



CALIFORNIA  
**ROAD  
CHARGE**  
PILOT PROGRAM

2017 | Final Report  
Senate Bill 1077



## **ACKNOWLEDGMENT**

The California State Transportation Agency would like to thank the following partners for their commitment and continued collaboration on the California Road Charge Pilot Program:

**The California Department of Transportation**  
**The California Transportation Commission**  
**The Road Charge Technical Advisory Committee**

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December 1, 2017

California Legislative and Policy Committees  
California Transportation Commission  
Road Charge Technical Advisory Committee

Dear Chairpersons and Members,

It is my pleasure to submit for your consideration the final report of the California Road Charge Pilot Program.

The enactment of the Road Repair Accountability Act of 2017 (Senate Bill 1, Beall) earlier this year signals the state's commitment to repairing and maintaining California's infrastructure. This historical legislation delivers the necessary funding to address the state's immediate backlog of transportation maintenance and repair needs. However, as California's fleet transitions away from fossil fuels, the state cannot continue to rely primarily on the gas tax to fund the maintenance and operations of our vital transportation system.

The report describes the policies leading to development of the pilot program, the pilot's development and operations processes and results. The report also discusses critical issues surrounding road charging, including those raised in Senate Bill 1077 and by members of the public and the project team. Finally, the report contemplates next steps toward additional research and the potential adoption of an operational road charge program.

I am pleased to report that the pilot program was a success. Completed one year ahead of the legislatively set schedule, the California Road Charge Pilot Program is the largest and most extensively researched program of its kind.

I believe this pilot program accomplished the objectives you sought to achieve and provides valuable information that will prove helpful in assessing whether to seek adoption of a road charge mandate in the future as an important long-term funding mechanism for California's highway system.

Sincerely,



BRIAN P. KELLY  
Secretary

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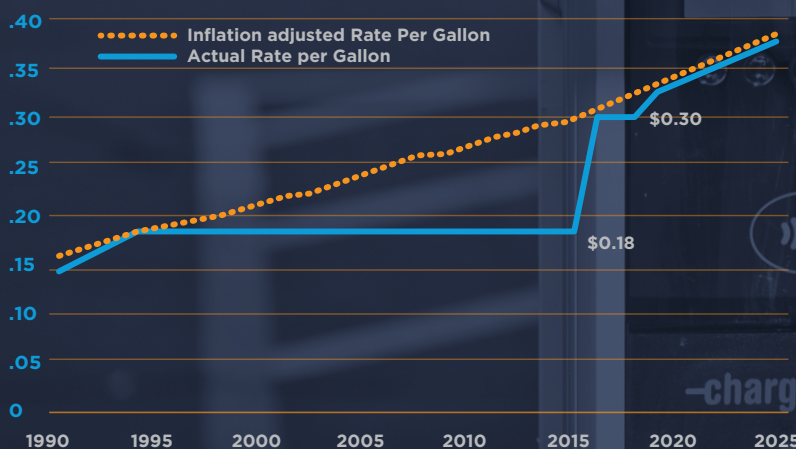
# Executive Summary

Nearly all of the 350 billion miles driven each year on California’s highways and roads are powered by gasoline or diesel fueled vehicles. Historically the taxes on those fuels provided the majority of the revenue required to maintain and operate our transportation network. As future consumption of gasoline and diesel fuel declines, due to increased fleet efficiency, California will be challenged to sustain its \$2.5 trillion economy. Continuing to depend on a consumption based model, while at the same time adopting policies to increase vehicle fuel efficiency and promote the reduction of vehicle miles traveled, puts into question the long-term viability of the gas tax as a sustainable revenue model. The Road Charge Pilot Program explored the feasibility of a possible sustainable solution to fund transportation infrastructure.

Historically, transportation funding has been impacted by two main factors: inflation and vehicle fuel efficiency. Up until this year, with the passage of the Road Repair and Accountability Act of 2017 (Senate Bill 1), the state gas tax had not been adjusted for inflation since 1994 which significantly reduced its purchasing

power. Senate Bill 1 adjusted fuel rates for past inflation and includes future inflation adjustments, solving the inflation issue and delaying the expected transportation funding shortage by a decade or more. However, the impact of improving vehicle fuel efficiency remains an issue, especially as new vehicles sold in the coming decades are expected to be much more fuel efficient.

**Figure 1-1: Senate Bill 1 Gas Tax Stabilization**



Source: Department of Finance

Without Senate Bill 1’s inflation adjustments, the transportation funding shortfall would be quickly and dramatically approaching. The new Senate Bill 1 revenues, as illustrated in Figure 1-1, stabilize the state’s short-term transportation infrastructure funding needs



and provides time to explore alternatives to continued reliance on fuel taxes.

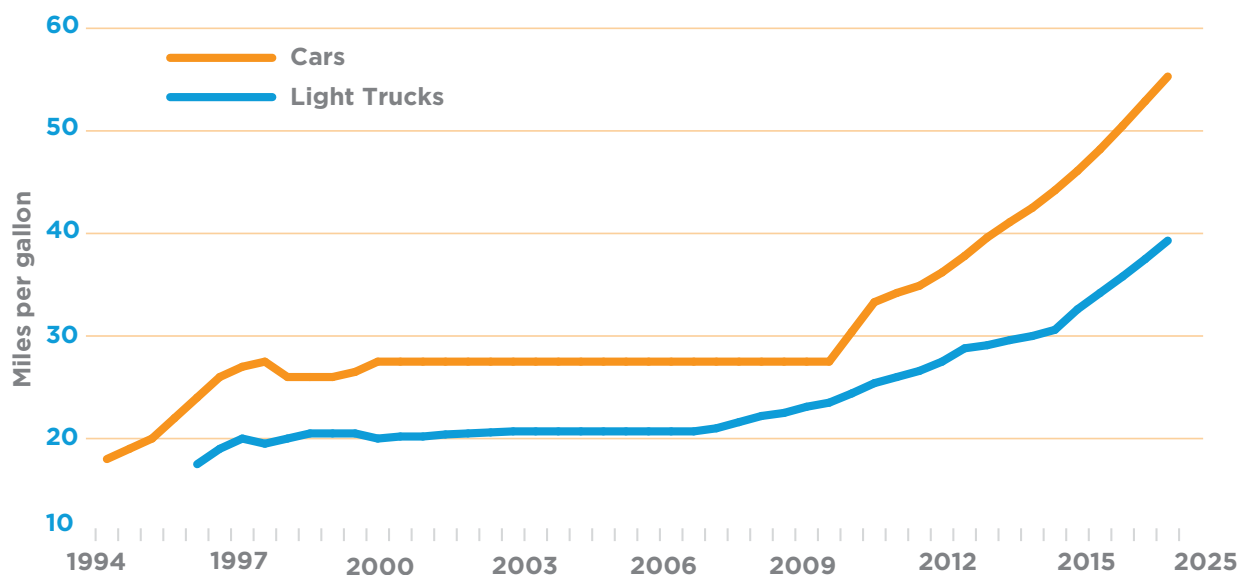
Senate Bill 1 took important steps to address the fuel efficiency issue with the inclusion of a new transportation revenue stream from vehicle registration, including electric vehicles, which diversifies the funding for transportation, making transportation investments less dependent on fuel taxes. However, the majority of revenue will still be derived from the consumption of fossil fuels.

In response to the 1973-74 Arab Oil Embargo, the United States Congress enacted the Corporate Average Fuel Economy (CAFE) Standards in 1975, with the goal of reducing oil consumption by increasing the fuel economy of cars and light trucks, as seen in Figure 1-2. Throughout the 1980s and 90s, the pressure to reduce fuel consumption lessened due to increased production and inventory of fuel, driving down the cost to the consumer. However, gas prices reaching in excess of \$4.00 per gallon in 2008, there was

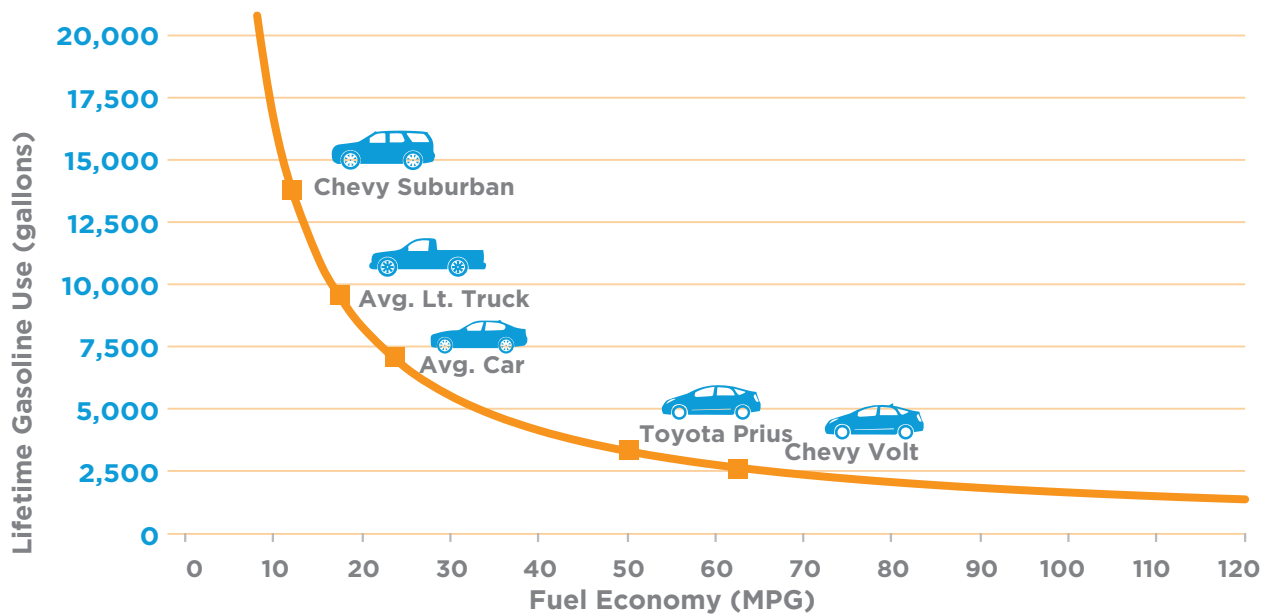
a renewed interest in the CAFE standards, and a desire to reduce greenhouse gas emissions, prompting President Obama to propose a new national fuel economy program which resulted in the adoption of uniform federal standards to regulate both fuel economy and greenhouse gas emissions.

Additional anecdotal data supporting this phenomenon based on national data collected by the U.S. Department of Energy illustrates that the relationship between fuel economy and consumption is not linear. Figure 1-3 further illustrates fuel economy improvements in vehicles with lower miles per gallon ratings (suburban/truck) have a greater impact on reducing fuel consumption than improvements to vehicles with higher miles per gallon ratings (hybrids). This is because increasing fuel economy by percentage has a greater impact than the numerical increase of fuel economy (miles per gallon). For instance, an increase in the miles per gallon from 10 to 12 mpg represents a 20 percent improvement in fuel economy, while increasing the same 2 miles per gallon from 20 to 22 is only a 10

**Figure 1-2: As Fuel Economy Increases, Fuel Consumption Declines**



**Figure 1-3: Increasing Vehicle Fuel Efficiency**



*VMT calculated from Tables 3.13 and 4.1 of U.S. Department of Energy, Transportation Energy Data Book (Edition 31, 2012), Table VM-1, Federal Highway Administration's Highway Statistics (2012), and the official MPG estimate for Chevy Volt provided by Environmental Protection Agency.*

percent improvement. In other words, if a driver trades in their average light duty truck for an average passenger car, they save over four times (4X) as much fuel as a driver that switches from a plug-in electric vehicle to a fully electric vehicle.

To advance the integration of fuel efficient vehicles into the fleet, California has adopted measures that enhance the vehicle fleet



efficiency in an effort to reduce greenhouse gas (GHG) emissions. In 2012, Governor Brown issued Executive Order (B-16-2012) establishing the goal of the California fleet to consist of a minimum of 1.5 million zero-emission vehicles (ZEVs) by 2025.

Similarly, in 2016, Governor Brown issued Executive Order (B-30-15), and signed Senate Bill 32 mandating a 40 percent reduction in California's GHG emissions by 2030. The California Air Resources Board (ARB), in response to Senate Bill 32 (Statute of 2016, Pavely), drafted "The 2017 Climate Change Scoping Plan Update - The Proposed Strategy for Achieving California's 2030 Greenhouse Gas Target" to further define the efforts needed to reach the 2030 GHG target. Included in ARB's Scoping Plan is a call for 4.2 million ZEVs on California roads by 2030. To add to the adoption of alternative fuel vehicles, in 2015 Governor Brown recognized

in his inaugural address, the necessity for cars and trucks to reduce gas consumption by 50 percent by 2030.

Policies promoting fuel efficiency are clearly beneficial for California's environment and for its efforts to combat climate change. Measures to achieve these goals, however, will adversely impact the revenues collected for transportation infrastructure based on the current gas tax model. In the long-term, California cannot rely primarily on the gas tax to fund the maintenance and operations of our vital transportation system, which directly impacts the overall quality of life for Californians.

Acknowledging the limited viability of the gas tax, the California Legislature and Governor Brown demonstrated the foresight to investigate a sustainable transportation funding mechanism, known as a road charge, with the passage of Senate Bill 1077 (Statute of 2014, DeSaulnier).<sup>2</sup> This legislation directed the Chair of the California Transportation Commission (CTC), in collaboration with the Secretary of the California State Transportation Agency (CalSTA), to create a Road Charge Technical Advisory Committee (TAC) to study road charge as an alternative to the state gas tax.

Senate Bill 1077 provided general policy direction and design parameters to guide the TAC's investigation, deliberation and design recommendations of a pilot to test the road charge concept in California. In December 2015, the TAC delivered their Road Charge Pilot Design Recommendations Report to CalSTA for implementation.<sup>3</sup>

Building off of the TAC's recommendations, CalSTA, with the assistance of the Department

of Transportation (Caltrans), used the following four overarching principles in the development and implementation of the Road Charge Pilot Program:

- **Feasibility** – the viability of recording and reporting of vehicle miles traveled for a statewide road charge system
- **Complexity** – the degree of difficulty of implementing a statewide road charge system
- **Security** – ensuring the safeguarding of personally identifiable information and data in a statewide road charge system
- **Acceptability** – surveying the acceptability of a road charge as an alternative to the gas tax

Working under the direction of CalSTA, Caltrans was tasked with the development, deployment, and evaluation of the Road Charge Pilot Program.

## PREPARING FOR THE CALIFORNIA ROAD CHARGE PILOT PROGRAM

Utilizing the parameters and overarching principles prescribed by the TAC, Caltrans commenced preliminary pilot development in late 2015 as the TAC was finalized recommendations in preparation for the pilot launch in July 2016.

Pursuant to the TAC recommendations, the Road Charge Pilot Program sought to recruit 5,000 vehicles to report miles traveled, pay a simulated road charge for each mile driven, and provide valuable feedback on the overall pilot program operations.

To help facilitate the Road Charge Pilot Program, third-party vendors (account

<sup>2</sup>Appendix A-1: Senate Bill 1077 (Statutes of 2014, DeSaulnier)

<sup>3</sup>Appendix A-2: TAC Recommendations Report

managers), were engaged to deliver road charge services and technology. The utilization of account managers provided an opportunity to develop the pilot with an open system, meaning a system in which the design of the system is independent of a particular supplier rather than a system constrained by proprietary technology.

Fundamental to establishing a road charge, each driver must report the amount of road usage (or miles traveled) over a designated period. The Road Charge Pilot Program offered a variety of methods to participants for reporting miles driven, ranging from manual (do not require reporting any personal information) to automated (with or without location-based services).

Pivotal to the Road Charge Pilot Program were the privacy and data security features implemented to ensure the protection of all personally identifiable information and data collected during the pilot program. Building off the statutorily mandated privacy provisions included in SB 1077, the TAC designed a robust set of privacy protection and data security measures which were incorporated in the pilot program.

Critical to evaluating the viability of a new and innovate method of paying for transportation infrastructure is not only testing the processes and technologies, but also a measurement of the attitudes and experiences of the participants. In order to gauge the participant perspective an Independent Evaluator was procured to analyze the data collected, and more importantly, the attitudinal and experiential information of the pilot participants. This assessment of the participant experience

was facilitated through a number of surveys during the pilot, as well as five focus group discussions at the conclusion of the pilot in March 2017.<sup>4</sup>

## CALIFORNIA ROAD CHARGE PILOT PROGRAM OBSERVATIONS

### Pilot Participation

The Road Charge Pilot Program represented vehicles from every segment of California's driving population, including a wide range of passenger vehicles, agency and business fleets, household vehicles and, for the first time, commercial trucking. In order to collect a large and valid set of perspectives, the pilot sought comprehensive representation of California's diverse demographic, geographic and socioeconomic population, including participants from various communities (rural/agricultural and urban/suburban), income levels, races and ethnicities, genders, and age groups throughout the state. **Observation:** Certain demographic targets and sub-targets set by the TAC were unattainable. This was due in large part to the truncated pilot delivery schedule, as well as limited resources for pilot recruitment. The most difficult targets to convert from volunteer to participant were rural, low-income, and certain ethnicities/races. In an operational system, where all vehicles are participating, this issue will be mute.

### Third Party Vendors

The Road Charge Pilot Program was successful in studying the viability of utilizing third-party vendors (account managers), to provide the necessary services and technologies used to record and report miles driven. **Observation:** Account managers provided the flexibility of services to pilot

<sup>4</sup>Appendix A-3: Independent Evaluation of the California Road Charge Pilot Program

participants and demonstrated the ability to offer other value-added features, enhancing the user experience.

### **Mileage Reporting Methods**

Pilot participants had a variety of manual and automated mileage reporting and recording methods to select from based on their unique needs and interests. **Observation:** Offering a multitude of choices caused a level of concern from the participants. In particular, the clarity of communications and instructions regarding the mileage reporting methods and technology options available during enrollment. Nevertheless, at the conclusion of the pilot the majority of the participants were happy with the method they chose.

### **Privacy/Data Security**

As stated earlier, privacy and data security were paramount to the Legislature, CalSTA, the TAC, and Caltrans. Incorporation of the TAC recommended privacy and data security provisions assured pilot participants that the information and data they provided for the pilot was secure. **Observation:** There were no data breaches or data security concerns throughout the duration of the pilot. However, the importance of data security should not be discounted and any future systems should strive to exceed standard security practices.

Based on participant feedback there was an overall 78 percent satisfaction rating in regards to the pilot privacy and data security. At face value, survey satisfaction rating could indicate that privacy and data security were not as critical as first assumed. However, due to the small sample size, compared to the overall state driving population, and the fact that the pilot participants are more likely early adopters, it is difficult to rely on these results to reflect perceptions of all California motorists.



### **Participant Perception**

Overall participant satisfaction was favorable with an overall approval rating of 85 percent, which is further supported by the low dropout rate of 4 percent. **Observation:** Some of the high-level survey results indicate that participants felt a road charge is a more equitable transportation funding solution than the current gas tax, but additional research is needed before implementation. Additionally, over 90 percent of the participants expressed willingness to participate in future road charge demonstrations.

### **Pilot Road Charge Rate**

For purposes of evaluating the effectiveness of a road charge, the TAC recommended establishing a revenue neutral rate to simulate a road charge. Given that direction, a rate was established prior to the deployment of the pilot, taking the five-year average of the gas tax (base and price-based excise) and dividing by the average miles per gallon of the entire California fleet. As a result, the rate used for the pilot was set at 1.8 cents per mile. **Observation:** While this rate reflects a revenue-neutral rate based on the California fleet average. When compared to the sample of vehicles participating in the pilot, this simulated road charge rate was not revenue neutral. This was due to the pilot sample fleet having an average miles per gallon higher

than the statewide average. At the time of the rate setting exercise, there was no way to predict what composition of vehicles would actually participate in the pilot.

### **Enforcement and Compliance**

From an operational perspective, the elements tested were successful. The pilot was able to test and audit the operational systems and requirements of the program.

**Observation:** The inability to adequately test the compliance and enforcement aspect of a road charge provides a level of uncertainty on the methodologies to employ, and the overall cost to enforce. Due to this program being volunteer based, and the fact that no revenue was collected, there is no measure of compliance to be extrapolated for a statewide program. The testing of enforcement and compliance is critical to reasonably estimate the administrative costs of a road charge program.

### **Technology**

All the mileage reporting options tested worked to some degree. **Observation:** While the manual options provided the highest degree of privacy and data security, they could be the most difficult to enforce. As in the case of the odometer readings, they could also be costly to administer. Of the automated methods, the plug-in devices (OBD II) are the most reliable options. However, as new technology emerges, this methodology could be obsolete by the time a road charge program is adopted. The more technologically advanced methods of the smartphone application with location services and in-vehicle telematics show great promise, but they both need further refinement.

## **NEXT STEPS**

The Road Charge Pilot Program successfully tested the functionality, complexity, and feasibility of the critical elements of this new potential revenue system for transportation funding. However, some questions remain unanswered, necessitating additional investigation into the mechanics and policy issues of implementing a road charge in California.

### **Pay-at-the-Pump Technology**

In the future, Caltrans, in partnership with the Federal Highway Administration, will be investigating the feasibility of a pay-at-the-pump option for a mileage reporting system. While the mileage reporting methods employed for the Road Charge Pilot Program are feasible, they cannot compete with the simplicity, cost effectiveness, and public acceptance of the current gas tax collection process. Acknowledging the need to investigate a road charging mechanism that replicates the current user experience, Caltrans is embarking on a study of a pay-at-the pump model that could produce reduced administrative costs over the other methods tested. This method could garner greater public acceptance as the road charge would be assessed on a pay-as-you-go approach.

If this study results in one or more potential pay-at-the-pump options, the next step will be to continue the partnership with the Federal Highway Administration to conduct a limited demonstration of this mileage reporting option.

### **Road Charge Collection**

The collection of revenue was simulated in the current pilot through mock invoices and payments. The actual flow of revenue through the state system was not tested,

but was reviewed through an institutional analysis. Depending on how the road charge program is designed, there could be a number of state agencies/ departments involved in the revenue collection process. Conducting a tandem test of collecting a road charge with the pay-at-the-pump demonstration will provide a controlled environment to evaluate the revenue flows through the state system, allowing identification of challenges, efficiencies, and synergies for future implementation.

### **In-Vehicle Telematics**

The pay-at-the-pump study and demonstration will address the internal combustion engine mileage collection, but the proliferation of alternative fuel vehicles requires a method for collecting mileage data, such as in-vehicle telematics. More and more auto manufacturers are offering in-vehicle telematics on their new vehicles, and industry analysts are projecting the majority of new vehicles will include in-vehicle telematics by 2020. Developing a road charge program that allows for the collection of mileage data via in-vehicle telematics will provide an immediate solution for alternative fuel vehicles and a long-term solution should California decide to completely transition off of the gas tax.

The adoption of built-in vehicle telematics as a means for collecting mileage data could dramatically reduce the impact of adoption, administrative and enforcement costs of the road charge program. However, standardization of mileage information collection and data transference needs to be discussed to allow for open-market application of a road charge. As seen with the telecommunications and tolling industries, proprietary systems reduce or delay entry into the market, thus limiting competition and

driving up costs. Early discussions, planning and development of technical specifications and standards will allow for the greatest level of innovation and competition.

### **Technology Collaborative**

With the continuous evolution in technology, the engagement of various state agency/ departments, federal and regional/local entities, academia, as well as the private sector interests, would assist in the alignment of emerging technology and road charge. The formation of a technology collaborative will ensure the latest technology will be considered in the formation and development of a road charge program, providing the framework for future evolution of the program.

### **Organizational Considerations**

The implementation of a road charge program will not happen overnight. Thoughtful consideration of a multitude of variables is needed to proceed with a statewide road charge program.

One of the initial issues to be studied is the organizational design of the road charge program. There are a number of agencies/ departments impacted by the potential transition from the gas tax to a road charge. The early identification of the implementing agency/department will be crucial to the coordination, development, and transition to a statewide road charge program.

Based on the information gathered during the Road Charge Pilot Program, and the acknowledgement of the complexities of developing and adopting a new transportation revenue collection mechanism, implementing a road charge program prior to 2025 could be problematic. Considering a target date

for implementation year of 2025, or later, will allow time for the designated responsible agency/department to establish the required specifications and regulations, coordinate with other impacted departments, procure vendors, thoroughly design and test systems, and gather input from the public on the transition.

California currently has over 34 million registered vehicles. Determining the phasing and timing of a potential future transition from the gas tax to a road charge will require careful consideration of the costs and the risks. There are a number of transition scenarios that range from conservative to very aggressive.

## CONCLUSION

California is known for its pioneering spirit and environmental leadership. Over the next several decades, California's fleet will become more fuel efficient and less dependent on fossil fuels. These advancements will require an innovative and sustainable approach to how the state funds transportation infrastructure. Technology will take a critical role in the future of mobility and transportation funding. Rapid advancements in both vehicle and mobile technologies will dramatically impact the future landscape of transportation infrastructure development and funding.

Taking direction from the Legislature, California completed the largest road charge research effort to date, piloting over 5,000 vehicles reporting in excess of 37 million miles over a nine-month duration. These statistics only serve to reinforce Californians' desire for mobility, and the overwhelming need for a safe and reliable transportation system.

As a testament to California's commitment to being an innovation leader, the Road Charge Pilot Program achieved many firsts:

- Maintained over 5,000 participating vehicles over a nine-month pilot
- Utilized four third-party vendors to collect mileage data and issue simulated invoices
- Demonstrated six reporting and recording methods
- Offered no-tech, low-tech, and high-technology reporting and recording
- Included, for the first time, heavy commercial vehicles; and

The Road Charge Pilot Program was an initial step in the exploration of sustainable funding solutions, however there are still many miles to go before an implementation decision can be considered.

The following sections of this report will provide the details of the Road Charge Pilot Program, lessons learned and next steps.





## II. Introduction and Background on Road Charging in California

California is under tremendous pressure to maintain the appropriate levels of service, quality, and safety of its transportation network, while at the same time, facing a long-term decrease in consumption based funding. These decreases in funding are attributed in great part to the advancements in vehicle fuel economy, meaning the existing per-unit funding method will generate less revenue over time, and will exacerbate the state's long-term transportation funding challenges.

As Californians drive increasingly fuel-efficient vehicles, the long-term viability of taxing fuel as a road funding mechanism will diminish. In an effort to examine potential solutions that address the erosion of the gas tax revenue, the California Legislature passed and Governor Brown signed Senate Bill 1077. The bill authorizes exploration of a mileage-based revenue collection system, also known as "road charge," which seeks a sustainable solution that could potentially replace fuel taxation as California's primary road funding source in future decades.

This report presents the rationale and policy background that started the alternative funding conversation in California, eventually resulting in the Road Charge Pilot Program. It also summarizes the design, achievements,

and lessons learned from the pilot program's inception to closeout.

### **SENATE BILL 1077: LEGISLATIVE AUTHORIZATION OF ROAD CHARGE STUDY**

In SB 1077, the California Legislature declared the total reliance on a consumption-based fuel tax to be ineffective to satisfy the state's long-term road funding needs because of the growing fuel efficiency of the California vehicle fleet. The Legislature recognized the potential for a road charge to someday replace the traditional fuel tax by distributing the road funding burden across all vehicles, based on usage, without regard to fuel source.

The legislation directed the chair of the California Transportation Commission (CTC), in consultation with the Secretary of the California State Transportation Agency (CalSTA), to create a 15-member Technical Advisory Committee (TAC) with the purpose of guiding the design and evaluation of a pilot program to assess the potential of road charge as a future alternative to the gas tax.

SB 1077 provided the necessary direction and provisions that drove the TAC process, directing the study of road charging, gathering public comment, and consulting with highway users and transportation stakeholders. It also mandated the TAC provide recommendations to the Secretary of CalSTA on the design for testing alternative approaches to road charge. Finally, the legislation directed CalSTA to implement a Road Charge Pilot Program based on the TAC's recommendations and prepare and submit a report (this document) of its findings to the policy and fiscal committees of the Legislature, the CTC, and the TAC.

Throughout 2015, the TAC publicly convened monthly meetings across the state to discuss various policy and technical issues related to the design and implementation of a Road Charge Pilot Program. SB 1077 provided

overarching policy, design, and privacy protections guidance to assist in the TAC's deliberations and recommendations in the development of the pilot to test road charging in California.

In December 2015, the TAC prepared and presented their Road Charge Pilot Design Recommendations Report to the Secretary of CalSTA for pilot implementation. Their report consisted of recommendations on key policy and design parameters the TAC had identified as critical for the implementation and investigation during the pilot phase of the program. In addition to specific recommendations, the TAC also identified areas they deemed as needing further consideration at the completion of the Road Charge Pilot Program.

## PRE SENATE BILL 1077

Prior to the enactment of SB 1077, California acknowledged the ever-increasing decline in transportation funding, conducting fact finding missions and facilitating discussions with stakeholders on potential sustainable funding solutions. The Legislature and Governor responded to the need for additional transportation funding by enacting Senate Bill 1.

## TAC REPRESENTATION

- *Telecommunications industry*
- *Highway user groups*
- *Data security and privacy industry*
- *Privacy rights advocacy organizations*
- *Regional transportation agencies*
- *National research and policymaking bodies*
- *Members of the Legislature*
- *Other relevant stakeholders as determined by the Chair*

## RUC WEST: AN INTRODUCTION TO ROAD CHARGING

At a special meeting of the 18 western state departments of the Western Association



of State Highway Transportation Officials (WASHTO) in August 2013, the concept of funding roadways by charging for distance traveled was discussed. Oregon and Washington presented the rationale of

charging by distance traveled, and announced the formation of a collaborative organization of western states to jointly pool resources to research distance-based charging as a road funding policy, the *Western Road Usage Charge Consortium*, now known as *RUC West*.<sup>5</sup>

The RUC West charter envisions a future where motorists choose how to measure, report, and pay a distance-based charge through an open, competitive market of service providers. The consortium's primary purposes include building expertise to prepare for a new funding system, sharing resources, achieving cost savings through economies of scale, developing best practices, testing concepts jointly, and exploring the feasibility of regional cooperation.

Intrigued by the proposition of collaborative research to address the accelerating decline of fuel tax revenues, California joined RUC West in the fall of 2013. The current membership of RUC West is 14 states.

### **CALIFORNIA'S VISIT TO OREGON: DOING THE HOMEWORK**

The Oregon Legislature initiated the earliest efforts to examine road charging as a road funding mechanism in 2001. In September 2013, California took initial exploratory steps to investigate a road charge by visiting Oregon.

During the visit, representatives from Caltrans and the California Division of the Federal Highway Administration engaged in an interactive seminar conducted by the Oregon Department of Transportation. Oregon provided a detailed account of their investigation of distance-based charging,

including background on two pilot tests (2006-07 and 2012-13). Additionally, Oregon shared their approach to policy development, and plans for implementation of the nation's first permanent road charge law for passenger cars, which passed the Oregon Legislature in July 2013. Caltrans representatives reported the information from Oregon back to their leadership, which acted as a catalyst to the California Transportation Infrastructure Priorities process.

### **CALIFORNIA TRANSPORTATION INFRASTRUCTURE PRIORITIES: COMMENCING EXPLORATION**

In 2013, CalSTA convened the California Transportation Infrastructure Priorities (CTIP) Workgroup to evaluate the status of the transportation system and discuss the challenges that lie ahead. The CTIP Workgroup formed a subgroup in early 2014 to examine the feasibility of distance-based charging as a road funding mechanism. This subgroup met throughout 2014, preparing a report of its findings.

The CTIP Workgroup concluded the declining state fuel excise tax revenues were insufficient to adequately maintain and improve California's transportation infrastructure. Although this conclusion was based on pre-Senate Bill 1, at that time revenues had not kept up with inflation for decades, the state had to continue to plan for future declines in fuel tax revenues as increasing numbers of Californians transition to alternative fuel vehicles.

The CTIP Workgroup found that a road charge "is a promising funding alternative that merits further exploration" and declared that for California to remain a leader in modern transportation practice and policy,

<sup>5</sup><https://www.rucwest.org/about/>

there “is an urgency to act.”<sup>6</sup> The workgroup recommended moving forward with a road charge demonstration, or pilot program, and pronounced an overall goal for the program:

**“[T]o advance the understanding and evaluate the viability of a road charge model in California, and to provide a sustainable and equitable source of revenue to maintain, operate, and improve California’s state and local transportation infrastructure.”<sup>7</sup>**

## **FIXING AMERICA’S SURFACE TRANSPORTATION ACT (FAST ACT)**

The Highway Trust Fund provides the financing structure for federal investment in transportation projects. It consists of two accounts: the highway account, which supports projects for the interstate system and other roads, and the transit account, which supports light rail and other mass transit projects across the country. For several years there has been a gap between the trust fund’s revenue and spending, these annual shortfalls have been closed primarily with short-term measures. As illustrated in Figure 2-1, The Congressional Budget Office (CBO) projects a trust fund over subscription of \$120 billion in 2024.

Well into California’s investigation into the viability of a road charge, Congress recognized the need to secure an adequate and sustainable revenue source to support the trust fund. With the passage of the Fixing America’s Surface Transportation Act

(FAST Act) in December 2015, Congress acknowledged the value of state research efforts underway by enacting the Surface Transportation System Funding Alternatives (STSFA) grant program.

Congress intends the STSFA program to accomplish several objectives for investigating user-based alternative revenue mechanisms. These objectives are to test design, measure acceptance, study implementation, improve functionality, conduct outreach provide information on possible approaches, provide recommendations regarding adoption and implementation, and minimize administrative costs.

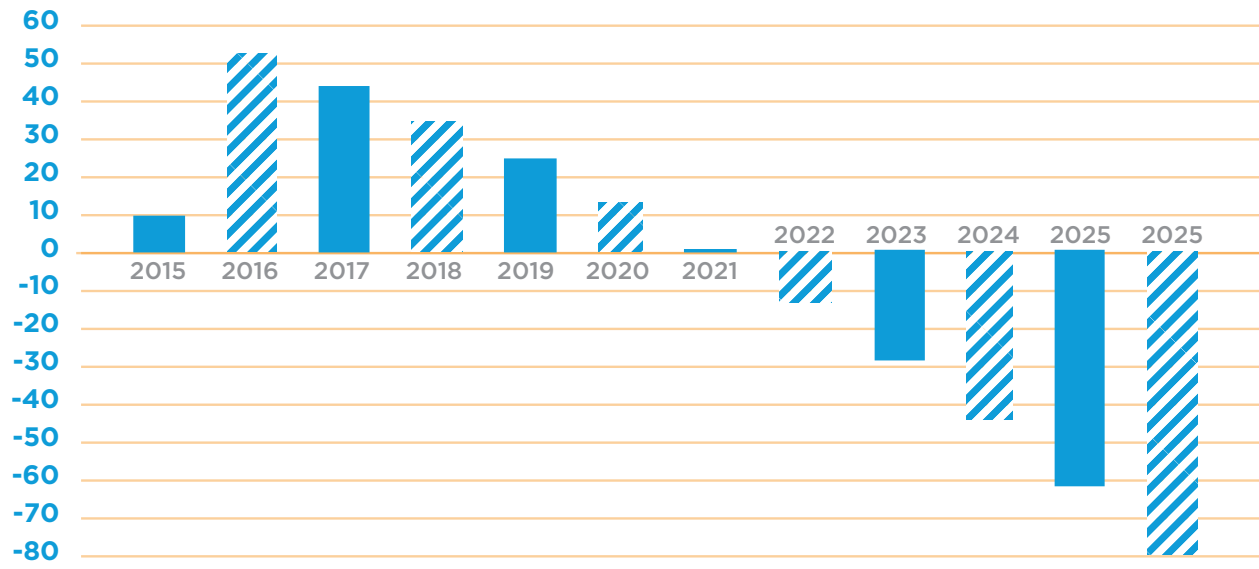
Leveraging the work of the Road Charge Pilot Program, Caltrans successfully applied for a STSFA grant to enhance the pilot program in the first year of the program. With these funds, California will study organizational design issues associated with the potential implementation of a statewide road charge program and investigate the feasibility of a pay-at-the-pump/charging station concept for mileage reporting that mimics the current fuel tax. Caltrans intends the pay-at-the-pump investigation “will establish the groundwork for a future demonstration” of a road charge option that may be “a more equitable, accessible, and cost-effective method of collecting revenues.”<sup>8</sup>

<sup>6</sup>Appendix A-4 “California Transportation Infrastructure Priorities Workgroup Whitepaper: Exploring a Road Usage Charge as an Alternative to the Gasoline Tax” (Recommendations to the Secretary), January 2015, p 8.

<sup>7</sup>Ibid. 6.

<sup>8</sup>California Department of Transportation, ‘Enhancing the California Road Charge Pilot Program’. Presented to the US Federal Highway Administration as STSFA Grant Application (Opportunity Number: DTFH6116RA00013), 2016 (unpublished).

**Figure 2-1: Federal Highway Trust Fund and Account Balance**



# III. Policy Development for the Road Charge Pilot Program Design

Specific public policies guide the research and development of an innovative program such as a road charge. Accordingly, the California State Legislature, through SB 1077, provided high level policy expectations and design criteria to the CTC, the TAC, and CalSTA on the Road Charge Pilot Program research, design, development, deployment, and reporting.

## THE CALIFORNIA LEGISLATURE: DIRECTIVES ON ROAD CHARGE POLICY DEVELOPMENT

The Legislature enacted its policy preferences in SB 1077, directing the TAC to take the following factors into account in designing the pilot:

- The availability, adaptability, reliability, and security of methods that might be used in recording and reporting highway use.
- The necessity of protecting all personally identifiable information used in reporting highway use.
- The ease and cost of recording and reporting highway use.
- The ease and cost of administering the collection of taxes and fees as an

alternative to the current system of taxing highway use through motor vehicle fuel taxes.

- Effective methods of maintaining compliance.
- The ease of re-identifying location data, even when personally identifiable information has been removed from the data.
- Increased privacy concerns when location data is used in conjunction with other technologies.
- Public and private agency access, including law enforcement, to data collected and stored for purposes of the RUC to ensure individual privacy rights are protected pursuant to Section 1 of Article I of the California Constitution.

## TECHNICAL ADVISORY COMMITTEE: REFLECTING POLICY PRIORITIES THROUGH PILOT DESIGN

Throughout 2015, the CTC, the TAC and Caltrans jointly led the public input and engagement process for the pilot's design phase. To facilitate receipt of input on pilot design, the TAC conducted a dozen public meetings; TAC members, Commissioners, and Caltrans executives met with a host of media outlets; and Caltrans maintained a website for communicating information about the program and facilitating public inquiries. The TAC carefully considered each comment made to formulate its report on pilot design recommendations.

For **mileage reporting**, the TAC recommended that the pilot offer a variety of methods for reporting distance traveled, including both manual and automated reporting options. The TAC believed offering pilot participants a choice of methods would make mileage reporting more acceptable to the public while also addressing privacy and income equity concerns, as well as the challenges presented by the diversity of the state's vehicle fleet and geography. The TAC recommended five operational concepts for road charge reporting, allowing the participants the ability to choose a concept that best suited their preferences.

Three concepts supported manual reporting.

- **Time permit**, the participant purchases a permit for a period of time with unlimited miles.
- **Mileage permit**, the participant purchases block of miles in advance.
- **Odometer charge**, the participant self-reports their vehicle's odometer reading, or opts to have it professionally read.

Two concepts supported **automated reporting**, one **with no location** information and one **with general location information**. For each, equipment added to, or within the vehicle, measures and automatically reports mileage traveled for processing.

To provide pilot participants a range of options, the TAC recommended testing a **variety of reporting technologies** for the Road Charge Pilot Program. Options recommended for testing included:

- Smartphone apps with and without location information
- On-board diagnostic (OBD-II) mileage meters with and without location information
- In-Vehicle Telematics measurement and reporting technology built into the vehicle
- Mileage meters specially designed for commercial vehicles

For management of road charge recording and reporting, the TAC recommended testing the use of **multiple account managers** for the Road Charge Pilot Program. The rationale behind testing multiple account managers is that it simulates real world competition and offers pilot participants the freedom of choice.

Rather than become constrained by proprietary technology that would limit options for future policy, the TAC also recommended that the Road Charge Pilot Program test an **open system**. In an open system, standards are established and published, but there are no requirements considered proprietary. Any company can provide mileage reporting hardware as well as account management services if it is certified to comply with the standards. The TAC



recognized that an open system for a road charge would allow multiple organizations to participate in a way that could ultimately lead to creation of an open market in a potential future mandatory road charge system. An open market, in which vendors may enter the market at any time so long as they are certified, encourages competition among vendors, potentially lowering operational costs and providing better customer care when operated on a large scale.

**Out-of-state vehicles** represent a small fraction of travel on California roads, for reasons of fairness the TAC recommended the inclusion of some out-of-state vehicles in the pilot. While reciprocal arrangements with other states may ultimately resolve road charge issues related to cross-jurisdictional travel, the TAC recommended testing the ability of commercial account managers to correctly assign miles in-state and out-of-state and assess a road charge by state jurisdiction.

The presence of multiple road charge systems in neighboring states will necessitate **interoperability** of systems—the ability to exchange data and communicate information











seamlessly. A vehicle owner would use only their home state’s road charge system to record data and report all miles driven, without having to confront the complexity of using multiple systems for each state. Ideally, a vehicle owner would receive one bill from its account manager and make one payment that would cover all miles driven during the period, both in-state and out-of-state. The TAC recommended testing interoperability of pilot program operations with the state of Oregon, which has an operational per-

***“The trucking industry needs an efficient transportation system to ensure the flow of goods and services throughout the state. We need a well-maintained highway system in order to deliver those goods to our customers. We were pleased to be included in the TAC process where our voice was heard in the design of the pilot.”***

*—Eric Sauer, Senior Vice President of Government Affairs, California Trucking Association and California Road Charge Technical Advisory Committee Member (Highway User Representative)*



**Figure 3-1: TAC Participant Targets**

Commercial Vehicles (Businesses)		North	Central	South	Trucks
					
		100	50	175	50
Private Vehicles (Individuals & Households)					Other
Urban & Suburban	 \$	475	175	1050	
	 \$\$	475	175	1050	
Rural & Agriculture	 \$	200	200	150	125
	 \$\$	200	200	150	

***“Privacy implications must be taken into account, especially with regard to location data. Travel locations or patterns shall not be reported, and legal and technical safeguards shall protect personal information.”***

*—SB 1077, Section 3090*

mile charge program. Alternatively, should testing interoperability prove infeasible in the time available, simulate interoperability with Oregon. Should a road charge prove effective, this new road funding methodology may be attractive to neighboring states.

In order to collect a large and insightful set of perspectives on the pilot, the TAC recommended enlisting a broad representation of California’s diverse geographies and socioeconomic groups to participate in the pilot. ***Pilot participation*** would draw vehicles from various geographies (north, central and south, as well as rural and urban), agency fleets, business fleets, household vehicles, and commercial trucking, representing a cross-section of, incomes,

racess and ethnicities, and age groups from all parts of the state. The diversity would also include an assortment of vehicle types, including internal combustion engines, hybrids, electric vehicles, and heavy trucks.

Utilizing these parameters for pilot participation, the TAC set targets for the ***number and distribution of vehicles*** for the Road Charge Pilot Program. The matrix in Figure 3-1 is a representation of the targets set by the TAC.

During their deliberations, the TAC noted several exemptions from existing fuel taxes and considered applying these types of exemptions to a road charge policy. For example, a road charge could mirror the current law exempting mileage driven in the operation of vehicles on private property for agricultural purposes or private roads. The TAC determined it would be helpful to test one or more mechanisms for exempting payment from the road charge to provide information that could inform decision-making on this topic. Consequently, the TAC recommended that the Road Charge Pilot Program offer

methods to **exempt miles driven on private roads and out-of-state** from the road charge.

Given the specificity of SB 1077 on the **protection of privacy**, and in recognition of the weightiness of the privacy issue for Californians, the TAC focused attention on developing and recommending precise policies protecting the privacy of residents and businesses participating in the pilot. This included not only protection of personally identifiable information, but also protection of all sensitive and personal information of pilot participants as well.

The TAC added additional detail to the state’s statutory privacy protection policies for the Road Charge Pilot Program by recommending application of the high-level privacy protection principles, in Table 3-1 below, to govern all decisions throughout the Road Charge Pilot Program.

To create actionable protections for privacy, the TAC developed the **Road Charge Privacy Protection Provisions** to guide the design, implementation, and operation of the pilot.

To protect the **security of data** used in, or generated for, the Road Charge Pilot Program by account managers, the TAC recommended application of requirements based on industry standards for online financial-grade transactions. These requirements include authentication and authorization for data access, notification of data modification, data masking, encryption and storage, data transmittal, ISO requirements for network security, and data destruction. The TAC recommended a third-party security verification to ensure all pilot program participants’ data are properly handled, and protected from unnecessary disclosure.

For data destruction, a critical issue for public acceptance, the TAC recommended

**Table 3-1 Road Charge Privacy Protection Principles**

The Road Charge Pilot Program must...

1. At all times recognize and respect an individual’s interests in privacy and information use pursuant to Section 1 of Article I of the California Constitution.
2. Offer motorists a time-based system of paying for road use as an alternative payment method for individuals concerned about disclosing their mileage driven.
3. Allow motorists choice in how mileage will be reported.
4. Be designed, implemented and administered in a manner transparent to the public and to individual motorists.
5. Comply with applicable federal and state laws governing privacy and information security.
6. Not disclose personal information to any persons or entities without motorists’ consent, specific statutory authority authorizing disclosure, appropriate legal process or emergency circumstances as defined in law.
7. Not collect information beyond what is needed to properly calculate, report and collect the road charge, unless the motorist provides his or her consent.
8. Remove all personal information from data retained beyond the period of time necessary to ensure proper mileage account payment and be used for public purposes (i.e., improving the safety and efficiency of the traveling public).
9. Require motorist consent to release personal information in a clear, unambiguous, written manner.
10. Not require use of specific locational information, including specific origins or destinations, travel patterns or times of travel.
11. Allow motorists an opportunity to view all personal data being collected and stored to ensure only data required for proper accounting and payment of road charges is being collected and retained.
12. Investigate all potential errors identified by motorists and make all corrections to ensure road charge records remain accurate.



destruction of mileage data within 30 days after this data was no longer needed. Additionally, the TAC recommended destruction of any data on mileage recording devices once an account manager reports confirmation of receipt of the data.

One area the TAC extensively deliberated on was whether, or how, to include enforcement and compliance in the pilot.<sup>9</sup> The TAC concluded it would be unsuitable to engage in enforcement activities for a pilot program for the following reasons:

- A pilot populated with volunteer participants, not paying real money, lacked the incentive to evade the road charge.
- Incorporating roadside enforcement (e.g., by police or other law enforcement officers) would prove too costly to simulate in a pilot.
- Given the small number of pilot participants in comparison with the population of drivers statewide, there was a low probability that a pilot program participant would be subject to roadside enforcement.

However, the TAC did not want to ignore enforcement and compliance entirely therefore they recommended that the pilot demonstrate certain **compliance** activities such as identifying and investigating anomalies found in electronic data logs.

The TAC wanted the pilot program to develop information that would help inform the analysis of the **impact on income equity** of a road charge relative to fuel taxes. To do so, the TAC recommended testing two assumptions: (1) that lower-income households drive older, less fuel-efficient vehicles; and (2) that the most important measure of tax affordability is the volume of road charges paid relative to the current fuel taxes. The TAC further recommended obtaining data relative to these two assumptions by targeting recruitment of lower-income households for participation in the pilot program to enable analysis of vehicle ownership and miles driven by this demographic group.

Throughout the design process, both the general public and highway user groups

<sup>9</sup>There is a difference between compliance and enforcement. Some activities, such as publishing rules or laws in public places, attempt to prevent violations from occurring by encouraging compliance. Enforcement is the act of compelling compliance by taking actions to make noncompliance undesirable. This includes activities such as detecting violations, sending infraction notices, assessing penalties, and conducting follow-up activities.

provided comments on the effects of road charge on California’s rural residents and long-distance commuters. Recognizing the sensitivity concerning how a road charge might affect drivers in various parts of California, the TAC recommended carefully monitoring the issue of *rural vs. urban equity*. The TAC recommended the pilot program enable assessment of the impacts of a road charge on rural drivers compared to their counterparts in or near urban areas. As a result, the recommended composition of pilot participation, represented in Figure 3-1 (page 18), illustrated the TAC’s commitment to oversample rural participants to ensure collection of sufficient data to assess road charge impacts on rural driving.

Although not an explicit requirement of SB 1077, the TAC took on the task of recommending *evaluation criteria* based on goals contained in SB 1077, the CTIP Workgroup, and evaluation criteria from similar programs in California and elsewhere. The TAC recommended evaluation criteria span the following eight categories:<sup>10</sup>

- **Revenue.** Ability of a road charge to serve as a suitable replacement revenue source for fuel taxes in the event a fuel tax becomes insufficient for the state’s needs as vehicle fuel efficiency continues to rapidly increase.
- **Cost.** Costs associated with administering and collecting road charges, both from a user perspective and from an agency perspective.
- **Operations.** Road charge collections operation, both from customer and agency perspectives.
- **User Experience.** Users experience and interface with the road charge system.

- **Privacy.** Privacy protection measures built into the Road Charge Pilot Program.
- **Data Security.** Security of participant data collected, transmitted, stored, and used in the Road Charge Pilot Program.
- **Equity.** Equity, perceived and real, along several dimensions.
- **Communications.** Communications with the road charge pilot project participants.

Thus, the initial policy requirements and preferences established by the Legislature were followed by many of the design features recommended by the TAC. The next step in the process was the detailed development, testing, and preparation of the pilot.

*“Conducting the Road Charge Pilot allowed California the ability to explore the feasibility, complexity, security, and acceptance of a road charge program, and specifically identify what works and what areas need further research and refinement.”*

*—Jim Madaffer  
California Transportation Commissioner and  
Chair of the Technical Advisory Committee*

<sup>10</sup>Appendix A-2 TAC Recommendations Report pages 42-46, 87-89.



## IV. Pilot Design and Preparation

Detailed pilot program development began in late 2015 as the TAC was completing its recommendations, with pilot preparations starting in January 2016 to meet an accelerated demonstration launch date of July 1, 2016. The Road Charge Pilot Program sought 5,000 volunteer vehicles from every segment of California's driving population.

### **PUBLIC INPUT AND INVOLVEMENT IN PILOT DESIGN AND PREPARATIONS**

The Road Charge Pilot Program was, in part, a public communications effort requiring outreach and communication of information to stakeholder groups, media outlets, and the general public. The program collected input during the early stages of the project to inform the design of the pilot and maintain a repository of policy issues, concerns, and questions.

Concurrent with the pilot preparations, Caltrans continued to solicit feedback from stakeholders and the public, as well as providing information about the pilot to stakeholders, media outlets, and the public.

### **VOLUNTEER RECRUITMENT**

The TAC reviewed extensive demographic data about the state of California, including data regarding distribution of the state's residents by geography, demographic aspects, and socio-economic status. In addition, public and stakeholder feedback revealed interest in ensuring adequate recruitment of volunteers from rural and low-income areas of the state, as well as a reasonable balance between Northern, Central, and Southern California. The TAC reflected these interests by adopting a recommendation to strive for pilot participation based on an apportioned geographic and demographic representation of the state. In addition, the TAC suggested that attention to the balance by gender,

race/ethnicity, age, and type of vehicle be considered during participant recruitment.

In order to fill the 5,000 available vehicle slots in the pilot, Caltrans undertook a statewide recruitment effort that involved the following tactics:

- Development and launch of a dynamic program website designed to communicate and encourage volunteer sign-ups and eventually the conversion of volunteers to pilot participants
- Presentations by project representatives at civic, community, and stakeholder meetings around the state
- Earned media, encouraging informative articles in newspapers all around the state with links to the program website volunteer form
- Flyers placed in DMV mailings of registration tags from mid-February to mid-April 2016
- Public Service Announcement, in English and Spanish ran in DMV field offices statewide calling attention to the program, with a call-to-action to enroll on the program website
- Ongoing monthly newsletters to program interest list
- Advertisements on social media targeting users whose demographics matched areas where other recruitment efforts fell short, namely rural and low income

On June 13, 2016, volunteers were invited to become pilot participants in batches. Early batches focused on the demographics most difficult to recruit, which included rural and low-income areas, to provide ample time to complete the conversion process from volunteer to participant. The conversion

*“As Vice Chair of the TAC, I valued the opportunity to work with colleagues representing a diverse set of regions and interests to design a road charge pilot to address the many questions that need to be answered before such a program moves forward. I believe that the fundamental design principles we set out – to protect privacy, provide technology and other options, and understand costs and administrative issues – reflect the input we received from many across the state and will lay a good foundation for future exploration of this issue.”*

*—Steve Finnegan, Automobile Club of Southern California (AAA SoCal)*

process included choosing an account manager, choosing a mileage reporting method, and setting up an online account.

Mileage reporting formally began on July 1, 2016, with 3,023 vehicles enrolled and reporting on day one. This number increased



during July, and by August, the pilot reached its 5,000 participating vehicle target. In anticipation of participants dropping out of the pilot, for a variety of reasons, the pilot had an attrition strategy for enrollment to remain open through December to maintain a pilot sample above the 5,000 vehicle target. The pilot concluded on March 31, 2017 with 5,129 vehicles enrolled, representing all regions of the state.

The final 5,129 participant vehicles also represented a range of vehicle types. Most participant vehicles (4,471) were private vehicles, with the balance consisting of 333 government fleet vehicles, 261 light commercial vehicles, and 55 heavy commercial vehicles. In special categories, there were 6 out-of-state participants and 3 tribal land participants who completed the pilot.

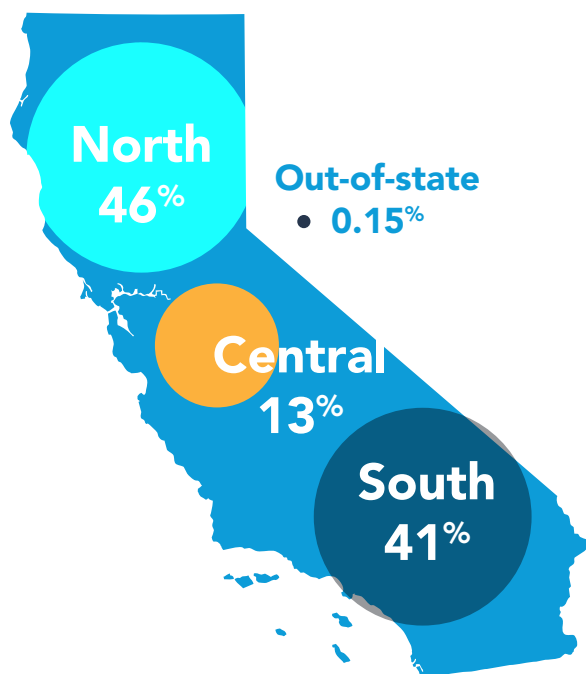
Of the final 4,471 private vehicles, 11 percent came from rural areas and 89 percent from urban areas.

## ESTABLISHING A PER-MILE RATE FOR THE PILOT

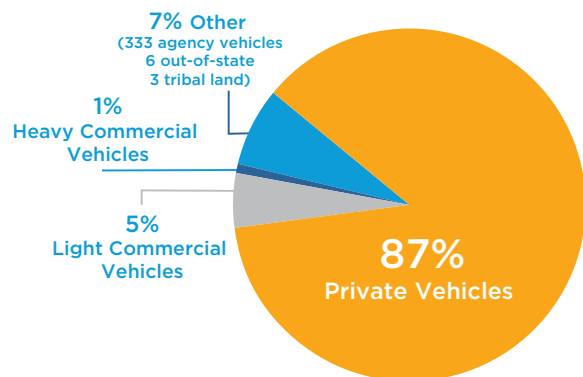
In establishing the Road Charge Pilot Program, SB 1077 expressed two policy preferences related to road charge rates: one, that “drivers pay the same rate per mile driven, regardless of what part of the roadway network they use,” and two, exploration of a road charge for potential future implementation in lieu of the gas tax structure now in place. Taking its cue from the Legislature, the TAC recommended that the pilot employ a “revenue neutral” per-mile rate strictly for testing purposes.

The pilot included both light vehicles (those under 10,000 pounds) and heavy commercial vehicles. Gasoline powers the vast majority of light vehicles in California, while diesel powers the majority of heavy vehicles. Since the taxing of gasoline and diesel are administered in

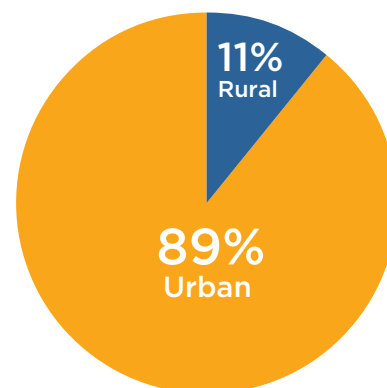
### Pilot Participant Breakdown by Region



### Vehicle Type Distribution



### Urban-Rural Distribution of Private Vehicles



distinct ways, CalSTA and Caltrans computed separate rates for light and heavy vehicles. Furthermore, since both gasoline and diesel excise tax rates in California fluctuate, it was determined utilizing a time-weighted average tax rate over the five-year period (July 1, 2011 through June 30, 2016) demonstrated a real world application of a revenue neutral rate. This resulted in average tax rates of 35.4 cents per gallon for gasoline and 11.4 cents per gallon for diesel. The final element in the calculation of the per-mile rate for the pilot was the determination of the average fuel economy of light and heavy vehicles. Utilizing data from the California Air Resources Board and U.S. Energy Information Administration, the computed average fuel economy of the California fleet of light and heavy vehicles was set at 20 and 6.2 MPG, respectively.

Based on these assumptions, the following rates were adopted for the pilot:

- Light vehicles: 1.8 cents per mile road charge, 35.4 cents per gallon fuel tax credit
- Heavy diesel vehicles: 1.8 cents per mile road charge; 11.4 cents per gallon fuel tax credit

These rates and the rationale were fully disclosed in the definitions section of all invoices issued to pilot participants by account managers. The description reiterates the TAC's guidance of establishing rates for test purposes only, not as policy.

## SECURING ROAD CHARGE TECHNOLOGY AND SERVICES

The TAC recommended an open system with multiple account managers for the Road Charge Pilot Program to ensure a future system would not become constrained by proprietary technology that would limit options. An open

system with multiple account managers would facilitate technological innovation and efficiencies in operations, leading to lower administrative costs. Recognizing the importance of providing realistic choices for public acceptance, the TAC believed an open market would deliver more choices. Although a 5,000-vehicle pilot could not fully demonstrate the true nature of an openly competitive road charge market, covering millions of vehicles, it could test public and political acceptance of the fundamentals of such a market.

The TAC anticipated that some participants may prefer reporting mileage to private firms in a commercial market, while others would prefer working with a state-run account manager. Caltrans provided four account managers in the Road Charge Pilot Program, offering a full complement of choices for road charge services including a state account manager (CalSAM) option as well as a Commercial Account Managers (CAMs).<sup>11</sup>

Due to time constraints, the recruitment of private sector vendors was facilitated through Caltrans' delivery partner. Official recruitment of the private sector vendors to perform account management road charge services began in late 2015. Reaching out to the industry nationally and internationally, 35 firms attended a Road Charge Pilot Program workshop in Burlingame, CA in November 2015. The Road Charge Pilot Program sought commercial support for seven service areas.

Account management for three functional areas:

- Commercial account manager,
- State account manager, and
- Heavy vehicle account manager

<sup>11</sup>Appendix A-18.1: Road Charge Pilot Program - Use of Commercial Account Managers Policy Paper



As well as four for mileage recording and reporting technology:

- Onboard diagnostic (OBD-II) port,
- Smartphone,
- In-vehicle telematics, and
- Other technologies

Firms were encouraged to bid alone, or as consortia, and on multiple service areas. On December 4, 2015, 17 proposals across the seven service areas were received. Upon reviewing those responses, the proposals for consideration were reduced to 14 firms for initial negotiation. Conducting due diligence, the proposers' capabilities were evaluated, and seven firms were advanced to the final round of negotiations.

Agreements were reached with all seven finalists to provide services for the Road Charge Pilot Program: two firms acting as CAMs, one firm acting as the CalSAM, one heavy vehicle account manager, and three mileage recording and reporting technology providers that partnered with one or more of the account managers. A CAM is a private sector vendor collecting mileage traveled data from the participants' vehicles, generating and issuing simulated invoices to the participants, and managing receipt of mock payments from the participants. Although contracted by the government to perform this service, the CAMs were permitted to offer value-added services as part of their business of collecting the road charge. The state account manager, or CalSAM, performed the same functions but did not offer value-added services.

For light vehicles, the pilot featured two choices as CAMs. **Azuga**, a firm experienced in providing fleet management services as well as account management and mileage reporting services for the Oregon Road

Usage Charge (OReGO) program, and **Intelligent Mechatronic Systems, Inc. (IMS)**, also experienced with providing mileage reporting services for and usage based insurance. **Arvato**, a firm with global expertise in design and delivery of customized data management and business services, provided the CalSAM services. **EROAD**, a supplier of commercial account management services for New Zealand's road user charge system and Oregon's weight-mile tax, handled the heavy vehicle portion of the pilot.

The mileage metering technology suppliers and account managers were joined strategically to ensure that all of the TAC's recommended reporting methods for the pilot were fulfilled.

## ENSURING CHOICES: MILEAGE REPORTING METHODS

Fundamental to establishing a road charge, each driver must report the amount of road usage (or miles traveled) over a designated period. The Road Charge Pilot Program provided choices to participants for reporting miles driven from among multiple methods. These included methods that ranged from no technology (do not require reporting any personal information) to high-technology (with or without location-based services). The pilot offered reporting options in two main categories: manual and automated, with additional technology choices for automated methods.

The **manual reporting methods** established for the Road Charge Pilot Program require the driver to take some personal action, by manual means, to purchase and renew permits, and report miles driven. The manual methods require periodic, hands-on update of their activity on the CalSAM website.

**Time Permit.** The time permit is a manual reporting method in which the participant pre-pays for an unlimited amount of driving for a fixed time period. The pilot offered 10, 30, and 90-day time permits. The time permit required no official odometer reading because there is no need for one. Those choosing a time permit may prefer not to share any personal driving information or simply want to make a single payment and have no reporting obligations. A gas tax credit does not apply because purchase of the time permit occurs in advance, before the use of fuel. To purchase a time permit, pilot participants signed up online and made a simulated payment for a preferred permit duration. To discourage evasion, the program set the time permit prices fairly high at the 95th percentile of driving.<sup>12</sup>



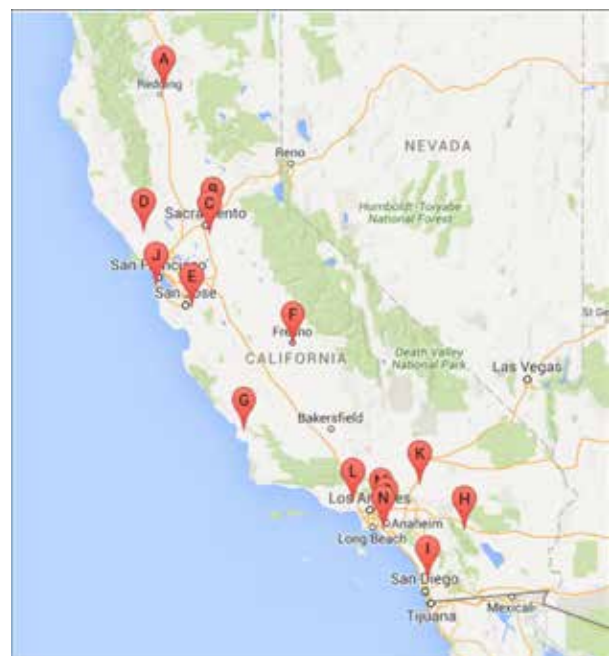
**Mileage Permit.** The mileage permit is a manual reporting method in which the vehicle owner pre-pays for a fixed number of miles. Pilot participants could purchase 1,000, 5,000, or 10,000-mile permits. The mileage permit method required odometer verification to ensure participant did not drive beyond permitted limits. The program required participants to self-report odometer readings at the start and end of the pilot and upon purchase of a new mileage permit.



To measure accuracy and compliance, the program required official odometer readings, either in-person at select Smog Check Referee locations available for the pilot, or by taking odometer images using the OdoCheck App, a smartphone application designed specifically for the pilot to validate odometer images. To obtain a mileage permit, a user signed up online, provided the vehicle's current odometer

reading, chose the length of the mileage permit, and made a simulated payment. The user also had the option of estimating the date of completion of the current permit to generate an automated e-mail reminder in advance of its invalidity.

**Odometer Charge.** The odometer charge is a manual reporting method in which a driver reports miles driven every three months and post-pays for the number of miles traveled since the last odometer reporting. The program required odometer charge participants to report their odometer reading initially upon enrollment but required no up-front payment. Then, after three months, the program asked these participants to self-report their odometer reading and pay the road charge for the number of miles driven since the initial reporting. To measure accuracy and compliance, the program required official odometer readings at the start and end of the pilot, either in-person at select Smog Check Referee locations available for the pilot, or by



<sup>12</sup>The 95th percentile of motorists drive just over 25,000 miles per year (365 days). Factoring a road charge rate of 1.8 cents per mile, Caltrans offered time permits through the CalSAM of \$12.38 for 10 days, \$37.13 for 30 days, and \$111.40 for 90 days.

taking odometer images using the OdoCheck App, the same smartphone application used in the mileage permit. As this method charged for all individual miles without distinguishing out-of-state, off-road, or private road miles, the pilot gave participants the opportunity to request refunds for such travel after the fact. This is similar to how fuel taxes can be refunded for uses off system such as mowing lawns and using a boat.

For participants using either the mileage permit or the odometer charge, the program needed a way to verify if self-reported readings were honest and accurate. Thus, the program required participants using these mileage reporting options to provide official odometer readings. They could make official odometer readings with a mobile phone, or by going to one (1) of 15 Smog Check Referee facilities<sup>13</sup> on one of two Saturdays near the start of the pilot and the end of the pilot.<sup>14</sup> Participants could find Smog Check Referee facilities on select California Community College campuses throughout the state.<sup>15</sup> Referees normally serve as the point of appeal for California drivers who are unhappy with the outcome of a Smog Check. For the pilot, these facilities opened on Saturdays (when they are normally closed) and offered official odometer reading appointments in 15-minute intervals. At the appointment, Referees visually confirmed participant odometer readings and entered them into the CalSAM system using a simple, secure interface via desktop computer or tablet. The pilot made 15 locations available for testing purposes, which spanned the majority of the state.

<sup>13</sup><http://asktheref.org/>

<sup>14</sup>July 9 & 16, 2016 at pilot start; March 18 and 25, 2017 at pilot conclusion.

<sup>15</sup>Foundation for California Community Colleges. Sites featured as illustrated in the image above include the following: Redding—Shasta College, East Sacramento—American River College, Sacramento—Cosumnes River College, Santa Rosa—Santa Rosa Junior College, San Jose—Evergreen Valley College, Fresno—Fresno Career and Technology Center, San Luis Obispo—Cuesta College, Palm Desert—College of the Desert, San Diego—Miramar College, San Bruno—Skyline College, Victorville—Victor Valley College, Woodland Hills—L.A. Pierce College, Whittier—Rio Hondo College, Huntington Beach—Golden West College, Fullerton—Fullerton Junior College.

Commercial Account Managers (CAMs) exclusively offered the following **automated reporting methods**:

- **Automated Reporting with No Location.** Automated reporting with no location allowed participants, should they prefer, to avoid use of location-based technology such as Global Positioning System (GPS). This concept featured technology without any location capabilities. Consequently, this method charged for all miles without distinguishing out-of-state, off-road, or private road miles. The pilot gave participants the opportunity to request refunds for such travel after the fact. Plug-in devices, smartphone applications, and in-vehicle telematics supported automated reporting with no location in the pilot.
- **Automated Reporting with General Location.** Automated reporting with general location allows drivers to avoid paying the road charge for non-chargeable travel such as driving out-of-state, off-road, or on private roads. These methods contain location-based technology, but only report general location through a process known as map matching, which immediately deletes precise location information once the system can accurately categorize travel as chargeable

**Caltrans partnered with the Foundation for California Community Colleges to offer the service for official odometer readings at the Smog Check Referee locations.**

or non-chargeable. Plug-in devices, smartphone apps, and commercial vehicle electronic logging devices supported automated reporting with general location in the pilot. Participants could opt in to retain location information for commercial services, but account managers transmitted no location information to the state.

The technologies described below supported the automated reporting methods for the pilot:

- **Plug-in Device.** A plug-in device is an electronic device that plugs into a vehicle's data port, more formally known as the on-board diagnostics (OBD-II) port. Automakers introduced ports for passenger cars in the 1990s following the California Air Resources Board's regulation requiring such ports for easy, standard provision of emissions and other vehicle-related information.<sup>16</sup> Recently, the OBD-II port has become popular with insurance companies, who created plug-in devices that record mileage data as the basis for insurance premium discounts, a trend called usage-based insurance. Such plug-in devices often offer a range of additional functions to the driver called value-added services, such as keeping a log of trips taken.<sup>17</sup>



In the pilot, the two CAMs offered plug-in devices with no location and plug-in devices with general location to the participants who enrolled with them. These devices differed only in that the devices with no location lacked the GPS location-determination technology found in the devices with general location.

Consequently, the devices with general location could support a range of value-added services that used location information, while the devices with no location could only support those value-added services that did not have location information.

- **Smartphone with No Location.** For the smartphone with no location option, the pilot deployed an application that measured mileage through vehicle odometer images that drivers submitted once each month. Instructions in the form of e-mails, text messages, in-application notifications, or a combination of the three, at the user's preference, remind users to submit the odometer images on time. Aside from taking periodic pictures of the odometer, the app requires no further action from users. This method generates no location information, users report all miles driven, including out of state. Users had the option of requesting refunds, after the fact, for miles driven out of state.



The smartphone application employs a range of security features that make fraud attempts easily detected. For example, the application requires users to submit an image of their Vehicle Identification Number (VIN) upon enrollment. Based on the VIN, the system determines the vehicle make and model, then draws upon its extensive database of passenger car dashboards, which includes nearly all vehicle makes and models sold in the U.S. going back to the 1950s, to ensure that the image provided matches the vehicle on the account. The system uses advanced algorithms to detect image manipulation,

<sup>16</sup>Section 1968.1 of Title 13, California Code of Regulations (CCR), originally adopted on September 14, 1989.

<sup>17</sup>Appendix 18.1: Use of Commercial Account Managers (CAMs) Policy Paper, p. 5-9

both digital (e.g., with Adobe Photoshop) or manual (e.g., taping a false odometer value on the vehicle dashboard and taking a picture of that).

- **Smartphone with General Location.** For the smartphone with general location option, the pilot deployed an application which measures mileage through a proprietary algorithm, that determines when a driver is driving in his/her vehicle using available data (GPS location data, Wi-Fi signals, and other data), and uses the location data to measure miles driven. As a backup to this algorithm, the pilot required smartphone with general location users to submit odometer images once per month through the app,<sup>18</sup> verified in the background through complementary technology. Automatic instructions, in the form of text messages and an in-application notification, informed users to submit odometer images each month. Aside from taking periodic pictures of the odometer, the application required no other action of users.

When users drove out of state, and they had the application running on their phone in the vehicle, the app recorded the miles as out-of-state miles, and thus not chargeable.

- **In-vehicle Telematics.**

Manufactured into vehicles, in-vehicle telematics allow transmission of a range of vehicle data to an internet-based system operated by the car manufacturer, such as Ford's Sync. Now common in new vehicles, industry analysts project that most new vehicles will include telematics systems



**62% of participants using an automated method chose one with location awareness capabilities.**

by 2020. Using in-vehicle telematics for road charge requires agreement from the automakers, allowing access to the in-vehicle telematics data from compatible vehicles. Only a limited number of vehicle makes and models with telematics agreed to offer their data in the Road Charge Pilot Program.

Both commercial account managers offered drivers of supported vehicles to use their telematics systems, allowing for the odometer to be read automatically. To use in-vehicle telematics for mileage reporting, participants with supported vehicles signed up through their commercial account managers and provided their vehicle telematics login information. The pilot did not support location-based services using in-vehicle telematics, as this application is not readily available for telematics.

- **Commercial Vehicle Electronic Logging Device.** A commercial vehicle electronic logging device is a device installed into a commercial vehicle to measure distance traveled for the purposes of paying a commercial vehicle road charge. Currently used in New Zealand to pay road user charges for heavy commercial vehicles.<sup>19</sup> Following professional installation into a commercial vehicle, these devices include a range of security measures that make them

<sup>18</sup>Data needed to be submitted by the final day of a month in order to be included in a given month's mileage reporting.

<sup>19</sup><https://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/>.

**Table 4-1 Comparison of Mileage Reporting Methods and Technologies**

Method/ Technology	Provider	Prepay or Post-pay	Manual or Automated	Fuel Tax Credits?	Value-Added Services?	Vehicles supported
Time Permit	CalSAM	Pre	Manual	N	N	All
Mileage Permit	CalSAM	Pre	Manual	N	N	All
Odometer Charge	CalSAM	Post	Manual	Y	N	All
Plug-in Device with NLNo Location	Azuga, IMS	Pre (Azuga), Post (IMS)	Automated	Y	Y	Most Post 1996
Plug-in Device with General Location	Azuga, IMS	Pre (Azuga), Post (IMS)	Automated	Y	Y	Most Post 1996
Smartphone with No Location	Azuga	Pre	Automated+ Images	Y	N	All
Smartphone with General Location	Azuga	Pre	Automated+ Images	Y	Y	All
In-vehicle Telematics	Azuga, IMS	Pre (Azuga), Post (IMS)	Automated	Y	N	Limited Post 2013
Commercial Vehicle Electronic Logging	EROAD	Post	Automated	Y	Y	CVs

impossible to remove or disable without notice to the device provider. Such devices offer a range of services to the operators of commercial vehicle fleets, such as fleet monitoring.

### SYSTEM DEVELOPMENT AND PRE-PILOT TESTING

The goals and objectives of testing the pilot systems verifies that the technology equipment and software providers develop systems in accordance with the TAC’s design recommendations. It also ensured readiness for a live pilot with real participants. Since the pilot design documents did not specify user interfaces, such as monthly road charge invoices or web portal layouts, testing also identified ways to improve the overall user experience. System testing took place in three phases: unit testing, integration testing, and end-to-end testing.<sup>20</sup>

**Unit Testing.** For unit testing, pilot technology equipment and software providers documented their compliance with technical design documents. The technology providers carried out unit testing themselves, following test procedures and documenting results in formats specified by the oversight team, consisting of staff from Caltrans and consultants. The oversight team allowed customization of certain testing steps to accommodate unique systems, but did not permit changes to the final requirements. Most importantly, the oversight team required vendors to specify how each testing step was taken and to provide written, graphical, raw data, or other evidence of the system passing (or failing) each testing step. To pass, the oversight team required vendors to achieve full compliance with all pass/fail criteria and 90 percent compliance with all other specifications.

<sup>20</sup>Appendices A-5, A-6, and A-7 pilot design documents: *Concept of Operations, Interface Control Document, and System Requirements Specifications, respectively.*

**Integration Testing.** For integration testing, pilot technology equipment and software providers verified the compliance of interfaces between system components against design requirements. As with unit testing, technology providers conducted the testing themselves and documented verification of performance to the oversight team. Importantly for an open system, the oversight team required technology providers to document successful transmission of data using the “standard mileage message” prescribed by the design documents. The oversight team also required technology providers to transmit test data to the account management oversight (AMO) entity, which received data monthly during the live pilot.

**End-to-end Testing.** As a sort of dress rehearsal, end-to-end testing consisted of a pre-operational trial with approximately 40 individual vehicles over a five-day period (May 16-20, 2016) to identify any lingering issues not addressed during unit and integration testing. End-to-end testing comprised several test cases designed to mimic a range of scenarios participants would encounter in the live pilot. Caltrans and partner agency employees volunteered their vehicles for the trial, and each tested a unique scenario during the week of end-to-end testing. Technology providers outfitted volunteer testers with information, and where necessary, assistance to complete enrollment, mileage reporting method selection, account setup, installation of equipment (if necessary), mileage reporting, payment, invoice processing, and account closeout.

**Pre-pilot Test Results.** Unit testing and integration testing proved successful. The devices functioned as specified. The test

results indicated some necessary adjustments for data transmittal, but all parties made changes promptly. End-to-end testing also proved successful and provided useful improvement information. The median error in distance measurement fell within required tolerances, ranging from 0.3 percent to 2.3 percent, depending on the mileage reporting method. The technology providers and oversight team learned the following lessons during end-to-end testing,<sup>21</sup> which were addressed prior to launch of the live pilot with actual participants:

- Participants needed better explanations of how to activate their accounts with an account manager, which required the participant to enter their email address and a six-digit activation code (for example, the pilot delivery team removed 0's, 1's, l's, and O's from the activation codes).
- Participants needed a clear, simple summary of onboarding procedures for each mileage reporting method.
- In the case of smartphone methods, participants needed better explanation for the roles of the smartphone app providers, relative to their account manager.
- Account managers needed to provide clear, itemized invoices to participants, including explanations of fuel tax credits for easier comparison with road charges.
- Smartphone participants needed reminders to submit their odometer readings.
- Vehicles needed screening to ensure compatibility with in-vehicle telematics.

<sup>21</sup>Appendix A-9 – Road Charge Pilot Program End-to-End Test Results Report

## PRIVACY PROTECTIONS IN THE DESIGN AND PREPARATION OF THE PILOT

In keeping with the “privacy by design” approach discussed throughout the TAC process, Caltrans narrowed the scope of information required from volunteers participating in the pilot. In particular, the pilot did not collect vehicle registration numbers, driver license numbers, and other similar personally identifying information often collected as part of other government tax collection programs. However, Caltrans requested, but did not require, additional personal information to assist in the pilot evaluation, such as demographic information and survey responses.

Caltrans developed and shared a *Road Charge Privacy Policy*<sup>22</sup> document with volunteers in advance of enrollment, taking special effort to use plain language in an easy to understand format. As a condition of participation, Caltrans required that volunteers certify they had read and agreed to the pilot’s privacy policy.<sup>23</sup>

- The pilot’s privacy policy makes clear that participant demographic information— would only be used for research purposes, to help policymakers better understand how a road charge might affect groups in distinct ways.
- Legislative directives and TAC recommendations for the pilot both pay special attention to location-based information, specifically travel patterns and trip details. Accordingly, the pilot’s privacy policy emphasizes that participants

**“Very few (4%) of final pilot survey respondents said they experienced a privacy concern while participating in the California Road Charge Pilot Program... Results from the account manager interviews found no instances of Personally Identifiable Information-compromising or other events in violation of the privacy provisions of the State Constitution.”**

*- Final Report on Evaluation of the California Road Charge Pilot Program*

must provide explicit consent to the use of location-based information in the pilot.

- The pilot’s privacy policy also explains that account managers may offer additional, value-added services; that some of these services may require use of location-based technologies such as GPS; and that participants could decline these services without consequence.

As an added protection measure, the pilot’s privacy policy informed participants of their right to review all personal information and data collected and stored by account managers as part of the pilot.

## DATA SECURITY IN THE DESIGN AND PREPARATION OF THE PILOT

The TAC adopted nine standard data security principles, which the project team strictly enforced on all account managers, and a tenth principle— recommending a third-party data security verification of all vendors handling personally identifiable information (Table 4-2). Although participants provided

<sup>22</sup>Appendix 9: Road Charge Pilot Program Privacy Policy

<sup>23</sup>Appendix 10: Road Charge Pilot Program - Policies & Participation Agreement





no financial information, and no real money transactions occurred in the pilot, the application of data security principles would truly test the strength of data security employed in the pilot. The project team translated the TAC’s nine principles into requirements for account managers who handled sensitive participant data, such as personal contact information and driving

data. The requirements covered areas such as minimum password standards, encryption of data for storage and transmittal, destruction of data, and general network security best practices. In fulfillment of the TAC’s principle on Data Security Verification, an independent contractor was hired to evaluate all account management and mileage reporting vendors, as well as the pilot delivery team, on 17 areas of data security.<sup>24</sup>

**Table 4-2 Data Security Principles in the Pilot**

#	Area of Data Security	How Applied in Pilot
1	Authentication	Minimum of 8-character passwords, letters and numbers, one capital, require periodic password change
2	Authorization	Employ user roles with limited rights to personally identifiable information access
3	Data Modification Notification	Participant notification to motorist via e-mail of changes to critical data
4	Data Masking	Mask means of simulated payment and VINs
5	Encryption	Use 128-bit AES encryption
6	Data Storage	Use 128-bit AES to encrypt primary and backup data; store location data only in mileage buckets
7	Data Transmittal	Use mileage buckets to transmit mileage data; use 128-bit AES
8	Data Destruction	Destroy mileage data within 30 days of end of the pilot program. Destroy data on devices when data receipt confirmation received from account manager.
9	General IT Network Security	Use ISO 27002 best practices
10	Third-party Data Security Verification	To independently verify that account managers had sufficiently secure systems, to reduce the likelihood of any data compromises, a third-party vendor performed a security verification on all account management and mileage reporting vendors, as well as the pilot delivery team. All firms passed verification.

<sup>24</sup>Appendix A-11: Road Charge Pilot Program Security Review - Final Report



# V. Road Charge Pilot Operations

Following setup and testing of the technology and software for mileage reporting, account management, recruitment and invitation of volunteers, the nine-month live pilot launched on July 1, 2016. The facilitation of the live Road Charge Pilot Program was performed by the following:

**Caltrans staff** oversaw and directed all activities related to the delivery and execution of the pilot, including identification of issues, review of all pilot operations, pilot communications, and making final decisions regarding pilot operations and participant communications.

The **pilot delivery team**, consisting of staff from a prime consultant and a number of sub-consultants, coordinated activities of the account managers and mileage reporting vendors, operated the account management oversight database, operated a customer service phone and email center, maintained a program website and participant registry, generated monthly reports on pilot progress, and responded to pilot operational issues as they arose.

**Account managers**, provided mileage reporting and account management services directly to participants as well as a customer service center. The account managers provided monthly data to Account Management Oversight (AMO) and interacted extensively with the pilot delivery team to answer questions and resolve issues as they arose.

Other **technology vendors**, offered mileage reporting technologies and services to participants through the account managers.

Together, the above entities composed the **project team**.

The **independent evaluator**, developed and launched surveys to pilot participants at the beginning, middle, and end of the pilot (as well as trigger-based surveys on topics that arose throughout the pilot). They facilitated five focus groups during the final month of the pilot with participants around the state, and conducted interviews with vendors, the interagency workgroup, the pilot delivery team, and Caltrans staff at the beginning, middle and end of the pilot. Lastly, they analyzed all data from account management oversight.

The pilot organization is illustrated in Figure 5-1.

## PARTICIPANT ENROLLMENT

The TAC identified thirty-five separate recruitment targets to fulfill for the pilot. These goals included participants based on location, vehicle type, age, income, gender, race, and

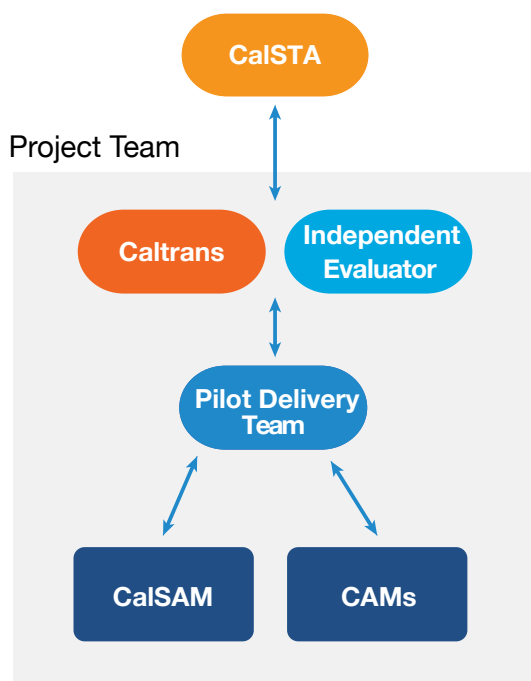
ethnicity. These targets were intended to include 4,500 personal vehicles and 500 commercial and government fleet vehicles. Some individual participants registered more than one vehicle, and in some cases with different account managers, so the number of participating individuals was less than 5,000 while the number of participating vehicles was slightly greater than 5,000.

An individual interested in volunteering for the pilot completed and submitted an online volunteer recruitment form, which included general geographic and demographic information. The pilot delivery team invited volunteers to register one or more vehicles with an account manager, via a welcome email.<sup>25</sup> Volunteers preferring engagement offline could call the state account manager, CalSAM, and request offline enrollment.

The initial enrollment period began on June 13, 2016 and lasted approximately eight weeks, with 8,698 individuals invited. The project team prioritized invitations to participate among those volunteers who best filled the various recruitment targets established by the TAC. A central program telephone and email help line service center, with customer support protocols, was established to assist volunteers with the enrollment process, and as a resource for selecting a mileage reporting method and account manager. Additionally, each account manager provided customer care centers, via telephone and email, to assist with enrollment completion. Figure 5-2 depicts the enrollment process.

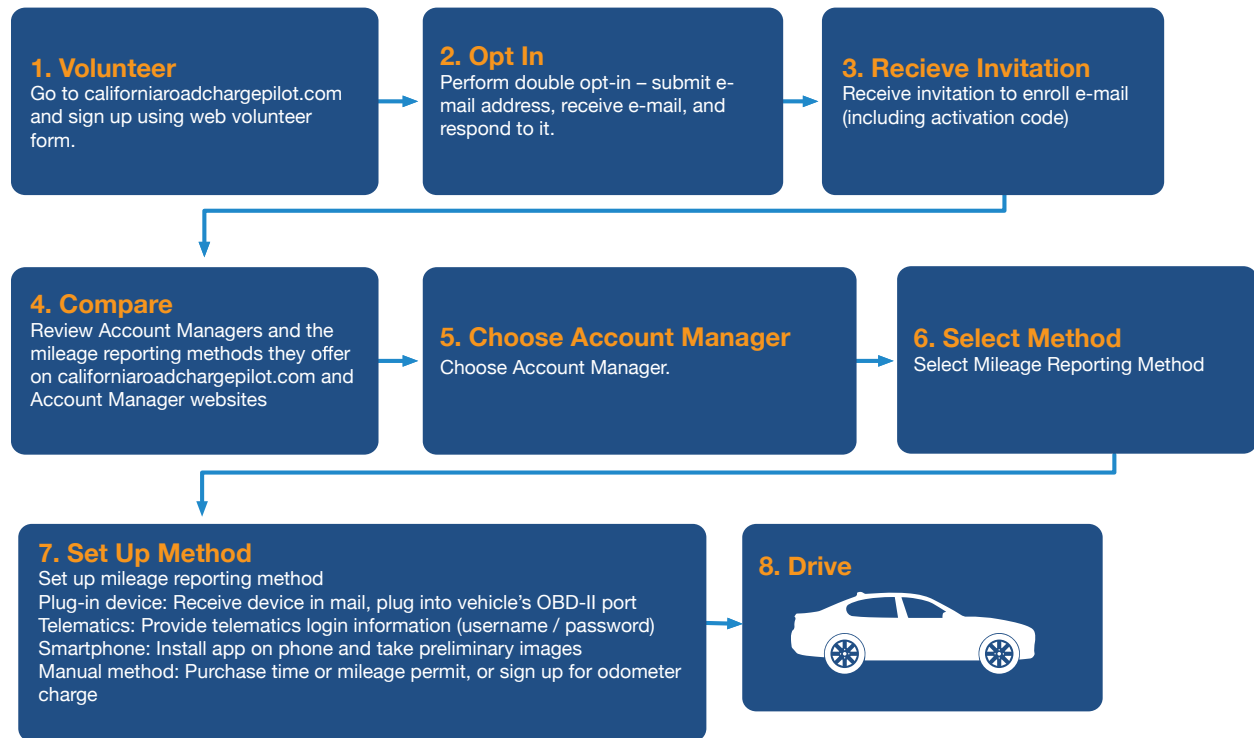
To avoid overwhelming the customer service centers and to ensure each participant received excellent customer service, invitations were sent sequentially to subsets of the volunteer pool in a tiered enrollment

**Figure 5-1: Pilot Organization**



<sup>25</sup>Appendix A- 12: Road Charge Pilot Program Sample Welcome Email

**Figure 5-2 Enrollment of Participants**



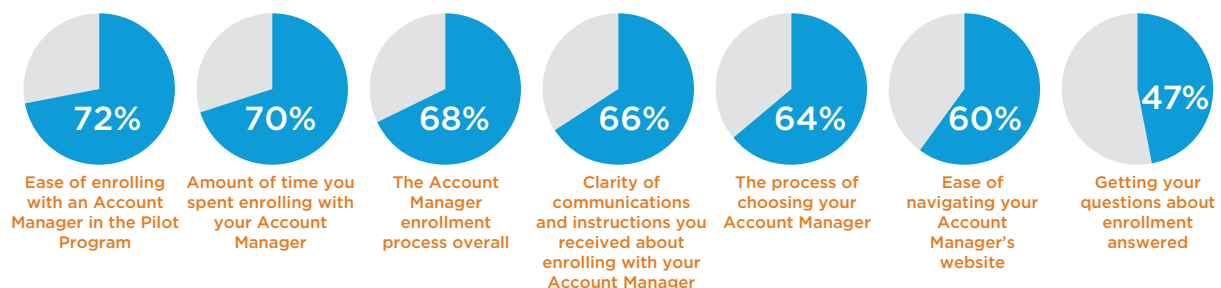
recruitment strategy. The majority of participants were satisfied with the enrollment process as evidenced by the survey results, shown in Figure 5-3.

Each invited volunteer received up to four reminder e-mails if they failed to create a vehicle account with one of the three account managers. Once an invitee created a vehicle account, the volunteer was deemed a participant, enrollment reminders ceased, and

the vehicle was counted toward participation goals.

For commercial participants, direct invitations were sent via either phone calls or e-mails, followed by a welcome e-mail. Additionally, the California Trucking Association assisted in the identification of potential participants for the heavy vehicle participation in the Road Charge Pilot Program.

**Figure 5-3 Participant Perspective on Enrollment Process**



Not everyone who enrolled in the Road Charge Pilot Program fulfilled the program requirements for initial compliance. Some participants received, but did not install plug-in devices in their vehicles. Others failed to report initial odometer readings, correctly install smartphone apps, enable telematics accounts, or purchase permits from the CalSAM. The CAMs and CalSAM contacted such participants to encourage them to comply, however some participants remained non-compliant even after several attempts to reach them. After a specific amount of time they were dropped from the program. In order to maintain the pilot sample, enrollment remained open through December.

## PARTICIPANT COMMUNICATIONS

Keeping pilot participants, stakeholders, policy makers and the general public informed on the progress of the pilot was critical to the research. The creation of the program website and central customer service center (offering both telephone and email support) was the primary means of communication. However, there were many ways for participants and the general public to provide feedback, and create two-way communication with the project team.

### **Program Website.**

The Road Charge Pilot Program website, [www.californiaroadchargepilot.com](http://www.californiaroadchargepilot.com), provided a broad range of information to the public and participants, as well as a means to contact the program delivery team, including:

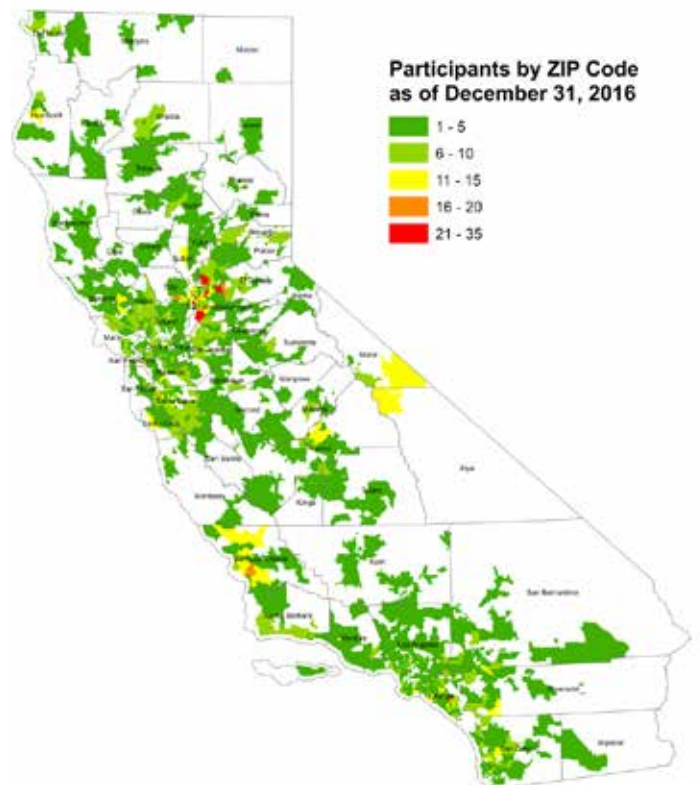
- Program landing page
  - » What is road charge?
  - » Introduction to mileage reporting methods
- Live pilot status and current events

- Road Charge Pilot Program background
  - » Why study road charge?
  - » Legislative authorization
  - » TAC process
- Frequently asked questions
- Sign-up page for participant enrollment
- Interest list sign up page for general pilot update
- Other general program resources

**Pilot Program Newsletters.** Caltrans prepared monthly newsletters for distribution to participants and the general public describing:

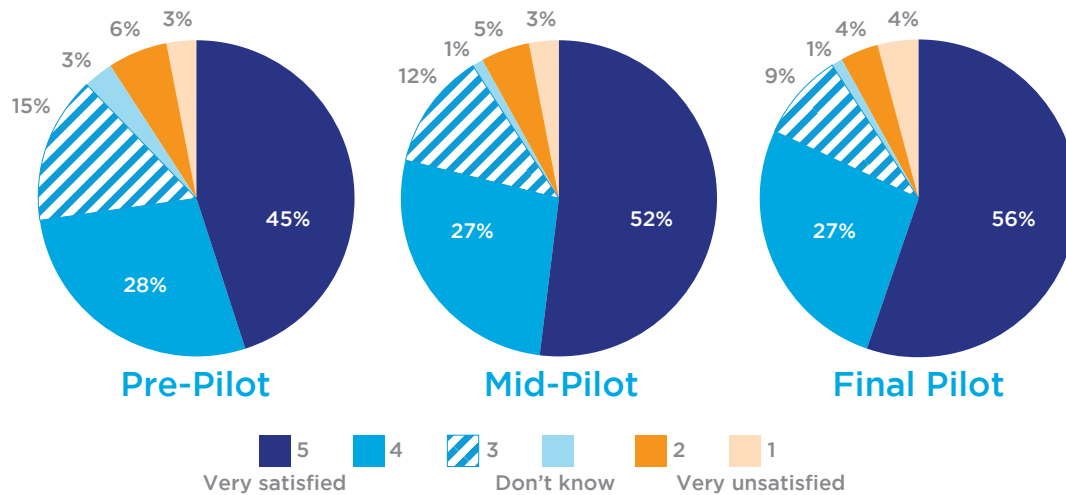
- Intermediate results and project progress
- Upcoming events and important pilot milestones
- Volunteer “spotlights” where participants could share personal stories

**Customer Service Center.** A customer service center was set up to provide e-mail and 24/7



## How satisfied are you with the following?

Clarity of communications and instructions you have received about the Pilot Program:



phone assistance for participants. The service center personnel were trained to handle the majority of road charge related inquiries throughout the pilot. The customer service center strived to respond to emails within 24 hours and achieved a 98 percent response rate.

**Surveys and Focus Groups.** In order to maintain the protection of personally identifiable information and participant anonymity, Caltrans and the pilot delivery team facilitated communications from the independent evaluator to participants in the following manner:

- **Surveys.** The pilot delivery team provided survey information to participants via e-mails featuring a link to the independent evaluator's surveys. And hardcopies of the surveys were mailed to offline participants.
- **Focus Groups.** The pilot delivery team informed pilot participants of the opportunity to participate in the five statewide focus groups via e-mails featuring a link to the independent evaluator's screening survey.

Additionally, all account managers communicated directly with their participants via their website, e-mail communications, and customer care centers. Caltrans required the account managers ensure pilot participants received accurate, relevant, and timely information. This put the responsibility on the account managers to have experienced, customer-oriented service centers to connect with participants one-on-one, handle general questions, field hardware and software installation questions, and investigate invoice issues.

## ADDITIONAL LIVE PILOT OPERATIONS

**Participants Leaving the Pilot.** Some participants decided to leave the pilot for various reasons. Exiting the pilot was facilitated through the account managers. Closeout instructions and materials were transmitted to the participants. Once the participant completed and returned the closeout materials, their account manager sent them a final statement. In total, 169 participants dropped out of the program, representing only 4 percent of the pilot participants.

**Participants Changing Vehicles.** For changing vehicles in the pilot, participants simply contacted their account manager and expressed their desire to change vehicles. The account manager responded by updating their account and providing new mileage reporting equipment. In total, 118 vehicles were changed, representing 2 percent of the vehicles that completed the pilot.

**Initial vs. Ongoing Compliance.** Pursuant to the TAC's observation that strict enforcement for a volunteer pilot would be inappropriate. Compliance activities consisted of direct communications from account managers to non-compliant participants to encourage both initial and ongoing compliance.

A participant achieved initial compliance for a given vehicle by performing the initial setup required, based on the following scenarios:

- For vehicles using plug-in devices, plugging the device into the vehicle for the first time.
- For vehicles using smartphone methods, this meant installing the app and sending in the first odometer and vehicle identification number images.

- For in-vehicle telematics, this meant providing the account identification and password for access to the carmaker's telematics account.
- For manual methods, this meant adding a vehicle to the customer's CaSAM profile, selecting a mileage reporting method, and self-reporting the odometer reading.

Participants who failed to become initially compliant within four weeks of signup received reminder emails beginning in late August 2016. These reminders indicated they would be dropped from the pilot in two weeks if they did not become initially compliant. If the participant failed to respond by becoming compliant, they were removed from the pilot and replaced with newly enrolled participants.

The procedure for maintaining compliance depended on the mileage reporting method. To detect ongoing compliance, account managers measured the number of participants who correctly reported miles driven in each month according to their method. For habitually non-compliant participants, account managers sent e-mails and, in some cases, placed phone calls, reminding participants to plug in their devices, provide photos of their odometers,



purchase a mileage or time permit, or update their in-vehicle telematics login information. The pilot delivery team compiled compliance rates monthly into a compliance report.

**Simulation of Interoperability.** During pilot operations, the project team successfully tested a simulation of interoperability with OReGO, an operational per-mile charge program in the state of Oregon. Simulated interoperability was available from January 1, 2017 - March 31, 2017 for all participants using the IMS plug-in devices with location (894 participants at the conclusion of the pilot).

**Handling Incidents.** No major incidents occurred during the pilot. Risk management strategies were incorporated in the Road Charge Pilot Program early in the process and throughout the pilot. For account managers, the pilot delivery team created detailed guidelines for how they should respond to a range of incidents, including safety, accuracy, lost data, participant dissatisfaction, and misbehavior. In general, this escalation process tasked the account managers with identifying the incident as soon as it occurred and notifying the pilot delivery team immediately, who documented the issue and resolution on behalf of Caltrans. In rare instances,

participants communicated concerns directly to Caltrans staff. A rapid response team consisting of Caltrans, pilot delivery team and account managers convened to address the issue, and in most cases, Caltrans staff and the pilot delivery team jointly decided the best course of action.

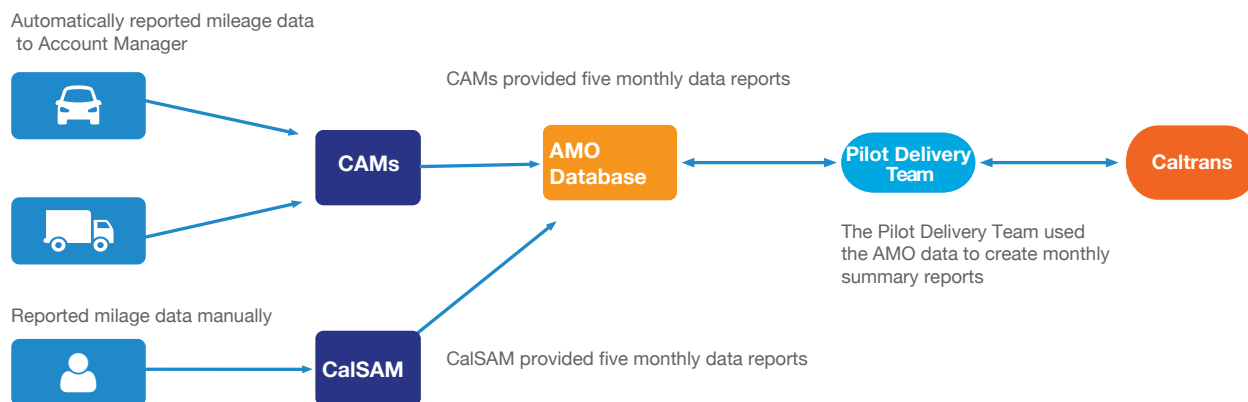
**Manual Simulated Refunds for Non-chargeable Miles.** For non-location reporting methods, the pilot treated all miles recorded as chargeable at the California rate of 1.8 cents per mile. The pilot gave participants using non-location reporting methods the opportunity to request an exemption for simulated road charges for non-chargeable miles by requesting a simulated refund.<sup>26</sup>

The full scope of pilot operations is depicted in Figure 5-4.

## DATA COLLECTION SYSTEMS AND OVERSIGHT

Account managers collected mileage data from participants for the purpose of gathering information essential to generating a simulated road charge invoice. The pilot delivery team and Caltrans staff provided oversight of all vendor data collection. Additionally, the pilot

**Figure 5-4: Pilot Data Collection Systems and Oversight**



<sup>26</sup>Appendix A-13: Road Charge Pilot Program - Non-chargeable Mileage Refund form



delivery team provided account management oversight, which constituted monthly data reporting, accounting, and reconciliation; and a one-time audit of the account management activities and processes for each of the four account managers.

**Monthly Data Reporting and Accounting.**

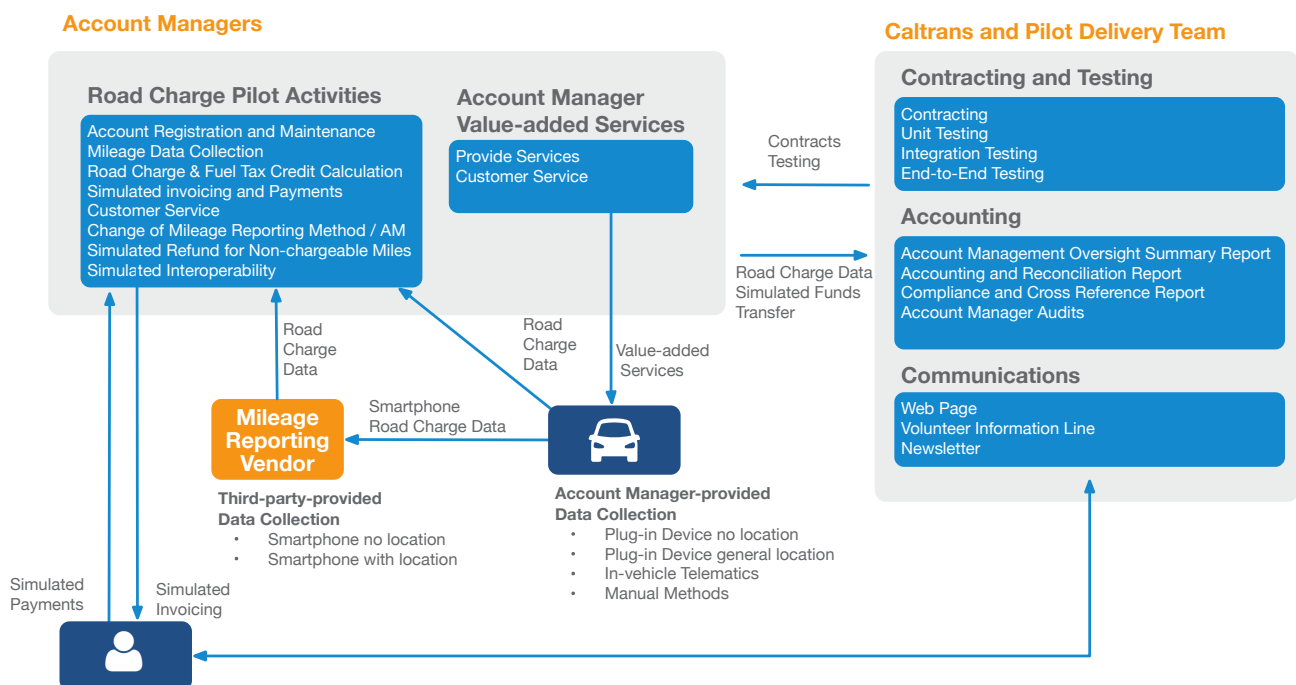
Monthly accounting included analysis of the monthly reports the account managers compiled for the previous month’s data. These five monthly reports included summary data on road charge activities for each day of the preceding month.

This suite of reports collectively provided information regarding total miles traveled, simulated revenue collected and fuel tax credited, and errors detected by the vehicle, mileage reporting method, and account manager. The pilot delivery team compiled a monthly summary of the five reports and corresponding data provided by each CAM and the CalSAM into an Account Management

Oversight (AMO) report. The five monthly data reports are as follows:

1. **Mileage and Road Charge Revenue Report**—total chargeable and non-chargeable miles by state, as well as fuel tax credits and net revenue, for each account manager
2. **VIN Summary Report**—total miles and charges by month for each vehicle with an automated mileage reporting method
3. **VIN Manual Methods Summary Report**—a record of each manual method permit (time permit, mileage permit, or odometer charge) purchased in a given month for each vehicle with a manual mileage reporting method.
4. **Errors and Events Report**—a report of any errors or events that may have occurred for each vehicle that experienced an error or event (such as a device being unplugged)
5. **Account and VIN Update Report**—a list of all accounts and enrollment (dropped/added/active)

**Figure 5-5: Pilot Operations**



**Monthly Reconciliation.** The pilot delivery team's Certified Public Accountant performed monthly data analysis with the goal of observing trends and potential issues, compiling this information into an **Accounting and Revenue Report**. This report included analysis of mileage and revenue trends, indicators such as miles driven per vehicle and average fuel economy per vehicle, as well as an analysis of trends in permit purchases, errors and events, and enrolled vehicles. The pilot delivery team investigated any anomalies pertaining to reconciliation of the number of miles, dollars, detection of excessive errors or events. Investigation typically entailed requiring the account manager for an explanation or providing additional data.

**Account Manager Audit.** The pilot delivery team's accountant performed an audit of each account manager in early 2017 to determine the auditability of the account managers in the context of the Road Charge Pilot Program. The audit entailed review of account manager documentation on internal procedures and controls, analysis of sample transaction data, and interviews with account manager staff. The pilot delivery team synthesized the results of the document review, raw data analysis, and interviews into a **Final Audit Report**.<sup>27</sup>



<sup>27</sup>Appendix A-14: California Road Charge Pilot Program Account Manager Audit Report

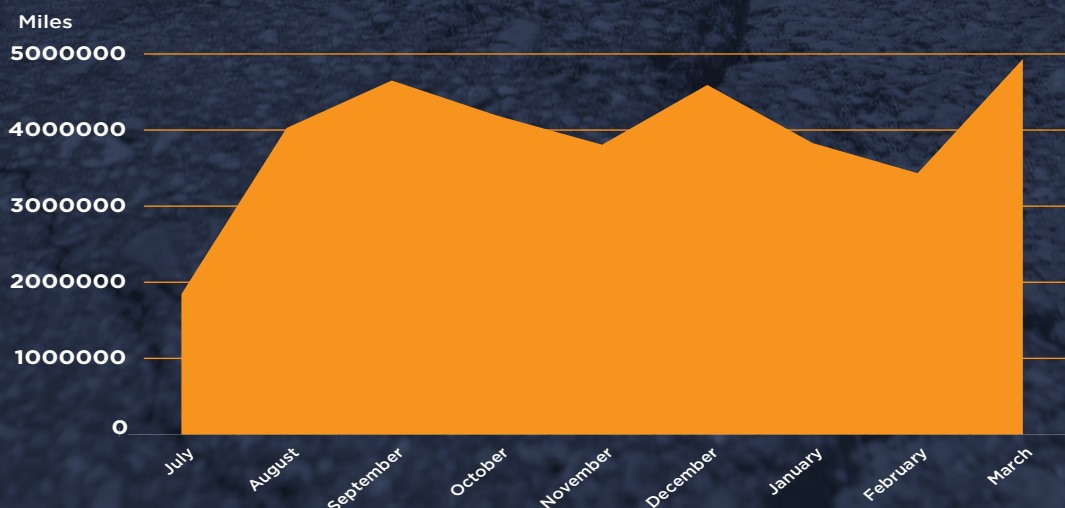
# VI. Pilot Results and Observations

Fundamentally, a road charge program must obtain mileage data from motorists, collect revenue, and provide a safe and positive experience for the motorists paying the charge. Nine months of operations produced sufficient information to analyze the effectiveness of the Road Charge Pilot Program and determine the feasibility of a future operational program. The following section covers the pilot results, followed by the observations made during this test.

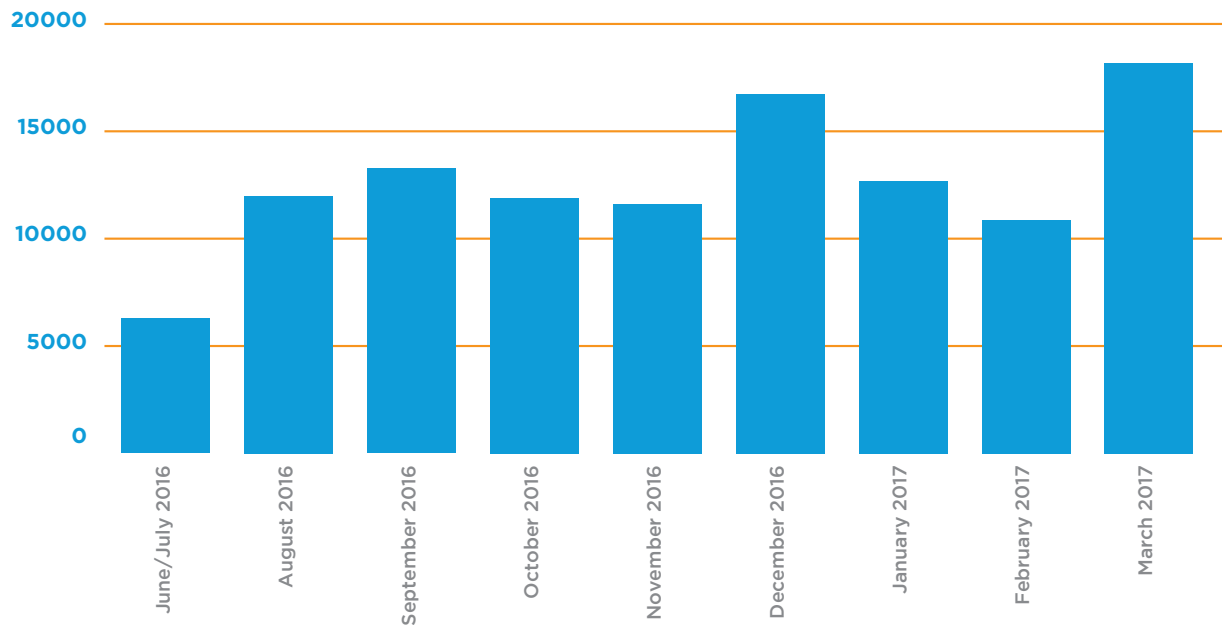
## MILEAGE AND REVENUE SUMMARY

Participants reported miles driven, either manually or automatically. During the initial month of the pilot, July, the program experienced a lag in mileage reporting due to ongoing enrollment. However, by August, total monthly mileage neared a fairly steady state. Monthly mileage remained steady thereafter except for small peaks in September, December, and March, due to quarterly mileage reporting by participants on the odometer charge method. The following figure illustrates the miles driven throughout the pilot.

**Figure 6-1 Total Miles Driven**



**Figure 6-2 Road Charge Net Revenue by Month**

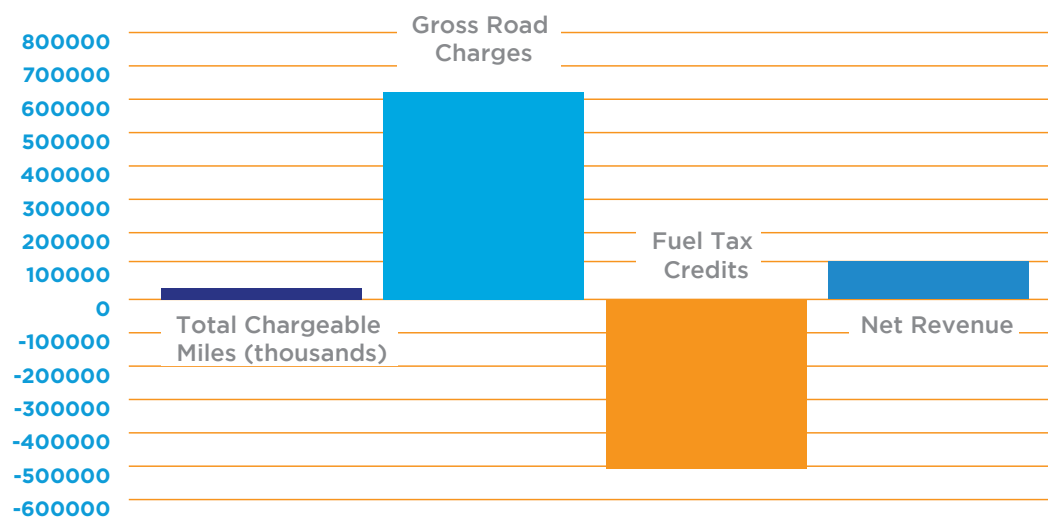


In correlation, road charge simulated revenue collected, as seen in Figure 6-2, also stabilized except for the months of September, December, and March, which produced an increased amount of road charge revenue due to quarterly reporting by participants utilizing manual road charge reporting methods with the CalsAM.

### SIMULATED PILOT REVENUE

For purposes of evaluating the effectiveness of a road charge, the TAC recommended establishing a revenue neutral rate to simulate a road charge. Given that direction, a rate was established prior to the deployment of the pilot, taking the five-year average of the gas tax (base and price-based excise) and dividing by the average miles per gallon of the entire California fleet. As a result, the rate used for the pilot was set at 1.8 cents per mile.

**Figure 6-3 Cumulative Net Revenue**



**Observation:** While this rate reflects a revenue-neutral rate based on the California fleet average. When compared to the sample of vehicles participating in the pilot, the simulated road charge rate was not revenue neutral. This was due to the pilot sample fleet having an average miles per gallon higher than the statewide average. At the time of the rate setting exercise, there was no way to predict what composition of vehicles would actually participate in the pilot. Figure 6-3 graphically illustrates the cumulative net revenue for the pilot.

### PARTICIPANT PERCEPTIONS

Critical to measuring the feasibility of a road charge was the gauging of participant perceptions throughout the pilot. These measures were performed via qualitative and quantitative methods:

- Analysis of Customer Service Center Inquiries
- Participant Surveys, and
- Focus Groups

The Road Charge Pilot Program developed and maintained a program Customer Service Center, as well as each Account Manager

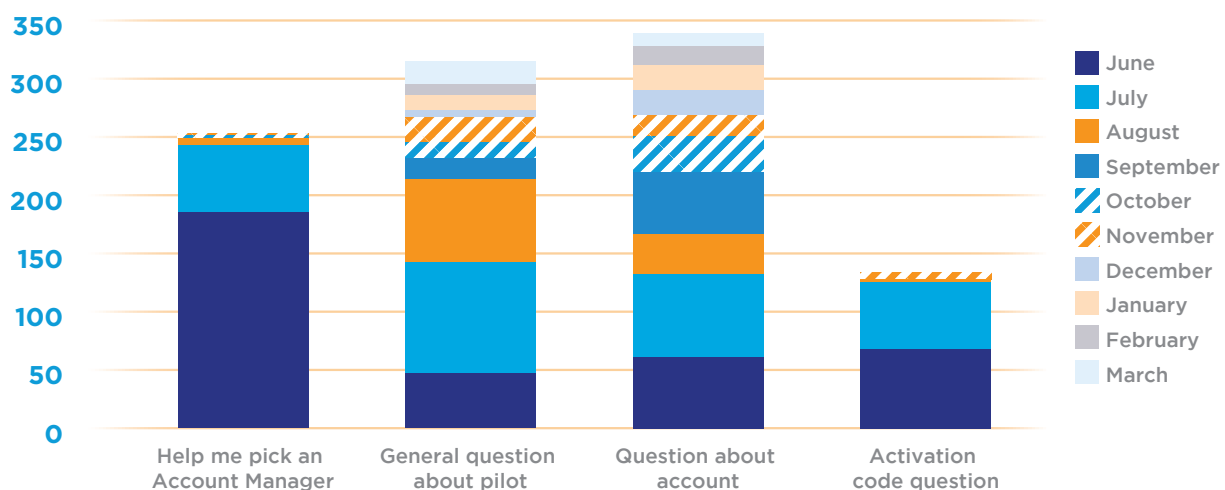
administered their own Customer Care Centers.

### Customer Service Center & Customer Care Center Activity

The program customer service center featured live agents available 24/7 to receive phone calls from customers, as well as a team of agents prepared to respond to email inquiries within 24 hours. The customer service center agents were trained on a detailed script developed by the pilot delivery team to include answers to a wide range of potential participant questions. During the pilot, the program customer service center received 214 phone calls and 1,512 emails. Figure 6-4 represents the top participant issues through the pilot, with most inquiries coming in the first two months of the pilot, when participants e-mailed or called seeking help selecting an account manager, setting up an account, installing devices, or downloading smartphone applications.

The four account managers maintained their own customer care centers featuring live phone agents and a team of agents able to respond via email to inquiries. Call volumes for each account manager varied, but generally

**Figure 6-4: Top Participant Issues**



were proportional to the number of vehicles enrolled. Similar to the program customer service center, most calls and emails came early in the pilot during account selection, setup, and installation (Figure 6-5). After initial enrollment was complete in August, the call volumes settled to a relatively low and steady state. Most calls to account managers involved billing questions, technical support, and enrollment (such as adding or changing vehicles).

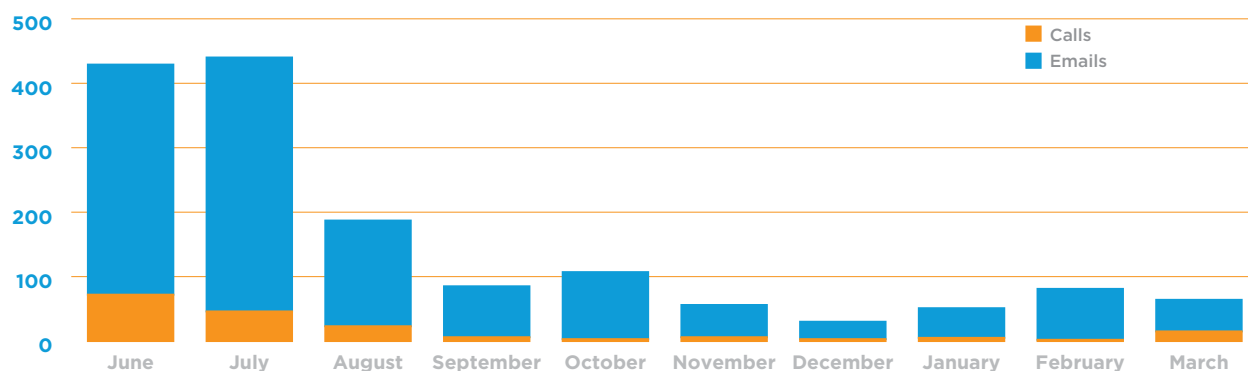
Overall, the customer service centers provided an indirect indicator of participant satisfaction and issues. Across all five service centers (the program customer service center and each of the four account managers) over 10 months (June through March), there was slightly more than one customer service interaction via phone or email per vehicle enrolled. Given the variety of issues and the short conversations (averaging 5 minutes with the general help desk), the customer

service center information provides a limited glimpse of participant experiences.

In an effort to solicit objective feedback on the Road Charge Pilot Program, Caltrans, at the recommendation of the TAC, enlisted the assistance of an Independent Evaluator to conduct a series of surveys and focus groups. Utilizing the evaluation criteria developed by the TAC the Independent Evaluator developed a series of experiential and attitudinal questions, to be administered to all the participants. Three surveys were facilitated at the beginning, middle, and end of the pilot, in order to measure any changes in participant perception over the life of the pilot. Additionally, two trigger-based surveys were administered to a smaller set of participants based of the following situations:

- Those who chose a method requiring device installation or downloading of a smartphone application at the outset; and

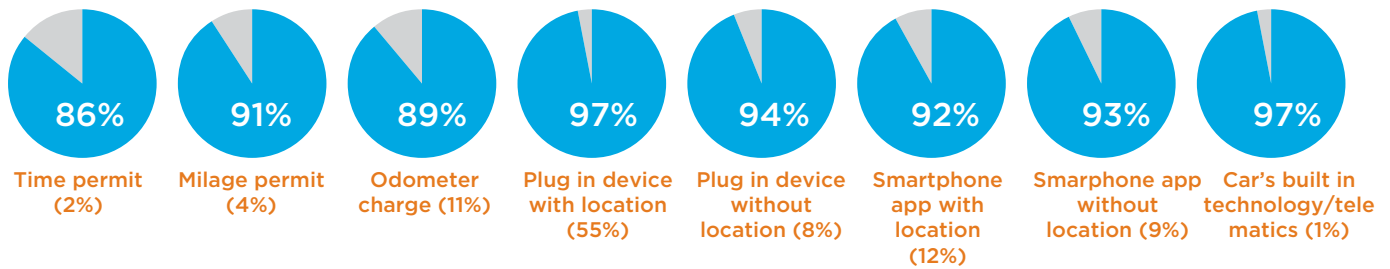
**Figure 6-5: Volunteer Information Line Call and Email Volumes**



**Table 6-1 Survey Responses and Margins of Error**

Survey	Number Distributed	Number Completed	Response Rate (percent)	Margin of Error (percent)
Pre-pilot Survey Part 1	4,237	3,529	83	± 0.7
Pre-pilot Survey Part 2	3,760	2,885	77	± 0.9
Mid-Pilot Survey	4,198	2,533	60	± 1.2
Open Enrollment Survey	90	68	76	± 5.9
Final Pilot Survey	3,998	2,748	69	± 1.1

**Figure 6-6: Participant Views on Ease of Reporting**



- Participants who changed reporting methods during open enrollment in November 2016

As illustrated in Table 6-1 survey response rates were: 83 percent, 60 percent, and 69 percent for the beginning, mid-point, and end surveys, respectively, providing a fairly comprehensive picture of participant experiences and views.

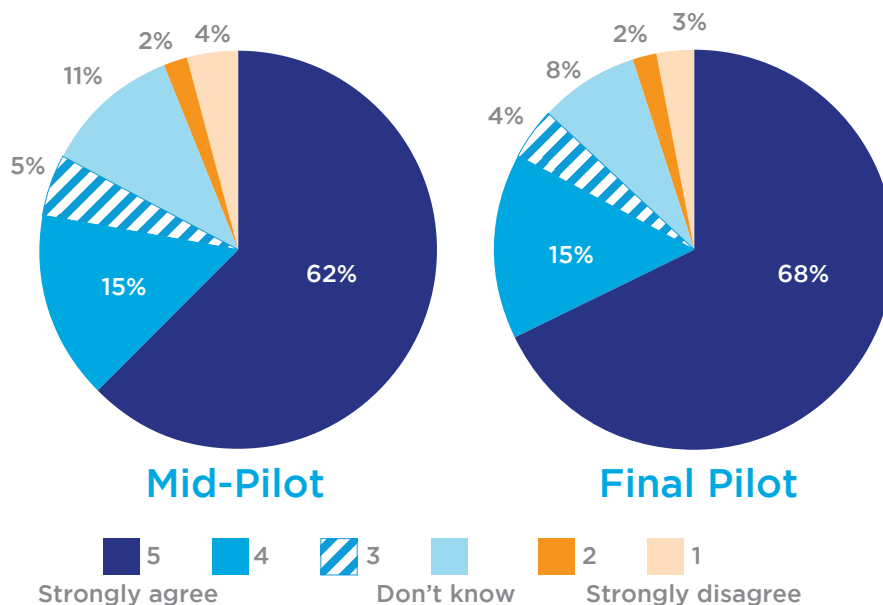
Based on participants that responded to the surveys:

- 73% felt assessing a road charge based on use was a more equitable transportation funding solution than a consumption-based gas tax

- 81% stated a road charge model should continue to be researched
- 91% were willing to participate in another road charge pilot
- 85% overall pilot satisfaction, which is further supported by the low rate of attrition of 4.1%

As Figure 6-6 shows, participants who chose an automated approach were more likely to agree that their reporting method was easy to use than participants using manual methods. That said, even manual method participants had high rates of satisfaction with ease of use.

**Figure 6-7: Participant Views on Data Accuracy**



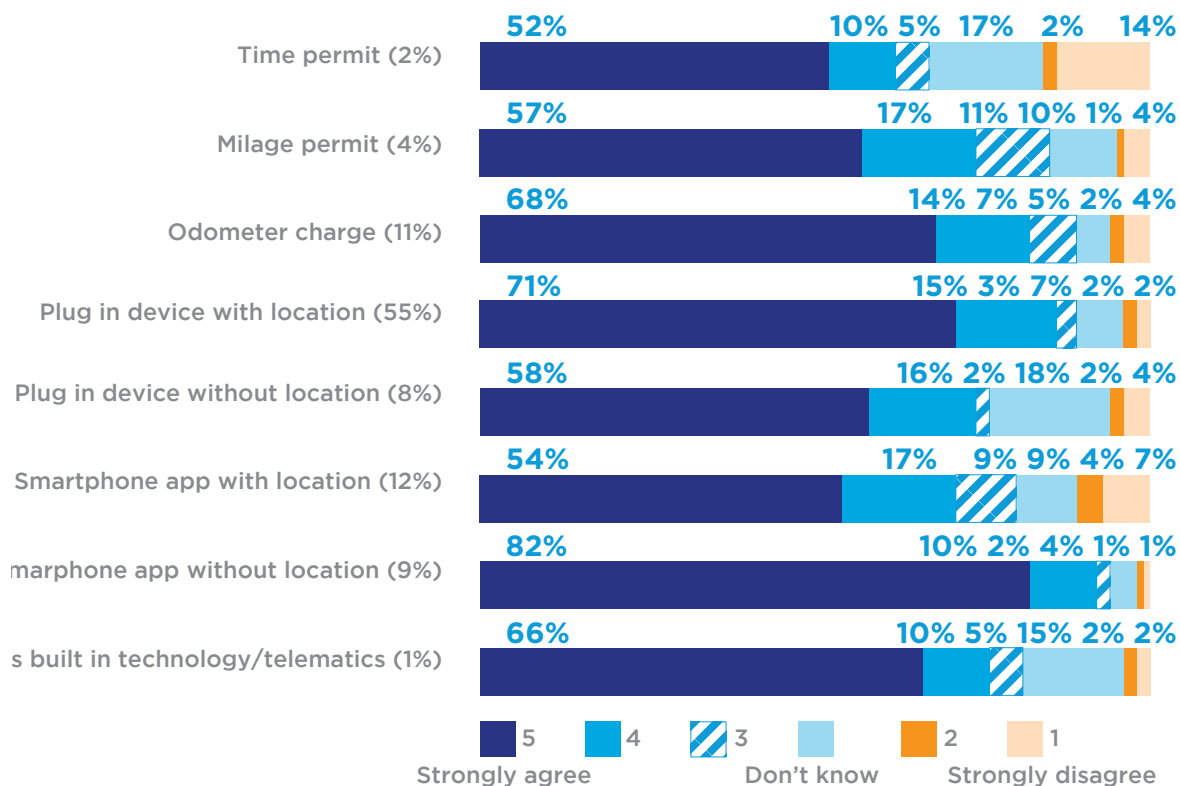
The majority of participants believed that their mileage reporting method accurately reported their trips (Figure 6-7), although these numbers skew higher for automated reporting methods (Figure 6-8). Participants believed the most accurate measuring method was the smartphone app without location, which is not surprising since it is based on a photo the participant takes of his or her own odometer.

The pre-pilot participant survey results indicated most participants (79%) were satisfied with the mileage reporting options they had to choose from, and over half were very satisfied. Few participants believed that a different reporting method would have been better than the one they chose, and most (83%) agreed that they made the right choice of reporting method.

Attitudes towards the clarity of invoices and transparency of charges increased during the pilot. With 78 percent of participants were satisfied with both the clarity and transparency of the charges on their invoices at the end of the pilot.

At the conclusion of the pilot, overall participant satisfaction levels with the program reached their peak, with 61 percent of respondents describing themselves as “very satisfied.” During the pilot, a total of 169 participants dropped out, representing 4 percent of the total enrolled. Most participants dropped without providing a reason, but for those who did, the most common reasons cited were personal reasons such as moving, illness, death, or vehicle being out of service.

**Figure 6-8: Participant Views on Data Accuracy by Mileage Reporting Method**





## Focus Groups

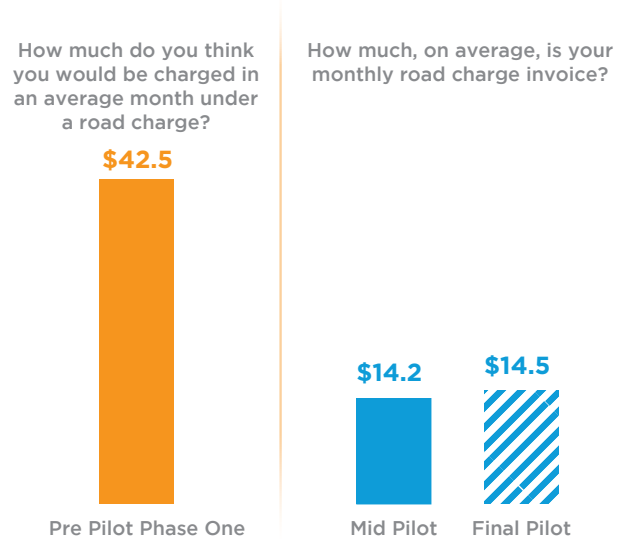
According to participant feedback through focus groups, most participants were satisfied with their choice of mileage reporting method, however some focus group participants did not have a good understanding of the other methods available. They stated information about the options at enrollment did not lend itself to a fully informed choice. That said, most of the focus group participants did not switch reporting methods or account managers during open enrollment, as they were comfortable with their initial choices.

Focus group participants had mixed feelings about their invoices. Some ignored their invoices because they knew no real money was at stake. While others scrutinized the information and discovered they paid less than expected. In fact, on average, participants paid only about one third of what they expected to pay (Figure 6-9).

The focus groups also reinforced the survey results regarding data security and privacy was not a major concern. Focus group participants believe their information is “already out there,” so they did not worry about it. Those who expressed concerns did not, by and large, investigate the privacy and data security procedures in place for the pilot.

Overall, focus groups believed that replacing the gas tax with road charge was “a good idea.” They understood the limitations of the current transportation funding methodology in California, and paying by the mile is a way to ensure everyone pays their “fair share.” That said, many remained skeptical about widespread implementation of road charge, particularly regarding how to ensure compliance among those seeking to cheat the

**Figure 6-9: Participant Initial Estimate of a Road Charge versus Actual**



system and proper use of revenues collected by government.

For more information on participant perceptions reference Appendix (A-3) the Evaluation of the California Road Charge Pilot Program.

## OBSERVATIONS

The Road Charge Pilot Program tested the functionality, complexity, and feasibility of the critical elements of this new potential revenue system for road funding, including participant enrollment, mileage reporting methods and technologies, invoicing and mock payments, and account management. Relying on the account-based approach for collecting road charges, the pilot also tested the effectiveness of business rules for account managers.

There were many valuable observations during the pre-pilot activities and live demonstration, which will help guide future demonstrations to refine the program for

potential statewide operation. The following section details the observations made in the following areas:

- Communications
- Vendor Procurement
- Systems Testing
- Mileage Reporting Methods
- Mileage Reporting Technologies
- Account Management & Account Management Oversight
- Road Charge Exceptions
- Organizational Design
- Compliance and Enforcement

## **Pilot Participation**

**Participant Enrollment.** The process for enrolling volunteers as pilot participants and selection of mileage reporting methods proved feasible and not complex. The strategy of enrolling participants in batches rather than all at once avoided overloading the account managers on a given day.

**Observation:** Enrolling in phases provided some challenges in achieving the targeted enrollment goals recommended by the TAC. In future demonstrations, a thorough recruitment and enrollment action plan, as well as an attrition strategy, needs to be developed as early as possible to better ensure full participation.

**Reporting Method Selection.** Choosing a mileage reporting method proved the most complex part of the enrollment process. Using an interactive decision tree on the main web page—[californiaroadchargepilot.com](http://californiaroadchargepilot.com)—participants chose a preferred mileage reporting method and an account manager by comparing the alternatives side-by-side.

**Observation:** Every effort to inform the participants of their choices, however in future demonstrations or a live program additional education is needed to help drivers new to the road charge concept differentiate between mileage reporting options.

**Comprehensive Guidance.** Once the participant identified their preferred mileage reporting method and account manager they were linked to the account manager web portals via the main web page. At this time, participants could sign up by (1) entering their personalized vehicle activation code provided in their welcome email; and (2) filling out some brief forms providing a range of personal and vehicle information.

**Observation:** Participants had the most difficulty locating and correctly keying in their vehicle's Vehicle Identification Number (VIN). However, there were mixed responses on the level of difficulty to complete enrollment. Some participants stated the enrollment process was easy and straightforward, while others found it cumbersome and onerous because it required certain information to complete the process, such as the VIN, license plate number and initial odometer reading.

In a future road charge program, the authorized agency must provide clear guidance to participants when selecting a mileage reporting method and account manager, both by web and phone. In addition, account managers should provide comprehensive guidance on the various ways to locate the VIN for a given vehicle.

**Program Cohesiveness.** Once the participants selected a mileage reporting

method, they were directed to an account manager web portal to establish an account. Some participants experienced confusion between the program organization (Caltrans) and the account managers' organizations. According to focus groups, some participants found the term "account manager" confusing and struggled to distinguish between them.

**Observation:** For ease and simplicity of enrollment, streamlining the process with one central branded sign-up website could help reduce the frustration and any confusion.

**Accessibility.** The pilot offered on-line and off-line support in choosing a mileage reporting method and account manager. The majority of the pilot participants utilized the web-based services, there were three participants that opted for a more personalized (not web-based) experience.

**Observation:** Currently the majority of the population is accustomed to enrolling for services on the internet, however some individuals may need help or prefer to do business over the phone, as evidenced by the 214 calls received by the Customer Service

Center. Processes, protocols and personnel will need to be trained and developed to assist those individuals that wish a more personalized experience.

### Third Party Vendors

**Account Managers.** For purposes of the pilot, account managers were procured through the prime consultant.

**Observation:** Without a direct relationship with the account managers, Caltrans did not have direct communications with the vendors, which led to delays in addressing issues and unclear expectations. These observations are validated through the interviews conducted by the Independent Evaluator of the vendors as well as the state representatives. Future demonstrations or an operational program should allow for the state to directly procure and oversee account managers.

### Systems Testing

**End-to-End Testing/Data Verification.** Prior to the launch of the live pilot the project team



conducted end-to-end system testing to verify account manager data accuracy. This testing included comparing the volunteers reported beginning and end of each trip recorded odometer data with account manager. To provide an added level of verification, the project team equipped select vehicles with GPS devices to measure distance traveled, including during a pre-pilot test trip to Reno, Nevada, to test the viability of segregating out-of-state miles driven. Fuel consumption and fuel tax credits were verified prior to system launch.

**Observation:** In a future system, testing and verifying the accuracy of mileage reporting technology should feature comprehensive and agreed upon criteria put forth in statute and/or regulation by state officials. Such verification should be provided at the outset, but also on an ongoing basis to provide motorists and state officials alike confidence in the road charge system's integrity.

### Mileage Reporting Methods



**Time Permit.** Participants selected the time permit (10 days, 30 days, or 90 days) over the CalSAM web portal. The time permit does not require the disclosure of any personally identifiable information, not even an odometer reading, the only requirement is activating the Time Permit for the vehicle for the given period. During the pilot an email reminded them to renew one week before their permit expired.

**Observation:** Many participants failed to purchase time permits to cover all of their days—only 41 percent of participants who

selected the time permit had valid permits during the final days of the pilot. Participants needed multiple reminders, as frequently as daily, when they failed to purchase a new time permit once their current permit expired. The Time Permit, being one of the most anonymous options, provides the greatest amount of privacy. However, without proper controls in place, one major drawback is the potential for misuse. Policy considerations regarding price should be taken into account to reduce leakage, yet provide for the privacy of personal information.

**Mileage Permit.** Participants selected a mileage permit (1,000 miles, 5,000 miles, or 10,000 miles) over the CalSAM web portal and self-reported their odometer readings. An email reminded them to purchase a new permit automatically on a self-selected date, as well as in three month intervals.

**Observation:** During the pilot it was observed that of the participants who selected a mileage permit and reported a final odometer reading, 39 percent had overrun their permit. This illustrates that participants often misjudge or ignore their self-prescribed reminders, therefore they also need fixed reminders (e.g., every three months, and/or assuming 1,000 miles per month of driving, at the expected time completion of the mileage permit) to check the validity of their mileage permit. Also, the readings from self-submitted odometer images should be directly integrated into the CalSAM system. With this process, when participants submit images every three months and need to purchase new mileage permits, they can receive automated reminders (via email and/or text) telling them so.

**Odometer Charge.** Participants selecting the odometer charge provided self-reported

odometer readings every three months via the CalSAM web portal. An email reminder was sent to them to self-report their odometer reading, every three months. Alternatively, if a participant chose to report official odometer readings either by Smog Check Referee or using the Odocheck App, they would receive an email reminding the participants, using the Odocheck App, to submit odometer images via text.

**Observation:** The use of verified odometer readings (such as odometer images submitted via text message) as the basis for periodic billings, in lieu of self-reported values, will help reduce errors and simplify the participant experience. Although not tested in the pilot, verified odometer readings for road charge could potentially be incorporated with smog testing requirements in California.

**Automated Distance Reporting with No Location.** This non-location aware method reported all miles traveled as chargeable miles.

**Observation:** The only drawback for the participant with this reporting method was the added step for receiving credits for miles driven in other states, which was simulated through the submittal of a refund application manually. During the pilot, few participants sought manual refunds. There were 13 simulated refunds made during the pilot, each requiring around 30 minutes of processing time. The verification of out-of-state miles was difficult to confirm without supporting documentation (such as a fuel or food receipt from a location along the reported route), and the processing of refunds proved time consuming.

Offering a manual refund option for non-chargeable miles for options that do not utilize location information will require significant effort for the state to operate. Depending on the number of refunds claimed in revenue operation, could significantly increase the cost of operating a mandatory road charge. As the pilot did not include the use of real money, conclusions cannot be reached on the number of refunds claimed or the potential losses due to fraud. Prior to implementing a mandatory road charge, these factors should be considered, along with the fundamental question of whether it is necessary to offer such refunds, or to require that participants who wish not to be charged for non-chargeable miles use a mileage reporting methods with location information.

**Automated Distance Reporting with General Location.** This method reported only miles driven on public roads in the state of California as chargeable miles. Two of the three commercial account managers automatically exempted miles driven on private roads from a road charge using proprietary map databases. A few participants with this reporting method experienced inaccurate readings of their off-system miles due to map databases not being up to date, but when participants reported corrections to their account managers, the account managers updated their map databases to correctly reflect the private or public status of the reported road.

**Observation:** If policy makers contemplate exemption of private road miles from a potential future operational road charge program, there would need to be accurate map databases containing information specifying whether a road is public or private.

## Mileage Reporting Technologies

**Plug-in Device - Installation.** Although the location of the On-Board Diagnostic (OBD-II) port itself varies from vehicle to vehicle, most participants found it relatively easy to install. According to participant surveys, over 85 percent of participants using plug-in devices “strongly agreed” they were easy to use. Account managers maintained detailed records of the port location on a wide range of vehicles to provide support to participants.

**Observation:** Installation is not a hindrance to the use of plug-in devices for recording and reporting road charge. However, some vehicle owners may need assistance in locating the port in their respective make and model of vehicle.

**Plug-in Device - Popularity.** Plug-in devices were the most popular mileage reporting method in the pilot. At the end of the pilot, 60 percent of vehicles were using a plug-in device.

**Observation:** Of the automated methods, the plug-in (OBD II) devices are the most reliable options. However, as new technology emerges, this methodology could be obsolete by the time a road charge program is adopted.

**Plug-in Device - Port Conflict.** Some vehicles entered the program already equipped with a plug-in device. A future operational road charge program may need to accommodate such vehicles.

**Observation:** Today, many drivers and fleet vehicles with usage-based car insurance use OBD-II plug-in devices. This offers a single plug-in device that can accomplish the needs of car insurance companies and fleet

service companies, as well as a road charge account management, may prove critical in an operational road charge program. The devices used in the pilot are theoretically capable of this multi-purpose functionality, but account managers will need to develop a single integrated platform to support all of these services.

**Plug-in Device - Errors.** Participants will remove plug-in devices from vehicles and forget to put them back in place, as experienced in the pilot. Between 1-3 percent of plug-in devices were unplugged for 7 days or more each month.

**Observation:** During the pilot, a number of participants removed their plug-in devices for a variety of reasons such as: vehicle servicing, smog checks, and forgetting or neglecting to plug them in again. In an operational road charge program, policies and procedures should be considered to remedy unintentional non-compliance.

**Plug-in Device - Diagnostic.** Vehicles may occasionally have mechanical conditions, such as a broken speed sensor, that prevent devices from accurately recording miles traveled. In the pilot, five vehicles experienced mechanical conditions.

**Observation:** In an operational road charge program, systems or devices should contain diagnostic software to detect if vehicle hardware is malfunctioning in order to notify

**At the end of the pilot 62% of vehicles used a location-based mileage reporting method (plug-in device, smartphone, or EROAD electronic logging device).**

the account manager and the participant of the situation.

**Plug-in Device - Interoperability.** For purposes of the pilot, the plug-in devices were pre-programmed to be associated with a specific vehicle.

**Observation:** This pre-programming caused some inconvenience for the fleet participants, specifically the fleet managers, because it meant that they would have to plug a specific device into a specific vehicle.

Plug-in devices should not contain any pre-programmed association with a specific vehicle, instead they should have the ability to transfer between vehicles. This should not technically hamper account management activities because of the availability of the vehicle identification number (VIN) on the data port as a standard data signal.

**Plug-in Device - OBD-II Update.** Critical to generating mileage data for calculating road charges, mileage reporting for light vehicles will undergo favorable technological advances in the next few years. New regulations developed by the California Air Resources Board governing data available through a vehicle's on-board diagnostic port (OBD-II), and development of the 5G standard for an ultra-dense telecommunications network, will make implementation of a road charge program more viable from an operational and cost perspective than it is today.<sup>28</sup>

**Observation:** These recent technological advancements confirm the need to develop a road charge program adaptable to future technology improvements.

**Smartphone with No Location.** The smartphone with no location application measures mileage through vehicle odometer images that the participant submitted monthly to their account manager. During the pilot, participants agreed to send in odometer images each month, between the 20th and 31st, and received three reminders to do so.<sup>29</sup>

**Observation:** Despite the simplicity of this method, some participants did not regularly send in images on their own without reminder notices. Even with reminders, between 20 and 40 percent of participants may not submit images for a given month. And in some cases, images submitted by the participant on the last day of a given month were not processed in time to be included on the invoice and mileage report for the given month. However,

#### **OBD-II Updates**

In 2016, the California Air Resources Board (ARB) made two updates to the OBD-II regulation with relevant to a Road Charge Program:

**Odometer:** Automakers will be required to include the odometer in the available OBD-II data, allowing for identification of all miles traveled when a device is not plugged into a vehicle.

**Fuel consumption:** Automakers will be required to include cumulative fuel consumed in the available OBD-II data, allowing computation of fuel consumed for all vehicles, and for identification of fuel consumed when a device is not plugged in to a vehicle.

These additions will be phased in between Model Year 2019 and Model Year 2021.

<sup>28</sup>Appendix A-16: Road Charge Pilot Program - Report on Impacts of OBD-II Updates and 5G

data on miles traveled in months without a report was not lost, as it was included in the next odometer image submitted, unless the participant never submitted another report for the vehicle.

**Observation:** Synchronization of mileage image submittals by participants and account manager’s monthly invoice processing needs to be coordinated. In an operational program billing cycles will most likely be similar to utilities with specified billing periods. Policies, procedures, and protocols will need to be developed to ensure the compliance.

**Smartphone with General Location.** This smartphone application measures mileage through a proprietary algorithm that determines when a driver is in his/her vehicle using available data (GPS location data, Wi-Fi signals, and other data), and uses the location data to measure miles driven. Verification of miles driven was provided via odometer images once per month.

**Observation:** Odometer images provided significant reassurance of the accuracy of

the mileage reported by a Smartphone App. However, some pilot participants using the smartphone with general location option reported increased data usage and decreased battery life.

**In-vehicle Telematics - Setup.** In-vehicle telematics transmit vehicular data from the vehicle’s onboard computer to the carmaker’s servers. Though increasingly common, the majority of vehicles enrolled in the pilot did not have in-vehicle telematics, however the pilot did feature 64 vehicles from six different carmakers using telematics to report mileage. Due to its ease, accuracy, efficiency, and embedded equipment, in-vehicle telematics could play a major part in any potential future road charge program.

**Observation:** In-vehicle telematics, though simple for participants to operate, and required varying levels of effort by participants to activate their account before mileage measurement could take place. Many participants with in-vehicle telematics had not set up a web account with the telematics system provided by their vehicle



<sup>29</sup>Reminders were generally sent on the 25th, 27th, and 29th of each month. Adjustments were made in December to account for winter holidays and in the 28-day month of February 2017.



manufacturer. To access their vehicle's telematics for mileage reporting, participants first had to gain access to the telematics system, create login credentials (username and password), and link their telematics system with their road charge account. To link the telematics system with their road charge account, participants had to share their login credentials with the Account Manager. Also, in order to create their road charge account, participants had to have active subscriptions to their vehicle manufacturer's in-vehicle telematics system. Such subscriptions may have an associated cost to maintain, although it is common for 3-5 years of service to be included in the purchase price of a vehicle.

Occasionally during the pilot, vehicle owners updated their in-vehicle telematics login credentials to maintain vehicle security. When these updates occurred, they were required to inform their account manager. Without current login information for the vehicle's telematics, the account manager was unable to access the vehicle's data to provide accurate road charge assessments and invoices. Protocols will need to be established to ensure account managers have up-to-date login credentials to in-vehicle telematics web accounts.

#### ***In-Vehicle Telematics - Location Information.***

At present, in-vehicle telematics do not support location-based road charge functionality. This means that participants reporting mileage via telematics did not receive exemptions from road charge for miles driven out-of-state or off public roads.

***Observation:*** Currently, in-vehicle telematics platforms cannot send or "push" data to an outside system such as a road charge. Rather, outside systems must request or "pull" data from the telematics system. Existing

limitations on many in-vehicle telematics systems prevent pulling data more than once or twice per day, and each individual data pull has an associated cost. Even at a fraction of a cent per data pull, frequent data pulls can become very costly, therefore does not provide a cost effective and sustainable alternative.

#### ***Commercial Vehicle Electronic Logging Device.***

The commercial vehicle electronic logging device recorded and reported mileage on the 55 heavy commercial vehicles in the pilot. Two aspects of the electronic logging device make it suitable only for commercial vehicles. First, the electronic logging device requires installation in the vehicle by a specially trained installer because it is physically anchored to the vehicle. Second, it occupies a noticeable amount of visible space in the vehicle cabin. However, these aspects proved they were not problematic for commercial vehicles. Indeed, the Federal Motor Carrier Safety Administration has required that all heavy interstate carriers include an electronic logging device by December 18, 2017.<sup>30</sup> The marginal burden of requiring an electronic logging device is minimal, provided it has been approved for measuring mileage. As the electronic logging device is hardwired into the vehicle and contains additional fraud detection measures, it cannot be removed or disabled without the account manager being notified.

***Observation:*** The electronic logging device is well-suited for supporting road charge in heavy trucks. Trucking fleets generally liked the additional services they received with the electronic logging device, as evidenced by the fact that two of the trucking fleets chose to keep the service after the pilot had concluded and continue utilizing the additional fleet services.

## Account Management & Account Management Oversight

**Invoicing.** Road charge account managers e-mailed invoices monthly to participants on the 5th day of each month. This is a shift from how fuel taxes are paid by drivers today (i.e., in small increments each time a vehicle fills up at the pump). In a potential future road charge program, invoicing could be continuous as it is for most utilities and cellular phone service (e.g., monthly or quarterly from the date of account opening).

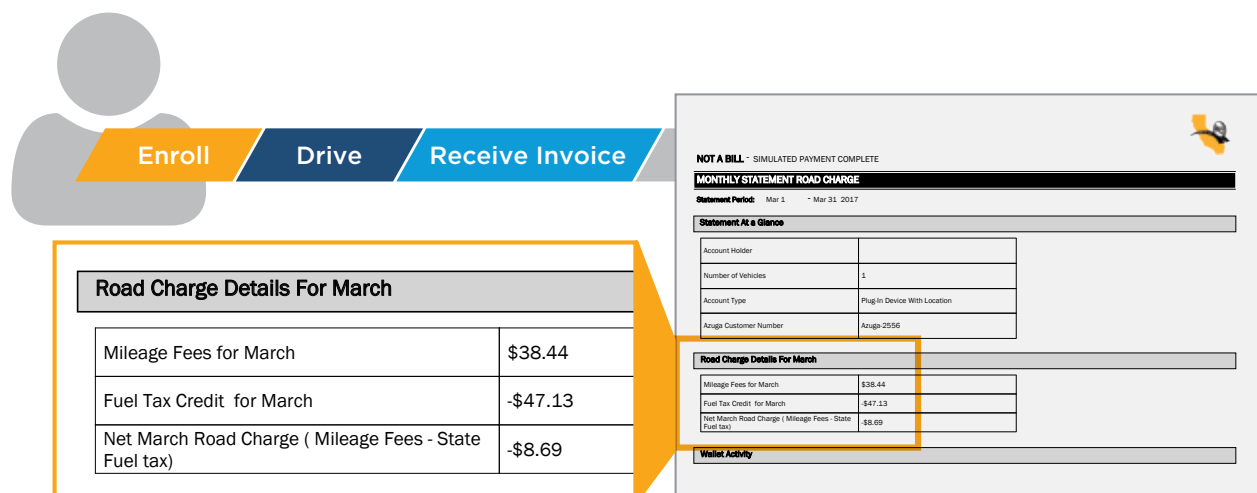
For manual methods, the CalSAM sent participant invoices when they reported miles for an odometer charge. In the case of time permits and mileage permits, which were required to be purchased before they were used, the CalSAM sent participants receipts when they purchased a permit.

**Observation:** Participants were not accustomed to receiving invoices for driving charges, as they typically pay for their road usage through the gas tax which is paid automatically when fuel is purchased.

Participants who owed additional road charges after their fuel tax credit were thus given an additional financial burden that they may not be accustomed to. In the pilot, road charge invoicing was once per month, however, in an operational road charge program, the frequency and potential financial burden of a road charge should be considered. A mandatory program may place increased responsibility on drivers to budget accordingly.

**Simulated Payment Methods.** The mock payment methods used in the pilot consisted of simulated credit card numbers and vouchers (intended to simulate payment by check), unique to each participant. Account managers made mock payment easy for participants employing either a standard post-payment methodology or a pre-paid electronic wallet with participants adding simulated dollars to the account, similar to FasTrak tolling system. These payment methods proved simple and feasible. Account managers supported various pre-payment (before miles are driven) and post-payment methods.

Figure 6-10: Participant Experience



<sup>30</sup>See <https://www.fmcsa.dot.gov/hours-service/elds/electronic-logging-devices>.

**Observation:** Without the exchange of money it is difficult to determine the acceptance of the payment methods or the frequency of the billing employed by the pilot.

Also both pre-and post-payments are feasible for an operational road charge. However, the time and mileage permits are better suited to pre-payment, all of the other methods can be supported by pre- and post-payment.

Figure 6-11 is the final page of invoices, “Understanding Your Invoice,” from an IMS invoice. A similar page was included on the other account managers’ invoices:

**Account Managers.** The CAMs and the CalSAM featured a web portal to display road charges and payments. All account managers offered a customer service center to promptly handle all questions or issues that participants raised by phone or email.

**Observation:** during the pilot, account managers provided generally good service to participants, but their performance was not flawless. The first month of the pilot a backlog of mileage accrued, which was not invoiced until the second month. During the initial months of the pilot, an account manager inadvertently sent blank invoices to 800 participants. Additionally, mileage reporting with in-vehicle telematics experienced several interface glitches, including a brief double counting of miles for certain participants and lack of mileage for others.

The pilot highlights the need for a robust trial, commonly known as end-to-end testing, as a final test prior to any statewide mandatory program. The state could accomplish such a trial with a small number of vehicles for a number of billing cycles.

**Account Management Oversight.** To support account management by multiple vendors in an open system, two items were required: (1) use of a standardized format to transmit mileage data for each vehicle, and (2) having a central repository to accept data from all account managers. The standardized format for mileage data is called the mileage message. The standardized mileage message format used for vehicles on automated mileage reporting included number of miles driven by day, with no specific vehicle location data. For the pilot, the central repository to accept data from account managers was the Account Management Oversight (AMO) database. All the account managers sent monthly electronic reports to this database.

During the pilot operations, the pilot delivery team compiled monthly AMO reports, which included miles by account manager, and by state. This report allowed the pilot delivery team to check the completeness of participant data provided by each account manager. The pilot delivery team followed up on anomalies discovered during the computation of this report, such as outlier mileage totals. The pilot

**Figure 6-11: Understanding Your Invoice**

**UNDERSTANDING YOUR INVOICE**

1. The invoice is produced every month on the 3rd of the month.
2. DriveSync features automatic billing of your charges to your (fictional) credit card so you do not have to remember to make a payment when the invoice is due.
3. Invoicing period for the month is defined as items with a posting date of 2nd of the month through to the 1st of the following month. Mileage charges are usually posted to your account the day after you drive. However, the posting date can vary depending on your location and driving habits.
4. The invoice separates your charges by vehicle nickname and the state and date on which they were recorded. Chargeable miles are for use of public roads.
5. **Chargeable miles** accrue when driving in the State of California.  
**Non-Chargeable miles** accrue when it can be determined you are driving on a private road or property.  
**Out-of-State miles** accrue when driving outside the State of California.  
**Account Adjustments** capture any mileage adjustments created for your account.
6. **Miles** shows your measured driving distance to the nearest 1/100th of a mile.  
**Mileage Rate** shows the current road charge in Cents per Mile charged.  
**Road Charge** is the dollar value calculated as **Miles \* Rate**.  
**Fuel Usage** shows the amount of fuel consumed to the nearest 1/100th of a gallon.  
**Fuel Tax Credit Rate** shows the current fuel tax credit in Cents per Gallon credited.  
**Fuel Tax Credit** is the dollar value to the nearest cent calculated as **Fuel Usage \* Fuel Credit Rate**.  
**Net Charge** is the dollar value to the nearest cent calculated as **Road Charge - Fuel Tax Credit**  
If the Road Charges exceed the Fuel Tax Credit then the Net Charge is positive and represents money due.  
If the Fuel Tax Credit exceeds the Road Charges then the amount shown represents a Credit to the Account.

Disclaimer from the State of California: The rates used to calculate your road charges and fuel tax credits are for testing purposes only. The pilot road charge rate of 1.8 cents per mile is equivalent to the five year historical average of California fuel excise taxes. The pilot gasoline tax rate of 35.4 cents per gallon is also based on the five year historical average of the California gasoline excise tax rate.

delivery team also computed a range of AMO data trends in a monthly Accounting and Reconciliation Report, such as average miles per account manager, which also served as an indicator of potential issues with the system. Finally, a Compliance Report, checking a range of compliance data including how many participants were actively reporting on the various mileage reporting methods each month. This report included a list of non-compliant participants by mileage reporting method.

**Observation:** In an operational program, clearly defined procedures need to be developed and shared with certified account managers to establish mutually-agreed expectations regarding vendor performance and issue resolution guidelines.

**Audit Capability.** An operational road charge program, supported by account managers, will require occasional audits. The Road Charge Pilot Program featured an audit of account managers during the live pilot to

establish and demonstrate the rudiments of an audit process.

**Observation:** For an operational road charge program, detailed processes for initial compliance and periodic audits in conjunction with procurement and certification of account managers, needs to be developed. Precise auditing processes will require customization to fit the specifics of any statute related to road charge. Account Management Oversight (AMO) should expand the rudimentary audit process applied in the pilot into a standard audit procedure, developing explicit steps for specific data and format for providing results, including findings and recommendations. In addition, the AMO should develop electronic audit techniques—automatic comparison of dollar and mileage values—to oversee the large volume of low dollar transactions. These techniques should compare mileage and dollar amounts to expected norms for periodic reporting. Also, anomalies found in an account manager’s data may trigger special audits.



**Business Rules.** Business rules define the capacity to collect and remit tax payments, support auditing, manage technology configurations and provide reconcilable reports that can show the collection and transfer of revenues through the account manager’s transaction and accounting systems. Business rules in the Road Charge Pilot Program proved simple, in part because participants did not pay with real money and the agency did not enforce payment. An operational road charge program employing real money would require a robust set of business rules and include enforcement activities. The business rules developed for the pilot complemented the technical requirements.<sup>31</sup>

**Observation:** Without collection of revenue during the live pilot, testing the rules for recognition of revenue was not implemented.

As a general accounting rule, an entity should recognize revenue upon consumption of the good for which payment occurs. For automated pre-pay methods—the participant pays money up front, but the receiving entity does not recognize the revenue until later, when actual road use happens. For automated post-pay methods, and the odometer charge, the receiving entity recognizes revenue upon payment. For the time permit, the receiving entity should recognize revenue evenly throughout the period of the permit’s validity. The mileage permit presents a greater challenge for recognition of revenue. Recognition of 1000 miles per month—an approximate number of miles an average driver drives per month—is one potential way to recognize revenue for the mileage permit. When the driver purchases a new permit, the road charge administrative authority

could recognize the remaining revenue not consumed by the driver.

## Road Charge Exemptions

**Private Roads.** The TAC recommended that private roads, those not maintained by a municipal or state government, but by a private entity, be exempt from a road charge, because the facilities are not funded by the state.

**Observation:** Providing private road exemptions requires account managers to have accurate comprehensive map databases identifying private and public roads. In the future, additional map databases with public/private road data sufficiently accurate enough to provide private road exemptions may emerge, especially as fully autonomous vehicles become more prevalent. In contrast, the state may have an interest in developing and providing raw, digital map data, open to the public on roads that it and local governments own.

## Enforcement & Compliance

**Anomaly Detection and Correction.** Due to the pilot consisting of volunteer participants and the lack of revenue collection the pilot was limited to the detection of anomaly’s and implementing corrective action.

**Observation:** Since the Road Charge Pilot Program did not feature enforcement activities, various approaches to enforcement require additional investigation.

- Research regarding detection of non-compliance and enforcement for the various mileage reporting methods.

<sup>31</sup>Appendix A-17: Road Charge Pilot Program Business Rules

- As a basic structure for enforcement for light vehicles, the state should maintain a database for all vehicles liable for the road charge to record the mileage reporting method and account manager for each vehicle. With that, the state will know what enforcement activities can or should be carried out for each vehicle.
- An effective road charging system captures revenue from all vehicles subject to the charge. To do so, it must identify all vehicles subject to road charge system, identify the responsible party (owner or lessee) for each vehicle, and have effective enforcement methods. To accomplish these tasks, the road charge system should consider integration with the state's motor vehicle registry.
- Enforcement for heavy vehicles will be different than for light vehicles because the dollars involved per vehicle could vary, and the industry is already heavily regulated. An investigation of the various enforcement mechanisms currently under use for heavy vehicles in other states and nations will help inform and select a combination suitable for the heavy vehicle road charging system deemed suitable for California.





# VII. Key Issues for a Road Charge in California

Senate Bill 1077 directed the California State Transportation Agency (CalSTA) to address the topics listed below in this report. Identifying them as vital to understanding the implications of a road charge and for potential future policy development. The remainder of this section provides discussion of each topic including alternative policy approaches for each issue raised.

## PRIVACY PROTECTION

In accordance with the privacy policies recommended by the TAC, Caltrans developed and incorporated into the privacy policy for the Road Charge Pilot Program (For more detailed information see Appendix A-2 and A-9). This privacy policy was provided to each participant, through the pilot participant agreement, describing the nature of information collected during operation of the Road Charge Pilot Program.

The privacy policy bound the state, account managers, and any other entity performing data collection and account management services to the legal requirement of protecting all participants' personal information on behalf of the state of California.

In an operational road charge program, protective language should be considered for inclusion into statute or regulation. In preparing draft privacy protection language for any future road charge legislation, policymakers could view the privacy issue from three perspectives:

1. In an account-based road charge system, providing the motorist the choice to select between government and private sector entities, the motorist has the explicit choice of which entity will manage his or her data collection.
2. Providing the motorist the option to select their preferred mileage reporting method.

3. Developing specific statutory provisions protecting privacy ensuring government agencies and road charge account managers protect all motorists' personally identifiable information from disclosure coupled with penalties for violation of these provisions.

Elaborating on current statutory provisions protecting privacy, a road charge program should consider the prohibition of any government agency, or its contractors, from disclosing any personal or personally identifiable information used to report metered use of a vehicle or for administrative services to collect the per-mile charge. For an operational road charge program, the Legislature could consider adoption of exceptions for disclosure by the vehicle owner, such as a financial institution involved with payment, law enforcement pursuant to a valid warrant, or an entity the vehicle owner expressly approves to receive the information.

Legislation should address the amount of time certain entities can hold location data and daily metered use data. Potential exceptions to the data destruction provision could include monthly summaries of metered use, anonymized traffic management data for research (with all personally identifiable information removed), and retention by a road charge account manager upon consent of the vehicle owner (i.e., the owner opts in to allow data collection and retention in exchange for tangible benefits like convenience, discounts, loyalty rewards, and general safety).

Statutory provisions could also contain certain rights granted to the vehicle owner pertaining to personally identifiable information. Following are among the possible rights for vehicle owners in a road charge program:

- The right to inquire about the accuracy, status, and use of the information
- The right to examine the information
- The right to request corrections in cases where there is error
- The right to request deletion of location and daily metered use data that has not been destroyed within the required timeframe

In a potential road charge program, the combination of offering choices for data reporting and management, requiring legal protection of personally identifiable information, and providing motorists' rights could provide a level of privacy protection that satisfies a large majority of the state's motoring population.

## DATA SECURITY

In this digital age, Californians rely upon the security of their data, especially in a government program. Yet maintaining the security of personally generated data and information has become ever more challenging. Maintaining security of systems to protect personal data and information requires management of data security according to international best practices. A potential road charge program must ensure that application of these best practices occurs not only by government agencies, but also private sector contractors measuring and collecting the road charge. The TAC recommended adoption of specific data security measures based on industry standards for online financial-grade transactions for authentication, authorization, and encryption.

The TAC's recommended security measures reflect best practices at a point in time. For a potential road charge program to succeed long-term, it will need to adapt to ever-



evolving data security challenges, not only meeting but exceeding best practices and industry standards. Legislative provisions should consider providing flexibility to implementing agencies to develop, deploy, and enforce data security measures over time, with statutory guidance focusing on higher-level principles such as the expectation of data security, the obligation of the state to take precautions to protect the sensitive data of its residents, and the ability of agencies to implement and enforce reasonable practices to achieve the policy goal.

## JURISDICTIONAL ISSUES

A future operational road charge program will have broader and more complex issue areas to address than what was represented in the Road Charge Pilot Program. Jurisdictional issues, both interstate and intrastate, are difficult to fully explore in a pilot, but need to be addressed for an operational road charge program.<sup>32</sup>

### Intrastate Jurisdictional Issues

Intrastate jurisdictional issues comprise of two main categories: road charge rates, and operations.

**Road Charge Rates.** As a potential long-term fuel tax replacement, the state may choose to set a revenue neutral road charge rate which is equivalent to an amount the average light duty vehicle pays in California fuel taxes.

Some regional or local governments may want the ability to set their own rates, in addition to state road charge, to fund local transportation systems or to achieve other policy objectives.

### Road Charge Jurisdictional Issues

- **Local rate setting**
- **Sales tax applicability**
- **Availability of driving data for local planning**
- **Charging for miles driven on toll roads**
- **Integration of motorist road charge and toll accounts**

Consequently, the Legislature should consider to what extent and how local options are employed to address local policy objectives. Providing the opportunity for regional and local agencies to establish an additional road charge would require location-based measurement of road use which would limit mileage measurement to location-based technologies.

Local jurisdictions may wish to access specific locational driving data collected under the road charge program. This information may prove useful for measuring usage of roadways within the local jurisdiction, which in turn might be used to improve safety, asset management, traffic enforcement, and transportation planning.

### Interstate Jurisdictional Issues

Referencing fairness for a road charge imposed upon residents, Californians raised the issue of how out-of-state driving would be handled. The degree to which the Legislature wish to address out-of-state driving in the road charge program may depend upon the relative cost to administer versus the revenue collected.

The impact of out-of-state driving may not be large. California shares borders with only

<sup>32</sup>Appendix A-18.3: Road Charge Jurisdictional Issues Policy Paper

three states (Arizona, Nevada, and Oregon), in addition to the international border with Mexico. Many cross-border roadways pass from California into neighboring states but none of these states have major metropolitan centers along the California border. According to a study by RUC West, approximately 1.2-2.6 percent of miles driven on California roads are by visitors.<sup>33</sup>

Three possible scenarios exist for out-of-state motorists traveling into California.<sup>34</sup>

1. A visitor entering from a state that imposes a gas tax, but not a road charge, drives on California roadways before returning home.
2. A visitor entering from a state that imposes a road charge drives on California roadways then returns home.
3. A visitor travels through multiple states, some that impose road charges and others that collect only gas taxes.

During the transitional phase, California will need to consider continuing to collect state fuel taxes and crediting those taxes paid on a motorist's road charge invoice. For the period in which road charge and the gas tax operate concurrently, the existing state fuel tax will act as a pre-payment mechanism for the road charge. During which time, the road charge account managers will need to collect miles traveled, as well as, fuel consumed in order to calculate the credit for fuel taxes paid against the motorists' road charge account (thus, avoiding double-taxation for roadway use).

#### **Legal Standards for Road Charge on Visitors.**

The U.S. Constitution prohibits special taxes or fees applied only to out-of-state motorists. Accordingly, there must be no discriminatory

#### **California Connections**

- **Six Interstate Highways**
- **21 State Highways**
- **156 Other Public Roads**

design or intent in collecting road charges from out-of-state drivers in California. Further, a road charge must reflect a fair approximation of the use of the state's roadways and must not be excessive in relation to the benefits conferred nor must methods of reporting and fee collection unduly burden out-of-state drivers.

Currently, only Oregon has an operational road charge program for light duty vehicles. There are two ways California could address interjurisdictional road charges between the two states.

1. Under **unilateral road charge (California-only collection)**, California would require all visiting motorists to become registered in the California road charge database and purchase a time permit or report mileage directly to the state and make payment to California. Frequent visitors could sign up with one of California's commercial account managers, select a location-based automated reporting method to simplify the process of reporting miles driven in California, and pay their road charge.
2. For a bilateral road charge (two-state collection), California enters into a cooperative agreement to capture and reconcile inter-jurisdictional travel between the two states and coordinate the performance of commercial account managers for inter-jurisdictional account management.

<sup>33</sup>RUC West. *Assessing Out-of-State Drivers in a Road Usage Charge System: Phase 2 Final Report*. April 2017.

<sup>34</sup>Appendix A-18.2: *California Road Charge Pilot Program - Assessing Road Charge on Out-of-State Visitors to California*

If the state fully transitions to a road charge, the operational alternatives contained in Table 7-1 should be considered for out-of-state drivers.

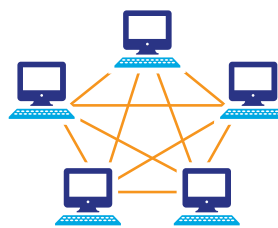
**Multilateral Road Charges (Multiple-state Collection).** A number of states, and the federal government, are considering a distance-based road charge system to replace some or all gas taxes. When more than two nearby states levy a distance-based charge, each with its own rate, the states must carry out more complex functions of mileage reporting, reconciliation and financial clearing in a multilateral format.

Under one method for multilateral reporting, reconciliation, and financial clearing, more than two jurisdictions report and reconcile distance charges in multiple bilateral agreements. This mesh approach requires many links among agencies. **The mesh approach image**, illustrated in Figure 7-1,

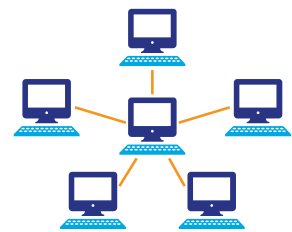
depicts five agencies involving ten links, four for each agency.

As the number of states entering into road charge agreements grows, **the star approach** offers greater efficiency, illustrated in Figure 7-2, with a single agreement among multiple jurisdictions and a single clearinghouse that handles multilateral reporting, reconciliation, and financial clearing. The star approach reduces the number of links for each agency to one and the total number of links in the network to number of entities involved.

**Figure 7-1: Mesh Approach**



**Figure 7-2: Star Approach**



**Table 7-1 Operational Alternatives for Transitioning to a Road Charge for Out-of-state Drivers**

Alternative 1	Continue Fuel Tax Collection	California continues to collect fuel taxes from visiting motorists, providing fuel tax credits only to California residents with active road charge accounts. This would apply to visitors from states with fuel taxes and require no visitor action.
Alternative 2	Time permit	Visitors could elect to pay for road usage in California based on time rather than distance traveled or fuel consumed. The time-based charge could vary by lengths of time (for example, one day, one week, one month, one year). While relatively easy to administer, it is challenging to enforce. Time-based charges would not require visitors to have an account or mileage reporting technology—such permits could be purchased by smartphone, on the internet, or at retail outlets—but California would have to create and operate a permitting system. Evasion might occur often without a strong enforcement regime in place.
Alternative 3	Mileage Permit	A charge based on distance traveled, would require a visitor to purchase a permit for blocks of miles to use while in the state (for example, 250, 500, or 1,000, miles). This alternative links revenue to road use rather than fuel consumption or time and therefore eliminates the revenue distortions associated with fuel taxes and time-based charges. Like the time permit, motorists could purchase mileage permits by smartphone, on the internet, or at retail outlets. The mileage permit may prove expensive to administer and more susceptible to fraud than other options.
Alternative 4	Choice of Time Permit or Automated Distance Charging	The state would require visitors to either equip their light vehicle with mileage reporting equipment and establish an account under the road charge program or pay a presumably high time-based charge. This approach supports interoperability with other state road charge programs but adds some complexity to the road charge system.

## COMPLIANCE AND ENFORCEMENT

In an operational road charge program, compliance from all road charge payers is required to ensure adequate revenues for the road system and fair treatment for all users. The TAC recommended measuring compliance through the detection of anomalies in mileage data collected in the Pilot.

In an operational road charge program, the agency/department must develop ways to maintain compliance. The most common technology for reporting mileage in the pilot, the on-board diagnostic (OBD-II) device, can be unplugged from the diagnostic port, causing gaps for data flowing into the system. The manual method of odometer readings, can be easily tampered with, however laws and penalties are in place to limit odometer manipulation. In-vehicle telematics on the other hand are much harder, but not impossible, to tamper with.

In an operational road charge program, if a participant intentionally violates the system by tampering with mileage reporting equipment, or providing false information, statute and/or regulations will need to be in place to require and empower a government agency to enforce the program.

## POTENTIAL FOR ADDITIONAL DRIVER SERVICES

The CAMs offered their participants additional services, also known as value-added services, other than road charges. These services are typically offered through a web portal or smartphone application, leveraging data the CAM receives during collection of the road

charge. These value-added services are only available to the participant, on an opt-in basis.<sup>35</sup>

As illustrated in Table 7-2 there are a number of value-added services currently provided by the CAMs. Table 7-3 represents some potential future services.

## COST EFFECTIVENESS

The cost of collecting a road charge from light duty vehicles is a challenge for design and implementation. To achieve reasonable administration costs, a road charge requires scale (a large number of payers) and flexibility (the ability to adopt new technologies and business models that reduce costs). Allowing road charge payers to choose from among CAMs competing for market share fosters innovation and cost efficiencies, and it allows for potential defraying of collection costs with the inclusion of value-added services.

Currently, the California gas tax collection administrative costs are approximately \$34 million annually, representing just 0.54 percent of fuel excise tax revenue collected (not accounting for evasion).<sup>36</sup> Few taxes enjoy such efficiency. Road charge, by contrast, is estimated to be more costly, resembling utilities such as gas, water, electricity, and telecommunications, whose collection costs generally range from 5-10 percent.<sup>37</sup>

However, examples of cost-effective road charge systems exist. New Zealand collects a road charge from over 150,000 heavy vehicles and 600,000 light diesel vehicles at a cost to government less than 5 percent of revenue.<sup>38</sup> Oregon likewise collects a weight-

<sup>35</sup>Appendix 18.1: Use of Commercial Account Managers Policy Paper, p. 5 - 9

<sup>36</sup>Board of Equalization 2015-16 Annual Report, Table 3 (<http://www.boe.ca.gov/pdf/pub306.pdf>)

<sup>37</sup>See, e.g., San Diego Water Utility, Fresno Water Utility, Pasadena Light & Power, Technical Advisory Committee Meeting #5, May 2015, Fresno, CA.

<sup>38</sup><http://www.nzta.govt.nz/vehicles/licensing-rego/road-user-charges/about-ruc/>

**Table 7-2 Currently Available Value-added Services**

<b>Usage-based Insurance</b>	Car insurance premiums based on actual driving behavior measured by a device in the vehicle.
<b>Driver Education</b>	Vehicle data can assist driver education, either by informal assistance for young drivers or formal recording of driver vehicle time for the purposes of commercial driver licensing.
<b>Trip Logs</b>	Storing logs of trips for future reference by vehicle owners. Drivers can use such references for creating expense reports, for allocating costs among multiple drivers,
<b>Geo-fencing</b>	Setting a boundary, which, when a vehicle crosses, typically sets off a notification or alarm.
<b>Fuel Monitoring</b>	Shared vehicles can benefit from having records of fuel usage by time and location. Such reports can help vehicle owners appropriately divide costs of fuel, and ensure that vehicles use fuel consistently.
<b>Maintenance Scheduling</b>	An application that reminds vehicle owners when a vehicle needs service, based on mileage, driving conditions, and vehicle Diagnostic Trouble Codes
<b>Gamification</b>	Turns the process of driving into a game. Participants can earn scores or rewards for performing certain actions. The design of such games usually encourages safer and more environmentally friendly behavior.
<b>Car Location</b>	Helps drivers locate their vehicles when they may have forgotten where they were parked.
<b>Check Engine Light Decoding</b>	Allows vehicle owners to see the reason or reasons for illumination of a check engine light.
<b>Environmental Impact Feedback</b>	Allows users to see the carbon footprint of the vehicle, as well as other potential environmental impacts.
<b>Theft Alert</b>	Provides the user notification of vehicle theft. It could also provide the real-time knowledge of the location of the stolen vehicle.
<b>Roadside Assistance</b>	Call for roadside assistance in case of a vehicle issue.

**Table 7-3 Potential Future Value-added Services**

<b>Mobile Emissions Testing (Remote Smog Check)</b>	Performing an official state emissions test, such as a California smog inspection, using the data from the vehicle.
<b>Toll Payment</b>	This service would be ideal for drivers who do not have a toll tag but want to avoid the wait to use a manual toll booth and potential penalties associated with driving through an electronic toll lane without a transponder. It would also provide drivers the convenience of paying tolls, road charges, and other fees from a single account.
<b>Parking Payment</b>	Would allow users to automatically pay for parking on streets of participating cities.
<b>Vehicle Registration and Licensing</b>	Incorporation of vehicle registration and license renewals into its interface.
<b>Financial Incentives</b>	Road charge commercial account managers may enter into commercial arrangements with other businesses, such as retailers, to provide financial incentives for road charge payments.

mileage tax from heavy vehicles for less than 5 percent of revenue.<sup>39</sup> Oregon’s light vehicle road usage charge program, OReGO, created a nascent, regulated, open commercial market for mileage measurement and account management services.<sup>40</sup> OReGO established a “market rate” of compensation for account management services, currently 40 percent

of gross revenue collected for up to 5,000 volunteer vehicles, with expectations that the rate will decline under 10 percent as the number of vehicles increases to the hundreds of thousands.

As both New Zealand and Oregon discovered, road charge costs less to collect using

<sup>39</sup>[http://www.oregon.gov/ODOT/MCT/docs/size\\_weight.pdf](http://www.oregon.gov/ODOT/MCT/docs/size_weight.pdf)

<sup>40</sup>[http://www.oregon.gov/ODOT/HWY/RUFPP/docs/IP-Road%20Usage%20Evaluation%20Book%20WEB\\_4-26.pdf](http://www.oregon.gov/ODOT/HWY/RUFPP/docs/IP-Road%20Usage%20Evaluation%20Book%20WEB_4-26.pdf)

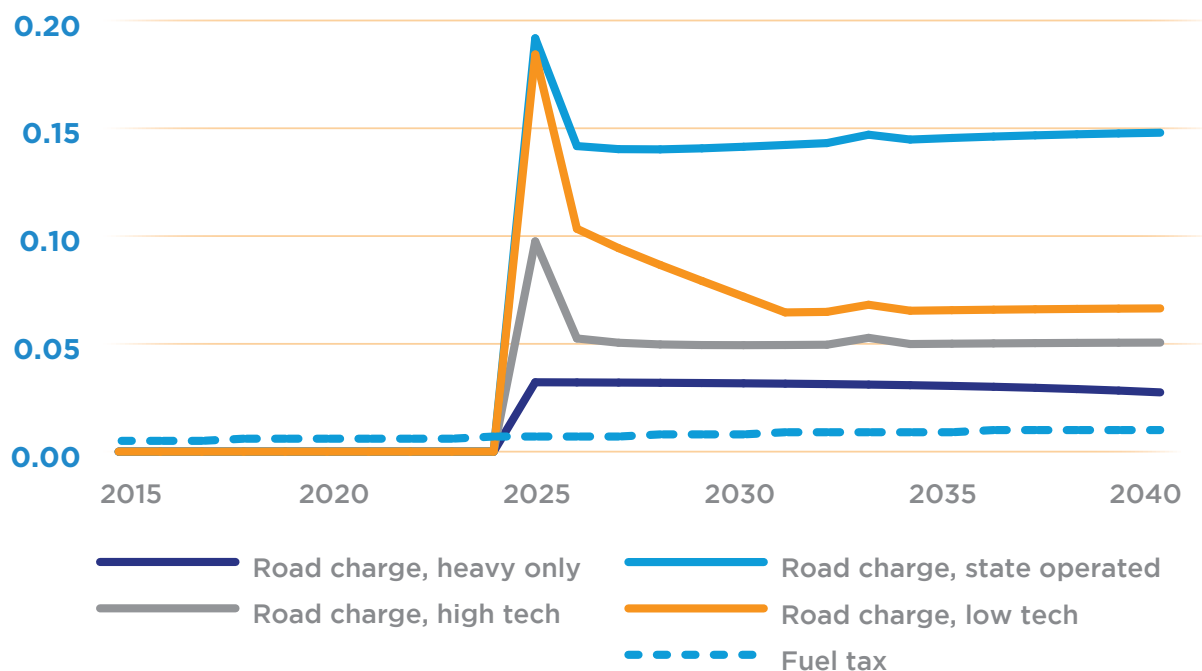
commercial partners than under a fully state-run system. The reason is not due to an inherently more efficient private sector, rather that commercial partners enjoy several advantages over public sector agencies:

- Commercial partners exist to engage in commerce – attract and retain customers
- Commercial partners can sell commercial services to motorists and use those revenues to offset system costs otherwise born by state agencies
- State agencies overseeing road charge programs, with millions of vehicles, can economize their operations by dealing directly with a small handful of intermediaries (such as commercial account managers) rather than with millions of individual drivers

The cost of collecting a road charge on small volumes, such as the pilot, is cost prohibitive. However, according to the financial tool built and employed by Caltrans to analyze road charge policy and operational scenarios, the

cost of collecting road charge is projected to decline between 5-10 percent of revenue within a decade, assuming the utilization of commercial partners and scaling to more than one million road charge payers. As shown in Figure 7-3, several scenarios support costs of road charge collection below 10 percent of revenue in the long term, and perhaps below 5 percent. These scenarios assume that technology and service companies in the automotive industry (including insurers, automakers, telecommunications providers, and others) make breakthroughs increasing consumer adoption of in-vehicle services that serve as a simultaneous platform for road charge. Many prospective technologies support this scenario including 5G, the next generation of on-board diagnostic ports, smartphones, and in-vehicle telematics. As these and other innovative technologies and business models evolve, the cost of providing services to consumers declines, developing a market around it.

**Figure 7-3: Cost of Collection**



## USE OF REVENUES

Although the state did not collect actual revenues in the Road Charge Pilot Program, the potential shift from indirect user fees (gas tax) to direct user fees (road charge) represents an opportunity to examine alternatives for use of revenues.<sup>41</sup> The states of Oregon and Washington developed road charge policy independently from consideration of use of revenues to avoid introducing complexity to the research and policy development process. SB 1077, on the other hand, specifically mandated a discussion of how road charge revenues could be used in an operational statewide program.

The question of how to use road charge revenues is fundamentally a policy question, which can be informed by analyzing public policy alternatives such as political, economic, public opinion, and existing law and practices for input.

The principle of user pays tends to support funding roads with revenue sources that are unique to accessing and using the road network and that do not have another primary purpose for their existence. Like the gas tax, road charge provides a direct correlation between the cost and the benefit.

The default option for use of road charge revenues is to make no change to current broad use of revenues. In other words, if road charges are a replacement for the gas tax then their use should likewise follow the current use of the gas tax. On the other hand, there are other alternatives ranging from minor adjustments to major reforms in how road transportation investments are allocated.

In California, as elsewhere in the country, many sources of revenue combine across multiple levels of government (county, metropolitan, state, and federal) to provide needed funding. Internationally, other models exist; some with greater emphasis on general funds and national control (e.g., Europe), others with greater emphasis on direct user fees (e.g., New Zealand).

Under a road charge, usage of the road system could be more accurately and comprehensively assessed at the aggregate level. Likewise, motorists would, individually and collectively, be more conscious of how much they are spending on roads and where that funding is going. This leads to an opportunity and a possibility to make changes to the way investment decisions are made.

## PARTICIPANT ACCEPTANCE

Caltrans sought to explore the acceptance of a road charge in California by solicited the views of participants in the Road Charge Pilot Program. Participant perception was measured via surveys and focus groups. Throughout the pilot participant feedback was utilized to gauge the overall performance of the pilot.

As shown in Figure 7-4, the majority of participants found road charge “more fair” than the gas tax, and this number increased incrementally from the beginning to the end of the pilot.

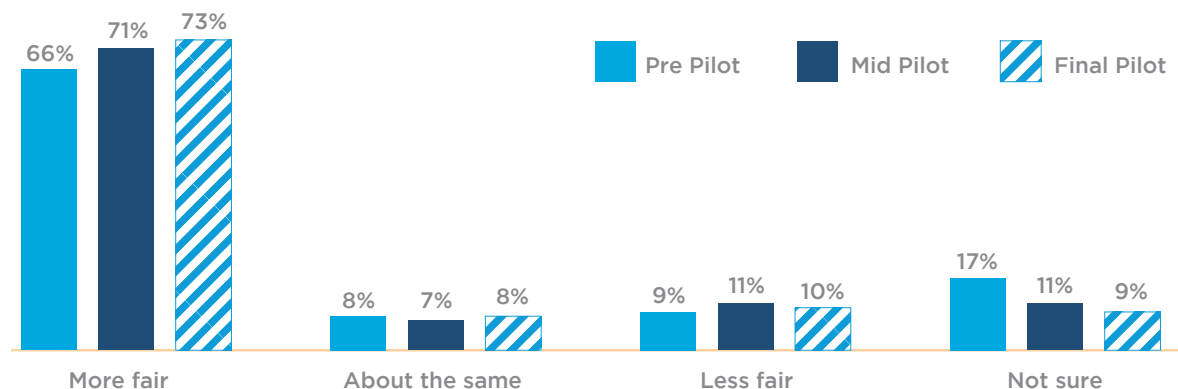
## IMPLEMENTATION ISSUES

Issues related to implementing a road charge have surfaced since the initial exploration into the mileage based user fee concept at the beginning of the 21st century. The utilization

<sup>41</sup>Appendix A-18.6: Road Charge Pilot Program - Use of Revenues in a Road Charge System Policy Paper

### Figure 7-4: Participant Views of Road Charge Fairness

Would you say that paying for road maintenance and repair based on the miles you drive is more fair or less fair than paying based on the amount of gas you buy?



**Table 7-4: Summary of Key Implementation Issues**

Difficulty of Operations	Implement a new tax payment system to manage millions of road charge payers is a complex undertaking. Tasking the public sector with regulations and auditing the market, is a more traditional governmental function. Whereas outsourcing some or all of road charge operations to the private sector relieves the public sector from operations and collection liabilities.
Scalability	The account-based system for road charge proved viable for a pilot with 5,000 participants. Since the pilot’s system heavily relied upon an open system and CAMs for light and heavy vehicles, opening up this market to other private sector firms should provide the necessary administrative capability to manage millions of payers. Current experience at DMV, with the Business Partner Automation (BPA) Program, indicates that this approach is a viable solution. The BPA program has allowed DMV to offer greater customer service by providing services in more venues. <sup>42</sup> A similar program could be implemented to support scalability of a potential road charge program. Firms from the tolling, auto-insurance, technology and banking industries could show interest in road charging, as a new line of business. The banking, insurance and electronic tolling systems have proven that once a computing system is in place, scaling to handle large numbers of electronic transactions is not difficult for private sector entities, thus, achieving economies of scale.
Flexibility for Policy Adaptations	The Road Charge Pilot Program tested an open system design with established standards and a certification process for the commercial account managers. The pilot’s CAMs agreed to contractual provisions for management of sensitive data and account management. In an operational road charge program, similar contracts could contain clauses requiring acceptance of alterations to policy applications and the vendor certification process could support simple adjustment of mileage reporting methods. As such, an open market for an operational road charge program, with provisions supporting adaptability for policy needs and variations, will be flexible by design, obligating CAMs to make adjustments and accept opportunities as road charge policies change.
Impact on Clean Vehicle Policies	The state offers numerous incentives for purchase and use of such vehicles, including loans for the installation of commercial and residential charging stations, tax credits for purchase of clean vehicles and for the retirement of high-emissions vehicles, single-occupant access to carpool or high occupancy toll lanes, free parking and vehicle charging in certain locations, and insurance discounts. Although a road charge as a potential gas tax replacement represents an increase in the cost of operating a clean vehicle, the savings from no longer needing to purchase fuel, or purchasing fuel less frequently, far outweigh the road charge. With the adoption of a flat vehicle registration surcharge on electric vehicles, under Senate Bill 1, a usage-based road charge could become an attractive method of paying for road use for clean vehicles. This is because flat fees have no nexus to roadway usage—drivers are charged the same whether they drive 2,000 or 20,000 miles per year—so may not seem fair to owners of clean or zero-emissions vehicles.
Equity by Income, Geography, and Vehicle Type	The perception of fairness among road charge payers is a matter of perspective. On one hand, charging all road charge payers the same rate seems fair. However, some may view it unfair to charge drivers of highly fuel-efficient vehicles the same rate as people driving low-efficiency vehicles. Fairness considered from the perspective of rural drivers, who drive longer distances for essential services, may also yield a different answer. Less affluent drivers may believe they deserve a lower rate. <sup>43</sup>

<sup>42</sup>DMV provides a description of the BPA program on their website: [https://www.dmv.ca.gov/portal/dmv/?1dmy&urile=wcm:path:/dmv\\_content\\_en/dmv/otherser/bpa/bpa](https://www.dmv.ca.gov/portal/dmv/?1dmy&urile=wcm:path:/dmv_content_en/dmv/otherser/bpa/bpa)

<sup>43</sup>See Appendix A-3 Evaluation of the California Road Charge Pilot Program, Page 2-66



of an open market for commercial account managers to collect distance data and apply charges was tested in the Road Charge Pilot Program. This has opened pathway toward resolving many of these issues, but some will likely require further study and policy discussions, as outlined in Table 7-4.

## POLICY ISSUES RAISED BY THE TAC

Through the course of public engagement, and technical research, the TAC identified other policy issues that merit addressing, as presented below:

### Urban vs. Rural Impacts

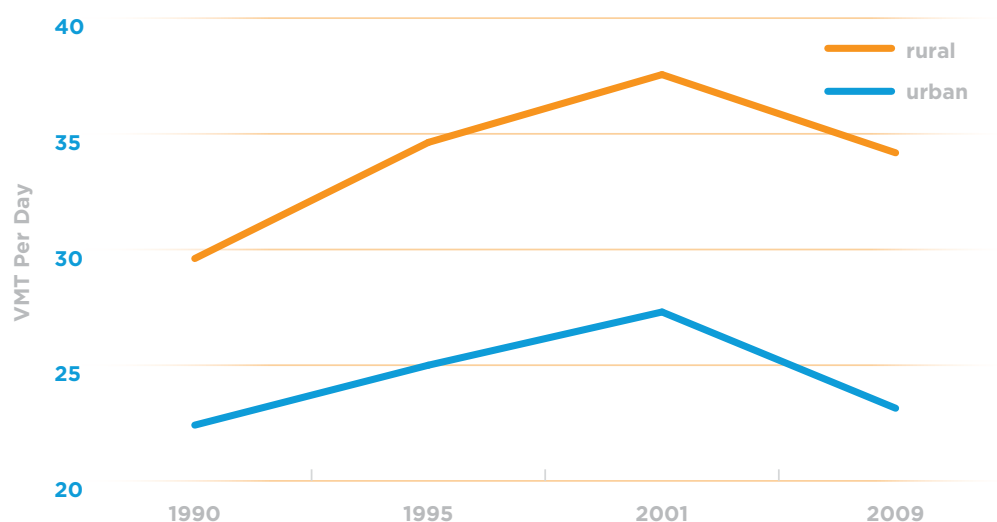
California residents who drive long distances, often necessary for day-to-day living, expressed concern about whether the impact of a road charge will disadvantage them unfairly. The reasons given for driving longer distances vary; rural drivers mention access to education, goods, and services, while long-distance commuters reference long distances between jobs and affordable housing.<sup>44</sup> Both

groups cite a lack of viable transportation alternatives to driving. National statistics reveal that rural drivers in the United States do drive longer distances (see Figure 7-5).

They reason that those who must drive longer distances would not get similar treatment under a road charge relative to urban drivers who drive shorter distances to obtain access to employment, goods, and services. Previous research suggests, however, that a road charge would benefit rural residents on average. A 2010 study examining impacts of adopting a per-mile charge for light vehicles in Oregon found a road charge as less regressive overall than a consumption-based fuel tax; that rural residents would benefit relative to their urban counterparts by experiencing a relative reduction in tax burden.<sup>45</sup>

Currently, under a consumption based system of taxation, the driver of a car that gets fifty miles per gallons pays much less in fuel taxes than the driver of a car that gets twenty miles per gallon. However, under a usage-based road charge system each would pay the same

Figure 7-5: Average Vehicle Miles Driven in Passenger Vehicles



<sup>44</sup>Appendix A-18.5: Road Charge Impact on Rural Residents and Long-Distance Commuters Policy Paper

<sup>45</sup>B. Starr McMullen, Lei Zhang, Kyle Nakahara. 2010. Distributional impacts of changing from a gasoline tax to a vehicle-mile tax for light vehicles: A case study of Oregon. *Transport Policy*. Volume 17, Issue 6, November 2010, Pages 359–366.

per mile. Figure 7-6 below illustrates the differing amounts that a range of common vehicle models would pay under a 1.8 cent per mile road charge, assuming that the cost of gas is \$2.30/gallon and that the per-gallon fuel excise tax that the road charge is replacing is 35.4 cents per gallon.

When considering a road charge as a potential future replacement for the gas tax, it is helpful to recognize that rural residents and long-distance commuters already pay more to fund roads than urban drivers because, presumably, higher vehicle miles of travel (VMT) correlates to more fuel tax paid at the pump. Whether the road charge would overburden rural drivers when compared to their current gas tax burden depends upon the relative fuel economy of urban and rural vehicle fleets.

Figure 7-7 indicates that the driver of a vehicle with a fuel efficiency 20 MPG or higher would pay more in a revenue-neutral road charge than under the current fuel tax system. And those drivers whose vehicles get less than 20 MPG would pay less.

Data collected during the pilot shows that the average fuel efficiency of vehicles in urban areas was 10.5 percent higher than those in

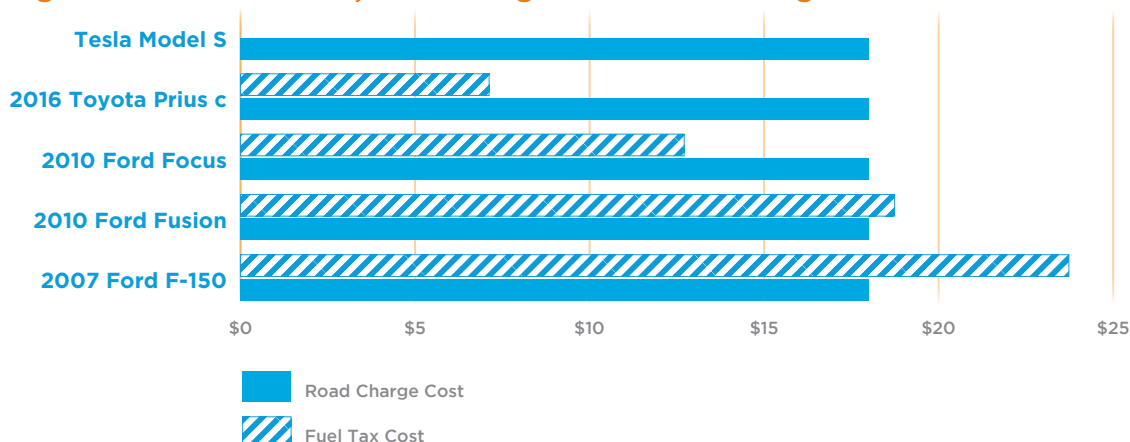
rural areas—23.5 mpg for rural drivers and 26.0 mpg for urban drivers—suggesting that urban drivers would pay more under a per-mile road charge, while rural drivers would pay less. Thus, if this value were representative of the state at a revenue-neutral road charge rate, approximately 10 percent of the cost burden would shift from rural to urban participants, significantly reducing the road funding burden borne by rural drivers.

The impact of road charge on long-distance commuters remains difficult to assess in broad terms. As with rural residents, long-distance commuters driving fuel efficient vehicles would pay more under a road charge, and those with low fuel efficiency vehicles would pay less.

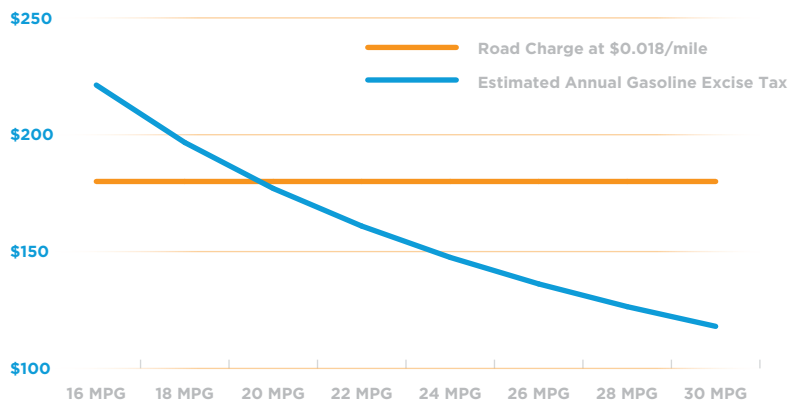
### OPEN SYSTEM

As states have proposed road charge systems as alternatives to the gas tax over the past decade, national tax policy experts have expressed concern that a state pursuing road charge systems on their own would not produce replicable systems to interoperate with other state systems. Based on previous practices experts had good cause to worry, up until recently. Historically, the public sector had the tendency to select closed proprietary

**Figure 7-6 Cost to drive 1,000 miles: gas tax vs. road charge**



**Figure 7-7 Cost to Drive 10,000 Miles, Gasoline Excise Tax vs. Road Charge**



systems<sup>46</sup> for data and tax collection, which quickly become outdated and did not have the capability to exchange information with other closed systems. Open systems in transportation did not emerge until the early 2000s, and government agencies have not immediately or universally embraced open systems preferring to remain with the closed systems.

The requirement for an open system presupposes competition among private sector entities. Implementation of an open commercial market for the road charge moves selection of the mileage reporting technologies and the operational business systems into the private sector, where competition influences action and decision-making. An open market, with easy entry for vendors supported by an efficient certification process, would encourage continual evolution of technologies and competitive pricing strategies, creating business systems with greater efficiency and lower operating costs for a road charge.

### Interoperability

Drivers in the United States travel from state to state freely. Under an operational road

charge program, California motorists driving across the border to another state will expect easy integration with the road charge systems in those states (if they exist). By applying an open system with identical or similar standards and requirements, road charge systems for neighboring states should easily interoperate. While some states' requirements, such as handling monetary transactions, may be unique to each state, generally requirements critical to interoperability such as electronic communication of data can be identical.

The Road Charge Pilot Program simulated a test of interoperability with Oregon's OReGO

***An open system for a road charge would allow multiple organizations to participate on all levels, typically in a manner that approximates an open market.***

- In an open system, any qualified company could provide mileage reporting hardware, and another group of qualified companies could provide account management services to motorists.***
- Companies are free to enter the market at any time, so long as their equipment or services meet standards set by the state.***

<sup>46</sup>A "closed system" is proprietary and which only one provider is, in practice, able to support.

program. Applied only to participants using location-aware mileage reporting devices, the pilot program charged their Oregon miles at 1.5 cents per mile, with a credit for fuel tax paid at Oregon’s rate of 30 cents per gallon, from January 1, 2017 until the pilot concluded on March 31, 2017. The pilot program continued to charge miles driven in California at the state’s simulated road charge rate of 1.8 cents per mile, with a credit for fuel tax paid of 35.4 cents per gallon. No money actually changed hands during the pilots simulated interoperability test, rather the account manager issued an invoice and collected mock payments for the total amount owed at the end of the month for travel in both states from their participants.

During the period of simulated interoperability, the account manager reported miles driven to the Account Management Oversight (AMO) monthly identifying Oregon miles as “out-of-state chargeable miles.” The pilot delivery team added a section to the monthly AMO Report detailing miles driven in Oregon simulated revenue collected for Oregon. Table 7-5 represents the simulated funds collected by the account manager which would, in theory, go from the account manager to Oregon versus California.

Results from the pilot interoperability test reveal that interstate operation of a road charge supported by private account managers is feasible, so long as both states

have an agreement with the account manager in question and the systems are compatible.

### Auditability

To ensure compliance, an operational road charge program must be auditable. Audits of account managers in the Road Charge Pilot Program established the rudiments of an audit process that a road charge authority could implement and expand an operational, statewide road charge system for account managers. Specifically, Table 7-6 describes the steps of the audit process.

The tests and procedures performed in the pilot audit confirmed that the pilot account managers successfully achieved compliance with the goals and requirements set for the pilot. The Road Charge Pilot Program system was auditable, however, as shown in Table 7-7, moving forward some additional enhancements are recommended.

Anomalies found in an account manager’s data may trigger special audits. For example, one account manager experiencing significantly fewer miles or less revenue relative to others may trigger a special audit when the difference cannot be attributed to differing services or consumer demographics. Instances of suspected malfeasance may also trigger a special audit. In such a case, the auditor should perform the special audit on the account manager’s premises and demand immediate access to systems.

Detailed processes for initial compliance and auditing, in conjunction with procurement of account managers should be developed for a future road charge program. Precise auditing processes will require customization to fit the specifics of any statute related to road charge.

**Table 7-5: Miles Driven in Oregon by selected Vehicles in Pilot**

Month	Miles	Oregon RUC	Oregon Fuel Tax Credits	Net Oregon Revenue
January	2,958.9	\$44.39	\$(42.54)	\$1.85
February	1,857.4	\$27.87	\$(26.95)	\$0.92
March	2,189.2	\$32.86	\$(30.53)	\$2.33
Total	7,005.5	\$105.12	\$(100.02)	\$5.10

**Table 7-6: Steps in the Account Manager Audit Process**

#	Step	Description
1	Road Charge Information Request	The auditor requests both detailed system documentation and raw data from the account manager. The account manager provides system documentation at the flowchart level (not the detailed code level), and should include descriptions of how various system components function. The auditor requests raw data by vehicle identification numbers (VINs) chosen at random. The auditor requests raw data for steps in the system where it makes sense, such as in the form of trip or day totals, in any case at a level of detail different from the level at which data are reported to AMO.
2	Numerical Data Analysis	The auditor analyzes data for the selected VINs to see whether they correspond to all expected values the AMO has received.
3	Account Manager Interview	The auditor asks questions about the system documentation provided, and the account manager's overall implementation of the system, such as interpretations of requirements and the nature of day-to-day operations.

**Table 7-7 Enhancements in the Account Manager Audit Process**

#	Enhancement	Description
1	Design with Audit Documentation	A business rule should require the account managers to maintain and provide documentation on their systems' raw data format and how it relates to the data transmitted. The pilot account managers all provided such data, but such a business rule would set expectations at the outset that all account managers must document and maintain a precise record of how their internal data relates to data sent to the AMO.
2	Add Financial Record Requirements	The pilot did not require real money payments, and the account managers therefore did not keep financial-grade records of monetary transactions. An operational road charge program will require real money payments, so maintaining financial grade records will be vital.



# VIII. Next Steps for Road Charge

The Road Charge Pilot Program successfully tested the functionality, complexity, and feasibility of the critical elements of potential mileage-based revenue system for transportation funding. However, there are some questions that remain unanswered.

Issues related to the cost to administer the program, enforcement, revenue collection, coupled with the ever evolving technology in transportation, necessitates additional investigation into the mechanics of implementing a road charge in California.

## PAY-AT-THE-PUMP TECHNOLOGY

While all the mileage reporting methods employed for the Road Charge Pilot Program are feasible, they cannot compete with the simplicity, cost effectiveness, and public acceptance of the current gas tax collection process.

Utilizing the Federal grant funding made available through the FAST Act, Caltrans will be applying the lessons learned in the Road Charge Pilot Program to investigate the

feasibility of a road charge mechanism that replicates the current user experience, pay-at-the-pump technology.

*As innovators, Californians will continue to stay at the forefront of the ever-evolving technology used to communicate from our vehicles through our transportation infrastructure. The Road Charge Pilot Program was a first step in researching ways for a long-term stable transportation financing model."*

*- Malcolm Dougherty  
Director of the California Department of  
Transportation*

If this study results in one or more potential pay-at-the-pump options, the next step will be to continue the partnership with the Federal Highway Administration to conduct a limited demonstration of this mileage reporting option.

A pay-at-the pump model, could result in reduced administrative costs over the other mileage recording and reporting methods tested, and has the potential to garner greater public acceptance, as the road charge would be assessed on a pay-as-you-go approach, similar to the current gas tax assessment.

## **ROAD CHARGE COLLECTION**

The collection of revenue was simulated in the Road Charge Pilot Program, through mock invoices and payments. The actual flow of revenue through the state system was not tested, but was reviewed through an institutional analysis. Depending on how the road charge program is designed, there could be a number of state agencies/departments involved in the revenue collection process. Conducting a tandem test of collecting a road charge with the pay-at-the-pump demonstration will provide a controlled environment to evaluate the revenue flows through the state system, allowing identification of challenges, efficiencies, and synergies for future implementation.

## **IN-VEHICLE TELEMATICS**

The pay-at-the-pump study will address the internal combustion engine mileage collection, but the proliferation of alternative fuel vehicles requires a method for collecting mileage data, such as in-vehicle telematics. More and more auto manufacturers are offering in-vehicle telematics on their new vehicles, and industry analysts are projecting

the majority of new vehicles will include in-vehicle telematics by 2020. Developing a road charge program that allows for the collection of mileage data via in-vehicle telematics will provide for the immediate solution for alternative fuel vehicles and a long-term solution for the complete transition off of the gas tax.

The adoption of in-vehicle telematics, as a means for collecting mileage data, could dramatically reduce the impact of the adoption, administration, and enforcement costs of a road charge program. However, standardization of the mileage information collection and data transference needs to be investigated to allow for open-market application of a road charge. As seen with the telecommunications and tolling industries, proprietary systems reduce or delay entry into the market, thus limiting competition and driving up costs. Early discussions, planning, and development of technical specifications and standards will allow for the greatest level of innovation and competition.

## **TECHNOLOGY COLLABORATIVE**

With the continuous advancement in the technology industry, and with various agencies/departments pursuing new technology solutions in the deployment of new programs, a concerted effort in aligning these new programs should be facilitated. The formation of a technology collaborative, with representatives from the public and private sector will ensure the latest technology and processes will be considered in the formation of a road charge program.

Various state agencies/departments are currently pursuing technology solutions for their business practices, such as DMV developing autonomous vehicle regulations,

ARB's new OBD-II regulations, and the arrival of 5G and Connected Vehicle technology. Providing for a more collaborative approach in developing a program, through a technology collaborative, could integrate new and emerging technologies, addressing our current needs as well designed to adapt to the dynamic nature of the industry.

California is a hub of technology and innovation. As such, the university systems and private sector could play an essential role in this technology collaborative. Involving private entities representing a variety of business interests, alongside higher education, will provide the greatest insights and ideas needed for an innovative and dynamic road charge solution.

## ORGANIZATION DESIGN

Statewide implementation of a road charge will not happen overnight. Thoughtful consideration of a multitude of variables is needed before any decision to proceed with a road charge program is made.

One of the preliminary issues to be addressed is the organizational design of the road charge program. There are a number of agencies/ departments potentially impacted by a road charge program. The early identification of the implementing agency/department will be crucial to efficiently and effectively facilitate the coordination, development, transition, and operations of a statewide road charge program.

Clearly defined roles and responsibilities, the establishment of a governmental organizational structure, and necessary resources are essential. While the Road Charge Pilot Program addressed the roles of commercial account managers and their

interactions, the pilot did not simulate aspects of the organizational design. Due to the limited nature of the pilot, organizational implications of an operational Road Charge Program could not be tested. However, to provide policymakers information regarding the complexities of implementing a new transportation revenue system, Caltrans assembled an Interagency Work Group to assist in the identification and discussion of organizational design issues.

The Interagency Work Group consisted of representatives from a number of agencies/ departments, all with a reasonable likelihood of having some functional responsibility in a future operational road charge program:

- Department of Motor Vehicles (DMV)
- California Department of Tax and Fee Administration (CDTFA) (Board of Equalization)
- Bureau of Automotive Repair (BAR)
- California Air Resources Board (ARB)
- California Highway Patrol (CHP)
- State Controller's Office (SCO)
- California Department of Insurance (CDI)
- California Transportation Commission (CTC)

The Interagency Workgroup convened as a group, as well as individually, to explore and discuss potential organizational design issues that may occur in a potential Road Charge Program. A critical guiding principle of this work was the identification of key functions of a Road Charge Program. Examining how existing California state government bodies could potentially assume the roles and responsibilities to execute a Road Charge program.





To facilitate these discussions Caltrans established the following overarching principles to guide the potential organizational design of the Road Charge Program:

- Identify all key functional areas, and tasks needed to administer a potential future Road Charge Program
- Avoid the expansion of government through the utilization, to the greatest extent possible, existing expertise within State agencies to manage appropriate functions and tasks
- Collaboration among the participating State agencies, including effective, seamless interfaces for tasks that require sharing of information
- Use of Commercial Account Managers (CAMs) from the private sector to effectively and efficiently administer the Road Charge Program
- The Account Management Oversight (AMO) would oversee account managers as they establish and maintain the individual accounts for each vehicle.
- Commercial Account Managers (CAMs) would provide road charge measurement and collection services to motorists not as agents of the state but as certified agents of the motorists.
- The California State Account Manager (CalSAM) would administer accounts for motorists who prefer not to engage with commercial entities.
- Audit and Economic Compliance (AEC) would analyze data for trends and outliers and audit the road charge program, including account managers.

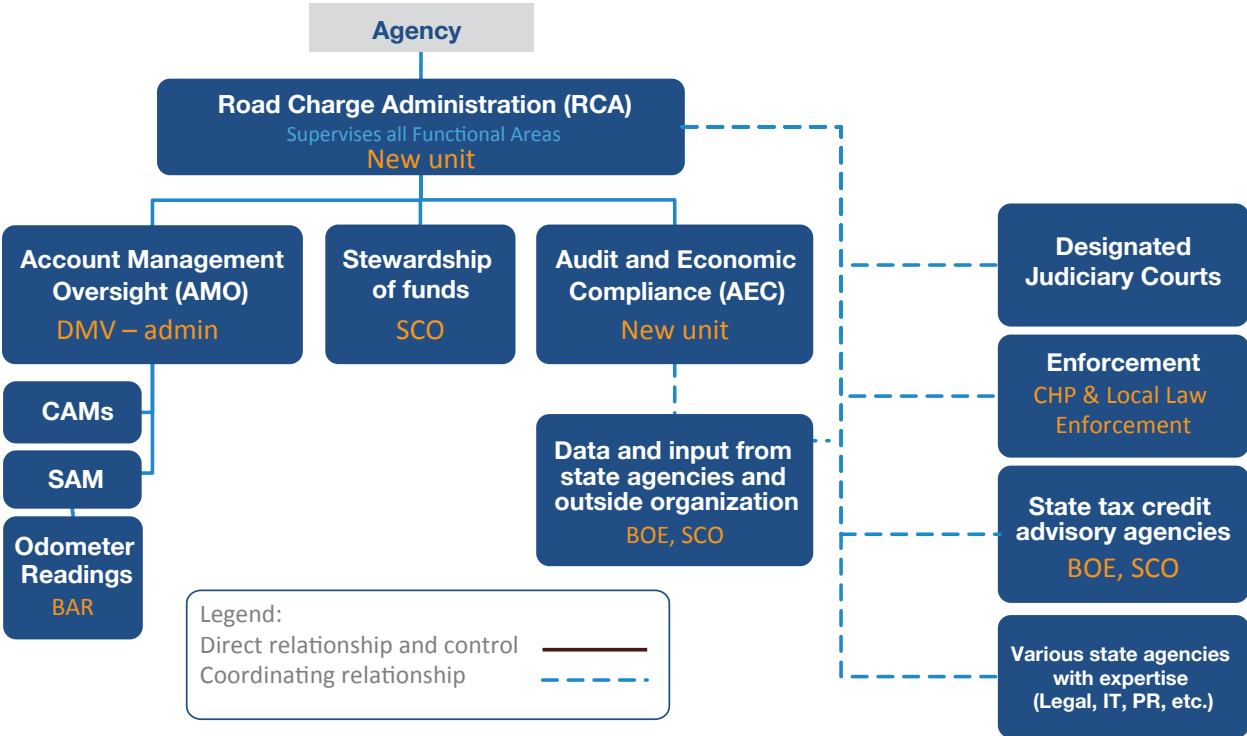
The Inter Agency Work Group identified five new organizational functional areas required to support a road charge program:

- The Road Charge Administration (RCA) would direct the effort and be the public face of the program.

Figure 8-1 (page 83), illustrates a potential road charge organizational structure, identifying the integration of functions with existing state agencies and resources, with a potential new functional area, RCA:

The challenges for the agency/department appointed to operate the Road Charge Program include attracting talent to execute an ambitious program with a lean

**Figure 8-1 Road Charge Organizational Design**



organizational structure and maintaining the credibility within state government to implement the necessary coordination among varying support agencies. More general organizational challenges include:

- Establishing an organizational structure supporting efficient direction of the road charge program;
- Speaking as the voice of the program to effectively communicate the program’s purpose;
- Managing the complex distribution of the program’s revenue as the road charge gradually replaces the fuel tax; and
- Effectively overseeing the commercial account managers by maintaining effective standards and responding quickly.

**POTENTIAL TRANSITION OPTIONS**

California policymakers desiring to implement a road charge will need to address the questions of how and when to transition from the current policy of taxing consumption to a new policy charging for distance driven. This transition requires both policy and operational decisions.<sup>47</sup>

Even an aggressive road charge implementation policy will require a transition period. Policymakers and the implementing agency/department must educate stakeholders and the general public of the new policy, its features, and compliance obligations required. Regulations will need to be developed and codified, information systems will need to be developed and tested, contracts with providers of technology and services will need to be negotiated and executed, and financial and accounting systems across

<sup>47</sup>Appendix A-18.4: Road Charge Transition Strategies and Issues

multiple agencies will need to be integrated and tested.

As policymakers contemplate road charge as a viable replacement of the gas tax, several factors need to be considered when transitioning the fleet:

- **Vehicles.** In formulating a transition to road charge, the consideration of what vehicles are subject to road charge, when they are subject to the road charge, and whether and how those vehicles should be eligible for fuel tax credits or refunds.
- **Replacing the fuel tax.** Perhaps the most important issue, policymakers must decide whether to eventually replace the gas tax with the road charge as vehicles become more fuel efficient in the coming decades. Senate Bill 1077, specifically states the road charge represents an alternative to the gas tax. Charging the fuel tax at the pump as part of the price of fuel means some combination of credits and refunds will almost certainly be needed.
- **Out-of-state drivers.** According to a study by RUC West, miles driven by out-of-state vehicles on California roads represent between 1.2 percent and 2.6 percent of total miles driven.<sup>48</sup> For out-of-state drivers on California highways, the



most expedient short-term policy would be continuance of fuel tax collections for non-residents. Should lawmakers want to extend road charge to out-of-state drivers, they will have to consider constitutional prohibitions on discriminatory treatment of non-residents as well as other states' road charge programs. (For further discussion on Out-of-State drivers see Appendix A-18.2).

- **Enforcement.** Without enforcement, even well-meaning residents intending to comply with reporting requirements may prove negligent. While enforcement may not be critical while the fuel tax is still collected, enforcement becomes essential for an operational road charge program when only a subset of vehicles may be subject to road charge. Policymakers must provide clear statutory guidance to the implementing agency/department for identifying subject vehicles, penalizing non-compliant subject vehicles and giving administrative tools and funding to enforcement agencies.
- **Cost.** Transitioning to road charge will be expensive regardless of how it is done, but the implementation and operational costs will vary depending on the speed and nature of the program and transition.

**Transition Alternatives.** There are several vehicle characteristics upon which to base future transition from gas tax to a road charge. These include vehicle age, vehicle fuel economy, vehicle weight, and combinations of these three. Four transition alternatives, described in Table 8-1, illustrate some of the possibilities. (For more detailed description see Appendix A-18.6).

<sup>48</sup>Assessing Out-of-State Drivers in a Road Usage Charge System: Phase 2. Western Road Usage Charge Consortium, December 2016.

**Table 8-1: Road Charge Transition Alternatives**

Transition Alternative	Description
Model Year	Transition by Model Year, assumes a gradual transition of the fleet by subjecting only new vehicles from a certain Model Year onward to road charge, leaving the older vehicles on fuel taxes. This slower transition requires a more modest upfront investment but would require the retention of the fuel tax system for a decade or more. The number of vehicles that the road charge system would handle in year one is an order of is approximately 2 million. The corresponding complexity and administrative ability to implement this system is similarly improved, thus reducing risks of technical failure, political backlash and public outcry, and cost overruns. Over time, as new vehicles continue to enroll into the road charge system, the system grows increasingly able to absorb new vehicles with lower administrative costs. It does have some drawbacks, namely the political and administrative challenge of sustaining two fee collection systems in fuel tax and road charge for an extended period.
Fuel Economy And/or Fuel Type	This transition assumes an even slower, more gradual transition of the fleet by subjecting only vehicles above a specified fuel economy or fuel type to road charge, leaving the remaining vehicles on fuel taxes. Depending on the precise cutoff point, the transition by fuel economy/type approach allows for smaller, controlled number of vehicles to enter the program in the early years. For example, if only plug-in hybrid electric vehicles (PHEVs) and electric vehicles (EVs) are included in the mandatory program, then the program would need to absorb approximately 100,000 vehicles in its first year. By starting at the high end of the fuel economy spectrum, there is little revenue risk, since PHEVs, EVs, and other vehicles with very high fuel economy consume little to no fuel and pay little to no fuel tax. Even so, the political challenge of “targeting” highly fuel-efficient vehicles may be seen as a disincentive to vehicle buyers, making this approach potentially politically risky.
Electric Vehicles (EVs)	Assessing a road charge to Electric Vehicles (EVs) either based by model year or the entire active EV fleet, while very similar to the Fuel Economy and/or Fuel Type option, and would even be a smaller universe of vehicles to transition in the early years. However, the availability of mileage data on EVs will need to be standardized across the fleet. Like the previous transition strategy this may be seen as a disincentive to EV buyers, making this approach potentially politically risky.
Autonomous Vehicles	The adoption and deployment of autonomous vehicles provides an opportunity to implement a road charge, initially, on a limited pool of vehicles. Allowing for development efficiencies based on the advanced data and technology of autonomous vehicles (AVs). It is uncertain what the timeline is for full deployment of the AVs into the fleet.
Vehicle Weight	Transition by weight, contemplates applying road charge to heavy vehicles, starting with those vehicles over 26,000 pounds, potentially adding a weight factor to the road charge. Administratively, this may be the most appealing option because the trucking sector is already regulated and familiar with mileage data reporting, but it introduces policy and political challenges for road charge more generally. The national trucking industry remains opposed to distance-based charging for heavy trucks.
Rapid Transition	<p>Rapidly transitioning all vehicles from fuel tax to road charge assumes the change occurs quickly, subjecting all of California’s vehicles (or all light-duty vehicles, under 10,000 pounds) over a one year period. After the transition year, the state could begin dismantling the infrastructure for collection of fuel taxes (or at least gasoline taxes, were policy makers to maintain diesel taxes as the principal source of revenue from heavy vehicles).</p> <p>The rapid transition approach is an intense and difficult transition policy. The cost of implementation in a rapid transition will be high because of the additional personnel and hours required, and the need to correct errors resulting from risks that could be more easily managed in a slower transition.</p>



## IX. Conclusion

The current gas tax revenue mechanism was developed and implemented on a consumption basis, when fuel efficiency of vehicles did not vary dramatically. Over the past decades, vehicle fuel efficiency has steadily increased with major advancements in the past five years, due in part to greater availability of alternative fuel vehicles.

Compounding the effect of improved fuel efficiency was the stagnant gas tax rate. However, after two decades without an adjustment for inflation, the passage of Senate Bill 1 restored the purchasing power of the gas tax, helping the state address the immediate backlog of transportation maintenance and repair needs.

Looking to the future, when gas-powered vehicles will be the minority, a revenue collection method based primarily on consumption will not be a sustainable option. As our fleet becomes increasingly efficient the necessary funding to maintain and operate our transportation infrastructure will diminish, putting a greater burden on segments of society with minimal disposable income when the only populations driving gas-powered cars are the poorest Californians. Moving towards a usage-based system of revenue collection, has the potential to equitably distribute the cost to maintain and operate our transportation infrastructure to those who use the system.

This Road Charge Pilot Program confirmed the viability of many aspects of a user-based

transportation revenue mechanism. However, many obstacles must still be evaluated before transitioning from a gas tax to a road charge is considered. Purposeful research, deliberative planning, and careful application, in a fully transparent process, will help to minimize the risks associated with adopting any new transportation funding mechanism.

While much of the concern regarding an immediate funding crisis has been addressed by Senate Bill 1's updates to the existing transportation infrastructure funding mechanism, a road charge program is worthy of further research to prepare the state for a future where most of the cars on the road are powered by alternative energy sources.

# Appendices

- A-1 Senate Bill 1077 (Statutes of 2014, DeSaulnier)**
- A-2 TAC Recommendations Report**
- A-3 Evaluation of the California Road Charge Pilot Program**
- A-4 “California Transportation Infrastructure Priorities Workgroup Whitepaper: Exploring a Road Usage Charge as an Alternative to the Gasoline Tax” (Recommendations to the Secretary), January 2015.**
- A-5 Concept of Operations**
- A-6 Interface Control Document**
- A-7 System Requirements Specification**
- A-8 End-to-End Test Results Report**
- A-9 Road Charge Privacy Policy**
- A-10 California Road Charge Pilot Program - Policies & Participation Agreement**
- A-11 Security Review Final Report**
- A-12 Sample Welcome Email**
- A-13 Non-chargeable Mileage Refund form**
- A-14 California Road Charge Pilot Program Account Manager Audit Report**
- A-15 California Road Charge Pilot Program Technical Lessons Learned**
- A-16 Report on Impacts of OBDII Updates and 5G on Road Charging**
- A-17 Business Rules**
- A-18 Policy Papers**
  - 1. Use of Commercial Account Managers
  - 2. Assessing Road Charge on Out-of-state visitors
  - 3. Road Charge Jurisdictional Issues
  - 4. Transition Strategies and Issues
  - 5. Road Charge Impact on Rural Residents and Long-Distance Commuters
  - 6. Use of Revenues in a Road Charge System

# Acronyms and Abbreviations

<b>AEC</b>	<b>Audit and Economic Compliance</b>
<b>AMO</b>	<b>Account Management Oversight</b>
<b>ARB</b>	<b>Air Resources Board</b>
<b>AV</b>	<b>Autonomous Vehicle</b>
<b>BAR</b>	<b>Bureau of Automotive Repair</b>
<b>BPA</b>	<b>Business Partner Automation</b>
<b>CAFE</b>	<b>Corporate Average Fuel Economy</b>
<b>CalSAM</b>	<b>California State Account Manager</b>
<b>CalSTA</b>	<b>California State Transportation Agency</b>
<b>Caltrans</b>	<b>California Department of Transportation</b>
<b>CAM</b>	<b>Commercial Account Manager</b>
<b>CBO</b>	<b>Congressional Budget Office</b>
<b>CDI</b>	<b>California Department of Insurance</b>
<b>CDTFA</b>	<b>California Department of Tax and Fee Administration</b>
<b>CHP</b>	<b>California Highway Patrol</b>
<b>CTC</b>	<b>California Transportation Commission</b>
<b>CTIP</b>	<b>California Transportation Infrastructure Priorities</b>
<b>DMV</b>	<b>Department of Motor Vehicles</b>
<b>EV</b>	<b>Electric Vehicle</b>
<b>FAST Act</b>	<b>Fixing America's Surface Transportation Act</b>
<b>GHG</b>	<b>Green House Gas</b>
<b>GPS</b>	<b>Global Positioning System</b>
<b>IMS</b>	<b>Intelligent Mechatronic Systems</b>
<b>ISO</b>	<b>International Organization for Standardization</b>
<b>MPG</b>	<b>Miles Per Gallon</b>
<b>PHEV</b>	<b>Plug-in Hybrid Electric Vehicle</b>
<b>RCA</b>	<b>Road Charge Administration</b>
<b>RUC</b>	<b>Road Usage Charge</b>
<b>SB</b>	<b>Senate Bill</b>
<b>SCO</b>	<b>State Controller's Office</b>
<b>STSFA</b>	<b>Surface Transportation System Funding Alternatives</b>
<b>TAC</b>	<b>Technical Advisory Committee</b>
<b>VIN</b>	<b>Vehicle Identification Number</b>
<b>VMT</b>	<b>Vehicle Miles Traveled</b>
<b>ZEV</b>	<b>Zero Emission Vehicle</b>

