

MINNESOTA DEPARTMENT OF TRANSPORTATION

MINNESOTA DISTANCE BASED USER FEE DEMONSTRATION PLAN

Concept of Operations

VERSION 2.2

MARCH 2020



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REVISIONS

VERSION	DATE	CHANGES
1.0	9/14/2018	Incorporated grammatical edits received after 90% ConOps workshop.
	9/20/2018	Incorporated remaining edits and addressed all comments received.
1.1	10/5/2018	Revised version submitted as final
2.0	10/24/2019	Revisions following completion of Proof of Concept and initiation of Demonstration phase
2.1	01/24/2020	Revisions following MnDOT and Revenue review
2.2	03/02/2020	Revisions to project goals language

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ACRONYMS

CAN	Controller Area Network
C/AV	Connected/Automated Vehicle
ConOps	Concept of Operations
COOP	Continuity of Operations plan
CSV	Comma Separated Value
DBUF	Distance-Based User Fee
DUA	Data Use Agreement
EPA	Environmental Protection Agency
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
GAAP	Generally Accepted Accounting Principles
GPS	Global Positioning Satellite
HUTDF	Highway User Tax Distribution Fund
IGA	Intergovernmental Agreement
ISO	International Organization for Standardization
ITS	Intelligent Transportation Systems
JSON	Java Script Object Notation
MnDOT	Minnesota Department of Transportation
MOU	Memorandum of Understanding
MPO	Miles per Gallon
NDA	Non-Disclosure Agreement
PCI DSS	Payment Card Industry Data Security Standard
PII	Personally Identifiable Information
Revenue	Minnesota Department of Revenue
RUC	Road Usage Charge
SM	Shared Mobility
SSAE	Statement on Standards for Attestation Engagements
STSFAs	Surface Transportation System Funding Alternatives
TAC	Technical Advisory Committee
TNC	Transportation Network Company
TPEC	Transportation Policy and Economic Competitiveness
VIN	Vehicle Identification Number
VMT	Vehicle Miles Traveled
XML	eXtensible Markup Language

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1 INTRODUCTION

Minnesota, like many other states, is at the precipice of a major transportation funding shortfall. A perfect storm of issues has created a current and projected shortfall in Minnesota's Highway Users Tax Distribution Fund (HUTDF):

- An increase in vehicle fuel efficiency and the influx of electric vehicles
- An increase of vehicle miles traveled (VMT) combined with declining purchasing power for transportation improvement projects
- A lack of consistent increases to the per gallon state excise tax to keep pace with inflation

The adoption of shared mobility (SM) services, such as car share and ride-hailing, presents both challenges and opportunities for MnDOT, as well as other owners and operators of infrastructure within the State of Minnesota. The SM business model is one that promises reduced car ownership by allowing users to pay-by-trip, a model that has been rapidly adopted by urban dwellers across the nation. This fleet-oriented business model's future is linked with electric and automated vehicles—vehicles that are highly efficient, and thereby promise to lessen revenue collected through the current gas-tax centric state HUTDF funding model.

SM provider's advancement in trip data collection and seamless, integrated payment, provides new opportunities for transportation infrastructure revenue collection. SM providers charge users a usage-based travel fee, similar to that of the Distance-Based User Fee (DBUF) concept. Many SM providers charge users a per-mile trip charge and have in-place hardware and software systems to calculate per-mile charges. Given support from SM providers, these systems could be leveraged to further evaluate DBUF feasibility and demonstrate how the use of onboard and embedded technology could greatly enhance the efficiency of DBUF collection. Thus, SM platforms pose a unique opportunity to evolve the highway funding structure in a rational, scalable, and efficient way.

Over the last several years, the Minnesota Department of Transportation (MnDOT) has conducted several research and pilot programs aimed at leveraging technology and innovation to support new ways of using, owning, and paying for transportation. This includes evaluating alternative financing and technology system solutions including launching one of the first-in-the-nation DBUF pilots; piloting rural intersection safety using connected vehicle technologies; and initiating its Connected Corridor Program.

In partnership with the University of Minnesota's Humphrey School of Public Affairs (Humphrey School), MnDOT is exploring how a DBUF, combined with SM, could be used to supplement other user taxes currently collected from drivers that use the state's roads. This work includes the compiling of a concept of operations (ConOps) and implementation of the proof of concept, which will culminate in a larger scale demonstration of the DBUF concept implemented on partner SM providers. Ultimately, the proof of concept and the larger scale demonstration could, with the proper legislative support, culminate in a highly efficient revenue collection mechanism that supports social and technological evolution, provides a more equitable and sustainable funding mechanism and can be used as a model both for deployment statewide and national consideration.

1.1 DOCUMENT PURPOSE AND INTENDED USE

This ConOps document provides a high-level overview of the DBUF demonstration proof of concept and associated larger scale demonstration. As identified within the Systems Engineering “V-Diagram” below, it is often the first engineering document produced in the systems development process. Among other items, this ConOps will identify the following:

- DBUF proof-of-concept and demonstration vision, goals and objectives
- Concept need, including related issues and needs that the demonstration concept must address
- Understanding the recommended concept
- Stakeholder oriented scenarios used to elicit the feedback required to develop the demonstration concept and gain consensus.

This ConOps also acts as the springboard for future planning, development and implementation activities and supports understanding of these activities. To this extent, this ConOps feeds into these activities and builds quality into the future system should the demonstration be proven successful.

The ConOps also provides stakeholders with a clear plan from which they can collaborate, exchange ideas, provide feedback and ultimately gain consensus on how to proceed with demonstrating the DBUF concept. Thus, the ConOps is written in a non-technical manner and focuses on clarifying stakeholder roles, responsibilities and project phases. The ConOps will establish how these stakeholders align with each phase, including roles and responsibilities in the context of implementing, operating, and maintaining the individual components of the proof of concept and demonstration system. In this manner, the ConOps helps flesh out operational needs early in the concept’s design and reduces the need to revisit this stage as the concept is being designed/demonstrated, which consequently may result in cost overruns and/or schedule delays.

Phase -1	Phase 0	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
Interfacing with Planning and the Regional Architecture	Concept Exploration and Benefits Analysis	Project Planning and Concept of Operations Development	System Definition and Design	System Development and Implementation	Validation, Operations and Maintenance, Changes & Upgrades	System Retirement / Replacement

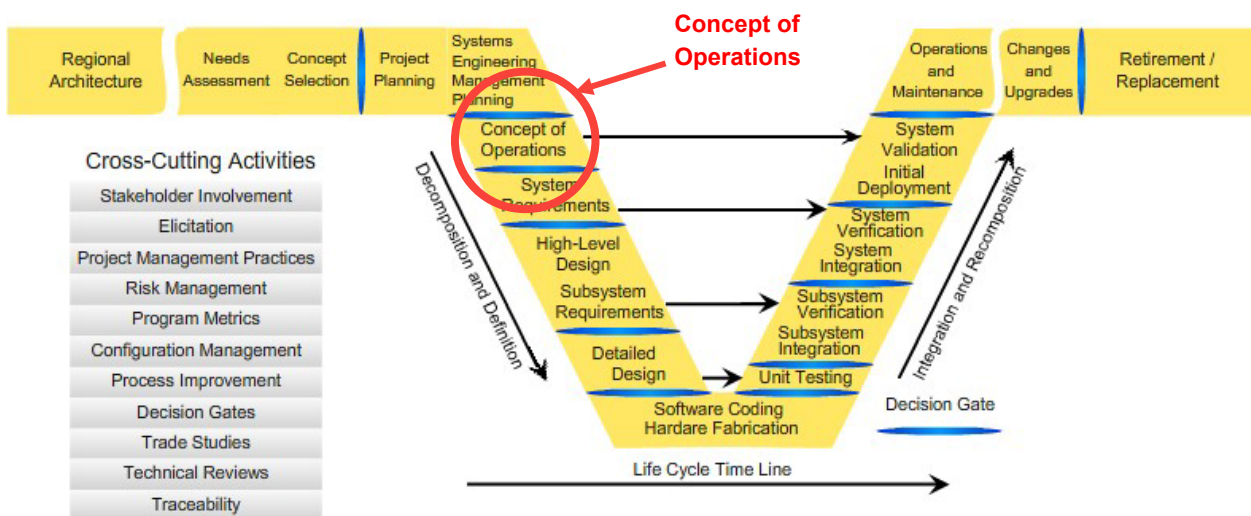


Figure 1: Systems Engineering V-Diagram

The ConOps does not describe specific technologies or technical details, many of which will be investigated as the parties move forward with the deployment phase. The ConOps is not intended to be a design document but rather addresses the high-level questions that are associated with the project that need to be answered before the concept is designed and ultimately demonstrated. To this end, the ConOps represents the transitional step that occurs between the time the concept is proposed and when it is formally designed/demonstrated. The ConOps begins to answer the who, what, where, why and how questions that surround the DBUF concept. Because the ConOps acts as the transitional step between concept exploration and concept design, it is important that the high-level characteristics and institutional understanding of the system are fleshed-out and that related details are communicated to all stakeholders potentially impacted by its implementation.

1.2 CONTENTS

This ConOps is organized per the American National Standards Institute standard outline for developing ConOps documents for ITS/technology projects. This outline is widely accepted by practitioners as a suitable outline for developing new systems. A brief description of each section included within this ConOps is provided below.

Section 2: Project Scope – This section provides an overview of the DBUF demonstration project. Included is a high-level description of the project, a description of its purpose, stakeholders, and geographic area to be covered.

Section 3: Referenced Documents – This section identifies and briefly describes documents that were referenced in developing this ConOps and that provides a context in the understanding of prior events leading up to the development of this ConOps and/or offer understanding of DBUF-related issues.

Section 4: Background – This section provides a brief description of existing revenue collection practices that MnDOT relies on to operate and maintain its transportation systems, as well as its limitations as a sustainable solution to adequately meet future needs.

Section 5: Operational Needs - This section identifies and describes users, state, and SM provider needs as they relate to successfully demonstrating the DBUF concept.

Section 6: Vision, Goals, and Objectives – This section provides the vision, goals, and objectives for the DBUF demonstration, as derived from the Operational Needs provided in Section 5.

Section 7: DBUF Concept Understanding – This section provides a recommended approach for collecting DBUFs and describes the operational concept for demonstrating it. It also describes the various agencies that have a stake in the concept and their roles and responsibilities with respect to design, implementation and operation of the concept.

Section 8: Operational Scenarios – This section identifies a range of possible scenarios in which the demonstration system is expected to operate, defining the sequence of events expected to occur under each scenario and the roles and responsibilities for completing activities defined from individual user perspectives.

Section 9: Operational and Support Environment - This section describes the physical environment in terms of facilities, equipment, hardware, software and personnel, operational procedures and support necessary to operate the demonstration system.

Section 10: Failure Scenarios – This section identifies potential failure scenarios for the DBUF demonstration. The scenarios captured in this section relate to the three key technology components of the demonstration system: vehicles, account management systems, and reporting.

1.3 TARGET AUDIENCE

This ConOps is primarily intended for those stakeholders who own and operate systems and equipment that will comprise either the proof-of-concept and/or the larger scale demonstration system. The primary audience that this ConOps is oriented includes:

- State of Minnesota
 - Department of Transportation
 - Department of Revenue
 - Department of Public Safety
 - Public Information Office
 - Office of Information Technology
- University of Minnesota, Humphrey School of Public Affairs
- SM providers
- Technology providers
- MnPass

In addition to the primary audience, there are several secondary entities whose interests and/or operations may be directly or indirectly affected by the demonstration. These entities include, but may not be limited to the following:

- Policymakers including State, Regional and legislators
- The Metropolitan Council and other metropolitan planning organizations within Minnesota
- Other States including other State Departments of Transportations
- Federal Highway Administration (FHWA)
- Other State of Minnesota Departments including the Department of Air Quality
- Academic institutions
- Engineering firms and consultants

Lastly, entities that are not directly involved or affected, but should be apprised on the demonstration activities include:

- The Public
- Media
- Private companies and business owners including 3M, Target, and the MAYO Clinic
- Professional organizations including the American Automobile Association

2 PROJECT SCOPE

Minnesota has a vision for exploring a sustainable transportation funding model, around the integration of three emerging trends – Shared Mobility (including various aspects of car sharing, ride-hailing, and vanpooling services), electric vehicles, and vehicle automation – with a distance-based fee. In 2017, MnDOT was awarded a STSFA grant in the amount of \$300,000.00 to explore ways to plan and design for a DBUF with a SM provider. Subsequently, in 2018, MnDOT was awarded an additional STSFA grant on the amount of \$999,600 to implement a 12-month DBUF demonstration. The STSFA grant requires a 50% local match, resulting in \$2,599,200 in total project funding. In response to receiving the grant, Minnesota is partnering with SM provider(s) to develop a per-mile fee mechanism that utilizes telematics already embedded in SM provider vehicles (e.g., no new systems will be built, no new hardware will be needed in the vehicle).

This concept will be demonstrated to assess the feasibility of replacing and/or supplementing other user fees now collected from drivers for the use of Minnesota's roads. For example, various aspects of fee collection, including fuel taxation, registration fees, leasing, rental, insurance, and other aspects of vehicle use, may also be eligible for conversion to a DBUF under the context of SM. This concept is being pursued by MnDOT to create a highly efficient revenue collection mechanism that recognizes the future trajectory of social trends and technology, and one that can be used as a model for deployment.

It is assumed that the convergence of SM, electric and automated vehicles will profoundly affect the way Minnesotans uses, owns, and pays for transportation in the future. It is also assumed that technologies already onboard many new vehicles (or soon to be) can collect, process, and share data easily and cost effectively. This capability provides the pathway toward wider deployment of DBUFs, and importantly, will show how these fees can be collected as efficiently and cost-effectively as possible using reliable and secure technologies already embedded in vehicles.

2.1 PROJECT PURPOSE

The goal for developing this project is to design, test and prove a DBUF structure to support the sustainability and long-term solvency of the State, and possibly, the Federal Highway Trust Fund. The intent is to explore how DBUF-related data could be accurately and securely transferred between a SM provider and the Minnesota Department of Revenue (Revenue), as well as better understand how this style of fee implementation would impact SM providers.

The project will have two phases.

Phase 1 – Proof of Concept: The project will explore how DBUF-related data could be accurately and securely transferred between a SM provider and the State, and to understand how a DBUF would technically impact SM providers and if the transmission is even possible.

Phase 2 – Demonstration: The Phase 2 deployment will focus on executing a larger scale demonstration of the SM DBUF collection system proof of concept designed in Phase 1. This will also include capturing public opinion, education of residents, and identification of any organizational or administrative gaps and key considerations to address moving forward.

Ultimately, the State of Minnesota expects to use a successfully proven design to demonstrate how a SM DBUF can address administrative efficiency, privacy, technological obsolescence and other issues identified in previous pricing demonstrations and pilots.

Through partnerships with SM providers, the larger scale demonstration project will lead to:

- Confirmation of the reliability and security of SM technology and the potential for integration of that technology with state fee collection systems;
- Development of an appropriate pricing structure (within given constraints) for various classes of vehicles, time of day and other variables;
- Development of a standard for highly efficient and effective collection of DBUFs; and
- Development of a plan that charts a path forward to validate the feasibility of DBUFs, a blueprint for future demonstrations, deployments, partnerships, applications, etc.

The State of Minnesota intends to research, demonstrate and examine the necessary policy and technical considerations needed for developing a DBUF, where users would pay certain road use fees on a per-mile usage basis, as opposed to fixed fees. This project also strives to simplify the driver-technology interface and to demonstrate a significant reduction in technology costs and the cost of operations over previous user-based fee demonstrations.

2.2 PROJECT SCHEDULE AND PHASING

In Phase 1, the DBUF proof of concept was demonstrated, conducted between the fourth quarter of 2018 and first quarter 2019. During the proof of concept, data was analyzed and a formal report developed. Based on a successful demonstration of the proof of concept, the project moved to Phase 2, consisting of a larger demonstration of the DBUF proof-of-concept tested in Phase 1. The larger scale DBUF demonstration is expected to begin in Spring 2020, based on the concept's final design, and procurement and negotiations with SM providers.

The larger scale Phase 2 demonstration is expected to last 12 months, to account for a seasonal considerations and to provide a robust data set for analyses of feasibility and potential pricing schemes and policy considerations. Assuming an April 2020 launch date, the demonstration will conclude in March 2021, with an additional 1-3 months for demonstration evaluation and final reporting.

2.2.1 PHASE 1: PROOF OF CONCEPT

In Phase 1, MnDOT partnered with a SM provider to collaboratively evaluate and design the necessary supporting systems and back office protocol to support a DBUF trial that is both publicly and politically supported. Additionally, this phase involved designing a feasible and affordable DBUF focused on the future of personal travel, as well as creating and leveraging partnerships to demonstrate how existing onboard technologies can be used to collect a DBUF. Phase 1 activities were conducted in 2018 and 2019, with the proof of concept operations lasting two months. Specific activities tied to Phase 1 included:

- Recruitment of SM provider(s)
- Modeling of pricing strategies
- Design of back office operations, protocol, and software

- Stakeholder analysis and outreach
- Multi-modal pricing options
- Development and execution of legislative strategies
- Planning and design for deployment in Phase 2 demonstration

MnDOT, in partnership with the Humphrey School and WSP USA, planned the proof of concept to address the immediate goals and objectives of the 2017 STSFA grant, and preliminary needs of a larger scale demonstration. MnDOT and its partners engaged in activities to understand stakeholder needs determine direct and indirect impacts to stakeholders, and to ensure a shared understanding moving forward.

2.2.1.1 PROOF OF CONCEPT DURATION AND SAMPLE SIZE

The proof-of-concept was conducted over a 2-month period. During this time, data was constantly collected (i.e., 24 hours a day, seven days a week for a total of 14 calendar days) from SM provider participating vehicles. MnDOT coordinated with SM provider to transmit raw trip data for the purpose of data analysis and verifying that required data can be easily transferred between the SM provider and the State.

2.2.1.2 PROOF OF CONCEPT RESULTS

The Proof of Concept was successful in meeting defined goals and objectives. MnDOT partnered with a SM provider to accurately and securely collect, sanitize, and transfer DBUF-related data using existing systems. From the 70 participating vehicles, 4,633 unique trips were taken, totaling 103,550 miles traveled and 3,542 gallons of fuel purchased. The data was used to create simulated invoices, assessing a DBUF of miles traveled and crediting fuels tax on gallons purchased. Revenue reviewed the simulated invoices and related data to determine potential integration with existing tax collection systems and processes and to confirm auditability.

Tests were also executed with a connected/automated vehicle (C/AV) research partner, logging 43 trips, 1,716 miles, and 79 gallons of fuel. For one of the logged trips, the C/AV research partner conducted a live data polling test. The C/AV collected, aggregated, and transmitted mileage and fuel consumption information on a second-by-second basis during the vehicle's travel using existing wireless connectivity. This short (25 minute) test confirmed the capability to send live data directly from a vehicle's embedded telematics systems, which can support several potential use cases, including real-time value-added services.

The Humphrey School also developed a framework for DBUF pricing schemes, further defined in the Humphrey School's Pricing Schemes Task 3 Report.

2.2.2 PHASE 2: LARGE SCALE DEMONSTRATION

Where Phase 1 demonstrates the DBUF concept can be done, the Phase 2 deployment, estimated for the 2020-2021 year, explores demonstrating the system at a larger scale. Prior to beginning the large-scale demonstration, MnDOT, working in collaboration with its partners, will develop a demonstration plan that clearly defines the demonstration's scope, budget, schedule, stakeholders, procurement alternatives, necessary resources and staff, risk management plan and communication and outreach plans.

It is anticipated that the large-scale demonstration conducted under Phase 2 will require additional resource commitments, funding, and possibly legislative authorization. Possible tasks include negotiation and execution of agreements, software development and testing, and other technical support as needed. Cost estimates for the demonstration will also be developed.

2.2.2.1 DEMONSTRATION DURATION AND SAMPLE SIZE

The demonstration project is expected to capture trip data from a SM provider's local (i.e., Minneapolis) vehicle fleet and may be expanded to include other connected/automated vehicle research fleets or other SM providers. These fleets will include several different vehicle classes and fuel efficiencies. The expected vehicle fleet size could be upwards of 200.

Vehicles are considered the participating entity for the purpose of the demonstration, regardless of number of customers using a particular SM vehicle.

2.3 GEOGRAPHIC COVERAGE

DBUFs will be assessed for all vehicle miles originating in Minnesota and driven both within and outside the State of Minnesota for both the Phase 1 Proof of Concept and the Phase 2 Demonstration. Customers that use participating SM provider vehicles will not be geographically constrained in their travels; interstate travel will be possible.

It is technically possible to assess fees on miles driven only within the State, though possibly outside the goals and objectives of the demonstration. SM providers may share location data as part of their trip dataset which MnDOT can use to geofence Minnesota's state lines and assess fees on miles driven only within the State. The assignment of fees based on miles traveled within the state or total miles will be invisible to users (i.e., miles will be aggregated based on vehicle and not be individual user). Detailed location-based travel may be implemented in the proof of concept and/or demonstration to conduct location-specific analyses and pricing scheme development.

3 REFERENCED DOCUMENTS

This ConOps was developed from several meetings with Minnesota stakeholders, SM providers, and key reference documents (listed below). The reference documents listed below provide the history of DBUF in Minnesota and provide context into how the DBUF efforts in Minnesota have evolved over the course of several years. The documents used as a reference in the development of this ConOps include:

- *Report of Minnesota's Mileage-Based User Fee Policy Task Force (December 2011)* -- The Mileage-Based User Fee (MBUF) Policy taskforce report presents the agreed upon policy objectives and the 6 recommendations voted and adopted by the taskforce. The report also presents a minority opinion section.
- *Mileage-Based User Fee Policy Study: Supporting Technical Information (April 2012)* -- The document serves to complement the aforementioned MBUF Policy Task Force Report; it summarizes activity within and inputs informing all phases of the MBUF Policy Study process, including findings from Greater Minnesota listening sessions; 2011 MBUF Symposium in Breckenridge, CO; perspectives from national experts; national expert and transportation finance roundtable events; Internet panel survey of Minnesotans; and additional targeted outreach.
- *Connected Vehicles for Safety, Mobility, and User Fees: Evaluation of Minnesota Fee Test (February 2013)* – This document provides a summary of the 2011 Mileage-Based User Fee study, and evaluation of its findings, and considerations provided by the evaluation team on the effectiveness of the MBUF pilot in Minnesota.
- *Connected Vehicles for Safety, Mobility, and User Fees: Operational Summary Report (February 2013)* – This document provides a summary of the 2011 Mileage-Based User Fee study including the operational considerations, project activities, and key policy and business considerations captured during the demonstration.
- *2016 Minnesota Distance-Based User Fee STSFA Grant Application (March 2016)* – This document is the proposal developed by MnDOT to acquire federal funding to support the development and planning for this DBUF demonstration.
- *MnDOT Distance-Based User Fee Proof of Concept Report (March 2019)* – This document provides an overview of the scope, approach, results and takeaways from the DBUF proof of concept concluded in early 2019.
- *MnDOT Distance-Based User Fee Demonstration Implementation Plan (January 2019)* – This document services as the implementation plan for the 12-month DBUF demonstration, defining the goals and objectives, key milestones and deliverables, evaluation strategy, stakeholder goals, and systems and resources necessary to support the demonstration.

4 BACKGROUND

The Minnesota state highway system consists of interstates, U.S. highways, and Minnesota highways. State transportation revenues, predominantly the state gas tax which accounts for almost 45% of generated revenue, provide the largest funding source for capital, maintenance and operations activities. Federal programs are also a significant source of funding for the state system, making up about 25 percent of the funding for capital projects.

In Minnesota, as in most other states, fuel taxes are collected from distributors who then pass that cost along to retailers, and subsequently, the customers. These taxes are easy to pay and easy to collect but are largely hidden from the consumer because the tax is contained within the per gallon cost of fuel. Because fuel taxes must be paid to receive the fuel, administrative costs of collecting the fuel tax are relatively low. Despite the low administrative costs, concerns have been raised regarding the ability of the motor fuel tax to sustain and expand Minnesota's roadway transportation system. Vehicles are increasingly using less gasoline/diesel fuel, and that trend is expected to continue. Additionally, the number of vehicles that use alternative fuels, some of which are subject to lower tax rates, will also increase over time. Decreasing reliance on petroleum-based fuels and greater fuel economy is a good development for the environment. However, a diminishing use of fossil fuels combined with an increasing use of alternatively powered vehicles will inevitably result in less motor fuel tax revenue available to directly fund the preservation and expansion of Minnesota's roadway transportation system.

The HUTDF also receives revenue from the Motor Vehicle Registration Tax and the Motor Vehicle Sales Tax. The Motor Vehicle Registration Tax is an annual tax based on a vehicle's value (cars, pickup trucks, vans) or weight (trucks, tractors, trailers, buses). Electric vehicles pay a \$75 surcharge. The Motor Vehicle Sales Tax is paid on the purchase price of a motor vehicle required to be registered in Minnesota. Revenues from the tax are split between the HUTDF (60%) and a Transit Assistance Fund (40%).

Born from the need to fill gaps in transportation revenue left by electric and alternative fuel vehicles, MnDOT has undertaken several studies that explore the feasibility of a DBUF. These studies, which are described at a high level in the following section, have led to the development of the DBUF concept outlined in this ConOps.

4.1 WHY USER FEES?

MnDOT recognizes the unsurpassed efficiency of the motor fuel tax and its long and durable history. The motor fuel tax has been the primary source of highway revenue since the 1920s and it continues to support roadway projects. With the advent of new sources of energy, and the increase in fuel efficiency, the long-term viability of the motor fuel tax is in question. On average, drivers can drive more and pay less per mile of travel.

The quick and rational approach to solving the problem of diminishing revenue is to increase motor fuel taxes to levels commensurate with the efficiency trends and the necessary inflationary adjustments, recognizing that alternative energy sources require special treatment. This has always been the prerogative of Congress and the States, which, some argue, have chosen to ignore or inadequately address these issues.

Political leaders have argued not to raise the motor fuel tax in the face of growing needs. This belief is that growing fuel efficiency and the emergence of alternative energy sources for motive power would

blunt any such increases, and inequities that may result. Although true, all user-based fee alternatives suffer from the same deficiencies if not designed to include sophisticated features such as allowances for vehicle weight, time-of-day, and very importantly, an inflation adjustment mechanism aka, indexing.

Minnesota's approach suggests the motor fuel tax, with all its advantages and deficiencies, is likely to continue for a long time. It is challenging to design a solution for universal replacement of the motor fuel tax that begins to approach its simplicity and efficiency. The cost of collecting the motor fuel tax in Minnesota is less than 0.5 percent of the fees collected. By the most optimistic forecasts, the cost of operations and retro-fitting vehicles with technology, as well as setting up the appropriate enforcement structures for a mileage-based fee, is likely to be in the range of 5-10 percent of total fees collected.¹ By comparison, the motor fuel tax, while imperfect, is likely to remain in place for a long time.

The approach Minnesota is taking to migrate toward user-based fees is sensible and nimble since it allows societal and technological trends to drive the change. SM is the change agent. It recognizes that a methodical migration to user-based fees will be incremental and is the path of least resistance. It will use onboard technology and communications capacity, not create new and expensive technology and back-office systems with increased administrative costs. It also recognizes that continuation of current trends in fee collection, if left unchanged, will likely be inadequate in the future. A new path toward a fair and rational user-based fee system must be charted.

4.2 PREVIOUS STUDIES

MnDOT's study of DBUFs dates back to 1995. In May of 2007, MnDOT conducted a research study to gauge public opinion about a MBUF alternative to the current motor fuel tax. Interviewees included transportation experts as well as the general public. Eight transportation experts participated in an online discussion about the issue and 10 focus groups (six in the Twin Cities Metro area and two each in Duluth and Mankato) totaling 89 people provided feedback.

In August 2008, MnDOT conducted nine mini-focus groups (five in the Twin Cities Metro area and two each in Duluth and Mankato) with Minnesota drivers to understand the perceptions and level of acceptance among participants about the implementation of a MBUF.

In June and July 2009, MnDOT conducted 821 phone-mail-phone interviews with Minnesota drivers selected by random sample augmented by drivers of hybrid vehicles to better gauge their understanding of funding of transportation issues.

In May 2011, MnDOT began conducting technical research of the MBUF in a Minnesota Road Use Test. Five hundred people from Hennepin and Wright Counties tested technology that could collect a mileage-based user fee. The research provided important feedback from motorists about the effectiveness of technology in a car or truck to gather mileage information. Results helped public policy leaders understand the challenges and opportunities in such a system.

Volunteers in the study used a Smart Phone with a GPS application in their vehicle. The phone was programmed for motorists to submit information. MnDOT used that information to evaluate whether the device provided timely, reliable travel data for a specific trip. In addition, the test examined whether other

¹ Background for the Per-Mile Road Usage Charge in the USA; Presentation for the IBTTA Transportation Finance and Road Usage Charge Conference Portland, Oregon. April 26, 2015

applications, such as real-time traffic alerts providing information on construction zones, crashes, congestion and road hazards, were effective in communicating safety messages to motorists. Three different groups of volunteers tested the devices for six months each.

The technical research was designed to record miles and road use while strictly protecting the privacy of participants. Participant names, data that identifies their vehicle, financial account information, travel routes, days and times of trips were classified as not public by the Minnesota Department of Administration to ensure the research and results were valid. The research concluded in December 2012, and the results were made available to the public.

4.3 LOOKING FORWARD – THE MINNESOTA SHARED MOBILITY MODEL

By some predictions, SM will account for 35 percent of all personal travel by 2030 and perhaps as much as 90 percent by 2040². Although relatively small at this time, various forms of SM are already impacting the way Minnesotans interact with the transportation system through ridesharing providers and car sharing services.

Discussions with car-sharing providers in the Twin Cities revealed that more than 2,000 drivers are already subscribers. These services are significant in their own right. However, when coupled with emerging fully automated vehicle technologies they stand poised to significantly impact personal mobility in a relatively short timeframe. This shift also offers a unique opportunity to develop a model that could positively and equitably change the user fee structure for the nation's highway system.

Currently in Minnesota, as in most other states, highway user taxes (fees) are collected from fuel distributors who pay taxes based on the number of gallons purchased by consumers at the gas pump. Based on the amount of gas purchased, the fees are easy to pay and collect but are largely hidden from the consumer. The SM model flips this paradigm and charges vehicle drivers distance-based fee for use of the roadway. This fee would be built into the provider's vehicle use fee structure that is charged to the consumer. SM providers will collect the distance-based fee portion of the charge and will pay it directly to the State of Minnesota. It essentially eliminates direct collection from thousands or even millions of drivers, as proposed for more traditional Mileage-Based User Fee (MBUF) or Road Usage Charge (RUC) programs.

Minnesota proposes to partner with SM providers to develop a per-mile road user fee mechanism that uses telematics and GPS technology. These are currently embedded in SM vehicles to automatically calculate and collect the fees. This technology has enormous capability to efficiently deliver a user-based fee system and will require virtually no driver-vehicle interface beyond what is already required of the driver. Fees charged can vary by vehicle type, roadway type, jurisdiction, and/or time of day. Because fees are collected from SM providers and not individual drivers, costs for administration, fee collection, and enforcement are substantially lower than other user-based fee models where individual vehicle owners are invoiced for miles driven.

² Navigant Research. Autonomous vehicles: self-driving vehicles, autonomous parking, and other advanced driver assistance systems: global market analysis and forecasts, 21 August. <http://www.navigantresearch.com/research/autonomous-vehicles> (2013). Accessed 26 September 2018.

5 OPERATIONAL NEEDS

This section will focus on defining the state, user, and SM provider needs. The original vision is presented, along with key goals and objectives for the demonstration.

5.1 STATE NEEDS

The overarching need for Minnesota is a reliable DBUF system that accurately collects, assesses, and transfers DBUF from SM providers accurately and cost effectively. Previous meetings with State of Minnesota staff resulted in several system considerations such as:

- Flexible to accommodate multiple SM options (car share, ride-hailing)
 - Leverage existing SM provider technologies
 - System and network reliability
 - Accuracy in the collection, processing, and transfer of data and funds
 - Auditable
 - Safeguards against unauthorized data dissemination
 - Cost effective to administer and manage
 - Increase public awareness and education on transportation funding
 - Expand collaboration with SM providers
 - Provide a platform that could be easily used by other states and cities
-

5.1.1 FLEXIBLE TO ACCOMMODATE MULTIPLE SHARED MOBILITY OPTIONS

The DBUF system must be flexible to accommodate multiple SM options. This includes the ability to collect, assess, and process DBUF charges from car share, rideshare, and transportation network companies (TNCs). The system should support open-platforms where DBUF-related data can be collected and seamlessly shared with Minnesota state agencies without using proprietary protocols. The system should also support scalability, allowing SM providers to enter the market with little to no required customization.

5.1.2 LEVERAGE EXISTING SHARED MOBILITY PROVIDER TECHNOLOGIES

The demonstration system will leverage existing technologies, embedded within shared mobility vehicles and back office systems. No aftermarket technologies will be specifically required to support DBUF collection, as the data should be readily available from other shared mobility provider services. However, there may be rental costs if the State decides to equip vehicles within its vehicle fleet with aftermarket telematics. This decision will be dependent on the ability to partner with a SM provider for the demonstration. If the State cannot partner with a SM provider, they may opt to equip state vehicles with privately owned telematics platforms to demonstrate the DBUF concept.

5.1.3 SYSTEM AND NETWORK RELIABILITY

The fee collection system must maintain a network that supports the accurate collection and reporting of mileage and associated DBUF. This means that the SM provider's systems and hardware must remain available to support daily operations, including data reporting and account management operations, at least a certain percentage of a 24-hour per day, 365-day per year period. Generally, a common network uptime for these types of systems is 99.9% (meaning the system should be operable at least 59.94 minutes every hour of a year). This does not include system outages for regularly scheduled maintenance or situations out of the SM provider's control. Maintenance outages should be scheduled when the system is least likely to impact data collection and retention.

5.1.4 ACCURACY IN THE COLLECTION, PROCESSING, AND TRANSFER OF DBUF DATA AND SIMULATED FUNDS

The accuracy of collection, processing, and transfer of DBUF data and funds between the SM providers and Minnesota state agencies, as well as the accurate calculation of distance-based charges, is a key objective for the success of the demonstration. The ability to accurately capture a vehicle's mileage, correctly process the associated DBUF (at a predetermined per-mile rate), and transfer the data and simulated revenues to the State is paramount. Additionally, the ability to accurately credit any fuel taxes based on fuel purchased or consumed whether it be based on the miles that fuel is consumed, the average EPA miles per gallon (MPG) rating, or simply based on all miles traveled relative to the fuel tax rate is a key objective for the accurate assessment of DBUF charges.

5.1.5 AUDITABLE

The ability to easily and successfully audit a SM provider, as well as maintaining compliance with state and federal standards is another objective. This includes compliance with Generally Accepted Accounting Principles (GAAP) recommendations, policies and recommendations established by Minnesota, compliance with Statement on Standards for Attestation Engagements (SSAE) 18, and any policies required by financial institutions with whom the SM provider may transfer funds, such as Payment Card Industry Data Security Standards (PCI DSS). The ability to audit SM providers will increase the credibility of the DBUF, reducing risk of public distrust adversely impact its viability as a long-term revenue source.

5.1.6 SAFEGUARDS AGAINST UNAUTHORIZED DATA DISSEMINATION

Given the public concern over privacy protection, coupled with recent well-known instances of data network breaches (such as Equifax), the need to safeguard data and the hardware and networks that collect and transfer data from hacking and unauthorized dissemination of data will be a key objective. This includes compliance with industry standards for data storage and network security, such as the International Organization for Standardization (ISO) standard 27001 Information Security Management.

Compliance with these standards (or their equivalents), coupled with penalties for the unauthorized dissemination of data, are paramount in protecting driver and financial information. Therefore, the public needs to be confident in the systems that will house their driving and financial information. These standards should apply to both the shared mobility providers as well as Minnesota state agencies that have access to SM provider systems.

5.1.7 COST EFFECTIVE TO ADMINISTER AND MANAGE

The increased complexity of distance-based systems relative to the fuel tax model leads to concern over increased expenses needed to administer and manage the system. The current fuel tax model costs less than 0.5 percent of collected revenues to administer. Previous statewide RUC pilot projects have conducted analyses that have estimated the cost to administer a program to be between 12 percent and 25 percent of collected revenues. While leveraging a DBUF on SM providers is a specific capability which should reduce overall administrative costs, relative to other RUC programs, Minnesota should also establish a series of cost metrics that the DBUF demonstration can be compared against to determine if the program is cost-effective relative to quantifiable metrics.

5.1.8 INCREASE PUBLIC AWARENESS AND EDUCATION ON TRANSPORTATION FUNDING

The success of any DBUF program will hinge on its acceptance by the public. For the Minnesota DBUF demonstration, this is no different. The DBUF demonstration should provide a platform for educating the public on how Minnesota's transportation network is currently funded, how the HUTDF plays a vital role in ensuring reliable transportation, how the current funding model is not sustainable, and how a DBUF program with SM providers can help bridge the funding gap.

Throughout the demonstration, MnDOT plans to conduct stakeholder and public awareness and education activities. The demonstration provides an opportunity to educate SM customers, members of the public and stakeholders on how a DBUF program could alleviate potential funding shortfalls while maintaining accuracy, reliability, and confidence in technology and data protection.

5.1.9 EXPAND COLLABORATION WITH SHARED MOBILITY PROVIDERS

Given the increases in SM subscribers, and how they may change the overall vehicle ownership model, Minnesota desires to expand collaboration with SM providers operating in the state. For the purposes of the demonstration, MnDOT, the Minnesota Department of Revenue (Revenue), and other state agencies will collaborate with participating SM providers early and often, gathering their key needs and concerns, evaluating any potential risks, and ensuring they are an active partner both through the demonstration as well as for future policy discussions related to transportation funding. In return, SM providers may be compensated for time and expenses.

5.1.10 PROVIDE A PLATFORM THAT COULD EASILY BE USED BY OTHER STATES AND CITIES

As Minnesota is the first state to consider assessing a DBUF with SM providers, there is a desire to provide a model that could be easily adopted by other states and cities. Through this demonstration, the research team intends to create a series of requirements documents (including this ConOps), systems architecture diagrams, and considerations for other states and cities to easily adopt for their own uses.

5.2 SHARED MOBILITY PROVIDER NEEDS

The SM providers will also have specific needs for the DBUF demonstration. As the frontline service provider to users and the liaison to the State, each SM provider will have unique needs and goals for the success of the demonstration. Some considerations related to the needs of the SM providers include:

- Non-intrusive to current operations
- Easily integrated with existing systems
- Improved collaboration with the state
- Manage visibility to potential subscribers

5.2.1 NON-INTRUSIVE TO CURRENT OPERATIONS

The business longevity of the SM providers depends largely on the performance of their operations and customer service components. The DBUF demonstration cannot impede the SM provider's current operations and must provide a way for them to maintain current operations while improving collaboration and visibility to potentially expand their subscriber bases.

5.2.2 EASILY INTEGRATED WITH EXISTING SYSTEMS

Coupled with being non-intrusive to current operations, the DBUF demonstration system must be easily integrated with a SM provider's existing systems. Specific systems' customizations needed for SM Providers to support DBUF should be kept at a minimum and should not require new systems or software to support DBUF data collection, assessment, or reporting. Prior to deploying the demonstration, the research team should collaborate with each SM provider to identify the unique needs and interfaces needed for the demonstration. Any specific data transfers should use industry-standard protocols to prevent unnecessary software or systems customization.

5.2.3 IMPROVED COLLABORATION WITH THE STATE

SM providers also wish to improve their collaboration with the state, and the DBUF demonstration provides the perfect platform to improve that collaboration. The SM providers can leverage this demonstration to help voice their concerns about DBUF, identify any barriers to entering or expanding the SM market, and establish ways that the State of Minnesota can help streamline processes, fees, and policies that may prove cumbersome for SM market expansion.

5.2.4 MANAGE VISIBILITY TO POTENTIAL SUBSCRIBERS

SM providers want to increase their number of subscribers. As such, SM providers' involvement in the demonstration and the shaping of a potential DBUF program will need to be carefully communicated to current and potential SM subscribers to ensure it does not negatively impact SM providers. A SM provider's involvement in the demonstration may provide an opportunity to promote SM provider services and support increases in subscriptions. MnDOT and its partners will work closely with participating SM providers to craft messages about transportation funding, DBUF and the demonstration.

6 VISION, GOALS, AND OBJECTIVES

Based on the needs provided above, the following vision, goals, and objectives for the DBUF demonstration are established.

6.1 VISION

The ultimate purpose of the proof of concept is to assess whether it is possible to exchange trip data from a SM provider to MnDOT and/or other departments within the State of Minnesota. If deemed possible, the vision of the large-scale demonstration is to test and prove a user-based fee structure that will ensure the long-term solvency of the Highway Trust Fund, and evaluate the capabilities of and potential gaps in the fee collection mechanism for both the SM Providers and the State.

The Highway Trust Fund, like transportation funding in most states, is experiencing severe stress due to factors such the growing demands for resources where revenues are not keeping pace with construction costs due to inflation, and an increasing diversity of new and highly efficient power systems, among other forces. Combined, these trends along with continued technology and product and service innovations, point to great uncertainty about the future.

Minnesota's DBUF system will strive to achieve broad public and stakeholder support. Rate setting will be rational and equitable and will be capable of being adjusted to address vehicle type, roadway design, jurisdiction, time-of-day, and other factors. The model that will be designed will be scalable to multiple service segments and exportable to other agencies. Migration to the new system will be incremental, painless, and cost effective.

6.2 GOALS AND OBJECTIVES

The goals and objectives of the proof of concept and demonstration are focused on developing and deploying a DBUF system that will be focused on the future of personal travel and will create an efficient and affordable path toward broader deployment.

Specific demonstration goals:

- **Fairness:** Ensures all road users subject to a DBUF pay a fair share for use of the roads;
- **Public acceptance:** If DBUFs are viewed as a solution, more travelers will support it;
- **Privacy protection:** Stringent security protocols must protect personal information;
- **Ease of payment and collection:** A system with low administration costs that uses existing technologies;
- **Transparency:** Use and fee data readily accessible as needed;
- **Low evasion rates:** Vehicle-embedded technology and encrypted transmission ensures low avoidance; and
- **Scalability:** DBUFs should be incrementally implemented.

Specific objectives to meet this goal are:

- Develop a scalable, secure and transferable approach to user-based fees that can be adopted widely and cost-effectively;
- Leverage partnerships with SM providers to demonstrate simulated DBUF collections with existing onboard technologies that minimize collection and, enforcement costs, and enhance user privacy and equity;
- Demonstrate how DBUF accounts from SM providers could be seamlessly integrated into existing Minnesota financial reporting, auditing, and enforcement systems;
- Confirm reliability and security of shared mobility data and financial systems, and potential for integration with state fee collection systems;
- Explore ways the nexus between connected and automated vehicles (C/AV), vehicle electrification, and SM ownership models can be used to promote a more sustainable transportation funding mechanism;
- Through targeted messaging and outreach, educate Minnesota's public and policymakers as to the decline in transportation funding, shared mobility's contribution to the problem, and how SM providers can be incorporated within a collaborative DBUF solution;
- Establish appropriate pricing structure for various parameters, such as vehicle classes, times of day, and other variables; and
- Develop a blueprint that charts a path forward to validate the feasibility of distance-based user fees.

7 DBUF CONCEPT UNDERSTANDING

Working from the existing situation and associated changes inherent to transportation funding and revenue sources, Section 7 details the DBUF Concept.

7.1 OVERVIEW

The SM DBUF proof of concept and demonstration are reliant on strong public-private partnerships with SM providers. The DBUF concept will leverage the telematics platforms already installed within SM provider vehicles to calculate and collect fees. SM providers already use this equipment as part of the underlying business models but more specifically to calculate user fees for services they currently provide. Since SM providers are already calculating distances traveled for each trip and have mechanisms in place for charging their users fees based on their mileage, MnDOT will partner with SM providers to evaluate the feasibility of integrating these fees with a DBUF.

7.1.1 FEES LEVIED

The demonstration project will levy a simulated distance-based fee for all vehicles used in the demonstration. Because the primary goal is to determine if a DBUF can be levied on SM vehicles, a rate table will be used for the demonstration that allows for flexibility in rates based on variables to be explored during the demonstration (e.g. time of day, state borders, etc.). Ultimately, through future pilots and demonstrations, MnDOT may elect to vary DBUFs based on certain conditions (e.g. time of day, specific corridors/areas, congestion, fuel economy, etc.) and would need to develop a fee table for these different criteria.

7.1.2 METERING MILEAGE

The effectiveness and credibility of the DBUF concept must ensure that miles traveled can be accurately recorded and reported. For simplicity, the DBUF concept demonstration will require SM providers to provide mileage readings as reported by technologies for each of the vehicles used in the demonstration. More specifically, providers will be asked to report mileage monthly for each month the demonstration is operational.

If a DBUF is widely implemented in the future, MnDOT or other appointed state agency may need to verify the accuracy of odometer readings and determine possible other sources that could be used to report mileage. Odometer reading during the life of the vehicle may vary from the actual distance traveled based on accuracy of the instrument and circumstances out of the instrument's control (e.g. tire size). Overly estimating vehicle miles traveled may result in public distrust of DBUFs and political pressure to abandon them. Alternatively, underestimating vehicle miles may result in revenue leakage and possibly increased administrative costs.

7.1.3 BILLING AND REPORTING MILEAGE

Ultimately, a DBUF system will require a mechanism for efficient billing and reporting mileage where actions to perform these activities do not significantly increase the administrative costs of collecting fees. For the proof of concept, SM providers will be asked to electronically submit trip data to a third party where Minnesota State departments can query provided data. At a minimum, data will be able to be sorted by vehicle ID, and time/date so that the project team can easily determine the number of miles each vehicle traveled during the prior month. For the demonstration, SM providers will electronically submit trip data to a third party repository for analysis, and will compile simulated revenue reports and transmit directly to the State for evaluation.

The specific calculation for the DBUF is as follows: The number of monthly aggregated miles traveled (VMT) multiplied by the DBUF rate (Rate) minus the motor fuel tax collected for the month. The motor fuel tax is the number of gallons of fuel purchases (Gal) times the state motor fuel tax rate* (Tax) of \$0.286.

$$\text{Net DBUF Fee Collected} = (\text{VMT} \times \text{Rate}) - (\text{Gal} \times \text{Tax})$$

* Federal motor fuels tax credits and a related federal DBUF may also be assessed.

7.2 PROOF OF CONCEPT FUNCTIONAL ARCHITECTURE

The proof of concept functional architecture is illustrated in Figure 2.

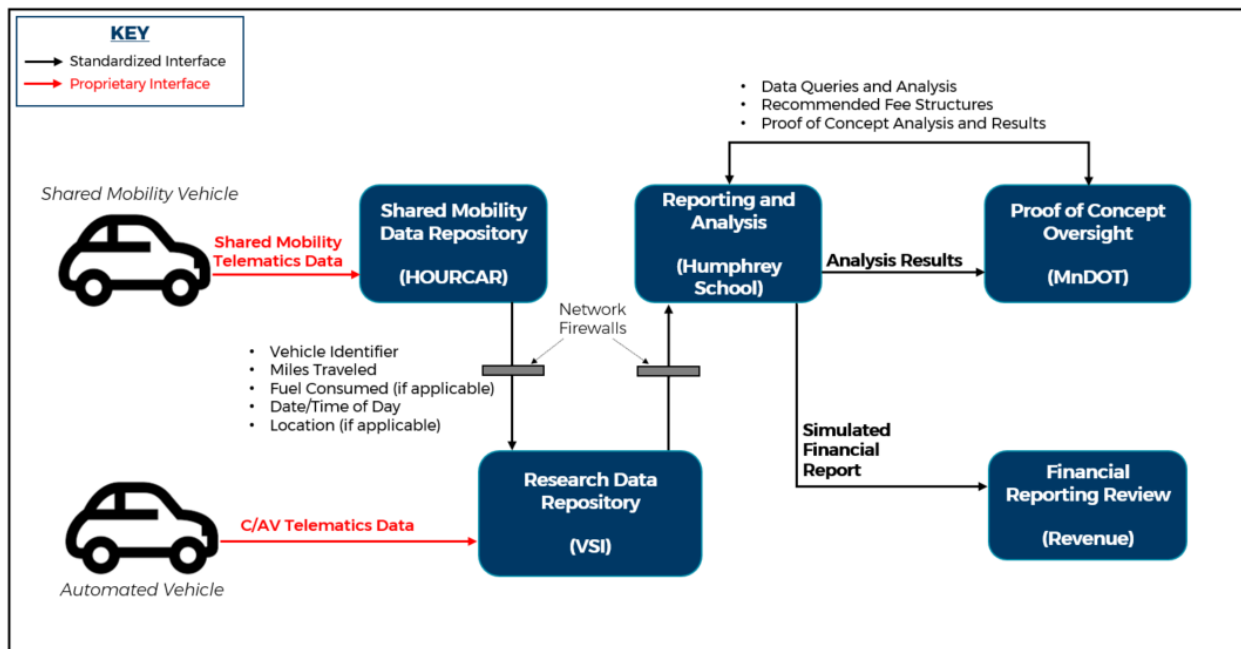


Figure 2: Minnesota Distance-based User Fee Demonstration Proof of Concept Architecture

7.2.1 SHARED MOBILITY PROVIDER INTERFACES

The SM providers participating in the proof of concept each own and operate account management systems that are currently used, in part, to receive and archive vehicle trip data. As a vehicle makes a trip, attributes of that trip (e.g. vehicle ID, time-stamped mileage, time of day, location data, and fuel consumed) are collected and stored within the vehicle's telematics platform. Trip data is locally archived within the vehicle until the time it is uploaded to the account management systems, normally through cellular network connectivity. The frequency of this communication (i.e. polling rate) varies by the provider (generally between one and three minutes).

Trip data that is archived on the account management system was sanitized of any personally identifiable information (PII) and aggregated monthly for the proof of concept. At the end of each month, the sanitized, aggregated data was pushed to a third-party research data repository. The data pushed from the SM providers to the research data repository was in industry-standard data formats (e.g. eXtensible Markup Language (XML), Java Script Object Notation (JSON), or Comma Separated Variable (CSV)).

7.2.2 THIRD PARTY DATA REPOSITORY INTERFACES

A third-party data repository served as MnDOT's data archive for all trip data generated during the proof of concept. To that end, the data repository directly received sanitized, aggregated trip data from the SM provider's account management system. This communication occurred via e-mail and through industry-standard data communications protocols (XML or CSV), therefore no changes to communications were required to enable the transmission of trip data from the SM provider to the third-party data repository. The third-party data repository enabled researchers from MnDOT's partner, the Humphrey School, to query data and generate reports.

The proof of concept also included a connected/automated vehicle (C/AV) that transferred DBUF-related data to the research data repository, thus demonstrating the ability to transfer data directly from a vehicle's controller area network (CAN) bus.

7.2.3 REPORTING INTERFACES

As previously mentioned, the Humphrey School analyzed the DBUF data provided by the third-party research data repository. The Humphrey School acknowledged the successful transfer of data from the research data repository, and used the data to generate simulated revenue reports for review by the State.

7.3 DEMONSTRATION FUNCTIONAL ARCHITECTURE

The demonstration functional architecture is provided in Figure 3 below. While similar to the architecture provided for the proof of concept, the demonstration will focus on developing channels and specifications for the SM providers to have direct communication channels with Minnesota public agencies for tax reporting, auditing and administration purposes.

During the demonstration, the project team will progressively move towards this final end state functional architecture, with anticipation of three or more stages of demonstration operations and communications channels for phased development of interfaces, tax report design, and validation checkpoints.

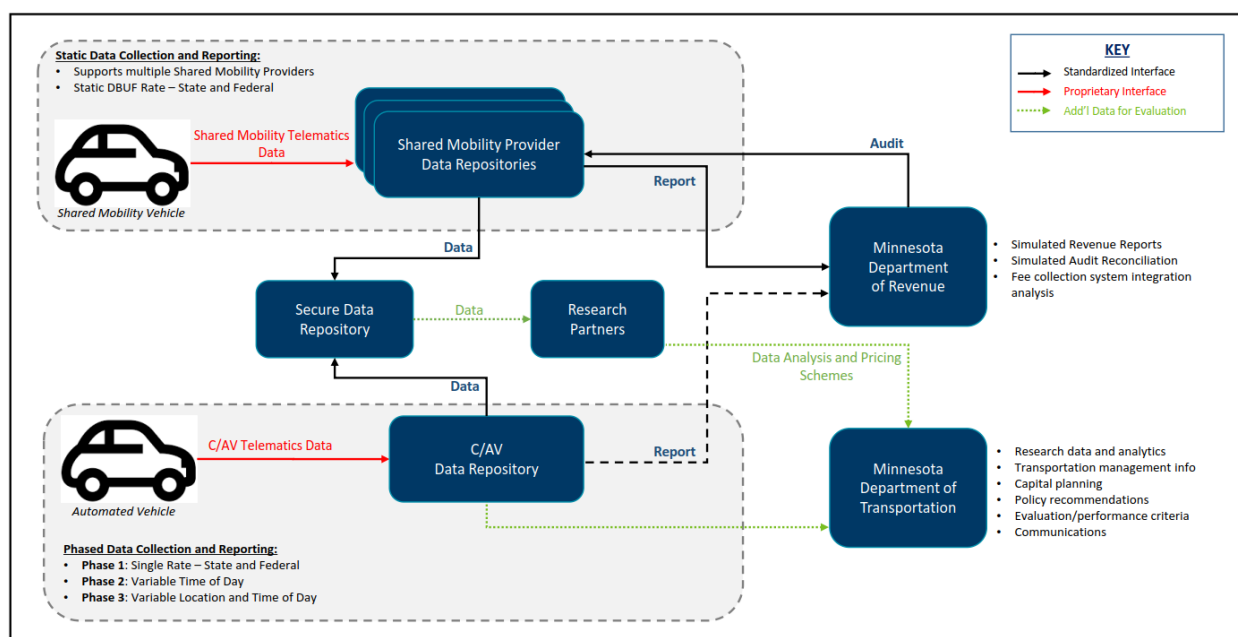


Figure 3: Minnesota Distance-Based User Fee Demonstration Notional End State Architecture

7.3.1 SHARED MOBILITY PROVIDER INTERFACES

Trip data from each SM provider’s account management system will be sanitized, aggregated, analyzed, and provided to Minnesota state systems in a series of reports. It is anticipated that this data push will occur within ten days following the end of each demonstration month. As with the proof of concept, the reports provided by each SM provider are expected to be provided in XML, JSON, or CSV formats. The monthly reports anticipated to be provided by each SM provider include:

- Revenue Report** – A monthly aggregate of the simulated gross and net compiled for all vehicles from each shared mobility provider (DBUF and motor fuels tax rates will include both a state and federal rate).

$$\text{Gross revenue} = [(\# \text{ of aggregate miles}) \times (\text{per-mile rate})]$$

$$\text{Net revenue} = [\text{Gross Revenue}] - [(\# \text{ of fuel gallons consumed/purchased}) \times (\text{motor fuels tax rate})]$$
- Vehicle Summary Report** – A monthly aggregate of the total vehicle miles traveled, and simulated gross, and net DBUF fees assessed per-vehicle, defined through either the VIN or through a vehicle’s unique identifier.
- Errors and Events Report** – A monthly report showing any data transmission errors that may affect how the DBUF is calculated.

In addition, there are reports that are not required for the demonstration, but may be relevant to future research of the DBUF concept:

- *Corridor or Area VMT Report (if available)* – A monthly report showing VMT miles for all vehicles within a SM provider’s fleet, traveled within specific areas or corridors, identified by MnDOT. Note this report would use monthly aggregated data and not specific trip data.
- *Congestion and Emissions Data (if available)* – A monthly report showing the number of minutes all vehicles within a SM provider’s fleet are idling and the particular timeframes where idling is at its peak. In addition, this report could identify whether vehicles are compliant with Minnesota emissions requirements, should automated emissions checks be considered a value-added benefit to the shared mobility providers.
- *Distance-Based Fee Report (if available)* – A monthly report showing how certain state or local imposed fees, levied on the SM providers, could be decomposed into a per-mile fee structure.

Each of these reports will be submitted to the State for simulated tax reporting and demonstration evaluation purposes. Network firewalls, certified to industry standards, such as the ISO 27001 family of standards for Information Management and PCI DSS (currently version 3.2), to prevent the unauthorized dissemination of data.

7.3.2 REPORTING INTERFACES

A third-party data repository will serve as MnDOT’s data archive for raw data and reports generated during the demonstration. Processing and reporting of DBUF data will be conducted in three (3) stages through the demonstration (timeframes for each stage are notional and will be confirmed during demonstration design:

- *Stage 1 – No Formal Reporting (~4 months)*: SM providers will sanitize and aggregate collected travel data on a monthly basis and transmit datasets to the third-party data repository. Simulated financial reporting to the State, using the information provided by the SM providers, will be conducted by MnDOT’s research partners, the Humphrey School and WSP USA. During this stage, the research partners will work with the State and SM providers to develop the reporting template to be used in subsequent stages.
- *Stage 2 – Initial Revenue Reporting (4 months)*: SM providers will sanitize and aggregate collected travel data on a monthly basis and transmit datasets to the third-party data repository. SM providers will also assess DBUF and fuels tax rates to the collected travel data, generate a Revenue Report (using the template designed in Stage 1) and transmit the report to the third-party data repository for validation by the research partners.
- *Stage 3 – Final Revenue Reporting (4 months)*: SM providers will sanitize and aggregate collected travel data on a monthly basis and transmit datasets to the third-party data repository. SM providers will also assess DBUF and fuels tax rates to the collected travel data, generate a Revenue Report and transmit the report to Revenue directly for simulated tax reporting, mock auditing, and demonstration evaluation purposes.

Additionally, Revenue may conduct one more mock audits, evaluating the information submitted in Revenue Reports against detailed SM providers’ records to validate data accuracy and integrity, and determine if the data points provided are sufficient for tax filing. During this audit, Revenue may request support from SM providers to answer questions, identify data types, and discuss the process for generating the Revenue Report.

For each data reporting stage, SM providers will produce and transmit datasets and/or Revenue Reports by the 10th of the month following the month of data collection.

7.4 STAKEHOLDERS

Agencies and entities that will have a stake in the proof of concept and demonstration are described below.

7.4.1 MINNESOTA DEPARTMENT OF TRANSPORTATION

The Minnesota Department of Transportation (“MnDOT”) is the DBUF demonstration project manager. MnDOT will administer the project, establishing ongoing project coordination with partners, and convene project team meetings and other technical and policy project meetings as necessary. MnDOT will maintain a project plan and schedule, monthly progress reports, copies of project correspondence and public meeting material including presentations and displays and a final report that will be developed in collaboration with the other primary stakeholders identified herein. As project lead, MnDOT will also be responsible for coordinating with the Technical Advisory Committee (TAC), driving the day-to-day operations of the demonstration, and managing contracts with other team members.

MnDOT will be responsible for receiving information from multiple entities during the demonstration, storing and forwarding that information as appropriate, and conducting analysis on provided information to evaluate and conduct the following:

- Per-mile/per-trip fee assessment recommendations;
- Project communications;
- Research and analytics;
- Transportation management information;
- Capital planning forecasts based on DBUF data;
- Policy recommendations;
- Evaluation/performance criteria; and
- General public and legislative communications.

MnDOT will also be responsible for communicating the following types of information to the SM providers and the TAC:

- Distance-based fee analysis results and reports;
- Recommended fee structures;
- Simulated fee credit reports;
- Data use agreements and memorandums of understanding; and
- Inquiries by other state agencies and legislature.

MnDOT will be responsible for conducting certification of SM provider systems and processes, as well as functionality provided directly by Revenue, Humphrey School, and MnDOT, to ensure that all demonstration requirements are met prior to launching the demonstration.

7.4.2 MINNESOTA DEPARTMENT OF REVENUE

Revenue will coordinate with MnDOT and its partners on a desired interface with SM providers to collect the DBUFs. This includes analysis and feedback on potential interface models and their characteristics such as:

- Technology/processing needs specifications
- Ease of user compliance
- Reliability and security specifications
- Developing tests to ensure accuracy of data
- Participant account reconciliation
- Auditability
- Business rules

Ultimately, Revenue will collect revenue reports, deposit records, and audit reconciliation from SM providers. To that end, they will be responsible for financial report design, auditing and financial analysis of DBUFs. Revenue will then process this information and pass along performance information to other agencies and departments within MnDOT.

Information will be pushed via reports from each SM provider to Revenue using XML, JSON, or CSV. Reports will be automatically provided on the 10th day of the month following the data collection month. For the demonstration, simulated audits and enforcement exercises will be conducted between Revenue and each SM provider.

7.4.3 MINNESOTA STATE LEGISLATURE

Legislative support will be critical for user-based fee systems and alternative approaches to be demonstrated and ultimately implemented. The Minnesota State Legislature has previously funded research for testing mileage-based user fees (MBUF), and legislative transportation leaders participated in a Minnesota policy task force examining the policy issues related to user fees in 2010. The task force identified the challenges that would be necessary for MBUF fees to move forward, which offers a useful roadmap as this project moves forward.

While legislative action is not anticipated to be needed during the pre-implementation and implementation phases of this project, it will be important to engage legislators so they are informed and engaged on the issues and policy considerations and implications of a DBUF program. In addition, their feedback will help inform the project team on the political sensitivity toward user-based fees and the necessary outreach and education to assure a successful outcome. Minnesota's experience with priced managed lanes demonstrates the importance of engaging legislative leaders and policy makers early on as a "grass tops" approach. These leaders play a critical role in explaining what can be a very complex and challenging issue to the public, and taking the correct steps to assure public support and avoid or address organized opposition.

The Minnesota State Legislature funds a multi-year project on Transportation Policy and Economic Competitiveness (TPEC) for research by the Humphrey School on transportation finance, economic

development and new technologies. The TPEC advisory board, which meets twice a year, includes the transportation committee chairs and ranking members from the Minnesota State Legislature as well as other transportation, business and community policy leaders. MnDOT may use the TPEC advisory board as a primary approach to engage state legislative leadership on legislative strategies related to this project in the pre-deployment phase.

In addition, periodic policy briefings will be conducted for legislators, and legislators will be invited to Rethinking Transportation Finance Roundtables hosted jointly by MnDOT, the Humphrey School and the University's Center for Transportation Studies. These roundtables have typically attracted policy leaders and interested citizens, and are an effective way of keeping the transportation policy community informed on transportation finance and pricing innovations. The project team will also work closely with MnDOT's legislative liaison to assure that legislators are well informed on the progress of the project at key points and that required legislative actions are incorporated into the MnDOT legislative program and that any legislative concerns or priorities are addressed in a timely way.

7.4.4 UNIVERSITY OF MINNESOTA, HUMPHREY SCHOOL

The Humphrey School will be responsible for coordinating with and recruiting SM providers to participate in the demonstration project. This includes working with providers to determine and implement an applicable DBUF pricing scheme (i.e., rate) that these providers can use during the demonstration. Other activities the Humphrey School will be responsible for include:

- Identifying SM provider needs and policy requirements for administering a DBUF demonstration.
- Conducting customer outreach and market research with SM providers.
- Determining the data privacy, security and enforcement expectations and needs and protocols of SM providers and customers.
- Developing a range of user-based fee options with SM providers and testing the financial viability and market response to transparent DBUFs.
- Identifying a scalable approach to administer DBUFs with SM providers' vehicle fleets.
- Documenting how telematics information will be collected with the lowest administration burden.
- Developing an understanding of software requirements, support systems, and compliance tools.
- Designing supporting system and incentives concepts.
- Participating in demonstration evaluation activities.

7.4.5 SHARED MOBILITY PROVIDERS

MnDOT has held informative and productive discussions with SM providers in the Twin Cities metropolitan area. As part of their existing operations, SM providers collect a host of information that is used to monitor vehicle usage and assess fees based on trips taken. As part of the proof of concept, SM providers will be responsible for coordinating with MnDOT to establish mutually agreeable terms for sharing information and working toward a desirable concept for automatically and seamlessly transmitting desired information during normal operations. For the demonstration, SM providers will collect, aggregate, sanitize and transmit travel data to State systems for the purpose of assessing a simulated DBUF, based on agreed to terms and requirements. No changes to the SM providers'

production operations are anticipated. SM Providers will provide additional data sanitization, aggregation and reporting services for the purpose of this project.

7.4.6 TECHNICAL ADVISORY COMMITTEE

The Technical Advisory Committee (TAC) will be responsible for program status, communicating with key legislators, and setting the direction of DBUF throughout the state. The TAC is expected to include members consisting of state agencies, civil rights and community organizations, local metropolitan planning organizations, cities and counties, local transit authorities, tribes, academia, the private sector, and professional organizations. Once chartered, the TAC will focus on not only demonstration-related initiatives, but also considerations for continued research and policies related to other DBUF-type endeavors. Some of these considerations may include needed policy/legislation, social and geographic equity, rate setting determinations, privacy, enforcement & compliance, traffic implications, and freight implications.



7.4.7 USERS

Users represent the SM provider’s customers (i.e., individuals that pay to reserve and use a vehicle from the SM provider’s vehicle fleet that participates in the demonstration). The user will be responsible for registering with the SM provider to use the SM provider’s services. This process will be no different than the process used today as part of the providers normal operating process. By registering with and paying to use the SM provider’s services, the user automatically will participate in the DBUF demonstration. Users will be responsible for reserving vehicles and paying for services in the same manner they are required to do today. Except for possibly being notified about the DBUF demonstration through targeted outreach, users will experience no changes because of the demonstration.

8 OPERATIONAL SCENARIOS

This section identifies possible scenarios in which the demonstration system is expected to operate, defining roles and responsibilities from individual user perspectives.

8.1 USER ORIENTED OPERATIONAL SCENARIOS

SM subscribers will continue to interact with their SM provider for standard business operations for SM services. Users in the context of this demonstration project are the SM providers participating in the project, and are addressed in the next section below.

8.2 SHARED MOBILITY PROVIDER OPERATIONAL SCENARIOS

8.2.1 *SUBSCRIBER ENROLLMENT AND RESERVATIONS*

SM providers enroll subscribers into the SM provider's operations platform to register for use of services. SM providers collect certain information to enroll each subscriber, including limited PII, payment method, and other information necessary to successfully bill the user for services and manage the account. Following successful enrollment, SM providers manage reservations created by subscribers to reserve a vehicle for use during a specific timeframe. No changes to SM provider enrollment and reservation management is expected to support this project. Data related to reservations may be included in trip data provided to the State during the demonstration for the purpose of simulated tax reporting and/or audit, with any PII removed.

8.2.2 *DATA COLLECTION*

SM providers will collect mileage, fuel consumption (if applicable) and location data from participating SM provider fleet vehicles, using existing telematics technologies installed in the vehicle for SM operations. The data will be transmitted to the SM provider's account management system per the SM provider's business model, and will be associated with the appropriate vehicle. Fuel consumption data will be collected via fuel purchase accounts and payment cards to determine the fuel purchased for (and therefore consumed by) each vehicle in the fleet. In some cases, physical odometer readings may also be captured during mileage collection or fuel purchase transaction to validate the telematics data.

During the demonstration, data from a C/AV may also be collected to demonstrate the ability to transfer data directly from a vehicle's controller area network (CAN) bus. Data collected from a C/AV would mirror the defined data set expected from a SM vehicle, with the addition of detailed location information for analyses of varied pricing schemes developed by the project research partners.

8.2.3 DATA AGGREGATION & REPORTING

SM providers, as collectors of the trip data, will be responsible for data aggregation. Aggregation for each SM provider will occur in multiple phases – by vehicle and by reporting period at a minimum. For the demonstration, the reporting period is anticipated to be monthly. As part of this aggregation, the SM provider will also ensure that no PII is reflected in any information provided to the State.

The SM provider will aggregate raw trip data by participating vehicle. SM providers will be required to report aggregated trip data for each participating vehicle as soon as possible, but no later than at least once a month.

Once data is aggregated, SM providers will apply the appropriate DBUF and fuels tax rates to miles traveled and fuel consumed/purchased for each participating vehicle, and calculate the net DBUF owed (simulated) to the State. Data aggregation and reporting is anticipated to be reflected in the following reports that each SM provider will submit to the State on a monthly basis during the demonstration:

- **Revenue Report** – A monthly aggregate of the simulated gross (total VMT * DBUF rate) and net (total VMT * DBUF rate – state fuel tax rate) compiled for all vehicles from each SM provider. If available, a further delineation of federal gas tax revenues would also be provided in this report.
- **Vehicle Summary Report** – A monthly aggregate of the total VMT, and simulated gross, and net DBUF fees assessed per-vehicle, defined through either the VIN, or through a vehicle's unique identifier.
- **Errors and Events Report** – A monthly report showing any data transmission errors that may affect how the DBUF is calculated.

In addition, there are reports that are not required for the demonstration, but may be relevant to future research of the DBUF concept:

- **Corridor or Area VMT Report (if available)** – A monthly report showing VMT miles for all vehicles within a SM provider's fleet, traveled within specific areas or corridors, identified by MnDOT. Note this report would use monthly aggregated data and not specific trip data
- **Congestion and Emissions Data (if available)** – A monthly report showing the number of minutes all vehicles within a SM provider's fleet are idling and the particular timeframes where idling is at its peak. Also, this report could identify whether vehicles are compliant with Minnesota emissions requirements, should automated emissions checks be considered a value-added benefit to the SM providers.
- **Distance-Based Fee Report (if available)** – A monthly report showing how certain state or locally imposed fees, levied on the SM providers, could be decomposed into a per-mile fee structure.

Each of these reports will be submitted to Minnesota state systems, such as Revenue's tax collection system, or data repository(ies) as identified by the State during the demonstration design phase.

8.2.4 PAYMENT COLLECTION

The only payment scenarios anticipated for the DBUF demonstration will involve the current payment operations between users and the shared mobility providers at the beginning and/or the end of a vehicle's use. To demonstrate the transfer of monies, an electronic funds transfer (simulated) may be implemented,

but no specific DBUF fees are expected to be paid by users, assessed by the SM providers, or paid to the State of Minnesota. Should this be implemented, a statement of deposit will be provided to each SM provider by the state showing successful transfer and acknowledgment of the funds.

SM providers may also be expected to support periodic spot (mock) audits conducted by Revenue during the demonstration to validate Revenue Report accuracy, completeness and integrity.

8.3 DEMONSTRATION ADMINISTRATION & GOVERNANCE

8.3.1 PROGRAM MANAGEMENT

MnDOT and its demonstration partners will oversee the demonstration. MnDOT will be responsible for providing periodic project updates to interested parties including the TAC, FHWA, State of Minnesota Legislature, Governor's office, and others as needed.

In addition to MnDOT's responsibilities, a TAC will be established to guide the project and to provide expertise to ensure successful outcomes. The TAC will also be beneficial for gaining stakeholder involvement and incorporating different viewpoints.

8.3.2 SIMULATED REVENUE COLLECTION

During the proof of concept and demonstration, SM provider DBUF tax reporting will be simulated. SM providers will generate simulated tax reports, using parameters defined by the State during the design phase, and will provide to the State and demonstration partners for validation of accuracy, data integrity, and compliance with format and data requirements. The use of the current, production tax collection and reporting system(s) used by the State are not anticipated to be used for this project, due to its temporary and simulated nature.

During the demonstration, Revenue will conduct one or more mock audits, evaluating the information submitted in the Revenue Report against detailed SM providers' records to validate data accuracy and integrity, and determine if the data points provided are sufficient for tax filing. During this audit, Revenue may request support from SM providers to answer questions, identify data types, and discuss the process for generating the Revenue Report.

8.3.3 CERTIFICATION

MnDOT, or an appointed representative, will certify that each SM provider is able to meet the technical and business requirements that will be established upon completion of this ConOps and prior to the start of the demonstration. This includes conducting the required testing of SM provider systems and ensuring that each provider has met the criteria necessary to successfully collect, administer and transfer data for the purpose of assessing a DBUF.

Certification testing will encompass three phases: specific systems for each SM partner (unit testing), testing the interfaces between each SM provider and the State (integration testing), and then a 2-week demonstration dry run (acceptance testing) where full functions of the demonstration will be tested using a focused set of participant vehicles. At the completion of testing, the SM partners will resolve any identified issues, retest as necessary, and prepare for the launch of the demonstration.

MnDOT, in cooperation with its partner departments and agencies, will create the requirements and criteria with which each SM provider must comply.

8.3.4 RATE SETTING

MnDOT and its demonstration partners will be responsible for setting and adjusting the per mile rates. The per mile rate that will be used for the demonstration will be set to generate revenues that would be approximately equivalent to revenues currently generated by the motor fuel tax. The per mile rate will be a flat fee applied to vehicles of all class types, fuel efficiency, and transportation corridors.

The data collected from the demonstration, including the VMT and revenue data, can then be used to explore potential variable rates, charging per-mile fees based on vehicle class, fuel efficiency, specific corridors, or other factors.

8.3.5 EDUCATION AND OUTREACH

MnDOT will initiate efforts to educate the public and stakeholders to encourage acceptance of DBUF. This will be a multi-tiered campaign including a DBUF demonstration website with links to other studies and marketing materials and key messages that SM providers can use to educate their customer base. This effort will include the various Minnesota State Departments and SM providers to ensure the message is clearly conveyed to system users both before the demonstration begins and throughout the demonstration.

To assess the public's thoughts on the DBUF, MnDOT, the Humphrey School, and/or the SM providers may recruit SM users to participate in data gathering sessions to gain their thoughts and opinions on the demonstration and the premise of a DBUF in general. These sessions would occur at various key milestones before, during, and after the demonstration. Any changes in opinions or key themes from participants would be captured and used to show whether the demonstration led to improved public understanding and acceptance of the DBUF concept.

8.3.6 LEGISLATIVE & FHWA COORDINATION

MnDOT will be responsible for providing the Minnesota State Legislature and the FHWA with quarterly updates on project progress and results. This may include information on the number of hours used and costs incurred in demonstrating the DBUF concept, as well as general observations, risks, and results identified/observed to date. MnDOT will also present a summary of the demonstration at its conclusion via a final report and presentation.

9 OPERATIONAL & SUPPORT ENVIRONMENT

This section describes the physical environment in terms of facilities, equipment, hardware, software and personnel, operational procedures and support necessary to operate the demonstration system.

9.1 EQUIPMENT AND INFRASTRUCTURE

9.1.1 SHARED MOBILITY PROVIDERS

9.1.1.1 FLEET VEHICLES

The SM providers will provide vehicles that will host the existing telematics technologies needed to collect and send operational data for calculating the DBUF. No new vehicles are assumed, but rather the concept will rely on existing vehicles that are currently part of the SM provider's existing vehicle fleet.

9.1.1.2 VEHICLE ONBOARD TELEMATICS

All vehicles participating in the demonstration would be required to have equipment capable of accurately recording mileage by date and time. Additionally, they are expected to have onboard communications systems that can transmit this data at periodic intervals to the SM provider account management systems. While embedded GPS capabilities are not required, they are highly recommended as location-specific data could be used to delineate between zones or even specific corridors. It is anticipated that all of the SM provider vehicles have some sort of GPS system, currently used for fleet monitoring.

No new telematics hardware or software is anticipated to be needed for the demonstration. All costs associated with the procurement, installation and maintenance of the vehicle telematics will be the responsibility of the SM provider. This includes monthly expense for cellular communication services.

9.1.1.3 ACCOUNT MANAGEMENT SYSTEMS

Account management systems represent the systems that SM providers use to store data received from the vehicle telematics. Account management systems are owned and operated by SM providers.

In addition to accommodating normal SM operations, these systems may need to be modified to support data aggregation and reporting required for the demonstration. MnDOT, Revenue, and the Humphrey School will work directly with these SM providers to identify the format of the reports and may conduct testing prior to the demonstration to ensure the reports can be provided in the required formats.

9.1.2 MINNESOTA DEPARTMENT OF TRANSPORTATION

MnDOT will provide a data repository, either directly or through a third-party provider, to store demonstration data for use in analyses and demonstration evaluation. Parameters for the data repository, including security, access, and data management, will be identified in the demonstration technical requirements.

9.1.3 MINNESOTA DEPARTMENT OF REVENUE

Revenue uses a system used to administer and process taxes. Due to the temporary and simulated nature of the proof of concept and demonstration, the use of the Revenue tax collection system for SM provider tax reporting will be simulated. The project team will work closely with Revenue during the demonstration to assess the effort and potential costs associated with modifying the tax collection system to receive and process DBUF Revenue Reports in a future program.

9.1.4 COMMUNICATIONS

The DBUF demonstration will require no new communications hardware, software or infrastructure, so long as existing communications are found to be stable, secure, and reliable. The expectation is that existing communications platforms used by all stakeholders fit this category, and that the transmission of data via these existing methods will not hinder existing agency operations or data limits. Each SM provider is expected to already transmit data using cellular 3G or 4G formats, which should prove adequate for the DBUF demonstration. Cellular coverage within the greater Minneapolis/St. Paul metropolitan area appears adequate and no additional communications hardware or infrastructure is anticipated to conduct the demonstration.

9.2 FACILITIES

While facilities will be required to host servers and other hardware (i.e., computers) required for storing, analyzing and interpreting DBUF-related data, no new facilities are anticipated or will be required. It is anticipated that stakeholders will conduct and operate DBUF-related systems from existing facilities. The DBUF demonstration does not reflect a change to any current operations and as such, no additional facilities are anticipated.

9.3 HARDWARE

9.3.1 VEHICLE ONBOARD EQUIPMENT

No new onboard hardware is anticipated for the demonstration. Hardware maintenance will be conducted using the same processes currently employed by the SM providers.

9.3.2 ACCOUNT MANAGEMENT SYSTEM

Based on the existing data collection, aggregation, and reporting capabilities within each of the SM providers, additional systems may be required to sanitize and aggregate the trip data, create and disseminate the reports, and support inquiries by MnDOT, Revenue, or the Humphrey School.

9.4 STAFF

The DBUF demonstration and initial proof of concept presents additional administrative burden on MnDOT for design, development, operations and evaluations efforts. MnDOT and other participating State agencies may utilize existing staff to undertake necessary duties, procure an implementation consultant(s), leverage partners such as the Humphrey School, or a combination of all to accomplish the necessary project tasks.

9.5 FUNDING NEEDS & OPPORTUNITIES

The demonstration is anticipated to be funded through a mix of state research funds, in-kind contributions (staff time, facilities, resources, etc.), and STSFA grant dollars. Additionally, the SM providers may also provide in-kind contributions to support the demonstration activities.

9.5.1 SURFACE TRANSPORTATION SYSTEM FUNDING ALTERNATIVES (STSFA) PROGRAM

The Fixing America's Surface Transportation (FAST) Act established the Surface Transportation System Funding Alternatives (STSFA) grant program to provide grants to states or groups of states to demonstrate user-based alternative revenue mechanisms that utilize a user fee structure to maintain the long-term solvency of the Highway Trust Fund. The objectives of the program are to:

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

Grant award recipients must provide a 50% match, and must address the following objectives:

- The implementation, interoperability, public acceptance, and other potential hurdles to the adoption of the user-based alternative revenue mechanism;
- The protection of personal privacy;
- The use of independent and private third-party vendors to collect fees and operate the user-based alternative revenue mechanism;
- Market-based congestion mitigation, if appropriate;
- Equity concerns, including the impacts of the user-based alternative revenue mechanism on differing income groups, various geographic areas, and the relative burdens on rural and urban drivers;
- Ease of compliance for different users of the transportation system; and

- The reliability and security of technology used to implement the user-based alternative revenue mechanism. [FAST Act § 6020(d)(1)]

Recipients may also address—

- The flexibility and choices of user alternative revenue mechanisms, including the ability of users to select from various technology and payment options;
- The cost of administering the user-based alternative revenue mechanism; and
- The ability of the administering entity to audit and enforce user compliance. [FAST Act § 6020(d)(2)]

In 2016, MnDOT was awarded a \$300,000.00 grant under the STSFA program to plan and design the proof-of-concept and demonstration. The award funds the design of a DBUF demonstration and conduct a proof of concept test.

In 2018, MnDOT was awarded an additional \$999,600.00 grant under the STSFA program to implement, operate and evaluate the DBUF demonstration.

9.6 OUTREACH & TRAINING

MnDOT, in cooperation with its partners, will conduct public and stakeholder outreach, education, and training. Each department will be responsible for training their staff with respect to changes that occur because of the demonstration. MnDOT will be responsible for conducting general outreach activities with the following agencies as needed to communicate project progress, related activities and to solicit required input.

- Legislature
- TAC
- SM Providers
- Public
- Media
- Professional Organizations
- FHWA

SM providers will generally be responsible for outreach to their customers but MnDOT will play a pivotal role in that they will develop outreach materials that SM providers can provide or reference in their direct communications with their customers. As part of this support, MnDOT will create a project website that provides comprehensive information about transportation funding and the demonstration project.

Outreach and training is expected to occur before the demonstration begins and will continue through the end of the project.

9.7 SUPPORTING POLICIES AND AGREEMENTS

Any information provided by SM providers that is considered proprietary will be held in trust by MnDOT and their partners and not shared outside of the research team. Non-disclosure agreements (NDAs), memorandums of understanding (MOUs), and data use agreements (DUAs) will be established as necessary to limit collection and use of any proprietary information. Additionally, Intergovernmental Agreements (IGAs) may be needed between state departments prior to launch of the demonstration.

10 FAILURE SCENARIOS

The failure scenarios presented in this section represent potential issues associated with the hardware and technology systems used for the DBUF demonstration. They represent system or subsystem failure scenarios and the potential impacts of those failures. Process failures are not covered in this section but should be evaluated as administrative processes are developed over the course of the demonstration. There are three overarching categories identified for failure: Vehicles, Account Management Systems, and Reporting. Details as to each failure scenario are provided below.

10.1 VEHICLE-ORIENTED FAILURE SCENARIOS

There are several vehicle-based scenarios which could pose failure. These failures would occur primarily due to malfunctioning hardware or software, and not necessarily user interaction. Telematics systems that use wireless communications to transmit data pose a risk of loss of communication failure. This will often be a temporary failure that will remedy once the vehicle reaches an area more conducive to cellular communication. The vehicle telematics systems should be equipped with sufficient electronic storage to collect trip data for a reasonable period of time prior to transmitting to a back-office system and clearing its storage. A minimum storage of up to one week of trips is recommended and additional storage for up to a month is highly preferred. If the SM provider has not received communication from a particular vehicle for a predetermined period of time, perhaps three days, they should have the ability to “ping” the vehicle (as long as it’s in service) to verify the system is communicating properly. Should the ping be unsuccessful, the user should be contacted to assist in correcting the issue.

A second source is the loss of communications to the vehicle data connection bus. Under this circumstance, recovery may be difficult, and mileage may need to be estimated based on odometer readings upon vehicle return.

Almost all failures can be mitigated to some extent by the payment of the fuel tax, with no credit given for fuel tax payments for those miles where reporting is questionable. For this reason, it is recommended that credit for the fuel tax paid be made when miles are reported, not when fuel is purchased.

10.2 ACCOUNT MANAGEMENT SYSTEM FAILURE SCENARIOS

Account management system failure scenarios are likely to be more serious to the integrity of the overall DBUF demonstration system, but they should be easier to quickly identify that the failure has occurred so that remedial action can be taken.

As with vehicle-oriented failure scenarios, loss of communication is a potential issue. This could be due to the failure of a data communications system used by, but not associated with, the SM provider. A second form would be failure within the account management system or network. In either case, if the vehicle telematics systems have sufficient storage, as outlined in the section above, recovery from either type of communication failure, provided it is not an unusually extended failure, should not be an issue.

As with any system that stores a significant amount of financial data, the potential for hacking will also exist for account management systems. For this reason, state-of-the-art safeguards should be in place to

prevent unauthorized access to account information. ISO 27001 provides recommended safeguards to maintain data integrity.

Loss of data could be a catastrophic failure. As with data security, state-of-the-art data backup, coupled with a robust Continuity of Operations (COOP) plan should be established to prevent data loss and support data restoration in the event of a catastrophic failure. SM providers should be required to provide safeguards from all types of data loss risk.

10.3 REPORTING FAILURE SCENARIOS

Reporting failure scenarios are a combination of the failure scenarios that could be associated with the vehicles and the SM provider account management systems (network outages, system failures, lack of data, etc.). If communications are lost for whatever reason with SM providers, the systems employed should have sufficient storage to accommodate large amounts of data. Once communications are restored, data transfer can resume.

Failures can also occur through breakdowns in the Revenue or MnDOT systems hardware and software. As with monitoring of administrative systems, regular auditing, with oversight by Revenue should occur.