



Appendix-5

Pilot Concept of Operations

Pilot Concept of Operations

Version 1.9

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Revision History

VERSION	MAIN CHANGES	CONTRIBUTIONS FROM	DATE
V1.0	First Draft	M Dorfman	20150514
V1.1	Update language usage for California program; extensive update of operational concept descriptions	M Dorfman	20150609
V1.2	Updates to language usage for consistency; further extensive update of operational concept descriptions; addition of description of components of a road charge system	M Dorfman	20150618
V1.3	Updates to language usage for consistency. Extensive updates to Executive summary, introduction, Policy Direction and Stakeholders.	M Dorfman	20150618
V1.4	Minor updates based on quality control in preparation for delivery to Caltrans. First version Officially Delivered to Caltrans	M Dorfman	20150707
V1.5	Added TAC and CTC to list of stakeholders.	M Dorfman	20150805
V1.6	Updates prior to review by vendors. Minor updates throughout document based on decisions made on the pilot since July. Removal of pre-pay odometer charge as a separate concept.	M Dorfman	20160222
V1.7	Minor updates throughout document based on review by vendors. Second version Officially Delivered to Caltrans	M Dorfman	20160229
V1.8	Creation of Final Pilot ConOps based on changes for pilot: update language/word choice to reflect use in the pilot program; update scope qualification; update information used to create rates; update description of operational concepts in chapter 3 to provide exact experience of participants in pilot; update descriptions of system usage scenarios in chapter 5 to provide exact experience of participants, the state, and account managers in pilot; update chapter 6 to provide exact descriptions of coordination and testing in pilot. Third version Officially Delivered to Caltrans	M Dorfman, T Dunn	20160709
V1.9	Post-pilot updates: Add reminders for smartphone reporting and becoming compliant Retroactive manual methods (not in pilot) Add simulated interoperability Add simulated refunds for non-chargeable miles	M Dorfman	20170509



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Executive Summary

This document provides a Concept of Operations (ConOps) for the California Road Charge Pilot Program for the California Department of Transportation (Caltrans). This ConOps served as the foundational document that guided and now documents the design of California's Road Charge Pilot Project, scheduled for July 2016 to March 2017. It has been updated after the pilot to reflect the activities that took place during the pilot.

A ConOps is often the first systems engineering document produced in a systems development process, with the intent of completely describing all system functionality. A ConOps supports discussions among stakeholders – discussions that should lead to agreement on major design decisions – before any implementation details are decided. After a ConOps, the next step in the systems engineering process is to develop a set of technical requirements¹ to serve as a basis for procuring system hardware, software, and integration.

Motor fuel tax revenues in California are projected to decline into the foreseeable future due to the increasing number of fuel-efficient vehicles, including hybrid and fully electric vehicles, in the fleet. Because of this, in 2014, the California State Legislature passed Senate Bill 1077 (DeSaulnier, 2014), which directed the Chair of the California Transportation Commission (CTC) to create a Technical Advisory Committee (TAC) to study road charging alternatives to the gas tax and make recommendations to the Secretary of the California State Transportation Agency (CalSTA) on the design and evaluation of a Road Charge Pilot Program.

The policy basis for this ConOps is the interest among the Legislature and the Administration in understanding the details of how a road charge would function in California. In approaching the concept of a road charge pilot, all activities have been framed under a single overarching goal: ***Identify and develop a sustainable, long-term revenue source for California's surface transportation system.***

A core element of the ConOps involves the design and delineation of methods for road charge collection. Six such methods are explored in this document:

- ▶ Operational Concept 1: Time Permit
- ▶ Operational Concept 2: Odometer Charge (post-pay)
- ▶ Operational Concept 3: Mileage Permit
- ▶ Operational Concept 4: Automated Distance Charge (no location)
- ▶ Operational Concept 5: Automated Distance Charge (general location)

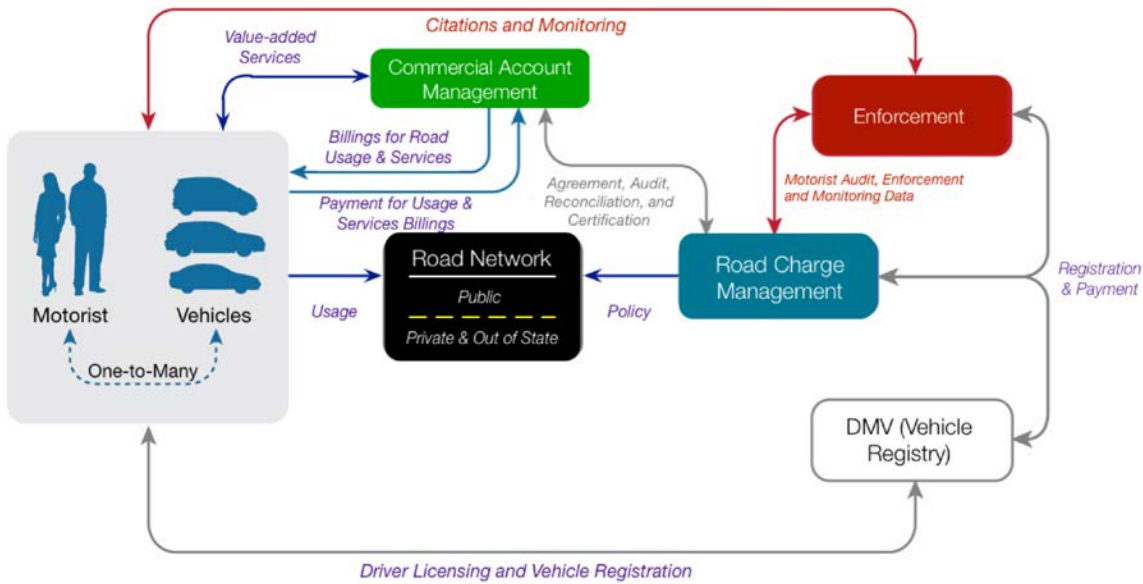
The following diagram illustrates the road charging system at a high level:

¹ A System Requirements Specification (SRS) and an Interface Control Document (ICD), which are included as appendices to the final report.



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Figure 1: Road Charging System Overview



The diagram above illustrates the following stakeholders' relationships:

- ▶ **Motorists** (who are pilot participants) and their road charge-liable vehicles use the road network consisting of public and out of state roads.
- ▶ Vehicles are authorized to use the road network once they are registered with **Road Charge Management**.
- ▶ The vehicle's usage of the road network is reported using one of the five Operational Concepts, provided by **Account Management**.

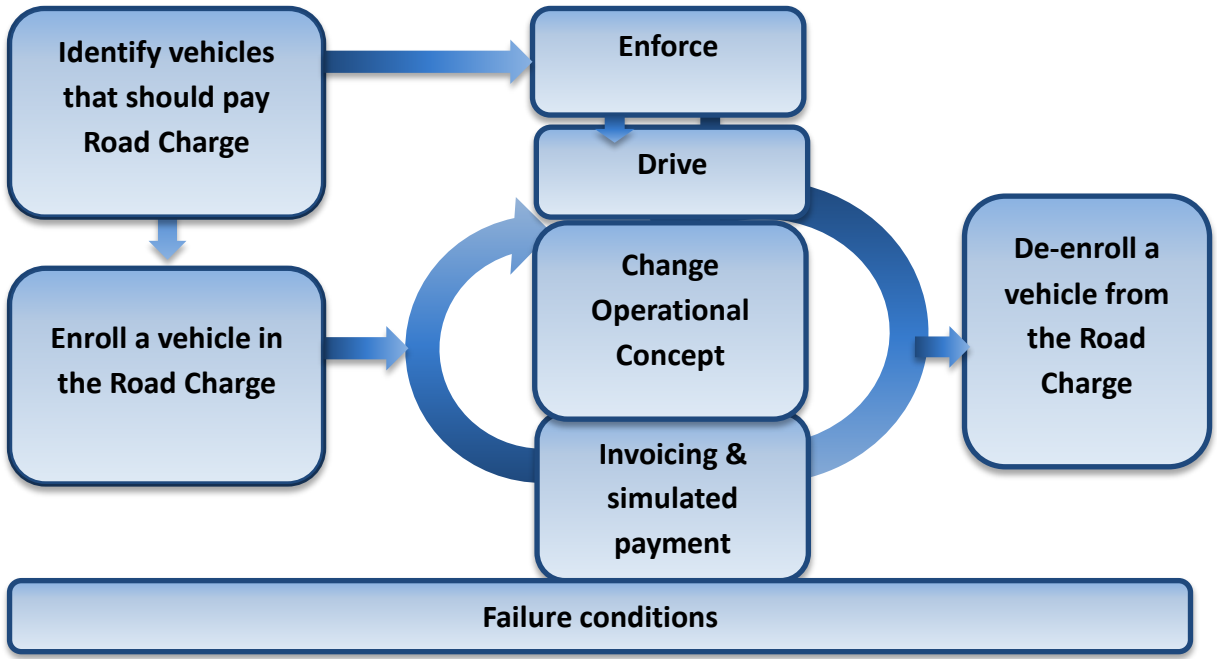
What are "Motorists"?
Throughout the study, we have referred to the person responsible for paying a road charge as the "Pilot Participant," recognizing that the "driver" or "owner" of a vehicle is not always the person responsible.

The ConOps also includes eight usage scenarios that further explain the operations of the road charging system, as illustrated by the following diagram:



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Figure 2: Road Charging System Usage Scenarios



The final section (section 6) in the ConOps describes how the system outlined here will be implemented in a pilot project to fulfill the policy goals of the Legislature and design directives of the TAC. It also gives takeaways and a list of issues to resolve.



Pilot Concept of Operations

1. Introduction

This document provides a Concept of Operations (ConOps) for the California Road Charge Pilot Program and served as the basis for California's Road Charge Pilot Project, which ran from July 1, 2016-March 31, 2017. Specifically, this document set the stage for a requirements development effort that was used to procure a road charge system for pilot testing. It has been updated after the pilot to reflect the activities that took place during the pilot.

This ConOps is intended to be non-technical enough that potential system stakeholders – the Legislature, California State Transportation Agency (CalSTA), California Transportation Commission (CTC), California Department of Transportation (Caltrans), the Road Charge Technical Advisory Committee (TAC), Department of Motor Vehicles (DMV), Board of Equalization (BOE), California Highway Patrol (CHP), and other interested organizations and residents – can understand and contribute to the system design. Feedback on this ConOps informed documents on the technical design and operation of the pilot project. Those documents² are more detailed than the ConOps, and served as a basis for the technical implementation.

The remainder of this section defines a ConOps; provides background information on highway funding in California and the motivations for considering road charging; summarizes high-level decisions made by the California Transportation Infrastructure Priorities (CTIP) Workgroup and the TAC; provides some important qualifications about the scope of this document; and outlines the remaining contents of the ConOps document.

1.1. What is a ConOps?

A ConOps describes the characteristics of a system from the viewpoint of an individual or organization who will be using the system. It is primarily a communications tool, not a specifications tool. While a ConOps may include quantitative details about a proposed system, it also contains qualitative descriptions of how a user can expect to experience the system: what their responsibilities will be and who they will interact with.

A ConOps is intended to inform a broad audience with varying levels of technical knowledge, and it is the first step in a systems engineering process. Using the systems engineering process, and in particular using a ConOps to define a system, is now standard practice for many transportation agencies. For example, the Federal Highway Administration (FHWA) encourages the use of a ConOps³ and provides the following description:⁴

The Concept of Operations is a description of how the system will be used. It is nontechnical, and presented from the viewpoints of the various stakeholders. This provides a bridge between the often-vague needs that motivated the project to begin with and the specific technical requirements.

This ConOps document has the following goals:

² A System Requirements Specification (SRS) and an Interface Control Document (ICD), which are included as appendices to the final report.

³ FHWA, "Developing and Using a Concept of Operations in Transportation Management System," 2005, available at: http://tmcps.ops.fhwa.dot.gov/cfprojects/uploaded_files/conops_tms_handbook.pdf.

⁴ Federal Highway Administration, California Division, "Systems Engineering Guidebook for Intelligent Transportation Systems, Version 3.0," November 2009. Available at: http://www.fhwa.dot.gov/cadiv/segb/views/document/sections/section8/8_4_5.cfm.



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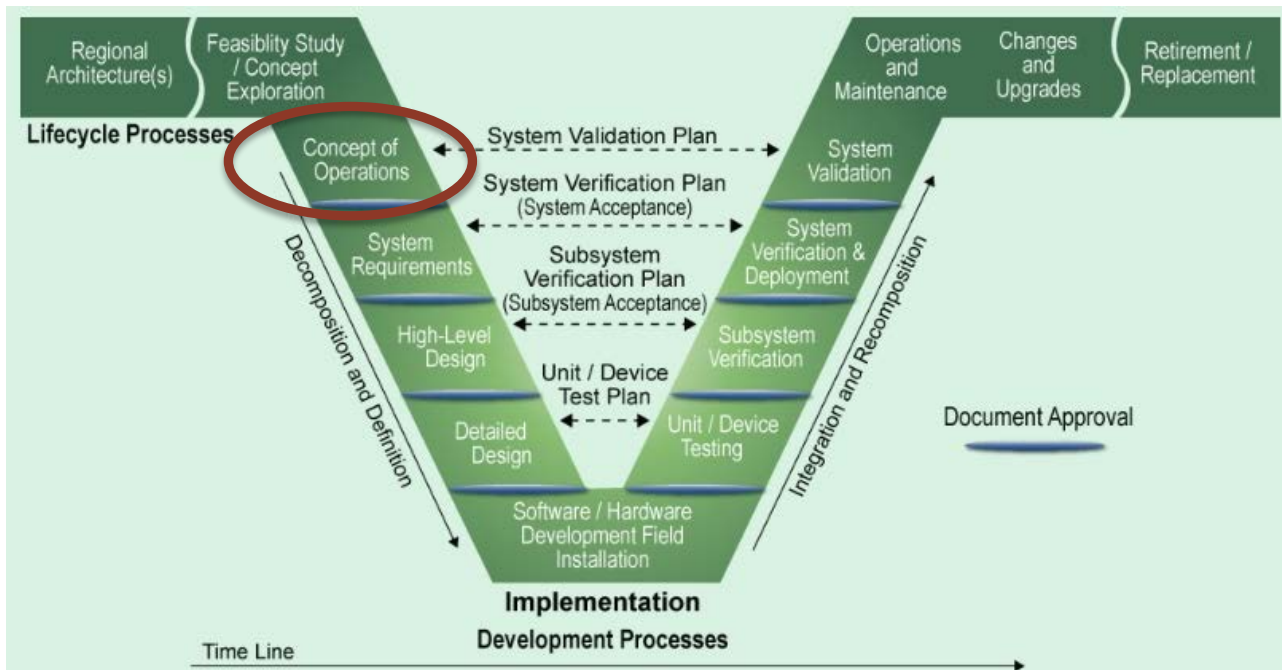
- ▶ Facilitate stakeholder agreement about the following:
 - > How the system is to be operated.
 - > Who is responsible for doing what.
 - > What the lines of communication are.
- ▶ Define the high-level system structure and demonstrate its advantages over other alternatives.
- ▶ Define the general organizational and technical environments in which the system will operate.
- ▶ Describe high-level user requirements.
- ▶ Establish the criteria to be used for validation of the complete pilot system.

This ConOps does *not* contain detailed technical specifications or requirements; those are reflected in the System Requirements Specifications (SRS) and Interface Control Document (ICD).⁵

Although there are many templates for a ConOps, the best known and most widely used was published by the Institute of Electrical and Electronics Engineers (IEEE).⁶ This document uses the IEEE’s ConOps template as a starting point, but omits sections that are more relevant to consumer electronics products.

This ConOps set the stage for further systems engineering development. The full systems engineering development process is illustrated in the U.S. Department of Transportation’s system engineering “V-diagram” (Figure 1.1),⁷ a standard illustration of the systems engineering process frequently used in transportation systems development:

Figure 1 Systems Engineering V Diagram



⁵ These documents are included as appendices to the final report.

⁶ This template can be accessed via the IEEE website: <http://standards.ieee.org/findstds/standard/1362-1998.html>.

⁷ Source: U.S. DOT, “Planning for Operations” <http://ops.fhwa.dot.gov/publications/fhwahop12001/images/f21.jpg>



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As the diagram illustrates, development of the ConOps follows the initial Feasibility Study or Concept Exploration and precedes development of any system requirements or detailed system design. Further, it informs the System Validation Plan, providing an important link between the early vision of how users will experience the system with later technical development. By virtue of providing the first comprehensive high-level outline of systems functionality, the ConOps document informs discussions among stakeholders – discussions that should lead to agreement on major design decisions – before any implementation details are decided. Getting agreement among stakeholders early in the design process is a major risk mitigation strategy that can prevent the need for costly design changes at later stages in the project.

Note that the V-diagram applies only to the technical development aspects of a system, and not to the broader policy development process within which it is nested. According to the V-diagram, the next technical steps after the ConOps in systems engineering are:

- ▶ **A system requirements document:** This describes the complete functionality of the system – how the system outwardly performs – in great detail but does not specify how the system operates internally to generate the outward performance.
- ▶ **High-level and detailed design documents:** These documents specify exactly how the system operates internally. At the lowest level, design documents may include such detailed information as circuit board layouts and computer algorithms.

As the Road Charge Pilot Project moved toward implementation, the detailed system requirements, design, procurement, and implementation documents were developed in January 2016. Following procurement, which concluded in early February 2016, the system was developed and installed during the period February-May 2016. A test plan was created to evaluate system functionality according to the right-hand side of the V-diagram, including unit testing, which occurred in April 2016, and integration testing and end-to-end testing, which occurred in April-May 2016.

The right-hand side of the V-diagram includes the tests to validate that the final product fulfills the specifications developed in the processes on the left-hand side of the diagram in Figure 1 above. These tests are performed in the order indicating the V-diagram, starting with the most detailed specification test and concluding with the system validation, which validates that the final product fulfills the ConOps.

A very important concept to keep in mind is that a ConOps is never “complete.” ConOps is a living document that can, and should, be changed. The current version of the ConOps, drafted in May 2017, has been changed to update the system description based on lessons learned during the live pilot portion of the Road Charge Pilot Program, which ran from July 1, 2016 to March 31, 2017.⁸

Even after an operational system is in place, it is important to revisit the ConOps frequently (perhaps annually) to account for changes such as policy, law, regulation, or other factors that impact how the system operates.

1.1.1. Who are the system users the ConOps addresses?

A ConOps is written from a system user’s perspective, and there is more than one type of system user. Thus, the ConOps describes high-level functionality from the perspectives of system administration users (such as

⁸ The Road Charge Pilot Program Lessons Learned document is included in the appendices to the final report.



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Commercial Account Managers or participating state agencies) as well as system end users (motorists who volunteer for the pilot).

1.2. Background: Highway Funding in California

Historically, user fees have funded construction, maintenance, and operations of California's public roads. Highway user fees include fuel taxes (on both gasoline and diesel), registration and licensing fees, tolls, weight fees on commercial vehicles, and Federal funds derived principally from fuel taxes. Of all these sources, fuel taxes represent the most important highway revenue source for California. However, improvements in on-road vehicle fuel economy and conversion of the fleet to other energy sources (e.g., electric vehicles), threaten to undermine fuel tax revenues.

1.2.1. Light vehicle fuel economy

According to the University of Michigan Transportation Research Institute (UMTRI), EPA-measured fuel economy of new light vehicle sales across the United States has improved each year since 2008, from 20.8 miles per gallon (MPG) for Model Year 2008 to 25.3 MPG for Model Year 2015. From 2012-2015, average fuel economy of new light vehicles sales in the United States improved about 1 MPG per year.⁹ Based on the new CAFE standards, the availability of new vehicle technology, consumer purchasing habits, government incentives, and other factors, the possibility exists for continued improvement in on-road fuel economy of the light vehicle fleet. For example, the U.S. Energy Information Administration (EIA) projects an improvement in on-road fuel economy of the light vehicle fleet nationally of 2% per year, or 73% through 2040, to 37.2 MPG.¹⁰ This trend is illustrated in the figure below.

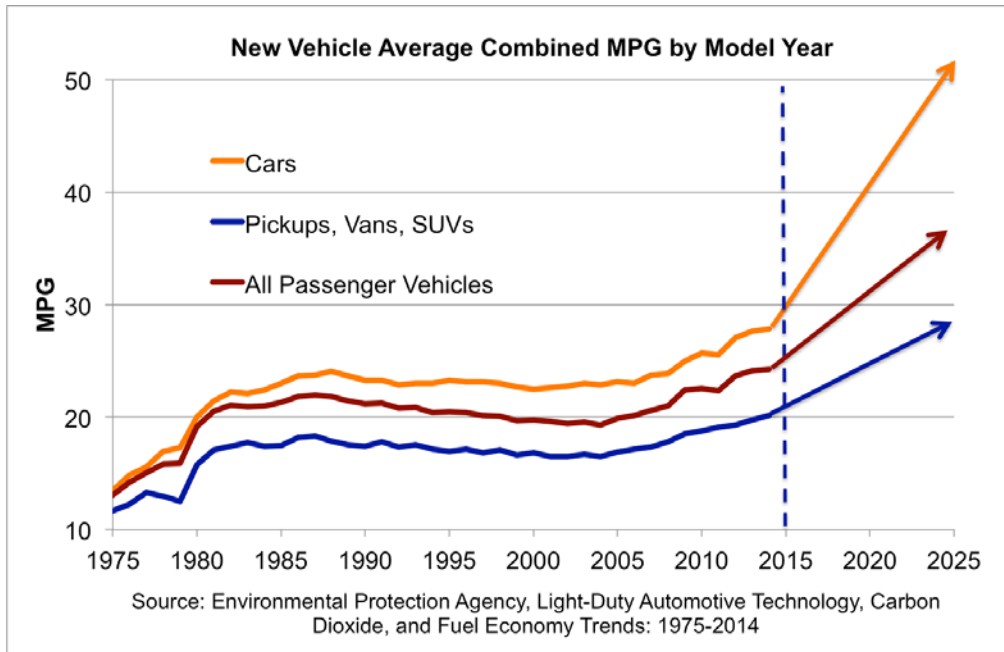
⁹ UMTRI. *Eco-Driving Index*. Accessed 6 November 2014. Available from: http://www.umich.edu/~umtriswt/EDI_sales-weighted-mpg.html

¹⁰ U.S. EIA. *Annual Energy Outlook 2014*, April 2014.



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Figure 3: New Vehicle Average Combined MPG by Model Year



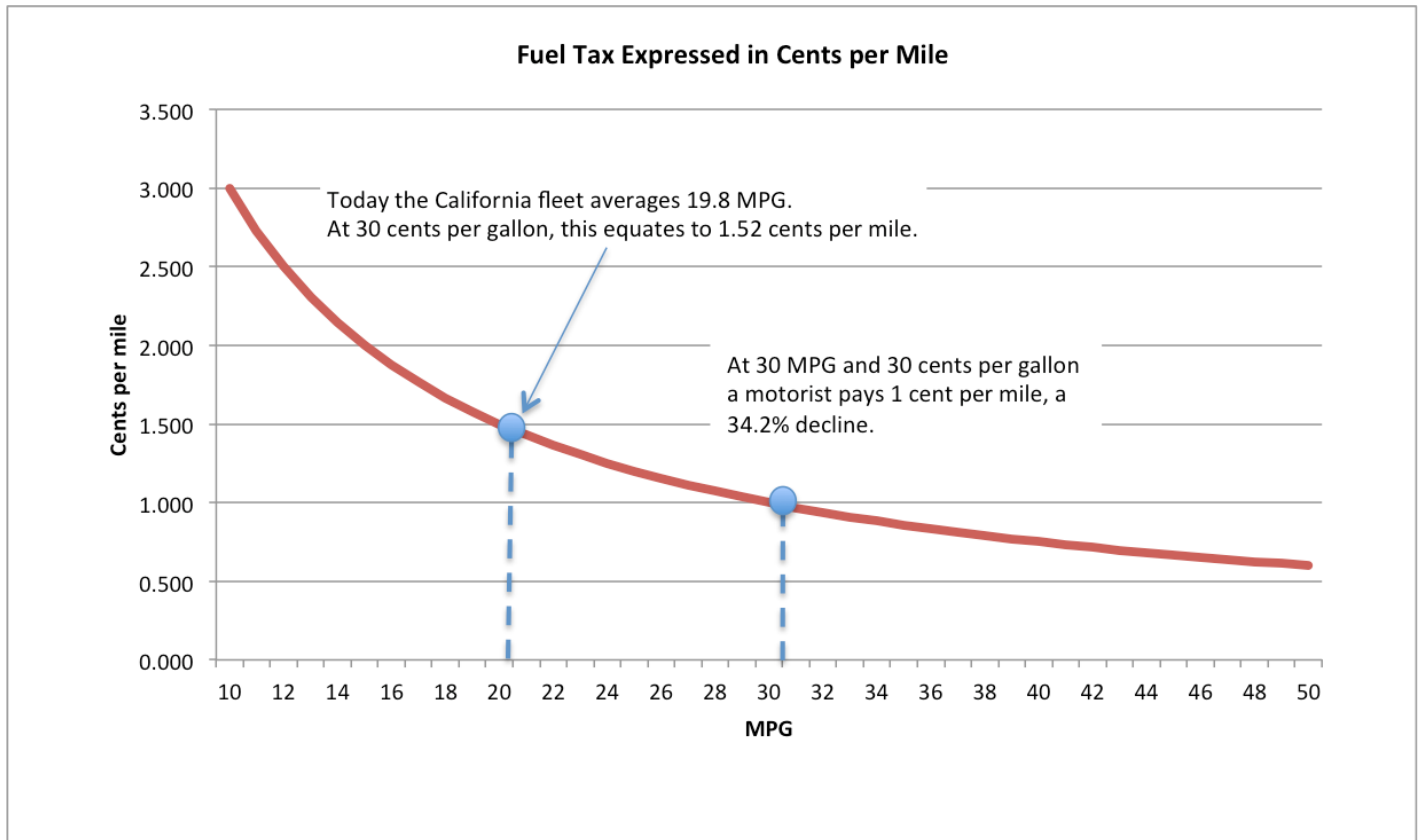
Since fuel taxes are the primary source of highway maintenance funding in California, increasing fuel economy translates directly into decreased per-mile funding derived from fuel taxes, in the absence of a tax increase. Figure 4 illustrates the relationship between fuel economy and fuel tax revenues on a per mile basis. The horizontal axis depicts on-road fuel economy as reflected in MPG, while the vertical axis represents the equivalent cents per mile in fuel tax paid, at 30 cents per gallon (the combined rate of the base excise tax and price-based excise tax on gasoline in California as of July 1, 2015). California light vehicles averaged about 20 miles per gallon in 2014.¹¹ This means that the average gasoline-powered car is contributing $30 \div 20 = 1.5$ cents per mile driven in fuel taxes. Over the past five years, the fuel tax has averaged 35.4 cents per gallon, and the average fuel tax paid has been about 1.8 cents per mile. The fuel economy for *new* vehicles in the 2016 model year is projected to average just over 26 miles per gallon, so those cars are contributing only 1.1 cents per mile on average. Using ARB’s projected light vehicle fleet fuel economy of 39 MPG, drivers will be paying only 0.77 cents per mile by 2040, a decrease of 37% from today. This purchasing power of this declining per-mile revenue will be further eroded by inflation. If fleet fuel economy continues to improve as newer cars replace older vehicles in the fleet, the equivalent amount paid by the average vehicle as measured in cents per mile will decline substantially.

¹¹ Based on analysis of data provided to the consultants by the California Air Resources Board from the EMFAC 2014 model.



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Figure 4: Fuel Tax Expressed in Cents per Mile as a function of Fleet Fuel Economy



1.2.2. Heavy vehicle fuel economy

A similar trend to that observed for the light vehicle fleet is expected for heavy vehicles. EIA projects improvements in on-road fuel economy of heavy vehicles averaging 2% per year, or 38% by 2032, based on first-ever CAFE standards published by the federal government beginning in Model Year 2012 for medium-duty trucks and Model Year 2014 for heavy-duty trucks.¹² Based on the average diesel excise tax rate over the past 5 years of 11.4 per gallon, a truck averaging 6.5 MPG currently pays 1.8 cents per mile driven in fuel taxes. An improvement of 14% to 8 MPG would reduce the amount paid in fuel taxes to 1.4 cents per mile. In August 2016, EPA published regulations bringing about further improvements in medium- and heavy-duty truck fuel economy for Model Years beyond 2018.¹³

1.3. Background: The California Road Charge Pilot Program

Senate Bill (SB) 1077 directed the Chair of the CTC to create the TAC to study road charging alternatives to the gas tax and make recommendations to the Secretary of CalSTA on the design and evaluation of a road charging pilot program. The TAC reviewed worldwide experience with road charging, examined alternative operational approaches to its implementation, and identified key policy issues to consider in implementing a

¹² United States Energy Information Agency, Annual Energy Outlook 2017, January 2017, p. 96.

¹³ See EPA Website Announcement “EPA and DOT Finalize Greenhouse Gas and Fuel Efficiency Standards for Heavy-Duty Trucks” at <https://www.epa.gov/newsreleases/epa-and-dot-finalize-greenhouse-gas-and-fuel-efficiency-standards-heavy-duty-trucks-0>



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road charge. Among the activities undertaken to support the development of California’s Road Charge Pilot Program are evaluation of alternative Operational Concepts for road charging and development of this Concept of Operations (ConOps) based on the TAC’s preferred Operational Concepts.¹⁴

1.4. Qualifications

This section provides some important qualifications about the scope of this ConOps.

This document was drafted as the first step in the systems engineering process for the pilot system specified in SB1077, following several years policy and stakeholder deliberations to formulate an overall policy and system design. Whether a real, revenue-generating road charge system is implemented depends on the success of the pilot and any potential legislative debates that may follow, should the Legislature choose to consider mandating a road charge system. Nonetheless, the contents of this document are written in a very general way. Approaching the pilot system generally should help it to simulate a real revenue generating system as closely as possible.

This document was composed in the periods included below in Table 1.

Table 1. Phases of ConOps Composition

Document Phase	Period of Composition	Revision Number	
First Draft	May-June 2015	1.4	Mathew Dorfman
Updates based on TAC decisions	February 2016	1.7	Matthew Dorfman
Updates based on development and testing	June-July 2016	1.8	Matthew Dorfman, Travis Dunn
Updates based on lessons learned in live pilot	May 2017	1.9	Matthew Dorfman, Travis Dunn

1.5. Document Contents

The remainder of this ConOps document is organized as follows:

Section 2: Policy Direction and Stakeholders explains the justification for the development, testing, and evaluation of road charging in California.

Section 3: Pilot Road Charge System Operational Concepts presents the Operational Concepts selected by the TAC for detailed study. They are:

- ▶ Method 1: Time Permit
- ▶ Method 2: Odometer Charge (post-pay)

¹⁴ California Road Charge Technical Advisory Committee, “Road Charge Pilot Design Recommendations,” Drafted 11-20-2015, section 2.1 p. 16.



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- ▶ Method 3: Mileage Permit
- ▶ Method 4: Automated Distance Charge (no location)
- ▶ Method 5: Automated Distance Charge (general location)

Section 4: Pilot Road Charge System Components provides a functional overview of the components needed to operate a road charging system. It also presents an example of detailed functional elements for a road charging system design; this example is illustrative and not meant to pre-empt any requirements suggested by in the usage scenarios in Section 5.

Section 5: System Usage Scenarios is the heart of the ConOps document. This section documents the complete functionality of the road charging system from the perspective of different types of system users.

Section 6: Pilot Implementation of ConOps describes how this ConOps document was implemented for the pilot system.

TAC members reviewing this document may be most interested in Section 3, which summarizes the Operational Concepts in greater detail, and in Section 5, which ties them all together into a complete system.



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2. Policy Direction and Stakeholders

2.1. Policy Direction

Faced with a very clear downward trend in fuel tax revenues, California has begun to explore a range of alternatives to the current transportation funding system. In 2015 the California Transportation Infrastructure Priorities (CTIP) Workgroup submitted a white paper to the California Secretary of Transportation in which the effects of improving vehicle fuel economy, increasing market share of alternative fuel vehicles, and impact of inflation on funding available for highway maintenance were examined. The workgroup recommended that the state move forward with a road charge pilot program, with its stated goal being:

To advance the understanding and evaluate the viability of a road usage 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 infrastructure¹⁵.

The Legislature acted simultaneously to the CTIP effort by passing Senate Bill (SB) 1077 in 2014, which directed the Chair of the CTC to create the TAC to study road charging alternatives to the gas tax and make recommendations to the Secretary of CalSTA on the design and evaluation of a road charging pilot program.

The policy basis for this ConOps is the interest of the Legislature and other bodies in understanding the details of how a road charge pilot would function in California. In approaching the concept of a road charge pilot, all activities have been framed in the context of a single overarching goal: *Identify and develop a sustainable, long-term revenue source for California’s surface transportation system.*

SB 1077 identifies several considerations that inform policy, institutional, and technical decisions about how to achieve the sustainable revenue source goal. The TAC, with stakeholder input, identified additional considerations. Table 2 below summarizes the key considerations from SB1077 and the additional considerations identified by the TAC.

Table 2. Key Road Charge Policy Considerations

Category	Policy or Technical Consideration
Acceptance	<ul style="list-style-type: none"> • availability, adaptability, reliability, and security of methods that might be used in recording and reporting highway use • providing users options in methods of recording and reporting highway use to help improve public acceptance and mitigate privacy concerns • potential for additional driver services
Accountability	<ul style="list-style-type: none"> • clear assignment of responsibility and oversight, and provide accurate reporting of revenue collected.
Cost-effectiveness	<ul style="list-style-type: none"> • cost of implementing the road charge system • cost of recording and reporting highway use

¹⁵ CTIP whitepaper – Exploring a Road Usage Charge as an Alternative to the Gasoline Tax



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	<ul style="list-style-type: none"> 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
Data collection technology	<ul style="list-style-type: none"> advantages and disadvantages of data collection equipment options
Data Security	<ul style="list-style-type: none"> security of methods that might be used in recording and reporting highway use.
Ease and Simplicity/Complexity	<ul style="list-style-type: none"> ease of recording and reporting highway use ease of administering the collection of taxes and fees as an alternative to the current system of taxing highway use through motor vehicle fuel taxes
Enforcement and Compliance	<ul style="list-style-type: none"> effective methods of maintaining compliance processes and security measures necessary to minimize fraud and tax evasion rates
Equity	<ul style="list-style-type: none"> all road users should pay a fair share with a road charge no group should be inequitably impacted by a road charge relative to the current gas tax
Feasibility	<ul style="list-style-type: none"> feasibility of implementing a full-scale operational system in California
Jurisdictional Issues	<ul style="list-style-type: none"> interoperability with other states' road charge systems ability to assess California's road charge on out-of-state vehicles
Long-term Sustainability	<ul style="list-style-type: none"> long-term revenue generation potential, relative to the gas tax
Privacy	<ul style="list-style-type: none"> necessity of protecting all personally identifiable information used in reporting highway use increased privacy concerns when location data is used in conjunction with other technologies ease with which location data can be re-connected to the driver, even when personally identifiable information has been removed from the data public and private access, including law enforcement, to data collected and stored for purposes of the road charge to ensure individual privacy rights are protected pursuant to Section 1 of Article I of the California Constitution
System Flexibility	<ul style="list-style-type: none"> adaptability of methods that might be used in recording and reporting highway use

Some of these considerations, such as **user choice**, **data security**, and **simplicity**, are incorporated directly into the ConOps. Others are outside the scope of the ConOps or depend on future policy decisions or legislative action, such as equity.

Based on TAC guidance, this ConOps includes commercial account management entities as one option for California's pilot participants to consider.

2.2. Stakeholders

Due to the somewhat limited scope of a pilot program, not all of the stakeholders who may be directly involved in an operational system are necessarily active in the pilot. For instance, no road charge funds will be collected



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or distributed during the pilot, so the BOE and State Controller will not have active roles in revenue collection. However, since they are likely to be directly impacted by any operational system, each of the entities below should be addressed as active participants in the development of the ConOps, and their ultimate roles in an operational system carefully matched to the roles in the pilot.

The primary stakeholders to the pilot program are:

- ▶ **Pilot Participants.** Pilot participants are the individuals and businesses who volunteer to “pay” road charges as the registered owners or lessees of California-registered vehicles that meet the criteria for such taxation.
- ▶ **Road Charge Management.** This would be either a new agency or housed within an existing agency (or group of agencies) in California state government, tasked with carrying out the development and collection of road charges. In the pilot program, the project team of Caltrans and its contractors fill the roles of Road Charge Management, including an entity called the Account Management Oversight.
- ▶ **California State Transportation Agency (CalSTA).** CalSTA was tasked by the Legislature to submit a report on the results of the pilot program by June 30, 2018.
- ▶ **California Department of Transportation (Caltrans).** As with fuel taxes, Caltrans would be the recipient of a considerable portion of road charge revenues and hence has an important stake in the design, implementation, and operations of a road charge system.
- ▶ **California Transportation Commission (CTC).** As facilitator of the TAC, the CTC ensures that the TAC has all the information and support they need to make informed decisions about the structure of the pilot program, and makes recommendations to the Legislature.
- ▶ **California Board of Equalization (BOE).** BOE presently collects fuel taxes and distributes funding to agencies.
- ▶ **Controller.** The State Controller currently distributes fuel tax refunds and handles other accounting duties for state transportation funding.
- ▶ **California Department of Motor Vehicles (DMV).** DMV has relationships with California motorists through the vehicle registration, titling, and driver licensing processes. Consequently, DMV could play a significant role in the implementation and ultimate operation of a road charge system. At minimum, the vehicle registration and titling processes are essential to identifying and enrolling vehicles subject to a road charge (Vehicle Registry).
- ▶ **Enforcement Agencies.** On-the-ground enforcement of road charge compliance may fall to existing law enforcement agencies, including the California Highway Patrol (CHP) and local police. Enforcement is not a part of the pilot, but such agencies will be invite to observe the pilot.
- ▶ **Equipment Suppliers.** Private companies will at a minimum provide the technology and systems to implement the road charge pilot.
- ▶ **Commercial Account Managers.** Private companies will offer account management services.
- ▶ **Authorized Reviewers.** Private companies such as auto repair shops or DMV agents who are authorized to verify odometer readings. During the pilot, the Bureau of Automotive Repair as supported by the Foundation of Community Colleges will fulfill this role.
- ▶ **Citizen Interest Groups.** Citizen groups representing various interests may be concerned with ensuring that the pilot supports the goals of those organizations.



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3. Pilot Road Charge System Operational Concepts

The term **Operational Concepts** (also called Mileage Reporting Methods) refers to alternative ways by which road use can be recorded and reported in a road charge system. The primary differentiators among the Operational Concepts are the way road use is measured (by time, by odometer, or by a device or software installed in the vehicle) and the way road use is reported (manually or automatically). The choice of how to measure road use has significant implications for the way the State administers road charges, how the motorist pays the charges, and other aspects of system operations.

The full set of Operational Concepts examined includes:

- ▶ Time Permit
- ▶ Mileage Permit
- ▶ Odometer Charge (post-pay)
- ▶ Automated Distance Charge (no location)
- ▶ Automated Distance Charge (general location)

This section presents the details of how each of these Operational Concepts will work in a pilot system. These details provide background for Section 5, which describes the user experience of a complete system comprising all Operational Concepts. While there is some overlap between the information presented here and the information in Section 5, the latter provides more detail on full system operations than the information presented here. Further, Section 5 is organized according to usage scenarios – specific ways in which different users will interact with the system. The organization in Section 5 is helpful for creating a requirements document, the next step in the systems engineering process.

The discussions that follow call out the special cases of **out-of-state travelers** (who will be best served by the Time Permit or the Automated Distance Charge with general location); and **vehicle fleets**, such as fleets of commercial trucks, agency fleets, and light commercial fleets, which will best be served by the Automated Distance Charge (with either no location data or general location).

The discussion of each Operational Concept within this section is organized as follows:

- ▶ Overview of Operational Concept.
- ▶ Operational Concept from motorist and account management oversight (AMO) perspectives.
 - > Motorist's perspective:
 - Acquisition
 - Usage (driving)
 - Paying (refreshing)
 - Deleting (selling car, switching Operational Concepts, or moving out of state)
- ▶ Road Charge Management perspective:
 - > Distribution
 - > Operation
 - > Decommissioning
 - > Accounting
- ▶ Compliance and enforcement [not part of the pilot but described for completeness]:
 - > Detecting fraud



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- > Tolerances
- > Issuing penalties
- ▶ Discussion of payment by the motorist also includes consideration of provision of credits for estimated fuel taxes paid. Credits for fuel taxes paid were included in the Road Charge Pilot Program, and could also be included in a potential future road charging system should the fuel tax and road charge co-exist for any period of time. Providing such credits can prevent double-taxation during a transition period when the current fuel tax system and the road charging system operate in parallel. Provision of gas tax credits against the road charge will also act as a deterrent to certain fraudulent practices, such as odometer fraud.

Although the Operational Concepts described here are intended for the pilot system, they are written so that the pilot system simulates an operational revenue-generating system as closely as possible.

3.1. Time Permit

A Time Permit allows the motorist unlimited road use (unlimited miles) for a specified time period of time. The motorist's payment status can be recorded in the road charging database for access by enforcement personnel.

This Operational Concept does not involve distance measurement and can be thought of as a “flat fee” for road use. Because distance is not measured, the charge for the Time Permit should to be set relatively high; otherwise no one would choose the other Operational Concepts, and revenues could conceivably drop compared with the fuel tax. For the pilot, CalSTA set the price of the Time Permit at the equivalent of 25,100 miles per year, which is the 95th percentile of California vehicles. Time Permits in the pilot were sold in three denominations: 10, 30, and 90 days. The price of each one is scaled proportionately (e.g., the 30-day permit is triple the price of a 10-day permit).

One of the benefits of this Operational Concept is that motorists do not have to report anything to Road Charge Management—not even an odometer reading—beyond simply activating the Time Permit for the vehicle for the given period. However, if the Road Charge Management does not have an odometer reading taken at the time that the vehicle began the most recent Time Permit, there is no way to tell how much a person has driven under the current permit. Therefore, in the pilot, although motorists will not be able to switch to another Operational Concept, they will not be refunded for any portion of an unexpired Time Permit. For research purposes, participants who select a Time Permit in the pilot will be asked to volunteer their odometer readings, although this information is not required and would likely not be provided in a real system.

The Time Permit is an Operational Concept that can accommodate socioeconomically disadvantaged communities. It provides the opportunity to possibly tailor the permit fee structure based on minimum household income thresholds.

A short-term Time Permit would be an ideal concept for people who use vehicles rarely or for short-term out-of-state visitors because it could be procured via web. Although not part of the pilot, it could also be procured by smartphone, or at a gas station on the state border, and easily enabled by the motorist.

3.1.1. Experience from Motorist's Perspective: Time Permit

The motorist has the following experience with the Time Permit:



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- ▶ **Acquisition:**
 - > Motorists may purchase a Time Permit valid for a given period of time from the Road Charge Management. In the pilot, Time Permits were available only from the California State Account Manager, also known as CalSAM. This could be done in person at a DMV (not included in the pilot), via mail, online, or via telephone. Out-of-state visitors could acquire short-term permits online or via telephone.
 - > The motorist receives a receipt indicating the validity period of the Time Permit.
 - > The Time Permit is entered into the road charge database and associated with the vehicle for which it is purchased. It is active as soon as it is purchased. Alternatively, it can be purchased retroactively for participants that have been non-compliant.
 - > Although it was not part of the pilot, the Time Permit could also involve placing a decal into the inside windshield of the vehicle, depending on the enforcement concept chosen.
- ▶ **Usage (driving):**
 - > There is no change in driving behavior from today.
- ▶ **Paying (refreshing):**
 - > Motorists can pay for the Time Permit at any time.
 - > Motorists are responsible for purchasing a new Time Permit when the current permit expires. In the pilot, CalSAM provided customizable, automated reminders when a certain amount of time is left on the Time Permit (e.g., one week) via email. In a real system, reminders could also be part of an in-vehicle paper decal.
- ▶ **Deleting (selling car, switching):**
 - > Although it was not part of the pilot, motorists could be allowed to apply for refunds of the unused portion of the permit (e.g., fraction of a year) upon canceling or transferring vehicle registration, should policy allow such refunds. As mentioned above, refunds should not be allowed simply to change Operational Concepts, unless an official start odometer reading is available.
 - > However, a refund process may be costly to administer. If no refund is available, the motorist could be forced to accept the money as lost, which is the case with registration fees when drivers move out-of-state shortly after re-registering their vehicles for the coming year.
 - > Short term Time Permits would likely have no possibility of refund of unused portions.

3.1.2. Experience from Road Charge Management's Perspective: Time Permit

Road Charge Management would encounter the following experience with the Time Permit:

- ▶ **Distribution:**
 - > Road Charge Management (in the case of the pilot, CalSAM provided Time Permits of 30, 60, and 90 day channels online and via telephone. DMV and other retail channels were not simulated in the pilot program.
- ▶ **Operation:**
 - > Monitoring Usage
 - Vehicle usage is not monitored under the Time Permit.
 - > Collection of payments
 - Payments are collected by the same means as vehicle registration; or they will be collected from retail outlets (although not part of the pilot).



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- The Road Charge Management recorded the activation of the Time Permit in the Road Charge Database upon purchase by a motorist who links the Time Permit to a specific vehicle.
- Payment by installment plan for longer period Time Permits (for example, 6 months or 1 year) could be possible, but was not included in the pilot. Instead, participants could simply choose shorter duration permits. In a potential future system, Road Charge Management may consider charging users an additional fee for payment by installment plan, to encourage less frequent transactions, but this is not simulated in the pilot.¹⁶
- ▶ **Decommissioning** (car sale, transfer out-of-state, or total loss):
 - > It is the motorist's responsibility to notify Road Charge Management when a vehicle is decommissioned.
 - > Upon cancellation of registration, the Road Charge permit is likewise canceled. The Time Permit can remain active for the vehicle in case of title transfer—the Time Permit can convey with the vehicle, thus allowing the seller to price in the cost of the Time Permit with the vehicle, and avoiding the need for a refund in the case of private vehicle sale (although this will not be simulated in the pilot).
 - > If allowed by the state, motorists can apply for a refund of the unused portion of the permit (fraction of permit length). However, the state may choose to deny refunds to those without an official odometer reading at the start of the permit.
 - > It is fairly common for people to neglect to cancel their vehicle registrations when they move out of state or even when they sell a car. However, to prevent fraud, motorists need to be charged for all time that a Time Permit is valid up until they cancel their registration, even if they moved out of state well before they canceled their registration. That is because it would be very difficult to verify when (or even if) a motorist actually left the state, creating a significant potential for fraud. Motorists should be clearly informed of this fact when they enroll in a live road charging program.
- ▶ **Accounting:**
 - > In the pilot, simulated payments were verified at the time a permit is purchased and activated for a vehicle.

3.1.3. Compliance and Enforcement: Time Permit (not part of pilot)

Mechanisms to deter/discourage attempts at cheating are fairly straightforward with a Time Permit. For motorists that select this option, it can be made impossible to renew vehicle registration tabs or register an eligible vehicle without purchasing a Time Permit. In instances where an invalid Time Permit prevents vehicle registration or renewal, allowing motorists to purchase a short-term permit in order to register their vehicles, then following up with them after the time has elapsed, may be desirable.

¹⁶ A for-profit business would likely charge customers for spreading their payments out over time (insurance companies typically offer payment spread out over time at an additional fee to cover their additional processing costs). However, the main reason to allow Motorists to spread their payments over time would be to acknowledge that a larger (likely several hundred dollar) up-front payment may be a hardship for some people. Levying a surcharge for spreading the payments for people that have difficulty affording the full amount poses a policy dilemma that will need to be addressed.



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Compliance can be encouraged through some combination of the following enforcement mechanisms:

- ▶ **Detecting fraud:**
 - > Time Permits that are not up to date or for which a motorist has failed to pay an installment payment can be detected via regular database operations.
 - > Traffic stops already include checking for valid registration. In cases in which a motorist has a significant, extended violation, a registration hold can be placed on the vehicle, allowing any vehicle pulled over with such a violation to receive an additional penalty.
 - > Fake registration stickers (tabs) could be detected in the same manner as fake tabs are detected for vehicle registration.
- ▶ **Issuing penalties:**
 - > Penalties could be issued in the same manner as penalties issued for failure to register a vehicle.
 - > The penalty would apply to out-of-state vehicles as well.

3.2. Mileage Permit

A Mileage Permit allows the motorist to drive for a specified number of miles. The motorist's payment status and the target odometer range under the permit will be recorded in the road charging database by CalSAM. In a real system, this database would be accessible to enforcement personnel.

To reduce fraud, this Operational Concept requires an official odometer reading before the motorist can begin to use it. An odometer reading is needed to establish the basis (starting point) from which the miles on the Mileage Permit will be counted. In the pilot, official odometer readings will be accomplished either by a representative official of the state reading the odometer through the Smog Check Referee Program or by means of a mobile phone-based image capture and processing system that incorporates verification and anti-fraud technologies.

Motorists will also be required to report an official odometer reading at the end of the pilot and at other times by request. If motorists switch to another Operational Concept, but then return to the Mileage Permit, another official odometer reading may be needed, depending on the enforcement strategy chosen.

The Mileage Permit is an Operational Concept that can accommodate socioeconomically disadvantaged communities. It provides the opportunity to possibly tailor the permit fee structure based on minimum household income thresholds.

3.2.1. Experience from Motorist's Perspective: Mileage Permit

The motorist has the following experience with the Mileage Permit:

- ▶ **Acquisition:**
 - > Motorists may purchase a Mileage permit valid for a given number of miles from the Road Charge Management through the CalSAM. This can be done in person at a simulated DMV (not included in the pilot), via mail (not included in the pilot), online, or via telephone.
 - > In addition, although not part of the pilot, motorists could purchase the Mileage Permit from a retail outlet, such as a convenience store, gas station, or grocery store. The Mileage Permit could be a scratch off card. To activate it, the purchaser would scratch off the secret code, and



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- enter the code into an app on a smartphone, or onto a website, or onto an automated phone system, along with the license plate number of the vehicle.
- > For the first use of the Mileage Permit, an official odometer reading (real or simulated) is required. In the pilot program, an official odometer reading was made using either Vehcon (a smartphone app that takes a secure image of the odometer) or by Smog Check Referees.
 - > The Mileage Permit is entered into the road charge database and associated with the vehicle upon activation. It could become active at the current self-reported odometer reading, or it could become active at a past odometer reading, allowing non-compliant participants to become compliant.
 - > Although it was not part of the pilot, the Mileage Permit could also involve placing a decal into the inside windshield of the vehicle, depending on the enforcement concept chosen.
- ▶ **Usage (driving):**
- > There is no change in driving behavior from today.
 - > Participants periodically (every 3 months in the pilot) got an official odometer reading using the Vehcon App. Participants using the Smogcheck Referee in the pilot only got official odometer readings at the start and end of the program.
- ▶ **Paying (refreshing):**
- > Motorists pay for the Mileage Permit when acquiring from CalSAM.
 - > Motorists are responsible for purchasing a new Mileage Permit before the current permit expires. In a real system, the Mileage Permit may include an inside-the-windshield reminder decal where motorists could write the mileage at which it would have to be renewed. In the pilot, CalSAM will provide customized, automated reminders via e-mail and/or text message. Motorists can also check their status online or by calling the customer service center.
 - > To reflect the fact that pilot participants are in reality paying gas taxes today, the pilot featured fuel tax credits on the Mileage Permit based on the EPA estimated city-highway fuel economy rating of the associated vehicle.
- ▶ **Deleting (selling car, switching):**
- > Although not part of the pilot, motorists could be allowed to apply for refunds of the unused portion of the permit (number of miles) when they sell the car or switch Operational Concepts. Alternatively, motorists who sell a vehicle could be allowed to transfer miles to a different, possibly newly purchased vehicle.

3.2.2. Experience from Road Charge Management's Perspective: Mileage Permit

Road Charge Management (CalSAM during the pilot project) has the following experience with the Mileage Permit:

- ▶ **Distribution:**
- > Road Charge Management provides Mileage Permits online and via telephone.
 - > In a potential future mandatory system, Road Charge Management could provide Mileage Permits through existing DMV channels and retail networks. These were not simulated in the pilot.
- ▶ **Operation:**
- > Monitoring Usage



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- For the pilot, official odometer readings were required at the beginning and end of the pilot period through the Smog Check Referee program, and also every 3 months for participants using the Vehcon smartphone app.
- Upon purchase of a Mileage Permit, participants must also enter a self-reported odometer reading.
- Vehicle usage can be measured as the sum of total Mileage Permits sold and registered in the database.
- > Collection of payments
 - In the pilot, payments were collected via simulated online payment or via telephone using simulated credit card and voucher credentials provided to each participant upon account setup.
 - In a real system, Mileage Permits could also be purchased at vehicle registration or retail outlets.
- ▶ **Decommissioning** (car sale, transfer out-of-state, or total loss):
 - > It is the motorist's responsibility to notify Road Charge Management that the vehicle is decommissioned.
 - > Upon cancellation of registration, the Mileage Permit would likewise be canceled.
 - > Although it was not part of the pilot, motorists could apply for a refund of the unused portion of the permit (number of miles).
 - > It is fairly common for people to neglect to cancel their vehicle registrations when they move out of state or even when they sell a car. However, to prevent fraud, motorists would need to be charged for all miles driven up until they cancel their registration. That is because it would be very difficult to verify when (or even if) a motorist actually left the state, creating a significant potential for fraud. Motorists should be clearly informed of this fact when they enroll in a live road charging program.
- ▶ **Accounting:**
 - > Payments are verified at time permits are purchased.

3.2.3. Compliance and Enforcement: Mileage Permit (not part of the pilot)

An official odometer reading is required when a vehicle first uses the Mileage Permit as an Operational Concept. After that, fraud attempts are discouraged by periodic requirements to present a vehicle for an official odometer reading, as was done in the pilot using the Smog Check Referee program and also using the Vehcon smartphone app.

As long as the fuel tax is in place, in which case those subject to a Road Charge would also receive a rebate for estimated fuel taxes in proportion to reported miles, there is little incentive to cheat for most motorists, presuming a baseline enforcement level and penalties designed to deter evasion. Compliance could also be encouraged through spot enforcement involving manual odometer checks by officers.

- ▶ **Detecting Fraud:**
 - > Odometer fraud (fraudulently setting the odometer to a false value) is possible, even with vehicles with digital odometers.
 - > To detect odometer rollback, cross-referencing current odometer values with odometer values for the vehicle from other sources (e.g., care history service reports and records of vehicle



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repair shop manifests) could be performed. Large deviations from expected mileage would indicate potential fraud, and could trigger an audit.

- ▶ Issuing penalties:
 - > Penalties for failure to pay the Road Charge could be issued whenever official odometer readings determine insufficient Mileage Permits have been purchased.
 - > Odometer tampering is a felony under Federal law¹⁷ and a gross misdemeanor under California law.¹⁸ Penalties for odometer tampering already exist at the Federal level (in the Odometer Act), but further penalties could be considered as relates to road charge avoidance.

3.3. Odometer Charge (post-pay)

With an Odometer Charge, the Road Charge Management will charge per-mile fees based on readings of the vehicle's odometer. Odometer readings will be self-reported, but participants will also be required to provide official odometer readings through the Smog Check Referee program or Vehcon smartphone app at the beginning and end of the program, as well as at other times upon request.

3.3.1. Experience from Motorist's Perspective: Odometer Charge (post-pay)

The motorist encounters the following experience with Odometer Charge (post-pay):

- ▶ **Acquisition:**
 - > Motorists have an official odometer reading at the start of the program, and register with the road charge database for the post-pay Odometer Charge. CalSAM, which was the exclusive provider of the Odometer Charge in the pilot, asked motorists to provide self-reported odometer readings at the time of enrollment and each quarter thereafter as the basis for quarterly Odometer Charge invoices.
 - > Participants who are noncompliant can select an odometer charge and retroactively pay for all miles since the vehicle's last odometer reading (not in pilot).
- ▶ **Usage (driving):**
 - > There is no change in driving behavior required from today.
 - > Participants must periodically (every 3 months) get an official odometer reading with the Vehcon App. Participants using the SmogCheck Referees only have to get official readings at the start and end of the pilot.
- ▶ **Paying (refreshing):**
 - > The motorist self-reports actual miles driven at a specified time in periodic (quarterly) reporting to CalSAM. The motorist is billed (and in the pilot, immediately paid) the total cost of the miles driven (end odometer reading minus previous odometer reading multiplied by the per-mile rate).
 - > All charges for miles traveled are offset by credits for estimated fuel taxes paid based on EPA combined city-highway MPG for the vehicle.¹⁹
- ▶ **Decommissioning** (selling car, moving out of state):

¹⁷ In the Federal Odometer Act of 1972, contained in 49 U.S. Code Chapter 327 - ODOMETERS, the U.S. Congress made odometer tampering a federal felony.

¹⁸ California Vehicle Code Section 28050-28053.

¹⁹ Several factors may make it hard to eliminate the fuels tax in the near term, including the need to fulfill bonding. However, when fuels tax elimination seems feasible, California might also consider the potential increases in tourism dollars from border areas resulting from a lowering or repeal of California fuel taxes.



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- > Motorists are asked to remove vehicles from the Road Charge program if they sell it or move out of state.
- > At that time, they pay the road charges for the miles driven since the last payment.

3.3.2. Experience from Road Charge Management's Perspective: Odometer Charge (post-pay)

Road Charge Management carries out the following procedures for Odometer Charge (post-pay). In the pilot, CalSAM offered these services.

► Distribution:

- > For the pilot, participants registered their vehicles for the Odometer Charge (post-pay) online or via telephone. In a real system, registration via existing DMV channels and retail outlets may also be offered.
- > The official "start" odometer reading is not be self-reported – it was verified by a Smog Check Referee or by the participant using Vehcon's smartphone app in the pilot. However, CalSAM asked motorists to provide self-reported odometer readings at the time of enrollment as well. During the pilot, participants enrolled with CalSAM, then provided an official odometer reading, whether in person or by smartphone app.

► Operation:

- > Monitoring of Usage.
 - Usage is monitored through periodic (quarterly) reports (from the participant to CalSAM in the pilot).
 - All vehicles must also have a verified odometer reading. In the pilot, it was done at the beginning and end of the pilot (Smogcheck Referee participants), or every 3 months (Vehcon App participants).
- > Collection of payments.
 - In the pilot, payments were quarterly according to the invoices provided by CalSAM to the participants. Invoices reflected an offset for estimated fuel taxes paid based on EPA combined city-highway MPG for the vehicle.

► Decommissioning (car sale, moving out-of-state, or total loss):

- > It is the motorist's responsibility to notify Road Charge Management that the vehicle is decommissioned.
- > Upon cancellation of registration, the Odometer Charge is canceled with it. Payment for miles driven since the last self-report is expected.

► Accounting:

- > Verifying that payments are correct.
 - An odometer reconciliation process may be employed to ensure payments are correct, and spot checks of some vehicles that are self-reporting will be employed to deter and detect significant under-reporting.

3.3.3. Compliance and Enforcement: Odometer Charge (post-pay) (not in pilot)

Periodic odometer reporting would be obtained through a combination of self-reporting, as with federal income taxes, and verified reporting, such as is being tested in the pilot through the Smog Check Referee program and Vehcon smartphone app. As long as the fuel tax is in place, those subject to a road charge would also receive an offset for estimated fuel taxes in proportion to reported miles, so there is reduced incentive to cheat for many motorists.



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- ▶ Detecting Fraud:
 - > Odometer fraud (fraudulently setting the odometer to a false value) is possible, even with many modern vehicles with digital odometers.
 - > To detect odometer rollback, cross-referencing current odometer values with odometer values for the vehicle from other sources (e.g., care history service reports and records of vehicle repair shop manifests) could be performed. Large deviations from predicted mileage either on a yearly average or dividing that yearly average over quarters would also be indicators of potential fraud, and could trigger audit requests.
 - > Reporting of false or fraudulent odometer readings should be detected by occasional official odometer readings, and possibly requirements to periodically provide pictures of odometers.
- ▶ Issuing penalties:
 - > Penalties for failure to pay the road charge would be issued at the same time as failing to register, but would be in addition to any registration violations.
 - > Odometer tampering is a felony under Federal law²⁰ and a gross misdemeanor under California law²¹. Penalties for odometer tampering already exist at the Federal level (in the Odometer Act), but further penalties should be considered as it relates to road charge avoidance.

3.4. Automated Distance Charge (no location)

With an Automated Distance Charge (no location), motorists have an in-vehicle device that reports road usage data to an account managed by a commercial account manager (CAM). The in-vehicle device requires:

- ▶ Memory for storage of road use data, and
- ▶ Communications technology for transmitting travel data for billing purposes.

Mileage data, while it is stored on the device, during the transmission of the data, and in its storage at an Account Manager's system, must be handled securely. Providing requirements for data security is beyond the scope of this document—they are covered in the System Requirements Specifications and Interface Control Document—but these requirements ensure data is encrypted while stored on the device and during transmission, and deleted appropriately from the device once it has been transmitted.

Technologies that support these requirements for the pilot include the following:

1. On-board units that plug into the on-board diagnostic port (called Onboard Diagnostics 2 or OBDII port) – such devices are here referred to as Electronic Mileage Meters (EMMs);
2. Smartphones with apps that can measure mileage traveled and guarantee it was from one specific vehicle; and
3. Telematics systems that are built into the vehicle by the automaker.

Commercial vehicle telematics systems designed to support road charge payment, such as those used in countries with nationwide tolls for commercial vehicles, were featured in the pilot, but only with location.

²⁰ 49 U.S. Code Chapter 327 - ODOMETERS

²¹ California Vehicle Code Section 28050-28053.



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It is not possible to install EMMs on vehicles without an OBDII port. OBDII ports are usually located under the dashboard of vehicles and allow mechanics to read trouble codes. Vehicles manufactured before 1996 typically do not have these ports (although some 1994 and 1995 models do). Most electric vehicles do not comply fully with the OBDII standard, making use of EMMs with electric vehicles more challenging, although electric vehicles may have in-vehicle telematics systems that could support an Automated Distance Charge (no location or general location) if automakers approved such an application.

Automated Distance Charge (no location) involves motorists being invoiced for their mileage on a regular (monthly or quarterly) basis. Automated Distance Charge (no location) would be run by CAMs that collect road charges on behalf of the Road Charge Management. CAMs would have the opportunity to sell motorists additional services and may be able to collect a fee (from Road Charge Management or from the motorist) for the service of collecting the road charge. CAMs would likely have technology expertise not currently available in government-run agencies. A system of CAMs is used to collect road charges or tolls in New Zealand, Ireland, and Portugal, and is used in other industries in the U.S. and abroad. Oregon has two CAMs to collect its road usage charge, which began as a voluntary program on July 1, 2015, and one CAM to collect its weight-mile tax, which began in 1925 but added electronic reporting and payment with a CAM in 2015.

Potential advantages of engaging commercial account managers compared to a government-run system for Automated Distance Charge (no location) include the following:

- ▶ They may bring a lower overall system cost when the system operates at a large scale (1 million+ users), due to their potential for serving multiple states and creating economies of scale.
- ▶ They may operate in multiple states, allowing easy transfer for individuals moving from state to state and allowing interoperability between the states.
- ▶ They may provide additional services for customers, such as teen driver feedback or fleet management services.

CAMs provide a standard set of account management tools for all of their registered customers. This includes the ability to link multiple vehicles to one account, and to pay for all linked vehicles on the account at once. This service appeals in particular to vehicle fleets. CAMs also provide additional value-added services designed both for fleets and individuals. Thus Automated Distance Charge (no location) is ideal for customers that prefer not to have specific location information.

3.4.1. Experience from Motorist's Perspective: Automated Distance Charge (no location)

The experience of a motorist with Automated Distance Charge (no location) is as follows:

- ▶ **Acquisition:**
 - > The motorist registers with a CAM. In the pilot, there were two choices of CAM. A CAM is a private company that collects road charges from the motorist, in addition to offering a range of value-added services. For the pilot, one CAM operated with post-pay accounts and the other with pre-pay accounts. In a real system, registering involves proving credit-worthiness, such as by providing a credit card or linked bank account; therefore, they may not have means to allow unbanked individuals (individuals without bank accounts or credit cards) to register with Automated Distance Charge (no location).



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- > The motorist acquires an electronic mileage meter (EMM) from a CAM, or uses his/her own smartphone to download an app, or activates his/her vehicle's compatible in-vehicle telematics. The EMM is a small electronic device that mounts in a vehicle, connected to the OBDII port, and measures the number of miles driven.
- > CAMs notify Account Management Oversight (AMO) of all vehicles registered with them.
- ▶ **Usage** (driving):
 - > The EMM, telematics app, or smartphone app measures distance driven.
 - > An EMM may also measure fuel consumed (using OBDII data) and/or fuel added to the vehicle (using data from a vehicle electronics system on a telematics device, if available) to compute a fuel tax credit.
 - > In the pilot, motorists were free to switch CAMs at the midpoint of the pilot. In a potential future mandatory system, if the motorist receives an EMM for free from his/her current CAM in exchange for signing a one- or two-year contract, that entity may charge an early termination fee if the motorist tries to leave before the contract is over.
 - > Data from the device, smartphone, or vehicle is sent via wireless communication to the CAM.
 - > Participants receive reminders each month to report smartphone images. They also receive reminders to become compliant, in case they are noncompliant, for all technologies.
- ▶ **Paying** (refreshing):
 - > CAMs invoice customers periodically for whatever services it provides (e.g., insurance, navigation) in addition to the road charges and process payments. In the pilot, all services are free and road charges are simulated. The pre-pay CAM provided a monthly statement to each customer, and the post-pay CAM provided a monthly invoice.
 - > Motorists are provided credits for fuel taxes paid. The value of fuel taxes paid is either estimated based on the EPA's Combined City-Highway fuel economy rating of the vehicle, or computed directly from the fuel used by vehicles for which this information is available to the EMM.
 - > Periodically, in a potential future mandatory system, CAMs remit the amount due from their customers to Road Charge Management.
 - > CAMs are responsible for collecting the funds due to government from their customers and would guarantee the revenues. If they fail to collect funds owed from motorists, they assume the loss.
 - > The state retains the right to audit both CAMs and individual accounts.
- ▶ **Decommissioning** (selling car, moving out of state):
 - > The motorist is responsible for paying the road charge for the vehicle until it is removed from the DMV vehicle registry.
 - > The motorist informs the commercial account manager or the State of account closure. Once the EMM is removed from the vehicle, the motorist can inform the CAM or the State that the final bill can be sent. The CAM reports the date of final invoicing to Road Charge Management. If Road Charge Management determines that there was a period when the vehicle still being driven in California with valid registration but without metering mileage and paying charges through an account management entity, it could assess a penalty.
 - > In the pilot, participants who wished to un-enroll had to notify their CAM, return any devices (if used), and close out their accounts (provide mock payment for the final invoice if post-pay, or review the final statement, if pre-pay).



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3.4.2. Experience from Road Charge Management's Perspective: Automated Distance Charge (no location)

CAMs carry out the following procedures with Automated Distance Charge (no location):

- ▶ **Distribution:**
 - > Motorists are informed of account management options (and possibly separate mileage reporting device options) at the time of enrollment.
 - > Motorists are given a certain number of days to sign up with a CAM.
 - > Enrolled motorists obtain EMMs from a CAM; or use their own smartphones or telematics systems.
- ▶ **Operation:**
 - > CAMs are responsible for metering road usage, invoicing, and collecting payments from motorists.
 - > CAMs send usage data in monthly reports and payments to Road Charge Management (in the pilot, this role will be fulfilled by the AMO).
 - > CAMs send reminders to participants to report periodically (for smartphone methods) or to become compliant in case of non-compliance (for all methods).
 - > In a potential future mandatory system, CAMs are responsible for remitting funds to the AMO corresponding to all miles traveled, even if the motorist does not pay the CAM. In other words, CAMs assume the risk of ensuring that their registered motorists pay all required fees.
- ▶ **Decommissioning** (car sale, transfer out-of-state):
 - > In the pilot, CAMs accommodated participants who wish to un-enroll at any time by closing out their accounts and providing instructions for returning any devices (if used).
 - > In a potential future mandatory system, the motorist is solely responsible for removing the vehicle from the DMV vehicle registry and liable for all road charges until the vehicle is officially removed.
 - > In a potential future mandatory system, after the motorist informs the CAM that the account has been closed, the CAM prepares a final invoice and report this date of final invoicing to Road Charge Management. If Road Charge Management determines that there was a period when the vehicle was still officially registered but not paying mileage fees through an account management entity, it may assess a penalty on the motorist.
- ▶ **Accounting:**
 - > Verifying that payments are correct:
 - CAMs periodically send reports to the AMO listing aggregate mileage by month for each vehicle. Precise mileage by day is not listed, except in cases that the AMO suspects fraud and makes a specific audit request on given vehicle.
 - CAMs also provide chargeable miles traveled by motorist, and amounts invoiced by motorist, so the entities can verify each motorist is correctly charged and maintain a running tally for each vehicle.
 - > Certification:
 - Each CAM is subject to initial certification, periodic focused audits, and periodic recertification. In the pilot, certification consisted of passing the testing procedures. Also, each EMM and app is subject to certification and include various anti-tampering measures – for example, transmitting an alert message if the device is disconnected.



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- Note that the processes of standardization (maintaining and improving the ConOps, SRS, ICD as standards) and certification (testing that vendors comply with the standardized design documents) is an important part in any future implementation. Updating the standards and setting up the certification body will be an important step prior to any future implementation.

3.4.3. Compliance and Enforcement: Automated Distance Charge (no location) (not in pilot)

Among location-based technologies, EMMs require the most attention for compliance and enforcement. EMMs transmit signals related to fraud detection – most notably, the approximate timing of the periods that it has been unplugged from the vehicle – to CAMs, which would in turn pass this information on to the State. Analysis of this data is the core of Automated Distance Charge (no location) compliance and enforcement.

► Detecting Fraud:

- > Detecting fraud by motorists:
 - Each EMM includes anti-tampering measures, including recording and transmitting alerts if the device has been opened or disconnected; security measures to determine if the mileage reporting device has been hacked; and security measures to ensure only legitimate communications with the State and/or commercial account managers.
 - Road charge management could demand detailed records of individual vehicles in cases of suspected fraud.
 - The commercial account manager is motivated to ensure compliance because it would still owe government for miles traveled even if the motorist does not pay.
- > Detecting fraud by CAMs:
 - CAMs are subject to initial certification, periodic recertification, monthly reporting, and periodic focused auditing to ensure that any attempt at fraud would be detected.

► Issuing penalties:

- > Motorists are subject to penalties by CAMs or by the State.
- > CAMs may issue penalties for late payment if legally empowered to handle such penalties. Alternatively, a CAM may not be empowered, but the terms of their agreement with Road Charge Management would prescribe a process for them to identify any motorist who is suspected of a penalty to Road Charge Management with supporting information.
- > CAMs could also handle penalties by terminating the motorist's service agreement and transferring the account to Road Charge Management for handling. Road Charge Management may issue penalties for attempts to defraud or for noncompliance. The legislative mandate should specify the specific penalties, their value, and the method of appeal or resolution.
- > CAMs would be subject to certification being revoked and financial penalties in case of fraud.

3.5. Automated Distance Charge (general location)

With an Automated Distance Charge, miles driven on public roads within California are charged, while miles driven outside of the State and off-road or on private roads would not be charged. In the pilot, Automated Distance Charge (general location) utilized an on-board unit with:

- Location-detecting technology that can distinguish whether miles are driven on California public roads, off road, or out of state,
- Memory for storage of road use data, and



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- ▶ Communications technology for transmitting travel data for billing purposes.

Mileage and any location data is handled securely while it is stored on the device, during the transmission of the data, and in its storage at an account manager's system. Precise requirements for data security are beyond the scope of this document—they are covered in the System Requirements Specifications and the Interface Control Document—but these requirements ensure data is encrypted under transmission and deleted appropriately on the device.

Technologies that support these requirements include:

1. Usage-based insurance on-board units that install in the on-board diagnostic port (called OBDII) – such devices are here referred to as Electronic Mileage Meters (EMMs);
2. Smartphones with apps that can measure mileage traveled and guarantee it was from one specific vehicle;
3. Commercial vehicles telematics systems designed to support road charge payment, such as those used in countries with nationwide tolls for commercial vehicles.

Telematics systems that are built into the vehicle by the automaker can be used to support this Operational Concept in the future. However, at the launch of the pilot, telematics systems were not capable of reporting location data in a format or frequency suitable for accurate billing and thus were not used in the pilot.

It is not possible for motorists install the simple, common type of EMMs on vehicles without an on-board diagnostic port (called OBDII). OBDII ports are usually located under the dashboard of vehicles that allow mechanics to read trouble codes. Vehicles manufactured before 1996 typically do not have these ports (although some 1994 and 1995 models do). Most electric vehicles do not comply with the OBDII standard, but may support use of an OBDII device that measures distance using location data, and electric vehicles typically do have in-vehicle telematics systems that could support an Automated Distance Charge (general location) if automakers approved such an application.

Automated Distance Charge (general location) involves motorists being invoiced for their mileage on a regular (monthly or quarterly) basis. Automated Distance Charge (general location) is run by CAMs that collect road charges on behalf of the Road Charge Management. CAMs have the opportunity to sell motorists additional services and may be able to collect a fee (from Road Charge Management or from the motorist) for the service of collecting the road charge (such a fee was not part of the pilot). CAMs would likely have technology expertise not currently available in government-run agencies. A system of CAMs is used to collect road charges or tolls in New Zealand, Ireland, and Portugal, and is used in other industries in the U.S. and abroad. Oregon has two CAMs to collect its road usage charge, which began as a voluntary program on July 1, 2015, and one CAM to collect its weight-mile tax, which began in 1925 but added electronic reporting and payment with a CAM in 2015.

Potential advantages of engaging commercial account managers compared to a government-run system for Automated Distance Charge (general location) include the following:

- ▶ They may bring a lower overall system cost when the system operates at a large scale (1 million+ users), due to their potential for serving multiple states and creating economies of scale.



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- ▶ They may operate in multiple states, allowing easy transfer for individuals moving from state to state and allowing interoperability between the states.
- ▶ They may provide additional services for customers, such as teen driver feedback or fleet management services.

Since Automated Distance Charge (general location) raises privacy concerns, it is vital for Road Charge Management to ensure all technical requirements related to privacy and data security are met, and to provide data protection and retention guidelines and a privacy policy that must be followed. One major privacy measure is for miles only be reported in three categories: miles driven in-state, miles driven out-of-state, and miles driven on private roads/off-road (miles driven in other states with a road charge program could also be reported by state). As an additional means of addressing privacy concerns, motorists may be offered switchable road charging devices that only record location data when users engage a switch. In such cases, users would be charged for all miles recorded while location detection was turned off, regardless of whether they were on California public roads or not, although such devices were not available during the pilot.

CAMs provide a standard set of account management tools for all of their registered customers. This includes the ability to link multiple vehicles to one account, and to pay for all linked vehicles on the account at once. This service appeals to vehicle fleets. CAMs also provide additional value-added services designed both for fleets and individuals. Thus Automated Distance Charge (general location) is ideal for customers that prefer having information about where their vehicles travel and the associated services.

Automated Distance Charge (general location) is ideal for two types of out-of-state users:

1. Frequent border crossers, such as daily commuters who live in another state and work in California, or who live in California and work in another state, and
2. Users registered with a road charging program in another state, such as Oregon's OReGO program.

In the case of frequent border crossers, the Automated Distance Charge (general location) provides the easiest way for drivers not to pay road charges on miles traveled in the other state. In the cases of motorists registered with a road charging program from another state, an interoperability agreement could be reached with that state, so that motorists on the Automated Distance Charge (general location) concept in the other state have their miles in California paid for directly by their CAM, and California motorists on the Automated Distance Charge (general location) concept have their miles in the other state paid directly by their CAM. For purposes of the pilot, since no exchange of funds occurred, such an agreement was not in place. However, one CAM provided simulated charging for select participants in multiple states, and simulated reconciliation of funds between states was conducted by the AMO.

3.5.1. Experience from Motorist's Perspective: Automated Distance Charge (general location)

The experience of a motorist with Automated Distance Charge (general location) is as follows:

- ▶ **Acquisition:**
 - > The motorist registers with a CAM. A CAM is a private company that agrees to collect road charges from the motorist, possibly in addition to offering a range of other value-added services such as automated parking payments, usage-based insurance, or concierge services. The pilot system included two commercial account managers that competed for motorists' business. For



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the pilot, one CAM operated with post-pay accounts and the other with pre-pay accounts. In a potential future mandatory system, registering involves proving credit-worthiness, such as by providing a credit card or linked bank account; therefore, CAMs may not have means to allow unbanked individuals (individuals without bank accounts or credit cards) to register with Automated Distance Charge (general location).

- > The motorist acquires an electronic mileage meter (EMM) from a CAM; or downloads an app to his/her own smartphone. The EMM is a small electronic device that mounts in a vehicle, connected to the OBDII port, and measures the number of miles driven in three different zones: in-state on public roads, in-state off road, and out-of-state.
- > CAMs notify Road Charge Management of all vehicles registered with them. The authority then verifies that all vehicles subject to the road charge for which the motorists have opted for Automated Distance Charge (general location) are registered.
- ▶ **Usage** (driving):
 - > The EMM and smartphone measure distance driven and determine the location of travel, e.g., via GPS. The electronic location information is used to differentiate travel between priced and non-priced zones. In general, each state may contain one priced and one non-priced zone. In the pilot, there were only simulated charges for travel on California public roads, and during simulated interoperability, for travel on Oregon public roads. All other travel was exempt from road charges.
 - > The specific coordinates of where the vehicle is located are not transmitted to the state (simulated by the AMO); after the location data is compared with an electronic map to determine if the miles traveled were chargeable miles, only miles by zone is transmitted further.
 - > The EMM or smartphone also measures fuel consumed (using OBDII data) to compute a fuel tax credit.
 - > In the pilot, the motorist was free to change CAMs at the midpoint of the pilot project.
 - > Data is sent via wireless communication to the CAMs.
 - > Participants receive reminders each month to report smartphone images. They also receive reminders to become compliant, in case they are noncompliant, for all technologies.
- ▶ **Paying** (refreshing):
 - > CAMs invoice customers periodically for whatever services it provides (e.g., insurance, navigation) in addition to the road charges and process payments. In the pilot, all services were free and road charges were simulated. The pre-pay CAM provided a monthly statement to each customer, and the post-pay CAM provided a monthly invoice.
 - > Motorists are provided credits for fuel taxes paid. The value of fuel taxes paid is either estimated based on the EPA's Combined City-Highway fuel economy rating of the vehicle, or computed directly from the fuel used by vehicles for which this information is available to the EMM.
 - > Periodically, in a potential future mandatory system, CAMs remit the amounts due from their customers to Road Charge Management.
 - > CAMs are responsible for collecting the funds due to government from their customers and would guarantee the revenues. If they fail to collect funds owed from motorists, they assume the loss.
 - > The state retains the right to audit both CAMs and individual accounts.
- ▶ **Decommissioning** (selling car, moving out of state):
 - > The motorist is responsible for paying the road charge for the vehicle until it is removed from the DMV vehicle registry.



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- > The motorist informs the commercial account manager or the State of account closure. Once the EMM is removed from the vehicle, the motorist informs the CAM that the final bill can be sent. The CAM reports the date of final invoicing to Road Charge Management. If Road Charge Management determines that there was a period when the vehicle still being driven in California with valid registration but without metering mileage and paying charges through an account management entity, it assess a penalty.
- > In the pilot, participants who wished to un-enroll had to notify their CAM, return any devices (if used), and close out their accounts (provide mock payment for the final invoice if post-pay, or review the final statement, if pre-pay).

3.5.2. Experience from Road Charge Management's Perspective: Automated Distance Charge (general location)

CAMs carry out the following procedures with Automated Distance Charge (no location):

▶ **Distribution:**

- > Motorists are informed of account management options (and possibly separate mileage reporting device options) at the time of pilot enrollment.
- > Motorists are given a certain number of days to sign up with a CAM.
- > Enrolled motorists obtain EMMs from a CAM; or use their own smartphones or telematics systems.

▶ **Operation:**

- > CAMs are responsible for metering road usage, invoicing, and collecting payments from motorists.
- > CAMs send usage data in monthly reports and payments to Road Charge Management (in the pilot, this role will be fulfilled by the AMO).
- > CAMs send reminders to participants to report periodically (for smartphone methods) or to become compliant in case of non-compliance (for all methods).
- > In a potential future mandatory system, CAMs are responsible for remitting funds to the AMO corresponding to all miles traveled, even if the motorist does not pay the CAM. In other words, CAMs assume the risk of ensuring that their registered motorists pay all required fees.

▶ **Decommissioning** (car sale, transfer out-of-state):

- > In the pilot, CAMs accommodated participants who wished to un-enroll at any time by closing out their accounts and providing instructions for returning any devices (if used).
- > In a potential future mandatory system, the motorist would be solely responsible for removing the vehicle from the DMV vehicle registry and liable for all road charges until the vehicle is officially removed.
- > In a potential future mandatory system, after the motorist informed the CAM that the account is closed, the CAM prepares a final invoice and reports this date of final invoicing to Road Charge Management. If Road Charge Management determines that there was a period when the vehicle was still officially registered but not paying mileage fees through an account management entity, it can assess a penalty on the motorist.

▶ **Accounting:**

- > Verifying that payments are correct:



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- CAMs periodically send reports to the AMO listing aggregate mileage by month for each vehicle. Precise mileage by day is not listed, except in cases that the AMO suspects fraud and makes a specific audit request on given vehicle.
- CAMs also provide chargeable miles traveled by motorist, and amounts invoiced by motorist, so the entities can verify each motorist is correctly charged and maintain a running tally for each vehicle.
- > Certification:
 - Each CAM is subject to initial certification, periodic focused audits, and periodic recertification. In the pilot, certification consisted of passing the testing procedures. Also, each EMM and app is subject to certification and include various anti-tampering measures – for example, transmitting an alert message if the device is disconnected.

3.5.3. Compliance and Enforcement: Automated Distance Charge (general location) (not in pilot)

Among location-based technologies, EMMs require the most attention for compliance and enforcement. EMMs transmit signals related to fraud detection – most notably, the approximate timing of the periods that it has been unplugged from the vehicle – to CAMs, which would in turn pass this information on to the State. Analysis of this data is the core of Automated Distance Charge (general location) compliance and enforcement.

► Detecting Fraud:

- > Detecting fraud by motorists:
 - Each EMM includes anti-tampering measures, including recording and transmitting alerts if the device has been opened or disconnected; security measures to determine if the mileage reporting device has been hacked; and security measures to ensure only legitimate communications with the State and/or commercial account managers.
 - Road charge management may demand detailed records of individual vehicles in cases of suspected fraud.
 - The commercial account manager is motivated to ensure compliance because it would still owe government for miles traveled even if the motorist does not pay.
- > Detecting fraud by CAMs:
 - CAMs are subject to initial certification, periodic recertification, monthly reporting, and periodic focused auditing to ensure that any attempt at fraud would be detected.

► Issuing penalties:

- > Motorists are subject to penalties by CAMs or by the State.
- > CAMs may issue penalties for late payment if legally empowered to handle such penalties. Alternatively, a CAM may not be empowered, but the terms of their agreement with Road Charge Management would prescribe a process for them to identify any motorist who is suspected of a penalty to Road Charge Management with supporting information.
- > CAMs could also handle penalties by terminating the motorist's service agreement and transferring the account to Road Charge Management for handling. Road Charge Management issues penalties for attempts to defraud or for noncompliance. The legislative mandate should specify the specific penalties, their value, and the method of appeal or resolution.
- > CAMs are subject to certification being revoked and financial penalties in case of fraud.



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4. Pilot Road Charge System Components

This section presents a conceptual set of road charge pilot system components and describes what they do. These system components, taken together, will create the pilot system that enables all of the usage scenarios that are subsequently outlined in Section 5. This section, while intended for the pilot system, is written in a very general way, so that the pilot system simulates a real revenue generating system as closely as possible.

This functional description of the road charging pilot system does not make any assumptions about institutional responsibility in a potential future revenue generating system. Certain components may be assigned, for example, to the California Department of Motor Vehicles (DMV), the California State Controller's Office, or the California Department of Transportation (Caltrans). Any discussion of specific institutional responsibilities or potential organizational structures is beyond the scope of this ConOps document. That said, in some places the document makes suggestions about an agency where a given function could be conveniently located, but these suggestions are not meant to be taken as decisions or even recommendations, but merely convenient examples.

This first part of this section presents an overview of the road charge pilot system components. The second part of this section presents an example of detailed functional elements for a road charging system design. This example is illustrative and not meant to pre-empt any requirements suggested by in the usage scenarios in Section 5.

4.1. Overview of Road Charge Pilot System Components

The objective of the road charge system is to operate, manage, and administer a viable Road Charge Pilot Program in the State of California. The road charge system can either be operated entirely by the government or by the government in collaboration with commercial account managers (CAMs). Government operation is most suitable for the Time Permit, Mileage Permit, and Odometer Charge, as described in the previous section, while CAMs are best suited for Automated Distance Charges. Two figures below illustrate these possible configurations.

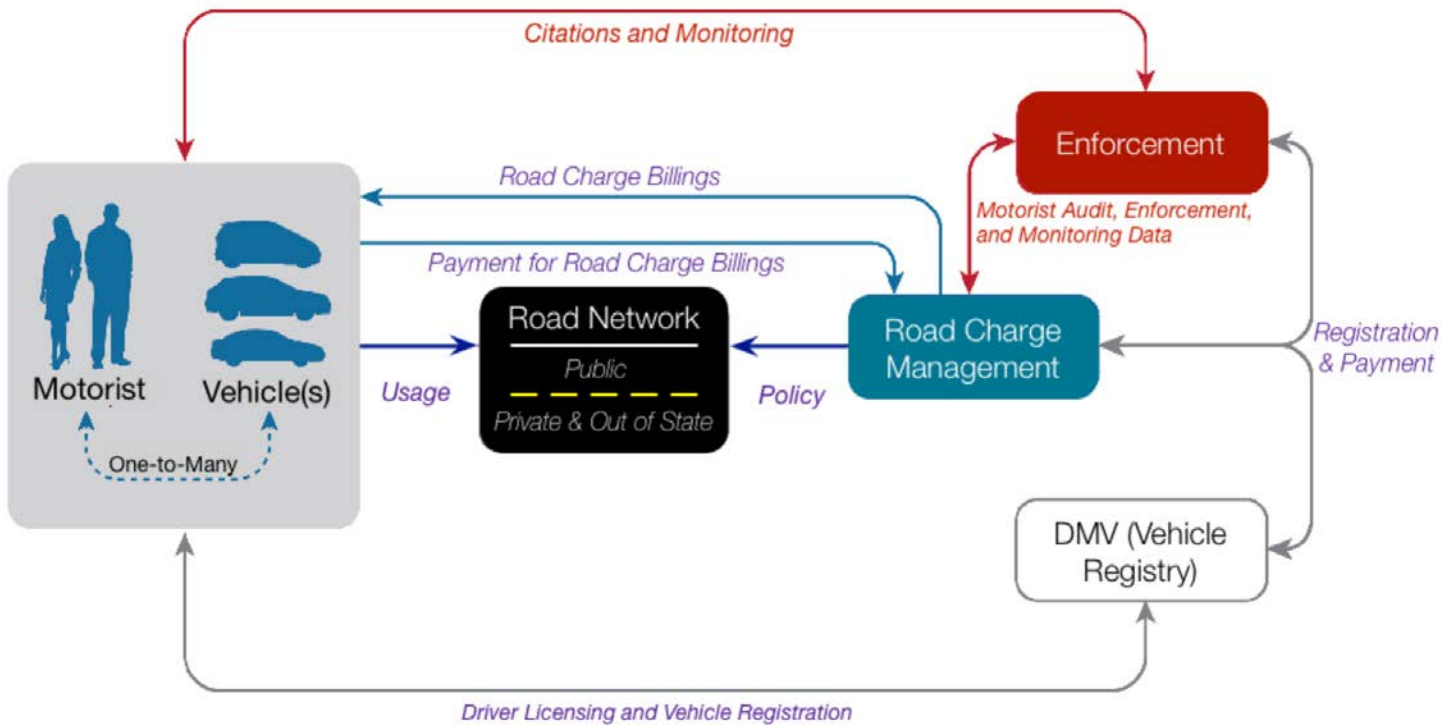
It should be emphasized that these diagrams are intended to illustrate functions only, not organizations. In some cases, these diagrams necessarily illustrate entities, but these diagrams are not intended to suggest any final organizational state. Road charge management, for example, could be part of DMV, could be part of Caltrans, or could be an entirely new entity.

First, Figure 5 represents the government-centric concept.



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Figure 5: Pilot Road Charge System Overview Without Commercial Account Managers



The system usage scenarios included in Section 5 below fully explain the operations of the system depicted here. This diagram illustrates the following stakeholder relationships:

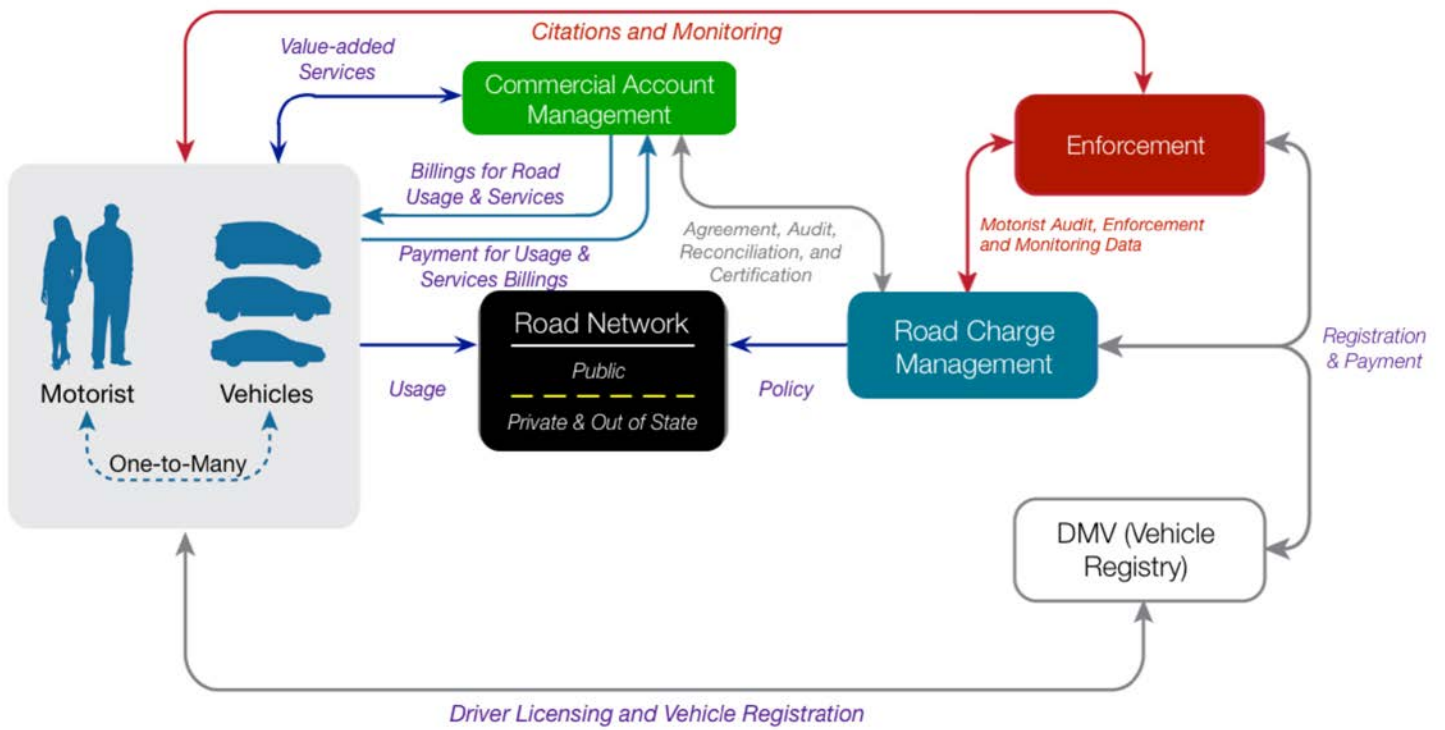
- ▶ Motorists and their vehicles liable for a road charge use the road network consisting of public, private, and out-of-state roads.
- ▶ Motorists are authorized to use the road network by virtue of registering their road charge-liable vehicles with Road Charge Management (which could be part of DMV, or part of Caltrans, or a new entity). Road Charge Management is used to denote whatever entity the legislature empowers to collect revenue and set policy related to the Road Charge.
- ▶ Motorist usage of the road network is reported using one of the Operational Concepts.
 - > If the motorist abides by the laws, they are considered compliant.
 - > If the motorist does not follow the laws (does not pay in a timely way or attempts to defraud the system), Road Charge Management will issue a citation.
 - > Road Charge Management handles the charges and the payment interface to the motorist.

California may choose to engage CAMs to handle the motorist-facing activities for Automated Distance Charge. CAMs would be authorized agents of the State certified by Road Charge Management to assist in the collection of road charges and manage the accounts of motorists who elect to have their accounts handled by such companies. Motorists may have an existing relationship with a CAM via existing services such as usage-based insurance or in-vehicle telematics. Figure 6 depicts the system with CAMs. In this diagram, the motorist interfaces with the CAMs that in turn have a relationship with Road Charge Management based on a certification process.



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Figure 6: Pilot Road Charge System Overview with Commercial Account Managers



Details on each of these component entities are provided in the next section.

4.2. Description of Components of a Road Charge Pilot System

4.2.1. Road Charge Management

Road Charge Management is the new body created in California government that is responsible for executing all duties that a potential future road charging law would assign to state government, including the duties of account management for those concepts that the state will perform directly, oversight of account managers, and other duties. The role of Road Charge Management will be simulated during the pilot program, as will the role of the DMV.



Upon receiving an invitation to enroll, motorists will be presented with the available options for registering their vehicle(s) for the road charge pilot. Motorists will be able to choose both an account manager (simulated state or CAM) and Operational Concept.

All information about the Road Charge Pilot Program is provided via internet, email, and in a few cases physical mail to offline participants. These information channels simulate DMV. The motorist registers each vehicle for the road charge Operational Concept they select with an account manager, and thus establishes a relationship with the Road Charge Management body within the state government.



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In a potential future road charging program, the Road Charge Management could certainly be housed within the DMV, but this assumption is not made here—it is illustrated as a separate body.

Either prior to use of the roadway (in the case of the Time Permit or the Mileage Permit) or afterwards (in the case of the other Operational Concepts), the motorist is presented with the charges, and the motorist pays for the road charge.

Road Charge Management comprises three sub-entities as follows:

- ▶ The State Account Management
- ▶ The Account Management Oversight
- ▶ Road Charge Administration.

All of these are described in greater detail in section 4.3 below.

4.2.1.1. State Account Management

Account management is the subsystem that takes in mileage data, updates user accounts based on mileage data, sends invoices to customers, receives payment from customers (simulated in the pilot), provides customer service, remits funds to the state (simulated in the pilot), and reports road charge data to the state for accounting purposes.

The California Road Charge Pilot Program will offer a State Account Manager (SAM). The pilot SAM is known as CalSAM. The main reason for having a SAM in a real system would be that private companies may not be able to find a business case for participating in some of the Operational Concepts. For example, the SAM could manage the accounts for all vehicles registered for Time or Mileage Permits. Another reason is that CAMs may not be able to service all customers, such as motorists without bank accounts or internet access.

A SAM could also manage technology methods. However, CAMs would generally prefer not to have the state competing with the services that they are providing, and may be able to offer those services at lower cost than the state. One possibility would be for a SAM to support only manual concepts and devices without location technology and not provide any value-added driver services. In the pilot, the CalSAM will offer only manual reporting methods.

The precise example functional elements of the State Account Management are the following:

- ▶ Account Registration
- ▶ Customer Service
- ▶ Invoicing and Payment Processing
- ▶ Modify, Transfer, or Close Account
- ▶ Change Operational Concept
- ▶ Handle Inquiries and Complaints
- ▶ Motorist Declare / System Detect
- ▶ Process Transaction Data
- ▶ Calculate Charges
- ▶ Reconcile Usage to Zones



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These functional elements are described in detail in section 4.3 below.

4.2.1.2. Account Management Oversight

Account management oversight is a state *function* (not an entity) comprising compliance and enforcement of the road charging system. The main functions of account management oversight are the following:

- ▶ Verify that all potential subject vehicles are registered for the road charge.
- ▶ Verify that all commercial account managers pay the correct amount on a monthly basis.
- ▶ Perform or oversee certification, recertification, and auditing of commercial account managers.

To verify that all potential subject vehicles are registered for the road charge, account management oversight involves examining the DMV's vehicle registry to note vehicles subject to the road charge. As vehicles are added to or eliminated from the vehicle registry, account management oversight includes updating its list of subject vehicles. The account management oversight function also collects current membership lists from all account managers, and verifies that all vehicles on the subject vehicle list are registered with an account manager.

To verify that all account managers pay the correct amount on a monthly basis, the entity performing account management oversight examines a series of data reports provided by the account managers each month, determines whether the account manager is making all computations correctly, and verifies that the account manager's deposit into state accounts is equal to the amount specified.

To perform or oversee certification, recertification, and audit of account managers, the account management overseer develops the framework for a method by which compliance to all road charging specifications can be checked. It then carries out the check itself, or has a third-party certification body do so.

The precise example functional elements of the account management oversight are the following:

- ▶ Identify Vehicles Subject to Road Charge
- ▶ Manage Master Chart of Accounts
- ▶ Audit
- ▶ CAM Contract Management, Procurement, Certification
- ▶ Reconcile Transactions to Zones and Accounts

These functional elements are described in detail in section 4.3 below.

4.2.1.3. Road Charge Administration

The Road Charge Administration is the body that carries out the administrative tasks of the road charge program. Administrative tasks include a range of activities that ensure that the system is running correctly, and in compliance with legislation; handle communications internally and externally; provide feedback on road charge policies and rates to the legislature; etc.

The precise example functional elements of the Road Charge Administration are the following:

- ▶ Ensure Compliance with Policy/Legislation
- ▶ Evaluate and Measure Operational Performance
- ▶ Manage System Performance
- ▶ Provide Planning and Controls



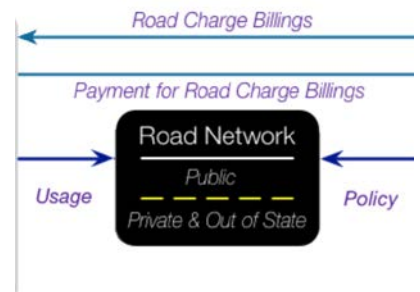
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- ▶ Manage Stakeholder Communications
- ▶ Manage IT Assets and Security
- ▶ Manage Human Resources
- ▶ Manage Technology Updates and Interoperability
- ▶ Manage DMV Interface
- ▶ Manage GIS/Map Certification
- ▶ Recover Charges
- ▶ Monitor and adjudicate appeals

These functional elements are described in detail in section 4.3 below.

4.2.1.4. Road Network

In return for payment of the road charges, the motorist uses (drives on) the roadway network, which is composed of public, private and out-of-state roads. Depending on the Operational Concept chosen, there may be no charge for private or out-of-state roads. The Road Charge Management implements legislative policy for road charging, and in some cases may have a role in recommending road charge policy.



4.2.1.5. Commercial Account Management

In the case that the motorist chooses an Operational Concept supported by the CAMs, the motorist chooses the CAM that he/she prefers, and registers his/her vehicle(s) with it. In a real system, depending on the rules adopted, the CAM may be allowed to reject a motorist application (e.g., for being known to have frequently failed to pay road charges invoiced by a CAM before). In that case, the motorist must apply for an Operational Concept that is supported by the State Account Manager. In the pilot, the only condition of participation with a CAM is that the motorist accept the CAM's terms and conditions of use (for example, there are legal terms and conditions associated with use of devices, wireless service, and accounting services; motorists who do not agree to these terms can use another account manager).

The CAM provides the motorist instructions (and possibly hardware, in the event the motorist selects OBDII-based mileage reporting) for recording and reporting distance traveled. Installation/setup varies by Operational Concept. The CAM also provides the motorist information about any potential value added services offered.

The CAM reports to the Road Charge Management the fact that the motorist is registered with them.

The motorist drives on (uses) the roadway network. If the motorist is signed up for Automated Reporting with General Location, the motorist is not charged for travel out-of-state or off road.

Periodically, the CAM sends the motorist an invoice for roadway usage, electronically or on paper, at the motorist's preference. The motorist's bill is likely combined with any costs for value-added services he/she has with the CAM and also includes applicable credits for fuel tax paid during the billing period. The motorist pays the bill with one of the available payment methods, possibly setting up auto-pay.



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The CAM also sends aggregate data on roadway usage to the Road Charge Management, obeying all privacy conditions in their contract with the state. The CAM also pays the state the road charges that they collect, per the terms and conditions of their contract.

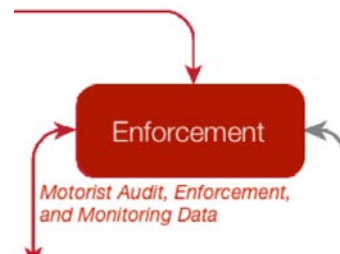
The precise example functional elements of the CAM are the following:

- ▶ Account Registration
- ▶ Customer Service
- ▶ Invoicing and Payment Processing
- ▶ Modify, Transfer, or Close Account
- ▶ Change Operational Concept
- ▶ Handle Inquiries and Complaints
- ▶ Distribute Technology and Inventory Management
- ▶ Motorist Declare / System Detect
- ▶ Process Transaction Data
- ▶ Calculate Charges
- ▶ Reconcile Usage to Zones
- ▶ Pay Road Charge Collected to State

These functional elements are described in detail in section 4.3 below.

4.2.1.6. Enforcement

In a potential future operational system, the Road Charge Management may execute some enforcement activities itself, and it may also provide access to enforcement-relevant information in the road charge database to an enforcement body. The enforcement body could be California Highway Patrol, local police, other enforcement officers, or some combination of these groups. With the information from Road Charge Management, enforcement officers should be able to determine (manually or automatically) that any given vehicle is registered for the road charge, as well as any relevant information for the Operational Concept chosen for that vehicle.



The precise functional elements of the Enforcement are the following:

- ▶ Analyze Data
- ▶ Enforce Against Fraud
- ▶ Recover Unpaid Charges
- ▶ Prepare Evidence Packages for Appeals
- ▶ Enforce Against Repeat Offenders

These functional elements are described in detail below.

As decided by the TAC, the pilot will not include a simulation of enforcement, although the Road Charge Management will investigate any anomalous data.



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4.2.2. Pilot Participant Coordination and Support

Pilot participant coordination and support is a vital component of a pilot program. It is not illustrated in the system overview diagrams in the previous chapter, as it exists only in a pilot system. Pilot participant coordination and support is an entity that provides any support needed by pilot participants. It consists of a staff that responds to e-mail and phone calls from participants with questions about the pilot.

Pilot participant coordination and support recruits participants and/or works with CAMs to recruit participants to meet program targets. Pilot participant support provides introductory information to participants, including a description of the full pilot program, how they will be involved, including choosing and using an Operational Concept, and interfacing with the evaluation team as needed. During the pilot, participants may contact pilot participant coordination and support to answer any questions that they have about any aspect of the pilot.

Pilot participant coordination and support is a complementary service to the CAM or SAM—a participant signed up with a CAM or SAM will have customer service from the CAM(s) or SAM, but can also call the pilot participant coordination and support line for guidance. A full description of pilot participant coordination and support is included in the Test Plan.

4.3. Example Detailed Functional Elements of the Road Charge System

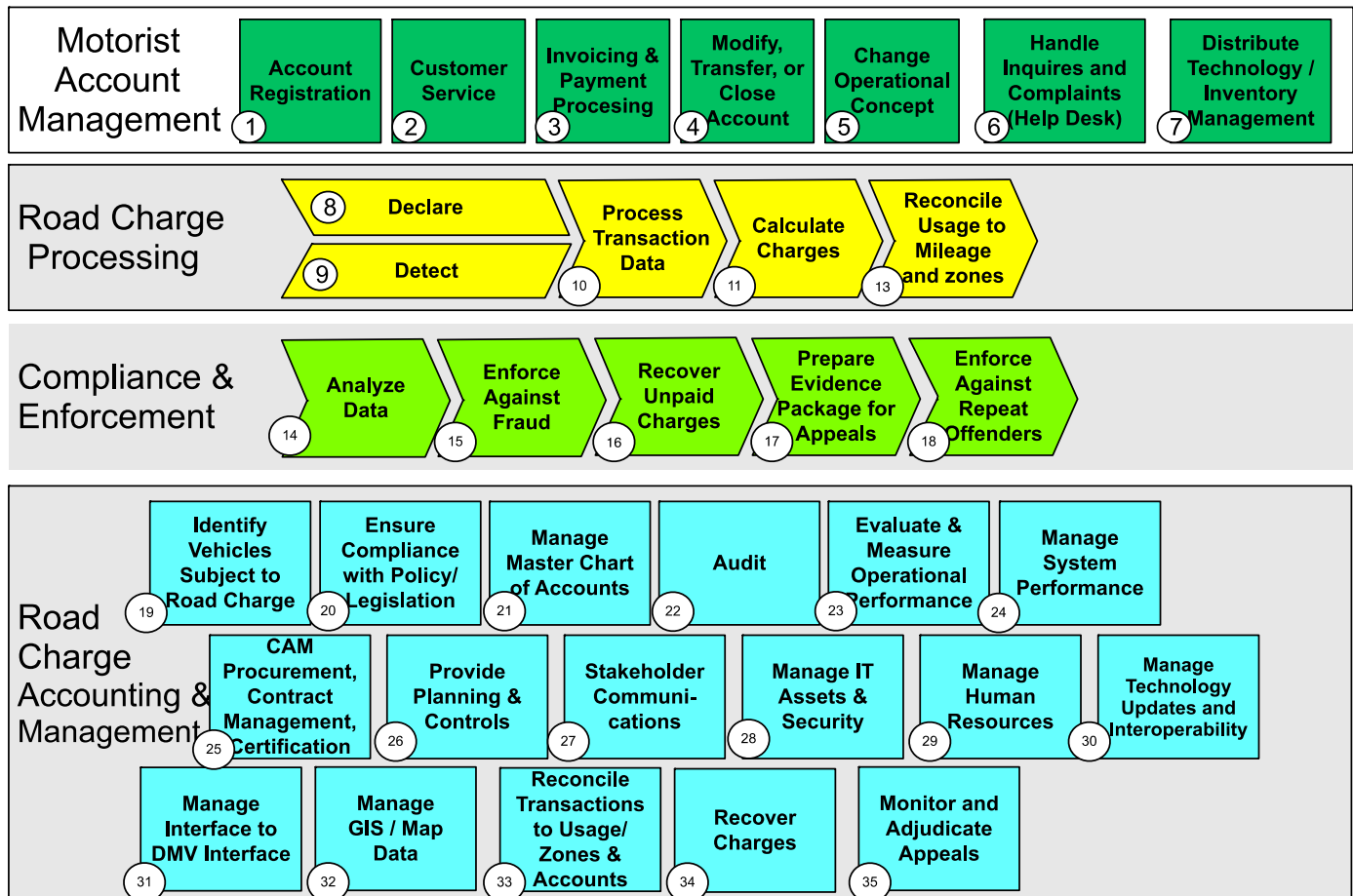
This section describes an example of the typical functions of a road charge system in greater detail in order to give the reader a flavor of what it could look like, and to provide a context for the usage scenarios in Section 5, but not to be prescriptive about the internal organization of a road charge system. Rather, the final system design should be created in the best way to support the usage scenarios described in Section 5. The functional elements presented here are neither exclusive nor exhaustive. Some functions described here may not be included in the pilot or may be accomplished in a different way. Thus, the functionality described in this section should not be used as a basis for pilot testing – rather, the requirements documents, which will be created based on the scenarios in Section 5, can serve as a basis for pilot testing.

Figure 7 depicts the proposed road charge functional elements grouped into four functional areas, which are described in the remainder of this section. The example functional elements in the first two functional areas (Motorist Account Management and Road Charge Processing) are accomplished by the Account Manager (state or commercial). The third functional area (Compliance and Enforcement) is accomplished by the Enforcement block. The fourth functional area, Road Charge System Accounting and Management, is accomplished by the Road Charge Management.



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Figure 7: Functional Elements, Grouped into Four Functional Areas



4.4. Motorist Account Management

Motorist account management functions comprise services provided to motorists, as summarized in this section.

4.4.1. Account Registration

- ▶ **Function:**
 - > Support motorists opening and creating accounts, including vehicle fleet accounts.
 - > Collect registration information from the motorist, including vehicle identification number (VIN), license plate number, address, phone, and payment information.
- ▶ **Considerations:**
 - > Special consideration for vehicle fleet account creation.

4.4.2. Customer Service

- ▶ **Function:**
 - > A range of services for motorists available via website, telephone, and possibly in person.



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- > Provision of general information as well as the ability to view account status, make payments, resolve technical and account issues via a complaint tracking system, and ask questions or post complaints or comments.
- ▶ **Considerations:**
 - > Road Charge Management could also provide in-person services at DMV locations or DMV agents (in a real system, not in the pilot).

4.4.3. Invoicing and Payment Processing

- ▶ **Function:**
 - > Sending invoices to the motorists, including single invoices to vehicle fleets on the Automated Distance Charge.
 - > Depending on policy parameters, motorists may be able to pay road charge via a range of payment channels, regardless of Operational Concept, including on-line, telephone, postal mail, and in person (the pilot will include email and postal mail only). Depending on the Operational Concept, multiple simulated payment options may be available.
 - > The Account Management subsystem will capture standard data regardless of the Operational Concept of payment. For example, checks received via mail or in person will be batch processed, with data (payment amount, date received, account number, payment Operational Concept, check number) entered into the system automatically whenever possible.
 - > Online payments will capture data as entered by customers.
- ▶ **Considerations:**
 - > Invoices may be sent by paper or email.
 - > Payment may be possible in person at a government facility or DMV agent (not in the pilot), by mail, or via web.
 - > Payments may be made periodically.
 - > Late payments may be referred to the enforcement arm of Road Charge Management (not in pilot).

4.4.4. Modifying, Transferring, or Closing Account

- ▶ **Function:**
 - > Modify account characteristics (e.g., name, address, vehicle, road charging Operational Concept of choice) and status (e.g., active, delinquent, closed) based on information received from motorists, including vehicle fleets.
- ▶ **Considerations:**
 - > Needs to be consistent with operating rules about modifying or closing accounts.
 - > Account close-out in particular involves reconciliation of any outstanding balance or credit as well as potentially the need for evidence that the corresponding vehicle is no longer in the possession of the account holder or is no longer legally required to be registered for the road charge (this feature will not be tested in the pilot).

4.4.5. Change Operational Concept

- ▶ **Function:**
 - > Support motorists when they want to change their road charging Operational Concept for a given vehicle.



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► Considerations:

- > This would involve closing out the account for one road charging Operational Concept, including invoicing for final miles traveled, and opening up a new account for the new road charging Operational Concept.
- > It may be undesirable to allow motorists using the Time Permit to switch to other Operational Concepts during the valid period of the Time Permit, as this could invite users to exploit the ability to drive at lower cost than intended (e.g., by driving a very high number of miles during the period while on Time Permit, before switching to one of the mileage-based Operational Concepts). If Road Charge Management does decide to allow switching from Time Permit, it may be beneficial to require a start-of-year official odometer reading for that account to screen for such potential exploitation.

4.4.6. Handle Inquiries and Complaints (Help Desk)

► Function:

- > Provide service to members of the public who are not paying road charges (non-motorists) who may soon become motorists. This activity includes maintaining a website and phone-based customer service functions for noncustomers with inquiries or complaints about the road charge system.

► Considerations:

- > This function may be integrated with the customer service function, but specific information/replies should be prepared for non-customers as well as customers, so it is presented separately.

4.4.7. Distribute Technology (Inventory Management)

► Function:

- > This function includes maintaining inventory and carrying out inventory controls for EMMs.

► Considerations:

- > This function includes forecasting future equipment needs and the timely ordering of that equipment to ensure sufficient inventory is maintained.
- > This function includes testing equipment received from suppliers, as well as replacement of malfunctioning or inoperative units.

4.5. Road Charge Processing

Processing road charging involves the interface between the “front end” or motorist-facing aspects of road charging and the accounting “back end” or data and payment processing analysis. Details are described below.

4.5.1. Motorist Declare, System Detect

► Function:

- > Collectively, these two activities refer to the collection of mileage data from motorists.
- > For Mileage Permit and Odometer charges, motorists self-declare the amount of miles they plan to drive or have driven.
- > For Automated Distance Charges, with or without general location, in-vehicle equipment automatically detects mileage.



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► Considerations:

- > Declarations for Odometer Charge could be handled once per year, or at shorter periods. For the purposes of the pilot, declarations may be handled two or three times during the pilot period. The purchase of a Mileage Permit constitutes a declaration.
- > Detection for Automated Distance Charge (with or without general location) would occur periodically throughout the year and be differentiated according to zone (in-state on public roads, off road, or out of state).

4.5.2. Process Transaction Data

► Function:

- > This function involves the collection, storing, and transmission of data relating to road charge liability, including validating and collating records, and other related processes to prepare road charge data into a suitable format.

► Considerations:

- > Data processing may be either manual or automated, depending on the road charging Operational Concept.
 - Vehicles under Time Permit provide no data.
 - Vehicles under the Mileage Permit must provide an initial official odometer reading. However, account managers may ask motorists to provide self-reported odometer readings at the time of enrollment. During the pilot, participants will sign up with an account manager first, before getting an official odometer reading, whether in person or by smartphone app. Every later purchase of a Mileage Permit constitutes a data transaction, which requires a self-reported odometer reading.
 - For vehicles using the Automated Distance Charge, the system receives data in a digital format compliant with the system's messaging standards.
 - For vehicles using the other Operational Concepts, the system will receive data directly from customers or third parties manually via web form entry, hand-written mail-in notices, or telephone.
- > This function will take all data collected, regardless of the medium by which it was collected, and convert them into standard data elements needed for calculating and assessing charges.
- > Data validation occurs as part of this function.
 - For example, the road charge system will validate that the data elements received are complete, that data elements match (e.g., account number and VIN), that the date and accumulated miles are incrementing logically, and that no error codes exist that might indicate missing mileage.

4.5.3. Calculate Charges

► Function:

- > After collecting and processing data from motorists, the next step involves calculating charges owed as well as credits or offsets based on a rate table, applying charges and credits to an account, calculating amounts owed or refunds due, assessing a charge or issuing a refund (although no refunds will be included in the pilot). The result of this automated back-end function is an invoice and account statement that can be mailed, emailed, or otherwise delivered to an account holder for payment. This could include a refund check or refund direct deposit for



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- instances when a refund is owed and where policy and regulations allow for refunds rather than for credits to carry forward to the next billing cycle.
- > For the Time Permit and Mileage Permit, no calculation is needed. Various blocks of time and miles are available for motorists to purchase, and it is up to the motorist to choose when and what size of block to purchase.
- > For the Odometer Charge (post-pay), the Road Charge system will generate an invoice when the final odometer reading is submitted, as determined by policy-makers. This will be sent to the motorist allowing for sufficient time for payment.
- > For Automated Distance Charge (with or without location data), the Road Charge system will continuously calculate charges owed and credits due as data are received, but will issue invoices only periodically either according to a minimum time schedule (e.g., quarterly) or once the account has exceeded a threshold balance (e.g., \$100).
- ▶ **Considerations:**
 - > This step is automated, completed by accounting programs running on central servers. Only when the automated system determines that an unusual circumstance has arisen is human intervention needed.
- ▶ **Considerations:**
 - > Mileage rates are provided by Road Charge Management and may be updated over time.

4.5.4. Reconcile Usage to Mileage and Zones

- ▶ **Function:**
 - > This function applies only to motorists using Automated Distance Charge with general location data.
 - > The objective is to verify that the total mileage reported by each individual is equal to the sum of the mileage reported as in-state on public roads, in-state on private roads, and out-of-state.
- ▶ **Considerations:**
 - > This function is automated, completed by accounting programs running on central servers. Only when the system determines that an unusual circumstance has arisen is human intervention needed.

4.6. Compliance and Enforcement

Enforcement is not being tested in the pilot. Rather, in the pilot, account managers and the account management oversight will simply investigate data anomalies that are observed. However, this section describes potential compliance and enforcement activities for completeness.

Compliance and enforcement activities involve analyzing data to determine suspected cases of noncompliance, contacting motorists to audit or justify their records, and pursuing enforcement activities such as penalties against motorists who are found to be noncompliant. Compliance and enforcement activities vary by Operational Concept:

- ▶ Time Permit – enforcement activities for individuals in Time Permit consist of verifying that there are no periods for which the vehicle is not covered by a valid permit. For motorists opting for Time Permit, it is impossible to evade miles; the sole issue is whether or not a vehicle has paid for the upcoming period.



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- ▶ Mileage Permit and Odometer Charge (pre and post-pay)— the enforcement group observes year-on-year trends in reported odometer readings and verifies that odometer readings by officers or authorized individuals are in line with the estimated readings made by the motorist. The group may ask motorists why large drop-offs in reported mileage have occurred. The group may also perform spot checks of odometers.
- ▶ Automated Distance Charge – enforcement activities for motorists under Automated Distance Charge would mainly involve the account manager (public or private, if available) monitoring activities via data from the on-board unit, including reported mileage along with any alerts sent by the mileage reporting device (e.g., that the device was disconnected or physically tampered with).

Full details of the enforcement activities are covered in the enforcement usage scenarios in Section 5. The following activities are the primary enforcement functions of the Road Charge system.

4.6.1. Analyze data to find and verify infractions

- ▶ **Function:**
 - > This activity involves analyzing trends in data to determine if there is any suspicious activity in an account that requires further follow-up by the enforcement group.
- ▶ **Considerations:**
 - > Most of this activity will be done automatically by computer algorithms established and calibrated by the enforcement group.
 - > For Mileage Permit and Odometer Charge, this activity involves reviewing the mileage driven by each motorist and looking for anomalies such as large drop-offs in the amount of miles driven.
 - > For Automated Distance Charge, it involves reviewing the reports from the devices and determining if fraud is suspected. This might result from device itself reporting a fraud attempt, or because the device has been disconnected too often or for long periods of time.

4.6.2. Enforce Against Fraud

- ▶ **Function:**
 - > When activity exceeding predetermined thresholds is found in data analysis, the enforcement group will ask the motorist (via email, phone, or postal mail) to explain the reasons for the suspicious activity.
 - > Alternatively, the enforcement group may call for an audit or may ask an enforcement officer to visit the individual for a routine odometer check. If the motorist cannot adequately explain the discrepancy, or if the officer measures the odometer at a much higher value than reported by the motorist, the enforcement group proceeds to the next function, recovering the road charge.
- ▶ **Considerations:**
 - > Unlike the preceding step (data analysis), this activity involves human interaction—looking at the algorithm output to determine that an infraction has occurred, and initiating an audit or requesting more data from the motorist.

4.6.3. Recover Unpaid Charges

- ▶ **Function:**
 - > This activity involves sending a penalty notice to a motorist suspected of fraud.
 - > The penalty notice includes charges for the miles traveled that the motorist is suspected of evading, and a fine component.



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- > The motorist could be offered the chance to appeal the penalty.
- > If an odometer is accurate, the miles traveled while evading can be measured exactly. If it is not accurate (in case of odometer rollback), a standard penalty may be used.
- ▶ **Considerations:**
 - > Depending on the size of the penalty, this could include forcing the motorist to transition to the Time Permit – unlimited driving – for the year, since that would likely make up for the evaded charges.

4.6.4. Prepare Evidence Package for Appeals

- ▶ **Function:**
 - > Some motorists suspected of evading road charge will want the opportunity to demonstrate their innocence. The intent of this function is to support appeals in a quick and easy manner, outside of the court system, by preparing evidence packages that an appeals group will use when they rule on appeals. Note that the enforcement group would not execute appeals themselves, for the same reason that policemen do not adjudicate traffic tickets—lack of objectivity.
- ▶ **Considerations:**
 - > The evidence package will contain all the raw evidence needed to determine that an infraction had occurred, as well as an explanation of how they reached their conclusion.

4.6.5. Enforce Against Repeat Offenders

- ▶ **Function:**
 - > This activity involves placing increased scrutiny on and demanding increased penalties of repeat offenders.
- ▶ **Considerations:**
 - > The road charge system should flag the record of every motorist who has been determined to have evaded the system.
 - > This flag should increase the likelihood of the motorist being audited.
 - > It should also increase the penalties the motorist receives for any future evasion attempt.

4.7. Road Charge System Accounting and Management

The road charge system accounting and management category includes 20 functional elements covering accounting activities spanning both aggregate financial and road use information. It also involves a series of management activities. Below is a discussion of a subset of these functions.

4.7.1. Identify Vehicles Subject to Road Charge (not in pilot)

- ▶ **Function:**
 - > Policy (legislation) will determine which vehicles are subject to road charge, but this translates into the need for a function that identifies those specific vehicles subject to road charge from among the entire population of vehicles.
 - > Using established policy criteria, the road charge processing system will identify subject vehicles and notify their corresponding owners or lessees of the need to register for road charge.
 - > Those vehicles failing to do so could be subject to enforcement action such as canceled registration, roadside penalties, or other mechanisms as determined by policy-makers.



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► Considerations

- > DMV is the most logical and reliable source of existing data on vehicles and their characteristics, which could be used to address this function either through the registration renewal process or through title transactions.

4.7.2. Ensure Compliance with Policy / Legislation

► Function:

- > This function involves actions to ensure compliance with law, policy, and regulation governing Road Charge Management by law. The duties and responsibilities of Road Charge Management derive from the empowering legislation and any associated regulations.

► Considerations:

- > This function includes the possibility of suggesting changes to road charge enabling law, regulation, and policy.

4.7.3. Manage Master Chart of Accounts

► Function:

- > This is the primary accounting activity of the road charge system.
- > It includes accounting for all vehicles in the pilot.
- > Vehicles are typically sorted by VIN, and total miles by vehicle are tracked.
- > This function also includes recording aggregate mileage by CAMs, and aggregate mileage by region (e.g., in-state public roads, in-state off road, and out-of-state).
- > Finally, it includes financial accounting – making sure aggregate sums received by Road Charge Management align with the sums that Road Charge Management should expect to receive.

► Considerations:

- > This is classical financial accounting with the addition of tallying vehicle mileage.

4.7.4. Audit

► Function:

- > Auditing in this case involves internal and external process audits of the overall system to be sure it is functioning properly.

► Considerations:

- > This function involves both self-evaluation and external evaluation.
- > External evaluation may be triggered by a poor performance in evaluations or by a desire to improve overall system performance and accounting.

4.7.5. Evaluate and Measure Operational Performance

► Function:

- > This function involves evaluation and measurement of Road Charge Management in the performance of its goals and mission, including:
 - Financial goals and financial performance.
 - Policy goals (as described above in Section 2).
 - A formal and independent operational review each year of each function and process. The review would include performance, and the effectiveness and efficiency of the whole



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organization. Metrics and key performance indicators should be kept, refined and evaluated yearly during the initial life of the organization. The report should be published after it is reviewed and approved by the Legislative committee responsible for the oversight of Road Charge Management.

▶ **Considerations:**

- > After the first several years, the evaluation and measurement can continue to be an independent contract awarded to an outside entity, or it can continue to be done by Road Charge Management. Either way, there is a need to manage and monitor the ongoing refinement of key performance indicators in the organization.

4.7.6. Manage System Performance

▶ **Function:**

- > This function includes the management of the entire universe of road charge functions.

▶ **Considerations:**

- > This function encompasses all aspects of system performance, but its major foci are financial performance (as measured by revenues, costs, efficiency of revenue collection, etc.) and operational performance (as measured by customer satisfaction, and other measures included in the preceding function).
- > This function governs all managers involved in the road charge program, but final authority and responsibility for performance rest with the director of Road Charge Management.

4.7.7. Commercial Account Manager Procurement, Management, and Certification

▶ **Function:**

- > This function includes the procurement, management, and certification of CAMs contracted by the state (if this approach is used) to handle motorist accounts, technology, and value-added services.

▶ **Considerations:**

- > This function reviews the performance of each CAM through key performance indicators and updates and follows up with each if the performance or contractual obligations fall short of desired levels. For purposes of the pilot, there are no performance metrics in place.
- > This function may also in some cases include termination of third parties that do not abide by the contract obligations and performance standards set for them.

4.7.8. Provide Planning and Controls

▶ **Function:**

- > This function handles the future planning and controlled growth of Road Charge Management itself. It charts the vehicle fleet and the eligible vehicle classifications into the future to address the needs of Road Charge Management to meet its obligations under the law. In addition, this function will address trends in the market and possible new vehicle classes that should be recommended for inclusion in a road charge program.

▶ **Considerations:**

- > This function should also address the competitive market needs of the CAMs (if used) and work closely with the contract management function to identify expansion or contraction of the marketplace, creation of new value-added service providers, and identification of data



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aggregators who can better service the motorists. This function will also work closely with other planning groups within state government for fostering a cohesive and responsive environment across the state.

4.7.9. Stakeholder Communications

▶ **Function:**

- > This function includes the outreach activities of the Road Charge Management. It involves provision of communications and public relations of Road Charge Management's mission and responsibility to the public.
- > It will involve managing and maintaining outreach activities in the form of marketing materials and general educational materials to the motorists and stakeholders involved in road charging (such as the public, legislators, CAMs, DMV, Caltrans, and motorists).

4.7.10. Manage Information Technology (IT) Assets and Security

▶ **Function:**

- > This function includes maintaining, updating, and providing security measures for all IT assets. It can be integrated into the overall IT and communications structure of state agencies, but the unique character of road charge transaction processing, cloud computing, communications, security requirements for motorist accounts, and privacy requirements for motorist data lend themselves to a dedicated and separate function.
- > The IT functions will manage and run Road Charge Management's overall IT architecture and keep it both in operation and updated with technology developments in both the hardware and the software services required.

4.7.11. Manage Human Resources

▶ **Function:**

- > This function includes personnel management activities of Road Charge Management.

▶ **Considerations:**

- > This function will either be executed by the parent agency of Road Charge Management, or if Road Charge Management is stand-alone, it will be part of the stand-alone entity.

4.7.12. Manage Technology Updates and Interoperability

▶ **Function:**

- > This activity involves ensuring that any future financial and data exchanges with other states to support are maintained and accurate.
- > It also involves ensuring that all technology used, especially mileage reporting devices, are up-to-date. It may involve updating device software, or changing hardware, and includes communications with commercial account managers on these topics.

4.7.13. Manage interface to simulated DMV database

▶ **Function:**

- > This activity involves insuring that the DMV database connection to the road charge program is maintained and accurate.



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4.7.14. Manage GIS / Map Certification

- ▶ **Function:**
 - > This function ensures that the digital maps used in Automated Distance Charging (general location) are compliant with a set of standards that Road Charge Management will establish.
- ▶ **Considerations:**
 - > Most digital maps have good representations of state lines and of all public roads, but these maps need regular updating (e.g., once a year).
 - > The mapping method needs to calculate off-road/private-road areas correctly.
 - > It will likely be preferable to certify digital mapmakers (e.g., Navteq, Tele-Atlas/TomTom, Google) instead of the maps themselves (since they are updated constantly), so this function may mean reviewing the processes used by the mapmakers.

4.7.15. Reconcile Transactions to Usage/Zone and Accounts

- ▶ **Function:**
 - > The objective in this function is to verify that the total mileage reported by each CAM is equal to the sum of the mileage reported across all zones (in-state on public roads, in-state off road, and out-of-state).
- ▶ **Considerations:**
 - > This is similar to the function included above in the Road Charge Processing category, but it involves looking at the comprehensive inputs of the CAMs instead of that of individuals.
 - > This function is automated, completed by accounting programs running on central servers. Only when the system determines that an unusual circumstance has arisen is human intervention needed.

4.7.16. Recover Charges

- ▶ **Function:**
 - > This function involves assembling and confirming charges are paid and tracking, accounting, and processing usage charges centrally.
- ▶ **Considerations:**
 - > This function is the final verification that all motorists have paid what they owe.

4.7.17. Monitor and Adjudicate Appeals

- ▶ **Function:**
 - > This function involves the establishment of an entity to ensure that violations or perceived unfair charges can be appealed. While Road Charge Management handles the evidentiary files to back up its claims, an independent body should carry out the actual handling of appeals and privacy concerns. This independent body is a “safety valve” for the overall system and provides the motorist a means to address any inequitable practices, perceived or real.
- ▶ **Considerations:**
 - > In this function, Road Charge Management sets up and manages an interface with the entity that manages the appeals.



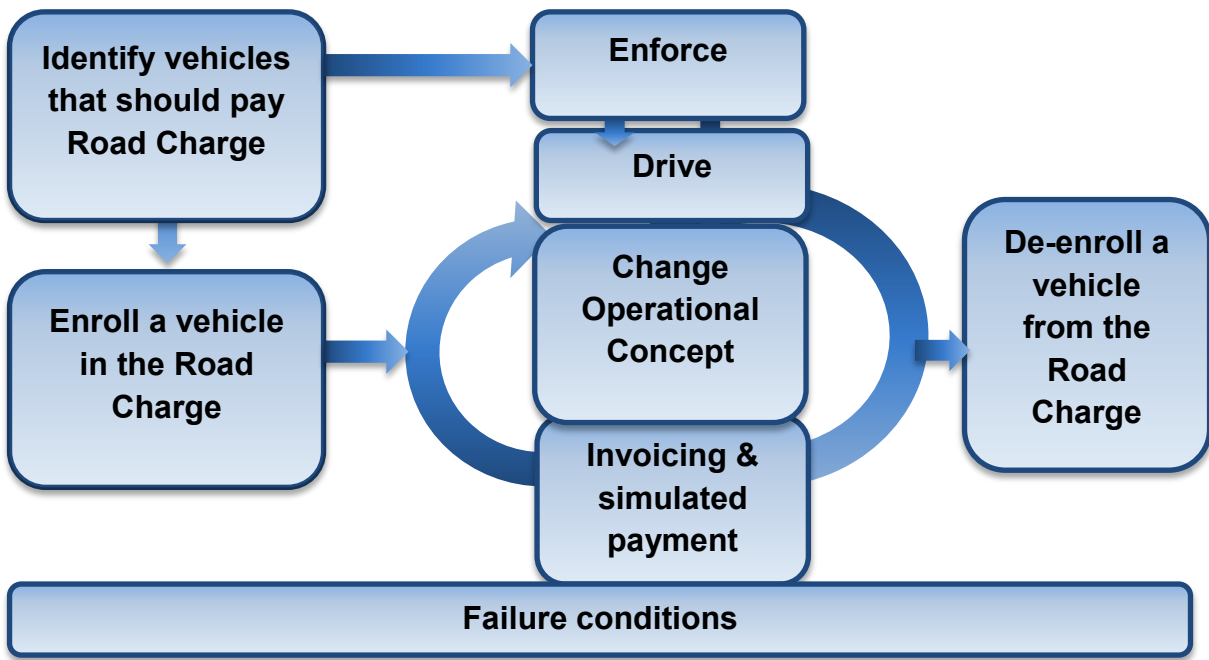
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5. System Usage Scenarios

Section 3 presented the details of each of the road charge pilot system Operational Concepts separately, laying the groundwork for this section. This section describes the user experience of the complete system, comprising all Operational Concepts, along with some additional general information.

The core of a ConOps is describing how people will use the system. The scenarios presented in this section show what actions will be taken by the motorists and Road Charge Management for the primary activities associated with the road charging system. While there is some overlap between the information presented in Section 3 and the information presented here, the treatment here is more detailed and more complete. This section is organized according to usage scenarios – specific ways in which the system will be utilized (see Figure 8). This section was used as the primary input for creating the requirements document, the next step in the systems engineering process.

Figure 8: Road Charging System Usage Scenarios



The very first scenario, *identify vehicles that should pay road charge*, would not normally be simulated in a pilot, because it would presume that a specific rule about which vehicles would be subject to a charge could be applied to a general database, and the output of the rule would be all vehicles subject to a charge. Instead, in a pilot project, all participants will have their vehicle (or vehicles) enrolled in the pilot. For the sake of specifying a complete revenue-generating road charge system, the *identify vehicles that should pay road charge* scenario is described here, but presented at the end of this section. All other scenarios will be included in the pilot project.

Several of these scenarios are complex and thus include sub-scenarios. The description of each usage scenario, or its component sub-scenarios, includes the following:

- ▶ Context
- ▶ Motorist activities



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- ▶ Road charge management activities
- ▶ Commercial account manager activities
- ▶ Issues

The following scenario descriptions follow the pilot design in that Automated Distance Charges (with either no location data or general location) will be provided by CAMs, while the other Operational Concepts are provided by the state (CalSAM).

5.1. Enroll a Vehicle in the Road Charge

Whenever a vehicle becomes subject to the road charge system, the motorist must register the vehicle with Road Charge Management. This scenario has two sub-scenarios:

- ▶ Provide participant information
- ▶ Enroll a vehicle in the road charge pilot

5.1.1. Provide Participant Information

- ▶ **Context:**
 - > Pilot participants are informed about the road charging program when they sign up for the program, and about available Operational Concepts.
- ▶ **Motorist activities:**
 - > The motorist must learn about the road charge program. Road charge program information can be included initial material sent to the participants. Motorists can learn more about the program by going to the web site, or by calling the pilot participants support line. Special information will be developed for vehicle fleets.
- ▶ **Road Charge Management activities:**
 - > Road charge management must:
 - Design and keep up-to-date a user-friendly web site and possibly a social media presence with complete information on how the program operates, including accommodations for vehicle fleets.
 - Prepare printed materials introducing the road charge and directing readers to sources for more information.
 - Operate a road charge pilot participant support telephone and email service.
- ▶ **CAM activities:**
 - > None.
- ▶ **Issues:**
 - > Information needs to be accurate, understandable, available, and up to date
 - > Communication systems must be robust, and links to the main road charge pilot website should be available to participants.
- ▶ **Possible changes over time:**
 - > As the system matures and applies to more vehicles, the details of the Operational Concepts may change. Thus, the web site literature should be updated on an ongoing basis as needed.
 - > Once enrollment in the pilot begins, communications to participants will wane as their primary communications relationship will be with the account managers.



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5.1.2. Enroll a Vehicle in the Road Charge Pilot

- ▶ **Context:**
 - > A participant chooses to enroll a vehicle in the road charge pilot
- ▶ **Motorist activities:**
 - > Receive and review information provided by Road Charge Management that explains road charge options. The Road Charge Management will email/mail the Road Charge information to the participant and enter the participant's information into Road Charge Management's accounting system.
 - > Motorists choose an Account Manager and set up an account, including choosing an Operational Concept.
 - > Motorists who choose the Odometer Charge or Mileage Permit reporting method must get an official odometer reading. Account managers may ask motorists to provide self-reported odometer readings at the time of enrollment as well. During the pilot, participants will sign up with an account manager first, before getting an official odometer reading, whether in person or by smartphone app.
 - > If the motorist chooses Automated Distance Charge, he/she must obtain and install an EMM in the vehicle, download and configure a smartphone app, or activate their vehicle's telematics system for road charge mileage reporting to the account manager of their choice.
- ▶ **Road Charge Management activities:**
 - > Enter a new participant's information into the road charge accounting system.
 - > For both Odometer Charges and for the Mileage Permit, the state account manager must enter the official start odometer reading into the database.
- ▶ **CAM activities:**
 - > CAMs will set up a new account for any motorist that opts for Automated Distance Charge and selects the commercial account manager as its service provider.
- ▶ **Issues:**
 - > Road Charge Management needs to decide the maximum time by which participants have to select an Operational Concept. Motorists who fail to select an Operational Concept by the maximum time may have their concept chosen for them by Road Charge Management, or they may not be enrolled in the system. Alternately, Road Charge Management may leave enrollment open to any motorist until a pre-determined limit is achieved (e.g., 5000 vehicles).

5.2. Change Operational Concept

- ▶ **Context:**
 - > This scenario occurs when a motorist decides to change his/her Operational Concept.
 - > Switching from a Time Permit to another option is not allowed until the Time Permit has expired, since a refund process could be exploited by some to pay less than the average per-mile rate during periods of heavy travel.
- ▶ **Motorist activities:**
 - > For changes from Odometer charge (pre- or post-pay) or Mileage Permit to Automated Distance Charge (no location or general location):
 - The motorist registers for the Automated Distance Charge with a CAM.



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- Motorists may discover that their vehicle is incompatible with the Automated Distance Charge (no or nonstandard OBDII port / telematics requirements), or that they do not pass any possible credit requirements needed for Automated Distance Charge.
- Motorists are required to provide a current odometer reading on a paper or Internet form at the time they install their EMM.
- Alternatively, the state account manager (or entity operating the Mileage Permit or Odometer Charge) requires the motorist to have an odometer reading by an officially designated agent.
- Road Charge Management enters the change in their database when it receives the application.
- The state account manager sends a final invoice to the customer for the miles driven under Odometer Charge.
- The state account manager records the final odometer reading under Odometer Charge as a basis for future enforcement.
- > Odometer Charge or Mileage Permit to Time Permit:
 - Motorists may switch between Odometer Charge, Mileage Permit, and Time Permit at any time by notifying the state account manager, which offers all three methods. No refunds or partial refunds will be allowed for the Time Permit or Mileage Permit if a switch is made before the permit is fully used.
 - Road Charge Management receives the application to switch and records the individual's change in the master database.
- > Automated Distance Charge (no or general location) to Odometer charge (pre- or post-pay), Mileage Permit, or Time Permit:
 - The motorist should file an application to their CAM requesting to switch and specifying the odometer reading at the time of the switch.
 - The CAM submits the application to Road Charge Management on behalf of the motorist.
 - The motorist must then enroll with the state account manager.
 - In the pilot, there was one opportunity to make this sort of switch, at the midpoint.
- ▶ **Road Charge Management activities:**
 - > Record changes in Operational Concept provided by the CAMs and state account manager in real time in the master participant database.
- ▶ **CAM activities:**
 - > CAMs and the state account manager receive change of Operational Concept applications from motorists;
 - > Perform accounting associated with changing Operational Concepts, including recording odometer readings as necessary;
 - > Send final invoices once the switch is final;
 - > CAMs assist with closing out the mileage payment under Automated Distance Charge for any motorist that switches from Automated Distance Charge to an alternate Operational Concept; and
 - > CAMs set up a new account for any motorist that opts into Automated Distance Charge and selects a CAM as its service provider.
- ▶ **Issues:**
 - > Road Charge Management needs to make sure that it is not possible for motorists to “game the system” by switching away from the Time Permit having driven a great number of miles at a



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relatively low rate and getting a refund against the remainder of the Time Permit, and put in place protections against that possibility. Prohibiting partial refunds of a Time Permit when switching to another concept before it is expired resolves this issue.

5.3. Driving

▶ **Context:**

- > The motorist drives. All Operational Concepts charge in-state for all driving on public roads. Automated Distance Charge (general location) vehicles, when location data is enabled, are not charged for driving in state off road or for driving out of state. All others are charged for all miles.

▶ **Motorist activities:**

- > The motorist drives the vehicle. Motorists using Automated Distance Charge with devices on which location data is always being registered are not charged for driving out of state or off road. Motorists using Automated Distance Charge with devices that allow location data to be switched on and off must ensure that their GPS location data is enabled in order that they not be charged for driving out of state or off road.
- > The motorist is reminded of the need for periodic reporting for smartphone methods. The motorist is reminded of the need to become compliant for all other methods, in case he/she is noncompliant.

▶ **Road Charge Management activities:**

- > None

▶ **CAM activities:**

- > For vehicles on Automated Distance Charge, private entities that manage accounts will receive and process data regularly from the mileage reporting devices.
- > Send reminders to report to vehicles on the Smartphone methods. Send reminders to become compliant to vehicles on all other methods, in case of noncompliance.

▶ **Issues:**

- > Accurate maps of public and private roads (or simply accurate maps of all public roads, and a default distance from the public roads to be considered private, e.g., 0.1 mile) must be maintained in order to allow this option for Automated Distance Charge (general location). For the pilot test, accurate maps of all roads are readily available; however, no available map sets distinguish reliably between public and private roads. Therefore, for the pilot, only true off-road driving is straightforward to determine as non-chargeable miles. CAMs maintain a map database that can be updated when users provide information illustrating that certain lands are private. CAMs also disclose their mapping policies and capabilities to motorists. In a live system, improved map data could allow for more accurate exemption of roads correctly labeled as private.

5.4. Charge Calculation, Invoicing and Simulated Payment

5.4.1. Road Charge Calculation

▶ **Context:**

- > This sub-scenario addresses how road charges are calculated.

▶ **Motorist activities:**

- > Time Permit: Not applicable – Time Permits are sold for prices that vary based on length of time valid.



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- > Mileage Permit: Not applicable – Mileage Permits are sold for prices that vary based on number of miles.
- > Odometer Charge: At the end of each reporting period, the motorist takes the odometer reading (or has it taken by an official), computes charges according to the formula (current odometer reading – previous odometer reading) x per-mile rate, and submits payment to the state account manager.
- > Automated Distance Charge (no location): The CAM computes the charge by multiplying the number of miles traveled by the per-mile rate. For vehicle fleets, the CAM prepares a single invoice for all registered vehicles.
- > Automated Distance Charge (general location): The CAM computes the charge by multiplying the number of miles traveled in state on public roads (along with all miles traveled when mileage reporting device's location capability is turned off) by the per-mile rate.
- > Participants who use automated charging methods that are capable of measuring fuel consumed will also receive an indication of how much estimated fuel is used and fuel tax paid. This will be applied as a credit against the amount of road charge owed. Participants who do not use methods capable of measure fuel use but who provide vehicle information including a valid vehicle identification number (VIN) that can be decoded to determine the vehicle make, model, year, and trim will have their fuel use estimated by joining this data to the EPA database of estimated city/highway miles per gallon. Motorists who choose the time permit will not have fuel taxes estimated or credited.
- ▶ **Road Charge Management activities (including the state account manager):**
 - > Time Permit: determine number of miles for flat fee (in the pilot, it will be 25,100 miles, or the 95th percentile of annual vehicle miles driven), scaled to the length of the permit for various lengths of time (in the pilot, it will be 10, 30, or 90 days).
 - > Mileage Permit: determine size of mileage blocks to offer (in the pilot, 1,000, 5,000, or 10,000 miles).
 - > Odometer Charge: The Road Charge Management receives the odometer reading from the customer periodically, along with payment by the customer, and verifies payment according to the formula (current odometer reading – previous odometer reading) x per-mile rate. There is a reconciliation at the end of the pilot based on a verified odometer reading with a Smog Check Referee or smartphone app.
 - > For Odometer Charges, estimated fuel taxes paid is calculated by using the EPA combined city/highway fuel economy average for the vehicle model, for all miles, for those vehicles who provide a valid VIN that can be decoded and matched against the EPA database. The amount of fuel taxes on presumed fuel usage is credited against the per-mile rate in computing the amount owed.
- ▶ **CAM activities:**
 - > For Automated Distance Charge (no location), if account management is handled by a private entity, the entity computes the charge by multiplying the number of miles traveled by the per-mile rate.
 - > For Automated Distance Charge (general location), if account management is handled by a private entity, the entity computes the charge by multiplying the number of miles traveled in state (including any miles traveled when the mileage reporting device's location capability is turned off) by the per-mile rate.



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- > Estimated fuel taxes paid is calculated either using the EPA combined city/highway fuel economy average for the vehicle model, for all miles, for those vehicles who provide a valid VIN that can be decoded and matched against the EPA database. Alternately, the amount of fuel consumed is measured directly for those participants who choose devices that can measure fuel use and for those vehicle models for which fuel use is accessible to measure. The amount of fuel taxes on presumed fuel usage is credited against the per-mile rate in computing the amount owed.

▶ **Issues:**

- > None.

5.4.2. Road Charge Invoicing

▶ **Context:**

- > Once a charge is calculated, the motorist is invoiced. This scenario addresses how charges are invoiced.

▶ **Motorist activities:**

- > Time Permit: Motorist pays for the Time Permit at the time of purchase. In the pilot, multiple time denominations were offered. In a potential future mandatory system, it may be desirable to offer only an annual and/or semi-annual permit.
- > Mileage Permit: Motorist pays for the Mileage Permit at the time of purchase. Like the Time Permit, multiple denominations will be offered in the pilot. In the pilot, the amount of fuel tax paid for the mileage purchased was indicated on the receipt.
- > Odometer Charge: The state account manager invoices for the entire estimated amount periodically. In the pilot, invoices will be quarterly. In a potential future mandatory system, it may be desirable to invoice at different frequencies. At the end of the pilot, charges will be reconciled with a verified odometer report. Road charges are offset with credits based on the estimated fuel tax paid for the mileage driven.
- > Automated Distance Charge (no or general location): The CAM invoices the motorist periodically (e.g., monthly or quarterly). The CAM offsets the road charges with credits for the cost of fuel taxes paid. The motorist pays the invoice. There are penalties for late payment. In the pilot, one CAM will configure the Automated Distance Charge for prepayment, the credit will decline as miles are driven, and the motorist will receive a monthly statement rather than an invoice (the motorist can add credit at any time). For vehicle fleets, the CAM prepares a single invoice (or statement in the case of prepayment) for all registered vehicles.

▶ **Road Charge Management activities:**

- > For the manual methods, the state account manager invoices the motorist once, at the time of purchase.

▶ **CAM activities:**

- > For Automated Distance Charge (with either no location data or general location), if the system includes CAMs, these entities invoice customers for miles driven on a monthly or quarterly basis (or other period as agreed with the state). The CAM offsets the road charges with credits for the cost of fuel taxes paid. Road Charge Management could allow CAMs to charge an administrative fee for collection and remittance of road charges. For vehicle fleets, such as commercial trucks, the CAM prepares a single invoice for all registered vehicles.

▶ **Issues:**



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- > In a potential future mandatory system, what payment frequencies to offer, what Time Permit and Mileage Permit denominations to offer, and whether to include or allow any additional administrative fees.
- > Whether Automated Distance Charge should be post-pay, as presented here, or prepay, or both. In the pilot, both approaches were offered, one by each CAM.

5.4.3. Road Charge Payment and Reconciliation

▶ **Context:**

- > This scenario addresses how the motorist reconciles (for Odometer Charge) and pays the road charge, and how Road Charge Management and CAMs follow up on those payments.

▶ **Motorist activities:**

- > Note that for all Operational Concepts, all payments in the pilot were simulated using mock credit cards or vouchers.
- > Time Permit: the motorist pays the state account manager at the time of purchase. Simulated payment could be made by web, mail, or at a retail location (not in the pilot).
- > Mileage Permit: the motorist pays the state account manager at the time of purchase or, in the case of an installment plan, multiple times. Simulated payment can be made by web, by mail, or at a retail location (not in the pilot).
- > Odometer Charge: the motorist pays the account manager every three months with each self-reported odometer reading. At the end of the pilot, a final payment was made and the mileage is reconciled with a verified odometer reading.
- > Automated Distance Charge (no or general location): the motorist pays the CAM by web, mail, or phone. CAMs may offer numerous payment options for motorists, such as by credit or debit, by check, or by bank transfer. In the pilot, with simulated payments, most were made using pre-populated mock credit or debit card numbers. A single payment was possible for all vehicles on the account, regardless of the size of the fleet, which was convenient for commercial trucking firms and other fleet owners.

▶ **Road Charge Management activities:**

- > For Time Permit, the state account manager collects the simulated payment.
- > For Mileage Permit, the state account manager collects the simulated payment.
- > For Odometer Charge, the state account manager must process the simulated payment and follow up on late payments. In a real systems, late payments would entail penalties and eventually referrals to a collections agency.

▶ **CAM activities:**

- > For Automated Distance Charge (no and general location), CAMs process the simulated payment. In a real system, they would follow up on late payments, typically with penalties and eventual referral to a collections agency. They must send a record of road charges collected and other reports (data on mileage driven, errors, etc.) to Road Charge Management per their agreement with the program.

▶ **Issues:**

- > Whether, under Odometer Charge, the motorist is always responsible for taking odometer readings, or if there are certain circumstances in which the reading should be taken by a designated representative of Road Charge Management. In the pilot, a verified before and after reading was required.



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- > What penalties and other consequences for not reconciling and paying on time (e.g., within X days of vehicle registration renewal) should be applied.

5.4.4. Simulated Interoperability

▶ **Context:**

- > This scenario addresses how a simulated exchange of funds is made between two states that both support road charging, thus creating interoperability between road charge systems in the two states.

▶ **Motorist activities:**

- > Motorist using automated distance charge with general location drives in a state for which simulated interoperability is being supported.
- > Motorist reviews invoice which includes simulated charges for both primary state (California) and other state that supports road charging (Oregon).

▶ **Road Charge Management activities:**

- > Road charge Management reviews monthly reports to review charges incurred by California participants in other state(s) that support road charging.

▶ **CAM activities:**

- > CAMs adjust their system to support the charge and fuel tax credit levels in all states that are supporting charging. They report the charges and credits incurred in other states in the same manner as they would the charges and credits in California, but

▶ **Issues:**

- > In an operational system, the timing and procedure for funds transfer between the two states would need to be decided.

5.4.5. Simulated Refunds for Non-chargeable Miles

▶ **Context:**

- > This scenario addresses how motorists who use a non-location-based mileage reporting methods obtain simulated refunds for non-chargeable miles driven.

▶ **Motorist activities:**

- > All motorists who choose a non-location-based mileage reporting method are charged for miles driven in other states, off-road, and on private roads, although these are not areas that would normally be subject to state road charges. Such motorists can claim a refund for these miles.
- > Motorists record dates of travel, start and end locations for each day, and major changes in travel direction on a single day, for travel in other states, off-road, and on private roads.
- > When the total value of all non-chargeable travel exceeds \$18 (1000 miles at 1.8 cents per mile), motorists may complete and submit a webform to claim a simulated refund for the miles driven. Motorists enter the start and end points for each day of travel, and number of miles driven.
- > The Road Charge Management reviews the webform, and if it is filled out correctly, send a Simulated Refund Statement to the motorist. If it is not filled out correctly, the Road Charge Management replies to the motorist with clarification questions. The motorist must then reply to the mail, and possibly re-submit the webform, before the simulated refund is granted.

▶ **Road Charge Management activities:**

- > Road Charge Management provides the web form for simulated refunds.



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- > Road Charge Management reviews each claim, validates that the miles requests are reasonable based on the starting and ending locations, and either issues the simulated refund statement, or asks clarification questions to the motorist.
- ▶ **CAM activities:**
 - > None.
- ▶ **Issues:**
 - > Whether motorists should be required to provide some type of proof that they drove on the given days in the given locations, and if not, whether the sub-scenario provides a great opportunity for fraud.
 - > Whether the cost of operating the refund scheme is justified, or whether it is sufficient for the state to offer location-based options to those who wish not to be charged for out-of-state travel.

5.5. De-enrolling a Vehicle from the Road Charge Pilot Program

The following are four sub-scenarios in which a vehicle will be de-enrolled from the program:

- ▶ Vehicle sold (private sale)
- ▶ Vehicle moved out of state
- ▶ Vehicle stolen
- ▶ Vehicle destroyed (e.g., totaled in a crash or scrapped)

During the pilot, these methods were simplified: the motorist simply de-enrolled the vehicle directly with the account manager, who notified Road Charge Management that a vehicle is de-enrolled. There were no follow-up activities in the pilot. This section deals with each of the sub-scenarios in turn for a real system.

5.5.1. Vehicle Sold (Private Sale)

- ▶ **Context:**
 - > A motorist sells his/her vehicle to another person. Under California law, a title transfer (and consequent notification of DMV) must be made within 15 days of the completion of the private sale.
- ▶ **Motorist activities:**
 - > At the time of the sale, the motorist de-enrolls the vehicle from their account manager. This is accomplished by notifying the motorist's account managers.
 - > Motorists indicate why the vehicle is being de-enrolled (sale, moving out of state, stolen or destroyed) and include a final odometer reading.
 - > In a potential future mandatory system, if an official odometer reading is required, it must be taken. In the case of sale, the motorist should also be asked to indicate the name and address of the party purchasing the vehicle. Road Charge Management can use this information to follow up with the new motorist.
- ▶ **Road Charge Management activities:**
 - > Road Charge Management processes the de-enrollment form, including noting a change in ownership of the vehicle to another state resident for accounting purposes.
 - > If the vehicle was enrolled with the state account manager, a final invoice or refund to the motorist is sent. The agency generally waits for the new motorist to set up the account for the vehicle when they register the vehicle for the road charge, per the above usage scenario. If



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needed, however, Road Charge Management can rely on the odometer reading provided at de-enrollment as the base odometer reading for the new motorist.

- > If the new motorist fails to register the vehicle in a timely way, the agency may assess extra penalties.
- > If there is any dispute regarding the odometer reading, the odometer reading on the vehicle title from the transfer is taken as authoritative.

▶ CAM activities:

- > If CAMs are involved in the system, they must provide and process any deregistration forms and pass that information along to Road Charge Management.
- > CAMs must also send a final invoice to the motorist involved in selling the vehicle and follow up on the payment.

▶ Issues:

- > Whether motorists should be allowed to claim a refund for any Time Permit time not used up at the time of sale.
- > Whether an authorized odometer reading is needed at the time of sale and, if so, how it should be obtained?
- > How long a new owner has to register the vehicle and what penalties should be applied for late registration.

5.5.2. Vehicle Moved Out of State

▶ Context:

- > A motorist moves out-of-state with vehicle subject to the road charge.

▶ Motorist activities:

- > At the time of the move, the motorist should de-enroll the vehicle from the road charge filling out a deregistration form provided by Road Charge Management or by the CAM, if applicable.
 - The form will indicate why the vehicle is being de-enrolled (sale, moving out of state, stolen or destroyed) and include a final odometer reading.
 - If an official odometer reading is required, it must be taken by an officer or authorized representative of Road Charge Management.
 - In the case of moving, the motorist should be required to provide the new address on the form such that the final invoice or refund can be forwarded to the new address.
- > If a motorist fails to de-enroll their vehicle from the road charge in a timely way, the motorist will be responsible for paying the road charge until the time that it is de-enrolled. No refund should be made, as there is no way to verify how many miles were driven in state in the intervening period.

▶ Road Charge Management activities:

- > Road Charge Management must process the deregistration form.
- > The agency must send a final invoice or refund to the motorist. For the former, Road Charge Management must also follow up on the payment.

▶ Vendor activities:

- > If CAMs are involved in the system, they must provide and process any deregistration forms and pass the information along to Road Charge Management.
- > They must also send a final invoice to the Motorist and follow up on the payment.

▶ Issues:

- > Whether motorists should be allowed to claim a refund for any Time Permit time not used up.



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- > Whether an authorized odometer reading is needed at the time of deregistration and, if so, how that should be obtained.
- > Whether there are any circumstances under which a refund is warranted if a motorist does not de-enroll on time.

5.5.3. Vehicle Stolen

▶ **Context:**

- > The vehicle is stolen. The motorist obtains a police report showing vehicle theft.

▶ **Motorist activities:**

- > The motorist reports the vehicle theft to Road Charge Management, including a copy of the police report.
- > If the motorist uses a CAM, Road Charge Management reports the theft to the CAM.
- > If the vehicle is recovered in a specified time period, the motorist must report the recovery, along with the latest odometer reading, to Road Charge Management (if the motorist uses a CAM, the information should be reported to the CAM as well).
- > If the vehicle is not recovered in the specified time period, the process proceeds as specified below in the “Vehicle Destroyed” sub-scenario.

▶ **Road Charge Management activities:**

- > Road Charge Management changes the vehicle status to stolen as soon as it receives a verified police report.
- > If and when the vehicle is recovered, the agency makes appropriate adjustments to the motorist’s account. The question of an appropriate refund for the period during which the motorist did not have possession of the vehicle merits additional attention.
- > Road Charge Management then resets the odometer reading in the account to a new base odometer reading taken after the vehicle is recovered.

▶ **CAM activities:**

- > If the system includes CAMs, Road Charge Management or the motorist notifies the CAM in the case of a stolen vehicle.
- > If location data are turned on in the device and the thieves do not remove the device, the CAM may be able to assist the police in locating and recovering the vehicle.
- > Depending on policy choices, the CAM invoices the motorist for any outstanding miles as of the date of the theft. The mileage accounting is then reset in the case of recovery.

▶ **Issues:**

- > The appropriate length of time after a vehicle is stolen before it should be considered destroyed (i.e., gone forever, from the perspective of the motorist at least). A related question is what to do if the vehicle is then subsequently recovered after that change in designation.
- > How to forgive motorists for any miles driven by thieves. The answer to this question is likely to vary depending on the Road Charge Operational Concept.

▶ **Possible changes over time:**

- > None foreseen.

5.5.4. Vehicle Destroyed

▶ **Context:**

- > The vehicle is damaged in an accident and declared a total loss by the insurer (or a vehicle is stolen and not recovered within a specified timeframe).



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- ▶ **Motorist activities:**
 - > The motorist de-enrolls the vehicle from the road charge program.
 - > The motorist does so by filling out a deregistration form provided by Road Charge Management or by a CAM, if applicable.
 - > The deregistration form indicates why the vehicle is being de-enrolled (sale, moving out of state, stolen/destroyed) and includes a final odometer reading.
 - > The motorist is given the option to indicate that the odometer is unreadable.
- ▶ **Road Charge Management activities:**
 - > Road Charge Management processed the de-enrollment form and provide a final refund or invoice as appropriate.
 - > The final refund for Time Permit and Mileage Permit may be based on a prorated version of charges already paid (e.g., if the vehicle is destroyed after 7 months of a 12-month cycle, the Motorist could be awarded $12-7=5$ months, so $5/12$ *the original cost estimate).
 - > The final invoice for Automated Distance Charge (no or general location) is based on the actual measured usage.
 - > Road Charge Management cross-references the odometer reading on the final title, if provided, when it is received from the insurance company.
- ▶ **CAM activities:**
 - > If the system includes CAMs, they process the deregistration form and provide a final invoice to the motorist.
 - > They also provide the vehicle destroyed information to Road Charge Management.
- ▶ **Issues:**
 - > Whether to allow refunds for Time Permit.
 - > How much to refund for Mileage Permit if the odometer is unreadable. One possibility would be to simply prorate the amount paid based on estimated mileage for the year, but this would not reflect the degree to which actual mileage deviated from estimated mileage.
 - > Whether car insurance would cover the cost of a mileage reporting device if the vehicle is lost or destroyed.

5.6. Enforcement (not in the pilot)

There are four sub-scenarios in which enforcement activities must be undertaken:

- ▶ Motorist does not set up an account.
- ▶ Motorist provides a false odometer reading (Odometer Charge or Mileage Permit), including odometer rollback.
- ▶ Motorist tampers with or removes a EMM (Automated Distance Charge).
- ▶ Motorist does not pay an invoice.

This section deals with each of these sub-scenarios in turn for a real system, since there will be no enforcement simulated in the pilot.

5.6.1. Motorist Does Not Set Up Account

- ▶ **Context:**
 - > The owner or lessee of a vehicle subject to the road charge does not register it for the charge.



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- > Because no current odometer reading is available for the vehicle, the number of miles driven until it is registered cannot be accurately measured. For this reason, it may be wise to make the Time Permit the default operational concept until a motorist registers for a different Operational Concept.
- ▶ **Motorist activities:**
 - > None. An individual buys or leases a vehicle subject to the road charge, or moves into state with one, but does not register for the charge in the specified time.
- ▶ **Road Charge Management activities:**
 - > Road Charge Management constantly monitors vehicle sales in the state using information provided by DMV, noting the people who purchase or lease vehicle subject to the road charge, either from dealers or from private sellers. This includes monitoring road charge deregistration forms and title transfers.
 - Road Charge Management also specifically records individuals who have registered their vehicles with the state but who have decided not to choose an Operational Concept with their vehicle registration, and those who have chosen to go to a CAM.
 - After an amount of time specified in road charging legislation or regulation, if a liable vehicle is not registered for the Road Charge, the policy and operational agency assesses a penalty against this person.
 - One logical penalty is to force the motorist to purchase a Time Permit starting at the time the vehicle was registered. This allows payment for any miles that they have driven while contemplating what Operational Concept to select.
 - Another possibility is to prorate a longer-term Time Permit for number of the days until the motorist registers for a Road Charge Operational Concept (although this option opens up the possibility of exploiting a short period of unlimited mileage).
 - Optionally, Road Charge Management may send a warning note or email to such owners or lessees before the penalty is exacted.
- ▶ **CAM activities:**
 - > Commercial account managers, if included in the system, must update their list of all registered customers on a daily basis.
- ▶ **Issues:**
 - > The length of time that individuals have to register with the road charge.
 - > Whether Road Charge Management should send a warning letter before exacting a penalty.
 - > What penalty to exact for delinquent road charge registrations: for example, automatic enrollment in the Time Permit.

5.6.2. Motorist provides a false odometer reading (Odometer Charge or Mileage Permit), including odometer rollback

- ▶ **Context:**
 - > The motorist, in an attempt to defraud Road Charge Management, provides a false odometer reading at reconciliation, at registration, or both (note that explicit tampering with the odometer is covered in the next sub-scenario).
- ▶ **Motorist activities:**
 - > The motorist intentionally reports to Road Charge Management a lower than accurate odometer reading at the end of the year in order to pay for fewer miles.



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- > Alternatively, the motorist reports a higher than accurate odometer reading at the start of the program.
- > When confronted about these deliberate falsifications, the motorist may claim “I misread the odometer” or “I wrote down the wrong number,” or some other similar variant. Sometimes these claims may be true.
- ▶ **Road Charge Management activities:**
 - > An authorized representative of Road Charge Management who also takes a digital image of the odometer makes a motorist’s first odometer reading when the motorist is registering the vehicle for road charge. This provides an irrefutable baseline for the odometer reading.
 - > As vehicles must be registered in person the first time at a DMV, this should be not be cumbersome for motorists.
 - > The final odometer reading (when vehicle is de-enrolled) is taken by an authorized representative. This could be somewhat more cumbersome given that deregistration would otherwise not need to be done in person.
 - > However, it might be sufficient to provide a digital image of the odometer reading – one that includes the whole driver’s side dashboard, yet in which the odometer numbers are still visible – as an alternative. This image could be compared with the initial image to determine fraud.
 - > Further, Road Charge Management should randomly select a certain percentage of individuals reconciling at the end of the year to have their odometers officially checked.
 - > Road Charge Management may require individuals who report many fewer miles than expected in a given year to have their odometers checked. Note that many of these motorists will not be fraudsters, but rather people whose driving habits changed due to life changes (new job, etc.).
 - > Digital image fraud can be detected automatically through software applications such as Izitru (<http://www.izitru.com/>), which detects all but the most sophisticated digital image fakes.
- ▶ **CAM activities:**
 - > None.
- ▶ **Issues:**
 - > Setting up authorized representatives to read odometers.
 - > Determining a reliable formula for what constitutes many fewer miles than expected.

5.6.3. Motorist Rolls Back Odometer Reading (Odometer Charge)

- ▶ **Context:**
 - > The motorist attempts to defraud Road Charge Management by “rolling back” the odometer reading.
 - > In the days of mechanical odometers, this was a mechanical process. In the days of digital odometers, it is a software process. Car manufacturers have secret electronic codes that allow digital odometers to be set, via the OBDII port, to an arbitrary value. These codes are used, for example, to reset the odometers of vehicles to zero when they arrive at a dealership, when in fact they have been driven for a few miles at the factory or while in transit.
 - Manufacturers attempt to keep these codes secret, but hackers, aided by dishonest mechanics that have access to proprietary testing devices that include the codes, often find the codes for popular models. They then sell these codes to dishonest individuals who offer the service of rolling back an odometer for the purpose of selling a vehicle with a lower odometer reading in order to get a higher sale price.



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- > Such a fraudulent odometer reading in effect only allows individuals on Odometer Charge or Mileage Permit to defraud the government. With Time Permit, allowable mileage is unlimited, while with Automated Distance Charge the mileage reporting device meters each mile as it is driven.
- ▶ **Motorist activities:**
 - > The motorist would go to the dishonest individual who is selling the service of reprogramming the odometer, pay a specified amount to reprogram the odometer, and get the odometer reprogrammed to a lower value than actually driven. Or they would purchase such a device themselves.
 - > As this is a fraudulent activity, there is no systematic data on how much such individuals charge for reprogramming the odometer. Anecdotally, such devices can be purchased for \$200 on the internet, but individuals who reprogram odometers for others have charged \$100 or more – prices so high that they are likely to offset the amount that most people could save. Thus such an option would likely be attractive to high-mileage drivers that have not opted for Time Permit.
 - > It is possible that the market for fraudulent odometer rollbacks could increase as a road charge is rolled out should the black market price for such rollback services drop.
- ▶ **Road Charge Management activities:**
 - > Detecting this type of fraud involves several activities for Road Charge Management:
 - Keeping a record of verified odometer readings and estimated readings. Road Charge Management should also maintain all odometer readings from prior title transfers.
 - Observing each year's estimated odometer readings and apply logical rules to ensure that the readings appear reasonable.
 - Requesting CarFax or equivalent records of selected vehicles, which sometimes include odometer readings (such requests entail a significant associated cost, but Road Charge Management may be able to negotiate favorable volume-based rates).
 - Requesting Department of Environmental Quality records with odometer readings for vehicles subject to emissions testing.
 - Request any odometer records available from mechanics' shops where suspected fraudulent vehicles have been serviced. Legal implications of such requests should be considered.
 - Keeping current with automotive fraud literature, which could provide clues about which vehicle make/models are most likely to be rolled back.
 - Ask owners of vehicles suspected of fraud to explain their low mileage.
 - Require estimated odometer readings not once per year, but twice or more. And require a dashboard image with each reading. This would require people who want to defraud the government to roll back the odometer multiple times per year, making the fraud even less financially attractive.
 - Work with the National Highway Traffic Safety Administration and the National Odometer and Title Fraud Enforcement Association (NOTFEA, <http://notfea.org/>) on the latest investigative techniques.
 - Ultimately, this type of fraud is likely to be rare given the cost, complexity, risk of getting caught, and relatively low payback.
- ▶ **CAM activities:**
 - > None.
- ▶ **Issues:**



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- > Creating algorithms to detect suspect patterns of odometer readings.
- > The cost and effort associated with finding odometer readings from multiple sources.
- > How to handle the responses of motorists when asked to explain low mileage.

5.6.4. Motorist Tamperers with or Removes EMM (Automated Distance Charge)

▶ **Context:**

- > The motorist tampers with or removes the EMM with the aim of reporting fewer miles.
- > Legitimate causes for device removal exist, such as taking the vehicle to a repair shop where the staff use a tester device on the OBDII port or getting an emissions test. Thus infrequent, brief periods of device removal cannot be considered intentional fraud.
- > Similarly, devices may be unintentionally kicked by a driver or passenger, so any rough physical contact with the device does not necessarily constitute tampering.

▶ **Motorist activities:**

- > The motorist commits intentional fraud by tampering with or removing the device.
- > Tampering with devices is very challenging, so the most likely tactic would be to simply remove it for a single long trip.

▶ **Road Charge Management activities:**

- > If Road Charge Management includes a state account manager that offers EMMs, it should observe device messages to determine if frequent removal is occurring or if device tampering has been detected.
- > If a pattern suggestive of fraud is detected, the agency should audit the motorist. This would include questioning the motorist to see if there is a reasonable explanation and asking for a verified odometer reading.
- > If no reasonable explanation is provided, Road Charge Management would assess a penalty on the motorist.

▶ **CAM activities:**

- > CAMs would observe device messages to determine if frequent removal is occurring, or if device tampering has been detected.
- > If a pattern suggestive of fraud is detected, the commercial account manager follows up with the motorist to see if there is a reasonable explanation.
- > If the motorist cannot offer a reasonable explanation, the account manager refers the motorist to Road Charge Management, passing along all relevant information, for potential assessment of fees and any other legal action.

▶ **Issues:**

- > Software should be developed to analyze messages that describe when a device was disconnected or if tampering has been detected to determine signals that indicate fraud.
- > Defining a sequence of escalating enforcement activities (e.g., penalty fee, criminal proceedings, a lien on the vehicle, etc.).

5.6.5. Motorist Does Not Pay Invoice

▶ **Context:**

- > The motorist is registered for the road charge but fails to pay an invoice.

▶ **Motorist activities:**

- > The motorist fails to pay an invoice.

▶ **Road Charge Management activities:**



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- > Follow state guidelines for collecting delinquent payments (second invoice, possibly with penalty, third invoice, etc.).
- > Eventually send to collections agency and possibly put a registration hold and/or lien on the vehicle in question.
- > Execute any follow-up enforcement activities as allowed by law.
- ▶ **CAM activities:**
 - > CAMs would follow their own internal guidelines for collecting delinquent payments (second invoice, possibly with penalty, third invoice, etc.).
 - > They would eventually send the invoice to a collections agency.
 - > They would inform Road Charge Management that the motorist is delinquent for specified amount such that Road Charge Management can execute any follow-up enforcement activities as allowed by law.
- ▶ **Issues:**
 - > Determine guidelines for delinquent accounts, including delinquency periods, level of penalties, when to send to a collections agency, what collections agency to use, etc.
 - > Define any follow-up enforcement activities (e.g., placing lien on vehicle) and who will execute these activities.

5.7. Failure Conditions.

To succeed, the road charge system must be reliable. Mileage reporting hardware should include diagnostics to indicate failure conditions. For automated methods, Road Charge Management's system should have a self-evaluation function that displays key performance indicators on a management dashboard.

When failures occur, the system should be able to continue functioning, albeit in a potentially degraded manner. The failure conditions included here are known possibilities. As-yet unknown failure possibilities may also exist.

- ▶ **Time Permit:**
 - > No known failure conditions.
- ▶ **Mileage Permit or Odometer Charge:**
 - > Odometer failure:
 - Although vehicle odometers are highly reliable, in rare circumstances they may fail.
 - Motorists should be expected to have odometer failures fixed promptly, and also to report the failures to the road charge program, along with best estimates of mileage driven and proof of repair records.
 - Odometer failure should not be accepted as an excuse by Road Charge Management except when repair records are presented. If the repair shop can recover mileage driven, it should do so. If not, then motorists should be asked to make their best estimate of mileage driven subject to adjustment by Road Charge Management based on individual historical driving patterns or general population averages.
 - Road Charge Management could also make motorists liable for a standard amount of mileage for a year in case of odometer failure.
 - Another approach would be for Road Charge Management to require all individuals claiming odometer failure to have their vehicles inspected by a special mechanic to determine if the failure was caused by intentional tampering.



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- > Unintentional reporting of wrong mileage:
 - Motorists may sometimes write down the wrong mileage unintentionally.
 - In case of large errors, such a negative difference with the previous year, or a mileage in excess of 100,000, Road Charge Management may ask the motorist to resubmit the mileage, along with a digital photo of the dashboard with the odometer. Alternatively, for more security, Road Charge Management may require that the motorist get an odometer reading by an officer or authorized representative such as a DMV agent or auto dealer.
 - Allowing revisions of previous odometer readings is not advised.
 - Motorists might request such a revision when they discover, at the end of a given driving year, that the previous year's reading was too high. They could discover this, for example, when they find that their odometer reading is lower than the odometer reading reported for the previous year.
 - Allowing revisions, however, could invite fraud. Smaller errors – say, 5,000 miles or so – will simply be corrected in subsequent years when an accurate reading is given.
- > Motorist fails to report mileage.
 - While Account Managers must send repeated reminders to participants to report their mileage, some participants may never do so. Enforcement activities will be needed to correct this situation.
- ▶ **Automated Distance Charge (no or general location):**
 - > Mileage recording device loses communications.
 - If the device attempts to communicate, but no network is available, it should retry until a network is available. The device should be able to buffer (store for transmittal) mileage data for at least 30 days.
 - > Failure at account management system.
 - Disasters, extended power failures, or widespread IT problems could cause an account manager to be down for some period of time.
 - Redundancy of utilities (uninterruptable power supply and power generators), IT equipment (backup servers), and offsite as well as on-site data backup should be provided by the system.
 - > Defective EMM.
 - All EMMS should include self-diagnostics and the ability to send error messages.
 - When the account manager receives such an error message, it should immediately notify the motorist of the problem.
 - Either the account manager or the motorist should be responsible for replacing the device, depending on policy choices.
 - To account for data missing when the device had failed, the mileage can be estimated by Road Charge Management (or by the CAM, if applicable), perhaps based on average daily travel in recent months.
 - If device failures are not promptly corrected after notification, the motorist should face a penalty.
 - > GPS failure:
 - The device should continue to record miles even when the GPS fails. It can do based on the vehicle speed signal from the OBDII port.
 - > Motorist fails to become compliant.



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- While Account Managers send repeated reminders to participants to become compliant, some participants may never become compliant. Enforcement activities are needed to correct this situation.

5.8. Identify Vehicles That Should Pay Road Charge

Note that this scenario only applies to a revenue-generating road charge system. It did not apply to the Road Charge Pilot Program.

▶ **Context:**

- > Legislation authorizing a road charge should specify which vehicles are subject to the charge and how they are to be phased in. During this transition, which may one or many years, some vehicles will be responsible for paying a road charge, while others will not. Road Charge Management will need to make this distinction. This activity will use information provided by the DMV registry and will need to be updated as new vehicles are registered and other vehicles have their registrations changed or canceled.

▶ **Motorist activities:**

- > None.

▶ **Road Charge Management activities:**

- > Identify those vehicles that are subject to the road charge based on the criteria in the enabling legislation. This activity should be completed on a daily basis, as vehicles change registration status.
- > Maintain and update a list of vehicle makes and models subject to the charge. Publish on the road charge program web site and also make available to car dealers.
- > Maintain a list of categories of vehicles that are liable for the road charge but do not have OBDII ports or have nonstandard ports.
- > Reach out to automakers of electric vehicles to try to allow telematics programs to support road charging. Motorists for vehicles without standard OBDII ports or telematics platform support will not be able to choose the Automated Distance Charge

▶ **Commercial account manager activities:**

- > None.

▶ **Issues:**

- > The criteria need to be specific enough so that there is no doubt about which vehicles are required to pay a road charge and which Operational Concepts each vehicle is eligible for.



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6. Pilot Implementation of ConOps

6.1. Key Takeaways from ConOps

- ▶ This document fulfills legislative and TAC guidance to generate an engineering design document constituting a feasible road charge system in California that reflects both statute and recommendations of the TAC.
- ▶ This document served as the technical basis for the financial model that is being used to forecast potential costs and revenues of the road charging system.
- ▶ This document provided the technical framework for the Road Charge Pilot Project (July 2016-March 2017) and could serve as the baseline of a revenue-generating road charging system.
- ▶ All road charging Operational Concepts described in the ConOps worked well together and were implemented in parallel.

6.2. Creation of Requirements and Interface Control Document

After the ConOps was drafted in October 2015, the project team formulated technical requirements that reflected the system specified in the ConOps. The technical requirements are functional—they specify what the system should do and what outputs it should generate—not *how* it should produce the desired outputs. The team developing the requirements was careful to ensure the requirements document reflects all the TAC’s wishes about a pilot, but also paid special attention to developing privacy and security requirements that fully reflect the TAC’s wishes, as the TAC has made clear that these areas are especially important and sensitive.

Prospective vendors were provided an opportunity to review the requirements document and provide feedback as part of their proposals. Contracted vendors had a further opportunity to review and provide feedback. Vendor input was used to shape the final requirements within the budget and accelerated timeframe needed for the road charge program. However, the basic principles of the program were not sacrificed, notably protection of privacy, data security, user choice, and ease of use.

6.3. Procurement of Pilot System Components

Based on the project team’s procurement strategy and in part on this ConOps, the following functions were procured and contracted for the pilot (note: in some cases, a single entity is providing more than one of these required functions:²²

- A. Two Commercial Account Manager to provide account management functions.
- B. One State Account Manager (SAM) to provide account management functions.
- C. One Commercial Vehicle Account Manager to provide account management functions to medium and heavy trucks, including automated mileage measurement (with location) technology.
- D. One provider of time-based road charge permits (SAM, which is simulating a public agency).
- E. One provider of mileage-based permits (SAM).
- F. One provider of odometer verification services, conducted through in-person (actual public agency)
- G. One provider of odometer verification services through smart-phone apps (private business)

²² Note that a provider of mileage reporting based on in-vehicle telematics is desirable but not necessary. Such a provider was procured and contracted.



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- H. Four automated mileage measurement and reporting technologies that use no location (private business).
- I. Three automated mileage measurement and reporting technologies that use general location to report only taxable miles (private business).
- J. One Independent Evaluator to evaluate the road charge pilot program's performance.

6.4. Create a Pilot Test Plan

Material in this ConOps was combined with other material to develop a Demonstration Plan, which comprised a detailed plan of how the demonstration options chosen by the TAC were implemented. The demonstration plan contains a detailed schedule that starts at the end of vendor procurement, and includes vendor setup, participant recruiting and onboarding, and customer support setup. The schedule specifies the group who will complete each of the activities. This schedule is synchronized with the testing activities. It also includes details for communications and coordination among the testing team, including design and setup of an internal testing website, weekly status calls, and other coordination measures. The plan provides for close coordination among all work streams, especially the technical, procurement, communications, and evaluation work streams.

Two areas that were given special attention in the test plan were pre-pilot testing and coordination throughout the pilot.

6.4.1. Vendor Pre-Pilot Testing

Vendor systems, including both their account management systems and any electronic mileage meters, were subject to extensive testing before the program began. Each of these tests had an individual test script, which was prepared by the project team and provided to the vendors when they agreed to participate in the Road Charge Pilot Program.

- ▶ **Unit testing**—Also referred to as bench testing, unit testing refers to tests performed by the vendors alone in their own facilities. Bench testing covered a range of desired performance characteristics, including functionality, as well as electrical and environmental characteristics of the individual components of the pilot system. All vendors passed unit testing.
- ▶ **Integration testing**—For integration testing, vendors demonstrated that the individual components fit together properly, including correct transmission of mileage messages and other data according to the Interface Control Document from mileage reporting devices to account management systems to account management oversight. All vendors passed integration testing.
- ▶ **End-to-end testing** (also known as system acceptance testing)—The project team tested the complete integrated system—with all account managers and hardware options—shortly (less than 45 days) before the actual go live date of the pilot (July 1). Testing included a demonstration of some product functionality already validated in on the bench and integration testing to Caltrans and other stakeholders. After testing, the project team required vendors to correct errors and deviations from the specifications. The project team also required the vendors to provide all customer facing language for review and updating prior to launch. Once all technical and public communications issues were resolved, launch began early, three weeks after end-to-end testing, on June 13.²³

²³ Included as an appendix to the final report.



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6.4.2. Coordination Throughout Pilot

The test plan established a means of coordination throughout the pilot. This coordination consisted of the following:

- ▶ Weekly calls—weekly updates on project progress.
- ▶ An official pilot contact list—with name, phone, e-mail, and a description of their role/area of responsibility for each of the pilot team members.
- ▶ Manage to schedule—management activities were be targeted at completing all phases of the project on schedule.



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