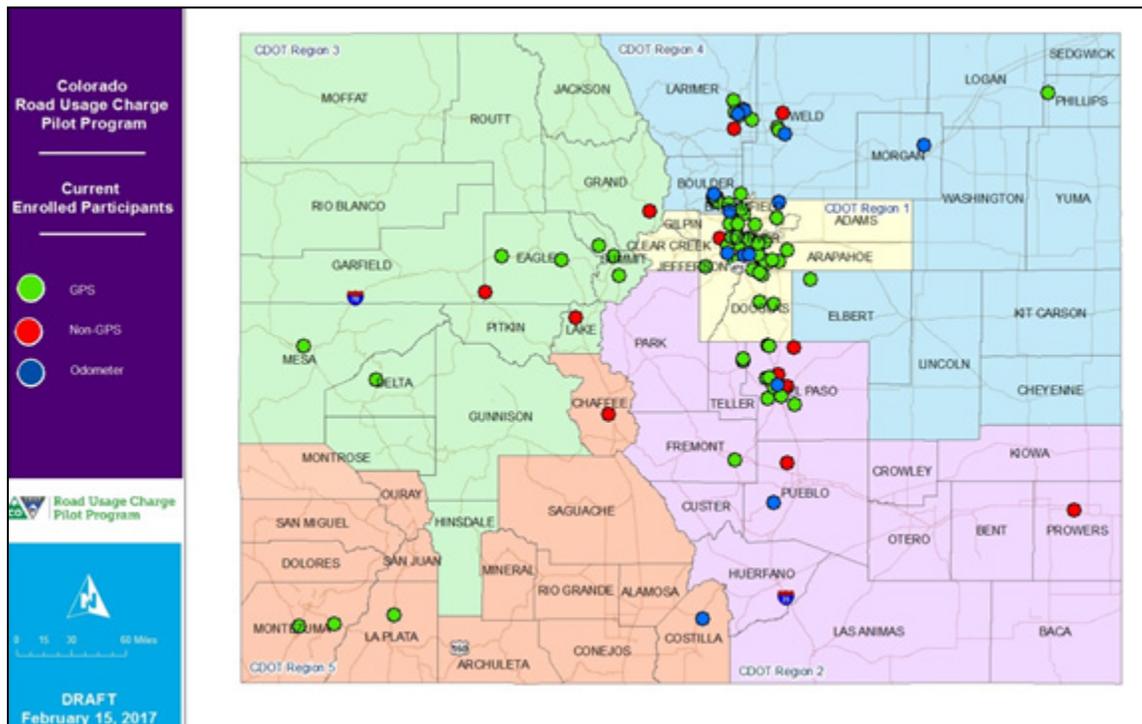


Figure 38: Geographic distribution of participants based on metering option

3.4 Vehicular Stratification

Table 9 below provides the average fuel efficiency of each participant vehicle. Please note that all vehicular stratification goals were met as of the end of the pilot. Also, note that only gasoline and electric powered vehicles were included in the RUCPP. Alternative fuel vehicles were not taken into consideration. As can be seen in the table, pilot objectives with regard to vehicle stratification based on fuel efficiency were met. Figure 39 shows the geographic distribution based on fuel type of the participating vehicle.

Table 9: Participating Vehicles by Fuel Efficiency

	Fuel Efficiency				
	10-25 MPG	25-45 MPG	>45 MPG	Electric Vehicles	Total Vehicles
# of participating vehicles*	61	34	3	3	101
<i>*These numbers do not include soft launch participants or pilot project team participants. It only includes recruited stakeholders and general public participants who volunteered for the RUCPP.</i>					

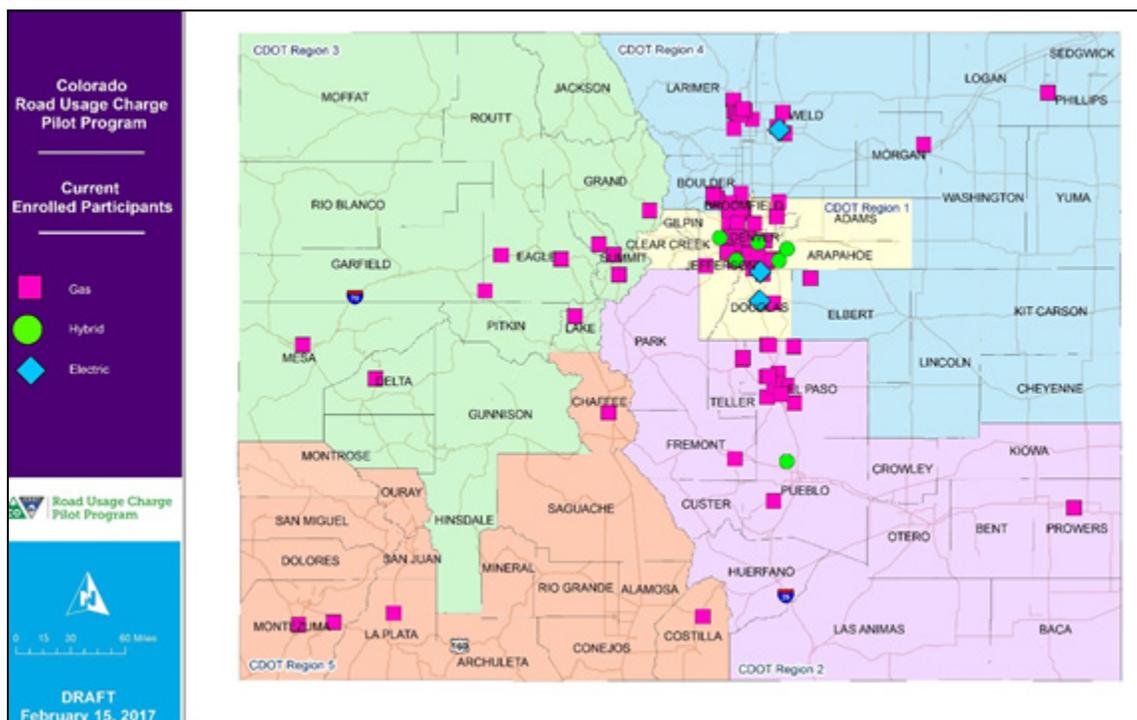


Figure 39: Geographic distribution of participants based on fuel efficiency

3.5 Road Usage Charges Assessed for Participants

Table 10 shows the average monthly RUC (minus any fuel tax credits) for participants based on the fuel efficiency of their vehicle. It is important to note that the purpose of the Colorado RUCPP was not to evaluate revenue impacts, but rather to assess the technical and operational feasibility of the RUC concept. The notional RUC rate of \$0.012 was calculated specifically for the pilot and is illustrative only; no money was exchanged as part of the Colorado RUCPP, and all payments and/or fuel tax credits were simulated. A per-mile rate for a road usage charge system would be determined by the Colorado State Legislature.

The values shown in this section only reflect notional revenues and no suggestions or determinations of cost or revenue impacts from a RUC should be made.

Table 10: Monthly RUC based on Mileage Reporting Option and Vehicle Type

Vehicle Type	Average Road Usage Charges					
	December	January	February	March	April	Average for Pilot
Low Fuel Efficiency (5 – 15 mpg)	\$(3.12)	\$(2.71)	\$(2.72)	\$(2.87)	\$(2.40)	\$(3.20)
Average Efficiency (15 to 25 mpg)	\$0.68	\$1.23	\$1.45	\$1.84	\$1.68	\$1.54
High Efficiency (25 to 45 mpg)	\$2.00	\$4.38	\$4.34	\$4.92	\$3.57	\$4.25
Over 45 mpg and Electric	\$2.38	\$5.98	\$6.49	\$6.50	\$4.66	\$5.70

As might be expected, the drivers of highly fuel efficient and electric vehicles “paid” the most under the Colorado RUCPP pilot with an average of \$4.25 per month for vehicles with fuel efficiency of between 25 to 45 mpg and \$5.70 for vehicles with over 45 mpg fuel efficiency (which includes hybrids) and electric vehicles. All of the electric vehicles enrolled in the pilot utilized the GPS enabled mileage reporting option.

As can be seen in Table 11, the pilot’s highly fuel efficient and electric vehicles tended to drive at least 1,000 miles less per month on average relative to other participating vehicle classes. Vehicles with an average fuel efficiency (between 15 and 25 mpg) tended to drive the most with an average of 4,305 miles per month.

Table 11: Average Mileage by Vehicular Fuel Efficiency

Vehicle Type	Average Mileage						
	December	January	February	March	April	Total for Pilot	Average per Month
Low Efficiency (5 to 15 mpg)	6,755	9,703	10,563	12,977	7,531	47,530	4,169
Average Efficiency (15 to 25 mpg)	38,036	76,467	71,649	76,527	74,006	336,686	4,305
High Efficiency (25 to 45 mpg)	13,761	32,085	31,551	33,836	24,854	136,087	4,026
Over 45 mpg and Electric	1,834	5,026	5,169	5,044	3,640	20,713	3,046

As these tables show, the drivers of electric vehicles and hybrid electric vehicles paid more under fee schedule tested for the Colorado RUCPP, even though they tended to drive fewer miles than their gasoline-powered counterparts. This is due to the fact that these vehicles received a smaller discount for fuel taxes paid as their fuel efficiencies are much higher. Participants with gasoline powered vehicles and average to low fuel efficiencies drove the most but actually paid the least or did not pay at all in the case of low fuel efficiency participating vehicles.

3.6 Participant Perceptions

Over the course of the Colorado RUCPP, three surveys were given to participants. Surveys focused on Colorado RUCPP participants' feedback on pilot activities at or close to the time of that activity. These surveys were also used to identify behavioral trends toward RUC and to determine whether the Colorado RUCPP provided increased understanding of Colorado's transportation funding shortfall and the viability of RUC. Given that pilot participants were more likely to be interested in RUC than the general population, results should not be generalized to all of Colorado. This was reflected in the survey results that showed pilot participants had a higher interest in RUC than the public as a whole. Surveys administered for the Colorado RUCPP included:

- **Pre-Pilot Survey:** The pre-pilot survey was administered after enrollment in the program and asked respondents provide information on the enrollment process, issues associated with device installation, etc. It also asked participants on their perceptions of the RUC concept and reasons for participating in the pilot.
- **Mid-Pilot Survey:** A second survey was administered to participants at the mid-point of the pilot. This survey focused on the operational components of the pilot, such as participant experiences with invoicing, use of the web portal, and use of the smartphone application.
- **Closing Survey:** Participants were issued a third survey upon the closing of the pilot. This survey asked respondents about their overall experience with the pilot and their perceptions of the RUC concept after their participation.

The following are general conclusions drawn from these three surveys:

- **Colorado RUCPP participants supported the RUC concept more readily than the general public.** Nearly three quarters of survey respondents agreed after participating in the program that RUC seems like a fair way to fund transportation improvements in Colorado. The fact that RUC would be a more sustainable funding source as vehicles get more fuel efficient was viewed as the most significant advantage. However, many were still concerned that a RUC would disproportionately impact rural drivers.
- **Operational aspects of the program also enjoyed strong support.** Survey respondents reported communications and instructions were clear, program participation was not onerous, and that opportunities to provide feedback and obtain additional information were adequately provided. Furthermore, satisfaction with information security and privacy protections increased over the course of the pilot. More importantly, as satisfaction in areas such as invoicing, account management and data security increased, so did overall support of the RUC concept.
- **Reporting options relying on an MRD enjoyed the highest levels of satisfaction, while those with the odometer reading were significantly less.** Over 90% of respondents who used an MRD to report mileage were satisfied with that option, compared to 55% satisfaction for the odometer reading-based reporting option.
- **Assessed RUC was generally less than what respondents had expected.** The majority of survey respondents had a monthly assessed RUC of \$10 or less, which was less than what most had expected to pay.
- **Additional areas for improvement were identified.** In spite of strong support for the RUC concept among program participants, there were still areas for improvement identified on the surveys for future work. The charging of out-of-state drivers was identified as an issue requiring further exploration. Additionally, survey respondents in seeing additional work to explore alternative rate structures.

The results of these pilot surveys are not generalizable to the wider Colorado general public. The Colorado RUCPP was very limited in terms of the total number of participants relative to other RUC pilots conducted in the US. The sample sizes for the three surveys administered are thus very small, limiting the statistical validity of many of the results. For example, the mid-pilot survey had a total of 63 responses resulting in a margin of error of 7.5%. As such, small changes in the composition of survey respondents could have a large effect on the overall results. Furthermore, the use of simulated payments may have caused different opinions in the surveys than had participants paid real monies.

3.6.1 Pre-Pilot Survey

Following enrollment, participants were asked to take an initial pre-pilot survey to gauge perceptions of the RUC concept and the RUCPP. A total of 82 surveys were completed; 74% of those being general public respondents and 26% being from stakeholders. Additional characteristics of the response pool are provided in Table 12 below:

Table 12: Pre-Pilot Survey Respondent Characteristics

Group (n=82)	General Public: 74%
	Stakeholder: 26%
Gender (n=82)	Male: 69%
	Female: 31%
Age (n=80)	18-29: 3%
	30-45: 39%
	46-65: 47%
	66+: 11%
Race (n=66)	96% White / Caucasian
Vehicle Type: (n = 82)	Gas: 92%
	Hybrid: 6%
	Electric: 2%
CDOT Region (n=80)	1: 48%
	2: 19%
	3: 9%
	4: 20%
	5: 5%

Respondents were asked about their reasons for participating in the RUCPP. About 67% of respondents wanted to learn more about the RUC concept, 29% wanted to “be at the forefront of this project,” and simple curiosity was the main reason for the remainder of participants. Respondents were also asked about their perceptions of the RUC concept (Figure 40). Almost a quarter (73%) of respondents agreed that RUC seems like a fair way to fund transportation; a significantly higher percentage than the 29% of respondents to the statewide baseline survey who indicated RUC appeared fair. Only 6% of respondents to the pre-pilot survey indicated that RUC was an unfair transportation funding option.

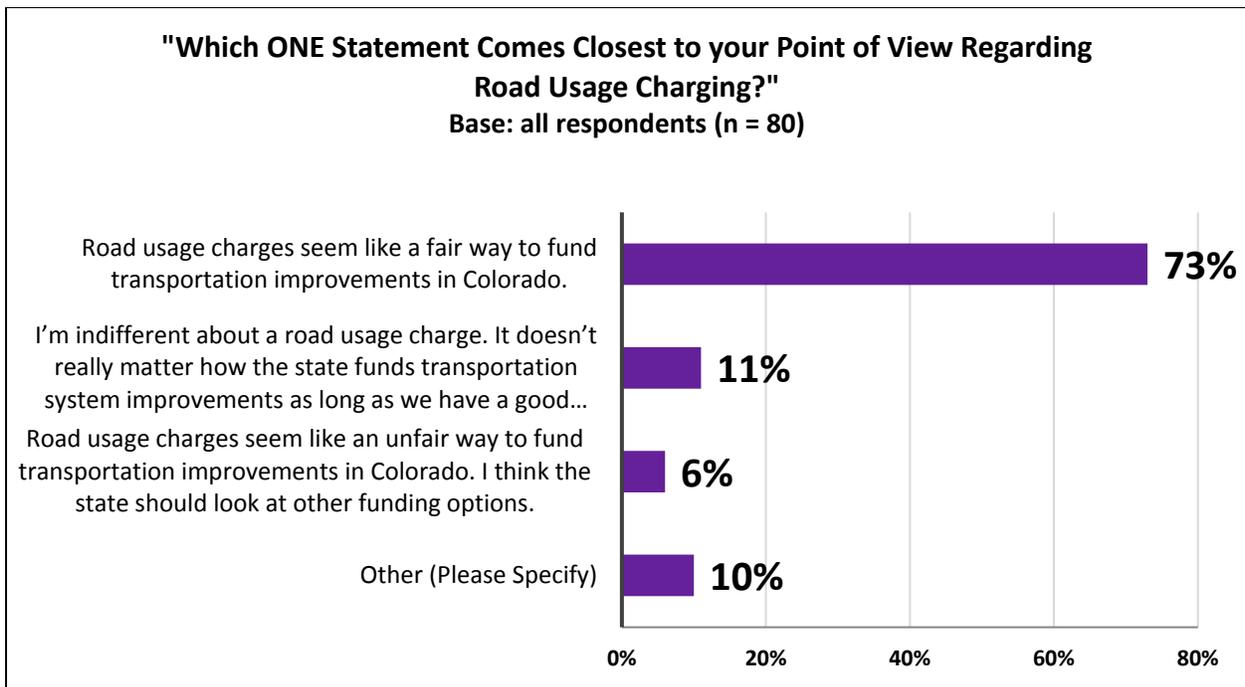


Figure 40: Pre-Pilot Survey – perceptions of the RUC concept

Respondents were asked about their perceptions of the RUC concept from the perspective of its benefits and drawbacks (Figure 41). The top benefit cited (61%) was that drivers pay their fair share for road usage. The top drawback (67%) was that the system will not capture travel from out of state drivers.

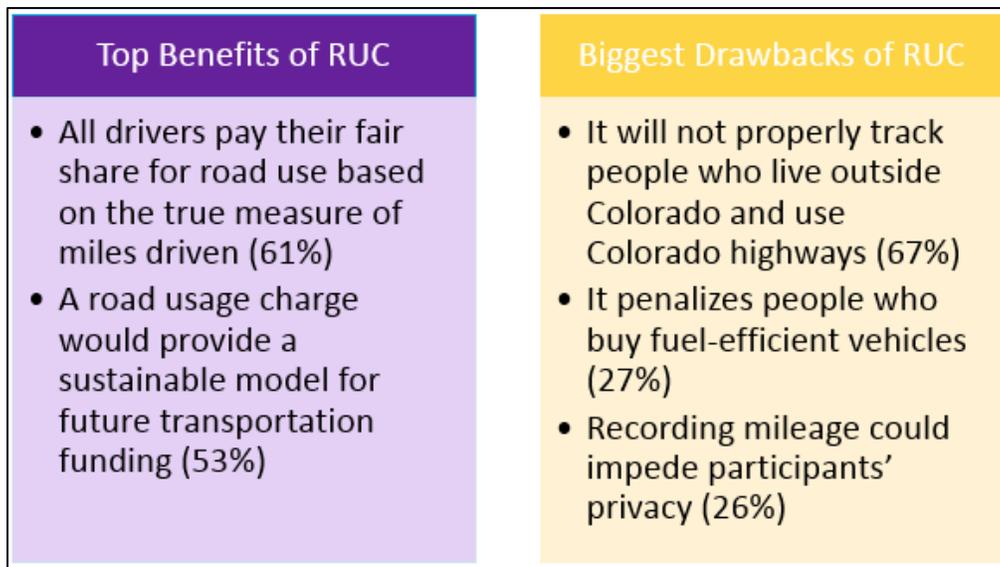


Figure 41: Pre-Pilot Survey – Participant perceptions of RUC benefits and drawbacks

3.6.2 Mid-Pilot Survey

A second survey was administered to pilot participants midway through the pilot. This second survey asked respondents to provide input on their experience with the pilot thus far and various account management aspects such as invoicing. As with the baseline and pre-pilot survey, this mid-pilot survey also asked respondents to provide information on their perspectives on the RUC concept. A total of 63 surveys were completed; 76% of those being general public respondents and 24% being from stakeholders. Additional characteristics of the response pool are provided in Table 13 below:

Table 13: Mid-Pilot Survey Respondent Characteristics

Group (n=63)	General Public: 76%
	Stakeholder: 24%
Gender (n=63)	Male: 70%
	Female: 30%
Age (n=48)	18-29: 2%
	30-45: 38%
	46-65: 46%
	66+: 15%
Race (n=48)	96% White / Caucasian
Vehicle Type: (n = 63)	Gas: 89%
	Hybrid: 8%
	Electric: 3%
CDOT Region (n=63)	1: 44%
	2: 14%
	3: 10%
	4: 27%
	5: 5%

As shown in Figure 42 the percentage of respondents who indicated that the RUC seems like a fair way to fund transportation actually declined slightly between the pre-pilot survey and mid-pilot survey. However, as noted earlier in this section, the relatively small size of the sample yields a rather large margin of error, meaning it is difficult to say definitively whether support for the RUC concept did, in fact, decline. Regardless of the existence or magnitude of any decline, support for the RUC concept remained higher among pilot participants relative to the general public.

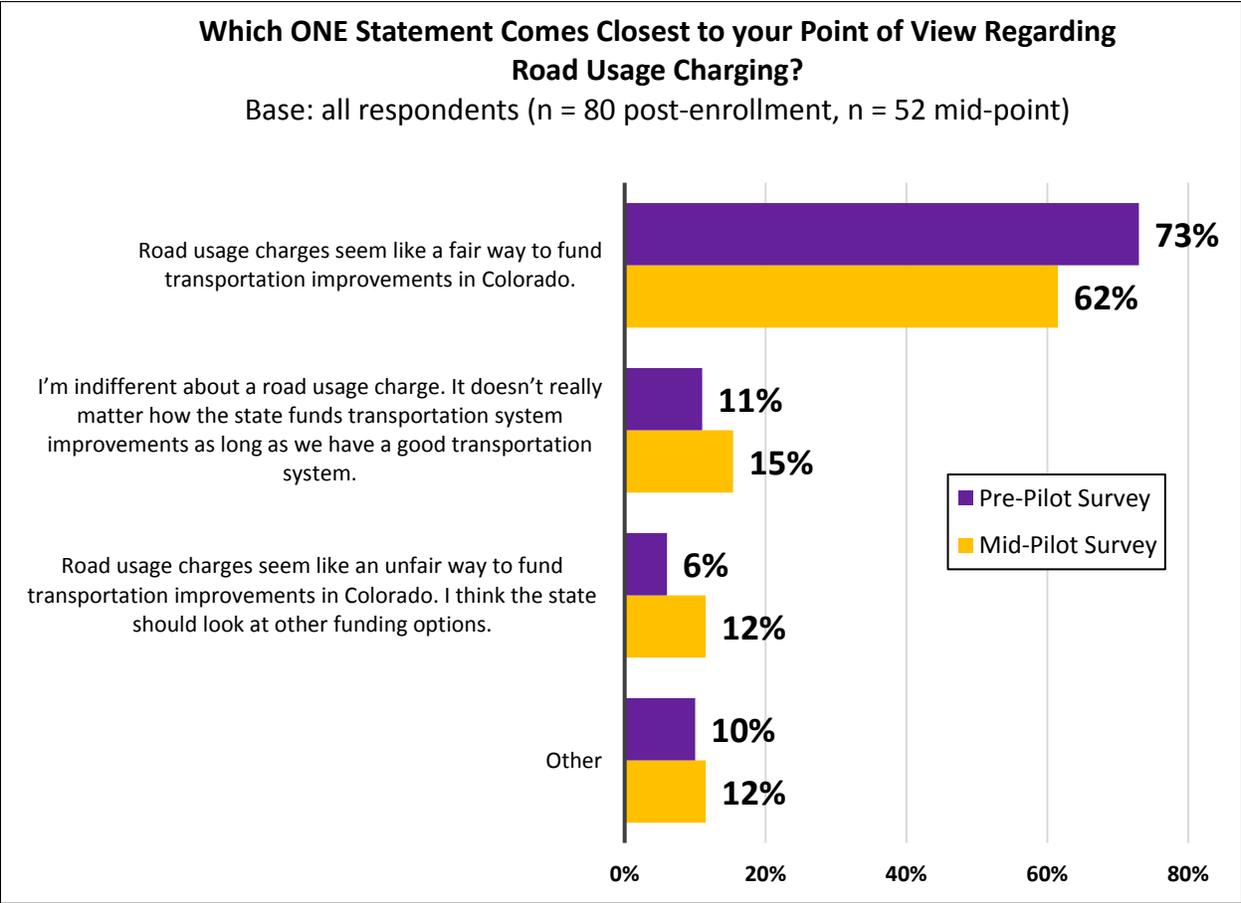


Figure 42: Mid-pilot survey - perceptions of the RUC concept

Respondents were also asked about the amounts and their perceptions of the amounts assessed under the program relative to fuel taxes. Most respondents (85%) owed \$10 or less in monthly RUC. Respondents' average estimate for how much gas tax they owed per month was \$13.91; a number which excludes three responses that were more than 2 standard deviations above the mean. For example, one respondent estimated that they paid an average of \$400 in gas taxes. Participants were also asked about how the amounts actually assessed for RUC and fuel tax credits aligned with their expectations (Figure 43). Nearly half (49%) indicated that the assessed RUC had been less than what they had anticipated, and one third stated that it was about what they expected. Most felt that the fuel tax credit was the same or more than what they expected it to be (75%). One in ten did not know how the fuel tax credit compared to their expectations.

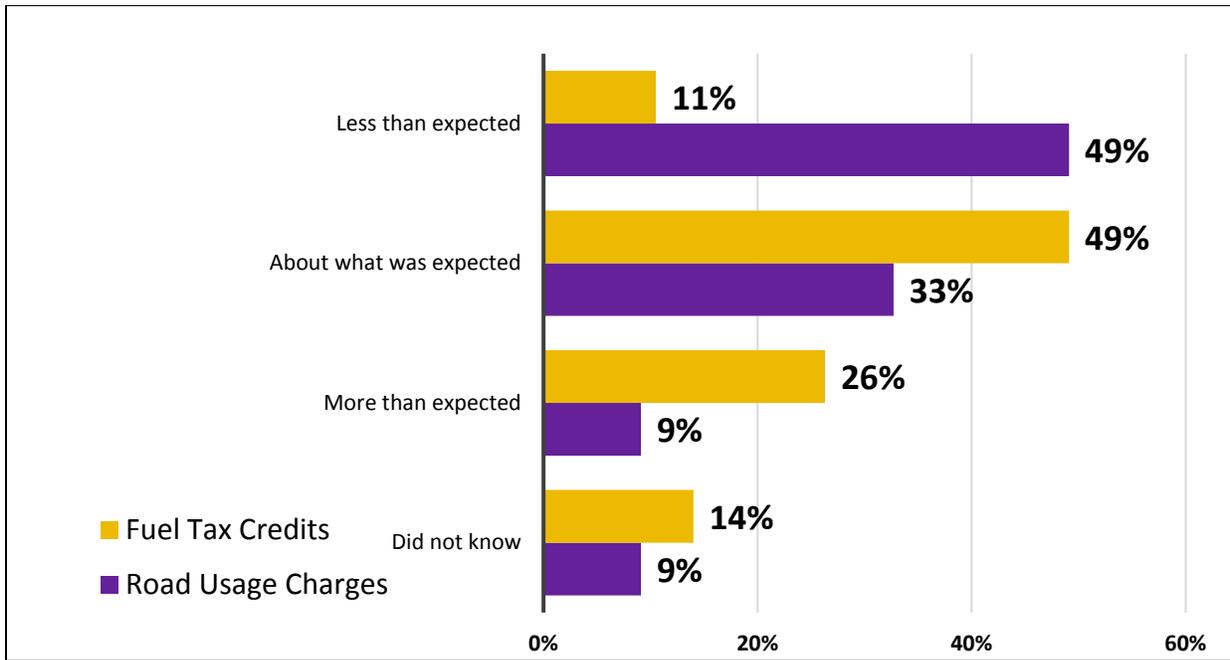


Figure 43: Participant perceptions of the amounts assessed for RUC and Fuel Tax Credits

Respondents were again asked about their perceptions of the RUC concept from the perspective of its benefits and drawbacks (Figure 44). As with the pre-pilot survey, the top benefit cited (at 50%) was that drivers pay their fair share. This was a decline from the 61% indicated on the pre-pilot survey. The top drawback was again that that the system will not capture travel from out of state drivers with 58%, a decline from the 67% indicated on the pre-pilot survey.

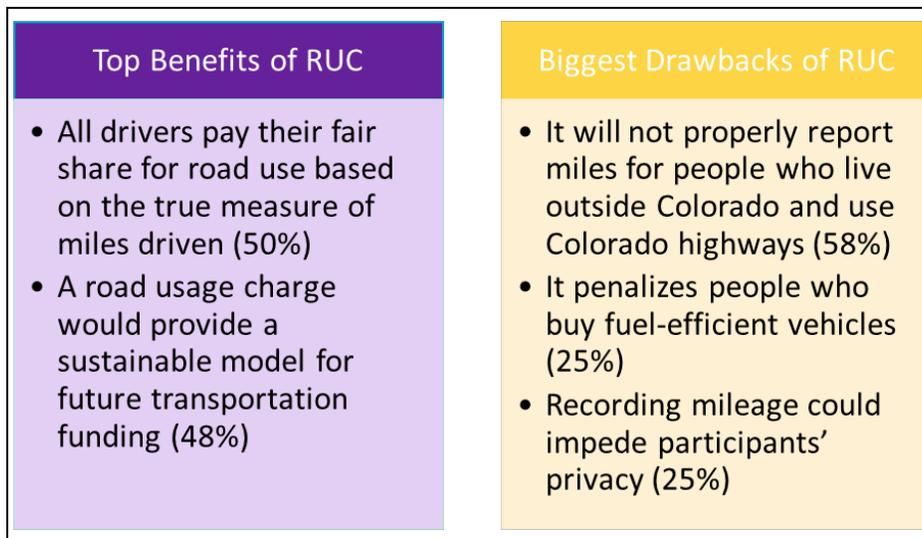


Figure 44: Mid-Pilot Survey - Participant perceptions of RUC benefits and drawbacks

Participants were asked about their use of the Azuga Insight Mobile app and web portal and their level of satisfaction with the experience. Among those who had installed the mobile app, just over a quarter (28%) used the mobile app often. The percentage of respondents who indicated that the app was easy to use (69%) declined since the pre-pilot survey, where 82% of respondents indicated it was easy to use. Over half (50%) indicated that the app was useful overall. When asked what the app was most used for, 62% of respondents stated that they used the app for reviewing trip information and/or reviewing road usage charges (Figure 45). Most respondents (70%) had used the Azuga web portal and most had positive perceptions of it; however, only 21% had used it often. Among those who had never visited the

web portal, the most common reasons given were that they had not had time or that the emails and/or phone app were sufficient for their needs.

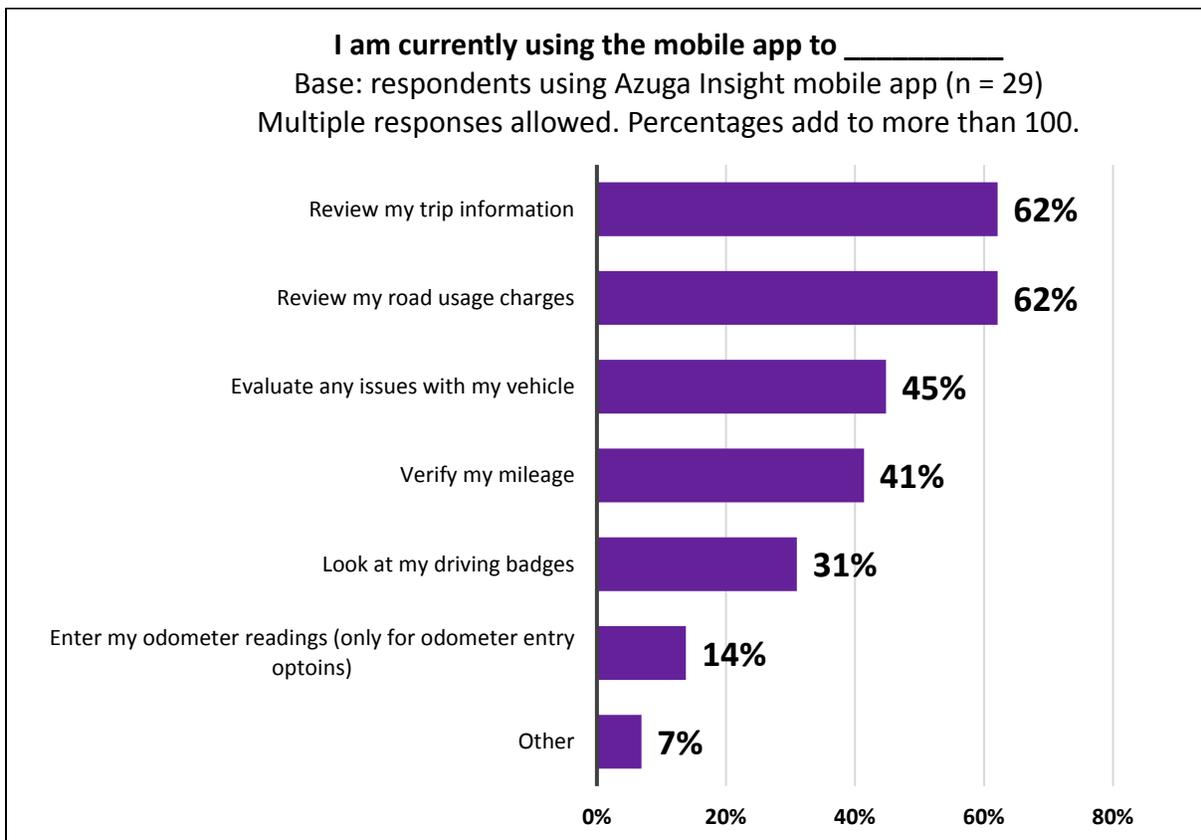


Figure 45: Participant use of the Azuga Insight mobile phone app

Respondents were asked about their level of concern with privacy as a result of their participation in the pilot. Over half (56%) indicated that they were not worried about the privacy of their data, and 67% said they were not concerned with privacy while participating in the pilot. Given CDOT's decision to prioritize other CDOT programs during the pilot program, this makes sense. In terms of data protection, 61% stated that they believed their personal information and the data provided for the pilot were secure, private and protected.

The majority of pilot participants utilized an MRD for reporting mileage and most appeared to have a positive experience. When asked about the devices used in the pilot, all of the respondents indicated that the devices were non-obtrusive and the vast majority (95%) indicated that the device seemed to work properly (Figure 46). Most (83%) did not even notice the device in their vehicle.

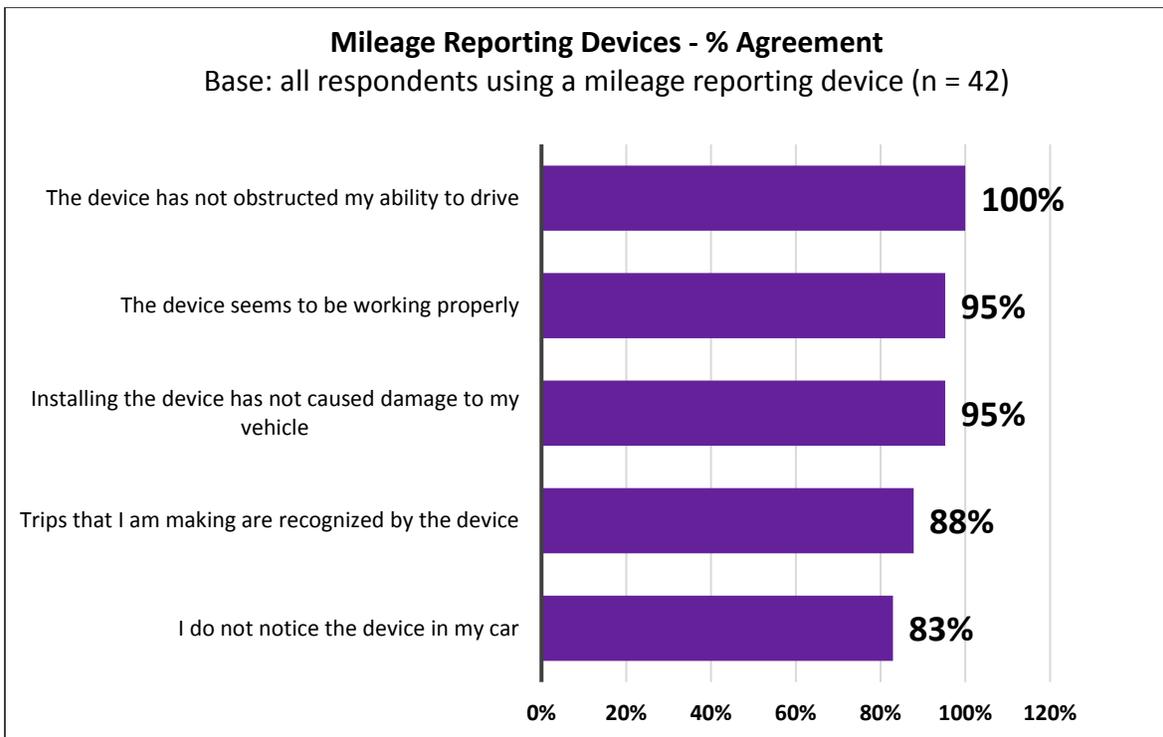


Figure 46: Participant perceptions of mileage reporting devices

Respondents were asked to provide input on the effectiveness of pilot communications. Most respondents (69%) said that RUC program information had been communicated well in terms of their participation in the pilot. However, only 8% indicated that the RUC program information had been effectively communicated to the general statewide public. In fact, 61% believed that the program had been communicated poorly to a statewide audience. For example, very few respondents indicated that they had seen RUC information in the media (Figure 47).

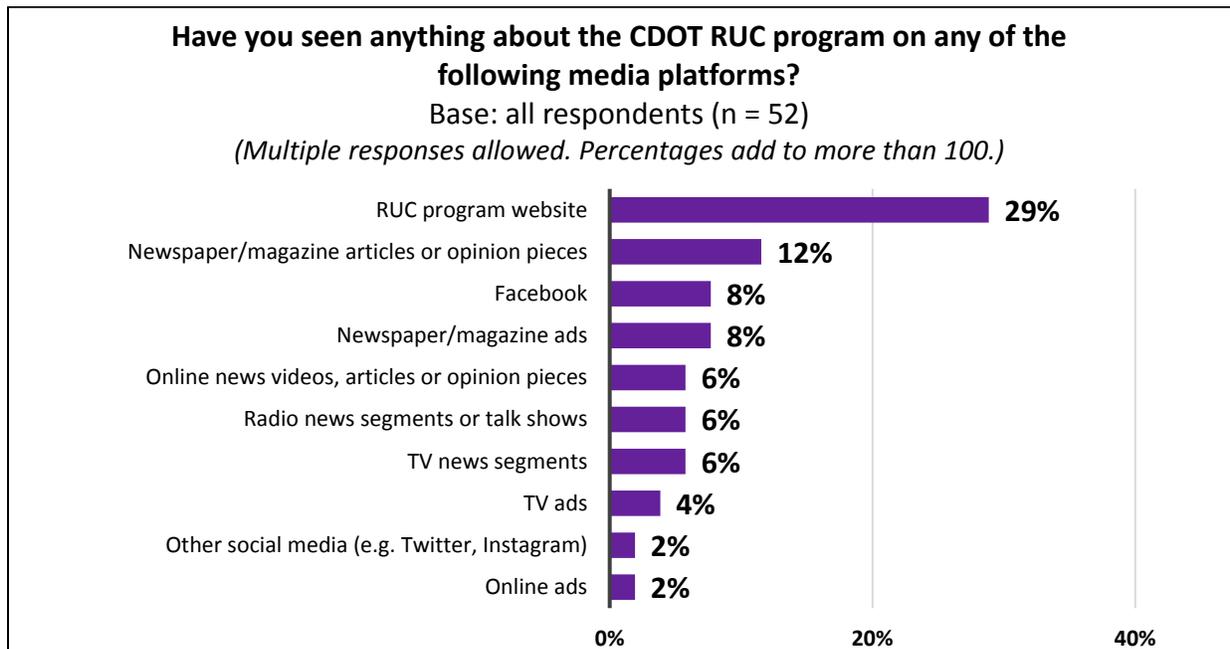


Figure 47: Participant awareness of RUC communications

Overall, survey respondents rated the pilot experience very positively (Figure 48). Most participants were satisfied with the ease of participating in the pilot as well as the overall experience. While some participants expressed concerns over the security of personal information, over half (65%) of participants were satisfied that their information was secure.

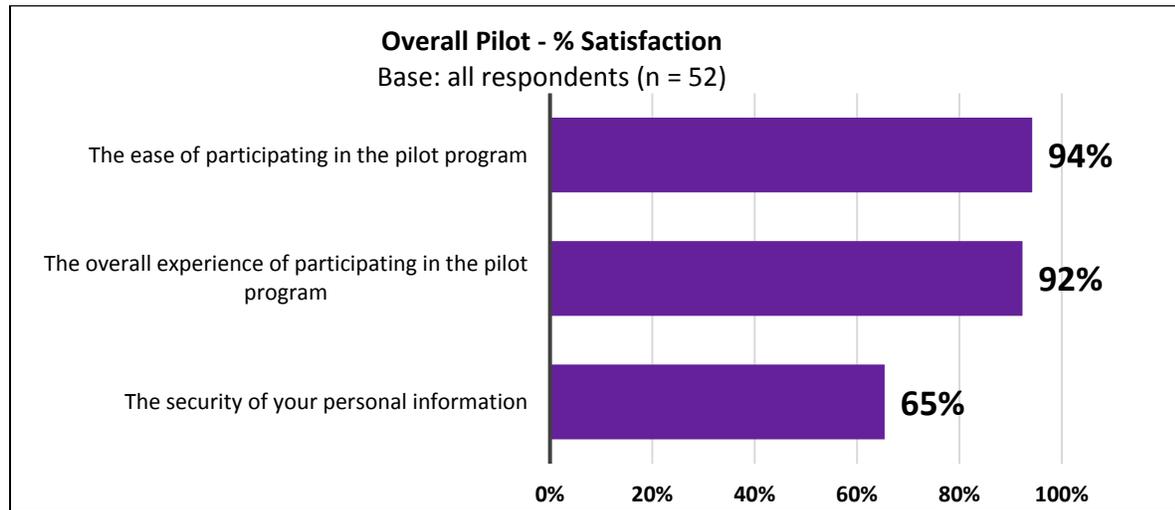


Figure 48: Participant satisfaction with pilot elements

3.6.3 Closing Survey

The third and final survey was administered to pilot participants at the conclusion of the pilot. It contained similar questions as the previous two surveys and also asked respondents to provide input on the overall pilot experience. The closing survey also asked respondents to provide their perspectives on the broader implementation of RUC in Colorado. The closing survey received the highest levels of participation with 84 total responses, 67% of those being general public and 33% being from stakeholder participants. Additional characteristics of the response pool are provided in Table 14.

Table 14: Closing Survey Respondent Characteristics

Group (n=84)	General Public: 67%
	Stakeholder: 33%
Gender (n=63)	Male: 72%
	Female: 28%
Age (n=48)	18-29: 3%
	30-45: 41%
	46-65: 45%
	66+: 11%
Race (n=48)	94% White / Caucasian
Vehicle Type: (n = 63)	Gas: 89%
	Hybrid: 7%
	Electric: 4%
CDOT Region (n=63)	1: 51%
	2: 16%
	3: 7%
	4: 21%
	5: 6%

Participants reported high satisfaction with all aspects of the Colorado RUCPP. As can be seen in Figure 49, none of the five evaluation areas received less than a 90% satisfaction rate from the respondent pool. Furthermore, 91% of respondents indicated that they would be willing to participate in a future pilot.

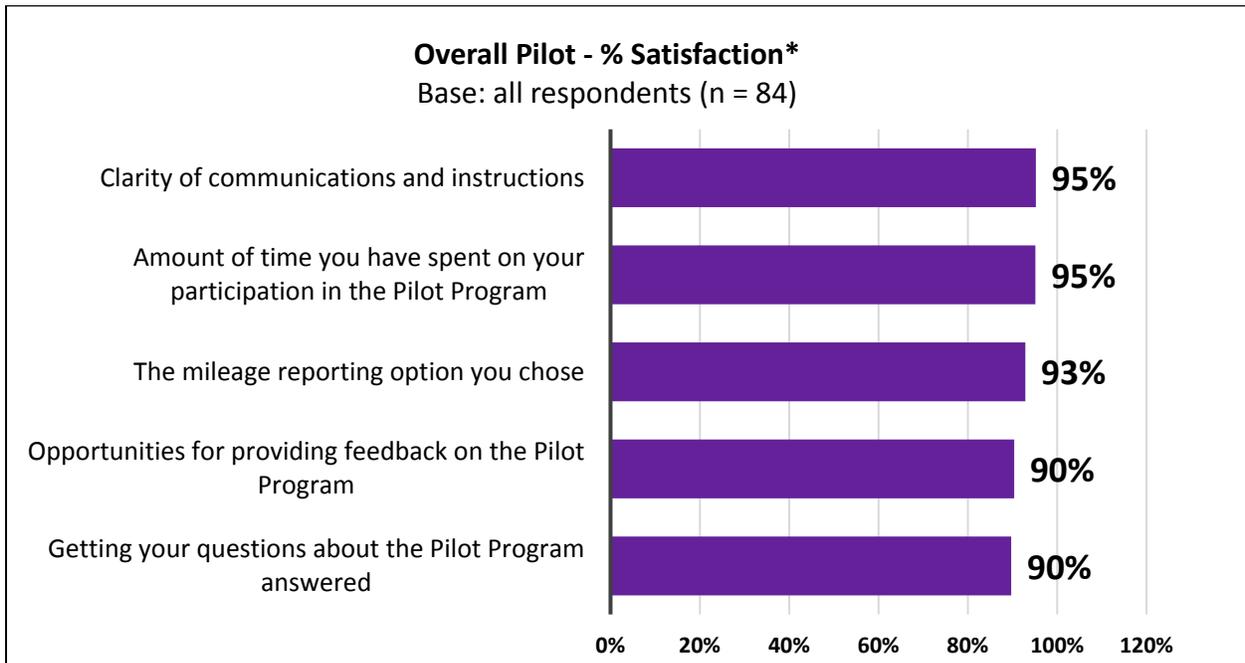


Figure 49: Participant satisfaction with various RUCPP elements

Respondents were very satisfied with the ease of participation and the overall experience (Figure 50). While security continued to be the lowest-rated aspect of the pilot, satisfaction with information security improved from 65% in the mid-pilot survey to 88% in the closing survey. This is a fairly significant increase even with the previously referenced size of the two response pools.

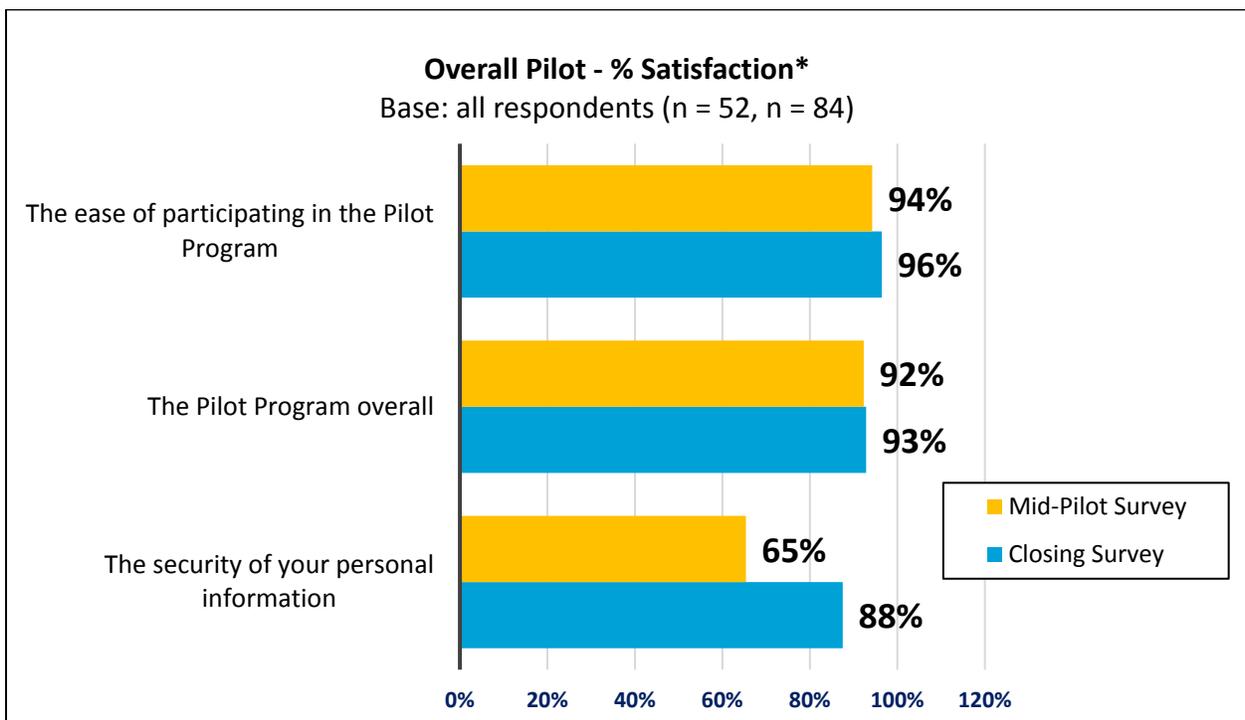


Figure 50: Change in participant satisfaction with RUCPP elements

Respondents were asked about how they perceived the pilot as influencing their travel behavior (Figure 51). Few participants (16%) agreed that the pilot had actually resulted in changes in their driving behavior. However, half indicated that they are now more aware of how many miles they drive. More than half indicated that they are now more aware of the amount they pay for road maintenance as a result of participating in the pilot.

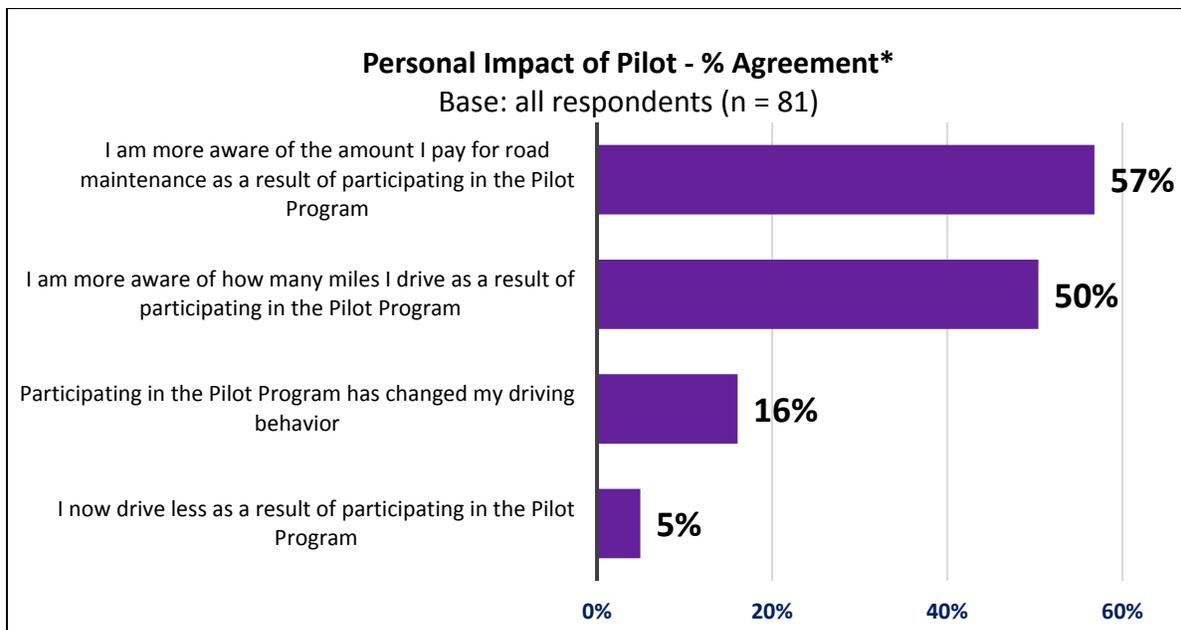


Figure 51: Participant perceptions of RUCPP impact

Support for RUC concept remained strong throughout the pilot, as shown in Figure 52. While support for RUC as a fair transportation funding mechanism dipped slightly on the mid-pilot survey, by the closing survey almost three quarters (73%) of respondents believed that RUC is a fair way of funding transportation in Colorado. Declines in positive perception of invoicing processes and the Azuga web portal were also observed on the mid-pilot survey, indicating that individual support for RUC overall might have been linked to participant experiences with aspects of the operational pilot at that point in time. However, these levels of support for the RUC concept stand in stark contrast to the 29% support that the concept received on the 2016 statewide survey.

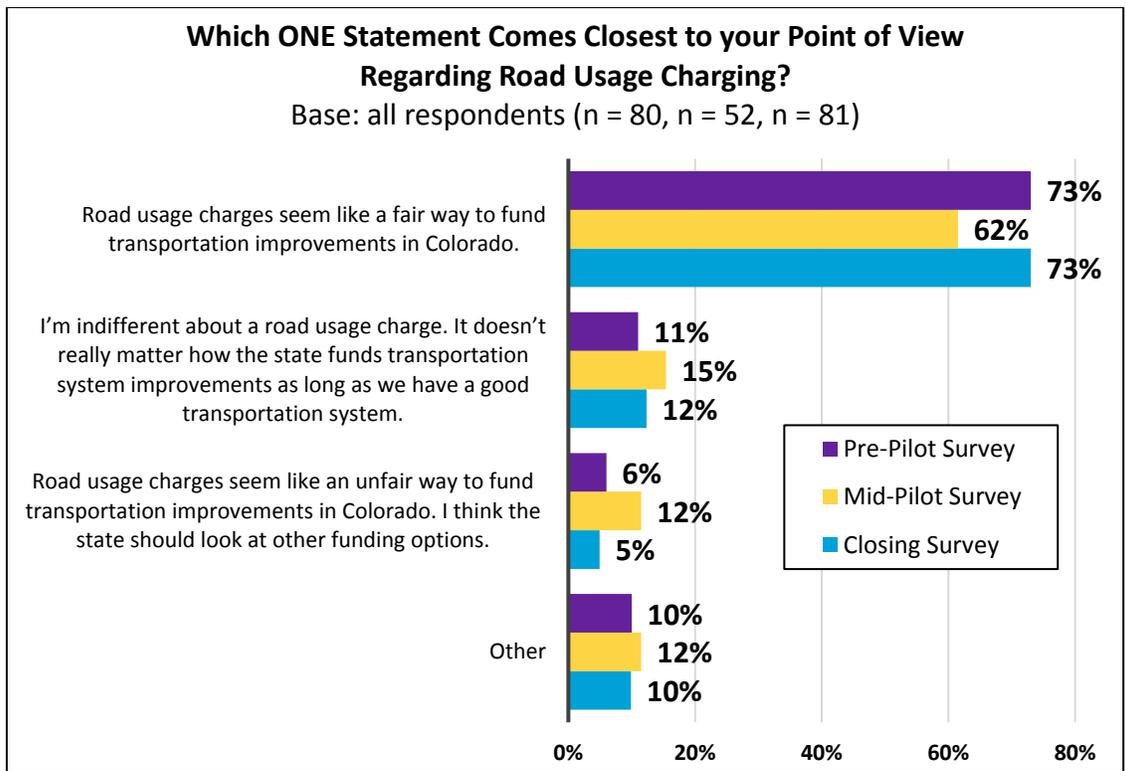


Figure 52: Change in participant support for RUC over all three surveys

To gather more insight on RUC equity perceptions, the closing survey asked respondents to indicate the extent to which they agreed with the statement that “funding Colorado’s transportation system with a mileage based road usage charge is a fair funding method.” More than four in five participants (86%) strongly or somewhat agreed that RUC was a fair funding method in the pre-pilot survey, which declined slightly to 81% in the closing survey (Figure 53).

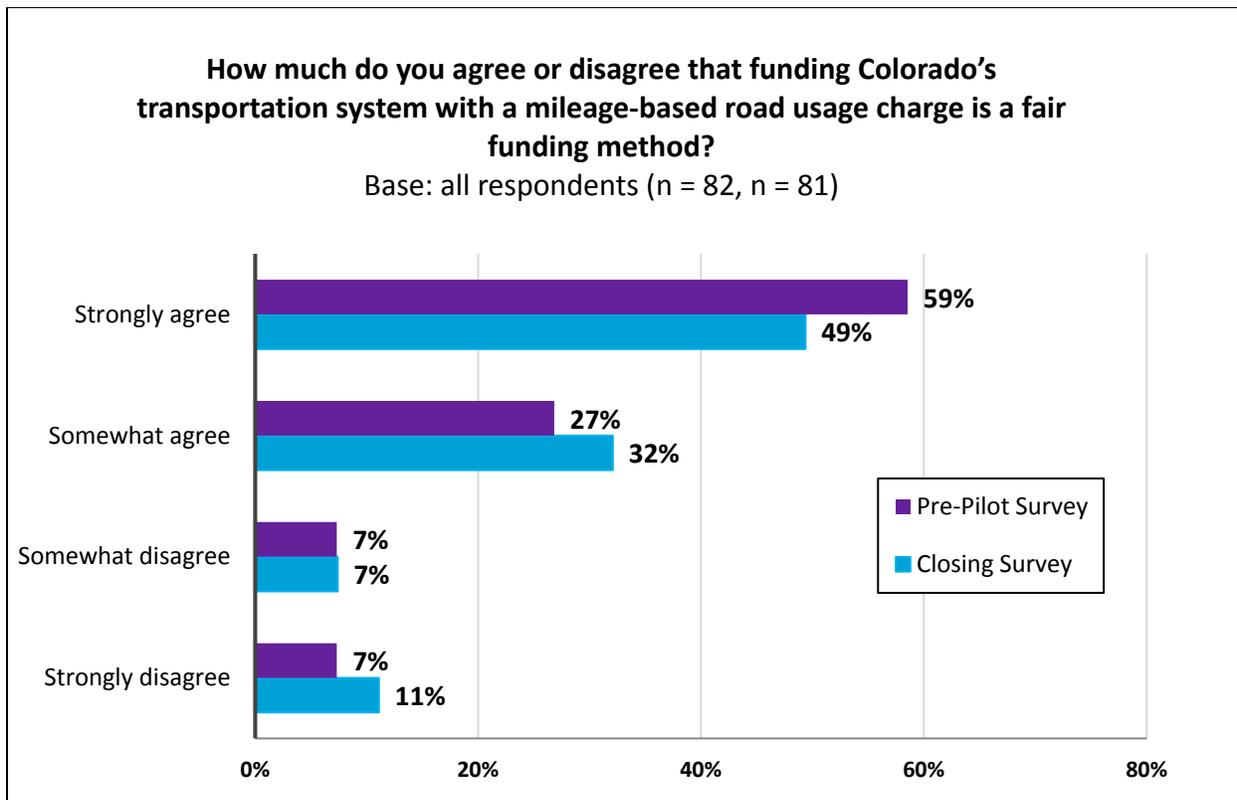


Figure 53: Participant perceptions of RUC fairness

The closing survey also asked respondents to provide input on future RUC work in Colorado. Overall, opinions were mixed about whether RUC needs further study before broader implementation (Figure 54). Although a majority of respondents (65%) agreed that they would look forward to future RUC implementation, about one third (35%) believed that the concept needs further study and refinement prior to implementation.

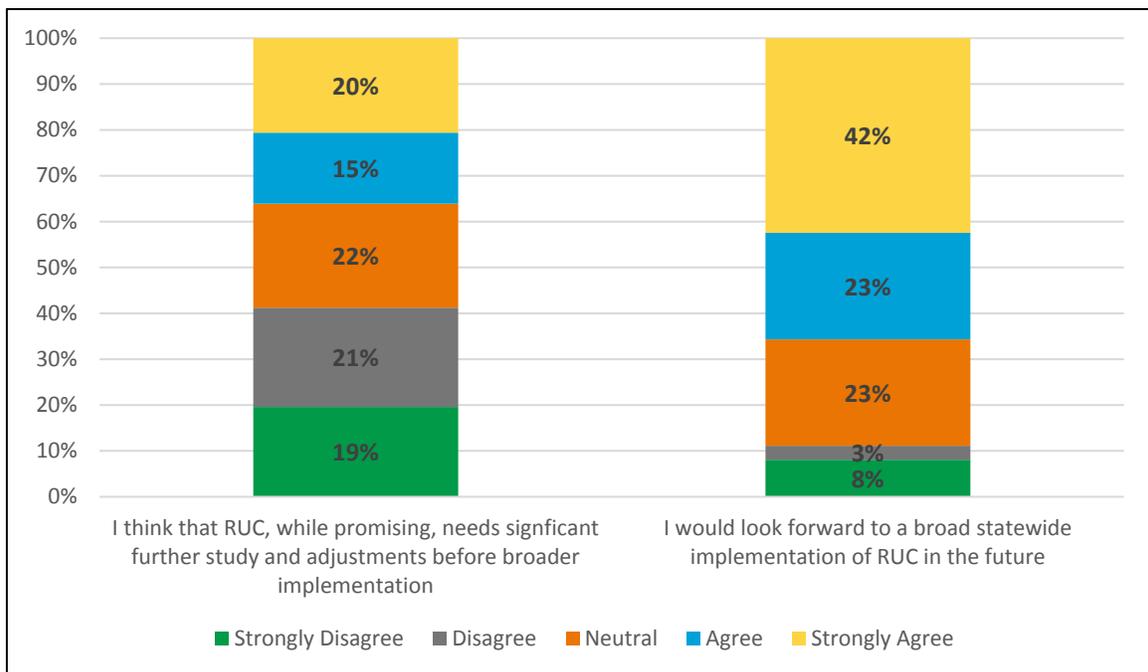


Figure 54: Participant perceptions on future RUC work

As in the mid-pilot survey, respondents were asked about their perceptions of the amounts assessed for RUC and gas tax credits. Well over three quarters (81%) of respondents believed that their assessed RUC was less than \$10 per month (Figure 55).

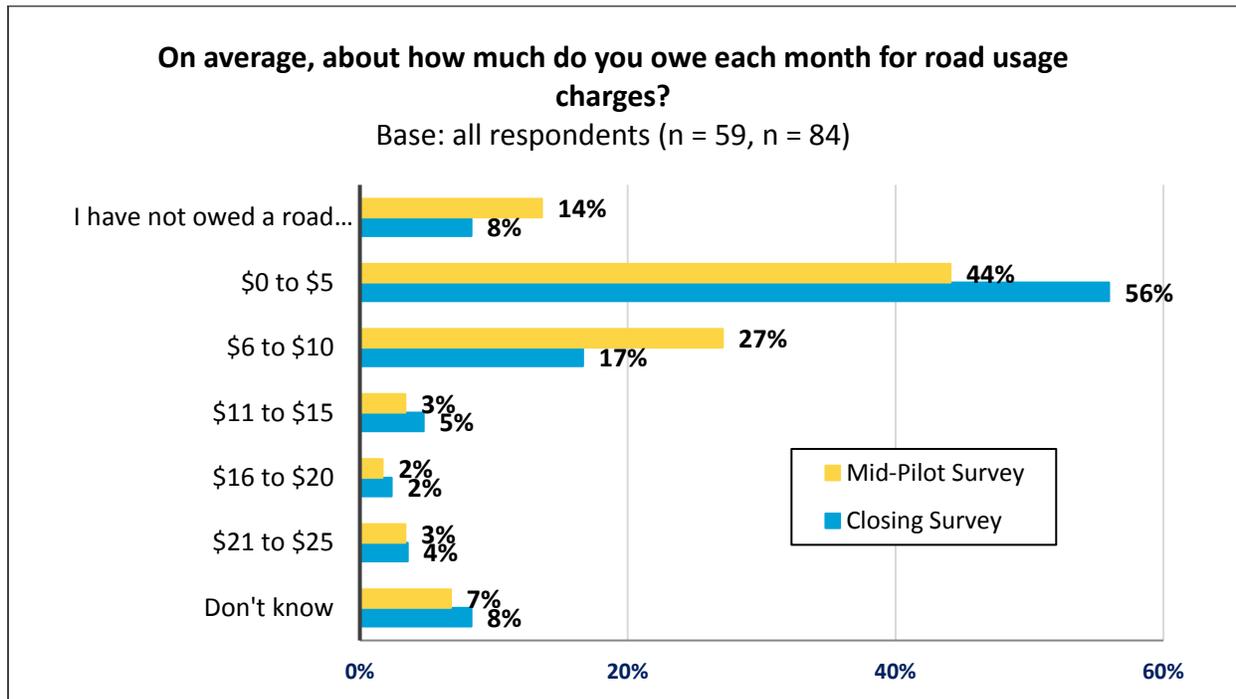


Figure 55: Participant perceptions of amounts assessed

About half (49%) of respondents to the mid-pilot survey and 40% of respondents to the closing survey stated that the amount assessed in road usage over the course of the pilot was less than what they had expected (Figure 56). Only of 11% of respondents to the mid-pilot survey and six percent of respondents to the closing survey indicated that assessed fuel tax credits were less than what they had expected (Figure 57). In general, most participants believed the monthly gas tax credit was about the same or more than what they had expected it to be.

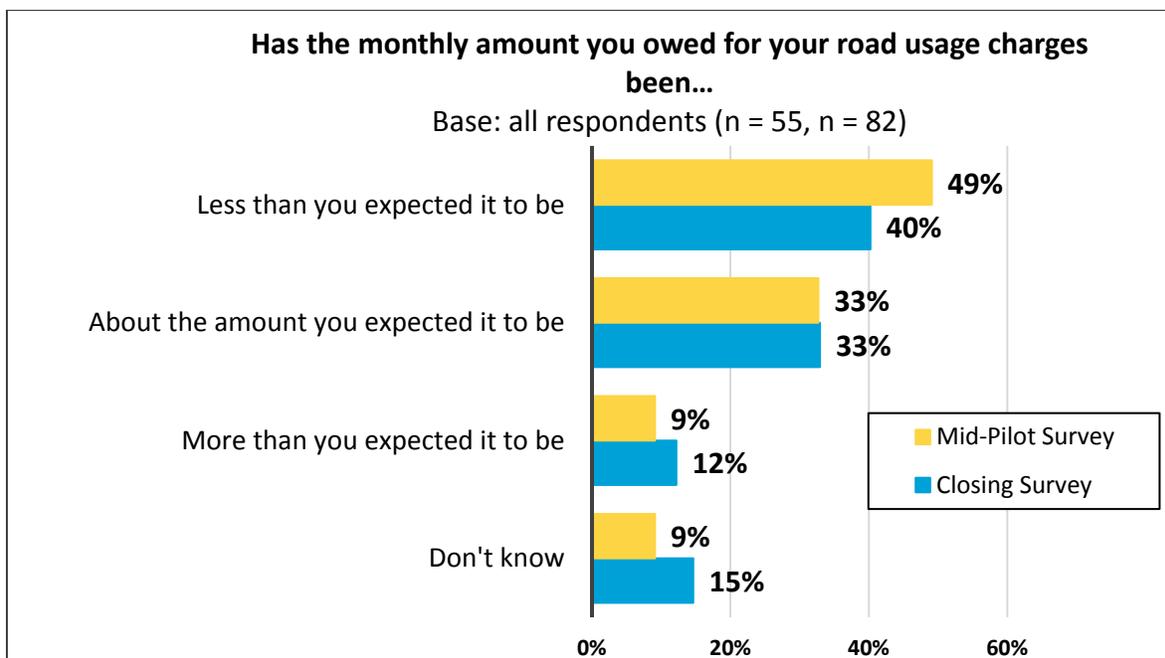


Figure 56: Participant perceptions of assessed RUC amounts

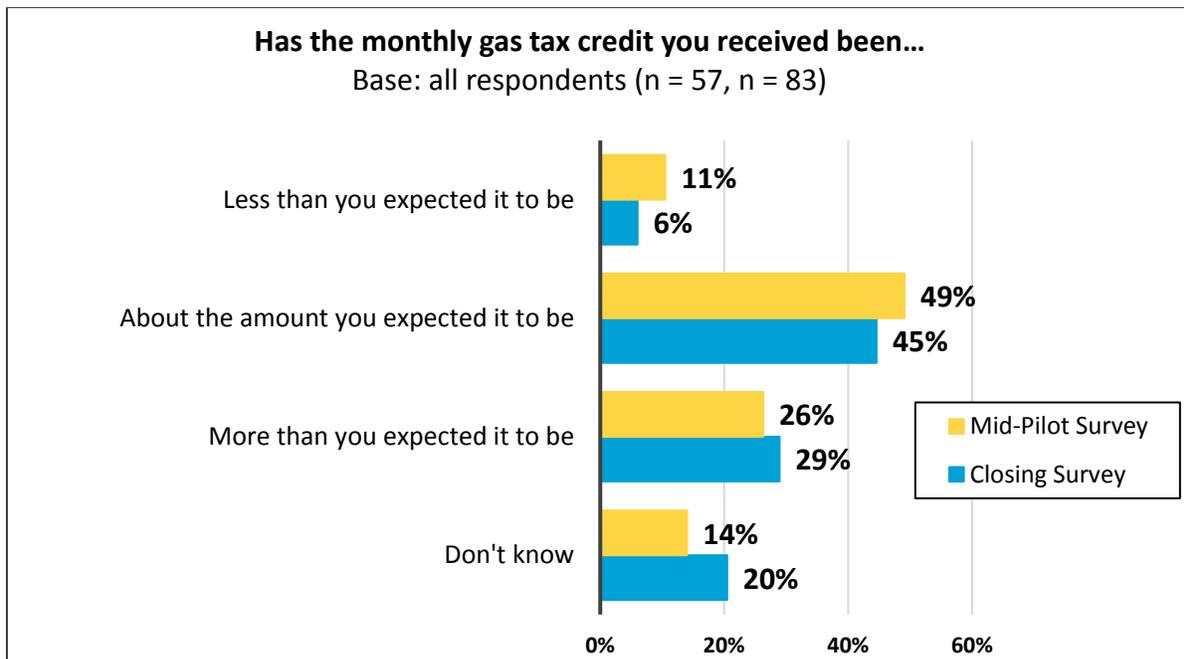


Figure 57: Participant perceptions of gas tax credit amounts

As with the previous two pilot surveys, respondents to closing-pilot survey were asked about what they perceived the top benefits and drawbacks of RUC to be. The top cited benefit of RUC was that it provides a sustainable revenue source (63%), followed by all drivers paying their fair share (48%). Interestingly, this order was flipped from what was observed in the pre-pilot survey (Figure 58). This indicates that messages centered on fairness could be effective in gaining acceptance for the RUC concept, but the importance of RUC as source of revenue resonates as people become more familiar with the concept.

What do you think are the top TWO benefits (if any) to a road usage charge program in Colorado?

Base: all respondents (n = 81, n = 52, n = 80)

Multiple responses allowed. Percentages may add to more than 100.

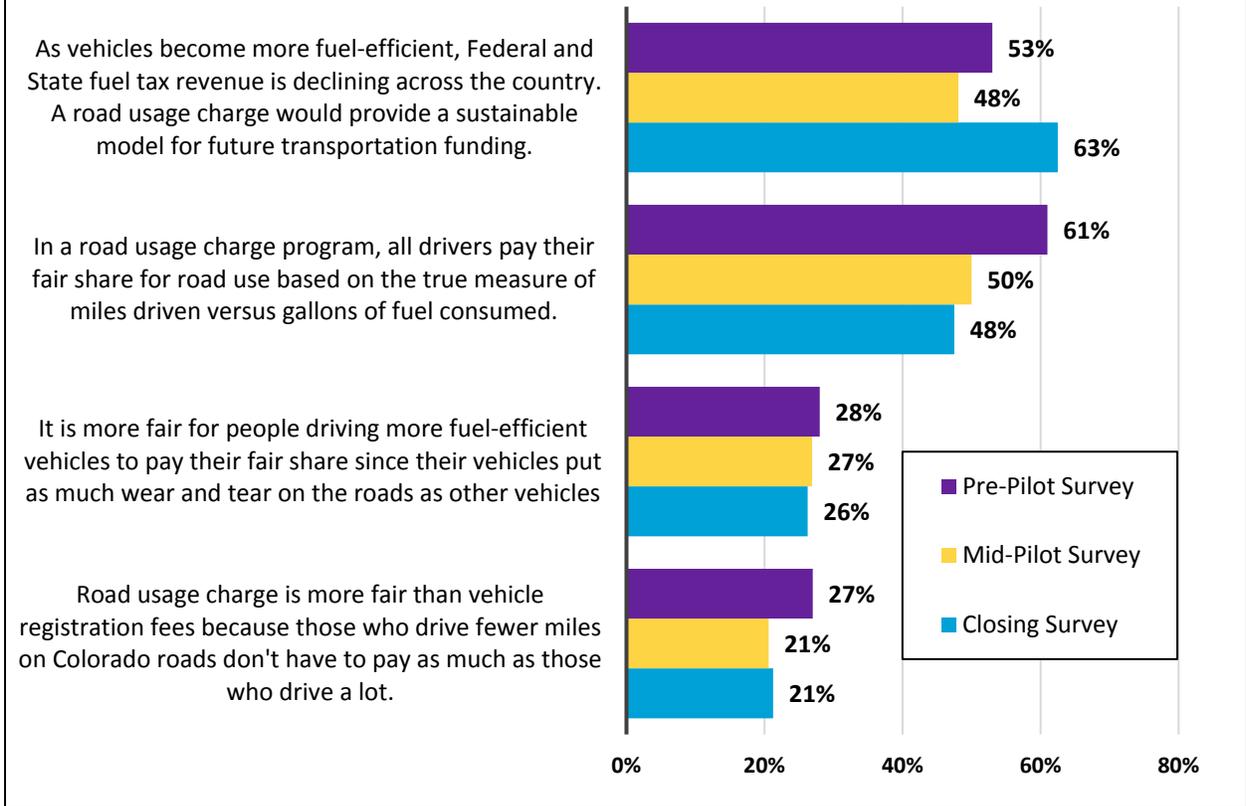


Figure 58: Participant perceptions of RUC benefits

The top drawback to the RUC concept cited by respondents was that RUC would not properly account for out-of-state drivers (Figure 59). This remained consistent across all three surveys.

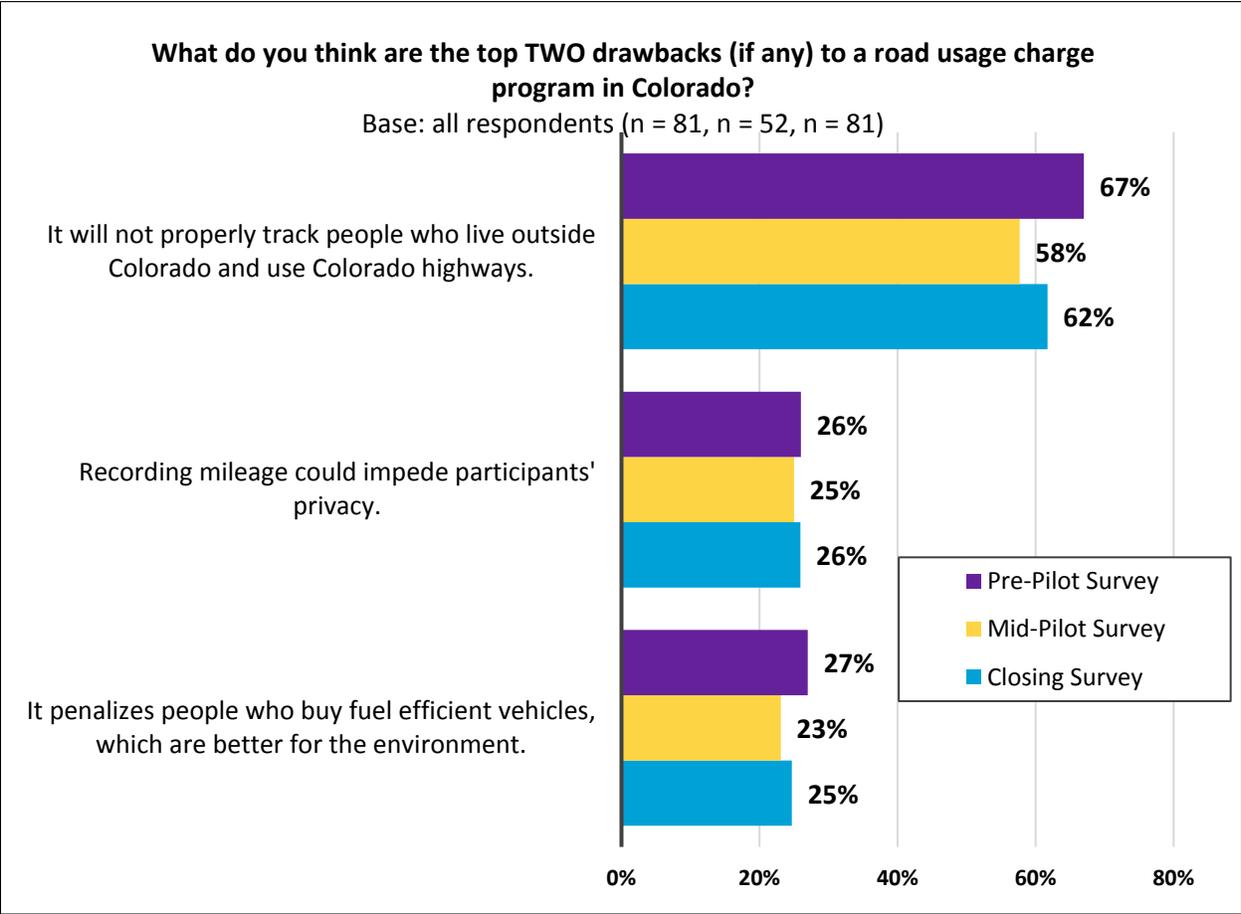


Figure 59: Participant perceptions of RUC drawbacks

As Figure 59 shows, around a quarter of respondents noted that RUC could be unfair to certain groups of people; specifically, the drivers of highly fuel-efficient vehicles. The closing survey asked additional questions to determine the extent to which RUC was perceived as being unfair to certain groups. As shown in Figure 60, just under half (44%) of respondents agreed that a RUC would impact all people in Colorado equally. Subsequent questions revealed that, for those who did not believe a RUC would impact all state residents equally, rural residents were viewed as being the most disproportionately impacted.

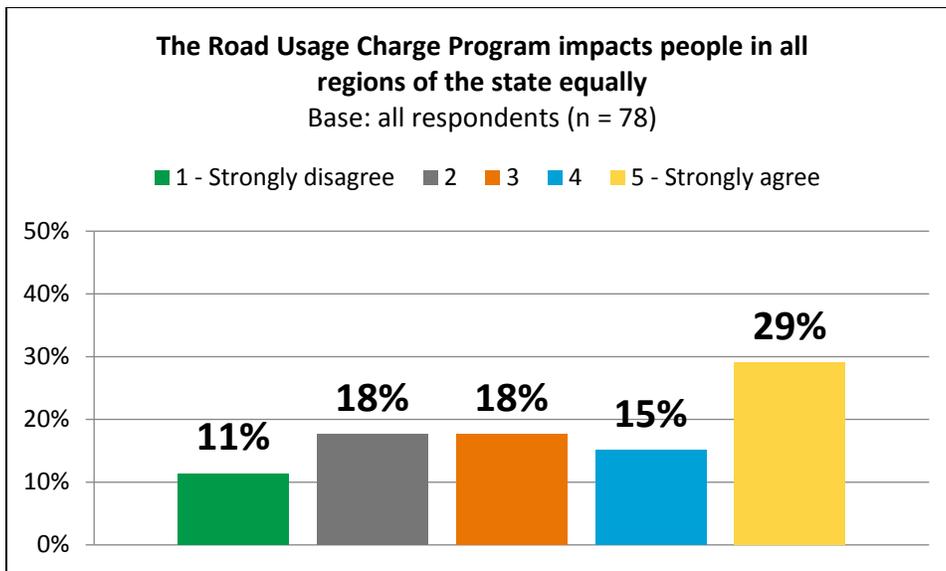


Figure 60: Participant perceptions on geographic equity of RUC

Participants were asked about their perceptions of the invoicing process. Most were satisfied with the clarity and fairness of invoices. Almost all (96%) had viewed their monthly road usage charging invoices. Furthermore, participants grew more confident between the mid-pilot and closing surveys with the accuracy of mileage reporting and the estimated fuel tax (Figure 61). The change appears to be a genuine improvement, rather than the result of the increased sample size for the closing survey. It is possible that this improvement was the result of participants becoming more familiar with the invoice process over the course of the Colorado RUCPP.

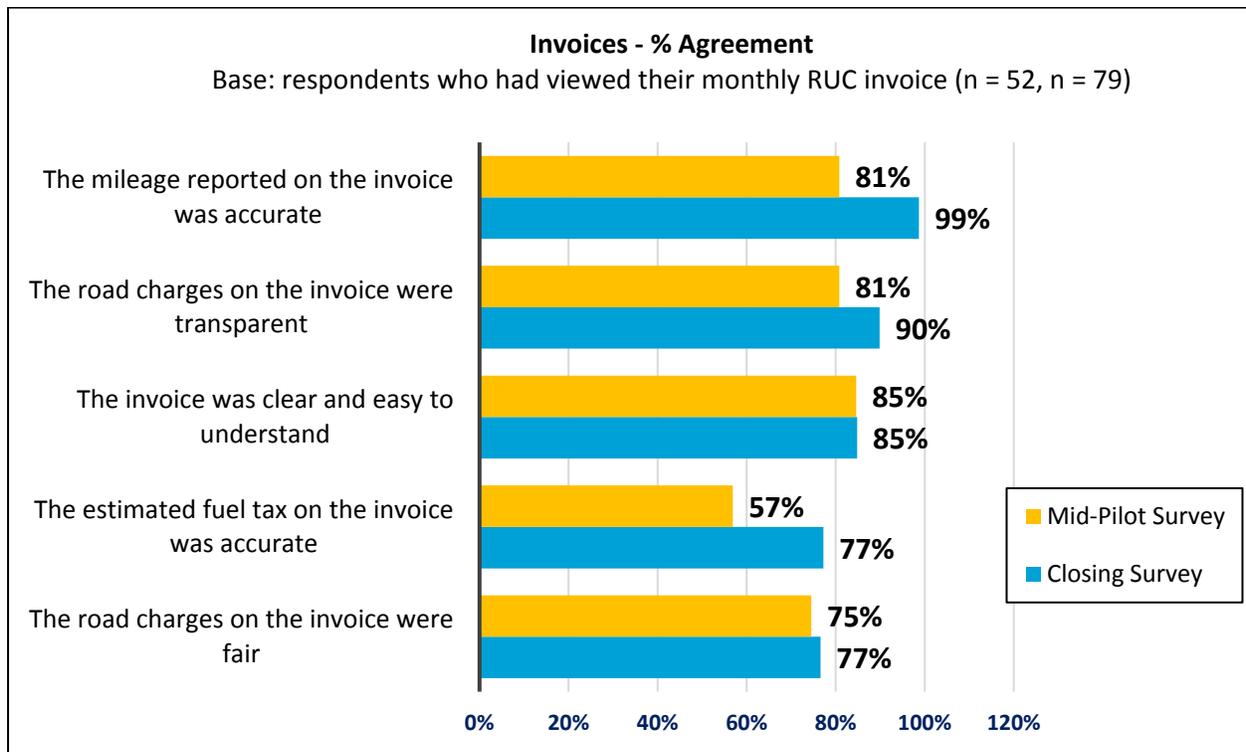


Figure 61: Participant perceptions of pilot invoicing

Respondents also provided input on the account management systems utilized by the private sector services provider. Almost three quarters (72%) had visited the Azuga web portal at some point, while 28% had not visited web portal at all. Among those who had visited the portal, 83% did so once a month

or less. In spite of the aforementioned dip in support for these systems on the mid-pilot survey, satisfaction with the accuracy and navigation of the website returned to high levels on the post pilot survey (Figure 62). Most (95%) of respondents found the website easy to navigate and believed that mileage reporting was accurate. Furthermore, 91% believed that RUC information was clear and easy to understand.

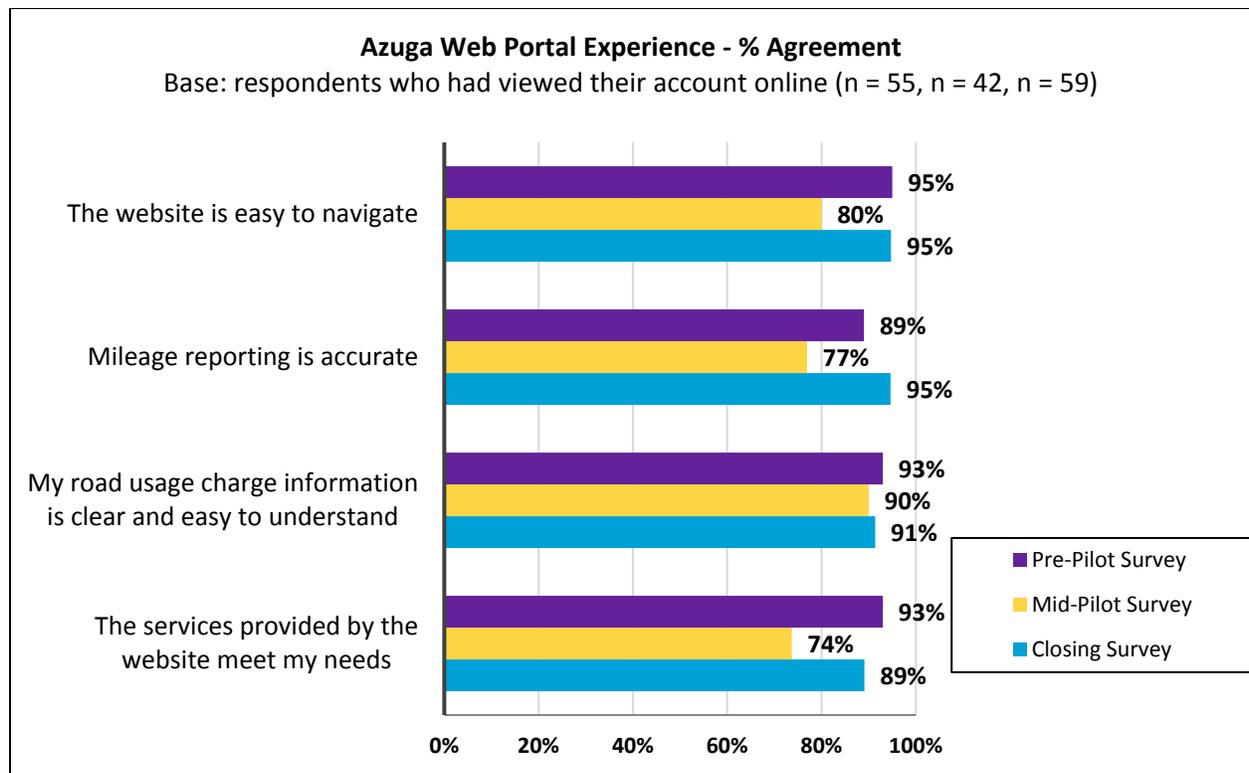


Figure 62: Participant perceptions of the Azuga web portal

Similar satisfaction was observed with the reporting options offered under the program. Most respondents were using a Mileage Reporting Device and reported much higher levels of satisfaction with that reporting option (Figure 63) as opposed to odometer reading. Of those participants who had used an MRD for mileage reporting, 93% indicated that they were satisfied with the options compared to 55% satisfaction for the odometer reporting option.

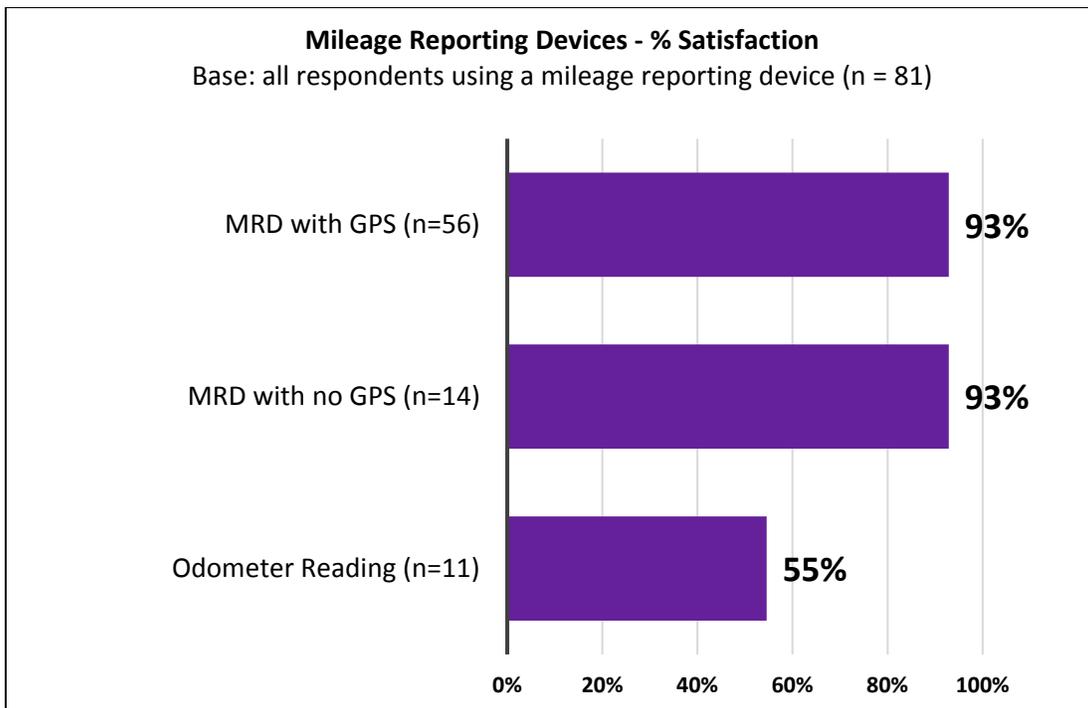


Figure 63: Participant satisfaction with mileage reporting options

The closing survey asked a series of questions to respondents to get their input on how such issues were handled with the Colorado RUCPP. About two-thirds of respondents said that the data and privacy protections in the Pilot Program were clear to them (Figure 64). About half (49%) believed that they had sacrificed some level of privacy by participating in the program, but only 14% indicated that they had experienced privacy concerns while participating. This indicates that many participants were willing to make compromises in terms of their personal privacy in exchange for ease of use and access to the detailed information that came with using a Mileage Reporting Device. Among respondents who had experienced a privacy concern, the primary factors at the root of their concerns were fears of “hacking” attempts and general discomfort with sharing detailed personal information with a governmental agency. However, in spite of these concerns, most (87%) or respondents were satisfied with the data security and privacy protections offered by the pilot (Figure 65).

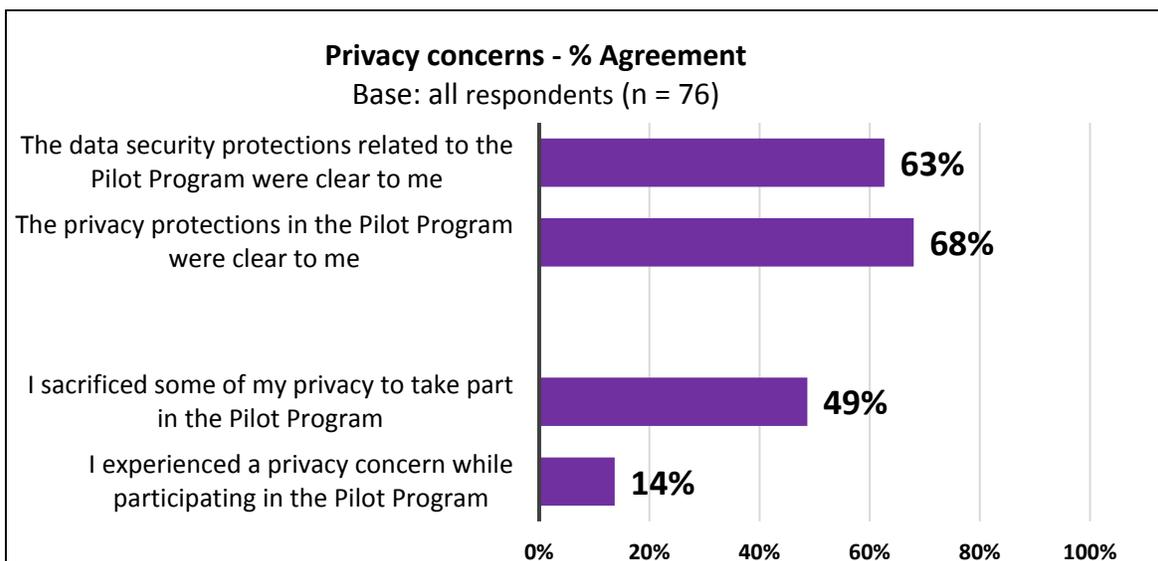


Figure 64: Participant privacy concerns

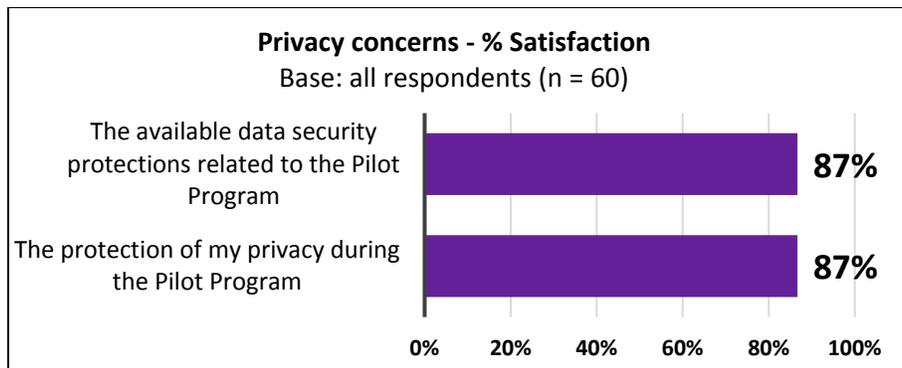


Figure 65: Participant satisfaction with privacy protections and data security

Participants were asked about pilot program aspects that should be addressed in the future (Figure 66). The item that received the most support was “adjustable rates,” with examples provided by respondents including “variable pricing to account for trailers and freight.” Not surprising, the issue of how to charge out-of-state drivers received the second highest amount of support as an issue for further development.

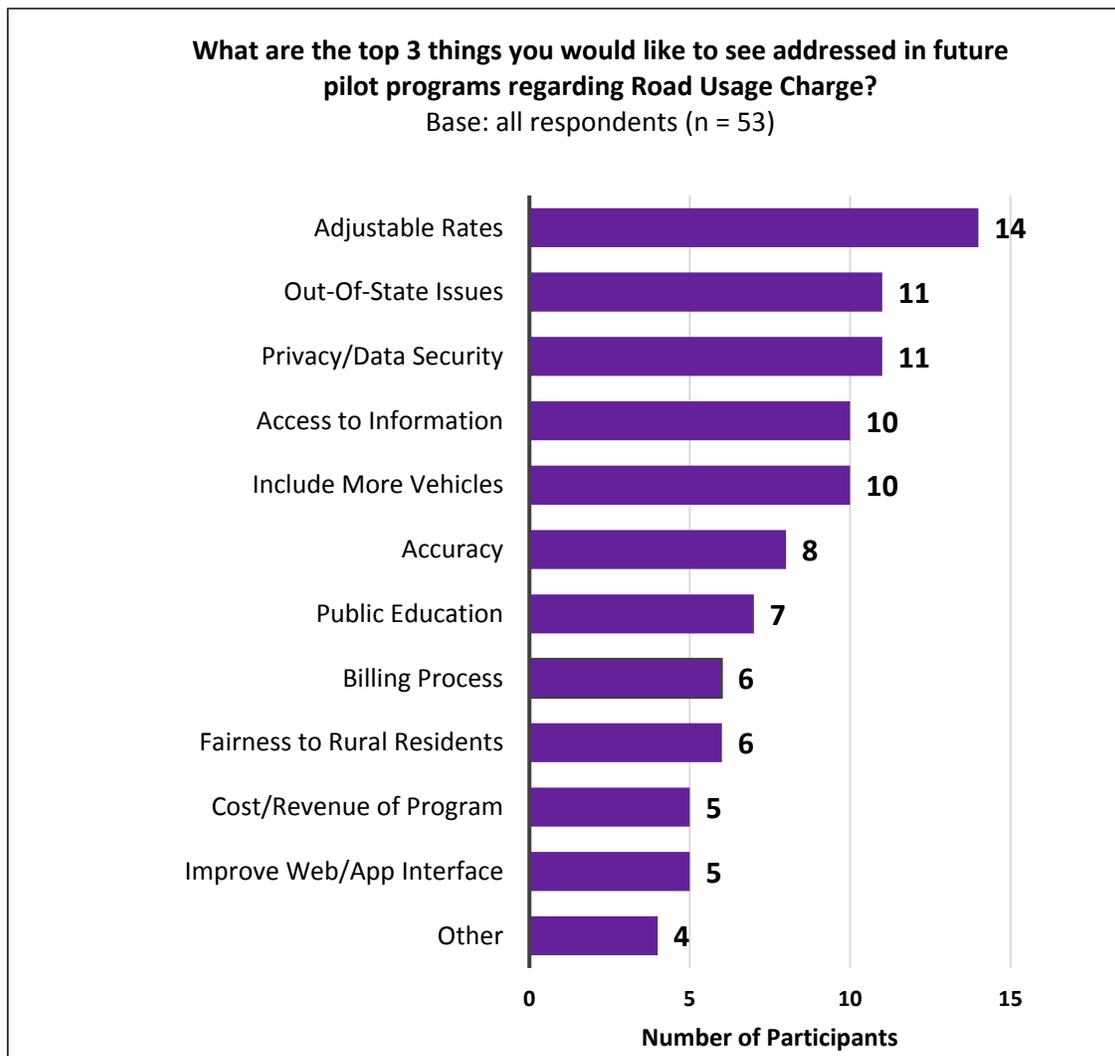


Figure 66: Participant perceptions of programmatic elements for future improvement

3.7 Summary of System Performance

Over the course of the pilot, the private account manager (Azuga) maintained a log of errors captured by the MRDs used to collect vehicular information for RUC assessment. For the entirety of the pilot, the only errors that were identified by the system were devices being disconnected and reconnected. These errors were triggered when there was a lapse in the connection with the vehicular OBD-II port. This occurred a total of 131 times (Table 15), often when a vehicle is undergoing repairs. The system was configured such that mileage data would not be lost when the device was disconnected from the vehicle.

Table 15: Errors and Events Logged by MRD Systems

	Number of Disconnects/ Reconnects
December	17
January	31
February	43
March	24
April	16
Total	131

The pilot team also maintained a log of issues that were submitted to the help desk by program participants. These are summarized in Table 16 below. As can be seen in the table, the majority of issues over the course of the pilot were related to questions regarding participant accounts. However, the greatest number of issues in a single month was in December and related to general enrollment issues. The mid-pilot survey asked respondents for input on their interactions with help desk with all respondents indicating that their issues had been resolved; generally, in less than 10 minutes. The post pilot survey found that 40% of respondents had sought help during the course of the pilot and, among these respondents, 59% visited the FAQ or web page, which was the most common method of obtaining help. About half (47%) were seeking assistance for a technical issue with their mileage reporting device. Most respondents (93%) who sought help had their issue resolved.

Table 16: Pilot Help Desk Log

	December	January	February	March	April	Total
Enrollment Issues	17	0	0	0	0	17
MRD Issues	7	3	1	0	1	12
Account Issues	7	3	9	4	5	28
Recruitment Screener Issues	0	0	0	0	0	0
Mobile App Issues	0	0	1	0	0	1
Other Issues	6	0	0	0	2	8
Total Issues	37	6	11	4	8	66

While odometer reading participants did not utilize an MRD for the collection of usage data, they were required to submit monthly odometer readings either through the website portal or the smartphone application. As can be seen in Table 17, a significant number of participants did not submit the required

readings. Even more troubling is the fact that the percentage of odometer reading participants not reporting mileage increased over the pilot from 18% in December to 55% in April. A picture verification was required for the initial and final odometer readings during the Colorado RUCPP and could be submitted via the Azuga Insight Mobile App, the Colorado RUCPP Help Desk, or via mail to CDOT. Only 8 of the 22 odometer reading participants submitted pictures with their initial reading and 10 of the 22 odometer reading users submitted their final odometer pictures during pilot closeout.

Table 17: Number of Odometer Reading Participants Not Submitting Monthly Readings

Month	Number of Accounts*	Accounts NOT Submitting Monthly Odometer Reading	Submitted picture of initial/final odometer reading**
December 2016	22	4	8
January 2017	22	5	**
February 2017	22	6	**
March 2017	22	9	**
April 2017	22	12	10
<i>*These numbers include soft launch participants and pilot project team participants, as well as recruited stakeholders and general public participants who volunteered for the RUCPP.</i>			
<i>** Picture verification was only required for the initial and final odometer readings during the Colorado RUCPP and could be submitted via the Azuga Insight Mobile App, the Colorado RUCPP Help Desk, or via mail to CDOT.</i>			

3.8 Technical Issues

While the pilot should be considered a success, there are still some technical limitations that were identified and future technical considerations that could be explored through subsequent projects. These include the following:

- **Delineation between public and private roads** -- While the delineation between public and private roads was tested during user acceptance testing, a determination was made to not include this capability due to inaccuracies in the map data. Further research and testing should be conducted using more detailed map sets to demonstrate how RUC charges could be waived for vehicles that travel on private roads.
- **Use of a single per-mile rate** -- The account management system supporting the Colorado RUCPP required the application of a single per-mile rate to all vehicles and could not support variable rates. Further research and testing of multi-rate capable systems would allow CDOT to explore RUC charges for other vehicle types such as diesel, LNG, or heavy trucks; or begin exploring variable rate pricing for time of day, specific corridors, or other factors. Furthermore, a true revenue neutral rate should be determined and subsequent research efforts should evaluate the revenue impacts this rate would provide.
- **Limitations on the use of multiple reporting options under a single account** -- While Azuga systems allow multiple vehicles under the same account, these multiple vehicles are restricted to using the same mileage reporting option. Should a larger-scale program be considered, account management systems should allow for multiple vehicles supporting the entire range of mileage reporting options offered.
- **OBD-II Port Competition** -- Access to the OBD-II port, where the MRD is fitted to the vehicle to receive diagnostic information, by private service providers has become very competitive in recent years. OBD ports can generally accommodate only one device, and several aftermarket service

providers already offer some of the value-added services that would be provided through a RUC system and RUC services market. As such, limitations on the number of devices that can access the OBD-II port will preclude user choice and may threaten overall user acceptance. To remedy this issue, data-sharing agreements and arrangements between aftermarket service providers and governmental agencies are needed to relieve competition.

- **Accommodation of different fuel types** -- The introduction of a more viable market for alternative fuels has created the need for accommodation of these fuels within the transportation network. In 2014 CDOT invested \$30 million of Congestion Mitigation and Air Quality (CMAQ) funds to establish a grant program that helped create a market for Compressed Natural Gas (CNG) and other alternative fuels through infrastructure and vehicles purchases. The introduction of these alternative fuels has created a need for a RUC per-mile rate structure that acknowledges and accounts for different fuel types.
- **Mobile Application Refinement** -- Based on user feedback from the Colorado RUCPP, there are a number of enhancements needed to the Colorado RUCPP Mobile Application. These improvements include:
 - Updating the mobile application to accommodate all reporting options, not just manual odometer reading.
 - Updating to include push notifications when billing due date is approaching;
 - Updating to include standardized process for monthly billing procedures that include odometer picture submissions for the manual odometer reading option;
 - Upgrading the private sector account manager ability to digitally analyze and validate user submitted odometer photos.
- **Additional Technical Support** – The Colorado RUCPP illustrated the need for technical support in a number of media to facilitate device installation. For example, while several different resources were provided to program participants, a need was identified for MRD installation support videos that could be viewed through the mobile application.

3.9 Administrative Issues

While not a direct requirement of the Colorado RUCPP, enforcement and compliance were the biggest administrative issues encountered. While technology-based systems were highly accurate and easily enforceable (as they used simulated prepaid accounts), there were many instances where participants who used the odometer reading option were not updating their odometer readings regularly, if at all. For future programs, especially those where actual monies are collected, this could cause a considerable amount of lost revenues. Future programs should explore ways to better enforce the odometer reading option including: online notifications, penalties for non-compliance, or using a third-party state or private agency to conduct periodic odometer readings.

4 Outstanding Policy Considerations

Throughout the Colorado RUCPP, the pilot team convened numerous meetings with a Technical Advisory Committee (TAC) and Executive Steering Committee (ESC). These committees were composed of people with specific areas of expertise, and included CDOT staff as well as various public and private transportation stakeholder groups (see Table 18). These meetings provided pilot updates and engaged committee members in discussions covering a range of issues related to transportation in Colorado as well as the Colorado RUCPP. These conversations resulted in the identification of numerous policy related issues that were not addressed in the Colorado RUCPP, but provided guidance for future transportation policy discussions pertaining to a RUC. A listing of these issues, as well as those raised by the public, is provided in Appendix G and a synthesis is provided in this section of the report.

Table 18: Colorado RUCPP Advisory Committees

Technical Advisory Committee	Executive Steering Committee
Colorado Department of Revenue	American Civil Liberties Union (ACLU)
Data Privacy Expert	Legislative Representation
Public Engagement Expert	Colorado Contractors Association (CCA)
Toll Operations Expert	Colorado Municipal League (CML)
Intelligent Transportation Systems Expert	Statewide Transportation Advisory Committee (STAC)
CDOT Staff	Environmental Organizations

Many of the policy considerations can be addressed through successive pilots and, in some cases, research even in the absence of a future pilot. These research and development needs are included in the discussion in this chapter as well as the subsequent section discussing next steps for RUC in the state of Colorado. Furthermore, many of the issues presented have been addressed to varying degrees as part of other transportation funding related initiatives within the state and they merely need to be reexamined within a RUC context.

Outstanding policy issues identified through the Colorado RUCPP Steering Committee, Technical Advisory Committee, and CDOT Executive Oversight Committee Members deliberations can generally be classified within the following categories:

- **User Oriented:** These policy considerations relate to specific road users and the associated impact of transportation fees and taxes on these individuals and entities.
- **System Oriented:** These considerations apply more to the transportation system as a whole and not individual users or user classes.
- **Technology:** Technical issues relate to emerging trends in technology and their impact on both the transportation system and its users.
- **Administrative:** These considerations relate to the state and state agencies that are involved in transportation service delivery and fee administration.

Policy issues identified and discussed in this section can be further classified in terms of whether they are general in nature or specific to RUC. In almost all cases, a general policy consideration will have implications for specific RUC policy issues. Furthermore, each RUC specific policy consideration may be supported by any number of general policy considerations.

Furthermore, subsequent research and development efforts with regard to these issues can be accomplished through any number of perspectives. For example, each policy issue can be examined from other perspectives such as:

- Rural versus Urban
- Commercial versus non-commercial
- Public versus Private

4.1 User-Oriented Policy Considerations

User-oriented policy considerations are those that have implications for individual users, user groups or transportation system stakeholders. Decisions made by Colorado policy makers will have an impact on household finances, individual travel behavior, and transportation related business decisions. User oriented policy considerations identified during the Colorado RUCPP are shown in Table 19 below.

Table 19: User-Oriented Policy Considerations

General Policy Issue	RUC Policy Considerations
4.1.1 Fiscal Impact Compared to the Gas Tax	What will be the financial impact of RUC on transportation system users and stakeholders compared to the gas tax?
4.1.2 Travel Behavior	What is the potential impact of a RUC on individual driver behavior?
4.1.3 Potential Impacts on Consumer Vehicle Preference	What will be the effect of RUC on the sales of alternative fuel vehicles?
4.1.4 Out-of-State and Private Road Travel Characteristics	What would be the impact of levying a statewide RUC that excludes charges for travel out-of-state or on private roadways?

4.1.1 Fiscal Impact Compared to the Gas Tax

Under a RUC system, the user’s financial impact compared to the gas tax varies. Since gasoline tax is contingent upon a vehicle’s fuel efficiency, results will vary depending on the MPG among vehicle types. Table 20 shows the correlation between state gas taxes paid and assessed RUC during the RUCPP. Note that these values are only provided to demonstrate the payment of RUC versus state gas taxes. As the per-mile rate used for the RUCPP was notional and did not truly reflect a revenue neutral rate, no additional comparisons should be made.

Table 20: Estimated fees paid for 1,000 miles driven per month

Type of Vehicle	Average Monthly Gas Tax Paid	Average Monthly Road Usage Charge Paid*	Difference
Low Efficiency 5-15 Mpg (10 MPG Median)	\$22.00	\$12.00	RUC will save \$10 for these drivers
Average Efficiency 15-25 Mpg (20 MPG Median)	\$11.00	\$12.00	RUC will cost \$1 for these drivers
High Efficiency Hybrid 25-45 Mpg (35 MPG Median)	\$6.29	\$12.00	RUC will cost \$3.71 for these drivers
Electric >45 Equivalent MPG (Gas Not Needed)	\$0.00	\$12.00	RUC will cost \$12.00 for these drivers
*Paid amounts are calculated assuming 1,000 miles travelled per month at a notional rate of \$0.012 per mile			

RUC allows drivers to pay based on the number of miles they drive, providing a direct correlation between the motorist's use of the transportation network and the amount they pay to support the system.

4.1.2 Travel Behavior

The Colorado RUCPP yielded information on aggregate travel patterns for RUCPP participants. However, it is not clear as to whether the observed travel behavior represented a significant deviation from typical travel behavior absent a RUC. For example, while the various surveys administered for this effort showed that driving behaviors did not change, it is unknown *to what extent* participants reduced/increased trips, reduced/increased distance travelled, or altered their driving behavior once they became aware of the cost of the gas tax or RUC. As such, a baseline assessment of Colorado driver elasticity in response to pricing would be beneficial and could be augmented in a future pilot.

4.1.3 Potential Impacts on Consumer Vehicle Preference

One item that remains unclear is the extent to which a RUC will impact consumer decisions among travelers. A more specific area of inquiry would be the impact of a RUC on the owners of alternative fuel vehicles that are either paying significantly less in fuel taxes (due to superior fuel efficiency) or not paying fuel taxes at all (such as electric vehicle owners). As noted in the previous section, hybrid and electric vehicle drivers did pay more on average during the RUCPP. Electric vehicle owners paid, an average of \$6.27 per month while hybrid vehicle participants paid an average of \$4.10 per month. This was due primarily to the fact that participants with gasoline powered vehicles received a credit for estimated fuel taxes paid. Although, a critical policy consideration moving forward is the extent to which an increase in travel costs for electric vehicle and hybrid vehicle drivers might impact decision making regarding the purchase of these vehicles.

4.1.4 Out-of-State and Private Road Travel Characteristics

The Colorado RUCPP allowed participants to select a GPS-enabled MRD which did not assess RUC for travel accrued out-of-state. As discussed previously, the Colorado pilot provides a potential baseline for the percentage of out-of-state travel, estimated between 1 and 3% per month. The technologies utilized in the Colorado RUCPP have the potential to delineate between public and private roads which would allow for mileage accrued on private roadways such as ranches and toll roads to be deducted from RUC charges. However, it is unclear as to the extent to which the trends observed among pilot participants are representative of wider statewide trends. The collection of information on current utilization of private roads and out-of-state travel will be beneficial in refining subsequent RUC efforts in the state. Furthermore, these questions have implications for potential future users as the greater flexibility and convenience offered by location-based methods, including automated differentiation of mileage by state and public /private roads and additional driver services, may give the perception of privacy tradeoffs between accepting lower levels of privacy with higher levels of flexibility or convenience. Even with these automated location-based approaches, specific routing and location information stays with the private account manager and is never provided to the state. Simply put, regardless of mileage reporting option user privacy is protected. A policy consideration should be made on regarding public/private road delineation. The outcome of that policy decision could also affect the per-mile rate.

4.2 System-Oriented Policy Considerations

System-oriented policy considerations are those that have implications for the statewide transportation system as a whole. Decisions made by policy makers in this area will impact future utilization of Colorado roadways and the revenue available for maintaining and expanding those roadways. These policy considerations are summarized in Table 21 below.

Table 21: System Oriented Policy Considerations

General Policy Issue	RUC Policy Considerations
4.2.1 Rate Setting and Fee Structures	What are the potential elements of a RUC fee structure?
4.2.2 System Goals and Objectives	What are the appropriate goals and objectives that should determine RUC fee calculation?
4.2.3 Vehicular Fuel Efficiency Trends	How should RUC systems be priced to account for future alternative fuel vehicles and fuel efficiency of the fleet mix over time?
4.2.4 Elasticity of Travel	What would be the impact of a RUC pricing on transportation system utilization?

4.2.1 Rate Setting and Fee Structures

The Colorado RUCPP applied a notional rate of \$0.012 per mile for travel. The objective was for the RUCPP per-mile rate to be revenue neutral, meaning, motorists driving average fuel economy vehicles would pay about the same under a RUC program as they currently do under the gas tax. Further RUC studies should consider rates where RUC revenues received by the state would equal those currently received from state gas tax. This rate could account for increased RUC administrative costs, which could vary based on the mileage reporting approach and technology used to collect mileage. This rate could also account for potential revenue loss under a RUC program including miles driven out-of-state, which are not assessed a RUC rate if the participant selects a location-based mileage reporting option. These studies should also evaluate additional costs of travel which can be very effective in attaining optimal use of the transportation network. As such, in the longer term, the state might look to incorporate other elements of use in rate setting, as shown in Table 22 below.

Table 22: Additional Considerations for Rate Setting

Charging Element	Aspect of Road User
Vehicle Weight	Different vehicle types place differing levels of stress on roadway infrastructure, which impacts maintenance and preservation costs. Pricing based on vehicle weight can help account for these costs.
Vehicle Age / Fuel Economy	Varying fees within particular vehicle classes based on the age of the vehicle or fuel economy can help to account for the cost of pollution from older model vehicles or less fuel-efficient vehicles.
Vehicle Type	Providing a varying rate by vehicle type could encourage the purchase of certain types of vehicles like hybrids, electric vehicles and other alternative fuel vehicles.
Time of Day	Drivers increase the cost of travel to other drivers when they choose to travel during congested periods of the day. Each additional vehicle increases volumes which reduces travel times. As such, a pricing system that varies by the time of day, with higher rates being set during periods of high congestion, can help to address congestion by internalizing the added cost of congestion each driver imposes. Drivers are provided a monetary incentive to travel during periods of lower congestion.
Location	Varying fees based on location, such as within certain defined locations or on specific roadways, can help better align revenues with the specific needs of regions or facilities.
Administrative Costs	The goal is for the administration costs of RUC to be essentially comparable to the current fuel tax (in regard to percent of revenues). However, movement to a RUC system would expand tax collection from several hundred points of sale to the total number of registered vehicles in the state. As a result, potential administrative costs could be higher. Accordingly, the RUC rate might include administrative costs.

4.2.2 System Goals and Objectives

The choice to incorporate additional charging elements (outside of distance) within any pricing system is inherently dependent on the goals and associated objectives of the system. Goals and objectives that might be considered for integration with RUC Systems include those shown in Table 23.

Table 23: Potential Goals and Objectives for RUC

	Potential Goals	Objectives	Pricing Components
Environmental	Reduce mobile source emissions	Encourage fuel efficient vehicles	Variance based on fuel efficiency, vehicle year, vehicle type
	Reduce mobile source emissions	Discourage driving during congested periods of the day	Variance based on time of day, congestion levels
System	Maintenance and Preservation	Reduce roadway wear and tear	Variance based on road type, vehicle type, vehicle weight
	Congestion Reduction	Reduce driving during peak periods	Variance based on time-of-day or congestion levels
Equity	Equitable distribution of costs based on impact	Charge in proportion to roadway damage	Variance based on vehicle weight
	Equitable distribution of costs based on use	Promotion of user-pays principle	Variance based on vehicles miles traveled

4.2.3 Vehicular Fuel Efficiency Trends

Trends in vehicular efficiency are a significant driver of RUC pursuits nationwide. As vehicles grow more and more fuel efficient they will return less and less revenue per mile driven. However, longer term trends in vehicular fuel efficiency and, in particular, alternative fuel vehicles will continue to have implications for transportation funding even if RUC systems are deployed.

The Colorado RUCPP sought to include a wide range of vehicle types with participation being stratified by fuel efficiency. Furthermore, the pilot included several hybrid electric and fully electric vehicles. It was not the intention of this study to acquire a fleet mix that is emblematic of the actual state fleet mix. It was the intention of this study to maintain a vehicular MPG stratification that would allow the project team to make inferences about fiscal impacts based on vehicle types. Current vehicle fleet data is maintained by the Colorado Department of Revenue through the Department of Motor Vehicles. Therefore, additional coordination between CDOT and the Colorado Department of Revenue is needed in order to identify the current composition of the Colorado vehicle fleet for future trends.

4.2.4 Elasticity of Travel

As noted earlier, the elasticity of travel among Colorado road users has significant implications in terms of the potential impact of RUC on individual roadway users. However, it also has significant system wide implications. Aggregated travel behavior among all transportation system users has a direct impact on system utilization and associated costs for maintenance and preservation. The impact of a RUC system on traveler behavior is yet to be determined. A more detailed assessment of baseline travel elasticity among Colorado residents, augmented by a pilot that collects and assesses before and after data, will allow for the evaluation of how RUC pricing might impact system utilization and associated costs.

4.3 Technology Considerations

Trends in these areas will impact how users access and utilize transportation infrastructure in the future and how the state will operate that infrastructure. Technology issues are summarized in Table 24 below.

Table 24: Technical Considerations

General Policy Issue	RUC Policy Considerations
4.3.1 In-Vehicle Telematics	What are the future opportunities to leverage standard OEM technology features for RUC assessment?
4.3.2 Transportation Networking Companies and Mobility as a Service (MaaS)	What are the future opportunities to leverage mobility as a service (MaaS) applications for RUC assessment and administration?
4.3.3 Automated and Connected Vehicles	What are the future opportunities to leverage AV and CV systems for RUC operations and administration through data collection?
4.3.4 In-vehicle Diagnostics-based Services	How can RUC systems be developed and structured in order to minimize competition for limited in-vehicle diagnostic access points (e.g. OBD-II port)?

4.3.1 In-Vehicle Telematics

The Colorado RUCPP offered both low tech (in the form of odometer readings) and high tech (mileage reporting device) mileage reporting options. The MRD option required the use of private sector equipment that, as discussed in previous sections of this report, caused some effort among program participants in terms of installation. Most RUC pilots to date have relied on similar aftermarket devices for mileage reporting, but it is increasingly common for vehicles to be pre-equipped with various technology systems for collecting and monitoring data on vehicular operations. These systems provide access to a number of value added services, similar to what is envisioned as supporting a wider RUC market place. There are, therefore, significant long-term opportunities for the state of Colorado to leverage these in-vehicle systems for the levying of RUC thereby simplifying the enrollment and data reporting process.

4.3.2 Transportation Networking Companies and Mobility as a Service (MaaS)

The “traditional” model of vehicle ownership is that of individuals owning their own vehicle and using it when they wish. Under this model, many of the costs associated with vehicle ownership (such as sales price and vehicle registration) are sunk and do not vary with regard to use. Technology, and in particular smartphone technology, has enabled the development and deployment of services that allow travelers to access personal vehicles without the need to actually own that vehicle. Transportation Networking Companies (TNC) such as Uber and Lyft use smartphone applications to connect drivers with an available vehicle with travelers looking for a ride. Other Mobility as a Service (MaaS) applications can serve to link potential carpoolers and provide expedited access to alternate modes such as transit and bike share.

One particular advantage of levying a RUC in conjunction with MaaS applications is that the fee can be imbedded along with the other fees assessed for the service, which could increase its acceptability to the public. Furthermore, depending on the extent to which MaaS services continue to grow it could potentially reduce the number of collection points and thus operational and administrative costs. Multiple trips for multiple travelers would be paid through one TNC/MaaS account per vehicle.

4.3.3 Automated and Connected Vehicles

Automated vehicles (AV) have the potential to dramatically alter the way that Colorado residents travel by removing the need to actively engage in the act of driving. Connected Vehicle (CV) applications have the potential to dramatically increase the awareness of AV systems while providing transportation agencies with a number of tools for better managing transportation infrastructure. Both of these systems generate, and rely on, significant amounts of data. A RUC system could potentially utilize this

data to delineate between private and public roads, returning value to the customer, or leverage the data to lower overall administrative costs. A RUC system could also be added to the connected vehicle application as an additional data element.

4.3.4 In-vehicle Diagnostics-based Services

As noted in the Technical Issues section of this report, there is already a market for in-vehicle services that rely on the connection of a device to the vehicular OBD-II Port. Drivers would be unable to participate in a future RUC program and still utilize their existing in-vehicle services, so long as the RUC technology components are dependent on a connection to the OBD-II Port. There are opportunities to explore data-sharing agreements and similar arrangements between aftermarket service providers and governmental agencies in order to alleviate these issues as part of subsequent RUC development efforts.

4.4 Administrative Considerations

Administrative issues are those that impact the state and state agencies responsible for administering RUC systems. Decisions made by policy makers in this particular area will impact the extent to which existing state support systems are utilized for RUC operations and administration, future reliance on private sector vendors for these functions, and associated costs. Issues of enforcement are also included in the administrative category. Administrative issues are summarized in Table 25 below.

Table 25: Administrative Considerations

General Policy Issues	RUC Policy Considerations
4.4.1 Private Sector Administration and Operations	How can the private sector be better leveraged to provide RUC administrative support? What are the associated cost savings associated with this?
4.4.2 State-based Customer Service	How can public sector customer support programs and systems (such as the DMV) be leveraged for future RUC pilots and/or implementation?
4.4.3 Interagency Data Exchange and Coordination	What are the opportunities to leverage a RUC system for toll collection or leverage private tolling systems for RUC operations and administration?
4.4.4 Out-of-State Drivers	How can a RUC system be structured so as to collect revenues from out-of-state users?
4.4.5 Compliance and Enforcement	What is the ease and cost of enforcement for different mileage reporting options?

4.4.1 Private Sector Administration and Operations

Current RUC development efforts have tested RUC implementation through a private sector supported RUC marketplace, which levies fees in conjunction with various value-added services, as a potential option. The Colorado RUCPP utilized a single private service provider. A wider and more diverse RUC marketplace with multiple service providers could provide competition that could result in system costs savings and improved user acceptance. The inclusion of a public-sector option into a diverse RUC marketplace was not tested, and therefore its impacts on administrative costs and user acceptance are not known.

4.4.2 State-based Customer Service

The state of Colorado currently interacts with Colorado drivers through a number of channels such as the DMV. While the Colorado RUCPP successfully relied on the private sector for all customer service

oriented activities, there may be opportunities to leverage existing state resources and capabilities in various state agencies to improve customer experience and reduce administrative costs for some functions. There is also the option that the state could administer a RUC program, creating efficiencies between various branches of state government.

4.4.3 Interagency Data Exchange and Coordination

Toll agencies currently possess the capacity and experience to handle millions of transactions on a periodic basis. As such, there are opportunities to explore opportunities for toll system administration and operation of various RUC system elements. There may be opportunities to combine customer services so that tolls and RUC can be paid through a single account. This would provide convenience for the user and lower overall administration costs.

4.4.4 Out-of-State Drivers

The state of Colorado is a popular tourist destination and the state receives millions of out-of-state visitors a year. A RUC system that can successfully capture out of state drivers was classified by stakeholders as a high priority. However, further research is needed to determine the technical feasibility of how a RUC system could be implemented to effectively capture mileage and assess fees for non-Colorado vehicles. Moreover, further research is also needed to determine the administrative costs for the out-state-driver fee collection.

4.4.5 Compliance and Enforcement

In addition to being low cost, fuel taxes are also relatively easy to enforce as any vehicle requiring fuel has paid the tax at the pump. However, enforcement of road usage charging is more complex. Different RUC approaches and supporting technologies will likely have different compliance rates and enforcement costs, with automated methods (such as 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). If mileage data are not received, no road usage charge can be calculated or invoiced, and the issue of providing a sustainable and equitable mechanism for funding the transportation network still remains. Moreover, without such voluntary compliance, then the need for enforcement of the road usage charge, and the associated administrative costs, increases. Compliance monitoring and enforcement activities were not addressed as part of the Colorado RUCPP, so further research is needed on the compliance and enforcement aspects of a road usage charge program.

5 Conclusions

The RUCPP represented Colorado's first pilot test of the road concept. Pilot participation was limited to around 100 participants, which provided the opportunity to test RUC operational and administrative systems while engaging the public without the need for extensive system development and outreach activities. CDOT developed a number of goals to gauge the success of the pilot. These included:

1. Demonstrate an operational RUC;
2. Identify and evaluate issues;
3. Test the feasibility of various mileage-reporting options.
4. Solicit feedback and ideas

As documented in this report and in subsequent concluding sections, all of the pilot's goals were met. An additional goal of the pilot was to solicit feedback and ideas. This particular goal was met through the provision of a general public and several participant oriented surveys. The results of these surveys were discussed in previous sections of this report but are summarized in this concluding sections.

5.1 Demonstration of an operational RUC

Successful demonstration of a basic RUC system is critical for developing future support for the concept. Perceptions by policy makers and the general public regarding RUC complexity and cost are often informed by a limited understanding of the concept and can be a significant hindrance to its advancement. As such, limited demonstrations such as the RUCPP illustrate how such systems might work and how users might be impacted. As a requisite for successful demonstration, CDOT developed several requirements, including the following:

1. **Participation Targets:** The pilot met its participation targets as a total was required to consist of 100-participants. Participants were representative of both the general public (70% of the participant pool) as well as key stakeholder groups and policy makers (30%). While a total of three vehicles dropped out of the pilot, a total of 140 were enrolled with the total number reporting mileage on any given month never dropping below 125.
2. **Vehicular Stratification Targets:** The pilot fulfilled its requirement to include different types of vehicles in terms of their fuel efficiency and fuel type. Two participating vehicles were required to have a fuel efficiency between 10 and 25 MPG and a total of 61 participated. Two vehicles were required to have fuel efficiency of between 25 and 45 MPG and a total of 34 participated. The pilot also required that at least two vehicles have a fuel efficiency above 45 MPG, of which there were three, and the pilot also required at least one electric vehicle. A total of three electric vehicles participated. Furthermore, the pilot attracted a range of vehicle model years that allowed for an assessment of technology issues associated with differences in in-vehicle technology compatibility.
3. **Geographic Stratification:** While participation levels were higher in urban areas, the pilot succeeded in attracting and maintaining participation from rural areas of the state. Approximately 15% of participating vehicles were domiciled in rural areas while 38% were domiciled in areas that represented a blend of rural and urban geography. Furthermore, several participants from mountainous regions of the state utilized GPS-based options, which was a final geographic requirement of the pilot.
4. **Understanding of Transportation Funding:** Several surveys of participants were used to establish a baseline of public understanding. An initial general public survey revealed that the general public in Colorado had a wide knowledge gap on transportation funding, with a majority not knowing state

and federal fuel tax rates and 10% being unaware that they were paying taxes on fuels. Almost three quarters of respondents were unaware of the RUC concept. These results were used as part of the RUCPP communications campaign which drove to further public education on Colorado's current transportation funding model.

5. **Identify Communications Techniques and Messages about Transportation Funding and RUC:** The RUCPP used a number of media including a project website, newsletters, general media (such as press releases) and social media to educate participants as well as the general public on the current transportation funding model and the RUC concept. Furthermore, a diverse TAC and ESC consisting of key transportation leaders throughout Colorado explored and discussed ways the RUCPP could address transportation stakeholder concerns within the state.

5.2 Identification and Evaluation of Issues

Enrollment and account management for the RUCPP was largely successful, with participants reporting fewer and fewer issues as the pilot progressed. Any issues that were reported by participants were resolved through the various customer support services and resources provided by the project team and vendor. Much of this success can be attributed to the November soft launch that allowed for potential barriers and challenges to be identified and mitigated prior to the full operational pilot. Items identified in the soft launch included:

- **A Need for Visual Intuitiveness** – Enrollment procedures and user interfaces should be structured and presented so that critical information is apparent. Many of the changes made in the Colorado RUCPP systems appeared cosmetic in nature but were done to facilitate quick and easy access to desired information.
- **Anticipate Information Needs** – Users must have all the information they need in order to be comfortable participating in the pilot, which can include any number of topics. However, the provision of information and guidance must be balanced with the need to provide that information in a concise and efficient manner, without cluttering website and app interfaces.
- **Minimize User Time** – Processes should be structured so as to minimize participant, as well as operations team, time and effort. This means streamlining processes or consolidating potentially duplicative steps.

RUCPP system components worked well and effectively assessed RUC charges under a number of reporting options. However, there were some technical issues identified, including:

- **Delineation between public and private roads** – Travel on public versus private roadways was not delineated due to inaccuracies in available map data. While this is not an issue specific to the RUCPP, additional research and testing is needed based on more detailed map if subsequent pilots are to demonstrate additional RUC mileage reporting options such as the crediting of mileage accrued on private roadways.
- **Use of a single per-mile rate** -- The Colorado RUCPP levied a single per-mile rate for all participating vehicles and variable rate models were not tested. It is likely that future RUC systems may need to support multiple rate structures and perhaps even rates that vary based on location and/or time of day.
- **Limitations on the use of multiple reporting options under a single account** – The RUCPP required that multiple vehicles reporting under a single account use the same reporting method. It is likely that, in future RUC deployments, households might desire the use of different reporting methods.
- **OBD-II Port Competition** – The in-vehicle devices used in the RUCPP used a connection with the vehicular OBD-II port to obtain information needed in the assessment of fees. Unfortunately, OBD-II-based aftermarket devices are increasingly popular for a number of services. Vehicles currently

using such devices were unable to also use a pilot MRD, and thus had to select the odometer reading option or discontinue use of their other aftermarket OBD-II device.

- **Accommodation of different fuel types** – The RUCPP only supported participation by gasoline-based vehicles. Diesel-based vehicles are a significant portion of the state fleet and it is likely that alternative fuel vehicles (such as CNG, LNG and LPG) will become more popular due to state investment in alternative fueling infrastructure and incentives towards vehicles purchases.
- **Mobile Application Refinement** – While the mobile phone applications used for reporting and account management worked well, several areas of improvement were identified. These included updates to accommodate all reporting options, the incorporation of push notifications, the use of standardized processes for monthly billing procedures, and enhancements to the account manager’s ability to digitally analyze and validate user submitted odometer photos.

Participant surveys indicated that in spite of strong support for the RUC concept, there were still areas for improvement identified on the surveys for future work. The charging of out-of-state drivers was also identified as an issue requiring further exploration. Furthermore, the RUCPP Steering Committee, Technical Advisory Committee, and CDOT Executive Oversight Committee identified numerous policy considerations for future consideration. These include:

- **User Oriented** considerations related to the impact of transportation fees and taxes on user finances, travel behavior, vehicle preferences, and out-of-state travel.
- **System Oriented** considerations such as rate setting, fee structures, system goals and objectives, vehicle fuel efficiency trends and impact on travel elasticity.
- **Technology** issues such as trends in in-vehicle telematics systems and associated devices, Transportation Networking Companies, Mobility-as-a-Service, and Automated and Connected Vehicles.
- **Administrative** considerations such as the role of the private sector and public sector in operations and administration, data exchange and coordination, and the handling of out-of-state drivers.

5.3 Feasibility of Mileage-reporting Options

The mileage reporting options tested during the pilot were shown to be feasible from several different perspectives. From the user perspective, devices were generally viewed as easy to install and those participants who did encounter difficulty were able to resolve issues through the various customer support services provided by the consultant team and vendor. Participants found that the resources provided throughout the operational phase provided sufficient information and the account website was perceived as easy to navigate. Overall, participant surveys showed that:

- **The RUC concept enjoyed strong support.** Nearly three quarters of survey respondents agreed after participating in the program that RUC seems like a fair way to fund transportation improvements in Colorado. The fact that RUC would be a more sustainable funding source as vehicles get more fuel efficient was viewed as the most significant advantage. However, many were still concerned that a RUC would disproportionately impact rural drivers.
- **Operational aspects of the program also enjoyed strong support.** Survey respondents believed that communications and instructions were clear, program participation was not onerous, and that opportunities to provide feedback and obtain additional information were adequately provided. Furthermore, satisfaction with information security and privacy protections increased over the course of the pilot. More importantly, as satisfaction in areas such as invoicing, account management and data security increased, so did overall support of the RUC concept.

- **Reporting options relying on an MRD enjoyed the highest levels of satisfaction.** Over 90% of respondents who used an MRD to report mileage were satisfied with that option, compared to 55% satisfaction for the odometer reading-based reporting option.
- **Very little change in driving behavior was observed.** Survey respondents were generally unaware of any actual changes in their travel behavior as a result of the RUCPP. However, respondents did indicate that awareness of their driving habits increased over the course of the pilot.
- **Assessed RUC was generally less than what respondents had expected.** The majority of survey respondents had a monthly assessed RUC of \$10 or less, which was less than what most had expected to pay.

System components performed well. The only errors that were identified by the system were devices being disconnected and reconnected. The majority of issues reported by participants over the course of the pilot were questions regarding participant accounts. The most issues raised in a single month was in December with the majority relating to general enrollment issues. All respondents indicated that their issues were resolved by the pilot help desk. One problematic issue was odometer reporting as the percentage of odometer reading participants not reporting mileage increased over the pilot from 18% in December to 55% in April.

5.3.1 Odometer Reading Findings

The odometer reading option performed as expected from an operational perspective. Participants who chose this option were able to successfully enter their odometer updates either through the Azuga website or through the mobile app. Also, the mobile app allowed participants to provide pictures of their incremental odometer readings.

The advantage to this option is there is no technology required. This option provides flexibility for participants whose vehicles are not compatible with plug-in technology options or those who prefer to not have technology installed in their vehicles.

Some of the major drawbacks with this mileage reporting option were directly related to enforcement. Of the 22 participants who selected this option for the RUCPP, only 10 (45%) reported their odometer readings at the end of the pilot. The number of participants reporting monthly odometer readings declined over the course of the pilot from 82% to 45%. While additional notifications and reminders were sent to participants, the number of compliant participants remained relatively low when compared to those participants who used plug-in mileage reporting options.

Additionally, the mobile app allowed participants to upload pictures of their odometer. This functionality was required at the beginning and end of the RUCPP; however, the option was allowed for the monthly odometer updates as well. Again, the compliance with odometer picture uploads was relatively low (only 8 out of 22, or 36%, provided an initial picture and 10 out of 22, or 45%, submitted a final picture). Please note though that the odometer picture upload was only provided to demonstrate the operational concept. Additional technologies support actual picture verification and can be used to support enforcement, but this capability was not included in the RUCPP.

5.3.2 Non-GPS Enabled Mileage Reporting Device Findings

The Non-GPS Enabled Mileage Reporting Device Option was the second most popular option, resulting in 18 participants (18%) choosing this option over the others.

The availability of some value-added services (e.g. driving scores, battery voltage, diagnostic code reading), while not requiring location-based technology was another key reason for the appeal of this option.

5.3.3 GPS-Enabled Mileage Reporting Device Findings

The GPS Enabled Mileage Reporting Device Option was clearly the most popular option. Seventy (70) participants (70%) chose this option over the other two.

This option allowed participants to not be assessed RUC for traveling out of state. Additionally, a full array of value-added services (e.g. geofencing, driving scores, detailed trip information, battery voltage, diagnostic code reading), were also made available to participants.

5.4 Feedback and Ideas

During the pre-pilot, soft launch participants provided feedback and ideas about how to make the enrollment and installation processes more seamless for participants. The project team modified instructions based on this feedback prior to the launch of the operational pilot. Participants provided Colorado RUCPP feedback and ideas through the helpdesk and participant surveys.

Over the course of the Colorado RUCPP, three surveys were given to participants. Surveys focused on Colorado RUCPP participants' feedback on pilot activities at or close to the time of that activity. These surveys were also used to identify behavioral trends toward RUC and to determine whether the Colorado RUCPP provided increased understanding of Colorado's transportation funding shortfall and the viability of RUC.

The following are general conclusions drawn from these three surveys:

- **Colorado RUCPP participants supported the RUC concept more readily than the general public.** Nearly three quarters of survey respondents agreed after participating in the program that RUC seems like a fair way to fund transportation improvements in Colorado. The fact that RUC would be a more sustainable funding source as vehicles get more fuel efficient was viewed as the most significant advantage. However, many were still concerned that a RUC would disproportionately impact rural drivers.
- **Operational aspects of the program also enjoyed strong support.** Survey respondents reported communications and instructions were clear, program participation was not onerous, and that opportunities to provide feedback and obtain additional information were adequately provided. Furthermore, satisfaction with information security and privacy protections increased over the course of the pilot. More importantly, as satisfaction in areas such as invoicing, account management and data security increased, so did overall support of the RUC concept.
- **Reporting options relying on an MRD enjoyed the highest levels of satisfaction, while those with the odometer reading were significantly less.** Over 90% of respondents who used an MRD to report mileage were satisfied with that option, compared to 55% satisfaction for the odometer reading-based reporting option.
- **Assessed RUC was generally less than what respondents had expected.** The majority of survey respondents had a monthly assessed RUC of \$10 or less, which was less than what most had expected to pay.
- **Additional areas for improvement were identified.** In spite of strong support for the RUC concept among program participants, there were still areas for improvement identified on the surveys for future work. Participants identified out-of-state drivers as a key topic for future study. They would also like to see CDOT explore alternative rate structures, including increased gas tax and a combination of RUC and gas tax.

In addition to the participant surveys, feedback was solicited throughout the project from the diverse Technical Advisory Committee and Executive Steering Committee consisting of key transportation leaders and special interest groups throughout Colorado. A total of five meetings were conducted over

the course of the project. These meetings provided pilot updates and engaged committee members in discussions covering a range of issues related to transportation in Colorado as well as the Colorado RUCPP. These conversations resulted in the identification of numerous policy related issues that were not addressed in the Colorado RUCPP, but provided guidance for future transportation policy discussions pertaining to a RUC (see Appendix G).

APPENDIX A: Enrollment FAQ

Enrollment

I just received an invitation to enroll. What do I do next?

If you received the invitation email, visit our enrollment page and follow the steps. You'll need to choose a mileage-reporting option and finish the enrollment process with Azuga, our account manager for the Colorado RUCPP. If you lost or accidentally deleted the invitation email, our team can resend it. You can call us at 1-1-844-662-4958, or send us an email at support@ColoradoRUCPP.com. Our operating hours are 8 a.m. and 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).

My activation code doesn't work. Can you help me get into the program?

There are a couple of reasons your activation code may not be working.

- If you do not enroll by midnight on Dec. 11, the activation code from your invitation email will deactivate.
- If it is before midnight on Dec. 11, contact us to have your code re-activated. You can call us at 1-844-662-4958 or send us an email at support@ColoradoRUCPP.com. Our operating hours are 8 a.m. - 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).
- If it is after midnight on Dec. 11, your spot in the Colorado RUCPP has been assigned to someone on the waitlist.
- Your code may have already been used to activate an account. Is it possible that you provided your code to someone else, who signed up with your activation code and last name? Or, you may have already have registered the number of vehicles you had originally indicated.

The system says my VIN number is wrong (or license plate, or other identifier). What do I do?

Make sure you typed in the VIN, or other identifier correctly. If you are still unable to proceed, call us at 1-844-662-4958, or send us an email at support@ColoradoRUCPP.com. Our operating hours are 8 a.m. - 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).

I got locked out of my account while I was enrolling. What do I do now?

If you didn't submit your enrollment details, you can start the process again using your enrollment link. None of your data is stored until you submit the enrollment request. Your activation code is not marked in use until your account is submitted and created.

My Vehicle

How do I know if I have an OBD-II port?

All new vehicles sold in the United States from 1996 forward have an OBD-II port, except some fully electric vehicles. Some vehicles sold in 1994 and 1995 also have the port. If you have a fully electric vehicle and no port, or a vehicle manufactured before 1996 with no port, we suggest you choose the manual-reporting option.

What is a VIN, and how do I find it?

VIN stands for vehicle identification number, a unique serial number for your vehicle. All VINs for vehicles made after 1981 are 17 digits long. VINs look like a random jumble of numbers and capital letters, and are most commonly found in the following locations of your vehicle:

- The front driver's side corner of the dashboard, facing outward. To find it, stand outside of the vehicle on the driver's side and look at the bottom corner of the windshield.
- The driver's side door post. To find the VIN there, open the driver's side door and look for a sticker on the door post (near where the door latches closed).
- The vehicle's registration certificate, maintenance invoices, and possibly on your insurance card. Your VIN is likely listed on paperwork you receive about your vehicle.

How do I read my vehicle's odometer?

The odometer is located near the bottom of the speedometer on the dashboard of your vehicle. It is important to remember that your vehicle must be on to get an odometer reading. In most vehicles, there may be multiple mileage readings visible. Make sure you are seeing the total mileage and not the "re-settable trip" meter. The total mileage will always be a larger number than the "re-settable trip" meter.

I don't know the engine specifications or trim of my vehicle. How do I find out?

The easiest way to find your vehicle's trim is to look at the chrome identifiers (badges) on the back of your vehicle. A trim badge could look like any of the following: 2.5 SL, C300, GT, Type S, etc.

In the Azuga system, the trim selector dropdown will include vehicle specifications for each trim type. They look something like this: 2.5L 4-CYL, FWD. If you know your vehicle specifications, you can match them to one of the options on the list.

If you still cannot determine the trim, choose the "I don't know my trim" checkbox and Azuga engineers will determine it from the VIN.

What do I do if I don't own the vehicle anymore?

A vehicle can be unenrolled at any time from the "Vehicles" tab in your online account. If you need additional help, you can also call us from 8 a.m. - 6 p.m. (Mountain Time) Monday through Friday and from 10 a.m. - 2 p.m. on weekends at 1-844-662-4958. But please return the mileage-reporting device as instructed.

I was in a collision and cannot drive my vehicle. What should I do?

Please call us right away at 1-844-662-4958—8 a.m. - 6 p.m. (Mountain Time) Monday through Friday and from 10 a.m. - 2 p.m. on weekends—and let us know the vehicle won't be driven for some time while repairs are being made.

If the vehicle can no longer be driven, we can either add a different vehicle or close your account. Either way, please keep the mileage-reporting device to use in another vehicle or to return to us.

My kids drive my car. Is this OK?

Yes; anyone may drive your car at any time. Just like filling your vehicle with fuel or paying an electronic toll, your account will be deducted for the miles driven by the vehicle and credited for the gallons of gas consumed by the vehicle—regardless of who is driving.

Your mileage-reporting device is specially paired to your vehicle, so you should not switch the device with someone else's or unplug it when someone else is using the vehicle.

Mileage-Reporting Device

How do I install the Azuga mileage-reporting device in my vehicle?

Azuga will mail you the device to record your miles along with device-installation instructions. To successfully install the MRD in your vehicle, please follow the instructions below:

1. Make sure the vehicle is parked outside, with a clear view of the sky to ensure proper GPS location (if applicable to selected mileage-reporting option) and/or cell coverage.
2. Make sure the ignition is OFF.
3. Locate the OBD-II port. It is typically below the steering wheel column. (Refer to picture.)
4. Plug in the device firmly. Make sure the device lights up initially.
5. Wait 2 minutes.
6. Turn on the ignition for 30 seconds.



Your vehicle is connected!

What is an OBD-II device? How does it work as a mileage-reporting device?

An OBD-II device plugs into your vehicle's data port (the port used for emissions and vehicle maintenance), which is typically located under the steering column. The device records the miles driven. If your vehicle is being serviced, you may temporarily remove the device, but please replace it when your mechanic has finished servicing your vehicle.

Where do I plug in the device?

The mileage-reporting device you received will plug into the vehicle's OBD-II port. The exact location of your vehicle's OBD-II data port can usually be found in the owner's manual for your vehicle. You may also be able to locate it by feeling under the steering column or kneeling down beside your vehicle with the driver door open. If you are not able to find it, please call us at 1-844-662-4958 or send us an email at support@ColoradoRUCPP.com. Our operating hours are 8 a.m. - 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).

Do I have to choose an option with a device?

No. We also have a manual-reporting option that requires you to take a picture of your odometer. [Learn more about the mileage-reporting options.](#)

I forgot to install my device right away. Can I still participate?

Absolutely. Please install the device as soon as you can. Customer support may follow up with you if the device is not installed within two weeks of receiving it.

What do I do if my device is lost or stolen?

Call us right away at 1-844-662-4958, or send us an email at support@ColoradoRUCPP.com. Our operating hours are 8 a.m. - 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).

Can I use my mileage-reporting device in other vehicles?

Devices can only be paired with a single vehicle that you identify during signup. If the device is plugged into another vehicle, our system will alert you that the device is not in the correct vehicle. This also includes swapping devices among multiple vehicles identified under the same account.

If you don't install the correct device back into its paired vehicle within 15 days, we are required to remove you from the program.

Does Azuga Insight work with any vehicle (i.e., motorcycles, ATVs, etc.)?

The Colorado Road Usage Charge Pilot Program is focusing on gasoline, hybrid and electric powered passenger vehicles only—no heavy-duty trucks, recreational vehicles, motorcycles or other alternative fuel vehicles. The two device-enabled reporting options require a vehicle with an OBD-II port. Many vehicles made before 1996 do not have an OBD-II port, and you will need to select the manual-odometer-reading-reporting option.

Is there a charge for replacement of an Azuga mileage-reporting device due to loss, theft or accident?

If any device failure occurs within normal usage, we'll replace it for free. We want to find the cause and make our devices better for the future.

Non-warranted cases of loss or damage are not covered free of charge. Non-normal wear or damage to the device, or any action that prohibits the return of a device can incur a \$50 device loss fee. That being said, if your device is having issues or is missing, call us and we may still be able to replace it for free.

Will I know if my mileage-reporting device isn't operating correctly?

You will be able to see whether the device has successfully paired to your online account when you sign in to the customer portal.

Mileage-reporting devices could malfunction for a few reasons including: incorrect installation, low vehicle battery power, poor cellular signal or a manufacture flaw.

The Azuga device has some safeguards to help you ensure your device is properly functioning. For example, the device will blink a green light when installed to signal that it is connected. If the pairing has failed, you will be able to see this in the portal as well.

Should the device in your car malfunction any time after installation, it will not regularly transmit data, and our system will flag it for review. We will notify you via email or phone and then determine whether the device needs to be re-installed or replaced.

If your vehicle's battery voltage is low, the device will report this information to your Azuga Insight customer portal for your review.

Info about Azuga Insight & the Colorado RUCPP

Who is Azuga and what is Azuga Insight?

Azuga is the account manager for the Colorado Road Usage Charge Pilot Program. Azuga is responsible for providing options to record miles, including any necessary hardware (i.e., mileage-reporting devices, if applicable), all the data collection, analysis and processing, and financial reports to be provided to CDOT.

Azuga Insight is Azuga's customer portal, which allows participants to access and review their daily mileage data and trip logs, review road usage charge (RUC) invoices (including fuel consumed and gas tax credits), remit simulated payments for monthly RUC charges, view driving behavior and scores (key features of Insight), and submit customer service issues. Azuga Insight gives Colorado Road Usage Charge Pilot Program participants all of the services and benefits of the [Azuga Connected Vehicle Platform](#) at no cost, just for opting in to the program.

How does Azuga Insight work with the Colorado Road Usage Charge Pilot Program?

How Azuga Insight works is simple: It's a comprehensive system that allows drivers to record their miles, whether manually or through a device.

If you choose to install a tool in your car, Azuga will provide a device that reports mileage you will plug into the Onboard Diagnostics (OBD-II) port in your vehicle. The device will collect important information including mileage, vehicle fuel usage, diagnostic and location (from GPS-enabled devices only). This information is sent over a secure connection to the Azuga servers, where Azuga manages your daily data—including mileage and fuel use for the Colorado Road Usage Charge Pilot Program, and your vehicle data for your own private use.

Azuga is also providing a self-reporting odometer reading option just for the Colorado Road Usage Charge Program. This option allows participants to submit their odometer reading monthly through the Azuga Insight web portal or mobile app.

The Azuga Insight Connected Vehicle Platform provides you with an array of vehicle-related services designed to connect you to your vehicle and make the driver's life easier. [Learn more.](#)

What information will Azuga Insight share with the CDOT or other Colorado state departments?

The only information we share with CDOT is the mileage you report, road usage charges you would incur if the pilot were collecting fees, and personal information required to identify you and your vehicle.

All location-based information (available with the GPS-enabled Advanced Azuga device option) is for your personal use and never shared with CDOT, Colorado state departments or any other outside party. Your information is stored on Azuga's secure servers.

How much does it cost to use Azuga Insight?

Participation in the Colorado Road Usage Charge Pilot Program and access to Azuga Insight is free for the duration of the pilot. You're getting an amazing deal on the Azuga Insight system and helping to make the Colorado Road Usage Charge Pilot Program successful.

Is Azuga Insight part of the Colorado Department of Transportation (CDOT)?

No. Revenues will not be collected as part of the Colorado RUCPP.

Will I be charged for driving on out-of-state or private roads?

No. We are a private company. Azuga is working in partnership with CDOT to provide you with Colorado Road Usage Charge Pilot Program service, but we're not a government agency.

Azuga Inc. has been certified by the Colorado Department of Transportation to offer account management services for the Colorado Road Usage Charge Pilot Program. Being certified means Azuga, the company's employees, and the Azuga Insight software platform have all been carefully built, trained, and vetted to provide safe, secure, and reliable pilot operations while also providing value-added services that make our customers' lives easier.

What options do I have if I sign up with Azuga Insight?

If income level is a barrier to purchasing more fuel-efficient vehicles, Pilot Program participants driving older or less-fuel-efficient vehicles will typically pay less RUC than they would in gas tax.

How do out-of-state drivers pay for their share of the roads?

Three mileage-reporting options exist with Azuga as your account manager.

The first option is a self-reporting odometer entry process where you enter the current odometer reading and submit an electronic picture of your odometer at least once a month via a smartphone application. All miles reported with the odometer reading option, regardless of whether they occur in Colorado, will be assessed as RUC.

The other two options use a device that records your mileage and installs into the OBD-II port on your vehicle. The first device option has no GPS capability, so all miles driven (whether within Colorado or outside Colorado) are reported and assessed as RUC miles. The second device option has GPS

capabilities and reports all miles driven (whether within Colorado or outside Colorado), but only miles driven within Colorado are assessed as RUC miles (miles driven outside of Colorado are not assessed RUC). This option also provides trip routes overlaid on a map shown on the Azuga Insight web portal.

Accessing your Azuga Insight Account

How do I access my account online?

To access your account online, you'll need to go to Azuga and log in with the credentials you created when you signed up for your Azuga Insight account. If you are having trouble with this, please call the Colorado Road Usage Charge Pilot Program Help Desk 8 a.m. and 6 p.m. (Mountain Time) Monday through Friday (10 a.m. - 2 p.m. on weekends) at 1-844-662-4958, and we'll be happy to help you out.

What if I forgot my login information or password?

If you forgot your password, you can go to your login page and select the "forgot password" link. You will be able to verify the email address on your account, and we'll send you instructions on how to reset your password.

If you forgot the email address on the account as well as your password, contact the Road Usage Charge Pilot Program Help Desk 8 a.m. and 6 p.m. (Mountain Time) Monday through Friday (10 a.m. - 2 p.m. on weekends) at 1-844-662-4958, and we will be able to verify your identity and get you logged in.

Managing your Azuga Insight Account

What happens if I change vehicles, license plate or registration address?

If you have changed vehicles, license plates or registration address, you must contact us to verify the changes and update your account. We may need to mail you a new mileage-reporting device. Please call us 8 a.m. and 6 p.m. (Mountain Time) Monday through Friday (10 a.m. - 2 p.m. on weekends). We're happy to help.

I need activity statements from previous months. What do I do?

Full statement histories are available for all previous activity periods as a downloadable PDF on the "Statements" page. You can simply select the month you need, and the statement will appear. If you would like to print your statement, you can do so by printing the web page (a browser function) in the statements page.

Who do I contact if the mileage-reporting device isn't working correctly, or if I get emails that my device isn't working correctly?

You should email us at support@ColoradoRUCPP.com, or call us right away at 1-844-662-4958. We'll get this fixed up for you in no time. Our operating hours are 8 a.m. - 6 p.m. (Mountain Time), Monday through Friday (10 a.m. - 2 p.m. on weekends).

Can I transfer my account to someone else?

During the short duration of this pilot, we will not be approving account transfer. If you know someone who is a selected participant, they would have to make a new account and register their own vehicles.

When is road usage charge calculated?

Road usage charges (RUC) are calculated daily after midnight based on Mountain Time (from 12:00:01 a.m. to 11:59:59 p.m.) Mountain Time (MT).

How to Download the Azuga Insight App

1. From your smartphone, open the app store specific to your phone type (App Store for iPhone or Google Play for Android). You may also click the appropriate download button within the welcome email you received from us when you first enrolled.
2. Search for the app named "Azuga Insight." Note: Azuga Fleetmobile and Azuga DriveSafe mobile apps will **not** accept your login.
3. Tap the "INSTALL" button to download the Azuga Insight app to your smartphone, and tap "ACCEPT" to accept the End User License Agreement.
4. To log in, enter the email and password you used to create your account when you enrolled.

APPENDIX B: Program FAQ

Overall Program

What is a Road Usage Charge?

A Road Usage Charge (RUC):

- Charges based on miles traveled
- Treats roads like utilities (pay for what you use)
- Collects fees for miles traveled*
- Replaces the fuel tax (credits fuel taxes on RUC invoices)

**For the CDOT pilot, payments will be simulated.*

What are some potential benefits to RUC?

RUC helps re-establish equity among drivers by having them pay for their use of the roads, as opposed to only the gas they consume. By doing this, RUC can also provide a more sustainable funding source for Colorado to use to improve the conditions of its transportation system.

What is the CDOT RUC Pilot Program?

CDOT is interested to learn if RUC could be relevant for Colorado. To know if RUC is feasible for Colorado, CDOT plans to test it through a pilot study—the Colorado Road Usage Charge Pilot Program (RUCPP). This is a four-month pilot project where Colorado residents will evaluate the feasibility of RUC. Some features of the Colorado RUCPP include:

- One-hundred people will participate in the pilot program.
- The Colorado RUCPP will last four months beginning in December 2016 and ending in April 2017.
- CDOT will simulate a per-mile charge of 1.2 cents per mile driven and simulate credits of any state gas taxes paid.
- Three mileage-reporting options will be available for participants to choose from: two technology options and one manual odometer reading option.

Why is Colorado evaluating a road usage charge?

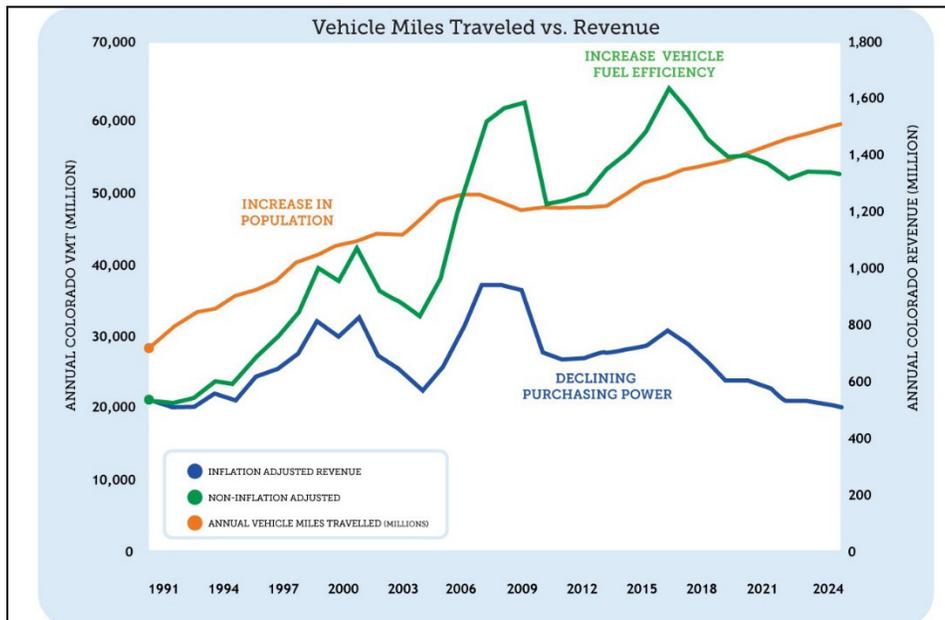
Colorado's annual funding for transportation can no longer keep pace with the costs of operating, maintaining and improving the statewide transportation system. A recent needs-and-gaps analysis, conducted as part of the 2040 Statewide Transportation Plan, showed an estimated gap of nearly \$1 billion annually over the next 25 years.

Much of the revenue required to preserve, maintain, repair, and operate Colorado roads comes from state and federal gas taxes. These taxes (18.4 cents per gallon federal, 22 cents per gallon state) are fixed amounts that do not fluctuate with the price of gasoline. Colorado voters have not increased the state gas tax since 1991, and the federal gas tax has not been raised since 1993.

As cars become more fuel efficient, less gas is being purchased and fewer gas taxes are being paid, resulting in a decline in the monies needed to repair and maintain Colorado roads. This problem is enhanced with emerging alternative fuel vehicles that pay little to no gas tax.

The gas tax is no longer a sustainable funding source as fuel efficiency standards rise, and the number of hybrid and alternative fuel vehicles (such as electric vehicles [EVs]) are paying little or no gas tax.

With increased vehicle fuel efficiency resulting in less gas tax revenues, increased population and VMT creating more wear and tear on the roads, and declining purchasing power with the value of the dollar worth half of what it was in 1991, CDOT is facing a \$25 billion funding gap over the next 25 years.



RUC allows drivers to pay based on the number of miles they drive, providing a direct correlation between each motorist's use of the transportation network and the amount he/she pays to support the system. It helps to ensure that everyone using the roadway network pays their fair share.

ESTIMATED TAX PAID FOR 1,000 MILES DRIVEN PER MONTH			
TYPE OF VEHICLE	GAS TAX PAID	ROAD USAGE CHARGE PAID*	TOTAL RUC (RUC – GAS TAX)**
LOW EFFICIENCY 5-15 MPG (10 MPG Median)	\$22	\$12	\$(10)
AVERAGE EFFICIENCY 15-25 MPG (20 MPG Median)	\$11	\$12	\$1
HIGH EFFICIENCY HYBRID 25-45 MPG (35 MPG Median)	\$6.29	\$12	\$5.71
ELECTRIC >45 Equivalent MPG (Gas not needed)	\$0	\$12	\$12
TOTAL	\$39.29	\$48	\$8.71***

**Paid amounts are calculated assuming 1,000 miles traveled per month at an estimated rate of 1.2 cents per mile.*

***Under a RUC program, drivers will be reimbursed for state gas taxes paid.*

****includes potential revenues captured from electric vehicles not currently paying gas tax*

Note: These numbers don't take into account the overall fuel-economy fleet mix in Colorado.

How much is the current Colorado gas tax?

The current Colorado gas tax is 22 cents per gallon. In addition, the federal fuel tax is 18.4 cents per gallon. Gasoline is defined as any flammable liquid used primarily as a fuel for the propulsion of motor vehicles, motor boats or aircraft. This includes conventional gasoline and several derivate blends.

[Learn more.](#)

What about alternative fuel vehicles such as diesel?

The Colorado RUCPP is focusing on gasoline, hybrid, and electric powered passenger vehicles only—no heavy-duty trucks, recreation vehicles, motorcycles or other alternative-fuel vehicles.

Will RUC cost me more than the gas tax?

For the Colorado Road Usage Charge Pilot Program (RUCPP), all RUC payments will be simulated. In general, the cost difference between RUC and the gas tax depends on your vehicles fuel economy. Find information on the [EPA's average MPG rating for your vehicle.](#)

Who can participate in the Pilot Program?

Anyone can sign up for the program as an "Interested Party" by simply registering on this website. All interested parties will be considered for participation in the Colorado RUCPP; however, CDOT may place restrictions on participants in order to maximize geographic and vehicle fuel-efficient diversity.

The Colorado RUCPP is focusing on gasoline, hybrid, and electric powered passenger vehicles only—no heavy-duty trucks, recreation vehicles, motorcycles or other alternative-fuel vehicles.

What information will CDOT receive about my driving if I participate in the pilot?

CDOT is taking special precautions to ensure no information about your vehicle use—including vehicle location, specific routes driven, driving behaviors or other vehicle information—is given to it over the course of the pilot or afterward. CDOT has partnered with Azuga, a well-established industry-leading account manager, which is currently providing RUC account management services in both California and Oregon.

Every month, CDOT will receive aggregated vehicle mileage reports from Azuga. The only participant-specific information CDOT will receive is based on each participating vehicle's Vehicle Identification Number (VIN), provided when a participant signs up with Azuga.

These reports will only contain the following information:

- Total miles traveled by each vehicle (identified by the VIN)
- Total miles traveled within Colorado
- The amount of simulated RUC based on the miles traveled in Colorado
- Equipment errors or malfunctions

Is Colorado the only state considering a Road Usage Charge?

No. In addition to Colorado, several other states are evaluating the feasibility of RUC—and some are even launching RUC programs. Oregon and California have already conducted feasibility studies and have passed legislation for large-scale RUC pilot programs. Other states, like Colorado, Hawaii and Washington, are also preparing for pilot programs. Elsewhere, Indiana, Wisconsin, Michigan, Illinois, Maine, Delaware, and Florida are studying or investigating per-mile charging for roads.

Colorado is a member of the RUC West (also known as the Western Road Usage Charge Consortium), a coalition of 14 western state departments of transportation that are committed to collaborative research and development of a new method for funding transportation infrastructure based on drivers' actual road usage.

All in all, over 30 states across the country are exploring RUC as a potential new transportation funding model. Each of these states is exploring RUC feasibility in varying ways—ranging from initial revenue forecasts to full, statewide pilots for up to 5,000 vehicles.

In addition, in 2016 the federal government allotted nearly \$15 million in grant money, allowing states and regions to study alternative funding mechanisms, such as RUC.

What is the Road Usage Charge per-mile rate, and will it increase over time?

The Road Usage Charge per-mile rate for the Colorado Road Usage Charge Pilot is 1.2 cents per mile. The calculation for the per-mile rate is based on the total Colorado state gas tax revenue, divided by the total vehicle miles traveled by Colorado passenger vehicles fueled by gasoline (based on 2014 data).

The rate was calculated specifically for the pilot and is illustrative only; no money will be exchanged as part of the Colorado RUCPP. All payments and/or fuel tax credits will be simulated. A per-mile rate for a road usage charge system would be determined by the Colorado State Legislature.

Why would drivers of high-fuel-efficiency vehicles volunteer for the Pilot Program?

The condition of Colorado roads is a burden shared by all, regardless of the fuel efficiency of their vehicles. The average Colorado driver pays up to \$737 annually in extra vehicle operating costs, including accelerated vehicle depreciation, additional repair costs, increased fuel consumption and tire wear due to the poor condition of Colorado's roads. The current transportation funding gap (approximately \$1 billion per year over the next 25 years) does not allow for CDOT to adequately maintain Colorado roads.

This gap is partially due to the increase in the number of fuel-efficient vehicles in Colorado, which do as much damage to the roads as lower-fuel-efficient passenger and light-duty vehicles. Transitioning to a user-based solution like RUC, would help realign the funding model and allow for more monies to road maintenance and repair.

The California and Oregon state RUC pilot programs have shown drivers of high-fuel-efficiency vehicles are in favor of paying a road usage charge because they recognize they are contributing to wear-and-tear on the road. Drivers have also noted they bought their high-fuel-efficiency vehicles for other benefits beyond saving money on the state fuel tax.

Could this be a permanent program?

The Colorado RUCPP is a four-month pilot expected to end in April 2017, with the final report in July 2017. Any decisions regarding future research, studies, pilots or programs for road usage charging in Colorado are determined by the Colorado State Legislature in conjunction with the governor. The information provided from the Colorado RUCPP may be used by the legislature to evaluate if future pilots or programs should be considered.

Participating in the Pilot Program

Where can I sign up to participate in the Pilot Program?

The first step to sign up is to complete the short survey on this site. Once you complete the survey, you are part of the pilot program as an "Interested Party." Leading up to the launch of the pilot, we will email newsletters to you that provide status updates on the Colorado RUCPP.

All interested parties will be considered for participation in the Colorado RUCPP; however, CDOT may place restrictions on participants in order to maximize geographic and vehicle fuel-efficiency diversity.

I pay at the pump. What will happen under the Pilot Program?

The Colorado RUCPP simulates payment, and no charges or credits will actually be applied to drivers. Participants in the Colorado RUCPP will continue to pay the Colorado gas tax at the pump. However, your monthly simulated invoice will show your total RUC for the month minus any gas tax paid.

Account Management

How will I get billed if I participate in the Pilot Program?

All bills for the Colorado RUCPP will be simulated and no payments will be made. Participants will receive a monthly simulated invoice that shows the total miles they have driven, total chargeable miles (total miles minus any out-of-state miles if GPS-enabled option is chosen), the amount of RUC that would be assessed and any credits based on gas taxes paid.

This picture shows a sample invoice sent to pilot participants. This is the only information sent to CDOT. Please note: Azuga, a well-established, industry-leading account manager that is partnering with CDOT for this pilot, will not send location-specific information to CDOT.

Vehicle Details				
Vehicle	Taxable Miles	Fuel Consumed (Gallons)	Total Adjusted RUC	Net RUC
Honda CRV 1997 JHLRD1845VC051964	318.7	15.20	\$0.00	\$0.19

Daily Log - Honda CRV 1997 JHLRD1845VC051964							
Date	Taxable Miles	Non Taxable Miles	Total Miles	Fuel Usage (Gallons)	Mileage Fees On Taxable Miles(\$)	Fuel Tax Credit On Taxable Miles(\$)	Daily RUC(\$)
08-1-2016	0.0	0.0	0.0	0.00	\$0.00	\$0.00	\$0.00
08-2-2016	12.5	0.0	12.5	0.60	\$0.19	-\$0.18	\$0.01
08-3-2016	9.9	0.0	9.9	0.47	\$0.15	-\$0.14	\$0.00

What if I have questions about my invoice?

Participants will enroll with an account manager and have open access to their mileage activity throughout the pilot, as well as simulated billing information. If a participant receives a simulated invoice and believes there is a mistake, he/she can contact the Colorado RUCPP Help Desk via email, at support@ColoradoRUCPP.com, or phone (1-844-662-4958). The customer support team will review the issue and respond to the participant with the resolution. If a mistake is evident, an updated invoice will be provided.

Will I be charged for driving on out-of-state or private roads?

It depends on which plan the participant chooses. If the GPS-enabled mileage reporting device option is chosen (with location-determination electronics via GPS), the device will identify any out-of-state mileage, and those miles will not be reported on the participant's invoice.

The other two options for the pilot (non-GPS-enabled mileage reporting device and manual odometer reading) options do not distinguish between in-state and out-of-state mileage.

The Colorado RUCPP is focusing on key elements to demonstrate the feasibility of RUC in Colorado. Therefore, all roads will be treated equally, so miles driven on private roads will not be differentiated. The final report for this pilot will provide considerations for further study or for future RUC pilots.

RUC Revenue

Will I be paying more tax dollars with the RUC than I do in gas tax?

While no actual payments will be made for the Colorado RUCPP, the answer to this question is it depends on your vehicle's fuel economy (miles per gallon). You can review information on the [EPA's average MPG rating for your vehicle](#).

RUC only charges for miles driven and does not account for vehicle fuel-efficiency, as the gas tax does. Since those who drive highly fuel-efficient or electric vehicles pay very little or no gas tax, those drivers might pay more under an RUC program. On the other hand, the driver of a larger, older or less-fuel-efficient vehicles might pay less under an RUC program.

ESTIMATED TAX PAID FOR 1,000 MILES DRIVEN PER MONTH			
TYPE OF VEHICLE	GAS TAX Paid	ROAD USAGE CHARGE PAID*	TOTAL RUC (RUC – GAS TAX)**
LOW EFFICIENCY 5-15 MPG (10 MPG Median)	\$22	\$12	-\$10
AVERAGE EFFICIENCY 15-25 MPG (20 MPG Median)	\$11	\$12	\$1
HIGH EFFICIENCY HYBRID 25-45 MPG (35 MPG Median)	\$6.29	\$12	\$5.71
ELECTRIC >45 Equivalent MPG (Gas not needed)	\$0	\$12	\$12
TOTAL	\$39.29	\$48	\$8.71***
<p><i>*Paid amounts are calculated assuming 1,000 miles traveled per month at an estimated rate of 1.2 cents per mile.</i></p> <p><i>**Under an RUC Program, drivers will be reimbursed for state gas taxes paid.</i></p> <p><i>*** includes potential revenues captured from electric vehicles not currently paying gas tax</i></p> <p>Note: These numbers don't take into account the overall fuel-economy fleet mix in Colorado.</p>			

Why would drivers of high-fuel-efficiency vehicles volunteer for this Pilot Program?

The condition of Colorado roads is a burden shared by all, regardless of the fuel efficiency of their vehicles. The average Colorado driver pays up to \$737 annually in extra vehicle operating costs— including accelerated vehicle depreciation, additional repair costs, increased fuel consumption and tire wear due to the poor condition of Colorado's roads.

The current transportation funding gap (approximately \$1 billion per year over the next 25 years) does not allow for CDOT to adequately maintain Colorado roads. This gap is partially due to the increase in the number of fuel-efficient vehicles in Colorado, which do as much damage to the roads as lower-fuel-efficient passenger and light-duty vehicles. Transitioning to a user-based solution like RUC would help realign the funding model, and allow for more monies to road maintenance and repair.

The California and Oregon state RUC pilot programs have shown drivers of high-fuel-efficiency vehicles are in favor of paying a road usage charge because they recognize they are contributing to wear-and-tear on the road. Drivers have also noted they bought their high-fuel-efficiency vehicles for other benefits beyond saving money on the state fuel tax.

Is RUC another tax on top of the state gas tax?

No. RUC is intended as a replacement to the state gas tax. For the purposes of the Colorado RUCPP, gas taxes paid—as calculated by the fuel consumed when traveling on Colorado roads—will be shown as a credit on the participant's simulated invoice. No actual payments or credits will be made for the Colorado RUCPP.

Will revenue be generated from the Colorado RUCPP?

No. Revenues will not be collected as part of the Colorado RUCPP.

Will I be charged for driving on out-of-state or private roads?

It depends on which plan the participant chooses. If the GPS-enabled mileage-reporting device option is chosen (with location-determination electronics via GPS), the device will identify any out-of-state mileage, and those miles will not be reported on the participant's invoice. The other two options for the pilot (non-GPS-enabled mileage-reporting device and manual odometer reading) options do not distinguish between in-state and out-of-state mileage.

The Colorado RUCPP is focusing on key elements to demonstrate the feasibility of RUC in Colorado. Therefore, all roads will be treated equally, so miles driven on private roads will not be differentiated. The final report for this pilot will provide considerations for further study or for future RUC pilots.

Will a Road Usage Charge be unfair to lower-income drivers?

If income level is a barrier to purchasing more fuel-efficient vehicles, Pilot Program participants driving older or less-fuel-efficient vehicles will typically pay less RUC than they would in gas tax.

How do out-of-state drivers pay for their share of the roads?

Out-of-state drivers will continue to pay their share through the state gas tax. The Colorado RUCPP is only for Colorado residents and doesn't address the issue of miles driven by out-of-state drivers. The final report for this pilot will provide considerations for further study or for future RUC pilots.

Alternative Funding Options

Why not just raise the state gas tax?

Colorado is considering increasing the gas tax as a short-term solution to the current transportation funding problem. While raising the state gas tax might be a good short-term option for increasing revenue, it fails to create a long-term and sustainable solution to the problem.

New federal Corporate Average Fuel Economy (CAFE) standards require new vehicles to get 54.5 mpg or greater by 2025. As consumers continue to buy highly fuel-efficient vehicles, they buy less and less fuel, and Colorado's revenues collected from the gas tax continue to decline. The Colorado RUCPP seeks to research whether RUC is a fair and sustainable solution to the problem.

APPENDIX C: CDOT RUCPP Newsletters

Newsletter #1 (February 3, 2017)

Colorado Road Usage Charge Pilot Program Newsletter [View this email in your browser](#)



Road Usage Charge Pilot Program

Happy February!

Welcome to *'What's up with RUCPP'* – a monthly newsletter series to keep you in the loop about the Colorado Road Usage Charge Pilot Program, or Colorado RUCPP for short.

How did we get here?

Whether on your daily commute or quick trip to the grocery store, safe and reliable roads are an essential part of our lives. Coloradans fund maintenance and improvements of our roads through a per-gallon gas tax at the pump.

Next time you fill up at the pump, consider this: \$1 in 2016 is worth approx. 56.5 percent less than it was in 1991 – the last time Colorado raised the gas tax rate. What else do you remember about 1991?

The outdated gas tax and the rise of fuel efficient vehicles leave us with an [estimated shortfall](#) of \$25B over the next 25 years! That's why we're exploring options like a road usage charge to fund future road maintenance and improvements.



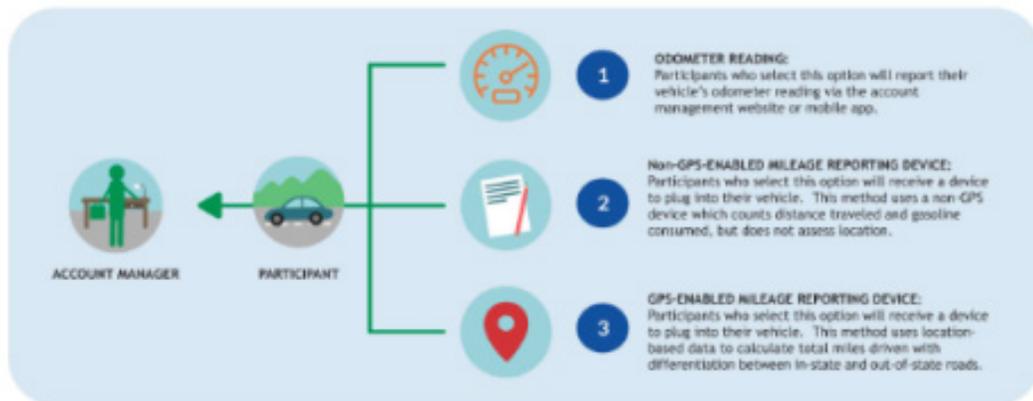
The timeline consists of six sequential steps in light blue boxes with icons and arrows:

- WINNER 2016 SECRET** (Thumbs up icon)
- FALL 2016 SELECT PARTICIPANTS** (Location pin icon)
- FALL 2016 PARTICIPANTS PERSONALIZE DRG EXPERIENCE** (Document icon)
- FALL 2016 PILOT BEGINS** (Checkmark icon)
- MONTHLY "INVOICES" BEGIN JANUARY 2017** (Invoice icon)
- APRIL 2017 PARTICIPANTS END PILOT** (Flag icon)

Where did we start?

With a study! CDOT launched the Colorado RUCPP in December 2016 with, 103 drivers, from nearly 30 different counties—representing drivers from all parts of the state. Each participant chose one of three [mileage reporting options](#):

- Odometer reading
- Non-GPS enabled
- GPS enabled



What happens next?

Their participation will help CDOT evaluate exactly how a road usage charge program would work for passenger vehicles in Colorado. When the program ends in April 2017, we will summarize our findings and recommendations in a report we'll share with you later this summer.

How can you get involved?

Stay tuned for more information about Colorado's road funding and the Colorado RUCPP throughout the course of the four-month pilot!

Want more information about the Colorado RUCPP? Check out ruc.codot.gov for details. Follow us on [Facebook](#) for more updates on road funding.





Road Usage Charge Pilot Program

Hello again!

In our last newsletter we provided a broad refresher on the Colorado Road Usage Charge Pilot Program, or RUCPP for short. This month, we want to break down how participants report their miles and how calculations and payments are simulated for the pilot.

It all starts with Azuga. A what?

Azuga is the Colorado RUCPP's account manager – they provide the technology to report mileage while drivers test out the pilot program. Azuga then takes the mileage data and translates it into simple, easy-to-understand monthly billing statements. They also offer a customer-friendly website and a suite of useful services at your fingertips.

There's more than one way to count your miles...

Pilot participants chose one of three mileage reporting options:



- **Odometer Reading:** For DIY enthusiasts, CDOT provides a manual entry option. Participants report their odometer reading via the account management website or mobile app each month.
- **Non-GPS-enabled:** Participants plug a mileage reporting device into their car, and it sends the odometer readings to Azuga.
- **GPS-enabled:** Participants plug in a mileage reporting device that uses location-based data to calculate miles-driven in and out of the state. Think of this like a map app on your smartphone. It counts and reports, and you don't have to lift a finger.

CDOT only receives the number of miles driven. All other data remains private between you and Azuga. *To learn more about each device and privacy, click [here](#).*

Most of Colorado RUCPP participants chose an option that uses a mileage reporting device, but these devices do so much more than count miles. Both the GPS and non-GPS devices come packed with additional tools to help when you're on the go. You could locate your parked car, understand your vehicle health—even learn more about your driving behavior. Don't worry -- none of that information is shared with CDOT. [Learn more.](#)

What's up with the Colorado RUCPP billing?

Participants will receive a monthly simulated invoice (no actual money exchanged) that shows the total miles driven, total chargeable miles (total miles minus any out-of-state miles if GPS-enabled option is chosen), the amount of applicable RUC, and any credits based on gas taxes paid. Check out a sample invoice [here](#).

Not in the pilot? Not a problem.

[Use our calculator](#) to find out how much you pay in gas tax at the pump vs. road usage charge.

Compare For Yourself

Curious about your potential Road Charge payment vs. the current fuel tax structure? Use this calculator to compare the current monthly fuel tax vs. the per-mile Road Charge payment.

Mileage:

How many miles do you drive per month?

Vehicle:

Enter your vehicle's MPG

- I know my vehicle's MPG
 Find my vehicle's MPG

What is the average MPG of your vehicle? Find your vehicle's MPG [here](#).

How Much You Pay Per Month:

Please enter your selection for Location, Mileage, and your vehicle's MPG in order to see your results.

Curiosity leads the way!

Next month we'll be sharing a few mid-point survey results from pilot participants. We'll find out how easy (or not!) it was to sign up, install a device, and report mileage. Stay tuned.

More information can be found at ruc.cdot.gov.





Colorado RUCPP: Participants share their experiences!

You already know the Colorado RUCPP basics, and in our last edition you learned how to report your miles. Now it's time to hear how it's going from the driver-participants themselves. This month we're sharing participant feedback through the post-enrollment survey we conducted in January. We'll find out more about the participants, how they reported miles, and what they think about RUC as a road funding option.

Meet the Participants

82 of our 102 Coloradans participating in the pilot completed the survey. Here's a breakdown on them: Participants are 69% male, 47% in their late 40s, 50s or early 60s, and 92% drove gas-powered vehicles.

The group of those surveyed is also geographically diverse. Nearly half (48%) of participants are from region one. Other participants reside in other parts of the state. Here's the exact breakdown:

- Region 1 – 48%
- Region 2 – 19%
- Region 3 – 9%
- Region 4 – 20%
- Region 5 – 5%



We asked them why they chose to participate in the Colorado RUCPP.

The three most popular reasons were:

- To learn more about road usage charging as a funding option
- To be at the forefront of this project in the state of Colorado
- To experience the results of the project firsthand

How did participants report miles?

In last month's newsletter, we told you there are three different ways to report mileage through our partners at Azuga:

1. **Odometer Reading:** Participants report their odometer reading via the account management website or mobile app each month.
2. **Non-GPS-enabled:** Participants plug a mileage reporting device into their car, and it reports mileage and gasoline consumed, but does not assess location.
3. **GPS-enabled:** Participants plug in a mileage reporting device that uses location-based data to calculate total miles driven and only assess a charge for miles driven in Colorado.

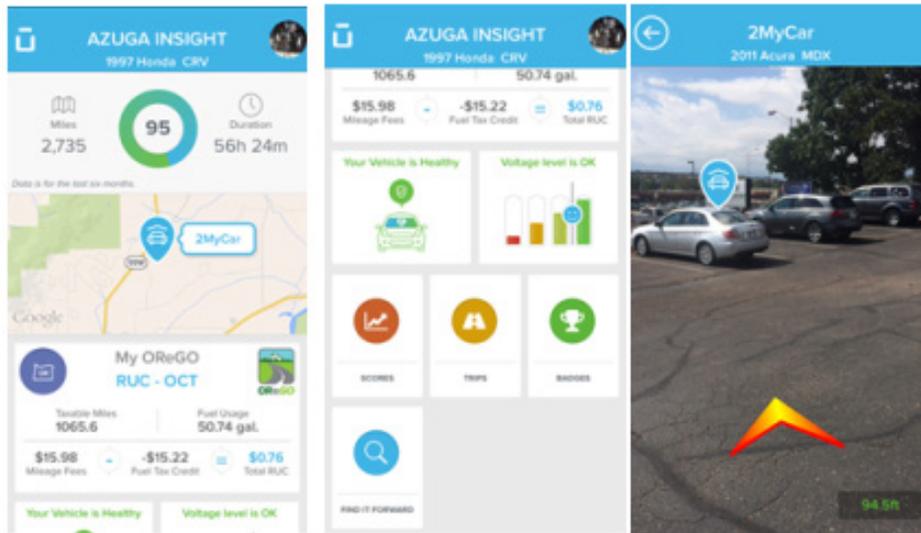
A significant 85% of participants chose a Mileage Reporting Device (GPS or non-GPS-enabled)– and most received their devices in the mail within a week of ordering. Installing the device took most drivers less than 10 minutes. In fact, 34% of those surveyed said there was "nothing difficult about activating the device."

Though the odometer reading option was chosen least, most participants who selected that option (67%) chose to manually enter mileage using the Azuga Insight mobile app to submit a photo of their odometer reading.

Did they use the Azuga App?

Azuga – Colorado RUCPP's account manager – provides the mileage reporting technology. They deliver simple, easy-to-understand monthly statements and have a customer-friendly website and services for assistance.

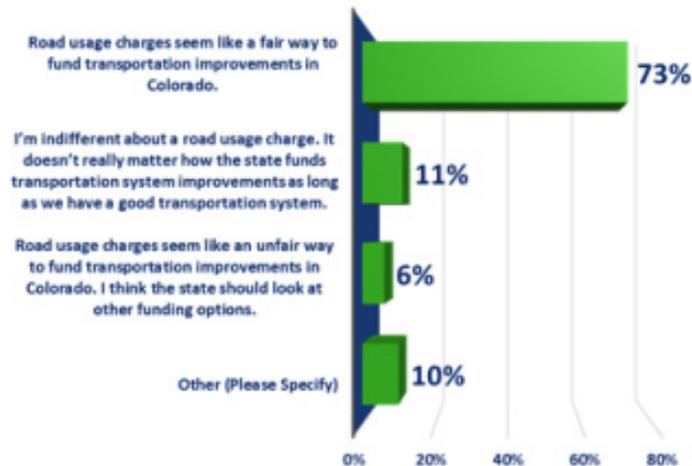
Participants loved that Azuga was there to help every step of the way. In fact, they overwhelmingly agreed that the Azuga mobile app was easy to use and the instructions were comprehensive. Of those who reported using the app, 51% used it to review their road usage charges.



Do they think RUC is fair?

We conducted a survey for the general public in August 2016, and only 29% of Coloradans agreed that RUC seemed like a fair way to fund transportation. However, that percentage increased dramatically with RUCPP participants, of which 73% agreed that a road usage charge seemed like a fair option to fund transportation.

Which ONE Statement Comes Closest to your Point of View Regarding Road Usage Charging?
Base: all respondents (n = 80)



What's next?

We will end the pilot at the end of April, and participants will return their devices at that time. They will receive their final invoice at the beginning of May and complete a "post" survey after that.

We'll be sending one final newsletter when we've wrapped things up and will share the final outcomes of this research study.

More information can be found at ruc.codot.gov.

DOT_RUC

Colorado Road Usage Charge Pilot Program



4201 E. Arkansas Ave. Denver, CO 80222

www.ruc.codot.gov



Colorado RUCPP: We've been busy closing out the Colorado RUCPP!

Colorado Road Usage Charge Pilot Program <dot_ruc@state.co.us>

Wed, Nov 1, 2017 at 4:09 PM

We've been busy compiling and tallying and finalizing the data from the Colorado Road Usage Charge Pilot Program (RUCPP) and soon, we'll release the final report – stay tuned for more! In the meantime, we want you to preview a few of our findings.

To recap, the Colorado RUCPP researched how a pay-by-mile system compares to the current gas tax in Colorado. The results of the study will help us to evaluate the pay-by-mile concept alongside other transportation funding alternatives – a process we hope will lead us to determine the best mix of options for sustainable transportation funding.

Overview

The four-month pilot included 100 participants from 27 different counties across the state of Colorado. Impressive! And, 91% of them said they would participate in a future pilot study. Based on what participants said in a series of surveys, here are some of the key findings:

✓ Increased support of Road Usage Charge (RUC) as a sustainable transportation funding option.

81% of participants agreed RUC was a fair and viable transportation funding method – the two biggest benefits noted in the study.

Participants noted the top benefit of RUC was that it provides a sustainable revenue source (63%), followed by all drivers paying their fair share (48%). Interestingly, this order was flipped from what it was at the start of the Colorado RUCPP. This indicates that the fairness message could be effective for drawing people in, but the importance of RUC as a revenue source resonates more as people become more familiar with the program.



✓ **Need for more public education and research.**

While general support for the concept grew, some agreed that Road Usage Charge is not one-size fits all. In fact, several participants agreed there was a clear need for more public education and research before a program like this could be actualized in Colorado. The next steps for CDOT will include further studies aimed at addressing participants' top concerns, like how to address out-of-state drivers.

✓ **The program set up was relatively easy to use, with helpful support.**

Participants were satisfied across the board with the pilot program, from mileage reporting to customer support.

86% of participants chose the GPS-enabled mileage reporting option. Those using Mileage Reporting Devices were much more satisfied with their choice (93% of participants were satisfied) than those who had opted for the manual odometer reading option (55% were satisfied).

"I liked the feature that provided feedback about the battery level in my car ... Although I was reluctant to select the GPS alternative due to privacy issues, after participating in the program, I don't think that would be an issue for me."

-Public

"I think if the pilot program is implemented it would be easier to report miles via GPS or options other than manually entering miles for me."

-Public

Some participants indicated they could benefit from the features of the GPS-enabled reporting option and would choose that option in the future. Also, 88% of participants felt their personal information was secure during the pilot.

What's next?

We'll publish the Colorado RUCPP final report this fall. We'll send an announcement as soon as it's published.

For more information about the Colorado Road Usage Charge Pilot Program (RUCPP), please visit ruc.codot.gov

DOT_RUC

Colorado Road Usage Charge Pilot Program

APPENDIX D: CDOT RUCPP Press Release

CDOT Announces Road Usage Charge Pilot Research Program

Program explores possible transportation-funding alternative.

DENVER—The Colorado Department of Transportation (CDOT) has announced that the Colorado Road Usage Charge Pilot Program (RUCPP) website has launched to test whether road usage charging—an approach where, instead of paying a tax on how much gas is purchased, drivers pay a fee for how many miles are traveled—could be feasible for Colorado.



Road Usage Charge Pilot Program

"Colorado's population is expected to nearly double by 2040 to 7.8 million residents, bringing more demands for mobility, and on our transportation infrastructure," said CDOT Executive Director Shailen Bhatt.

"A healthy transportation system is the backbone of our state's economy and way of life. As the state's transportation funding gap under the current gas tax grows, we need to explore possible funding opportunities—such as road usage charging (RUC)—to ensure Coloradans the mobility they need to live, work and play."

To learn why CDOT is exploring the RUCPP (a pay-by-mile charge), understand what RUC is (and isn't), receive updates on the status of the pilot, compare a driver's current gas tax paid with an estimated RUC, visit ruc.codot.gov. The website is also the place to express interest in being a pilot participant.

The pilot will research how a pay-by-mile system compares to current gas tax paid. Research topics include:

- mileage-reporting technologies along with a manual-reporting option;
- how these technologies work in Colorado's environment; and
- the difference between rural and urban drivers, and others.

With this pilot, CDOT will gain real-world experience about road usage charging as a funding alternative. Approximately 100 Colorado drivers will participate in the pilot study, which will begin in late fall and end in spring 2017. The research team will share its findings later in 2017.

CDOT is facing a nearly \$1 billion annual funding gap over the next 25 years and is looking to explore transportation funding alternatives as the gas tax continues to become less reliable over time, due decreased purchasing power and more fuel efficient and electric vehicles. This pilot is the first step in an extensive process of evaluating the concept alongside other funding alternatives.

"CDOT is proud to be working with the public, stakeholders, elected officials, and community and transportation leaders on the RUC pilot program," said Tim Kirby, CDOT's manager of Metropolitan Planning Organizations (MPO) & Regional Planning section.

"The Colorado Road Usage Charge Pilot Program will engage a diverse group of drivers, from rural to urban, mountains to plains, and cars and trucks to be participants. We look forward to learning from the RUC pilot participants' experiences to learn more about this potential funding alternative."

Learn more

For more information on CDOT's Colorado Road Usage Charge Pilot Program (RUCPP), visit ruc.codot.gov.

APPENDIX E: CDOT RUCPP Mileage Reporting Device Quick Start Installation Guide




Connect with your car

Quick Start Guide




1 Device Installation

- Make sure you are parked outside
- Plug the device firmly into your vehicle's Onboard Diagnostics (OBD-II) port

The OBD-II port is typically under the driver's side dashboard.

Consult your vehicle's Owner's Manual for assistance on finding the OBD-II port location



3 Verify Installation

- Go to <https://coloradoruc.azuga.com>
- Log in using the email and password you created during enrollment

Note: The first time logging in after installing the device, the device to vehicle association screen is displayed

- If the device did not automatically associate to the vehicle, select it from the 'Select Active Device' drop down
- Click the green "Continue" button at the bottom of the screen

Verification is complete! You're ready to roll!

If you have any issues during the installation or verification process, please call us at 1(844) 662-4958 or email us at support@coloradorucpp.com

2 Device to Vehicle Association

- Wait 2 minutes
- Start your vehicle and allow it to idle for 30 seconds 

If the device does not light up during this process, please call support

You are now connected!

Your vehicle should now be visible on the Azuga Insight website.

APPENDIX F: Colorado Road Usage Charge Pilot – Account Management Monthly Summary Report – April 2017

Introduction

The Colorado Road Usage Charge Pilot Program (RUCPP) began on December 5, 2016 and lasted four months, ending in April 2017. The Colorado RUCPP Account Manager, Azuga, provided monthly reports including the raw data collected for each month of the operational pilot. This report provides a summary of the monthly raw data, which the project team aggregates and removes all personally identifiable information (PII) to prepare a summary report for the Colorado Department of Transportation (CDOT). This April monthly report summarizes the data from the fourth month of the operational pilot beginning April 1, 2017 through the final date of the pilot, April 26, 2017. This report also provides an overall summary of the raw data collected throughout the entire pilot.

This report is subdivided into four sections based on the raw data received from the Account Manager, Azuga, and the Colorado RUCPP Help Desk, CH2M. The individual reports containing the raw data are provided in the appendix.

- Vehicle Identification Number (VIN) Summary Report
- Mileage and Road Usage Charge Revenue Report
- Errors and Events Report
- Help Desk Report

Pilot activities in the month of April primarily consisted of March invoicing, ongoing account management and help desk activities, and pilot closeout activities.

The data in this summary report includes data from all soft launch participants that opted to continue through the operational pilot in addition to the participants including stakeholders and general public that were invited to participate in the operational pilot.

The following section provides a summary of data included in the monthly reports.

Summary of Monthly Reports

VIN Summary Report

Table 26 summarizes the total enrollment statistics based on the Account and VIN Update Report. Since this report contains PII, the raw data is not provided as an appendix to this report. In April, there were 0 vehicles added, and 0 vehicle removed, resulting in 140 vehicles remaining in the study. It is important to note this includes total vehicles, not participants, as some participants have more than one vehicle enrolled in the pilot.

Table 26: Account and VIN Summary

Reporting Period	Added Vehicles	Dropped Vehicles	Change in total Enrolled Vehicles	Vehicles Reporting Mileage
November (Soft Launch)	41	--	+41	39
December 2016	105	3	+102	125
January 2017	1	1	0	136
February 2017	0	2	-2	134
March 2017	0	1	-1	131
April 2017	0	0	0	128
Cumulative Totals				
Pilot Total	147	7	140	

Of the 140 vehicles enrolled at the end of the pilot, 128 were reporting mileage in April:

- All of the vehicles not reporting mileage are odometer reading option participants that did not provide their odometer reading in the month of April.

For the odometer reading option, Azuga's VIN Summary report also provides information on which participant accounts did not submit odometer readings. Table 27 provides a summary of the number of Odometer Reading Option accounts and the number of people who did not submit monthly odometer readings each month.

Table 27: Odometer Reading Option Summary

Month	Number of Accounts	DID NOT Submit monthly odometer reading	Submitted picture of initial/final odometer reading
December	22	4	8
January	22	5	*
February	22	6	*
March	22	9	*
April	22	12	10

** Picture verification is only required for the initial and final odometer readings during the Colorado RUCPP and can be submitted via the Azuga Insight Mobile App, the Colorado RUCPP Help Desk, or via mail to CDOT.*

Only ten of the 22 odometer reading users submitted their final odometer reading picture during pilot closeout.

Mileage reported by participants using the odometer reading option does not have a fixed date range like the GPS and Non-GPS accounts, which begin reporting on the first of the month and end on the last day of the month. For odometer readings, one month could have three weeks' worth of miles, the next could have mileage for 7 weeks. Therefore, a month-by-month comparison of mileage and net revenue for odometer accounts is not an accurate indicator of trends during that particular month.

Mileage and Road Charge Revenue Report

Table 28 summarizes total vehicle miles traveled including both chargeable and non-chargeable miles, road usage charges, fuel tax credits, and net revenue for the month of April. For the Colorado RUCPP, all miles driven in the state of Colorado are assessed the road usage charge (RUC). For participants who selected the GPS-Enabled MRD option, the RUC is only based on miles driven in Colorado, any out-of-state miles are not included in the RUC.

Table 28: Mileage and Road Charge Revenue Summary

Location (State)	Miles	Road Usage Charges	Fuel Tax Credits	Net Revenue
April Chargeable Miles				
Colorado	107,646	\$ 1,291.74	\$ (1,028.48)	\$ 263.26
<i>Odometer</i>	16,595	\$ 199.14	\$ (158.05)	\$ 41.09
<i>Non-GPS</i>	20,443	\$ 245.31	\$ (205.86)	\$ 39.45
<i>GPS</i>	70,608	\$ 847.29	\$ (664.57)	\$ 182.72
April Non-Chargeable Miles (Out-of-State)				
Iowa	542	\$ -	\$ -	\$ -
Minnesota	493	\$ -	\$ -	\$ -
Nebraska	770	\$ -	\$ -	\$ -
New Mexico	579	\$ -	\$ -	\$ -
Totals				
December	60,387	\$ 699.86	\$ (606.40)	\$ 93.46
January	123,282	\$ 1,465.39	\$ (1,207.74)	\$ 257.65
February	118,933	\$ 1,415.09	\$ (1,135.76)	\$ 279.33
March	128,383	\$ 1,513.32	\$ (1,194.24)	\$ 319.08
April	110,031	\$ 1,291.74	\$ (1,028.48)	\$ 263.26
Cumulative Total	541,016	\$ 6,385.40	\$ (5,172.62)	\$ 1,212.78

Table 29 shows the average monthly mileage and road usage charges per vehicle. For this pilot, the average vehicle enrolled drove just over 900 miles per month, equating to about \$11 per vehicle, per month in road usage charges. This amount is just over \$2 more per vehicle, on average, than the estimated fuel tax paid at the pump.

Table 29: Mileage and Road Usage Charge Revenue per Vehicle

Month**	Monthly Totals				Vehicles Reporting Mileage	Monthly Averages per vehicle			
	Miles	Road Usage Charges	Fuel Tax Credits	Net Revenue		Miles	Road Usage Charges	Fuel Tax Credits	Net Revenue
January	123,282	\$1,465.39	\$(1,207.74)	\$257.65	136	906.49	\$10.77	\$(8.88)	\$1.89
February	118,933	\$1,415.09	\$(1,135.76)	\$279.33	134	887.56	\$10.56	\$(8.48)	\$2.08
March	128,383	\$1,513.32	\$(1,194.24)	\$319.08	131	980.02	\$11.55	\$(9.12)	\$2.44
April	110,031	\$1,291.74	\$(1,028.48)	\$263.26	128	859.62	\$10.09	\$(8.04)	\$2.06
Total	480,629	\$5,685.54	\$(4,566.22)	\$1,119.32	132	908.42	\$10.74	\$(8.63)	\$2.12

**** The month of December was removed from the table because it wasn't a complete month of reporting by every vehicle due to enrollment.**

Errors and Events Report

Table 30 summarizes aggregate errors and events for Azuga. The data in this table reflect errors and events related to the two mileage reporting options requiring MRDs, the GPS Enabled and Non-GPS Enabled MRD options. Again, during the month of April, the only type of error/event reported by pilot participants was the number of disconnects/reconnects. This error occurs when there is a lapse in the connection of the OBD-II device, however all miles driven the date of the error event were still collected, no mileage was lost. This particular error type is anticipated in pairs (once for disconnect and once for reconnect), however the arbitrary break in monthly reporting may result in an odd number of events reported in the monthly summary.

Table 30: Errors and Events Summary

Error Event Date	Event Type	Error Event Date	Event Type
	Number of Disconnects/Reconnects*		Number of Disconnects/Reconnects*
Previous Months		Current Month (April)	
December Total	17	4/2/2017	1
January Total	31	4/3/2017	2
February Total	43	4/10/2017	2
March Total	24	4/11/2017	1
April Total	16	4/14/2017	4
		4/17/2017	2
		4/20/2017	2
		4/25/2017	2
Totals			
Cumulative Total	131	April Total	16

Throughout the pilot, 131 instances of only one type of Error and Event was reported (Disconnects / Reconnects). The other types of errors that can be monitored and recorded by the account manager including low voltage, anomalies in vehicle function, full storage, new vehicle connection, communications failures, location data degradation, software resets, software updates, degraded mileage data, or missed mileage, were not logged at any point for any user during the pilot.

APPENDIX G: Colorado RUCPP Policy, Technology and Administrative Issues Matrix

Table 31: Colorado RUCPP Policy, Technology and Administrative Issues Matrix

Future Considerations	Type (Policy, Technical, Administrative)
Look at what the Colorado vehicle fleet make up is to better understand how a RUC system would impact the state, particularly in terms of rural versus urban.	Policy
Evaluate implementation strategies for a RUC system rollout in Colorado. What does future implementation look like and who would be subject to it? How do you transition drivers from the gas tax into a RUC system, and would this incentivize certain vehicle types?	Policy/Administrative
What are the issues associated with using a RUC system to also collect tolls on roads like E-470? (Could/should toll roads be excluded from RUC?)	Technical/Policy
How would RUC apply to other fuel types beyond gas – diesel, compressed natural gas, electric, etc.?	Technical/Policy
What would the per-mile rate and/or rate structures be for a Colorado RUC system? Should rates vary among vehicle types?	Policy
What is the effect each vehicle places on Colorado roadway infrastructure (weight, congestion, etc.)? This information could be useful in determining RUC rates, equity assessments and constructing business cases for different RUC rate structures.	Technical/Policy
What is the actual impact of RUC on electric vehicle ownership costs and will that cost be under various RUC rate structures?	Technical/Policy
What is the elasticity of travel in Colorado, and would a RUC impact travel behaviors?	Technical/Policy
Could a RUC model influence redistributing highway trust fund allocations based on where travel is actually occurring?	Policy / Administrative
Future pilots should incorporate fleet vehicles and/or ridesharing companies (i.e. rental car companies, Uber, etc.).	Administrative
Future pilots should address enforcement and tampering issues.	Technical
How would gas tax refunds be handled under a state RUC?	Administrative
What is the revenue potential for a Colorado RUC system?	Policy
Future pilots should test the feasibility of differentiating miles driven on private and public roads in addition to in-state and out-of-state, and deducting private road mileage from “chargeable miles”.	Technical
CDOT should consider eliminating the FASTER program which might improve support of RUC from rural communities.	Policy
How will RUC capture out-of-state drivers or visitors to Colorado?	Technical / Administrative
What are the potential costs to administer a RUC system?	Administrative