



I-95 CORRIDOR COALITION  
**MILEAGE-BASED USER FEE STUDY**

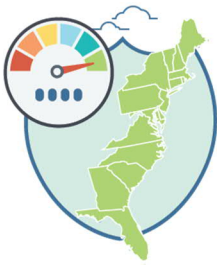
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# I-95 Corridor Coalition Mileage-Based User Fee Study Final Report

September 2019

Prepared by:



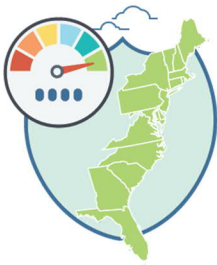


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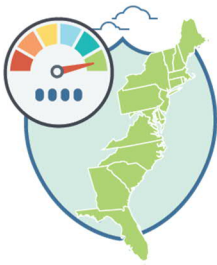
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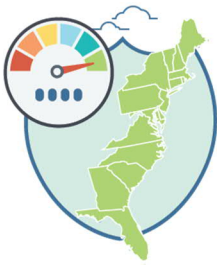
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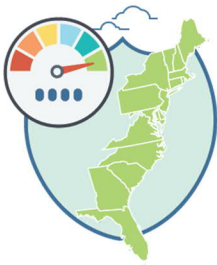
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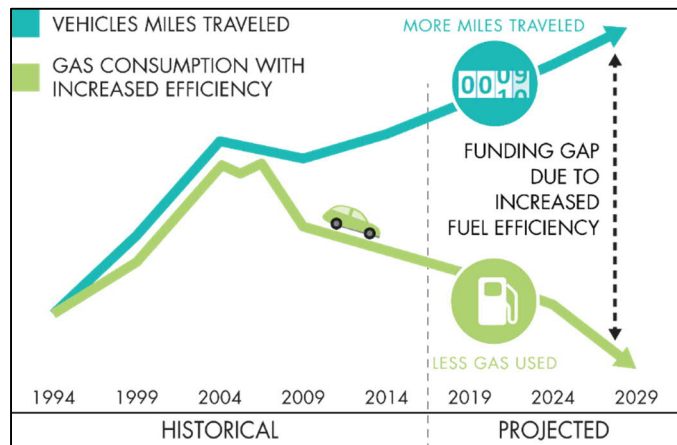
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

# Executive Summary

## Background

Funding for constructing, maintaining, and operating roadways and bridges along the eastern seaboard comes primarily from state and federal fuel taxes that are part of the transaction when purchasing gasoline or diesel fuel at the pump. The purchasing power of pay-at-the-pump fuel tax revenues has been eroding over the past two decades. This is a result of several factors, including: inflation, more fuel-efficient vehicles, and an increase in electric and hybrid vehicles.

The overall impact of these factors means that while the number of miles driven are expected to increase in the United States, fewer gallons of fuel will be sold, with a corresponding decrease in revenues from fuel taxes as illustrated in the graphic to the right. To address this decrease in revenue, new and sustainable methods of funding transportation need to be explored.

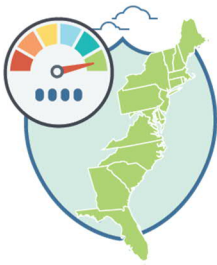


Increased Fuel Efficiency Results in Less Transportation Revenues

To ensure the voices of citizens along the I-95 Corridor are a part of this critical exploration, the I-95 Corridor Coalition, working through the Delaware Department of Transportation (DelDOT) as the lead state, submitted a Surface Transportation System Funding Alternatives grant application in May 2016 and was subsequently awarded a grant to explore the feasibility of replacing the fuel tax with a mileage-based user fee (MBUF) approach in a multi-state environment. The application addressed three major items: education and outreach, analysis of issues associated with an MBUF, and an MBUF-focused regional pilot.

## The I-95 Corridor Coalition MBUF Study Overview

The eastern seaboard possesses several unique characteristics that will likely impact any future approach for transportation funding – issues that have not been addressed in other MBUF explorations around the country. The overall vision for the study was to gain an understanding of the foundation necessary for a viable MBUF approach for funding transportation improvements that would enable a smooth transition from the current fuel tax to a more sustainable and user-based funding source.

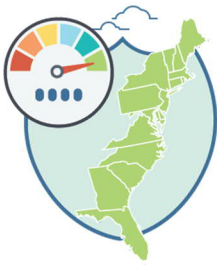


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The focus areas of the I-95 Corridor Coalition's efforts include:

- **Out of State Mileage** – A fundamental shift that an MBUF would create is linking transportation system revenue to the actual use of the roads versus where fuel was purchased. Currently, if a driver purchases a tank of gas in northern Delaware and then proceeds to cross the state line and mainly drive in Pennsylvania, only Delaware will receive gas tax revenue, with Pennsylvania roads accruing most of the mileage. Given the relatively small geographic size of many states in the mid-Atlantic and northeast regions, cross-state travel and the potential impact on transportation funding, are major issues and concerns for many state DOTs along the I-95 Corridor. To gain a better understanding of how a shift from fuel tax to an MBUF would affect DOT revenue, a regional pilot was conducted with participants from 13 east coast states who traveled up and down the eastern seaboard. Mileage by state was collected to determine the importance of out-of-state travel and interoperability. The study also included a high-level financial analysis comparing projected MBUF revenues when the MBUF is based on the driver's state of residence and when the MBUF is based on the state in which the miles are driven.
- **Tolling** – The approximately 3,000 miles of toll facilities along the eastern seaboard carry significant amounts of passenger car and commercial vehicle traffic. Therefore, it will be critical to maximize the interoperability and integration of toll roads, bridges, and tunnels with any future MBUF system. The Phase 1 effort started addressing these interoperability and integration issues, including the possibility of using tolling back offices for MBUF transaction processing, and the ability of MBUF technologies to also calculate existing tolls and accurately mimic toll collections.
- **Trucking** – The movement of freight within the I-95 Corridor is of national importance. Much of this truck traffic crosses multiple state lines, serving the numerous ports and distribution centers throughout the eastern seaboard. Although trucks account for 14 percent of vehicle miles traveled on the national highway system, the trucking industry currently covers approximately 45 percent of the Highway Trust Fund through the commercial truck diesel and gas tax and other trucking-specific excise taxes. It will therefore be critical to address commercial vehicles and bring the perspective of the trucking industry to the national evaluation of MBUF. The Coalition will conduct a multi-state truck pilot - the first in the nation - in Phase 2. How MBUF for commercial vehicles might be integrated into existing regulations (e.g., International Fuel Tax Agreement) will also be examined.
- **Amenities** – Another consideration in promoting public understanding and acceptance is to potentially "link" MBUF with driver amenities – services that can make owning / leasing and driving a car better. This pilot explored whether value-added amenities offered through MBUF technology could make MBUF more acceptable.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

The Coalition is committed to exploring MBUF in a multi-state environment and bringing solutions to the important national discussion about sustainable transportation funding. However, it is important to remember the following.

The I-95 Corridor Coalition and its members want to promote a better understanding of why investing in transportation is important, and why the current fuel tax does not provide a long-term and equitable solution in this regard. The Coalition, representing transportation agencies along the entire Eastern Seaboard, believes exploring the feasibility of a MBUF solution is important; for now, however, the Coalition and its partners are neutral if MBUF is the ultimate solution.

### The I-95 Corridor Coalition MBUF Study: Phase 1 Purpose

National experience has shown that experiencing a MBUF system first-hand through pilots can help expand public understanding and acceptance of the concept. The Phase 1 pilot was “focused” in that the participants – consisting of senior staff from departments of transportation, members and staff from state legislatures and the U.S. Congress, thought leaders from national organizations, local officials, representatives from the trucking industry, toll authorities, and the media – were actively recruited and invited. In this manner, the Phase 1 pilot itself was an important education and outreach effort.

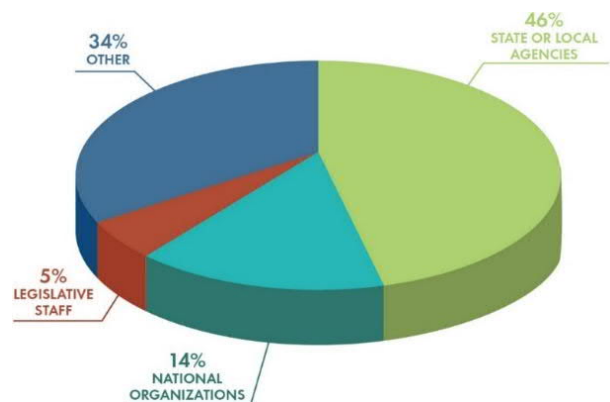
The purpose of the Phase 1 pilot was to start the conversation on the east coast about the feasibility of MBUF.

### Phase 1 Characteristics

#### Participants

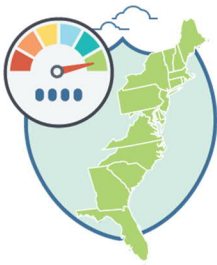
The Coalition, DelDOT and the Pennsylvania Department of Transportation were responsible for participant identification and recruitment for the Phase 1 pilot. Participants were recruited from 13 Coalition states and included people from departments of transportation, members and staff from state legislatures and the U.S. Congress, transportation thought leaders, local officials, representatives from the trucking industry, toll authorities, local media and national organizations.

Two hundred and seven people were recruited for the Phase 1 pilot, of which 155 enrolled and participated. The chart to the right shows the breakout of Phase 1 pilot participants by organization category. The “other” category includes residents, transportation consultants, Coalition members and other private companies.



#### Vehicle Types

The Phase 1 pilot vehicles were all light-duty and were either gasoline powered or hybrid vehicles.



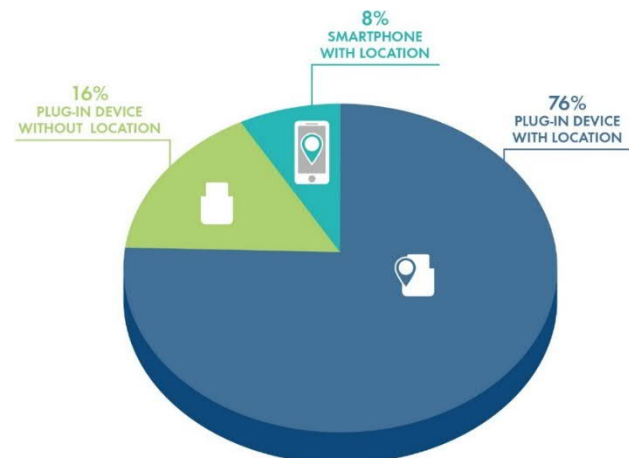
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### Mileage Reporting Options and Technologies

Three mileage reporting options were available for the Phase 1 pilot including two devices that plug directly into the vehicle's on-board diagnostic (OBD-II) port and one device that works through an Android smartphone app paired with a credit-card sized device that stayed in the vehicle.

The following is a summary of the three options provided:

- **Plug-In Device with Location:** A device designed to plug in to the vehicle's OBD-II port that automatically calculates the MBUF based on the state(s) where miles were actually driven. The device collects mileage data and gas consumption data directly from the vehicle's computer, with the location of the miles driven derived from a global positioning system (GPS) chip.
- **Plug-In Device without Location:** A device designed to plug in to the vehicle's OBD-II port that automatically calculates the MBUF based on estimates of the state(s) where miles are driven. The device collects mileage data and gas consumption data directly from the vehicle's computer. This mileage and gas information is distributed between the home state and adjacent states based on 2010 census statistics coupled with the assumption that most out-of-state mileage has an origin or destination in adjoining states.
- **pre-established assumptions about the percentage of in-state and out-of-state travel.** The non-location MBUF reduces privacy concerns regarding trip data but does not provide an accurate connection between the funds collected and where the miles were accrued. Not having the location technology also limits the number of value-added amenities available.
- **Smartphone with Location (Android phones only):** An app downloaded on the participant's smartphone that works with a credit card-sized device (beacon) to automatically calculate the MBUF. The app uses the phone's GPS to measure mileage and record the state(s) where miles are driven.



As show in the graphic to the right, of the 155 participants, 84 percent chose location-based technology.





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### Value-Added Amenities

Vehicle technology and driver interest in data potentially create an opportunity to change how transportation is funded. An example of the changing landscape is the growing market for devices that use information stored in a vehicle's computer (or collected by the device) and convert these data into information for drivers. These "value-added" amenities – one of the four key focus areas of the Coalition MBUF effort – were offered to Phase 1 pilot participant to assess the interest in vehicle and driving behavior information. Available amenities included trip logs, vehicle health monitoring, battery voltage monitoring, driver scoring, and "safe zones."

### Participant Activities

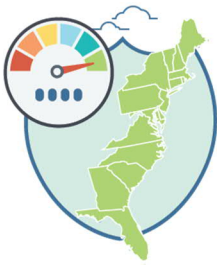
Pilot participants were asked to perform several activities before, during, and after the pilot as shown in the graphic on the following page.



Summary of participant activities

### Mileage Recording and MBUF Calculations

Mileage recording and MBUF calculations, along with collecting the amount of gas used and the corresponding credit, was done automatically by Azuga, the vendor selected to provide mileage reporting hardware and account management support. The driver had no responsibility in this regard



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other than plugging the device into the OBD-II port at the beginning of the pilot, or – for participants using the smartphone approach – to turn the app on prior to starting a trip.

All mileage driven and recorded during the Phase 1 focused regional pilot was charged the MBUF (less credit for the estimated gas tax) as follows:

- For vehicles that used a location-based approach, all mileage was differentiated by the state where the mileage occurred, with each state's MBUF rate (derived from each state's gas tax) applied to the mileage driven in each state..
- For vehicles that used a non-location-based approach, a specified percentage of mileage and gas tax payments was assumed to have occurred in the vehicle's home state, and the MBUF was calculated using that state's per-mile rate and state gas tax. The remaining percentage of the vehicle's mileage was assumed to have occurred out of the home state, with an average per-mile charge and average gas tax for all out-of-state mileage based on the per-mile rates and state gas taxes in nearby states. These percentages were based on census statistics, coupled with the assumption that most out of state mileage has an origin or destination in adjoining states.

### Pilot Survey Results

Two participant surveys were administered electronically over the course of the pilot.

- Initial Survey: This survey was administered at the beginning of the pilot after participants enrolled and installed their devices. The survey focused on capturing participants' attitudes about the enrollment and onboarding processes, as well as their baseline attitudes about an MBUF and knowledge of transportation funding.
- Final Pilot Survey: This survey was administered after the pilot was completed and focused on pilot activities, such as the participants' understanding of and reaction to their first invoice, what participants thought about the accuracy of the data collected, participants' overall experience, changes in driving behavior, and their experience with the account manager. It also provided a final update on attitudes about an MBUF.





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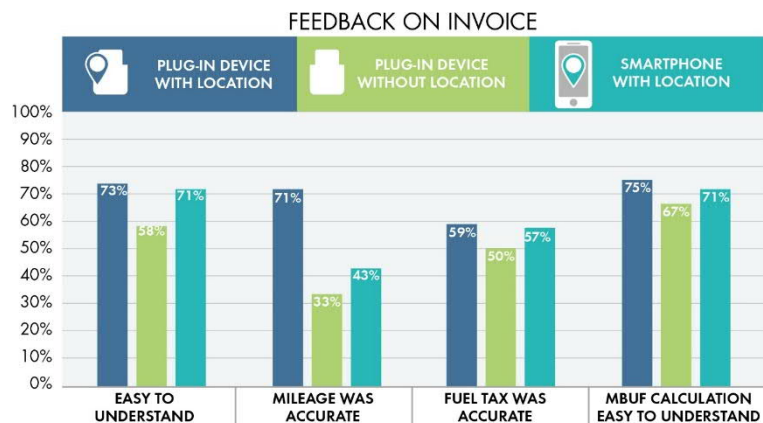
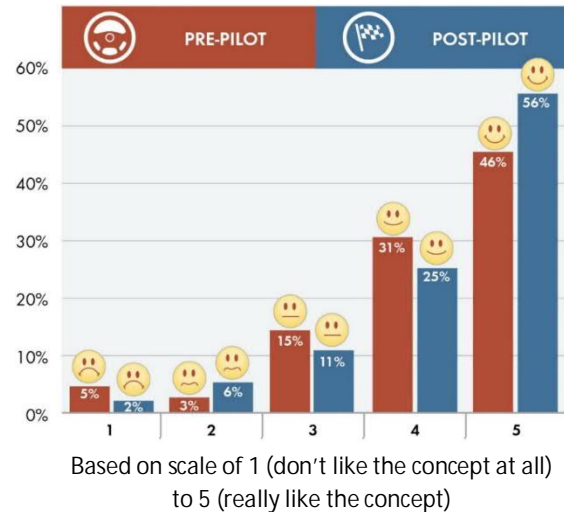
## Participant Awareness and Perceptions

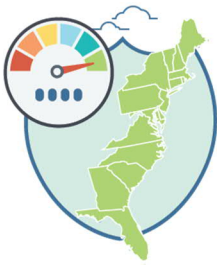
Pilots have shown to be an excellent mechanism to help people understand the MBUF concept. As shown in the graph to the right, participating in the Phase 1 Pilot increased participants' opinions of an MBUF with 75 percent liking the concept at the beginning of the pilot and 80 percent at the end. Ninety-four percent of participants support doing more research on MBUF and most participants (more than 90 percent) indicated they would participate in another pilot program.

Overall, the participant survey results showed overall satisfaction with the Phase 1 Pilot was very high (90 percent), with the level of satisfaction increasing over the course of the pilot. The average ranking was 4.5 on a scale of 1 to 5, with 5 being very satisfied.

Pilot participants also had an increased awareness of how much they pay in state gas taxes. In the pre-pilot survey, when asked how much they thought they paid in state gas tax each month, participants' answers ranged from \$1 to \$500. The monthly MBUF invoices showed the estimated amount of state gas tax paid, with the average amount of state gas tax paid during the pilot being approximately \$14 for each participant. The post-pilot survey indicated that 31 percent of participants thought they actually paid more in state gas taxes, with 7 percent thinking they paid less.

Of those surveyed, 25 to 30 percent of the participants did not find the invoices and the associated MBUF calculations easy to understand. A redesign of the invoice format may be necessary for future pilots where all costs are shown – gas, federal gas tax, state gas tax, and MBUF – to provide a complete picture of costs. The monthly invoice may also provide additional information on how the fuel usage and associated costs are calculated.





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The graphic on the right shows the overall survey feedback on the mileage reporting options. Participants who chose plug-in device options – with and without location – had the highest levels of satisfaction in all categories. Over 90 percent of participants who chose the plug-in device with location would not switch mileage reporting options, compared to 57 percent who chose the Smartphone app. In fact, less than half of Smartphone app participants believed this option was a good choice, with nearly 60 percent experiencing some sort of technical issues. This finding suggests that the Smartphone option may not be the best technical option at this time due to the reliance on participants taking action for the approach to be viable. The survey results also revealed the top reasons participants chose the “plug-in device with location” mileage reporting option: ease of installation (96 percent), use of GPS (86 percent), and data accuracy (75 percent).

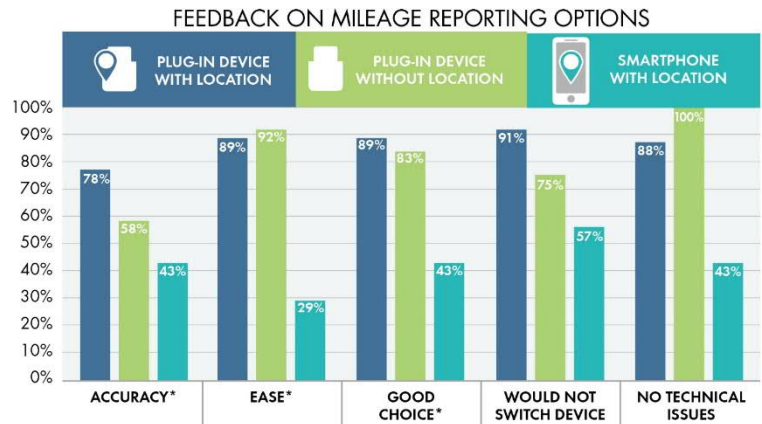


Chart shows ratings of 4 or higher with scale of 1 (strongly disagree) to 5 (strongly agree)

### Value-Added Amenities and Driver Services

Value-added amenities are a key focus area of the Coalition’s work in the context that such additional services may function as the “spoonful of sugar” that could help in a transition to MBUF. Phase 1 Pilot amenities included: trip logs, vehicle health monitoring, battery voltage monitoring, driver scoring, and “safe zones”. Such amenities could increase acceptance of the MBUF approach. However, as shown in the graphic below, there were mixed reactions to the usefulness of the value-added amenities. Of the amenities offered, participants valued those for vehicle and battery health the most. Overall the usage of the value-added amenities was low with very few participants even used the “safe zone” feature. One conclusion is that they participants were not fully aware of these amenities and how they

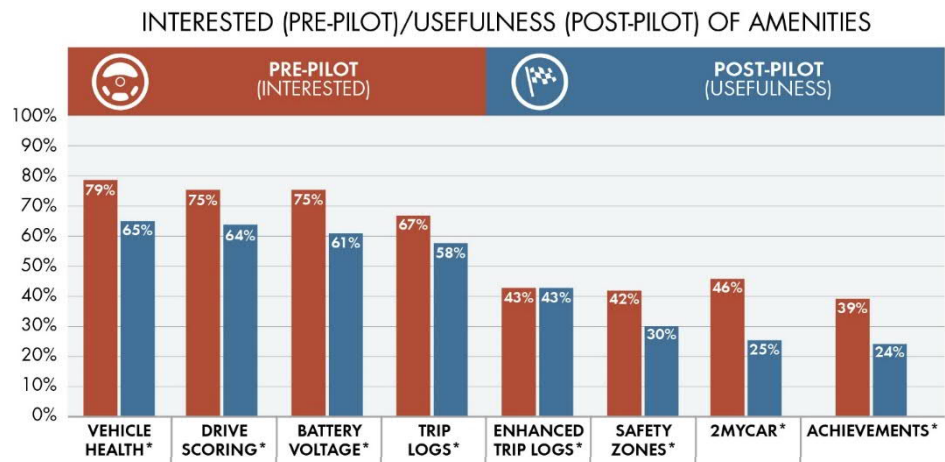
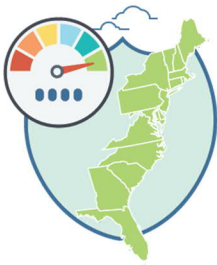


Chart shows ratings of 4 or higher, (Pre-Pilot: 1 - Not at all interested to 5 -Very interested, Post-Pilot: 1 - Not at all useful to 5 -Very useful). Percentages are based on availability of amenity given mileage reporting option selected.



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worked. A solution to implement in future pilot is to provide additional information about the value-added amenities and reminders during the pilot to log in to one's account.

### Privacy Protection and Data Security

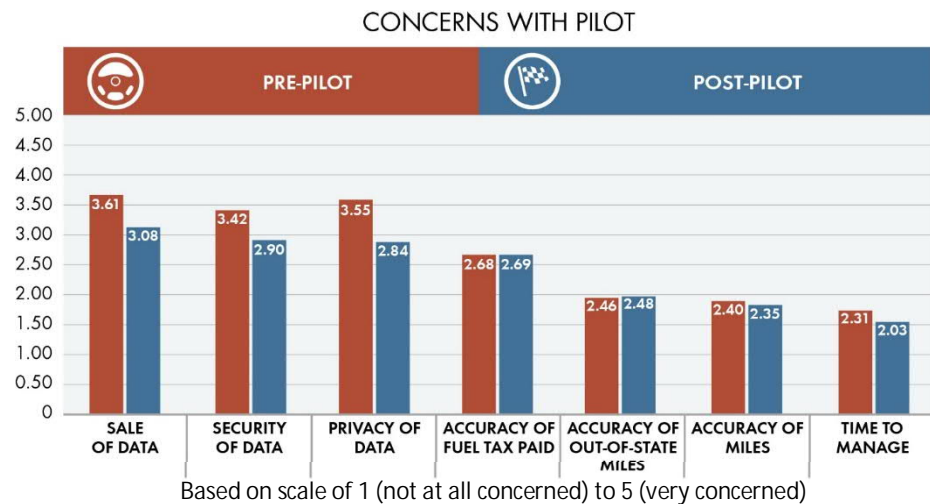
Privacy and data security are typically raised as major barriers to an MBUF approach. Of the range of data concerns, the sale of data was a major concern of participants and was the only concern that had an average ranking over 3 (with 5 being very concerned) at the end of the pilot. A key finding of the survey was the

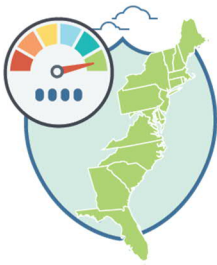
revelation that participation in the pilot helped reduce data concerns. The rating of "privacy of my personal data" as a high concern from the surveys dropped from 57 percent to 30 percent of the participants over the course of the pilot. Concern with the "security of data" also dropped as a result of the pilot experience but remained a one of the top three. Participant concerns with data accuracy were consistently lower than the sale, security and privacy of data suggesting some comfort with the MBUF technology.

### Equity and Fairness Perspectives

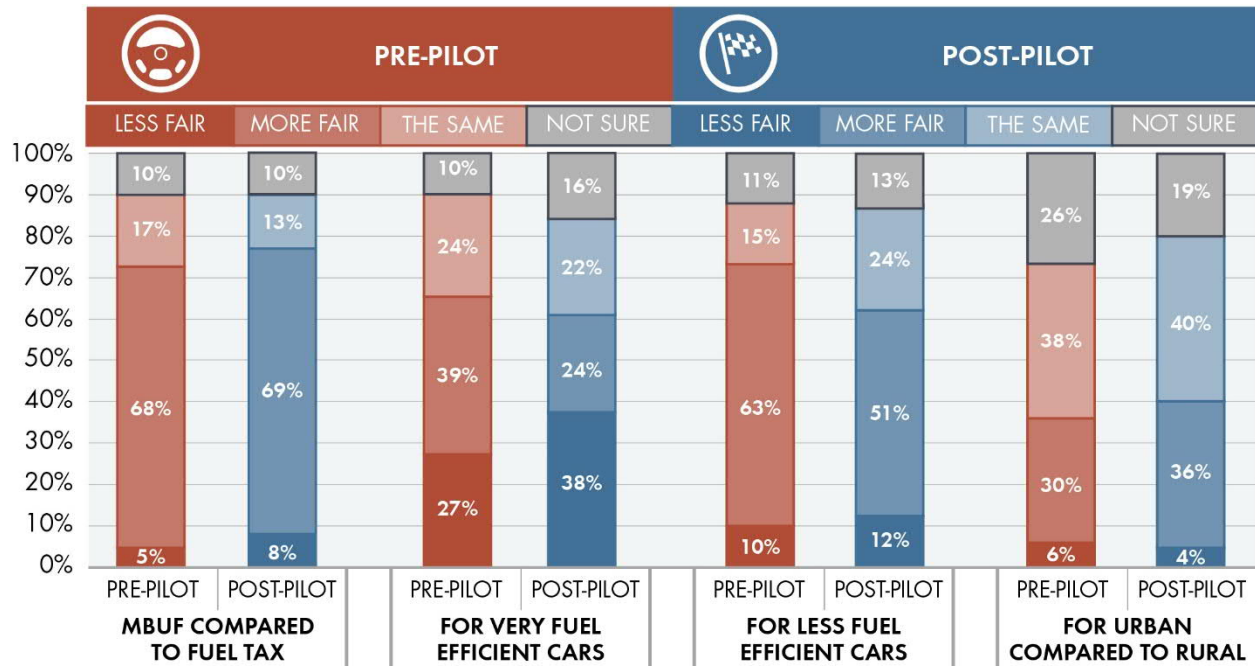
A question surrounding MBUF is how an MBUF system would affect different populations (e.g., rural vs. urban or owners of fuel-efficient vehicles). Over the course of the pilot, participant thoughts on the fairness of an MBUF changed especially with regards to very fuel-efficient vehicles, specifically:

- The number of people who believed MBUF was less fair for very fuel-efficient cars increased from 27 percent at the beginning of the pilot to 38 percent.
- The number of people who believed that an MBUF was fairer for very fuel-efficient cars decreased from 39 percent at the beginning of the pilot to 24 percent.





# I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

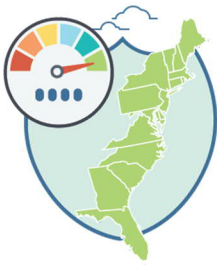


## Education and Outreach Activities

The importance of education and outreach cannot be overstated. The lack of understanding of drivers about the infrastructure funding needs and the long-term issues with the fuel tax could pose one of the greatest hurdles to solving the transportation funding issue.

Based on the Coalition's and project team's previous experience and lessons learned from other states investigating the feasibility of an MBUF, it was recognized how critical it is to understand public values, beliefs, and priorities around transportation, and then create an MBUF education and outreach campaign and materials with these considerations in mind.

Education and outreach were major components of the study, with efforts to inform people about the need to establish a sustainable and equitable transportation funding approach as well as the MBUF concept. Key target audiences for these efforts included decision-makers such as legislators other elected officials, DOTs, DMVs, tolling agencies, interest groups (e.g., trucking associations, AAA), and the public in states within the study area. The following techniques and materials were developed:



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### Communicating with Participants

A [website](#) included a project overview, information about the current fuel tax funding system, information from other MBUF studies, frequently asked questions, news articles about the study, a calculator for users to see what they could pay under an MBUF system as compared to the current fuel tax, and fact sheets about the study. In addition, the website was used to share information with participants.



Sample Webpage from Project Website

The Coalition also developed a more than three-minute [video](#) briefly describing the describing the need for a sustainable funding approach for transportation, the MBUF concept, the results of the Phase 1 pilot, and setting the stage of future phases of the Coalition's work.

Members of the Coalition also did a number of presentations during the study, sharing general information on the issues with the current fuel tax funding system, the concept of MBUF, and the study that was underway.

## Pilot Findings/Results

### Privacy

Studies and surveys have identified privacy concerns as one of the participants' key objections to a MBUF system (or any system requiring personal data). A related concern is the security of the data that are collected. The Phase 1 effort reviewed numerous studies and surveys regarding privacy. This included the European Union's (EU) General Data Protection Regulation (GDPR), which was adopted in mid-2016 and went into effect on May 25, 2018. (While the US has enacted privacy rules in areas such as health care, it has never passed an overarching data-protection law at the federal level.). A more robust explanation on privacy concerns can be found in a [tech memo](#) on the pilot's website.

### Administration and Compliance

Another MBUF issue often identified involves the additional costs, potential bureaucracy, and enforcement requirements associated with administering an MBUF system relative to the fuel tax. To help understand the administrative requirements, it is helpful to understand how a mandated MBUF might function. It is envisioned that the private sector will play a lead role in developing and managing an MBUF system. This includes commercial account managers (CAMs) – private entities that provide technology-based approaches for MBUF along with other driver services and amenities. There will also likely be a state account manager (SAM) that provides manual approaches





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

such as an annual time permit (for unlimited mileage) and manual odometer readings (as part of a mandated safety inspection and/or emissions testing program). The SAM would accommodate those individuals that do not want a technology-based approach (as provided by CAMS), as well as those individuals who do not have credit cards or bank accounts, or have poor credit, resulting in a CAM not supporting them as a customer.

As part of the project, a high-level financial analysis was performed comparing MBUF revenues and costs relative to the current fuel tax system. Two analyses were performed – one for Delaware and one for Pennsylvania (the two states providing match funding for Phase 1). More information on administration and compliance can be found in a [tech memo](#) on the pilot's website.

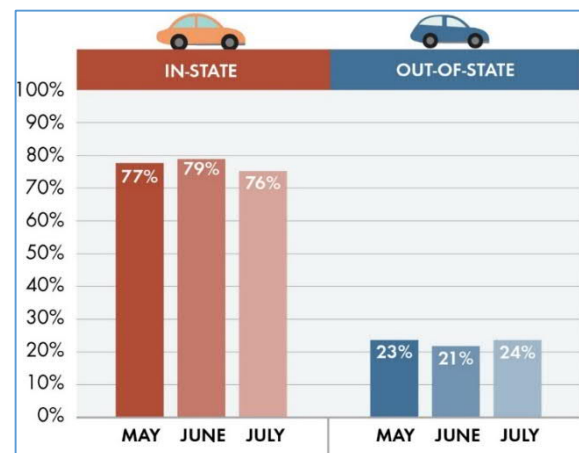
### Equity

The MBUF concept is based on the “user pays” principle whereby those who use the transportation network pay an amount proportional to how much they use it. Fairness and equity issues are frequently raised with respect to how an MBUF is applied across different population and demographic groups. Some areas of concern include drivers with longer commutes, income differences, vehicle type, differences in fuel efficiency, and urban-rural concerns. More information on equity concerns are available in a [tech memo](#) on the pilot's website.

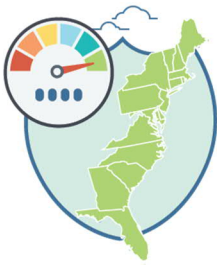
### Out-of-State Mileage

This pilot was the first to fully address the issue of out-of-state travel under a MBUF system and the potential impact on transportation funding, including charging for out of state mileage. This was one of the key focus areas of this I95 Corridor Coalition MBUF study given the significant amount of cross state travel that occurs along the eastern seaboard. The Phase 1 Pilot fully demonstrated why it is so critical to address out of state mileage in any MBUF system along the eastern seaboard – of the 459,448 total miles driven during the pilot, more than 20 percent were outside the participant's home state.

The Phase 1 Pilot did demonstrate that such an approach for distributing MBUF between states for drivers who do not use a location-based approach is valid. What is necessary are more accurate percentages reflecting out of state mileage – information that could be obtained and regularly updated using MBUF data from a significantly large (and statistically accurate) number of participants in a mandated system; and assuming that most of these drivers would be using location-based technologies to record mileage. More information on out-of-state mileage can be found in a [tech memo](#) on the pilot's website.



Out-of-State Mileage by Month (Location-Based Approaches)

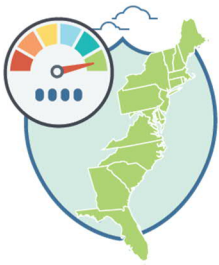


## I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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### Summary

The I-95 Corridor Coalition Pilot successfully started the conversation on the east coast about the feasibility of MBUF. As the first MBUF pilot along the eastern seaboard, the “east coast voice” was brought into to the national MBUF discussion. The pilot was the first in the nation to dive deeply into the unique challenges of managing out-of-state mileage, approaches to the associated interstate transfer of MBUF funds, and interoperability with toll facilities. It also provided an opportunity for key stakeholders – both within the Corridor and nationally – to gain a first-hand understanding of how MBUF could work and reduce some of the concerns that individuals and the public at large may have regarding this concept. The pilot, along with the various Phase 1 analyses, addressed each of the project goals and potential MBUF issues, including privacy and data security, equity and fairness, and administration needs and the associated costs.



# I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

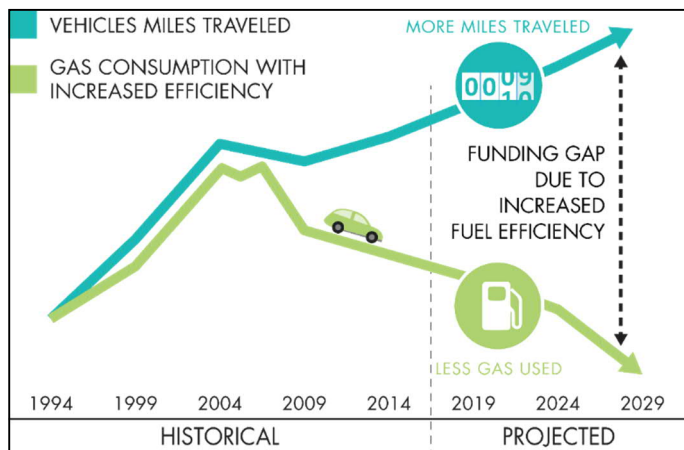
## 1 Background

Funding for constructing, maintaining, and operating the non-tolled roadways and bridges along the eastern seaboard comes primarily from state and federal fuel taxes<sup>1</sup> that are part of the transaction when purchasing gasoline or diesel fuel at the pump. The purchasing power of pay-at-the-pump gas tax revenues has been eroding over the past two decades; a combined result of several factors, including:

- Inflation. The federal fuel tax – 18.4 cents per gallon for gas, and 24.4 cents per gallon for diesel fuel – was last raised in 1993. At the same time, highway construction costs have more than doubled (a 131 percent increase) over the last 25 years.
- More fuel-efficient vehicles. The average fuel efficiency of cars bought each year in the United States has been increasing over the past decade. This increase is due in part to sales of more fuel-efficient vehicles in accordance with the Corporate Average Fuel Economy (CAFE) standards<sup>2</sup>.
- Changing fleet composition. Plug-in electric vehicles (PEV)<sup>3</sup> pay little or no gas tax. As such, they contribute only a small fraction of the overall cost of roadway maintenance and operations. The number of such vehicles currently using the roadways is relatively low, but the PEV market share of new vehicles sold annually has been rapidly growing, with expectations that these vehicles will become more ubiquitous along the nation's roadways in the future.

The overall impact of all the factors noted above is that while the number of miles driven are expected to increase in the United States, fewer gallons of fuel will be sold, with a corresponding decrease in revenues from fuel taxes as shown on Figure 1-1. As an example, in almost every year since 2001, spending from the federal Highway Trust Fund (HTF) has exceeded the annual revenues from the federal fuel taxes. To help cover those shortfalls, the fund has received \$144 billion in

Figure 1-1: Increased Fuel Efficiency Results in Less Transportation Revenues



<sup>1</sup> The term “fuel tax” is primarily used throughout this document to identify the current per-gallon tax paid at the pump for either gas (as used by internal combustion engine [ICE] vehicles) or diesel (as used by some light duty vehicles and most trucks). Nearly all of the vehicles in the pilot were ICE using gas. Accordingly, the term “gas tax” is used in places when related directly to the pilot.

<sup>2</sup> The CAFE standards are an average 54.5 miles per gallon (MPG) for vehicle fleets in 2025. However, the current administration has developed a new rule proposing to maintain the existing fuel economy standard (37 MPG by 2020) and then freeze it at that level.

<sup>3</sup> The PEV category includes electric vehicles (EV) – consisting of battery electric vehicles (BEV) and hydrogen fuel cell electric vehicles (FCEV) – and plug-in hybrid electric vehicles (PHEV) – which can run on either gas or electric.





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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transfers, primarily from the Treasury's general fund. The Congressional Budget Office projects that under current law, the HTF will be exhausted by 2022. Sustaining it will require continued transfers from the general fund, reduced spending on highways and transit programs, increases in existing taxes on highway users, new taxes credited to the fund, or some combination of those approaches.

### 1.1 Section 6020 of FAST Act

Recognizing the concerns with the fuel tax as a long-term sustainable funding source for transportation, the U.S. Congress established the Surface Transportation System Funding Alternatives (STSFA) Program under Section 6020 of the Fixing America's Surface Transportation Act (FAST Act) passed in 2015. The STSFA Program authorized up to \$95 million in federal grant dollars over a 5-year period. The purpose of the STSFA program is to provide grants to state departments of transportation—with a 50 percent match requirement—to conduct demonstration projects that explore user-based alternative revenue mechanisms. Mileage-based user fees (MBUF) is one example. The goal of these projects is to assess potential approaches that can help maintain the long-term solvency of the federal HTF. The goals associated with the STSFA funding include:

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

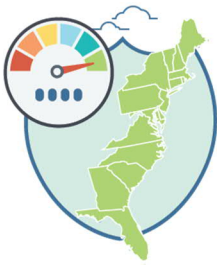
#### 1.1.1 STSFA Grant Process

To ensure the voices of citizens along the I-95 Corridor are a part of the critical national discussion of how to establish a sustainable and equitable transportation funding approach, the I-95 Corridor Coalition, working through the Delaware Department of Transportation (DelDOT) as the lead state, submitted a STSFA application in May 2016<sup>4</sup> and was subsequently awarded a grant to explore the feasibility of replacing the fuel tax with a MBUF approach in a multi-state environment. The application addressed three major items:

- Education and Outreach
- Analysis of Issues Associated with MBUF
- MBUF Focused Regional Pilot

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<sup>4</sup> In response to the Federal Highway Administration (FHWA) Notice of Funding Opportunity (NOFO) DTFH6116RA00013.



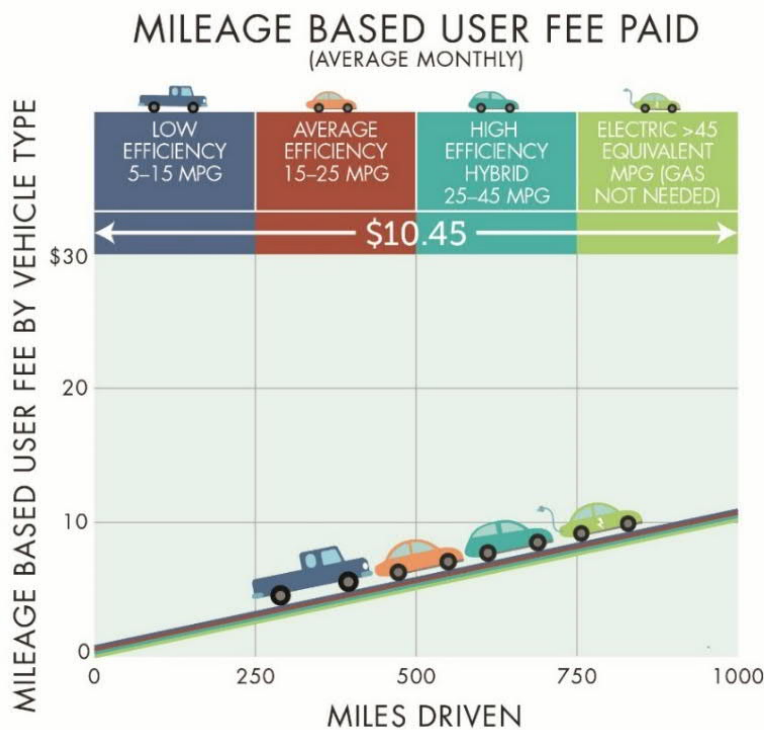
# I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

## 1.2 Overview of MBUF as a Transportation Funding Alternative

MBUF charges motorists a fee for their road use based on miles driven rather than fuel consumed. As shown on Figure 1-2, under the simplest application of MBUF – with a single per mile rate applied to all vehicle types – all drivers pay an equal amount for the same miles traveled, which captures revenue not currently being collected under the gas tax. As concluded by the National Surface Transportation Infrastructure Financing Commission in 2009 and stated in their Final Report<sup>5</sup>: “The most viable approach to efficiently fund investment in surface transportation in the medium to long run will be a user charge system based more directly on miles driven rather than indirectly on fuel consumed.”

Figure 1-2. Average Monthly MBUF Paid by Vehicles with Different Fuel Efficiencies

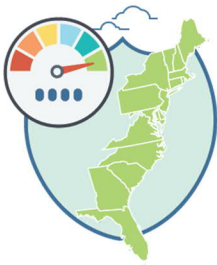
Values Based on a Single Revenue-Neutral Rate for Delaware



### 1.2.1 MBUF System Functions and Processes

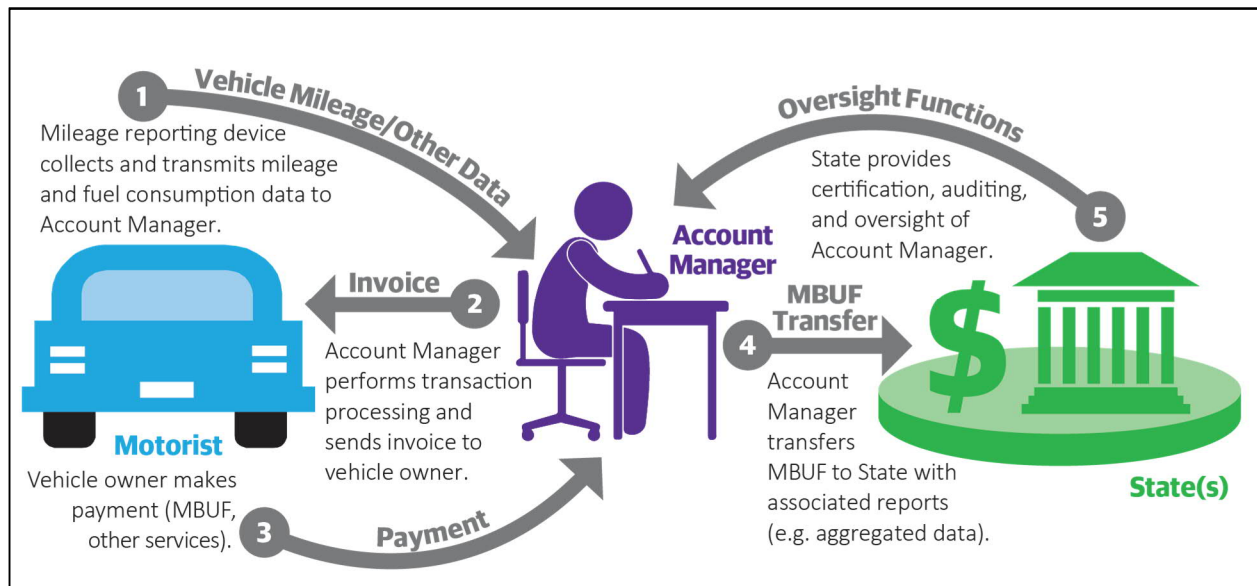
Figure 1-3 illustrates the basic concepts, functions, and participants of a likely MBUF system, including the following major components and processes.

<sup>5</sup> “Paying Our Way – A New Framework for Transportation Finance;” 2009; [www.itif.org/files/NSTIF\\_Commission\\_Final\\_Report.pdf](http://www.itif.org/files/NSTIF_Commission_Final_Report.pdf)



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 1-3. MBUF Charging Activities and Functions



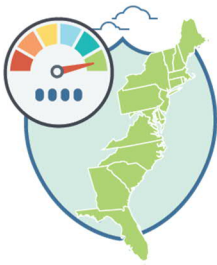
### Data Collection and Reporting

The MBUF system would likely provide multiple approaches—both automated (using technology) and manual (e.g., as part of an annual vehicle inspection process, flat fee as part of vehicle registration)—for collecting and reporting mileage and other data. It is assumed that most data collection and reporting functions will likely involve technology-based solutions, wherein a device and/or in-vehicle software automatically records the vehicle identification number (VIN), measures the miles traveled, and calculates (or otherwise estimates) the fuel usage. Location and routing data may also be collected to support other in-vehicle and driver-oriented services, as well as being used to differentiate mileage by the state where the miles were driven. Information on locations, dates and times will also be important for collecting tolls in some instances. This information would be transmitted to the MBUF account manager through wireless communications (“1” as identified in Figure 1-3).

### Account Management

This system feature encompasses several functions and activities starting with “transaction processing”—transforming the transmitted vehicle data into a per-mile charge through calculating and applying the appropriate fee per mile and any applicable fuel tax credits. Transaction processing may also involve using location data to allocate mileage by state or other jurisdiction where the driving occurred, and potentially to charge tolls. Other account management administrative functions include setting up accounts for payers and their respective vehicles, issuing invoices and statements (“2” in Figure 1-3), receiving payments<sup>6</sup> (“3” in Figure 1-3), managing accounts receivables, transmitting collected monies to the state treasury (“4” in Figure 1-3), and providing customer service activities and

<sup>6</sup> All payments in the I-95 Corridor Coalition MBUF pilots are simulated. No actual funds are transferred.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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supporting audit activities. The account management functions may be provided by a government or private entity, or some combination thereof.

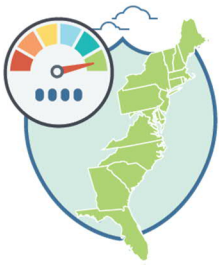
### System Administration and Accounting

This activity focuses on financial collection and accounting, with the primary goal that all MBUF funds—as paid by the vehicle owners or lessees—make their way into the states' treasuries. This also includes managing and reconciling any fund transfers associated with out-of-state mileage and toll collection. The state government entity (e.g., finance) receives account information and funds from the account managers ("4" in Figure 1-3). The state also provides oversight of account managers ("5" in Figure 1-3). These oversight and administrative activities may include performing auditing and reconciliation functions, ensuring that the MBUF payments are ultimately provided to the state, and certifying private entity account managers and their MBUF hardware and systems. Other system administration activities will include compliance and enforcement.

## 1.3 Overview of Document

Throughout the document, reference is made to "Phase 1" – the work done as part of the 2016 STSFA grant award, and the focus of this Final Report. "Phase 2" refers to the work currently being done under the 2017 STSFA grant award, and "Phase 3" refers to the planned work under the 2018 STSFA award. Following this initial "Background" Section, the report contains the following sections:

- Section 2, Overview of I-95 Corridor Coalition, Study Goals, and MBUF Issues, briefly discusses the I-95 Corridor Coalition and its mission. It also describes the Phase 1 project vision, goals, and objectives. Unique attributes of the Coalition states as they relate to MBUF, including out-of-state travel and tolling (i.e., focus areas), are discussed, along with other important MBUF issues that were analyzed during the Phase 1 project.
- Section 3, Education and Outreach Activities, describes the education and outreach activities used throughout Phase 1.
- Section 4, Overview of Phase I Pilot, describes the purpose of the pilot as well as the processes and activities that led up to the operational pilot. It describes the data that were collected and analyzed, and addresses participant recruitment information along with participant statistics.
- Section 5, Pilot Results and Lessons Learned, presents the results of the pilot study addressing the three project goals, focus areas, and the lessons learned.
- Section 6, Next Steps, identifies next steps for the I-95 Corridor Coalition MBUF Study based on the lessons learned and issues and policies that still need to be addressed.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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## 2 Overview of I-95 Corridor Coalition, Study Goals, and MBUF Issues

### 2.1 Coalition Organization and Mission

The I-95 Corridor Coalition is a partnership of transportation agencies, toll authorities, public safety, and related organizations, from the State of Maine to the State of Florida (Figure 2-1), with affiliate members in Canada. At the time of the Phase 1 STSFA grant, the I-95 Corridor Coalition included the following 16 states plus the District of Columbia: Connecticut, Delaware, District of Columbia, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, and Virginia. Member agencies include all the state departments of transportation (DOTs), the major toll and turnpike authorities within the corridor, and various agencies of the U.S. Department of Transportation (USDOT) (including the FHWA). Affiliate members include many of the metropolitan planning organizations and transportation planning boards in the corridor plus several other regional and national organizations (e.g., TRANSCOM, American Association of Motor Vehicle Administrators [AAMVA], E-Zpass Interagency Group, International Bridge Tunnel and Turnpike Association [IBTTA], Intelligent Transportation Systems [ITS] America, and the American Trucking Association [ATA]).<sup>7</sup>

Figure 2-1. I-95 Corridor Coalition States



These 16 states (and the District of Columbia) form a massive economic driver for the United States. If the Coalition region were a separate country, it would constitute the third largest economy in the world. Some of the key population and economic statistics for the I-95 Corridor Coalition as a whole are summarized in Table 2-1.

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<sup>7</sup> A complete list of Coalition members may be found at <http://i95coalition.org/the-coalition-2/member-agencies-2/>.





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 2-1. Summary of I-95 Corridor Coalition Population, Economic, and Transportation Statistics

Category	Statistic
Population	113.2 million—37 percent of the United States' population
Population Density	280 people per square mile—more than three times more densely populated than the United States as a whole
Employment	64 million people—38 percent of all United States' jobs
GDP	\$ 5.644 trillion—nearly 40 percent of United States gross domestic product
Roadway Mileage	12,058 interstate miles – 26 percent of national interstate network 907,000 total road miles – 23 percent of the national network
Vehicle Traffic Flow	Average daily traffic more than 72,000 vehicles, peak daily traffic over 300,000 35 percent of nation's vehicle miles traveled (VMT)
Rail and Transit	1,111 heavy-rail directional route-miles (70 percent of the national total) 4,356 commuter rail directional route-miles (62 percent of the national total)
Freight Movement	5.3 billion tons of freight shipments annually 46 major seaports – \$172 billion (34% of U.S. total) imported through these seaports

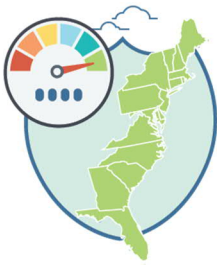
Source: I-95 Corridor Coalition Website<sup>8</sup> - Data from 2008

The Coalition region's economy depends on the efficiency of its transportation system—the ability to move people and goods quickly, cost-effectively, and reliably. Even with the Corridor's impressive rail and transit assets, most of which are used at or near capacity during peak periods, the Coalition region's highways are highly congested, especially in the 29 major urban areas within the Coalition region. As a result, the various state DOTs, transportation authorities, and local agencies within the Corridor have implemented and continue to expand upon a variety of transportation systems management and operations strategies and the supporting technologies. These agencies are also faced with the maintenance and rehabilitation of an aging roadway infrastructure.

Reliable transportation infrastructure is vital to the region's continued economic prosperity and quality of life. Continued funding for operating, maintaining, and expanding this critical transportation network requires an adequate and sustainable funding method.

The I-95 Corridor Coalition provides a forum for key decision makers to address transportation management and funding issues of common interest. This volunteer, consensus-driven organization enables its many state, local, and regional member agencies to work together to improve transportation system performance far more than they could working individually. The Coalition has

<sup>8</sup><https://i95coalition.org/>



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

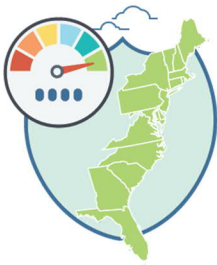
successfully served as a model for multi-state/jurisdictional interagency cooperation and coordination for over two decades.

### 2.2 The I-95 Corridor Coalition MBUF Study Vision, Goals, and Objectives

The overall vision for the study, as defined in the grant application, was to gain an understanding of the foundation necessary for a viable MBUF approach for funding transportation improvements that would enable a smooth transition from the current gas tax to a more sustainable and user-based funding source. Moreover, this vision is placed in the context of a multi-state environment and the unique attributes of the eastern seaboard. The goals and objectives of the I-95 Corridor Coalition's STSFA efforts are identified in Table 2-2. Table 2-2 also identifies related activities associated with each goal, including the key focus areas of the project listed in Table 2-3 (and bolded in Table 2-2).

Table 2-2. Project Goals and Objectives

Goals	Objectives	Actions
Address regional issues necessary for national adoption and implementation of MBUF.	<ul style="list-style-type: none"> <li>Create a low-risk environment to address cross state-issues.</li> <li>Balance the unique needs of each state within a multi-state framework, including MBUF administrative issues and concerns.</li> </ul>	<ul style="list-style-type: none"> <li>Address and evaluate MBUF technologies and approaches to managing of out-of-state mileage.</li> <li>Develop a financial tool that each state can use to address alternative per-mile rate structures and administrative and compliance costs for MBUF relative to the current gas tax.</li> </ul>
Increase public awareness of funding issues and assess the acceptance of MBUF.	<ul style="list-style-type: none"> <li>Educate the public about transportation revenue challenges and the MBUF solution.</li> <li>Demonstrate the ease of use and viability of MBUF.</li> <li>Address privacy and equity concerns.</li> </ul>	<ul style="list-style-type: none"> <li>Conduct a MBUF pilot focused in Delaware with regional and national stakeholders. Subsequent pilots will extend and enhance this initial pilot in terms of number of participants (including volunteers), and duration).</li> <li>Present methods for reporting mileage data within the broader context of driver amenities and services.</li> <li>Conduct a variety of education and outreach activities. Subsequent phases will include statewide surveys, focus groups, and interviews to gain a better understanding of East Coast drivers' knowledge of transportation funding, as well as their primary issues or concerns related to MBUF.</li> </ul>



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 2-2. Project Goals and Objectives

Goals	Objectives	Actions
Create a low-cost framework to administer MBUF.	<ul style="list-style-type: none"> <li>Identify cost-saving opportunities through a multi-state approach.</li> <li>Include departments of motor vehicles (DMVs), finance, and other key stakeholders (e.g., tolling, trucking, and automobile manufacturers).</li> <li>Include the private sector.</li> </ul>	<ul style="list-style-type: none"> <li>Explore potential interoperability with tolling infrastructure. This includes evaluating the ability of MBUF technologies to also calculate tolls on existing toll facilities, thereby providing an integrated invoice for all roadway-related charges</li> <li>Address cost issues during the MBUF pilot. This will include (in subsequent phases) a multi-state pilot involving trucks using technology and services that also support the regulatory environment for commercial vehicles.</li> </ul>

Table 2-3. Key Focus Areas of the I-95 Corridor Coalition MBUF Project

Out of State Mileage. How will travel across state boundaries be handled?	
Tolling. What is the relationship between tolling and MBUF?	
Trucking. How does a user-fee fit into current requirements? This focus area was addressed only peripherally in Phase 1.	
Amenities. Will value-added amenities help with public acceptance of MBUF by drivers?	





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

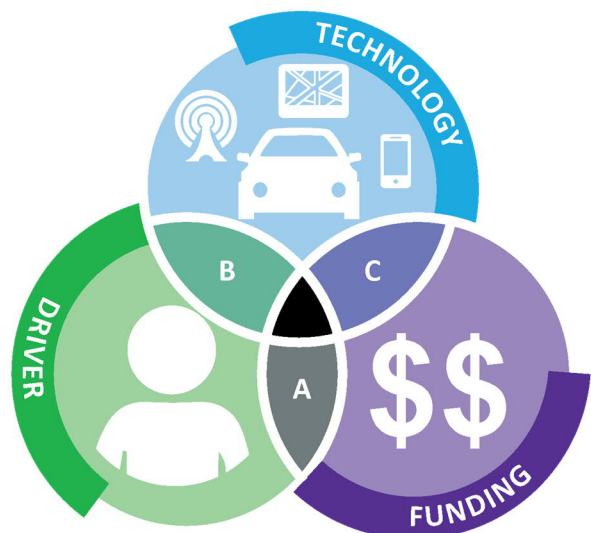
In addition to the four focus areas noted above, the Coalition work was performed in the broader context of how sustainable transportation funding can be found in the intersection of the following three major currents (Figure 2-2) of today's transportation landscape:

- **Technology:** the fast-paced advances in technology are affecting all aspects of transportation from connected infrastructure to autonomous vehicles.
- **Drivers:** transportation system users are asking for more choices, convenience, and better information about transportation.
- **Funding:** transportation revenue is declining because of improved fuel economy, shift to electric and hybrid vehicles, and the lower purchasing power of the fuel tax.

The intersection of these three currents creates an opportunity for a sustainable transportation funding option that embraces new technology, addresses the changing demands of the transportation system users, and tackles the declining revenue stream. However, changing how the nation's transportation system is funded is no small task and will require a shift in ways that public agencies have traditionally interacted with the traveling public and advances in technology.

The Coalition is committed to exploring MBUF in a multi-state environment and bringing solutions to the important national discussion about sustainable transportation funding. However, it is important to remember the following:

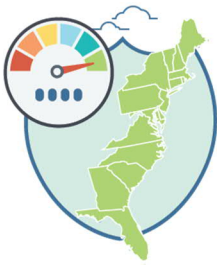
Figure 2-2. Currents pushing innovation in transportation



The I-95 Corridor Coalition and its members want to promote a better understanding of why investing in transportation is important, and why the current fuel tax does not provide a long-term and equitable solution in this regard. The Coalition, representing transportation agencies along the entire Eastern Seaboard, believes exploring the feasibility of a MBUF solution is important; for now, however, the Coalition and its partners are neutral if MBUF is the ultimate solution.

### 2.3 Unique East Coast Attributes and Other MBUF Issues

It is critical that the voices of citizens and transportation decision makers along the I-95 Corridor are part of the broader national discussion of how to establish a sustainable and equitable transportation funding approach. Moreover, the eastern seaboard possesses several unique characteristics that will likely affect any future approach for transportation funding – issues that have not been addressed in other MBUF explorations around the country and were therefore major areas of “focus” for this project, as listed in Table 2-3. An overview of these key focus areas is



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

provided below, along with a discussion of other issues that are relevant to an MBUF approach regardless of location.

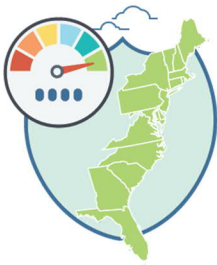
### 2.3.1 Out-of-State travel

Given the relatively small geographic size of many states in the mid-Atlantic and the northeast, cross-state travel and the potential impact on transportation funding, are major issues and concerns for many state DOTs along the I-95 Corridor. Statistics from the U.S. Census Bureau bear this out (Table 2-4), indicating appreciable levels of work-related cross-state travel within Delaware (the lead state) and several other states in the region.

Table 2-4. Work-Related Cross State Travel in the I-95 Corridor

State	Workers Living in State; Working in Another State	Workers Working in State; Living in Another State
Maine	4.7 %	1.8 %
New Hampshire	17.0 %	10.8 %
Vermont	7.2 %	7.1 %
Massachusetts	4.5 %	6.3 %
Rhode Island	15.6 %	12.8 %
Connecticut	6.4 %	6.4 %
New York	2.8 %	6.4 %
New Jersey	14.0 %	7.8 %
Pennsylvania	5.4 %	4.6 %
Delaware	16.4 %	14.8 %
Maryland	18.3 %	9.1 %
District of Columbia	25.2 %	72.4 %
Virginia	9.5 %	6.8 %
North Carolina	2.5 %	2.6 %
South Carolina	5.1 %	3.6 %
Georgia	3.0 %	3.0 %
Florida	1.2 %	0.7 %

Source: 2010 Census



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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Additionally, according to the 2015 Northeast Corridor Intercity Travel Study<sup>9</sup>:

- More than 4 million person-trips are made annually by car between the Washington, DC / Baltimore, Maryland area and the Philadelphia, Pennsylvania area. Undoubtedly, many, if not most, of those trips go through Maryland, Delaware, and Pennsylvania (and possibly Virginia and New Jersey).
- More than 9 million person-trips are made annually by car between the Philadelphia, Pennsylvania area and New York City. Undoubtedly, most of those trips go through Pennsylvania, New Jersey, and New York.
- More than 6.5 million person-trips are made annually by car between the New York City and the greater Boston, Massachusetts / Providence, Rhode Island areas. Undoubtedly, most, of those trips go through New York, Connecticut, Rhode Island, and Massachusetts.

The Census and Northeast Corridor work suggests a large amount of out-of-state travel occurs along the eastern seaboard but currently, there is no detailed source of data for the number of miles driven in each state by out-of-state residents.

Knowing the number of miles driven by residents in their “home” state and in other states, along with a measure of the number of miles driven by “visitors” in one’s home state, will likely be an important consideration for any future MBUF approach, at least along the eastern seaboard. States only collect fuel taxes when passenger vehicles and trucks purchase fuel within their state borders, not based on the miles driven (their “use”) on a state’s transportation system. In other words, if a driver purchases a tank of gas in northern Delaware and then proceeds to cross the state line and mainly drive in Pennsylvania, only Delaware will receive gas tax revenue, with Pennsylvania roads accruing most of the mileage and associated congestion and wear and tear. A fundamental shift that MBUF would create is linking transportation system revenue to the actual use of the roads versus where fuel was purchased.

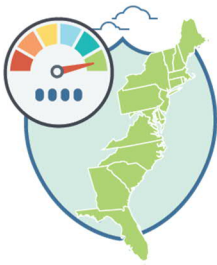
To get a better understanding of how a shift from fuel tax to MBUF would affect DOT revenues, the Phase 1 study included a high-level financial analysis comparing projected MBUF revenues under the following two scenarios:

- **Baseline** - All mileage driven by the residents of a particular state is charged that state’s MBUF rate, less the state’s gas tax credit, regardless of which state the residents actually drive in, with the net MBUF going to the state.
- **Incorporating Out-of-State Mileage** -- All mileage driven in a particular state – regardless of the drivers’ residences – is charged that state’s MBUF pilot rate less gas tax credit, with the net MBUF going to that state. Mileage driven outside the state by the state’s residents is not charged that state’s MBUF (although it is charged the MBUF rate in those other states).

This simple analysis highlighted that how MBUF is implemented could result in some states becoming net gainers in revenue, while other states could become net revenue losers from a MBUF

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<sup>9</sup> Northeast Corridor Commission, 2015



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

system, depending on the levels of out-of-state mileage. Take for example Figure 2-3, which shows the large discrepancy between Pennsylvania and Delaware state gas taxes. It may very well be that a significant number of residents of southeast Pennsylvania accrue most of their mileage in Pennsylvania, except for a few miles in Delaware to purchase gas, given that the Delaware gas tax is much less than Pennsylvania's state gas tax. Additional details about the financial analysis conducted under Phase 1 are summarized in the technical memo on Out-of-State Mileage, available at <https://www.i95coalitionmbuf.org/tech-memos>.

### 2.3.2 Potential Synergies With Tolling

There are numerous toll facilities in the I-95 Corridor Coalition states. All but a few states have toll facilities as shown in Figure 2-4. The major toll facilities and their mileage within the Corridor Coalition states are identified in Table 2-5. In addition to the facilities listed in Table 2-5, there are several toll bridges and tunnels that cross state lines, such as:

- Port Authority of New York / New Jersey: George Washington Bridge, Lincoln Tunnel, Holland Tunnel, Goethals Bridge, and Outerbridge Crossing connecting New Jersey and New York
- Delaware River and Bay Authority: Delaware Memorial Bridge connecting New Jersey and Delaware
- Delaware River Port Authority: Commodore Barry Bridge, Walt Whitman Bridge, Benjamin Franklin Bridge, and Betsy Ross Bridge connecting Pennsylvania and New Jersey

The approximately 3,000 miles of toll facilities along the eastern seaboard carry significant amounts of passenger car and commercial vehicle traffic. Therefore, it will be critical to maximize the interoperability and integration of toll roads, bridges, and tunnels with any future MBUF system to the greatest extent possible.

Figure 2-3. Gas Tax Difference Between Pennsylvania and Delaware

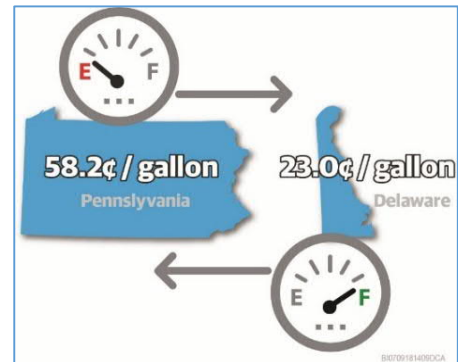
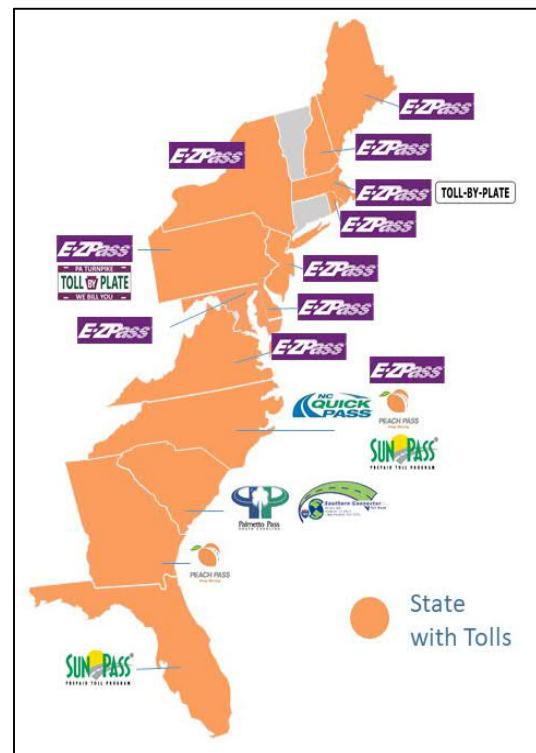
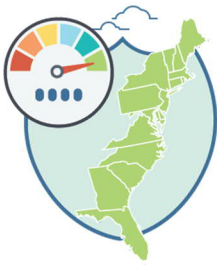


Figure 2-4. Coalition States with Tolls



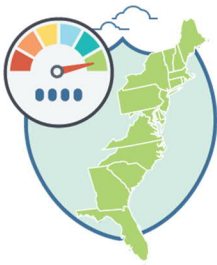


## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 2-5. Major Toll Facilities Within the I-95 Corridor Coalition States

State	Major Tolled Facilities	Tolling Entities	Approx. Miles
Delaware	I-95, State Route (SR) 1, US 301	DelDOT	76
Florida	Florida Turnpike, I-75, several state and county roads	Florida Turnpike, SunPass, Others	745
	Managed Lanes / Express Toll Lanes		40
Georgia	I-75 and I-85 Express Toll Lanes	Peach Pass	55
Maine	I-95	Maine Turnpike Authority	107
Maryland	Tunnels and Bridges (I-95, I-695, I-895, Chesapeake Bay Bridge), MD 200, I-95	Maryland Transportation Authority (MDTA)	27
	I-895 Express Toll Lanes		8
Massachusetts	I-90, Various Bridges and Tunnels in Boston	Massachusetts DOT	145
New Hampshire	I-95, Everett Turnpike, Spaulding Turnpike	New Hampshire DOT	86
New Jersey	New Jersey Turnpike, Garden State Parkway	New Jersey Turnpike Authority	190
	Atlantic City Expressway	South Jersey Transportation Authority	44
New York	New York Thruway (I-87), I-95	New York State Thruway Authority	534
North Carolina	Triangle Expressway, US 74 Bypass	North Carolina Quick Pass	36
	I-77 Express Lanes		26
Pennsylvania	Pennsylvania Turnpike (I-76) NE Extension (I-476), Other Extensions	Pennsylvania Turnpike Commission	559
Rhode Island	I-95	Rhode Island DOT	43
	Various Bridges	Rhode Island Turnpike and Bridge Authority	3
South Carolina	I-185, US 278	South Carolina DOT	23
Virginia	Dulles Toll Road / Greenway, Chesapeake Expressway, Other	Various (e.g., Washington Airport Authority for Dulles Toll Road)	69
	Express lanes on I-64 (Norfolk), I-66, I-395, and I-495 (Beltway)	Virginia DOT	56
	Chesapeake Bay Bridge Tunnel (CBBT)	CBBT	23

(Source: Tolling Authority websites; accessed April 2019)



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The Phase 1 effort started addressing these interoperability and integration issues, including the possibility of using tolling back offices for MBUF transaction processing, and the ability of MBUF technologies to also calculate existing tolls and accurately mimic E-ZPass toll collections.

### Back Office Processing

MBUF account management and administration encompasses several activities that are also activities are also performed as part of tolling back office processing (Table 2-6). MBUF pilots around the nation have numbered less than 10,000 total vehicles over the past 6 years, with Oregon being the only state actually collecting MBUF funds (and only for about 900 vehicles at any one time). Tolling account management activities encompass millions of vehicles and billions of dollars. For example, members of the Interagency Group (IAG) operate the largest toll interoperability network in the world, with more than 35 million toll transponders in use, collecting over \$12 billion in annual toll revenues of which more than \$9.8 billion is collected electronically and over \$4 billion transferred between agencies through toll reciprocity programs.

Table 2-6. Account Management Activities Common to MBUF and Tolling

- Setting up accounts
- Transaction processing (i.e., transforming the transmitted vehicle data into a per-mile charge /toll)
- Issuing invoices and statements
- Receiving payments
- Compliance and enforcement
- Managing accounts receivables
- Providing customer service activities
- Supporting audit activities

Given this experience and the commonality of functions, using the tolling back offices to perform these account management activities for MBUF in a multi-state system could conceivably provide synergy and significant economies of scale. For example, tolling agencies often have links to state DMVs for exchanging vehicle and related data – a critical component for a mandated MBUF system. Most existing tolling providers and concessionaires do not offer MBUF technologies plug-in devices and the associated communications, and tolling transaction processing is different than MBUF transaction processing. These gaps and differences between MBUF and tolling back office processes would have to be addressed. It is noted that some tolling concessionaires are showing increased interest in becoming involved with MBUF. Further investigation and testing of the potential integration of MBUF account management activities with tolling back office operations will be addressed in future project phases.

### Using MBUF To Also Collect Tolls

Another area of potential synergy between MBUF and tolling is using MBUF technologies to calculate exiting electronic tolls (e.g., E-ZPass, NC Quick Pass, Peach Pass and SunPass) in an accurate manner. This approach was explored to assess if MBUF technologies could provide another choice for users, and perhaps reduce the number of toll transactions requiring license plate reading, the cost of which is relatively high. Investigating this concept came about during a meeting of the





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I-95 MBUF Steering Committee<sup>10</sup>. The question was raised if E-ZPass tags could be used for MBUF. The need for the increased infrastructure (i.e., gantries with readers and video enforcement hardware, and the associated communications network) installed across all roadways would be cost-prohibitive. Instead, the suggestion was made that MBUF technologies might be used as another alternative approach for collecting tolls, in lieu of E-ZPass. Thus, began the Phase 1 pilot tolling proof of concept to examine and test if MBUF technologies could be used in this manner. The results of this initial tolling proof of concept (POC) are discussed in Section 5. Additional details about the potential interoperability between MBUF and tolling is summarized in a Phase 1 Technical Memo, available at <https://www.i95coalitionmbuf.org/tech-memos>.

### 2.3.3 Freight Movement

The movement of freight within the I-95 Corridor is of national importance. Average daily truck traffic in the I-95 region is over 10,000 vehicles, with peak daily truck traffic reaching 31,000 vehicles. These trucks carry 5.3 tons of freight shipments annually. Moreover, the amount of truck traffic is expected to more than double by 2035. Much of this truck traffic crosses multiple state lines, serving the numerous ports and distribution centers throughout the eastern seaboard.

Trucks also contribute a significant portion of the transportation revenues. Although trucks account for 14 percent of VMT on the nation's roads, the trucking industry currently covers approximately 45 percent of the HTF through the commercial truck diesel and gas tax and other trucking-specific excise taxes<sup>11</sup>.



Unlike passenger vehicles, commercial vehicles also have a long list of existing reporting requirements to comply with.

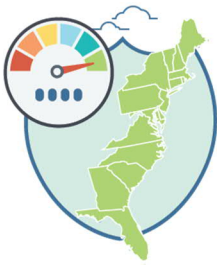
Commercial vehicle owners are required to keep records to comply with these regulations, including the following:

- International Fuel Tax Agreement (IFTA), a program for redistributing state fuel taxes between states, based on the number of miles driven and fuel purchased in each state by interstate trucks greater than 26,000 pounds gross registered weight and all trucks with three or more axles.
- International Registration Plan (IRP) for distributing state registration fees between states based on the mileage driven in each state. IRP applies to commercial vehicles of 26,000-pound gross

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<sup>10</sup> As discussed in Section 4, the project Steering Committee is comprised of key transportation stakeholders representing a range of interests and perspectives, including tolling experts.

<sup>11</sup> <https://www.trucking.org/article/America%E2%80%99s-Truckers-Challenge-Policymakers-to-Support-Bold-Infrastructure-Plan>; January 24, 2018



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registered weight or above and vehicles with three or more axles, operating interstate. Vehicles of lesser weight may also be included (unlike IFTA).

- Electronic Logging Devices (ELD) required on every commercial motor vehicle with a gross vehicle weight of 10,000 pounds or greater in the United States; although there are numerous exceptions. with exceptions). ELDs are used to monitor the hours of service regulations issued by the Federal Motor Carrier Safety Administration (FMCSA). The ELDs are self-certified and must be registered with FMCSA. From a MBUF perspective, ELDs do not report mileage.

### MBUF and Trucking

It is critical to bring the perspectives of the trucking community to the national discussion of MBUF. The I-95 Corridor Coalition has a long history of working with the trucking industry. As an example, the Coalition has developed a “Freight Academy” – a comprehensive one-week immersion program for public agency personnel focused on goods movement. The goal of this nationally recognized program is to ensure current and future public-sector decisions and investments are made with an understanding of the comprehensive supply chain. Additionally, the ATA has been a member of the project Steering Committee since the beginning.

Recognizing that it is vital to bring the perspective of the trucking industry to the national evaluation of MBUF, the Coalition will conduct a multi-state truck pilot - the first in the nation - in Phase 2. This multi-state truck pilot is important because motor carriers face unique challenges and it is crucial to gain a better understanding of their needs and viewpoints. Commercial vehicles are not only heavy users of the transportation system, they also pay a significant amount to help build and maintain the system. Another aspect of Phase 2 will be to examine and evaluate the potential of integrating MBUF into existing regulations such as IFTA, IRP, and ELD rules.

The Phase 2 effort also includes the establishment of a Motor Carrier Working Group to promote an ongoing dialog with key freight movement stakeholders, to identify and highlight concerns and recommendations of the industry, and to ensure they are being considered when policy-makers discuss a potential MBUF system.

### 2.3.4 Public Understanding and Awareness

The importance of education and outreach – particularly for a new paradigm that involves the collection of funds from drivers for their use of the roadway – cannot be overestimated. This is a key reason one of the project goals is to “increase public awareness of funding issues and assess the acceptance of MBUF.” The lack of understanding of drivers about the infrastructure funding needs and the long-term issues with the gas tax, coupled with the “gut reactions” against a user fee, can immediately put MBUF into a negative context.

Based on the Coalition’s and project team’s previous experience, coupled with lessons learned from other states investigating the feasibility of MBUF, it was recognized from the beginning just how critical it is to understand public values, beliefs, and priorities around transportation, and then base



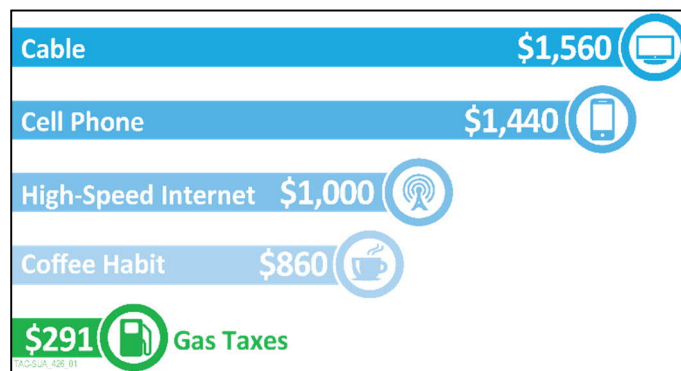


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the MBUF education and outreach campaign and materials with these considerations in mind. For example, based on public surveys from other areas of the country<sup>12</sup>:

- Residents believe transportation is important – it has many ties to what the public values, including quality of life, freedom to travel, connection to family and friends, and access to jobs. But there is a lack of urgency to address improvements. This impacts perceptions around funding needs and support for new funds.
- Voters and residents don't know how transportation is funded and how revenues are obtained (e.g. how many drivers know that the amount of fuel tax they pay is less than frequent visits to coffee shops, not to mention other items that are considered essential [Figure 2-5]). This can make funding discussions complicated and lengthy.
- Lack of urgency is tied to low levels of awareness (how transportation is funded, that funds are decreasing significantly, no to little support to increase the gas tax, etc.). Starting messages with funding will likely not resonate with the public.
- Perceptions of government waste and inefficiency continue to be linked to transportation.
- Perception that low income households and other vulnerable populations may drive long distances for work or school and would pay more (equity).
- Concerns with the privacy and the security of the data collected.

Figure 2-5. Average Annual Cost of Selected Items



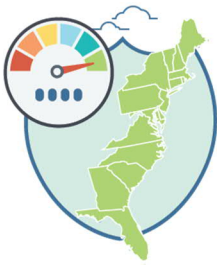
Additional details on the education and outreach effort conducted during Phase 1, and the associated materials developed, are provided in Section 3.

### Value-Added Amenities

Another consideration in promoting public understanding and acceptance – and one of the four key focus areas of the Coalition's MBUF work – is to potentially "link" MBUF with driver amenities – services that can make owning / leasing and driving a car better. Vehicles are becoming more sophisticated in terms of technology and driver feedback – a "fitbit on wheels." The question to be explored was: can the value-added amenities offered through the MBUF technology make MBUF more acceptable? Several value-added amenities were made available to pilot participants as described in Sections 4 and 5.

Are value-added amenities a "spoonful of sugar" that could help in a transition to MBUF?

<sup>12</sup> Statewide surveys will be conducted in Delaware and Pennsylvania during Phase 2.

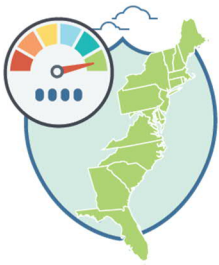


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### 2.3.5 Privacy

Privacy is a major issue – perhaps the most important issue – for a MBUF approach to funding the transportation system. Studies and surveys have identified privacy concerns as one of the participants’ key objections to a MBUF system (or any system requiring personal data). A related concern is the security of the data that are collected. The Phase 1 effort reviewed numerous studies and surveys regarding privacy. This included the European Union’s General Data Protection Regulation, which was adopted in mid-2016 and went into effect on May 25, 2018. (While the United States has enacted privacy rules in areas such as health care, it has never passed an overarching data-protection law at the federal level.) Based on the review and analysis of these materials, Table 2-7 was developed summarizing the key issues that need to be considered in the context of protecting privacy in a MBUF system. Additional details about privacy and data security issues in an MBUF system are summarized in the Phase 1 Technical Memo on Privacy, available at <https://www.i95coalitionmbuf.org/tech-memos>.

Table 2-7. Summary of Key Privacy-Related Issues and Considerations for a MBUF System
<ul style="list-style-type: none"> <li>• <b>Choice</b> - Providing choices for mileage reporting, thereby providing drivers with a range of options. This would include at least one approach that does not involve any sort of mileage reporting (such as a time-based system), as well as not requiring a location-based approach, including specific origins or destinations or travel patterns.</li> <li>• <b>Control and Consent</b> - Providing drivers with control in terms of how their data are collected (i.e., “choice” as noted above) and used. Consent means an unambiguous identification by the user signifying agreement to their personal data* being collected and shared. From a MBUF perspective, this includes the ability to opt-in or opt-out of approaches that involve: location information, data sharing with other entities, and/or long-term retention of the data. It also applies to other value-added amenities these individuals may be using.</li> <li>• <b>Purpose Limitation</b> – The collection of data must have a specific and defined purpose.</li> <li>• <b>Transparency</b> - Developing an education and outreach program focusing on how information will be used and how privacy will be protected. A key component of such a program will be to describe why location data are important to the MBUF program (e.g., differentiating mileage by state), the associated driver amenities (and possibly MBUF-related discounts) that are linked to location information, and how this information will be protected.</li> <li>• <b>Data Retention</b> - Defining how long the collected data may be retained, with the goal that data should not be stored any longer than necessary.</li> <li>• <b>Other Use of Data/Sharing</b> - Defining the extent and circumstance under which private-sector providers and account managers are allowed to share (i.e., “sell”) collected data to other entities. This also includes protections and notifications should a government entity request detailed data (e.g., routes by time of day) from a private sector MBUF provider.</li> </ul>



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Table 2-7. Summary of Key Privacy-Related Issues and Considerations for a MBUF System

- **Data Anonymizing** – Defining the extent to which data should be anonymized (i.e., removing personally identifiable information [PII]) and/or aggregated before providing the information to others.
- **Integrity and Security** – Defining PII and ensuring PII and other collected data are secure from unauthorized or unlawful processing. This includes both technical and organizational safeguards (e.g., adoption of data security standards, encryption of personal data, and notification requirements should a data breach occur.)

\* Personal Data, also known as personally identifiable information (PII) refers to any information relating to a person who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural, or social identity of that person.

### 2.3.6 Administration and Compliance

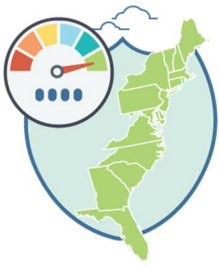
Another MBUF issue often identified in a negative manner involves the additional costs, potential bureaucracy, and enforcement requirements associated with administering a MBUF system relative to the gas tax. To help understand the administrative requirements, it is helpful to understand how a mandated MBUF might function. It is envisioned that the private sector will play a lead role in developing and managing a MBUF system. This includes commercial account managers (CAMs) – private entities that provide technology-based approaches for MBUF along with other driver services and amenities. There will also likely be a state account manager (SAM) that provides manual approaches such as an annual time permit (for unlimited mileage) and manual odometer readings (as part of a mandated safety inspection or emissions testing program). The SAM would accommodate those individuals that do not want a technology-based approach (as provided by CAMS), as well as those individuals who do not have credit cards or bank accounts, or have poor credit, resulting in a CAM not support them as a customer.

A MBUF system will encompass several administrative functions, including the following.

#### Vehicle Enrollment

In a mandated MBUF system, it will be necessary to ensure all vehicles are properly enrolled in the MBUF system, have chosen a CAM or the SAM, and have selected an approach by which mileage is collected and by which payment will be made. A potential related activity is to make sure the appropriate per-mile rate is identified and applied to each enrolled vehicle. It is envisioned that the enrollment process would be integrated with the state vehicle registration process in some manner, requiring changes to current DMV systems and process, such as:

- Additional fields in the DMV database (e.g., name of CAM / SAM with which the vehicle has been enrolled, per-mile rate for the vehicle, whether MBUF payment has been made and when, amount of payment, portion of MBUF payment due to other states)



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- Automated and secure data linkages between CAMs or SAM and the DMV database for exchanging necessary information (e.g., verification of VIN, addresses, and per-mile rates from DMV to CAMs or SAM; list of enrolled vehicles, approaches, and payment information from CAMs or SAM to DMV). The linkages and information sharing must also accommodate changes in vehicle ownership and registration (including moving to a different state) and when a vehicle is stolen, abandoned, or destroyed.
- Flagging vehicles for not enrolling or for nonpayment of the MBUF and placing an automatic vehicle license and title stop on registration. This is similar to what happens today in several DMVs when vehicles have no proof of insurance.

### Invoicing and Collection of MBUF Funds

The frequency of collection and billing may be a significant cost driver in administering a MBUF system, with more frequent billing (relative to annual or biannual collections for vehicle registration) resulting in greater administrative effort. Other considerations associated with this issue include the impact on cash flow to the state and the need to provide a billing system that allows individual to pay on a recurring frequent basis (e.g., monthly) instead of having to make a single large annual payment.

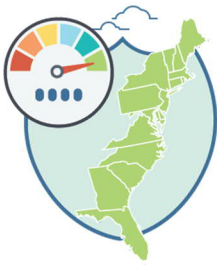
### Enforcement and Compliance

The success of a MBUF program will depend on widespread compliance such that all individuals pay their fair share in support of funding the transportation infrastructure. It is envisioned that the vast majority of vehicle owners and lessees will undoubtedly pay the charge, but they will not tolerate a system that permits a substantial number of free riders or mileage-collection technologies and approaches that can be compromised. Given the experience in the tolling industry, it should be assumed that a small percentage of motorists will not set up an account, will try to manipulate the mileage reported for their vehicle, or otherwise not pay the MBUF. The system must have processes in place for verifying and enforcing these MBUF activities, including the associated penalties (e.g., inability to re-register one's vehicle) for individuals who are not in compliance.

### Auditing and Reconciliation of Account

MBUF audits will need to be conducted as part of the overall compliance effort. It is envisioned that the state will perform periodic audits of account managers' performance. The potential list of MBUF activities and processes to be verified through these periodic account manager audits is extensive, including (but not limited to), verifying that:

- All subject vehicles are included in the MBUF system with accounts set up and linked to the vehicle VIN.
- Mileage and other data reported by the various mileage collection approaches and technologies is being accurately received and processed. This also includes confirmation that all vehicle MBUF accounts are receiving mileage data from vehicles (and if not, why).
- The proper rate-charging table and gas taxes are being used for MBUF calculations and gas tax credits, and that the transactions and MBUF charges and credits are properly posted to the correct account.



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- VIN changes are properly coded and reported (additions and deletions/close outs).
- Historical transaction statistics are being maintained, and monthly reports are being sent to the state, and that the reports are reconciled with one another.
- All MBUF revenues owed by the account managers are being transferred to the state at the required time intervals.

### Account Manager Certification

Prior to being allowed to sign up customers and conduct operations for a MBUF program, account managers (CAMs and SAM) should undergo initial certification. This step would require prospective account management vendors to undergo a series of technical testing, financial, systems, and performance process audits, and validation of the vendors' ability to comply with the specifications and requirements set forth in the MBUF contract. The requirements established for the initial certification process would generally be outlined in a series of requirements and specification documents, including a service level agreement (SLA) identifying performance criteria and key performance indicators (KPIs).

### Multi-State Considerations

As previously discussed – and as demonstrated during the Phase 1 MBUF Pilot (discussed in Section 5) – accommodating out-of-state mileage in an MBUF system is critical for the eastern seaboard. Such a multi-state MBUF system will need address out-of-state mileage and accommodate different rates in each state. Each of the participating states in the MBUF system will need to address and provide the administrative functions summarized above. It may also prove beneficial if there are consistencies between states in terms of their respective enabling legislation and in violation enforcement reciprocity.

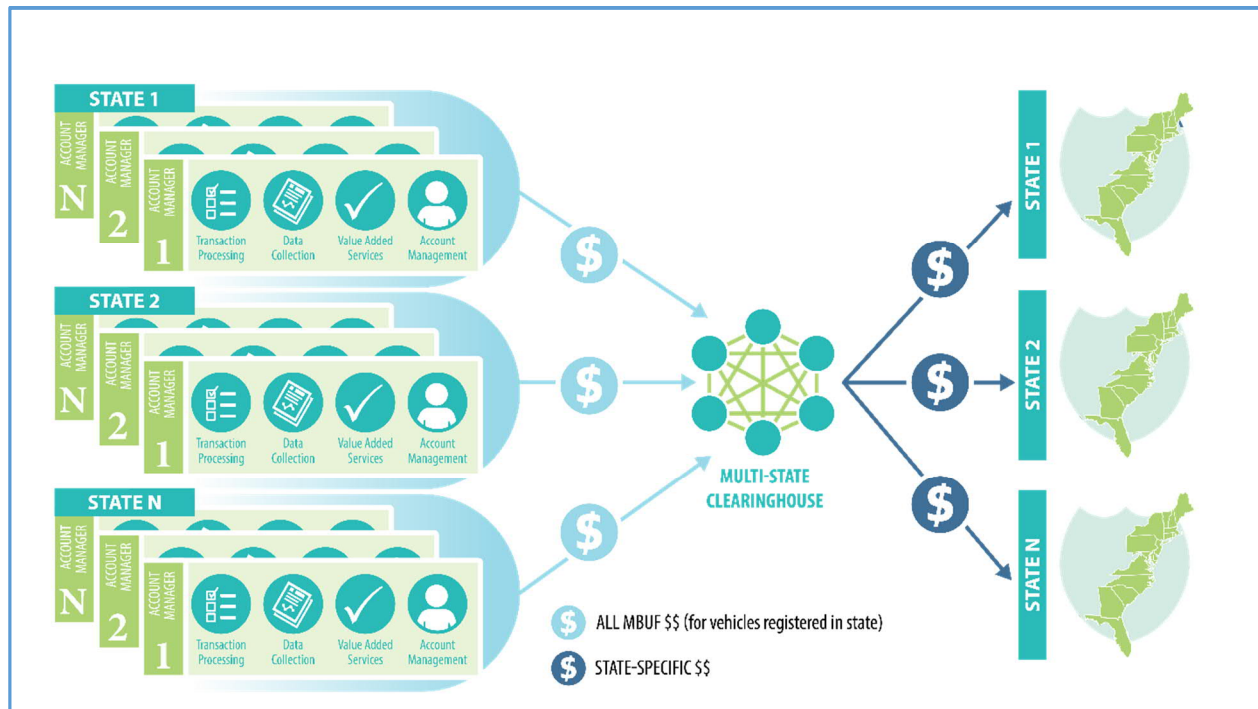
The cost-effectiveness of a multi-state MBUF system will depend on the appropriate and efficient distribution of the charges and revenues between states, based on out-of-state mileage and, possibly, where and how much fuel was purchased. An administrative mechanism will need to be established to provide a clearinghouse function that receives funds from account managers and redistributes funds between states such that each agency receives the net revenues it is owed – not unlike what IFTA and IRP do for heavy trucks. Figure 2-6 shows such a multi-state MBUF architecture. The multi-state clearinghouse could also perform certification and auditing functions on behalf of the states (although, the states will need to audit the multi-state clearinghouse.) Some sort of cooperative agreement would also need to be developed between the states to address the operation and funding of the multi-state clearinghouse.





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 2-6. Regional Clearinghouse Focused with Different Set of Account Managers for each State



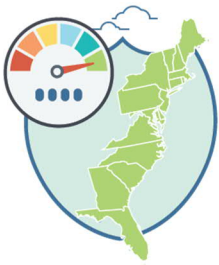
### Potential Impacts of Administrative Costs

As part of the project, a high-level financial analysis was performed comparing MBUF revenues and costs relative to the current gas tax system. Two analyses were performed – one for Delaware and one for Pennsylvania (the two states providing match funding for Phase 1). Data for estimating annual revenues were obtained from FHWA and state records plus the results of the Phase 1 Pilot. Inputs used are shown in Table 2-8. The analysis timeframe was 15 years. The results for the estimated annual gas tax revenues – \$167K for Delaware and \$3,511K for Pennsylvania – were compared with the state projections and were found to closely match.

Table 2-8. Inputs for Estimating State Transportation Revenues

Input	Delaware	Pennsylvania	Source
Registered Light-Duty Vehicles	935,000	9,772,982	FHWA, State DMVs
Total Annual Mileage	14.7 Billion	124.4 Billion	Phase 1 Pilot Data - Expanded
Average Fuel Efficiency	22 MPG	22 MPG	National Average
State Gas Tax	23¢ / gallon	58.2¢ / gallon	Actual in 2018
Per-Mile Rate	1.05 ¢ / mile	2.65 ¢ / mile	Revenue neutral, calculated based on state gas tax
Annual Increase in Mileage	1.2%	1.2 %	FHWA VMT projections (thru 2036)





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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To calculate the net revenues, estimated costs associated with administering a MBUF system, including compliance and enforcement, were developed. The net MBUF revenues were then compared to the net revenues with the current state gas tax. Only light-duty vehicles were included in the analysis.

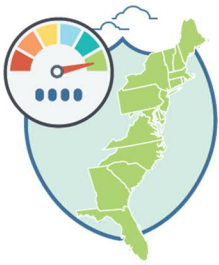
**Gas Tax Costs** – A previous I-95 Corridor Coalition study of MBUF in 2010 estimated the average administrative costs for the gas tax (within the Coalition states) as 0.86 percent of gas tax revenues. A November 2012 paper by the Reason Foundation<sup>13</sup> claims “the cost of collection for motor fuel tax revenues is significantly greater than the widely believed figure of 1% of the revenue collected. Indirect costs, such as losses incurred at several levels of the process and taxes hidden in the collection of revenues (some are even imposed on those exempt from the fuel tax program), suggest that the costs of motor fuel tax collections may well be in the vicinity of 5% of the revenue collected.” Given this range, the costs for administering the gas tax were assumed to be 2 percent of gross revenues.

**MBUF Costs** – The administrative and compliance costs for an MBUF system were assumed as follows:

- **Account manager costs** = 10 percent of gross revenues. This is based on several discussions with MBUF account managers – private entities that have closely investigated such costs as part of their business model. They generally believe that in a system with 1 million customers or more, their cost would be around 10 percent of annual gross revenues. This is a similar figure – albeit slightly higher – than the operating costs associated with all electronic tolling (AET), which can be used as a proxy for MBUF in many respects, including payment enforcement. For example, the aforementioned 2012 Reason Foundation publication indicates that the net collection costs for AET can be in the vicinity of 5 percent for a \$5 toll, and 8 percent for a \$2 toll. A recent study for Connecticut DOT on implementing AET on the state’s freeways indicated that annual operating costs would be less than 10 percent of gross annual toll revenues in 2023.
- **State costs** = 8 percent of gross revenues. This figure is four times the administrative costs for the gas tax. But based on discussions with the participating states, it was determined that a conservative approach should be used in the analyses. This increased percentage reflects the additional effort on the part of the state for MBUF in terms of education and outreach, certification and ongoing monitoring of account managers, changes to DMV operations and software to support system enrollment and compliance efforts, payment enforcement and collection activities, and the need for the state to accommodate cash payments. As the MBUF system matured, it is envisioned that this percentage would decrease.
- **Other Costs.** In addition to the MBUF costs noted above (as a function of the gross revenues), a fixed annual cost of \$20,000 was also assumed to cover administrative overhead and related activities, including start up, that need to occur regardless of the amount of revenues. As the MBUF system matured, it is envisioned that such fixed annual costs would also decrease.

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<sup>13</sup> “Dispelling the Myths: Toll and Fuel Tax Collection Costs in the 21<sup>st</sup> Century; Reason Foundation; November 2012



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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Using these assumed costs in the financial analysis – and using a single “revenue neutral” per mile rate based solely on the current gas tax – the net revenues for MBUF are less than the net revenues for the gas tax. The analysis then calculated “net revenue neutral” per-mile rates such that the net MBUF revenues would equal the net gas tax revenues – in essence, including the additional administration costs for MBUF in the per-mile rate. The Delaware per mile rate would increase from 1.05 cents per mile to 1.25 cents per mile (i.e., 1/5<sup>th</sup> of a penny) to cover the additional MBUF administrative costs; while the Pennsylvania per mile rate (based on the 2018 gas tax<sup>14</sup>) would increase from 2.65 cents per mile to 3.16 cents per mile (i.e., half a penny). In both instances, the net-revenue rates are 19 percent greater than the gross-revenue neutral rates.

Additional details about the various administration activities and issues associated with a MBUF system are summarized in the Phase 1 Technical Memo on Administration, available at <https://www.i95coalitionmbuf.org/tech-memos>.

### 2.3.7 Equity

The MBUF concept based on the “user pays” principle, whereby those who use the transportation network pay an amount proportional to how much they use it. As such MBUF provides greater fairness and equity as compared to the gas tax. Nevertheless, fairness and equity issues are frequently raised with respect to how MBUF is applied across different population and demographic groups, as summarized below.

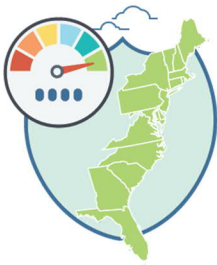
#### Longer Commutes and Income

One concern that is that MBUF will charge somebody more for living a long distance from work. In many respects, that is the whole point behind the MBUF concept. Just like the person who uses more electricity ends up with a higher utility bill, the person who uses the roadway network more (as measured by the number of miles driven) should also pay more. Moreover, in considering the fairness of MBUF on those individuals who drive long distances, it is important to note that these long-distance drivers are already paying more in fuel tax (unless they have an EV) as compared to drivers with a shorter commute and a similar type of vehicle.

One way to possibly mitigate potential adverse impacts on low income families from MBUF is to tailor the MBUF system such that low-income families would be charged a lower per-mile rate, receive a discount, or obtain assistance from the government in paying their MBUF. Such discounts could be based on actual reported income, household size, or location of their residence. Going back to the utility analogy, such an approach would be very similar to the discounts many electric and fuel companies offer low income customers along with government-assistance programs for lower income families.

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<sup>14</sup>The Pennsylvania state gas tax is adjusted every year based on a formula.



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### Vehicle Type and Fuel Efficiency

By and large, the MBUF concept was developed in response to the growing number of electric and other alternative fuel vehicles that currently pay little no fuel tax. Nevertheless, when it comes to equity and fairness considerations, there are two conflicting arguments concerning charging MBUF on electric and other high-efficiency vehicles for using the roadway.

- On one hand, MBUF is fairer than the gas tax because with MBUF, all drivers using the roadway, including highly fuel-efficient and alternative-fuel vehicles, pay similar amounts of tax to maintain and operate the roadway network they all benefit from.
- The counter argument is that switching from the gas tax to MBUF is unfair to EV and hybrid vehicle owners, penalizing them for “doing their part” to protect the environment and reduce greenhouse gas (GHG) emissions. Moreover, fuel-efficient vehicle owners will pay comparatively more in MBUF than they pay under the gas tax system, while owners of less fuel-efficient vehicles will pay comparatively less (assuming a single per-mile rate applied to all vehicles and drivers) with MBUF as compared to the gas tax.

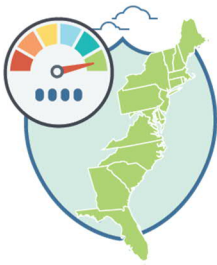
In addressing this issue, particularly as it pertains to benefitting the environment, it is important to look beyond the singular perspective of the “muck” that comes out of the exhaust pipe. Rather, the life-cycle of a vehicle’s emissions needs be addressed, including those pollutants created by the mining of material for batteries, during the construction of the vehicle, the production of fuel and the generation of electricity, the operation of the vehicle, and the vehicle’s subsequent disposal. Several studies have analyzed these lifecycle emissions – what is also referred to as “well to wheel” – with consistent findings as summarized below:

- Emissions are usually higher in the raw materials extraction and production phases of EVs.
- These increased production-based emissions may be more than offset by lower emissions in the operational and use phase over time. It depends on the power source from which the BEV is charged. If the power that is used to charge the BEV is also clean, the lifecycle emissions are lower. For example, the lifecycle emissions of a BEV could be almost 90 percent lower than an equivalent ICE vehicle using electricity generated from wind power. On the other hand, a BEV charged with electricity generated from coal has higher lifecycle GHG emissions than an ICE vehicle.

A study conducted by the University of Minnesota<sup>15</sup> evaluated the air quality-related human health impacts of various vehicle types and power options. The focus of this analysis was on ozone (O<sub>3</sub>) and fine particulate matter (PM<sub>2.5</sub>), with the paper indicating that such “non-GHG air pollution damage externalities generally exceed those from climate change.” Overall, the research shows that electric cars are cleaner than those that rely on internal-combustion engines only if the power used to

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<sup>15</sup> “Life Cycle Air Quality Impacts of Conventional and Alternative Light-Duty Transportation in the United States;” Christopher W. Tessum, Jason D. Hill, and Julian D. Marshall, University of Minnesota; Proceedings of the National Academy of Sciences; December 15, 2015; <https://www.pnas.org/content/early/2014/12/10/1406853111>.



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charge them is also clean. As shown on Figure 2-7 (reproduced from the Economist<sup>16</sup>), EVs whose batteries are topped up from wind, solar, or hydroelectric sources came out cleanest. BEVs recharged with power from natural-gas-fired stations were also a lot less lethal than petrol-driven ones. But if those same BEVs are recharged ultimately by coal, they would be responsible, according to the analysis, for just over 3,000 deaths per year.

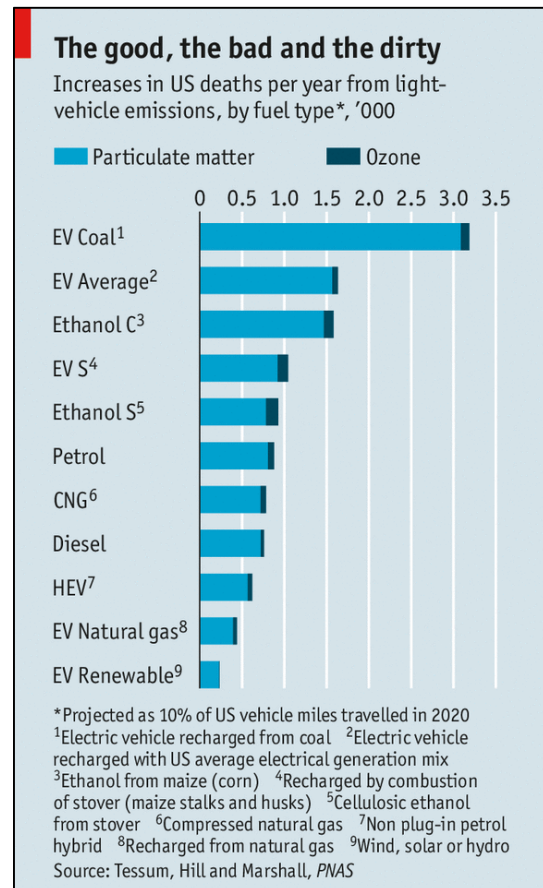
### Urban - Rural

A recurring equity issue with MBUF involves the potential impacts on rural households relative to urban households, with the greatest concern being that rural drivers will have to pay more MBUF because they drive greater distances. This urban-rural issue has received a significant amount of study, particularly in the western states. Summarizing the findings:

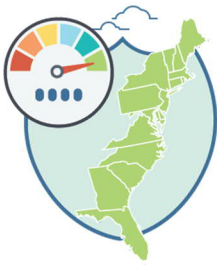
- Per National Household Travel Survey (NHTS) data, there is little difference between urban and rural households nationally in terms of trip frequencies, but the NHTS showed much longer trip lengths for rural households, including nearly twice as much travel for shopping trips.
- Analysis of the financial impacts when replacing the gasoline tax with a revenue-neutral MBUF showed that households in rural census tracts will generally pay less under MBUF than they are currently paying in gasoline taxes. The net reduction in MBUF payments in rural areas is because of the lower average fuel efficiency of the vehicles in rural areas, even though rural drivers accrue more mileage than their urban counterparts.
- Households in urban areas could see a slight increase in payments, in part because urban areas typically have greater concentrations of highly fuel efficient vehicles.

A similar analysis of urban and rural characteristics in several East Coast states, and the potential relative impact of MBUF on these demographics, is planned for Phase 2 and Phase 3 of the I-95 Corridor Coalition MBUF effort.

Figure 2-7. Impact of Non-Greenhouse Gas Vehicle Emissions for Various Vehicle Types and Power Sources



<sup>16</sup> "Cleaner Than What," The Economist; December 17, 2014



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

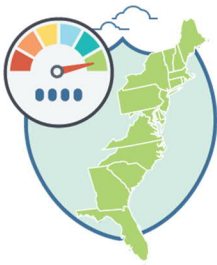
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### Discussion

Handling equity and fairness concerns with MBUF – both real and perceived – is a major policy issue. The MBUF concept does allow such equity considerations to be addressed using different rates for different demographics and/or vehicle types. As an example, a variable MBUF rate structure could be developed as follows and shown on Figure 2-8:

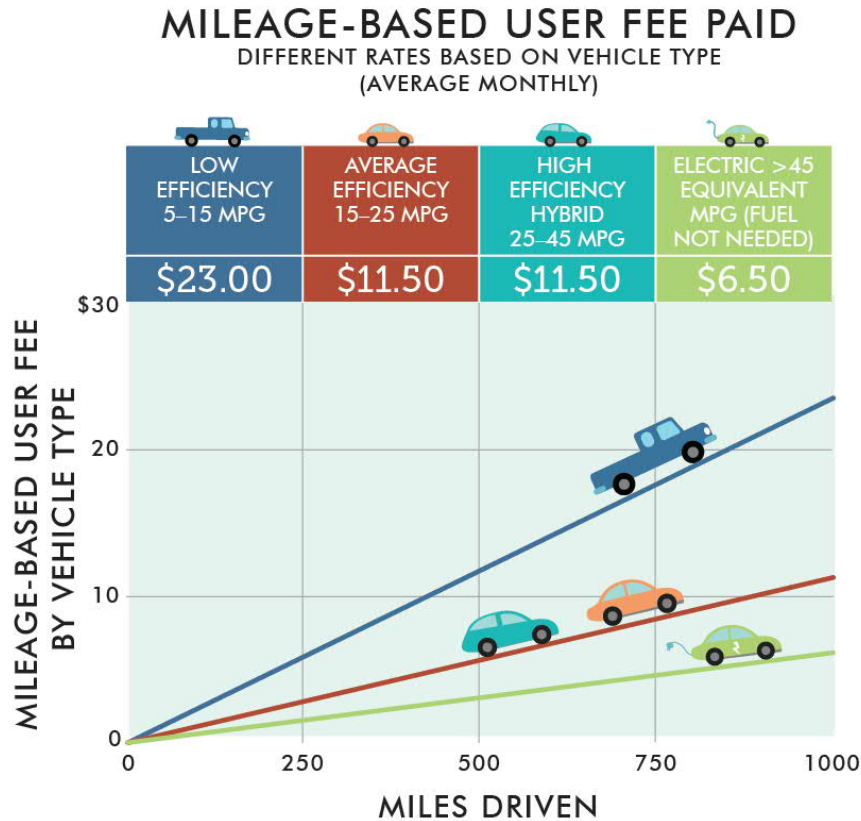
- A higher per-mile rate for vehicles with lower fuel efficiencies such that these vehicles pay no less than they currently pay in gas tax (ignoring the possibility that many of these vehicles may be owned by low-income or rural residents).
- A lower rate would be charged for those vehicles with fuel efficiencies at about the average MPG – in essence, a “revenue-neutral” rate. In this manner, there would be no reduction in transportation revenues from these vehicles relative to what is currently collected from the gas tax.
- Highly fuel-efficient and EVs would still be charged MBUF – thereby increasing revenues – but at the lowest per-mile rate, recognizing their “contribution” to the environment (assuming, of course that the power to charge them is also clean).

Because these fairness and equity issues are often interrelated, and perceptions may not always match reality, such a variable rate approach can get very complicated, likely leading to increased administration and compliance costs. For example, charging different rates for BEVs, based on their respective registration addresses and the associated power sources, would be challenging requiring a major education and outreach effort. Additionally, a variable rate structure based on vehicle efficiency could negatively impact rural drivers as their vehicles typically get the fewest MPG. There is also the income variable to consider – higher income drivers can afford to purchase more expensive vehicles (such as BEVs) and can therefore to pay more in MBUF relative to the near zero cost of the gas tax.



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Figure 2-8. Hypothetical Average MBUF Paid by Vehicles with Different Fuel Efficiencies  
(Different Per Mile Rates for Low and Average Efficiency Vehicles, and for EVs)



Additional details about equity issues a MBUF system are summarized in the Phase 1 Technical Memo on Equity and Fairness, available at <https://www.i95coalitionmbuf.org/tech-memos>.





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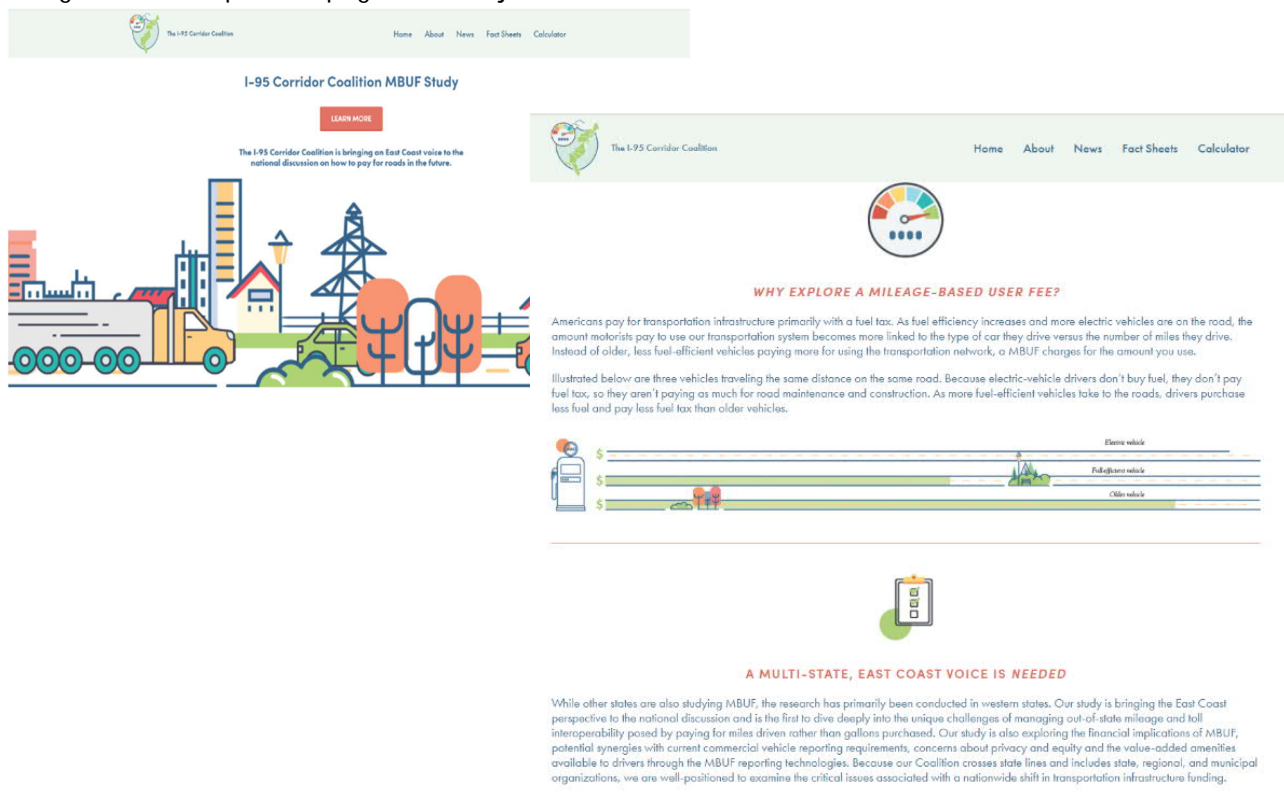
## 3 Education and Outreach Activities

Education and outreach were major components of the study, with efforts to inform people about the need to establish a sustainable and equitable transportation funding approach as well as the MBUF concept. Key target audiences for these efforts included decision-makers such as legislators other elected officials, DOTs, DMVs, tolling agencies, interest groups (e.g., trucking associations, American Automobile Association [AAA]), and the public in states within the study area. This section summarizes the education and outreach activities included in the study.

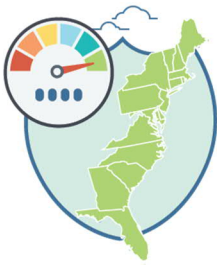
### 3.1 Website

A website<sup>17</sup> (Figure 3-1) was developed at the beginning of the study and included a project overview, information about the current fuel tax funding system, information from other MBUF studies, frequently asked questions (FAQs), news articles about the study, a calculator for users to see what they would pay under an MBUF system as compared to the current fuel tax, and fact sheets about the study.

Figure 3-1. Sample Webpage from Project Website



<sup>17</sup> <https://www.i95coalitionmbuf.org/>



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In addition, the website was used to share information with Phase I Pilot participants, including the participant agreement, a decision tool to help people determine which mileage reporting option they wanted to use (Figure 3-2), and FAQs specific to participation in the pilot.

From April 1, 2018 to December 31, 2018, the website had 1,683 unique visitors with more than 4,000 page-views. The busiest months for the website were April and May, coinciding with recruitment and enrollment for the pilot. The most popular pages were the home page, which provided overview information on the study, followed by the pilot study enrollment page and the pilot participant information page.

## 3.2 Fact Sheets

Fact sheets were developed to share information about the MBUF concept and the study. The first fact sheet was published at the beginning of the study to provide overview information and was distributed via email and at in-person meetings and conferences. It was also posted on the project website. At the conclusion of the Phase I Pilot, a fact sheet (Figure 3-3) was published, sharing summary findings from the pilot, including information gathered from surveys of pilot participants. This fact sheet was distributed at in-person meetings and presentations as well as posted on the project website. Copies of the fact sheets are included in Appendix B.

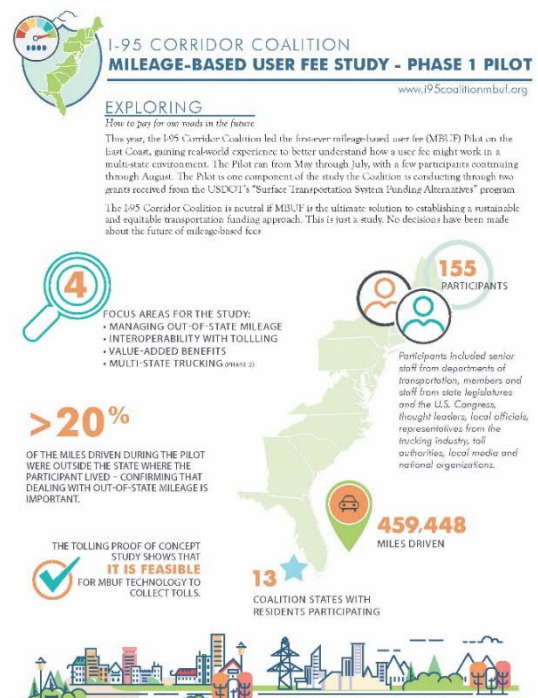
## 3.3 Frequently Asked Questions

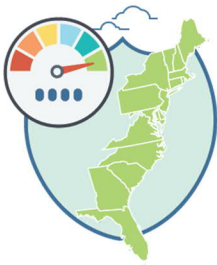
A series of FAQs were developed and posted on the project website. The purpose was to provide information on the MBUF concept – why it is being studied, how it could be implemented, and how it compares to the current fuel tax system. An additional set of FAQs were developed specifically for Phase I Pilot participants to provide more information on the Pilot

Figure 3-2. Guide for Choosing MRO

	Plug-In Device with Location	Plug-In Device without Location	Smartphone with Location (Android Only) <a href="#">Click for description</a>
	<a href="#">Enroll Now*</a>	<a href="#">Enroll Now*</a>	<a href="#">Enroll Now*</a>
<b>Device Operations</b>			
Uses GPS to determine where you traveled	✓	✗	✓
Uses a device that plugs in to your vehicle	✓	✓	✗
Requires a smartphone with downloaded app	✗	✗	✓
<b>Value-Added Amenities</b>			
<b>Mileage-Based User Fee (MBUF) Details View</b> all the data pertaining to MBUF charges, including your miles traveled, fuel tax credit and wallet balance.	✓	✓	✓
<b>Trip Logs</b> Detailed trip logs remember each trip you've taken, so you can see details about your trips like duration, cost, and carbon footprint.	✓	✓	✓
<b>Vehicle Health</b> Get valuable information about what's really happening with your vehicle when the Check Engine light goes on.	✓	✓	✗

Figure 3-3. Page from the Fact Sheet Following the Pilot





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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experience. Copies of the FAQs are included in Appendix B.

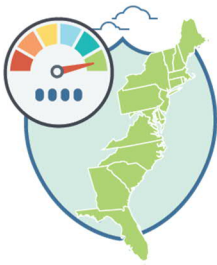
### 3.4 Presentations

Members of the Coalition did a number of presentations during the study, sharing general information on the issues with the current fuel tax funding system, the concept of MBUF, and the study that was underway. In 2018, the following presentations were made on behalf of the Coalition about the Phase 1 MBUF project:

- March 2018
  - Road User Charging Conference – Brussels, Belgium
- May 2018
  - Build America Transportation Investment Center (BATIC) Institute's Road User Charge Pilot Programs: Examples of Regional Collaboration and Innovation webinar
  - National Congestion Pricing Conference – Washington, DC
  - WTS International Annual Conference – San Diego, California
  - AAMVA Region 1 Conference – Wilmington, Delaware
- June 2018
  - Baltimore Regional Transportation Board – Baltimore, Maryland
- October 2018
  - American Association of State Highway Professionals Committee on Transportation Communications (TransComm) Annual Meeting – Biloxi, Mississippi
- November 2018
  - International Road Federation Global Road2Tunnel Conference – Las Vegas, NV

### 3.5 News Release and Media Tracking

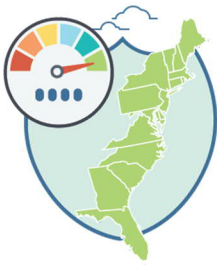
The I-95 Corridor Coalition issued a joint news release with the DelDOT in May 2018 as the Phase I Pilot launched (Appendix C). Table 3-1 lists the news articles that were published during the course of the study.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 3-1. Articles Published During Study

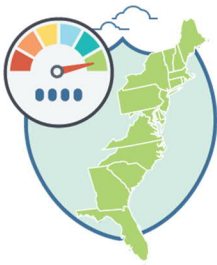
Article Date	Title	Source	Topic	Link
8-14-17	Letter from Pennsylvania: Taxed by the Mile, Not by the Gallon of Gas?	Townhall	Overview of I-95 MBUF study	<a href="https://townhall.com/columnists/colinmcnickle/2017/08/14/letter-from-pennsylvania-taxed-by-the-mile-not-by-the-gallon-of-gas-n2368395">https://townhall.com/columnists/colinmcnickle/2017/08/14/letter-from-pennsylvania-taxed-by-the-mile-not-by-the-gallon-of-gas-n2368395</a>
8-16-17	Pa., other states worry about life after gas tax	The Tribune Democrat	Overview of gas tax alternatives; mention of I-95 MBUF	<a href="http://www.tribdem.com/news/pa-other-states-worry-about-life-after-gas-tax/article_e2a96870-821b-11e7-8469-437ec5038e7c.html">http://www.tribdem.com/news/pa-other-states-worry-about-life-after-gas-tax/article_e2a96870-821b-11e7-8469-437ec5038e7c.html</a>
10-20-17	I-95 Corridor Coalition, Delaware DOT to Test Mileage-Based Revenue Project With Trucks	Transport Topics	Overview of I-95 MBUF study	<a href="http://www.ttnews.com/articles/i-95-corridor-coalition-delaware-dot-test-mileage-based-revenue-project-trucks">http://www.ttnews.com/articles/i-95-corridor-coalition-delaware-dot-test-mileage-based-revenue-project-trucks</a>
12-12-17	CA lawmakers consider per-mile tax to spur construction revenue	Construction Dive	Mention of study as example	<a href="https://www.constructiondive.com/news/ca-lawmakers-consider-per-mile-tax-to-spur-construction-revenue/512809/">https://www.constructiondive.com/news/ca-lawmakers-consider-per-mile-tax-to-spur-construction-revenue/512809/</a>
2-2-18	Nikola Motor Co. plans \$1B Arizona plant	Construction Dive	Mention of study as example	<a href="https://www.constructiondive.com/news/nikola-motor-co-plans-1b-arizona-plant/516191/">https://www.constructiondive.com/news/nikola-motor-co-plans-1b-arizona-plant/516191/</a>
5-1-18	I-95 Coalition and DelDOT Launch Mileage-Based User Fee Study	Delaware News	Announcement of MBUF study launch	<a href="https://news.delaware.gov/2018/05/01/95-coalition-deldot-launch-mileage-based-user-fee-study/">https://news.delaware.gov/2018/05/01/95-coalition-deldot-launch-mileage-based-user-fee-study/</a>
5-2-18	Real-time truck parking data aims to strengthen Midwest freight corridors	FleetOwner	Study mentioned in passing	<a href="http://www.fleetowner.com/driver-management/real-time-truck-parking-data-aims-strengthen-midwest-freight-corridors">http://www.fleetowner.com/driver-management/real-time-truck-parking-data-aims-strengthen-midwest-freight-corridors</a>
5-2-18	Delaware latest state to study VMT tax	Land Line	Announcement of MBUF study launch	<a href="http://www.landlinemag.com/story.aspx?storyid=72236#.WutOHYgvxhE">http://www.landlinemag.com/story.aspx?storyid=72236#.WutOHYgvxhE</a>



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 3-1. Articles Published During Study

Article Date	Title	Source	Topic	Link
5-4-18	DelDOT study to explore if fuel tax can be replaced	Transportation Today	Announcement of MBUF study launch	<a href="https://transportationtodaynews.com/news/9304-deldot-study-explore-fuel-tax-can-replaced/">https://transportationtodaynews.com/news/9304-deldot-study-explore-fuel-tax-can-replaced/</a>
5-4-18	I-95 Corridor Coalition, Delaware DOT to Pilot Mileage-Based User Fees	Transport Topics	Announcement of MBUF study launch	<a href="http://www.ttnews.com/articles/i-95-corridor-coalition-delaware-dot-pilot-mileage-based-user-fee">http://www.ttnews.com/articles/i-95-corridor-coalition-delaware-dot-pilot-mileage-based-user-fee</a>
5-8-18	Pay per mile or gas tax? I-95 corridor tests tracking drivers	WTOP	Overview/description of MBUF study launch	<a href="https://wtop.com/dc-transit/2018/05/95-corridor-tests-tracking-drivers-charge-per-mile-rather-gas-tax/">https://wtop.com/dc-transit/2018/05/95-corridor-tests-tracking-drivers-charge-per-mile-rather-gas-tax/</a>
6-28-18	Delaware-led pilot study looks at MBUF vs. fuel tax	Delaware News Journal	Overview of the study	<a href="https://www.delawareonline.com/story/news/2018/06/28/delaware-led-study-looks-mileage-based-user-fees-vs-fuel-tax/734065002/">https://www.delawareonline.com/story/news/2018/06/28/delaware-led-study-looks-mileage-based-user-fees-vs-fuel-tax/734065002/</a>
7-2-18	I-95 study tests taxing cars per miles-driven, not gas used	MyTwinTiers.com	Overview of the study	<a href="https://www.mytwintiers.com/news/i95-study-tests-taxing-cars-per-milesdriven-not-gas-used/1278615003">https://www.mytwintiers.com/news/i95-study-tests-taxing-cars-per-milesdriven-not-gas-used/1278615003</a>
7-2-18	Delaware Studying if Miles Driven Should Replace Gas Taxes	WBOC 16	Overview of the study	<a href="http://www.wboc.com/story/38555091/delaware-studying-if-miles-driven-should-replace-gas-taxes">http://www.wboc.com/story/38555091/delaware-studying-if-miles-driven-should-replace-gas-taxes</a>
7-2-18	I-95 study tests taxing cars per miles-driven, not gas used	WFTV 9	Overview of the study	<a href="https://www.wftv.com/news/i95-study-tests-taxing-cars-per-milesdriven-not-gas-used/781435798">https://www.wftv.com/news/i95-study-tests-taxing-cars-per-milesdriven-not-gas-used/781435798</a>



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 3-1. Articles Published During Study

Article Date	Title	Source	Topic	Link
8-7-18	Azuga® selected by I-95 Corridor Coalition for first mileage-based user fee study on the East Coast	Cision PRWeb	Announcement of Azuga being used for study and an overview of the study	<a href="https://www.prweb.com/releases/azuga_selected_by_i_95_corridor_coalition_for_first_mileage_based_user_fee_study_on_the_east_coast/prweb15674817.htm">https://www.prweb.com/releases/azuga_selected_by_i_95_corridor_coalition_for_first_mileage_based_user_fee_study_on_the_east_coast/prweb15674817.htm</a>
8-7-2018	California company to manage Delaware user highway fee pilot	Delaware Business Now	Announcement of Azuga being used for study and an overview of the study	<a href="https://delawarebusinessnow.com/2018/08/california-company-to-manage-delaware-user-highway-fee-pilot/">https://delawarebusinessnow.com/2018/08/california-company-to-manage-delaware-user-highway-fee-pilot/</a>

### 3.6 Video

The Coalition developed a 3+ minute video briefly describing the describing the need for a sustainable funding approach for transportation, the MBUF concept, the results of the Phase 1 pilot, and setting the stage of future phases of the Coalition's work. The video can be viewed at <https://www.i95coalitionmbuf.org/#play-video>.





## 4 Overview of Phase I Pilot

Phase 1 of the Coalition's MBUF project included a "focused pilot in Delaware with regional and national stakeholders". The 155 participants – directly recruited and selected by DeIDOT, Pennsylvania Department of Transportation (PennDOT), and the Coalition – had a choice of technology to record their miles driven during the three-month pilot which ran from May 1 through July 31, 2018.<sup>18</sup> Each technology option offered a variety of services and amenities for participants, such as visual trip logs, driving scores, and vehicle health monitors. All vehicles in the initial MBUF pilot were light-duty vehicles. Invoices were sent out monthly showing what participants would have been charged under a mileage-based system, although no actual payments were made as part of this study. The following sections provide details of the Phase 1 Pilot and related activities.

### 4.1 Purpose of Pilot

National experience has shown that experiencing a MBUF system first-hand through pilots can help expand public understanding and acceptance of the concept. The Phase 1 pilot was "focused" in that the participants – consisting of senior staff from DOTs, members and staff from state legislatures and the U.S. Congress, thought leaders from national organizations, local officials, representatives from the trucking industry, toll authorities, and the media – were actively recruited and invited. In this manner, the Phase 1 Pilot itself was an important education and outreach effort.

The purpose of the Phase 1 pilot was to start the conversation on the east coast about the feasibility of MBUF.

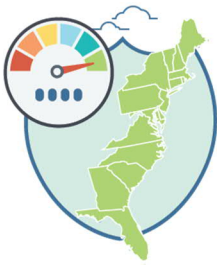
This pilot was the first to dive deeply into the unique challenges of managing out-of-state mileage, and to explore interoperability with toll facilities. As previously discussed in Section 2, these are issues of great importance to states along the eastern seaboard. This study also explored the financial implications of MBUF, concerns about privacy and equity, and the value-added amenities available to drivers through the MBUF reporting technologies.

### 4.2 Process and Activities

The I-95 Corridor Coalition managed this project on behalf of the participating states, with guidance from the project Steering Committee (see Table 4-1) and work by CH2M (now part of Jacobs Engineering Group Inc., and the Coalition's lead consultant), Burns & McDonnell, High Street Consulting, and Azuga. As a Coalition-led effort, all the member states were kept abreast of the MBUF project and findings. The project was delivered in partnership with FHWA—the STSFA grant manager. By working together, the Coalition, Steering Committee, consultant team, Coalition members and FHWA ensured the delivery of a successful project.

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<sup>18</sup> Approximately 25 participants participated through August 31, primarily to participate in the tolling proof of concept discussed in Section 5.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

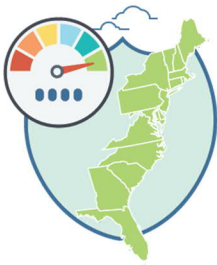
Table 4-1. I-95 MBUF Steering Committee Members for Phase 1

Agency	Position
Delaware DOT (DelDOT)	DOT Secretary
	Assistant Director of Engineering
	Director of Finance
	DMV Director
Pennsylvania DOT (PennDOT)	DOT Secretary
	Executive Department Secretary
	Policy Director
	Manager Vehicle Registration
I-95 Corridor Coalition	Executive Director
Port Authority of New York and New Jersey	Deputy Director
American Automobile Association (AAA)	Vice President, Public and Government Affairs
America Trucking Association (ATA)	Vice President, Highway Policy
International Bridge, Toll, and Turnpike Association (IBTTA)	Director and Chief Executive Officer
Federal Highway Administration (FHWA)	STSFA Lead, and Delaware and Pennsylvania Division Representatives

Table 4-2 lists the major activities that led up to the launch of the Phase 1 pilot, with additional details provided in the following sections.

Table 4-2. I-95 MBUF Phase 1 Pilot Timeline of Key Activities

Activity	Date
RFI to Potential Vendors and Shortlisting	July-August 2016
Vendor Day (with Steering Committee)	September 2017
Operational Concept Workshops	November 2017 - Delaware
	December 2017 - Pennsylvania
Pre-RFP Notice to Shortlisted Account Managers	January 2018
RFP to Shortlisted Account Managers	February 2018
Vendor Selection	March 2018



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 4-2. I-95 MBUF Phase 1 Pilot Timeline of Key Activities

Activity	Date
Testing/Soft Launch	April 2018
Pilot Launch	May 1, 2018

RFP = request for proposal

### 4.2.1 RFI and Vendor Day

All hardware and software required for the Phase 1 Pilot, and MBUF account management activities, were provided by a private sector account manager (acting as a CAM). The involvement of the private sector in the pilot began with a Request for Information (RFI) that was sent to 15 private entities who had been involved or had shown an interest in the MBUF approach. The RFI requested information on the company's capabilities and experience with MBUF, emphasizing that the Coalition was looking for entities (or partnerships involving multiple entities) that could provide a turn-key system comprising all necessary MBUF components and activities, plus a preference for solutions that have been successfully deployed in other MBUF pilots around the country.

Three companies responded to the RFI providing the required information<sup>19</sup>—Azuga, eMovis, and IMS. All three had the necessary solutions and experience and, accordingly, were shortlisted for the Phase 1 Pilot. These private entities were then invited to make presentations during a "Vendor Day" on their respective approaches and technologies to collect mileage data (both in-state and out-of-state) and their associated value-added amenities. The vendor day attendees included the I-95 Corridor Coalition MBUF Steering Committee, staff from the participating states (DelDOT and PennDOT), DMVs, and finance agencies, along with other key stakeholders from the Port Authority of New York/New Jersey, IBTTA, ATA, and AAA. Additional guests included FHWA, American Association of State Highway Transportation Officials (AASHTO), Transportation Research Board (TRB), and other Coalition member agencies.

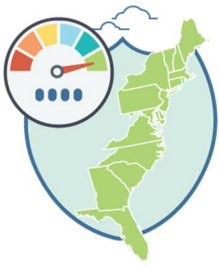
### 4.2.2 Operational Concept Workshops

Representatives from Delaware and Pennsylvania participated in workshops to discuss and finalize the operational concepts of the pilot. Discussion topics and outcomes included:

- Determine approaches and technologies to include in the pilot
- Decide which additional services to include and how much "vendor marketing" to allow
- Create preliminary list of participants (entity and individuals)
- Discuss per-mile rates
- Review pilot set-up and evaluation (e.g., what questions to ask)

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<sup>19</sup> Others did respond, noting that they did not have the necessary capabilities or previous experience.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Based on the results of the workshops, an Operational Concept Document (OCD) was developed for the Phase 1 Pilot. This OCD also formed the basis for developing a System Requirements Specification (SRS), Interface Control Document (ICD), account manager RFP, and system acceptance test plans.

### 4.2.3 RFP and Vendor Selection

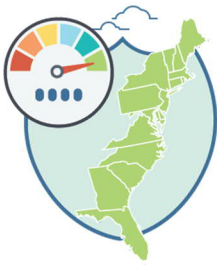
To be ready to launch the Phase 1 Pilot on May 1, 2017, a pre-RFP notice was sent out the three short-listed vendors providing them a summary of the work scope (Table 4-3), the schedule, the approximate number of participants, per-mile rates for each state, and the payment approach, thereby giving the prospective vendors the opportunity to begin work on the RFP response.

Table 4-3. Summary of Account Manager's Scope  
(As included in the Pre-RFP Notice)

The selected vendor will be responsible for providing mileage reporting and account management support during the soft launch and the operational pilot – essentially the same hardware and services as “Commercial Account Managers” (CAMs) have provided in the earlier pilot in California and the ongoing OReGO program. The intent is for the vendors to utilize their existing mileage reporting approaches, account management systems, and invoicing process with only minor modifications (logos, per-mile rates, accommodate mileage and associated MBUF charges from multiple states, etc.). The services to be provided will include, but not be limited to, the following:

- Provide a website for participants to choose their options for mileage reporting and create and manage their user accounts. This account management website shall be linked to the MBUF Program website provided by the Coalition.
- Provide content for the Coalition's website describing the various other driver services and amenities, thereby allowing participants to review these available services prior to choosing a MBUF approach and/or vendor. Vendors will not be allowed to provide marketing materials directly to participants before or during the pilot.
- Provide and distribute plug-in (to OBD-II<sup>20</sup>) devices – with and without location – and a smartphone app (and “beacon”) as mileage reporting options (MRO), and applications for participant smartphones following account set up by the participants.
- Provide transaction processing and account management services, including the collection and processing of mileage and other data from each participant, calculation of the MBUF fee based on per-mile charge in each state (with different rates in each state), and calculated estimate of the gas tax paid for each state. Vendor(s) will not be required to identify private roads (other than toll roads and facilities).

<sup>20</sup> OBD stands for on-board diagnostics. The OBD-II port enables external devices to access data on mileage, emissions, speed and other subsystems that are already stored in a vehicle's computer. The port is most often on the driver's side of the vehicle either on or under the dash. The OBD-II port is typically available on any vehicle made after 1996. As the OBD-II standard was developed by California to monitor emissions, some electric-only vehicles may not have the port.



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Table 4-3. Summary of Account Manager's Scope  
(As included in the Pre-RFP Notice)

- Issue faux invoices to participants (via email or web) every month, indicating the total MBUF charge and the calculated gas taxes paid by state.
- Provide customer support through a Help Desk accommodating phone and email during the soft launch and the pilot. The Help Desk will be operational between the hours 8 AM and 6 PM, Monday through Friday, at a minimum.
- Prior to the start of the pilot, support internal system acceptance testing by CH2M of each of the vendor's mileage reporting options, account management, website, and mobile app offerings. This test will evaluate the full turnkey capability of the vendor's system.
- Support a one-week pilot soft launch.
- Generate monthly reports in accordance with the ICD (e.g., Mileage and Revenue Report, VIN Summary Report, Errors and Events Report, Account and VIN Update) and other information as may be required. The reports will be sent to CH2M for review and aggregation and summarization of the data, including removal of any personally identifiable information. The summarized information will be forwarded to the I-95 Corridor Coalition.
- As an option, examine and test if location-based MBUF approaches and technologies can also be used for tolling.

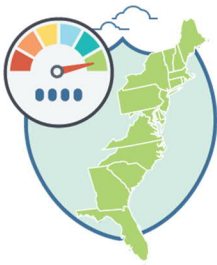
Subsequently, the RFP was issued to the three shortlisted entities (i.e., Azuga, emovis, IMS) which included a detailed scope of work (consistent with the high-level scope provided in the pre-RFP), the project schedule, a copy of the Operational Concept Document, the System Requirements Specifications (SRS) and the Interface Control Document (ICD)<sup>21</sup>, preliminary test plans, and the contract documents for the Phase 1 pilot. As part of their response (limited to 15 pages), vendors provided a firm quote for providing the various hardware, software, and account management services during the Phase 1 Pilot.

Vendor proposals were reviewed and evaluated by CH2M, with points assigned based on the degree to which the following criteria were satisfied:

- Ability to provide all the services defined in the work scope, and in accordance with the proposed schedule (35 points max)
- Ability to conform to the SRS and ICD, and concurrence with the test plans (15 points max)
- Cost (50 points max, with the lowest bidder receiving 50, with others receiving a pro-rated amount based on amount over lowest bidder)

A recommendation was made to the Coalition and then presented to the Delaware and Pennsylvania members of the Steering Committee. Both Delaware and Pennsylvania agreed to

<sup>21</sup> The SRS and ICD were largely based on the same documents used for other recent MBUF pilots.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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select Azuga as the vendor to provide mileage reporting technology and account management support for the Phase 1 pilot.

### 4.2.4 Testing and Soft Launch

In April 2018 acceptance testing was conducted by CH2M in association with Azuga. The purpose of this test was to verify that the pilot system was ready for operational use and met the system and functionality requirements identified by the I-95 Corridor Coalition MBUF Study Team. Specific test cases were developed to verify the operation of each subsystem, the adequacy of the processes established for the pilot program, and the ability of the system to support those processes. The test cases were developed to verify not only the system's ability to accurately collect mileage and calculate and process MBUF, but also to verify the adequacy of all the processes required to join and participate in the program, such as enrollment and working with the Help Desk. As an example, enrollment testing included activities that were not supposed to work, such as attempting to enroll without a valid activation code, without a signed participant agreement (as identified in the participant database), and by entering an incorrect VIN. The enrollment testing also included calling the Help Desk to get information on how to find the OBD-II port.

The operational acceptance testing utilized multiple vehicle types, including an EV, a hybrid EV, and ICE vehicles with different fuel economies. Testing participants were assigned different mileage reporting options to ensure all three options were tested. Testers drove their vehicles for 2 days, recording odometer readings at the start and end of each trip and at state border crossings. Trips were started with a full tank of gas, with each test vehicle being filled back up at the end of the day. At the end of the day, the mileage and gas usage for each vehicle was compared to the data collected by Azuga. The results of the operational system acceptance testing are summarized below:

- The total miles recorded by Azuga were generally accurate when compared to the tester logs – within 3 percent and the typical tolerances for odometers (approximately +/- 4 percent<sup>22</sup>) – as shown in Table 4-4. There were some exceptions to this:
  - Smartphone with Location Beacon (Vehicle 1 in Table 4-4) – data were not reported consistently (i.e., several trips were missed) during testing for one of the participants. The smartphone app was updated and retested successfully.
  - The original OBD-II device assigned to the EV did not transmit data, nor did a replacement device as provided onsite. Another plug-in device was specially configured by Azuga for the test EV with the subsequent trips properly recorded (as shown for Vehicle 6 in Table 4-4).
  - Issues with mileage reporting for the specific model and trim of the test BMW (a BMW X5 50i). It was determined that this model and trim was incompatible with the OBD-II device, which continually set off the vehicle's alarm system.

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<sup>22</sup> There is no federal law that regulates odometer accuracy, only guidelines by The Society of Automotive Engineers (SAE) that allow for a margin of error of plus or minus four percent.





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- Gas consumption estimates were generally accurate for the non-location plug-in device. There were differences in the gas calculations for the location-based plug-in device, with the Azuga numbers being higher than actual for only two test points. Gas estimates for the smartphone were based on U.S. Environmental Protection Agency (EPA) ratings for the specific make, model, and year of the vehicles, not on vehicle data.
- The smartphone app required all permissions be turned on to use the app. Azuga updated their software to require only specific permissions for applicable features such as location data, camera, storage, and phone.

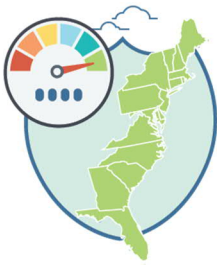
Table 4-4. Pilot System Acceptance Test Mileage Accuracy Results

Vehicle	Fuel Type	Mileage Reporting Option	Participant Logged Mileage	Azuga Reported Mileage	% Difference
1	Gas	Smartphone with Location	156.1	63.5	59%
2	Gas	Smartphone with Location (retest)	301.1	309.3	-3%
3	Gas	Plug-In Device without Location	300.6	297.8	1%
4	Gas	Plug-In Device without Location	221.3	221	0%
5	Hybrid	Plug-In Device without Location	301	297.7	1%
6	Electric	Plug-In Device with Location	977	959	2%
7	Gas	Plug-In Device with Location	242.7	241.7	0%
8	Gas	Plug-In Device with Location	249.3	247.1	1%

This iterative process of problem identification, solution, and confirmation proved very useful in improving the performance of the system and moving it toward readiness for the larger rollout. As a result of this testing and (in some cases) re-testing, it was determined that the I-95 Corridor Coalition MBUF Pilot was ready for operation and for participant enrollment to commence on May 1, 2018.

Another aspect of the acceptance testing involved a “soft launch” of the pilot with selected staff from DelDOT. Soft launch participants went through the full cycle of account creation and pilot operations. The purpose of the soft launch was to gather user experience feedback through an early preview of the pilot enrollment and device installation process and allow time to test and correct any pilot system design issues before the pilot launch. As a result of the soft launch, several enhancements were made to the I-95 Corridor participant microsite, the Azuga enrollment website, Help Desk operations, and the email formats sent from Azuga to participants. Examples of these enhancements and changes included:

- Coalition microsite – Keep menu bar across the top of the website locked or frozen, so when you scroll down on each page it stays there.



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- Coalition microsite – Have the fact sheet open in a new window.
- Coalition microsite – After going through the questions, and hitting "enroll", it did not go the Azuga site for enrollment.
- Azuga enrollment site – Remove the "billing" box because it does not apply to this pilot.
- Azuga enrollment site – Error message when put in a comma in the odometer reading. Maybe have a note that says no commas (versus enabling commas).
- Azuga enrollment site – On the vehicle page it is not clear that a user must click "add vehicle" before they can continue on, causing them to get hung up at the next screen without clear indication of what step they are missing. Change wording to say "submit" (or something similar) so it adds the vehicle they entered. Concern was that "Add Vehicle" makes it sound like you hit this button to add another vehicle.
- Monthly statement – Minor edits to the monthly statement.

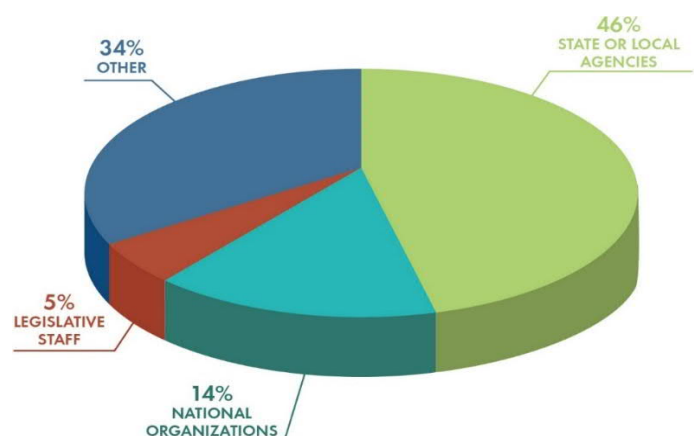
### 4.3 Pilot Participants, Vehicles, and Reporting Options

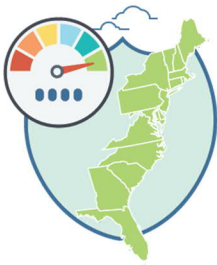
#### 4.3.1 Recruitment

Given the purpose of the Phase 1 Pilot was to start the conversation on the East Coast about the feasibility of MBUF, the participants were limited to targeted stakeholders and was not open to general public volunteers. The Coalition, DeIDOT, and PennDOT were responsible for participant identification and recruitment for the Phase 1 Pilot. Participants were recruited from DOTs, members and staff from state legislatures and the U.S. Congress, transportation thought leaders, local officials, representatives from the trucking industry, toll authorities, local media, and national organizations. To engage multiple Coalition states, individuals from 13 of the 17 member states were recruited.

A total of 207 people were recruited for the Phase 1 Pilot, of which 155 enrolled and participated in the Phase 1 Pilot. The Coalition's and state partners' persistent recruitment resulted in this high participation rate (75 percent) of senior officials and staff from their respective organizations. Figure 4-1 shows the breakout of Phase 1 Pilot participants by organization category. The "other" category includes residents, transportation consultants, Coalition members, and other private companies. Figure 4-2 shows the number of participants in each Coalition state. (The participants from Connecticut were not state employees.)

Figure 4-1. Pilot Participant Makeup





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### 4.3.2 Vehicle Types

The Phase 1 Pilot included light-duty vehicles only, and participants were limited to enrolling only one vehicle in the program. Additionally, only gasoline and electric-powered vehicles were included in the pilot<sup>23</sup>. Table 4-5 provides the fuel efficiency breakdown of the participating vehicles.

Table 4-5. I-95 MBUF Phase 1 Pilot Vehicles

Vehicle Fuel Efficiency	Number of Vehicles
0-10 MPG	0
11-20 MPG	48
21-30 MPG	88
31-40 MPG	15
> 40 MPG	4*
Electric Vehicles	0
<b>TOTAL VEHICLES</b>	<b>155</b>

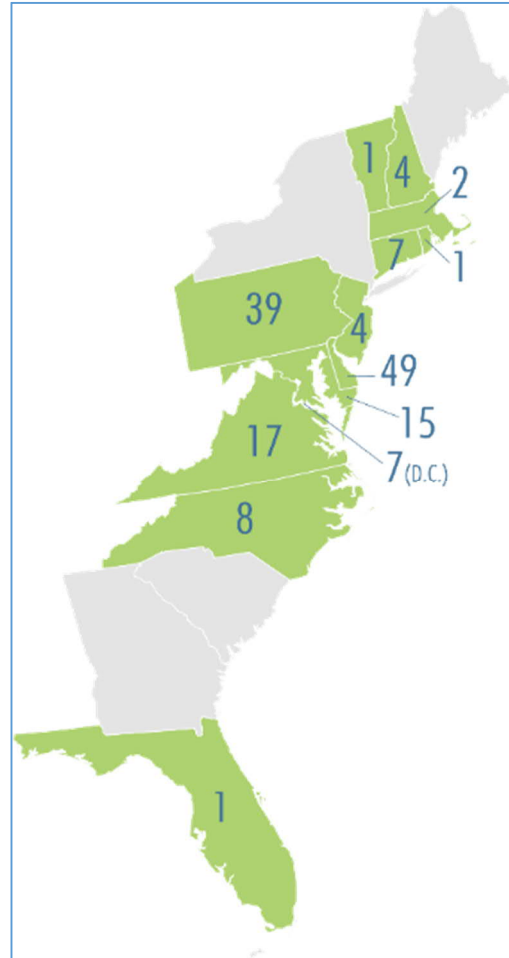
\* All vehicles in this category were hybrid-EVs for the Phase 1 pilot

### 4.3.3 Mileage Reporting Options and Technologies

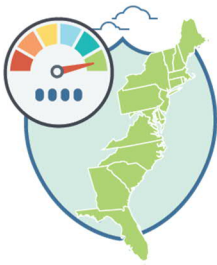
Three mileage reporting options were available for the Phase 1 Pilot including two devices that plug directly into the vehicle's on-board diagnostic (OBD-II) port and one device that works through an Android smartphone app paired with a credit-card sized device that stayed in the vehicle. The following is a summary of the three options provided:

- **Plug-In Device with Location:** A device designed to plug in to the vehicle's OBD-II port that automatically calculates the MBUF based on the state(s) where miles were actually driven. The device collects mileage data and gas consumption data directly from the vehicle's computer, with the location of the miles driven derived from a global positioning system (GPS) chip. Taking the recorded mileage and location data, along with the amount of gas consumed, participant pays for

Figure 4-2. Number of Participants by Coalition State



<sup>23</sup> One diesel vehicle attempted to participate in the pilot, but given the system was only set up for gasoline vehicles, the associated invoices did not show the MBUF and fuel tax credits correctly. The data from this vehicle was not included in the project data analysis.



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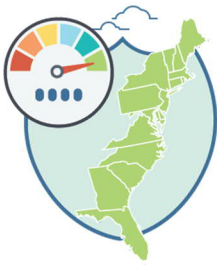
miles driven based on the actual state(s) in which they drove and receive credits for gas taxes paid. A location-based MBUF enables funds collected to be accurately distributed between states based on where and how many miles were driven in each state.

- **Plug-In Device without Location:** A device designed to plug in to the vehicle's OBD-II port that automatically calculates the MBUF based on estimates of the state(s) where miles are driven. The device collects mileage data and gas consumption data directly from the vehicle's computer. This mileage and gas information is distributed between the home state and adjacent states based on pre-established assumptions about the percentage of in-state and out-of-state travel. The non-location MBUF reduces privacy concerns regarding trip data but does not provide an accurate connection between the funds collected and where the miles were accrued. Not having the location technology also limits the number of value-added amenities available.
- **Smartphone with Location (Android phones only):** An app downloaded on the participant's smartphone that works with a credit card-sized device (beacon) to automatically calculate the MBUF. The app uses the phone's GPS to measure mileage and record the state(s) where miles are driven. The beacon is used to tie the smartphone app to the specific vehicle; otherwise trips taken with the smartphone via other modes or vehicles (i.e. train or in another vehicle) could be billed for that additional mileage. To work correctly, the beacon and smartphone must be in the vehicle. The smartphone and its GPS functionality must be turned on and the participant must be logged into their account while in the vehicle. Combining the recorded mileage and location data with official vehicle fuel consumption ratings (as determined by EPA), participant pays for miles driven based on the actual state(s) in which they drove and receive credits for gas taxes paid. Because there is no connection to data stored in the vehicle's computer, several value-added amenities (e.g., vehicle health, battery performance, safe zones) are not available.



### 4.3.3.1 Value-Added Amenities

As previous Figure 2-2 (Currents Pushing Innovation in Transportation) illustrates, vehicle technology and driver interest in data potentially creates the opportunity to change how transportation is funded. An example of the changing landscape is the growing market for devices that use information stored in a vehicle's computer (or collected by the device) and convert these

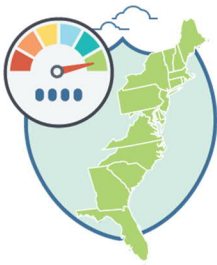


## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

data into information for drivers. These “value-added” amenities – one of the four key focus areas of the Coalition MBUF effort – were offered to Phase 1 Pilot participant to assess the interest in vehicle and driving behavior information. Table 4-6 summarizes the features of each device and identifies the available value-added amenities and services for each mileage reporting option. This table was also provided on the I-95 Corridor Coalition MBUF Study’s microsite enrollment page. Figure 4-3 provides pictures and screens of some of these value-added amenities.

Table 4-6. I-95 MBUF Device Features and Value-Added Amenities

	Plug-In Device with Location	Plug-In Device without Location	Smartphone with Location (Android only)
Device Operations			
Uses GPS to determine where you traveled.	X		X
Uses a device that plugs in to your vehicle	X	X	
Requires a smartphone with downloaded app.			x
Value-Added Amenities			
MBUF Details: View all the data pertaining to MBUF charges, including your miles traveled, gas tax credit, and wallet balance.	X	X	X
Trip Logs: Detailed trip logs remember each trip you’ve taken, so you can see details about your trips like duration, cost, and carbon footprint.	X	X	X
Vehicle Health: Get valuable information about what’s really happening with your vehicle when the Check Engine light goes on.	X	X	
Battery Voltage: See how well your battery is performing and see right away if your battery is dead or getting old. This includes automatically receiving an email when the battery level drops below a specified level.	X	X	
Driver Scoring: Driver scoring that shows how smooth you drive. Driving factors that are scored: high speed, acceleration, braking, and idling.	X	X	
Achievements: Earn badges that unlock for good driving behavior. Compete with friends and family to see who can unlock the most badges. A great tool for drivers to stay engaged and connected with their driving.	X	X	



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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Table 4-6. I-95 MBUF Device Features and Value-Added Amenities

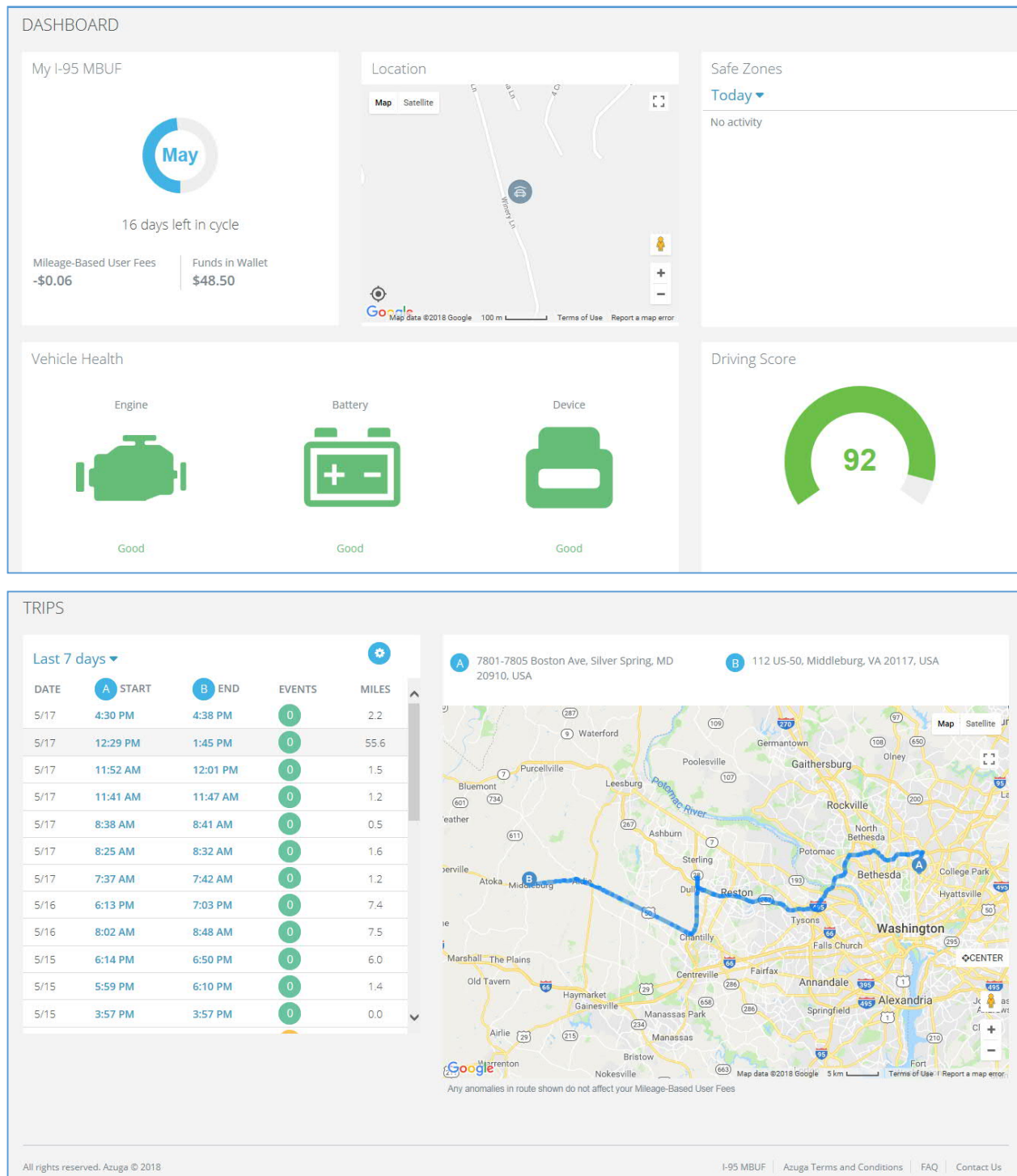
	Plug-In Device with Location	Plug-In Device without Location	Smartphone with Location (Android only)
Safe Zones: Offers peace of mind that anyone driving your car (such as a teenager) is safe by allowing you to set up geographical zones on a map and be notified when the vehicle has entered or exited those zones.	X		
Enhanced Visual Trip Logs: Trip logs that show individual trips on a map and are shareable with friends.	X		X
2MyCar: Guides you back to your car using your smartphone with either turn-by-turn instructions or by a straight-line route.	X Smartphone App Required		X Smartphone App Required

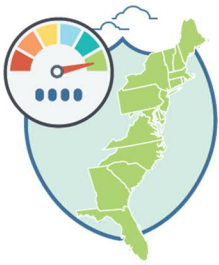




# I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 4-3. Examples of Value-Added Amenities





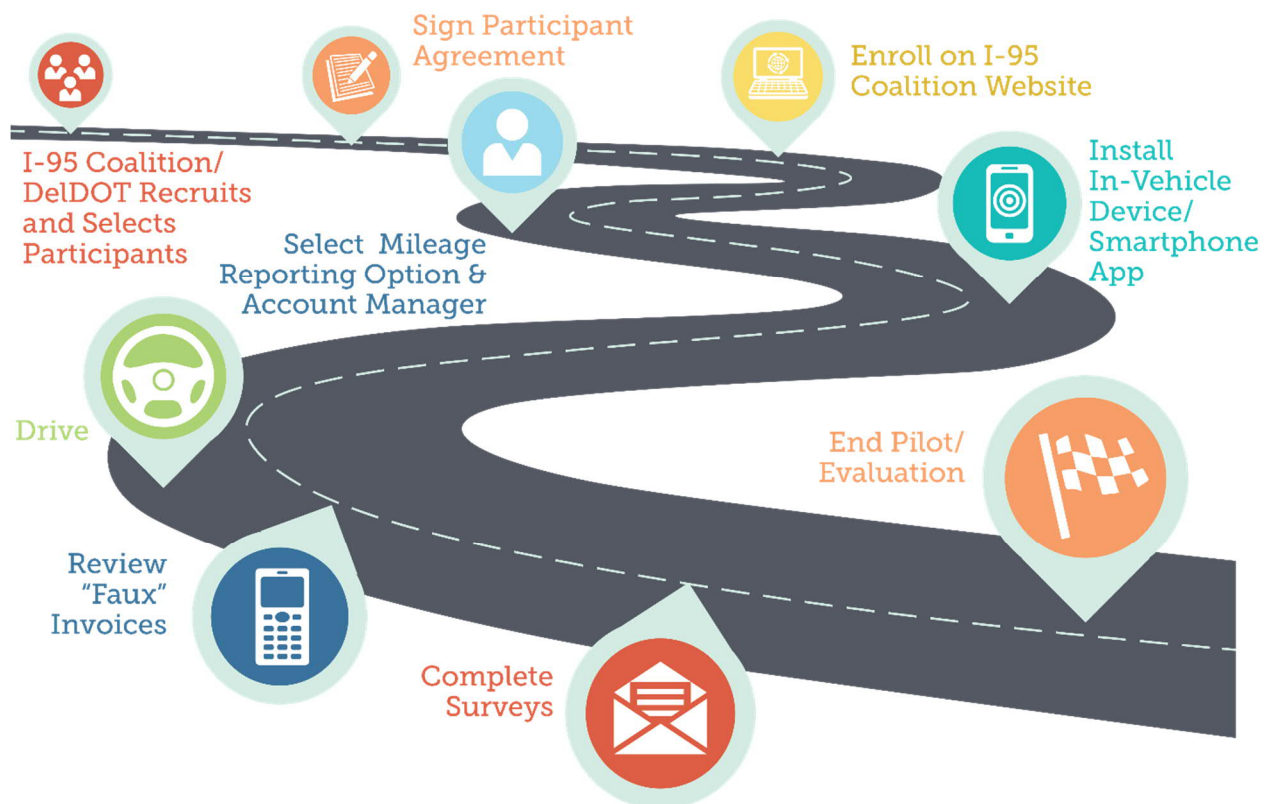
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

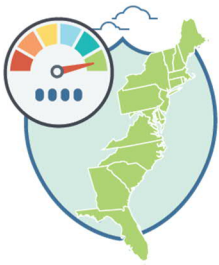
### 4.3.4 Participant Activities

Pilot participants were asked to perform several activities before, during, and after the pilot as shown on Figure 4-4. Participants had to first sign a participant agreement (Appendix C) before enrolling in the pilot, which outlined the expectations for participation and provided information about data security and privacy. Participants then began the enrollment process by first reviewing the available mileage reporting options and the associated value-added amenities via the Coalition's pilot microsite, setting up an MBUF account via the account manager's website, and installing the device in their vehicle and/or downloading a MBUF app on their smartphone, as appropriate. The enrollment process and device installation are explained in more detail in the following subsections.

After the enrollment process, participants simply had to drive, review monthly "faux" invoices for accuracy, and initiate customer service requests (using the account manager's Help Desk), if required. Another responsibility involved participation in the pilot evaluation through two surveys—one at the beginning of the pilot and one after the conclusion of the pilot. The surveys and the results are discussed in Sections 4.4 and 5.

Figure 4-4. Participant Activities during the Pilot





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### 4.3.4.1 Enrollment

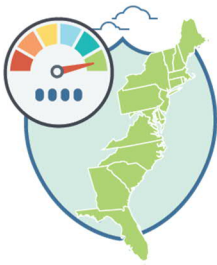
Upon signing the participant agreement, the Coalition sent each participant a personalized email including a weblink to the pilot microsite enrollment page and unique activation code. This email included the information needed to complete the enrollment process:

- Email address (username for account setup)
- Vehicle identification number (VIN)
- Current mileage on your vehicle
- License plate number and state
- Vehicle year/make/model/trim
- Activation code (from the enrollment email)

The first task on the pilot microsite enrollment page was to choose what type of device the participant wanted to record miles driven. A summary of each mileage reporting option was provided, including the value-added amenities for each. The pilot microsite enrollment page also included a selection tool to help pilot participants choose their mileage reporting option (see Figure 4-5). If participants needed further assistance or had any questions, the pilot help desk contact information was provided.

After learning about the three mileage reporting options, participants were directed to the account manager, Azuga's, enrollment page. This is where participants created an MBUF account, selected their mileage reporting option, and accepted Azuga's terms and conditions related to liability, data protection, and equipment care and damage.

Figure 4-6 provides information on the mileage reporting options selected by participants during enrollment. Of the 155 participants, 84 percent chose location-based technology.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 4-5. Enrollment Survey Tool

To help you decide what device you'd like to use, please answer the questions below.

### I-95 Enrollment

**Which is more important to you?**

☐ Whether or not the device uses GPS to identify my location.

☐ The value-added amenities that are available with the device.

[Next](#)

**Yes - I'd like an option that uses GPS**

☐ I want a device that plugs in to my car's [OBD-II port](#).

☐ I want to use an app downloaded on my Android smartphone and a credit-card sized device called a beacon that stays in my car throughout the pilot.

[Prev](#) [Next](#)

**Do you want a device that uses GPS to determine your location?**

A device that uses GPS automatically collects mileage and uses GPS to record the location of miles driven. Choosing a device with GPS means your MBUF will be based on the state(s) you actually drove in and it increases the number of value-added amenities that are available to you, such as Safe Zones and Enhanced Visual Trip logs.

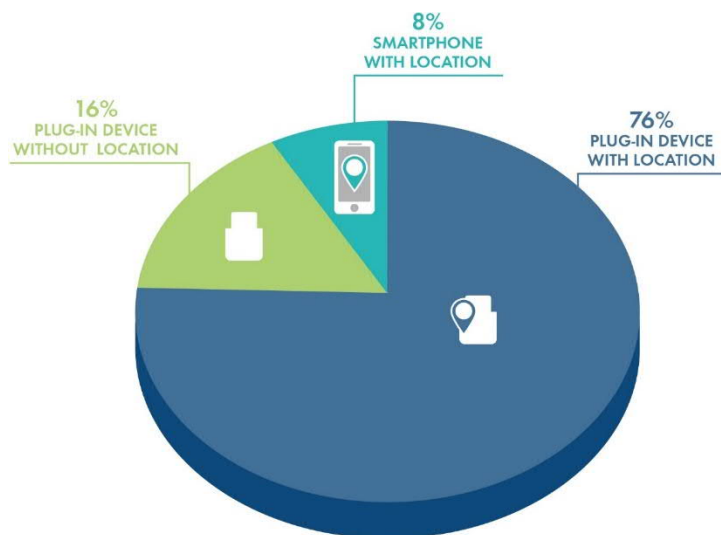
☐ Yes - I'd like an option that uses GPS

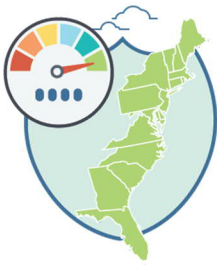
☐ No - I do not want an option that uses GPS

**Based on your responses, the best device for you may be the Plug-In Device with Location.**

[Click Here](#) to learn more about the Plug-In Device with Location.

Figure 4-6. Mileage Reporting Option Selections






## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

### 4.3.4.2 Device Installation

Once accounts were created, Azuga shipped the appropriate devices (plug-in or smartphone beacon) to pilot participants, and participants were asked to install these devices in their vehicles. For participants that chose the plug-in devices (to the vehicle's OBD-II port), a Quick Start Guide (see Figure 4-7) was provided with instructions on how to locate the vehicle's OBD-II port and install the device. Help Desk information was also included if participants encountered difficulty with the installation.

Figure 4-7. Azuga Plug-In Device Quick Start Installation Guide

<div style="background-color: #0070C0; color: white; padding: 5px; text-align: center;"> <b>1 Device Installation</b> </div> <ul style="list-style-type: none"> <li>- Make sure you are parked outside</li> <li>- Plug the device firmly into your vehicle's Onboard Diagnostics (OBD-II) port</li> </ul> <p>The OBD-II port is typically under the driver's side dashboard.</p> <p>Consult your vehicle's Owner's Manual for assistance on finding the OBD-II port location</p>  <div style="background-color: #008000; color: white; padding: 5px; text-align: center;"> <b>2 Device to Vehicle Association</b> </div> <ul style="list-style-type: none"> <li>- Wait 2 minutes</li> <li>- Start your vehicle and allow it to idle for 30 seconds</li> </ul> <p>If the device does not light up during this process, please call support</p> <p style="text-align: center;"><b>You are now connected!</b></p> <p>Your vehicle should now be visible on the Azuga Insight website.</p>	<div style="background-color: #4F6078; color: white; padding: 5px; text-align: center;"> <b>3 Verify Installation</b> </div> <ul style="list-style-type: none"> <li>- Go to <a href="https://i95mbuf.azuga.com">https://i95mbuf.azuga.com</a></li> <li>- Log in using the email and password you created during enrollment</li> </ul> <p><small>Note: The first time logging in after installing the device, the device to vehicle association screen is displayed</small></p> <ul style="list-style-type: none"> <li>- If the device did not automatically associate to the vehicle, select it from the 'Select Active Device' drop down</li> <li>- Click the green "Continue" button at the bottom of the screen</li> </ul> <p style="text-align: center; font-weight: bold;">Verification is complete! You're ready to roll!</p> <p><small>If you have any issues during the installation or verification process, please call us at 1(888) 229-0466 or email us at <a href="mailto:i95mbufsupport@azuga.com">i95mbufsupport@azuga.com</a></small></p>
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## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

For participants that chose the Smartphone with Location option, instructions were provided for the app and beacon device installation (see Figure 4-8).

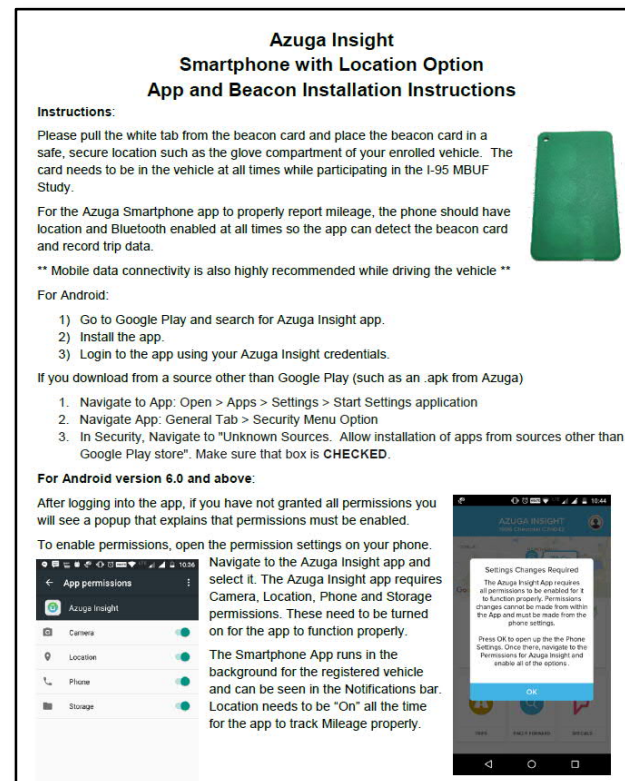
### 4.4 Mileage Recording and MBUF Calculations

Mileage recording and MBUF calculations, along with collecting the amount of gas used and the corresponding credit, was done automatically by the Azuga hardware and account management system. The driver had no responsibility in this regard other than plugging the device into the OBD-II port at the beginning of the pilot, or – for participants using the smartphone approach – to turn the app on before starting a trip.

All mileage driven and recorded during the Phase 1 focused regional pilot was charged the MBUF (less credit for the estimated gas tax) as follows:

- For vehicles that used a location-based approach, all mileage was differentiated by the state where the mileage occurred. The net mileage fee was calculated based on each states' per-mile rate, less a credit for the state tax for the estimated gas consumed in each state<sup>24</sup>. The per-mile rates for the states along the I-95 Corridor, and their corresponding state gas taxes, are shown in Table 4-7 (in alphabetical order). These Phase 1 per-mile rates were developed based on the concept of the per-mile fees being "revenue neutral"—that is, a vehicle that gets the national average of 22 MPG<sup>25</sup> would pay a MBUF that is equal to the amount paid for the state gas tax. As an example calculation of this revenue neutral rate, a Delaware vehicle averaging 22 MPG and driving 1,000 miles (all in Delaware) will use  $1,000 \text{ miles} / 22 \text{ MPG} = 45.45$  gallons of gas, paying  $45.45 \times \$0.23 \text{ cents per gallon} = \$26.68$  in Delaware state gas tax. This equates to  $\$26.68 / 1,000 \text{ miles} = 1.05 \text{ cents per mile}$ .

Figure 4-8. Smartphone App with Beacon Instructions



<sup>24</sup> The devices that plugged into the OBD-II port calculated the gas consumed in each state using real-time vehicle data and the GPS. The smartphone approach calculated gas consumed in each state based on the vehicle's average MPG rating from the EPA and the GPS.

<sup>25</sup> Wall Street Journal, March 2, 2017 (<http://247wallst.com/autos/2017/03/02/average-fuel-economy-for-264-million-us-light-vehicles-22-miles-per-gallon/>); based in information from the University of Michigan Transportation Research Institute.



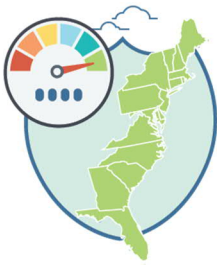


## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 4-7. Per Mile Rates and Gas Taxes Used in the Phase 1 MBUF Pilot for Location-Based Approaches

State	Per Mile Rate (cents per mile)	Gas Tax Credit (cents per gallon)
Connecticut	1.81	39.85
Delaware	1.05	23.00
District of Columbia	1.07	23.50
Florida	1.67	36.80
Georgia	1.41	31.09
Maine	1.36	30.01
Maryland	1.52	33.50
Massachusetts	1.21	26.54
New Hampshire	1.08	23.83
New Jersey	1.69	37.10
New York	1.99	43.88
North Carolina	1.57	34.55
Pennsylvania	2.65	58.20
Rhode Island	1.55	34.00
South Carolina	0.76	16.75
Vermont	1.38	30.46
Virginia	1.02	22.39

- For vehicles that used a non-location-based approach, a specified percentage of mileage and gas tax payments was assumed to have occurred in the vehicle's home state, and the MBUF was calculated using that state's per-mile rate and state gas tax. The remaining percentage of the vehicle's mileage was assumed to have occurred out of the home state, with an average per-mile charge and average gas tax for all out-of-state mileage based on the per-mile rates and state gas taxes in nearby states. The assumed percentages and average out-of-state per-mile rates and gas taxes for each state are shown in Table 4-8. These percentages were based on the census statistics provided in Table 2-2, coupled with the assumption that most out-of-state mileage has an origin or destination in adjoining states.

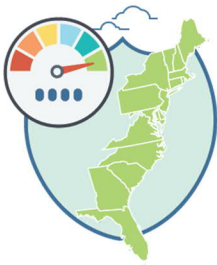


## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 4-8. Assumed Percentages of Out-of-State Mileage by In-State Vehicles and Associated Out-of-State Per-Mile Rates and Gas Taxes Used during Phase 1 MBUF Pilots for Non-Location-Based Approaches

State	Out of State Mileage by Resident Drivers	Out of State Per Mile Rate (cents per mile)	Out of State Gas Tax Credit (cents per gallon)	Out of State Rates and Gas Taxes Based On
Connecticut	8%	1.69	37.08	NY (50%), RI, MA
Delaware	18%	2.13	46.75	PA (50%), NJ, MD
District of Columbia	30%	1.27	27.95	VA, MD
Florida	1%	1.41	31.09	GA
Georgia	3%	1.22	26.78	SC, FL
Maine	5%	1.15	25.19	NH, MA
Maryland	20%	1.29	28.24	DC (35%), VA (35%), PA, DE
Massachusetts	5%	1.61	35.39	CT, NH, RI, NY
New Hampshire	18%	1.29	28.39	MA (50%), VT, ME
New Jersey	15%	2.32	51.04	NY, PA
New York	4%	1.75	38.48	NJ, CT
North Carolina	3%	0.89	19.57	VA, SC
Pennsylvania	6%	1.56	34.37	DE, MD, NJ, NY
Rhode Island	16%	1.59	34.93	CT, MA
South Carolina	5%	1.49	32.82	GA, NC
Vermont	8%	1.54	33.86	NH, NY
Virginia	10%	1.30	28.50	DC, MD

For example, consider a vehicle registered in Delaware with an average MPG of 30 that is driven 1,500 miles in one month, with 1,000 of those miles driven in Delaware and the remaining 500 miles driven in Pennsylvania. With the differentiated approach (GPS) the mileage is charged as shown in Table 4-9. For the non-differentiated approach (i.e. no GPS), mileage is charged based on the assumptions and rates identified in Table 4-7 as shown in Table 4-10.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 4-9. MBUF Charging Example with Location-Based MRO

With Location	MBUF Charge	Gas Tax Credit	Net Charge
Delaware	$1000 \times 0.0105 = \$10.50$	$(1000/30) \times 0.23 = \$7.67$	\$2.83
Pennsylvania	$500 \times 0.0265 = \$13.25$	$(500/30) \times 0.582 = \$9.70$	\$3.55
Total	\$23.75	\$17.37	\$6.38

Table 4-10. MBUF Charging Example with Non-Location-Based MRO

With No Location	MBUF Charge	Gas Tax Credit	Net Charge
Delaware (82%)	$1230 \times 0.0105 = \$12.92$	$(1230/30) \times 0.23 = \$9.43$	\$3.49
Other states (18%)	$270 \times 0.0213 = \$5.75$	$(270/30) \times 0.4675 = \$4.21$	\$1.54
Total	\$18.67	\$13.64	\$5.03

A copy of a typical monthly invoice is provided on Figure 4-9.

Figure 4-9. Typical MBUF Monthly Invoice

**azuga**  
2570 N. 1st Street  
San Jose, CA 95131

Statement Period: Jul 1, 2018 - Jul 31, 2018  
Account Number: Azuga-3608  
Questions? Email: [azugamail@azuga.com](mailto:azugamail@azuga.com)  
Phone: 1(888) 229-0466

Hello Louis, here's your statement for this month. For a glossary of terms used in this statement, please see the last page.

**Mileage-Based User Fee Totals**

2017 Volvo S60	\$1.06
<b>Toll Totals</b>	<b>\$1.06</b>
2017 Volvo S60	\$0.00
<b>Toll Totals</b>	<b>\$0.00</b>

Wallet Balance

Beginning Balance	Activity	Amount	Final Balance
\$97.63	July MBUF	-\$1.06	\$96.57
			<b>\$96.57</b>

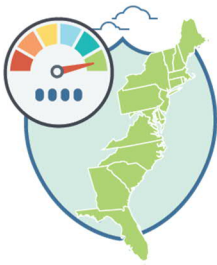
**azuga** Statement period Jul 1, 2018 to Jul 31, 2018 | Account # Azuga-3608

**Mileage-Based User Fee**

Smartphone with In-Vehicle Beacon

2017 Volvo S60

State	Billable Miles	Non-Billable Miles	Fuel Used (G)
DC	8.6	0.0	0.37
	Mileage Fees	Fuel Tax Credit	Mileage-Based User Fees
	\$0.09	-\$0.09	\$0.00
MD	338.0	0.0	14.73
	Mileage Fees	Fuel Tax Credit	Mileage-Based User Fees
	\$5.13	-\$4.93	\$0.20
INT	0.0	0.9	0.00
	Mileage Fees	Fuel Tax Credit	Mileage-Based User Fees
	\$0.00	\$0.00	\$0.00
VA	1638.9	0.0	79.92
	Mileage Fees	Fuel Tax Credit	Mileage-Based User Fees
	\$18.75	-\$17.89	\$0.86



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### 4.5 Data Collection and Analysis Approach

The STSFA grant program includes the requirement for an “evaluation and reporting plan that includes a quantitative and qualitative assessment of: what was done; how well the demonstration worked to meet the objectives of the STSFA program; challenges that had to be overcome; potential to deploy the pilot on a broad scale; findings and recommendations.”

The Phase 1 pilot data evaluation had two primary objectives:

- Measuring the perceptions and attitudes of the pilot participants, both before and after the pilot.
- Measuring the performance of the technology and its ability to provide accurate mileage information and the associated charges and credits. This also included the ability of the location-based MBUF approaches to accurately collect tolls based on the E-ZPass toll rates.

The data collected and analyzed to complete this evaluation included:

- Participant surveys
- Participant interviews
- Monthly reports from account manager
- Participant mileage logs
- Review of toll statements

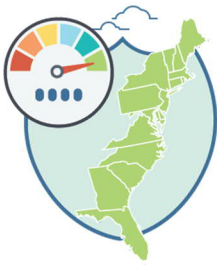
#### 4.5.1 Participant Surveys

Two participant surveys (administered electronically) were conducted over the course of the pilot:

- **Initial Survey:** This survey was administered at the beginning of the pilot after participants enrolled and installed their devices. The survey focused on capturing participants’ attitudes about the enrollment and onboarding processes, as well as their baseline attitudes about MBUF and knowledge of transportation funding
- **Final Pilot Survey:** This survey was administered after the pilot was completed and focused on pilot activities, such as the participants’ understanding of and reaction to their first invoice, what participants thought about the accuracy of the data collected, participants’ overall experience, changes in driving behavior, and their experience with the account manager. It also provided a final update on attitudes about MBUF.

Each of the surveys included questions designed to learn about the attitudes and perceptions of participants towards an MBUF system and to what extent their attitudes change over the course of the pilot. The survey questions focused on the following:

- Attitudes toward fuel taxes and the fairness of MBUF
- Attitudes and satisfaction with the pilot enrollment process
- Attitudes toward technologies and mileage-reporting options for MBUF, including satisfaction with chosen approach and ease of compliance
- Participant satisfaction with the accuracy of miles driven, including out-of-state mileage



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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- Participant satisfaction with the accuracy of estimate of gas tax paid
- Time spent by participants devoted to MBUF pilot activities related to reporting miles
- Attitudes towards value-added amenities, including any changes in driving behavior
- Satisfaction with the ability to access and view data, including ease of understanding the faux invoices
- Attitudes towards privacy protections and data security and concerns with MBUF approaches and technologies (including level of understanding of the privacy protections in the pilot)
- Whether participants experienced issues during the pilot and how they were resolved (help desk experience)
- Suggestions for improving the MBUF approach

Participants received an email with a unique web-link inviting them to participate in each survey. Each link was tied to the participant's activation code which allowed for the comparison of responses between the two surveys to determine differences in responses. Upon completion of the surveys, an extensive analysis of the data gathered was completed, which provides insights for policy-makers about the MBUF pilot participants' attitudes toward key issues like use of technology to deploy user fees, concerns about privacy or accuracy, fairness, and ease of use. Many of the survey questions used a rating scale so that any attitudinal changes over the course of the pilot could be identified.

### 4.5.2 Participant Interviews

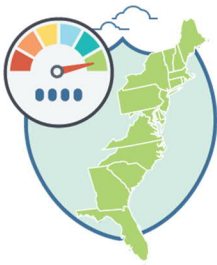
At the conclusion of the pilot, the Coalition conducted follow-up interviews with a select group of participants, including executives in DelDOT and PennDOT, and other regional stakeholders and thought leaders. These interviews were conducted in person to further evaluate attitudes, opinions, and experiences of participants over the course of the pilot. The discussions focused on the following questions:

- What did you learn from the pilot?
- What are the biggest barriers to implementation?
- What are the greatest opportunities for achieving success with MBUF?
- What questions still need to be answered to make MBUF viable?
- What insight could a national pilot provide?

### 4.5.3 Monthly Reports from Account Manager

Over the course of the pilot, a series of monthly reports were provided from the pilot account manager (Azuga) to the pilot consultant team. This information was used to evaluate the effectiveness and accuracy of the technologies and approaches included in the pilots, plus any other issues that arose during the month.

The monthly reports from the account manager that were used for the evaluation included:



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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- Mileage and MBUF Revenue Report: Provided the reported mileage from each vehicle and the gross and net (minus gas tax credits) MBUF charges by state.
- VIN Summary Report: Included a list of all vehicles enrolled with the account manager for the Phase 1 focused regional MBUF pilot.
- Errors and Events Report: Provided any technical errors, anomalies, or events encountered by mileage reporting hardware or the data gathering process.
- Account and VIN Update Report: Report of all account attribute changes and status updates regarding participants and vehicles in the pilot. This report also includes the status of the participants in the pilot.
- Help Desk Report: Report of all customer support issues, resolution actions, and associated response and resolution times logged by the account manager.

Additional information was also provided by the account manager in terms of the participant usage of some of the value-added amenities (e.g., safe zones, low battery emails)

Every month, the I-95 Corridor Coalition received an aggregated summary report from the consultant team based on account manager reports and raw data. The information included in these monthly summary reports included:

- Total number of vehicles enrolled in the pilot versus total number of vehicles actually reporting mileage
- Total miles traveled by state and out-of-state mileage
- Net road charge paid compared to gas tax paid (including by state of travel where applicable and gas tax credits) and average monthly MBUF
- Errors and events by type (e.g., new vehicle connection, disconnects/reconnects)
- Analysis and summary of Help desk logs (e.g., instances, types, time to respond and fix)

It is emphasized that in preparing the monthly summary reports for the Corridor Coalition, all data included in the account manager reports were sanitized and anonymized to protect participant privacy. This included removing all participant-specific personal information (for example, names and mailing addresses) before sending it to the Coalition. Individual participants' data were not shared with the participating states or with the Coalition. Additionally, no detailed location information (e.g., routes taken) nor information on driving behavior was provided to the I-95 Corridor Coalition, the Coalition member states, the project consultant team, or any third party.





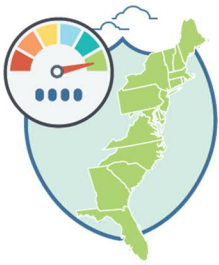
### Figure 4-10. Participant Mileage Log

[illegible]

Another data analysis activity was to examine and test if location-based MBUF approaches and technologies could be used to also collect tolls. Thirty participants – who had vehicles equipped with E-ZPass tags and who chose the plug-in device with location mileage reporting option – volunteered to participate in this test in July and August. The Consultant Team and the AECOM points at the following toll facilities:

- The tolling participants were asked to provide their E-ZPass statements so the toll charges on the statements could be reviewed and compared against the account manager's calculated toll amount as part of the MBUF system. This analysis helped determine the accuracy of this approach and to identify potential reasons for any difference and how to improve the concept in subsequent pilots.

September 2019



# 5 Pilot Results and Lessons Learned

This section is organized by the three project goals, previously identified in Table 2-2, with special emphasis on the key focus areas of out-of-state mileage, tolling and value-added amenities (refer to Table 2-3). Each subsection provides the analysis results and lessons learned during the Phase 1 Pilot using the data and analysis methods presented in Section 4.4.

## 5.1 Goal: Address Regional Issues Necessary for National Adoption and Implementation of MBUF

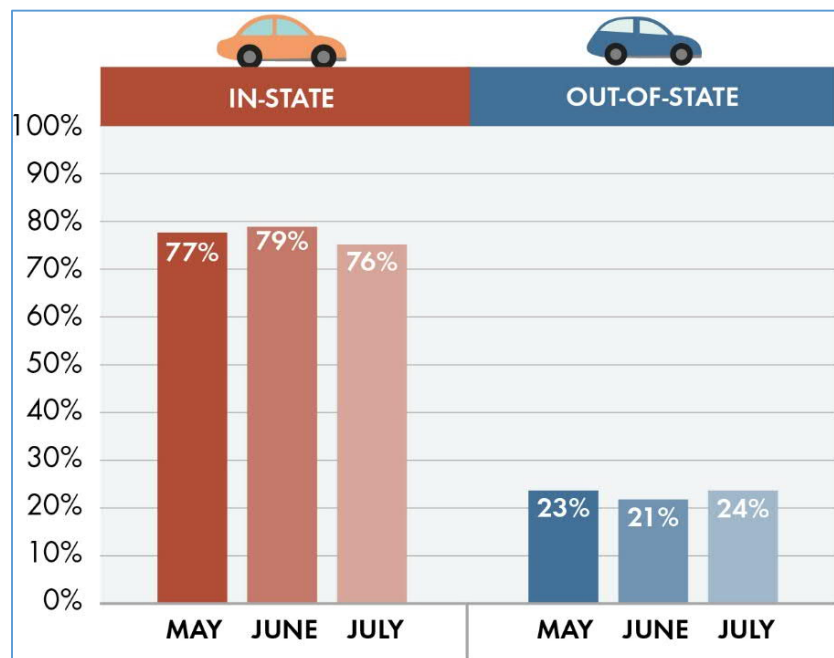
### 5.1.1 Out-of-State Mileage

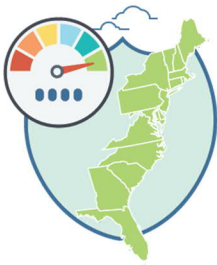
This pilot was the first to fully address the issue of out-of-state travel under a MBUF system and the potential impact on transportation funding, including charging for out-of-state mileage. This was one of the key focus areas of this I-95 Corridor Coalition MBUF study, given the significant amount of cross-state travel that occurs along the Eastern Seaboard. The Phase 1 Pilot fully demonstrated why it is so critical to address out-of-state mileage in any MBUF system along the Eastern Seaboard – of the 459,448 total miles driven during the pilot, more than 20 percent were outside the participant's home state, as shown on Figure 5-1.

As previously discussed in Section 4.4, this pilot had a unique approach for participants that chose a non-location-based mileage reporting option. Unlike other MBUF pilots, the pilot assumed a percentage of in-state/out-of-state mileage based on the vehicle's home state (refer to Table 4-8) and distributed the mileage and MBUF charges based on these assumed percentages.

Table 5-1 presents a comparison of the assumed out-of-state mileage to the actual out-of-state mileage (based on the data from participants with location-based approaches) for residents

Figure 5-1. Out-of-State Mileage by Month (Location-Based Approaches)





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of Delaware, Pennsylvania, Virginia, and Maryland, the four states with the highest number of participants in the pilot. These four states included approximately 78 percent of pilot participants.

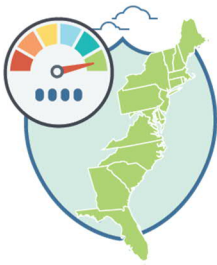
Table 5-1. Comparison of Assumed versus Actual Out-of-State Mileage

State	Number of Participants	States the Out-of-State Rates and Gas Taxes are Based On *	Assumed Out-of-State Mileage*	Actual Out-of-State Mileage**
Delaware	49	Combined	18%	18%
		Pennsylvania	50%	25%
		New Jersey	25%	18%
		Maryland	25%	48%
		Other	0%	9%
Maryland	15	Combined	20%	34%
		District of Columbia	35%	31%
		Virginia	35%	42%
		Pennsylvania	15%	3%
		Delaware	15%	5%
		Other	0%	19%
Pennsylvania	39	Combined	6%	12%
		Delaware	25%	15%
		Maryland	25%	31%
		New Jersey	25%	25%
		New York	25%	5%
		Other	0%	24%
Virginia	17	Combined	10%	33%
		District of Columbia	50%	16%
		Maryland	50%	30%
		Other	0%	54%

\*From Table 4-7

\*\*Averaged over the 3 months

There are differences – often-times quite large – between the assumed percentages and the actual percentages. This is not surprising given that the assumed combined percentages were based on census data, and the distribution among the contiguous states was primarily based on a review of maps and the roadway network. Additionally, no mileage was assumed beyond the contiguous states, a somewhat



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unrealistic view, particularly during the summer vacation months. Another important consideration is that the sample sizes (i.e., the number of participants in each state) is very small. Moreover, the distribution of the sample within each state probably does not match reality, particularly in terms of where individuals live in the state and how close they are to a state line. All of the above considerations notwithstanding, the Phase 1 Pilot did demonstrate that such an approach for distributing MBUF between states for drivers who do not use a location-based approach is valid. What is necessary are more accurate percentages reflecting out-of-state mileage – information that could be obtained and regularly updated using MBUF data from a significantly large (and statistically accurate) number of participants in a mandated system; and assuming that most of these drivers would be using location-based technologies to record mileage.

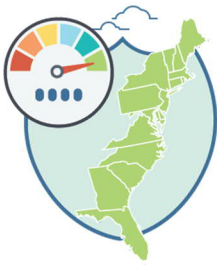
That last assumption – most drivers using a location-based approach on which to base the distribution of out-of-state charges for vehicles without such location-based capability – is critical. The greater number of drivers that choose a location-based device, the greater the accuracy of the information. In the Phase 1 Pilot, 84 percent of the participants chose a location-based approach, the highest percentage of any pilot to date. In the 2016-2017 California Road Charge Pilot Program, nearly 72 percent of the participants chose a location-based approach. Only 40 percent chose a location-based approach in the 2017-2018 Washington pilot. To maximize the number of drivers who choose such a mileage reporting option, and therefore increase the accuracy of the data, it may be necessary to offer incentives connected with location-based approaches, such as enhanced value-added services and/or reduced per-mile rates in some instances, coupled with rigid privacy and data security requirements, and the associated education and outreach effort.

## 5.2 Goal: Increase Public Awareness of Funding Issues and Assess the Acceptance of MBUF

The Phase 1 Pilot was considered an integral part of the education and outreach effort, focusing on increasing awareness of the transportation revenue challenges and the MBUF approach, demonstrating the ease of use and viability of MBUF, while also addressing potential privacy and equity concerns. The potential benefits of how including value-added amenities with the MBUF technologies would affect participant acceptance.

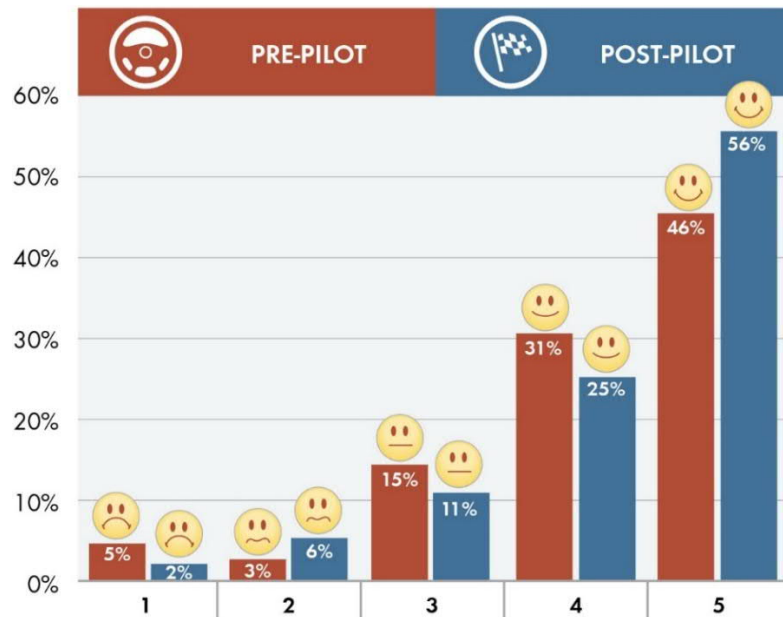
### 5.2.1 Participant Awareness and Perceptions

Pilots have been shown to be an excellent mechanism to help people understand the MBUF concept. As shown on Figure 5-2, participating in the Phase 1 Pilot increased participants' opinions of MBUF with 75 percent liking the concept at the beginning of the pilot and 80 percent at the end. Ninety-four percent of participants support doing more research on MBUF and, most participants (over 90 percent) indicated they would participate in another pilot program.



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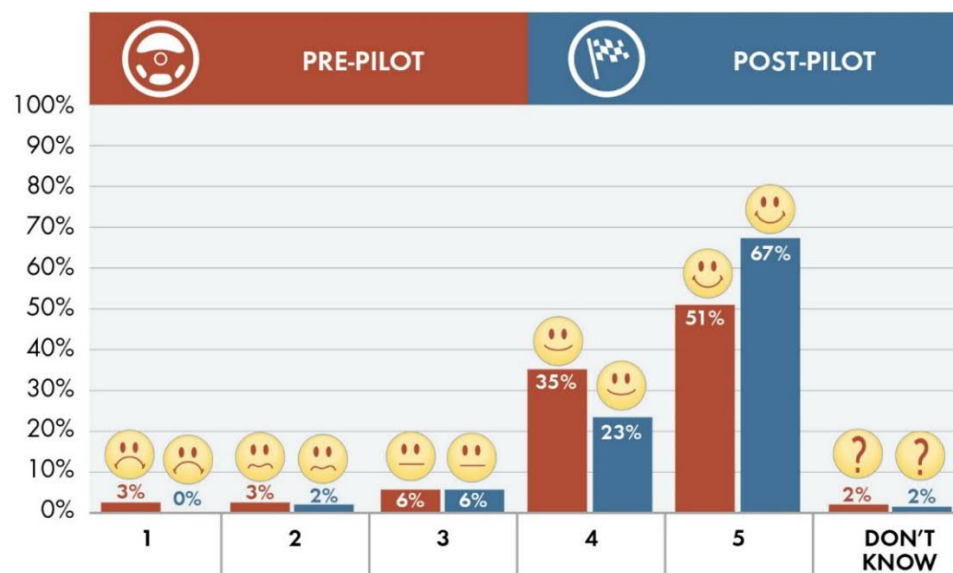
Figure 5-2. Opinion of MBUF



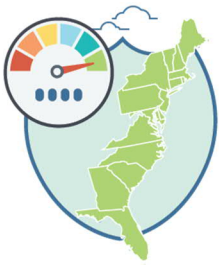
Note: Based on scale of 1 (don't like the concept at all) to 5 (really like the concept)

Overall, the participant survey results showed overall satisfaction with the Phase 1 Pilot was very high (90 percent), with the level of satisfaction increasing over the course of the pilot (see Figure 5-3). The average ranking was 4.5 on a scale of 1 to 5, with 5 being very satisfied.

Figure 5-3. Overall Satisfaction with the Pilot



Note: Based on scale of 1 (very unsatisfied) to 5 (very satisfied)

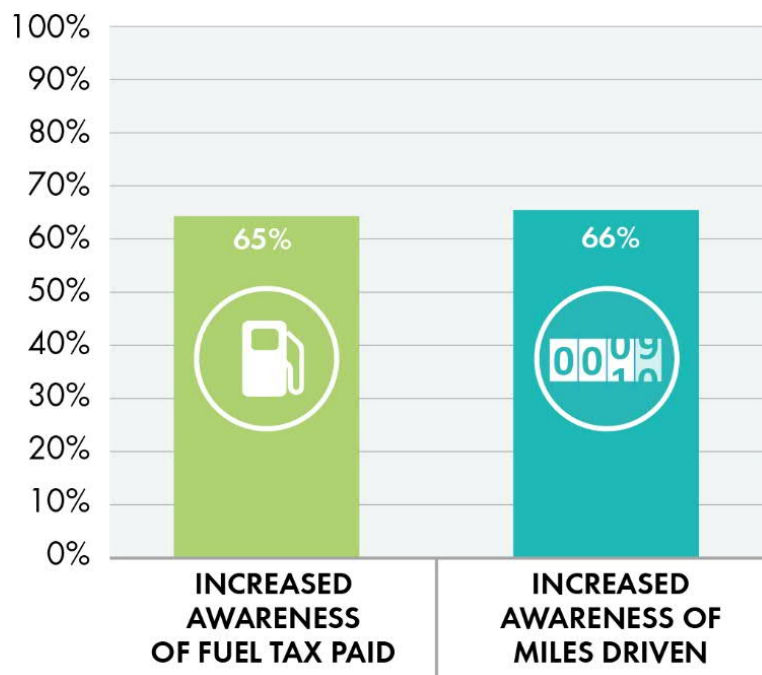


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Pilot participants also had an increased awareness of how much they pay in state gas taxes. In the initial pilot survey, when asked how much they thought they paid in state gas tax each month, participants' answers ranged from \$1.00 to \$500. The monthly MBUF invoices showed the estimated amount of state gas tax paid, with the average amount of state gas tax paid during the pilot being approximately \$16.50 for each participant. The post-pilot survey indicated that 31 percent of participants thought they actually paid more in state gas taxes, with 7 percent thinking they paid less.

As shown in Figure 5-4, 65 percent of participants had a high level of agreement that after the pilot they were more aware of the amount they pay in state gas taxes to maintain and operate the roads, and 66 percent agreed the pilot increased their awareness of how much they drive.

Figure 5-4. Survey Results of Increased Awareness of Taxes Paid and Miles Driven



Note: Chart shows ratings of 4 or higher with scale of 1 (strongly disagree) to 5 (strongly agree)

Some participants (about 30 percent) even indicated that MBUF might change their driving habits, with 81 percent of those participants saying they think they would drive less while the other 19 percent thought they would consider alternative modes of transportation or carpooling.

### 5.2.2 Data Accuracy and Invoicing

A key element for increasing public acceptance and ultimately national adoption and implementation of MBUF is the accuracy of the mileage reported, the associated gas tax credits, and the invoicing process. As discussed in Section 4 (and shown in Table 4-4), accuracy testing of the three mileage reporting options was conducted by the MBUF Study team before the start of the pilot. Except for the EV and the





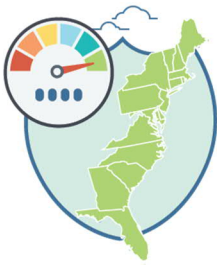
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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smartphone app, the difference between the MBUF mileage and the odometer mileage was + / - 3 percent -- well within the 4 percent margin of error typically cited for odometers. The issues with the EV were fixed, and in the last EV test, the MBUF mileage was within 2 percent of the odometer. The smartphone app was also fixed and tested before the start of the pilot.

During the pilot, a few participants – including members of the consulting team – completed mileage logs (Figure 4-10) which were used to compare odometer readings (including state boundary crossings) to the MBUF data collected by the account manager to ascertain the accuracy of the MBUF mileage data by day and state travelled. Again, overall accuracy was good (within +/- 5 percent of the vehicle's odometer). Nevertheless, the data analysis – coupled with comments made by participants during the interviews – did identify some anomalies that will need be addressed in future pilots, such as:

- Mileage on one day might be low, and the next day high. This was because the 24-hour time was based on Greenwich Mean Time (7 PM on the east coast). Thus, if a person drove after 7 PM, the mileage showed up as occurring on the next day. The solution is to adjust the 24-hour time to be based on Eastern time.
- The mileage as shown in the trip log and associated mapping did not always match the invoice. This was because of different processing being done for each. The trip log mileage (and mapping) is based on GPS calculations (and GPS may not always function properly in some area or the road is not recognized by the mapping database), whereas the invoice mileage is based on the data from the OBD-II port. The solution is to provide information to participants why these differences can occur.
- There were minor differences between the monthly statement amounts and the daily log of mileage and charges. This was because in part to rounding when kilometers (how mileage is measured) is converted to miles. The solution is to have the mileage initially measured in miles.
- The per-state mileage was not always accurate. This was because of the fact that the Coalition Phase 1 Pilot was the first to fully explore and identify out-of-state mileage. The account manager's platform had been based on a single-state centric platform (as used in other pilots). Different sources were used to convert the geocode latitude / longitude points sent from the mileage reporting device into the state identifier. Sometimes the string names did not match what was defined in the state-specific rate table. For example, sometimes the string returned was "NY," where the rate table expected to see "New York." When the returned string value could not be identified, the mileage went to the default "international." The solution is to verify the strings and mileages per state during acceptance testing, covering all the Coalition states.
- The one participant using the smartphone app who maintained a log noted that the mileage reported by the account manager, including by state, was always within 4 percent of the odometer reading, when the smartphone app was actually turned on in sufficient time before the start of the trip. If the smartphone's GPS could not identify the vehicle's location before a trip commenced, the errors could be significant. Perhaps the worst case scenario in this regard occurred as follows: the participant last used the phone's GPS in Denver (for Google Maps, not for the mileage app); the app and GPS was not turned on until just before the vehicle turned out of the driveway for a trip



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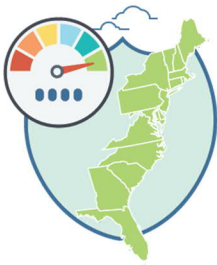
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from Cape Charles, Virginia to Norfolk, Virginia; and the system recorded the trip as if the vehicle had been driven from Denver to Norfolk in 45 minutes. During the interviews, one of the participants using the smartphone app noted several errors; likely because their car was kept in a multi-story garage where there was limited GPS availability. Smartphone apps for collecting MBUF data have shown similar problems in other pilots. The solution may simply be to not include the smartphone and apps as a choice for mileage reporting.

- One of the participants using the plug-in device had a diesel vehicle, and the fuel estimates were very inaccurate. This was because the fuel estimation algorithm is based on the Controller Area Network (CAN) Bus (e.g. Mass Air Flow) for gas-powered vehicles. The solution for future pilots is to estimate fuel usage for diesel vehicles based on the vehicle's EPA rating for average MPG.

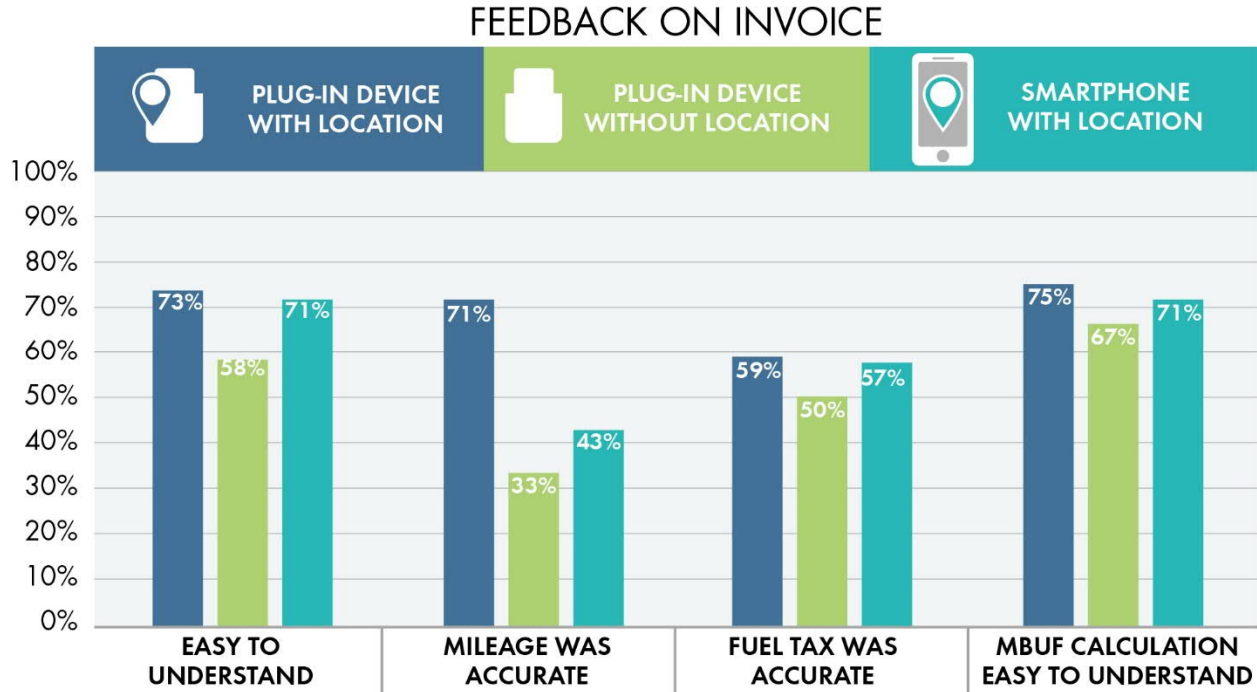
Figure 5-5 shows the satisfaction levels of mileage and gas tax credit accuracy as reported on invoices (based on feedback from the participant surveys.) The final pilot survey results indicated that the “plug-in device with location” had the highest level of agreement (71 percent) in terms of accurate reporting of mileage by state, while the plug-in device without location had the lowest level of agreement (33 percent), followed by the smartphone app with location (43 percent). The low level of agreement on accuracy for the “plug-in device without location” is likely because of a misunderstanding of how out-of-state mileage was identified for this option. As previously discussed, out-of-state miles for the non-location-based option was calculated based on assumed percentages of in-state/out-of-state mileage, even if the participant never traveled outside their home state, a percentage of out-of-state mileage was calculated. Disagreement with the accuracy of mileage for the plug-in device without location option is not completely unexpected, and also indicates the need for more and better education and outreach in this regard.

Figure 5-5 also indicates that only about half of the participants (across all three mileage reporting options) were satisfied with the accuracy of the estimated gas tax on their invoices. 13 percent disagreed with the notion that the invoices accurately estimated gas tax. Figure 5-5 also shows that 25 to 30 percent of the participants did not find the invoices and the associated MBUF calculations easy to understand. A redesign of the invoice format may be necessary for future pilots such that all costs are shown – gas, federal gas tax, state gas tax, and MBUF – to provide a complete picture of costs. The monthly invoice may also provide additional information on how the fuel usage and associated costs are calculated.



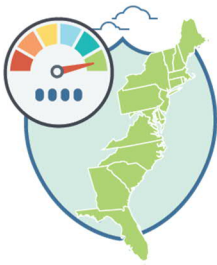
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 5-5. Survey Results on Satisfaction with Accuracy of Invoice Data



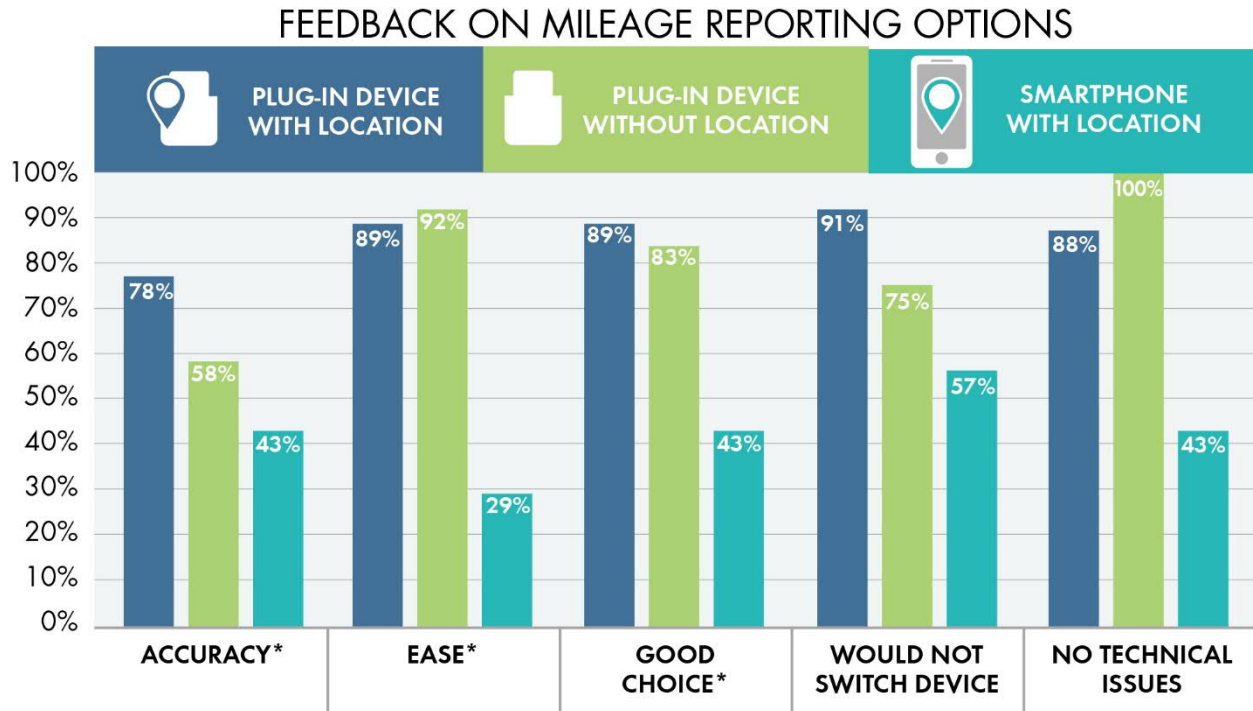
Note: Results are shown for satisfaction ratings 4 (Agree) or higher, with 1 - Strongly disagree to 5 - Strongly agree

Figure 5-6 shows the overall survey feedback on the mileage reporting options. Participants who chose plug-in device options – with and without location – had the highest levels of satisfaction in all categories. Over 90 percent of participants who chose the plug-in device with location would not switch mileage reporting options, compared to 57 percent who chose the smartphone app. In fact, less than half of smartphone app participants believed this option was a good choice, with nearly 60 percent experiencing some sort of technical issues. The survey results also revealed the top reasons participants chose the “plug-in device with location” mileage reporting option – chosen by 76 percent of participants – as follows: ease of installation (96 percent), use of GPS (86 percent), and data accuracy (75 percent).



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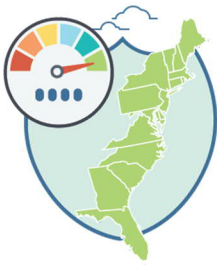
Figure 5-6. Survey Results of Feedback on Mileage Reporting Options



Note: Chart shows ratings of 4 or higher with scale of 1 (strongly disagree) to 5 (strongly agree)

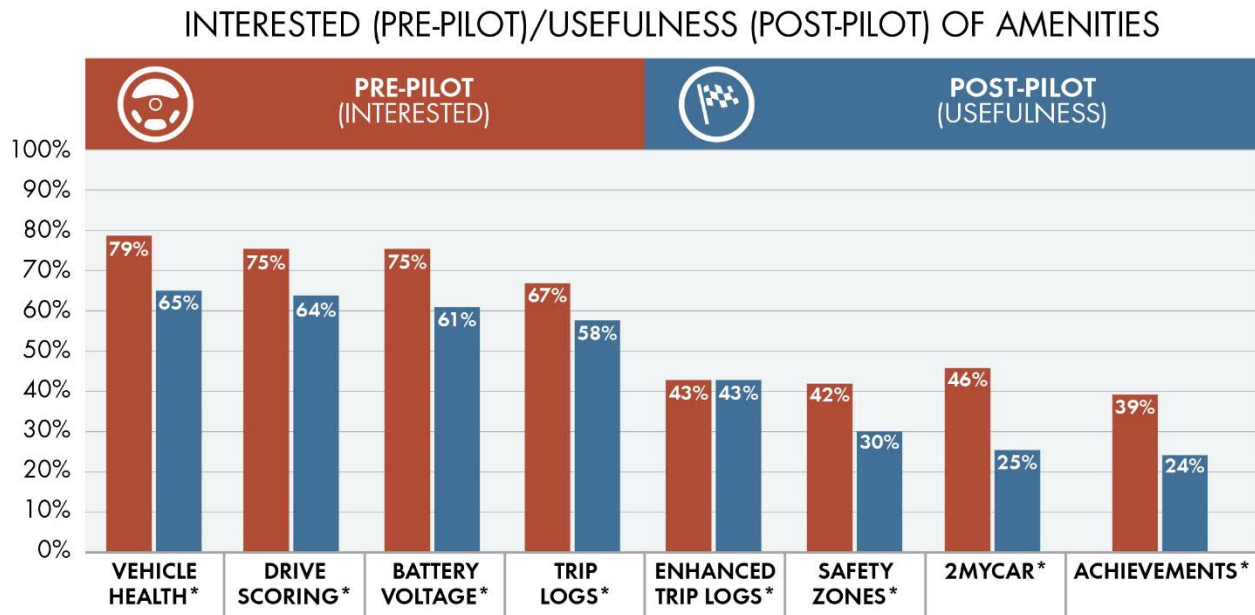
### 5.2.3 Value-Added Amenities and Driver Services

Value-added amenities are another of the key focus areas of the Coalition's work in the context that such additional services may function as the "spoonful of sugar" that could help in a transition to MBUF. As described in detail in Section 4.3.3, several value-added amenities were included in the Phase 1 Pilot, including trip logs, vehicle health monitoring, battery voltage monitoring, driver scoring, and "safe zones." As previously discussed, it is envisioned that offering such amenities could increase acceptance of the MBUF approach and also perhaps increase the number of drivers using a location-based approach. However, as shown on Figure 5-7, there were mixed reactions to the usefulness of the value-added amenities. Of the amenities offered, participants valued those for vehicle and battery health the most. Very few participants even used the "safe zone" feature. All but one of the survey respondents who chose the smartphone with location and plug-in device without location options indicated the value-added amenities did not contribute to their selection of those options. A solution to implement in future pilots is to provide additional information about the value-added amenities and reminders during the pilot to log-into one's account.



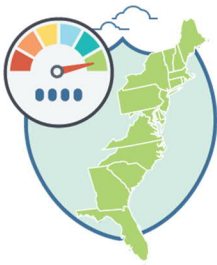
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Figure 5-7. Interest and Usefulness of Value-Added Amenities



\* Note: Chart shows ratings of 4 or higher, (Pre-Pilot: 1 - Not at all interested to 5 -Very interested, Post-Pilot: 1 - Not at all useful to 5 -Very useful). Percentages are based on availability of amenity given mileage reporting option selected.

Another driver service was the ability to access one's MBUF account via the web and smartphone. Figure 5-8 shows the number of times participants accessed their Azuga accounts during the pilot. Almost 70 percent of participants either never logged into their account (38 percent) or logged in only once (28 percent) during the pilot. The survey findings (Figure 5-9) showed similar results where respondents answered that they rarely or never accessed their MBUF account. This further emphasizes that participants did not have much use or interest for the value-added amenities provided in the pilot. As previously noted, additional information about the value-added amenities and reminders during the pilot to log-into one's account may be included in future pilots.



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Figure 5-8. Participant Account Log-In Statistics

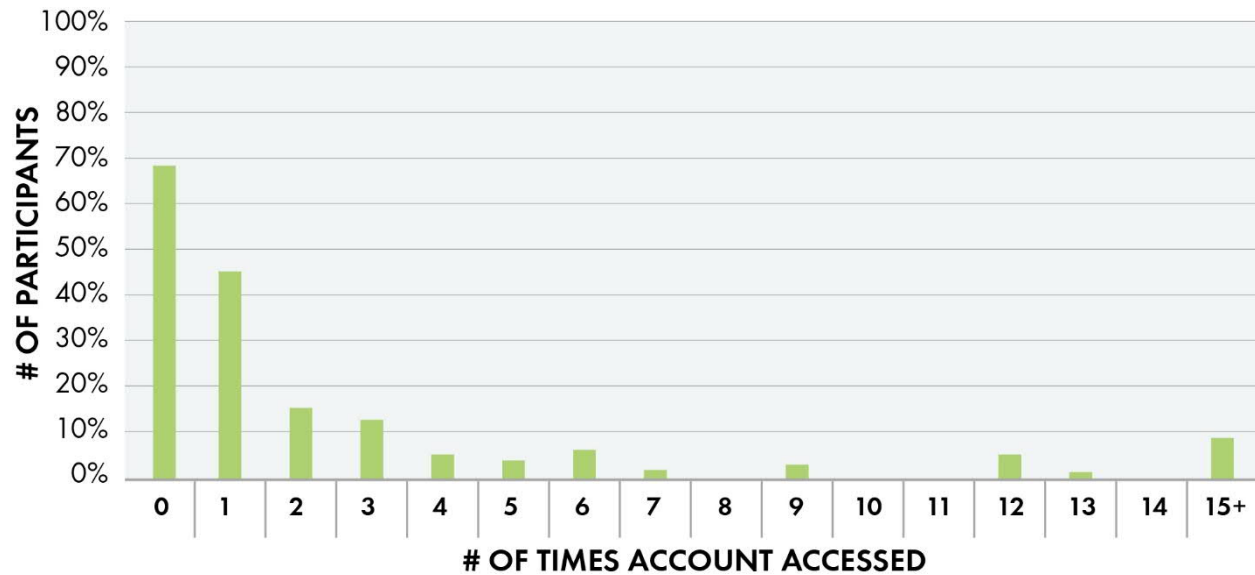
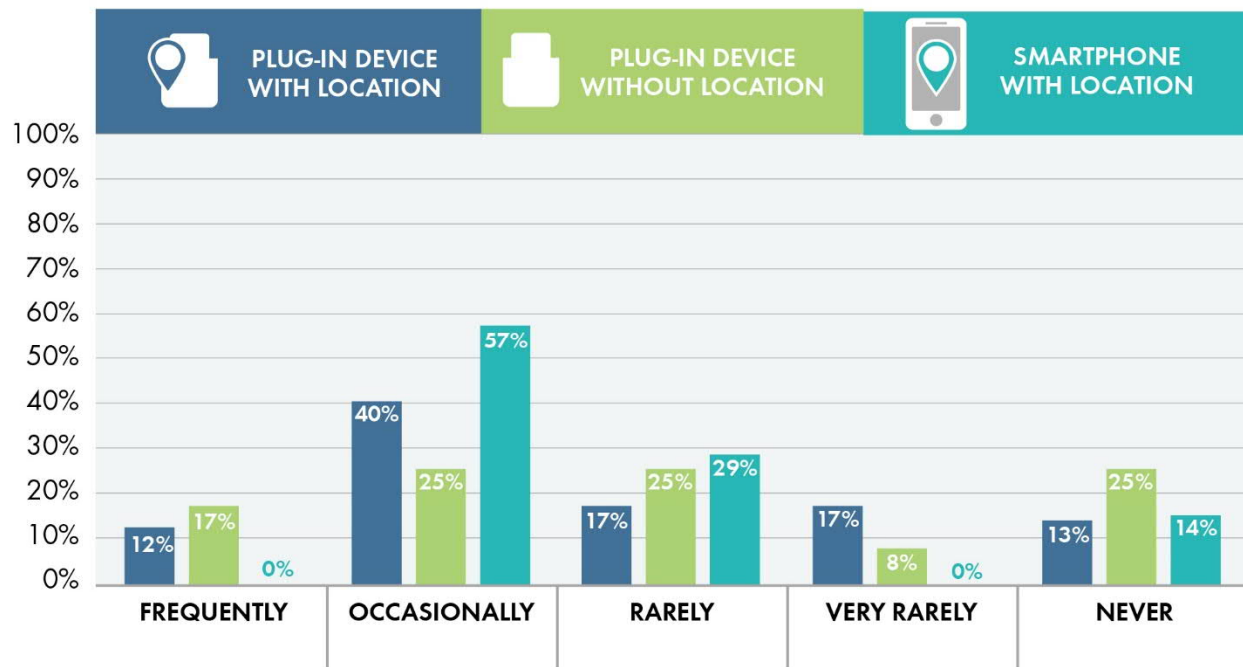


Figure 5-9. Survey Results of How Often Respondents Accessed their MBUF Account







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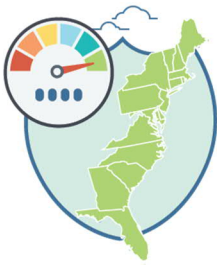
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### 5.2.4 Privacy Protection and Data Security

As discussed in Section 2.3.5, privacy and data security are major concerns with the MBUF approach. The Phase 1 Pilot adopted many of the privacy considerations summarized in Table 2-4, including:

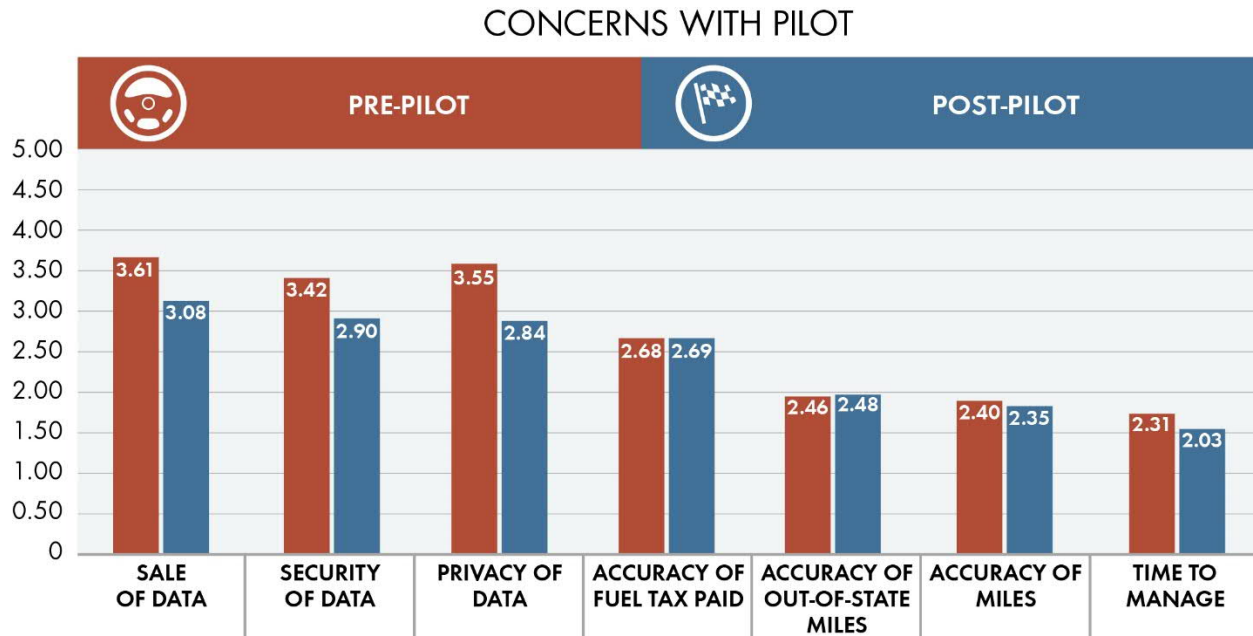
- Choice – Three mileage reporting options were offered, including one approach that did not require location information.
- Consent – All the participants were recruited volunteers. Additionally, the Participant Agreement included several privacy-related provisions (e.g., location is optional, collection and use of non-personal information, disclosure of information to third parties)
- Purpose Limitation – Only that data necessary to calculate MBUF, develop faux invoices, and to provide value-added amenities were collected.
- Data Retention – The account manager scope of work required all personal information collected to set up and manage participants' accounts, including mileage (by location and routing) and other data collected during the 3-month pilot, to be destroyed within 30 days of the completion of the pilot.
- Other Use of Data/Sharing – The account manager was not allowed to share or sell the collected data to other entities. Moreover, all members of the project team signed a non-disclosure agreement (NDA) also requiring that no PII (e.g., name, address, email of participants; employer and state the participant works in; vehicle make, model and year; mileage information; location information; survey results for individual participants) could be released to any third parties, including other employees within the Parties' firms or other Coalition staff and members, without the individual's permission.
- Data Anonymizing – All pilot reports and survey results were aggregated (such as shown in the various figures herein).
- Security – Azuga conformed to the various International Organization for Standardization (ISO) / International Electrotechnical Commission (IEC) 27002 information security standards (e.g., addressing securing data from internal process exposure, addressing internal technical vulnerabilities, controlling access to systems, controlling how physical media are handled, controlling access, and controlling the use of cryptographic controls and keys.)

Figure 5-10 shows that participant concerns with the pilot were mostly related to data security and privacy, though not "very concerned," versus data accuracy. However, the survey results revealed that participation in the pilot helped reduce these concerns. The rating of "privacy of my personal data" as a high concern from the surveys dropped from 57 to 30 percent over the course of the pilot. However, the sale of data remained a major concern of participants at both the beginning and the end of the pilot. This was the only concern that had an average ranking over 3 (with 5 being very concerned) at the end of the pilot.



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Figure 5-10. Survey Results of Concerns with the Pilot



Note: Based on scale of 1 (not at all concerned) to 5 (very concerned)

### 5.2.5 Equity and Fairness Perspectives

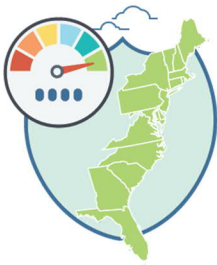
Over the course of the pilot, participants' thoughts on the fairness of MBUF changed, as shown on Figure 5-11. The largest change in opinions on the fairness of MBUF was related to very fuel-efficient vehicles, specifically<sup>26</sup>:

- The number of people who believed MBUF was less fair for very fuel-efficient cars increased from 27 percent at the beginning of the pilot to 38 percent.
- The number of people who thought MBUF was more fair for very fuel-efficient cars decreased from 39 percent at the beginning of the pilot to 24 percent.

Also interesting was the number of people who thought MBUF was less fair for less fuel-efficient vehicles went up slightly from 10 to 12 percent, but more people at the end of the pilot felt it would be about the same for less fuel-efficient vehicles (15 percent increased to 24 percent). Levels of fairness did not change much during the pilot for MBUF compared to the gas tax.

A main concern in MBUF studies across the country is that a MBUF system would be unfair to rural drivers who tend to travel further distances and therefore would be charged more under an MBUF system. While Phase 1 of the Coalition's MBUF Study didn't directly address the urban versus rural equity issues through the targeted pilot participant demographics, the opinion of participants

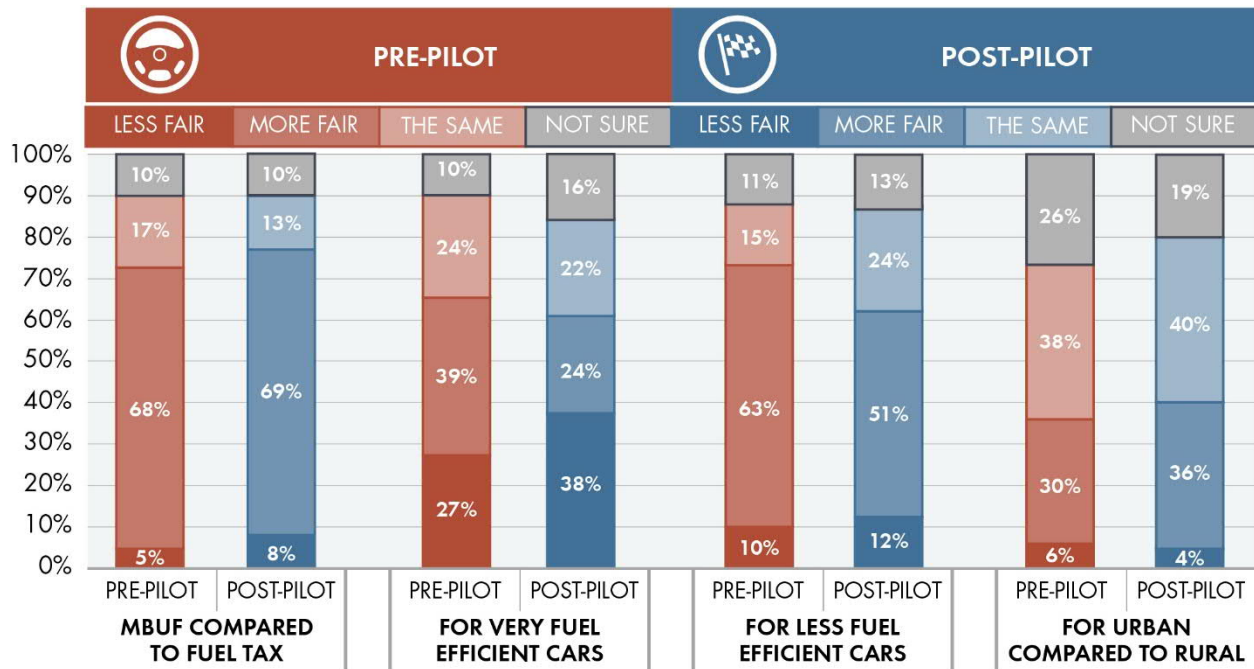
<sup>26</sup> Also refer to the discussions in Section 2.3.y



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regarding this issue was asked during the surveys. As shown on Figure 5-11, most participants in this pilot believed MBUF would be the same (40 percent) for both urban and rural drivers. However, at the end of the pilot, the number of people who felt it was fairer for urban drivers compared to rural drivers increased from 30 to 36 percent. (As discussed in Section 3.2.7, this may not be the case in actuality).

Figure 5-11. Survey Results of Fairness of MBUF

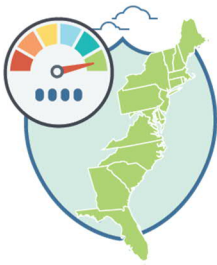


### 5.3 Goal: Create a Low-Cost Framework to Administer MBUF

The administrative and compliance issues associated with MBUF – including an estimate of the additional costs relative to the gas tax – is discussed in Section 2.3.6. The Phase 1 Pilot did address cost and financial issues, as summarized below.

#### 5.3.1 Financial Results

Among the 155 pilot participants, 150 vehicles were gasoline (ICEs), 4 were hybrid-electric, and 1 was diesel. There were no EVs enrolled in the pilot. The average EPA-estimated MPG rating for the pilot participants is presented in Table 5-2. The actual MPG of the vehicles in the pilot – based on the data on gas consumption and mileage collected during the pilot – are presented in Table 5-3. Pilot participants had more fuel-efficient vehicles than the national average vehicle fuel economy of 22 MPG that was used to develop the per-mile rates.



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Table 5-2. Average EPA-Estimated MPG Rating of Pilot Participants

EPA-Estimated MPG Rating	Total Number Of Participants
0 – 10 MPG	0
11 – 20 MPG	48
21 – 30 MPG	88
31 – 40 MPG	15
Greater than 40 MPG	4

Table 5-3. Actual Average MPG of Pilot Participant Vehicles

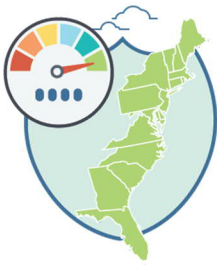
Participant State of Residence	Actual Average MPG	Maximum MPG	Minimum MPG
Delaware	26.6	73.3	14.9
Maryland	23.9	49.2	12.6
Pennsylvania	23.6	42.1	12.8
Virginia	26.0	46.8	5.0
Other States	23.7	54.2	12.7
All Participants	24.9	73.3	5.0

Given that the actual average MPG for the Phase 1 Pilot vehicles was greater than the number (22 MPG) on which the revenue-neutral rate was based, one would expect there to be a net MBUF charge (i.e., MBUF is greater than the gas tax paid). As shown in Table 5-4, this was indeed the case. The average net MBUF for each participant was \$1.61 per month.

Table 5-4. Mileage and MBUF Revenue Summary (All Participants)

	Miles	MBUF	Gas Tax Credits	Net MBUF
May	114,546	\$1,820.11	-\$1,696.91	\$ 123.2
June	164,517	\$2,588.52	-\$2,410.07	\$178.45
July	180,385	\$2,771.35	-\$2,389.76	\$385.59
Cumulative Total	459,448	\$7,179.98	-\$6,496.74	\$687.24

Another MPG consideration is that some areas of a state may have different average MPG values depending on specific locations within the state, such as congested urban locations and



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uncongested rural areas. This scenario, and the potential financial ramifications, came to light during the Phase 1 Pilot. One of the Project Team members accumulated most of their mileage in the Washington, DC area; but in one month drove to and from North Carolina (via Virginia). The invoice for that month, and the calculated MPG by state<sup>27</sup> is shown in Table 5-5.

Table 5-5. Example of Different Net MBUF Results by State Because of Varying MPG (For One Vehicle for One Month)

State	Miles Driven	Net MBUF	Average MPG
MD	171.8	-\$0.41	18.7
DC	41.2	-\$0.07	19.2
VA	405.1	\$1.37	32.9
NC	146.8	\$0.67	31.1

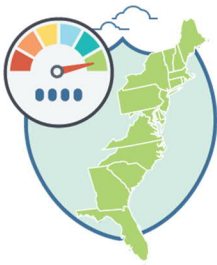
Note: EPA rating for this vehicle is 23 MPG City, 34 MPG Highway.

Discussions with the participant indicated that the DC and Maryland mileage was predominately city (often in congestion), while most of the Virginia and North Carolina mileage was free-flowing interstates. The result was that the North Carolina and Virginia – where the average MPG for the miles driven was greater than 22 MPG (the basis for developing the revenue-neutral rates) – would receive net MBUF funds; while Maryland and DC – where the average MPG was less than the base 22 MPG value – would end up providing a net MBUF credit. This suggests that the difference between the fuel taxes paid today compared to an MBUF of the future will be affected by a vehicle's MPG as well as the driving conditions (e.g., urban congested versus rural interstates).

### 5.3.2 Compliance

Another important “financial” consideration for a potential future mandated MBUF program is compliance, or how many people actually report mileage. If mileage data are not received, then MBUF charges cannot be calculated or invoiced, and the goal of providing a sustainable and equitable transportation funding mechanism could be compromised. During the Phase 1 Pilot, the number of vehicles reporting mileage data to the account manager varied from month to month. Figure 5-12 shows the monthly comparison of the number of vehicles reporting mileage relative to the number of vehicles enrolled in the program that month. The figure shows that the first month of the pilot had the lowest percentage of vehicles reporting mileage across all three mileage reporting options. This was because of delays during the enrollment process – not everyone who enrolled in the first month (e.g. those that enrolled towards the end of the month) received their device and/or installed it in their vehicle before the end of the month. The plug-in device options had the highest

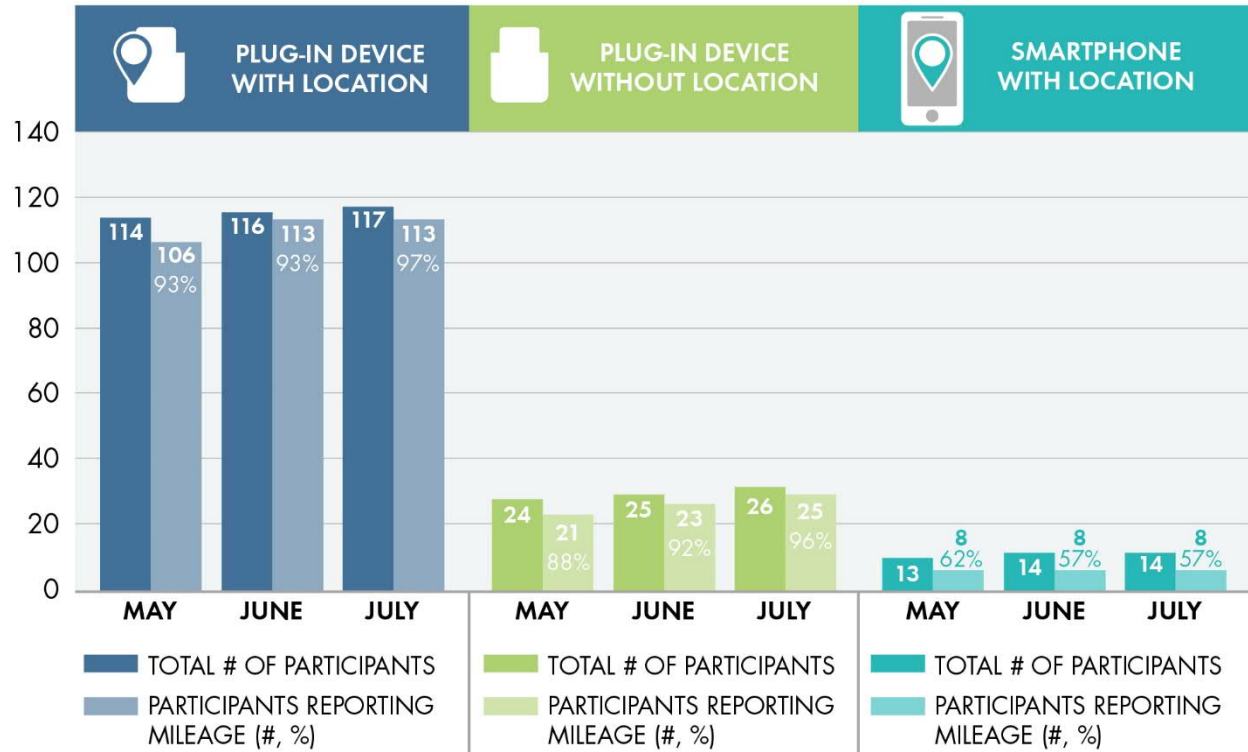
<sup>27</sup> The plug-in device with location uses OBD-II data to estimate the amount of gas used, differentiated by the state where the gas was consumed by the vehicle.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

percentage of vehicles reporting mileage with about 96 percent reporting mileage at the conclusion of the pilot. The small percentage of non-compliance is likely due to user error, such as failing to plug in the device, because faulty devices and OBD-II ports are rare.

Figure 5-12. Monthly Comparison of Total Enrolled Vehicles to Vehicles Reporting Mileage



The smartphone option had the greatest percentage of vehicles not reporting mileage each month. During the first two months of the pilot, just over half of these participants reported mileage. This is not unexpected, because the smartphone option required more effort on the part of the user. To work correctly, participants had to have the beacon and smartphone in the vehicle, the phone turned on, and the MBUF app and GPS functionality also turned on. If someone other than the enrolled participant drove the vehicle or if the participant forgot to login to the app, no mileage would be recorded. Moreover, as previously noted, enough lead time must be provided between the time that the app is turned on and the driving commences such that the phone's GPS can identify the vehicle's location before a trip begins. A vehicle that is parked in a garage (where GPS reception may not be available) may also have a problem in accurately recording mileage with a smartphone approach. The only viable way of recapturing this missed mileage would be during a mileage "true-up" – a certified odometer reading conducted as part of the registration process, during vehicle inspection, or when the vehicle is sold.

This finding is comparable to the results and lessons learned from other pilots across the country – that the greatest compliance issues occur with mileage reporting approaches that require recurring





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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action by the driver (e.g., turning on the MBUF app prior to every trip, taking a picture of the odometer every month), whereas more automated approaches, like plugging a device into the OBD-II port once, or obtaining data via in-vehicle telematics, result in significantly fewer compliance issues. Moreover, the plug-in device can also detect when it has been removed from the OBD-II port.

### 5.3.3 Interoperability with Tolling

Another “financial” aspect of the Phase 1 Pilot was an initial proof of concept to determine the feasibility of using MBUF technologies (with location capability) to also calculate tolls on existing toll facilities using the E-ZPass toll charge structure. If such an approach is indeed feasible, it could potentially lead to potential synergies and economies of scale between tolling and MBUF. Moreover, a combined invoice showing both MBUF and tolling charges would help give drivers a clearer picture of the cost of travel

The initial proof of concept occurred in Delaware along the following tolled routes:

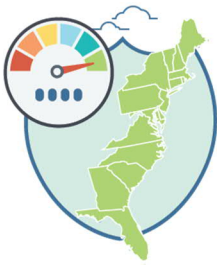
- I-95 Barrier Plaza (two-way toll).
- Delaware River Memorial Bridge (one-way toll entering Delaware).
- Delaware SR-1 (toll depends on where you entered and exited, with two-way barrier tolls at the beginning and end of the tolled segment. There are different rates on the weekends for the barrier plazas).

The work included identifying the geo-locations (i.e., GPS coordinates) of the toll points along these routes, and then placing a “safe zone” around each point. (A “safe zone” is one of the value-added amenities offered by Azuga and by other account managers. The customer can place a variable diameter circle around a location on a map. When the vehicle enters or exits the safe zone, the owner of the vehicle is automatically notified via email. This feature can be used to notify someone when and individual is headed how from work, or to set up notification when one’s teenage driver enters a designated location. The same logic was used to identify when a vehicle entered a toll zone and was therefore subject to a toll.

This approach was further enhanced by increasing the polling rate from once per minute, which works fine for a vehicle that is stopping within the safe zone – such as someone’s house – for a fairly long period of time, to once per second. The increased polling rate was necessary to account for the fact that vehicles seldom stop within a toll zone; and if they do, it is momentary at best to manually pay the toll or to wait for a gate to open.

Approximately 10 participants were involved with this proof of concept, which ran from July 1 to August 31, 2018. Copies of their monthly E-ZPass statements for this period were requested. The toll data as collected and processed by Azuga (using the plug-in device with location) was then compared to the E-ZPass statements.

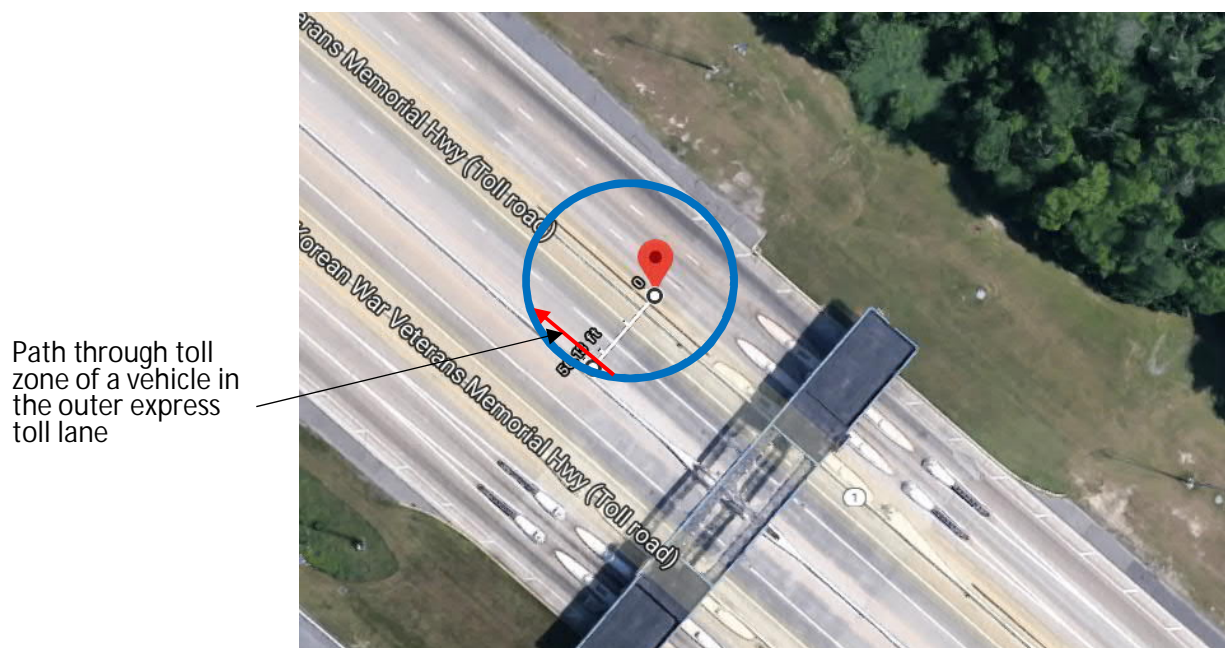
This initial tolling proof of concept showed that using MBUF location-based technology to also calculate tolls is feasible. For example:



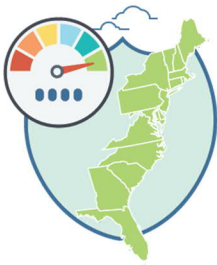
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

- The accuracy at the Delaware River Memorial Bridge was nearly 100 percent. The toll plaza coming off the Delaware River Memorial Bridge is physically separated from the northbound traffic lanes (which are not tolled). That allowed the zone to go beyond the limits of the roadway. Moreover, E-ZPass equipped vehicles approaching the plaza must slow down, even at the E-ZPass only lanes. As a result, most vehicles were captured within the 1-second polling rate.
- The accuracy at the barrier toll plazas on Delaware SR-1 was only 64 percent, with the Azuga count always lower than the E-ZPass statements. The reason for these errors is primarily because of a combination of Euclidian geometry and time-space relationships. Specifically, the barrier toll plazas on SR-1 – Biddles Corner and Dover – include express toll lanes (i.e., full speed with a speed limit of 65 mph) for both north and southbound traffic. However, these express lanes are adjacent to one another and separated by only a few feet. A 50-foot radius zone barely extended to the edge of the express toll lanes; and it was not possible to enlarge the zone without extending into the express toll lane of the opposite direction, as shown on Figure 5-13. Applying a bit of geometry and algebra indicates that the length of the chord running through the circular toll zone at the most outer express lane is approximately 55 feet. A vehicle going through this outer lane at 100 feet per second (68 mph, and vehicles often drive through these express toll lanes faster speeds than that), will be in the zone for a half of second. At a polling rate of once per second, there is a 45 percent chance that the passage through the zone will not be identified by the MBUF system.

Figure 5-13. Toll Zone Configuration at Northbound Dover Toll Plaza on SR-1



Given that the estimated capture rate (based on toll zone size, location of lanes within the zone, vehicle speed, and polling frequency) was very similar to the accuracy at the various plazas, using MBUF technology to also calculate and charge tolls does appear feasible. It will be necessary to



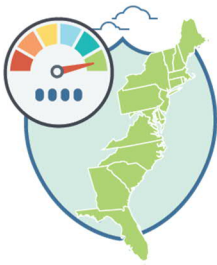
## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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modify this approach to use rectangular tolling zones with user-defined and variable dimensions, thereby increasing the likelihood of a vehicle being in the tolling zone during the polling period.

### 5.3.4 Summary

Overall, the I-95 Corridor Coalition Pilot was very successful in starting the conversation on the East Coast about the feasibility of MBUF. As the first MBUF pilot along the Eastern Seaboard, the “East Coast voice” was brought into to the national MBUF discussion. The pilot was the first in the nation to dive deeply into the unique challenges of managing out-of-state mileage, approaches to the associated interstate transfer of MBUF funds, and interoperability with toll facilities. It also provided an opportunity for key stakeholders – both within the Corridor and nationally – to gain a first-hand understanding of how MBUF could work and reduce some of the concerns that individuals and the public at large may have regarding this concept. The pilot, along with the various Phase 1 analyses, addressed each of the project goals and potential MBUF issues, including privacy and data security, equity and fairness, and administration needs and the associated costs. Additional work is still needed, as summarized in the next chapter.



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

### 6 Next Steps

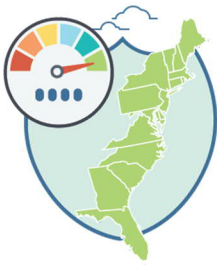
The I-95 Corridor Coalition Pilot successfully started the conversation on the east coast about the feasibility of MBUF. The project made significant contributions to the MBUF knowledge base, moving the state-of-the-practice of an alternative transportation funding method forward. Moreover, several project attributes were “firsts” in the area of MBUF, such as accommodating out-of-state mileage, using MBUF to potentially collect tolls and other synergies with tolled facilities, and a financial analysis of the potential impact of administration and compliance cost on MBUF net revenues.

It also provided an opportunity for key stakeholders – both within the Corridor and nationally – to gain a first-hand understanding of how MBUF could work and address some of the misconceptions that individuals and the public at large may have regarding this concept. The pilot, along with the various Phase 1 analyses, addressed each of the project goals and potential MBUF issues, including privacy and data security, equity and fairness, and administration needs and the associated costs.

As is often the case with the exploration of new concepts, answering one question can lead to the discovery of several new questions. Table 6-1 provides a summary of some of the key lessons learned from the Phase 1 and identifies related issues still to be addressed.

Table 6-1. Summary Key Phase 1 Key Lessons and Next Steps To Further Expand the Analysis of MBUF

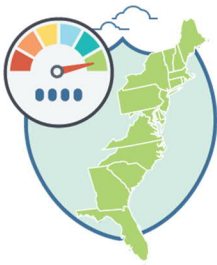
Phase 1 Key Lessons	Next Steps
Pilots are an integral part of the education and outreach effort, exposing state and national decision makers and other key stakeholders to the MBUF concept and how it can work. For example, most participants were more aware of the amount they pay in state fuel taxes following the pilot. Additionally, participation in the pilot reduced privacy and security concerns.	<ul style="list-style-type: none"> <li>• Expand MBUF pilots to other states within the Coalition.</li> <li>• Expand pilots to accommodate more participants, including the driving public.</li> </ul>
<p>MBUF technologies can accurately record the number of miles driven and the amount of fuel used, including differentiation of this information by state (i.e., out-of-state mileage) when the technologies are location-based.</p> <p>MBUF technologies and approaches that require recurring actions by the driver (e.g., turning on an app before each trip) have significant accuracy issues (e.g., driver can forget to turn on the app).</p>	<ul style="list-style-type: none"> <li>• Include other potential MBUF technologies – such as in-vehicle telematics – in future pilots.</li> <li>• Examine the possibility of using MBUF technologies to also identify where (i.e., state) and how much fuel is purchased; and include this information into the MBUF financial analyses.</li> <li>• Examine approaches (e.g., value-added amenities, per-mile rate structures) that incentivize participants to use a location-based approach.</li> </ul>



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

Table 6-1. Summary Key Phase 1 Key Lessons and Next Steps To Further Expand the Analysis of MBUF

Phase 1 Key Lessons	Next Steps
MBUF technologies can be used to also collect tolls; however, enhancements to this concept are needed to improve effectiveness.	<ul style="list-style-type: none"> <li>• Implement enhancements to the tolling proof of concept (e.g., adjustable polygons rather than circles to designate toll zones).</li> <li>• Expand proof of concept to other toll facilities, including express toll lanes with a variable toll rate structure.</li> <li>• Further explore other aspects of tolling interoperability (e.g., using tolling back office as a regional MBUF clearinghouse).</li> <li>• Examine how MBUF might be applied to support congestion management and pricing.</li> </ul>
Value-added amenities (e.g., low battery warning, trip logs, safe zones, check engine light diagnostics) had mixed reactions, but some participants saw value.	<ul style="list-style-type: none"> <li>• Expand on value-added amenities to further enhance driver convenience (e.g., automated emissions testing, carbon footprint information for trips)</li> <li>• Provide additional information on these amenities and services to pilot participants to increase awareness.</li> </ul>
Based on detailed analyses conducted in several western states, the fairness of MBUF to rural drivers relative to urban drivers may not be an issue.	<ul style="list-style-type: none"> <li>• Conduct a similar urban-rural analysis for East Coast states.</li> <li>• Includes the results in the education and outreach efforts.</li> </ul>
Administrative and compliance costs for MBUF will likely be higher than the fuel tax, at least initially. However, based on financial analyses using a toll developed in Phase 1, these additional costs can be readily incorporated into the per mile (i.e., “net revenue neutral”).	<ul style="list-style-type: none"> <li>• Conduct similar financial analyses for other East Coast states.</li> <li>• Explore the impact of including where and how much fuel is purchased in the financial analyses.</li> </ul>
Communicating the need for transportation funding is an ongoing challenge. The principle of fairness seems to resonate with people. However, there are several potential equity issues – urban vs. rural (as previously noted), the fact that with a single per mile rate EVs may pay more while inefficient vehicles may pay less, and the effect on low-income households.	<ul style="list-style-type: none"> <li>• Include an appropriate representation of demographics and vehicle types (i.e., means of propulsion, average MPG) in the pilots.</li> <li>• Continue examining these equity issues using participant surveys.</li> <li>• Address the possibility of using different per-mile rates for different vehicle types or demographics to reduce equity concerns.</li> </ul>



## I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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In addition to the next steps identified above, the I-95 Corridor Coalition MBUF project will also implement a multi-state truck pilot focusing on heavy commercial vehicles. This effort will also explore how MBUF might fit into existing commercial vehicle reporting requirements such as IFTA.

The education and outreach activities will also continue to further increase the public's understanding of transportation funding (including long-term issues with the gas tax). Expanded work will include surveys and focus groups to better understand what drivers want from their vehicles and mobility, as well as their interests and concerns.

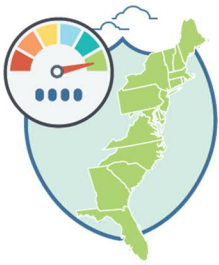




# I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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## Appendix A: Acronyms and Abbreviations

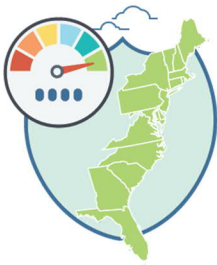


## I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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# Acronyms and Abbreviations

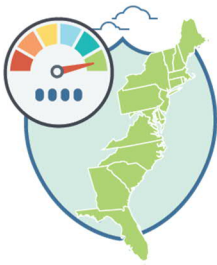
AAA	American Automobile Association
AAMVA	American Association of Motor Vehicle Administrators
AET	all electronic tolling
ATA	American Trucking Association
BEV	battery electric vehicle
CAFE	Corporate Average Fuel Economy
CAM	commercial account manager
DelDOT	Delaware Department of Transportation
DMV	department of motor vehicles
DOT	department of transportation
ELD	Electronic Logging Device
EPA	U.S. Environmental Protection Agency
EV	electric vehicle
FAST Act	Fixing America's Surface Transportation Act
FAQ	frequently asked question
FHWA	Federal Highway Administration
GHG	greenhouse gas
GPS	global positioning system
HTF	Highway Trust Fund
I-	Interstate
IBTTA	International Bridge Tunnel and Turnpike Association
ICD	Interface Control Document
ICE	internal combustion engine
IFTA	International Fuel Tax Agreement
IRP	International Registration Plan
MBUF	mileage-based user fee
MPG	miles per gallon
MRO	mileage reporting option
OBD-II	On-Board Diagnostic



## I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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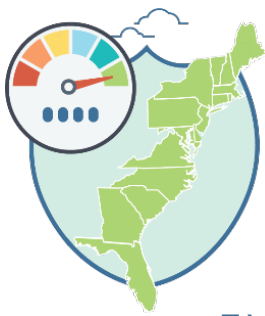
PennDOT	Pennsylvania Department of Transportation
PEV	plug-in electric vehicle
PII	personally identifiable information
RFI	Request for Information
RFP	request for proposal
SAM	state account manager
SR	State Route
SRS	System Requirements Specification
STSFA	Surface Transportation System Funding Alternatives
USDOT	United States Department of Transportation
VIN	vehicle identification number
VMT	vehicle miles traveled



# I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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## Appendix B: Fact Sheets



# I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE PILOT

[www.i95coalitionmbuf.org](http://www.i95coalitionmbuf.org)

## EXPLORING

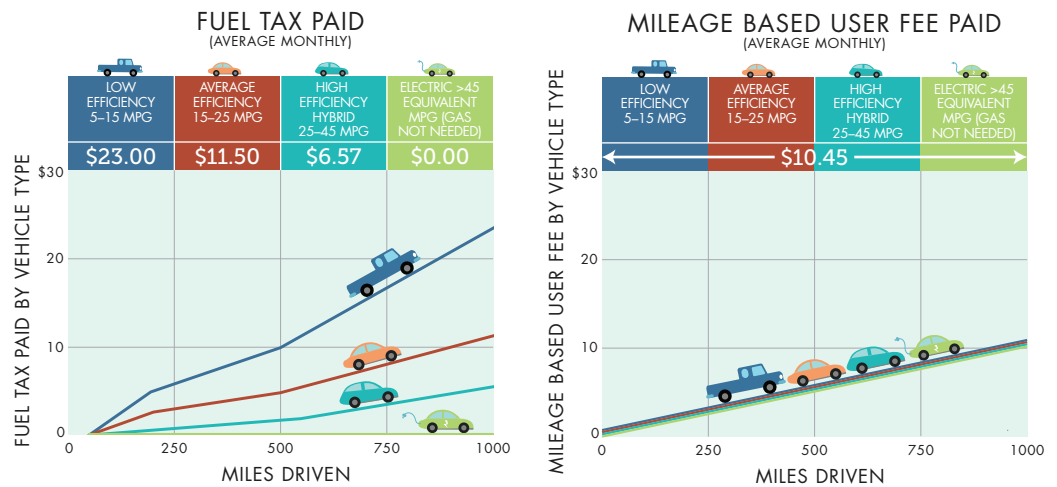
*how to pay for our roads in the future*

To ensure the voices of citizens along the I-95 corridor are a part of the critical national discussion of how to establish a sustainable and equitable transportation funding approach, the I-95 Coalition applied for and received funding through the USDOT “Surface Transportation System Funding Alternatives” (STSFA) program for two phases of a multi-year pilot. The purpose of the Coalition’s pilot is to explore the feasibility of replacing the fuel tax with a mileage-based user fee (MBUF) approach in a multi-state environment through a focused pilot in Delaware and with regional stakeholders.

## MBUF

*What is a mileage based user fee?*

Americans pay for transportation infrastructure primarily with a tax on fuel each time they fill their tank. As fuel efficiency increases and more electric vehicles are on the road, the amount motorists pay to use our transportation system becomes more linked to the type of car they drive versus the number of miles they drive. Instead of older less fuel efficient vehicles paying more for using the transportation network, a MBUF charges—for the amount you use.



## KEY MESSAGES

- I-95 Corridor Coalition is neutral if MBUF is the ultimate solution.
- This is just a pilot. No decisions have been made about the future of mileage-based fees.
- Results will help policy-makers decide on next-steps.
- The pilot will explore equity across urban and rural areas.
- The pilot provides the opportunity to experience how mileage-based fees might work in real life.
- This pilot will respect the privacy of drivers and protect personal information.

## NOW

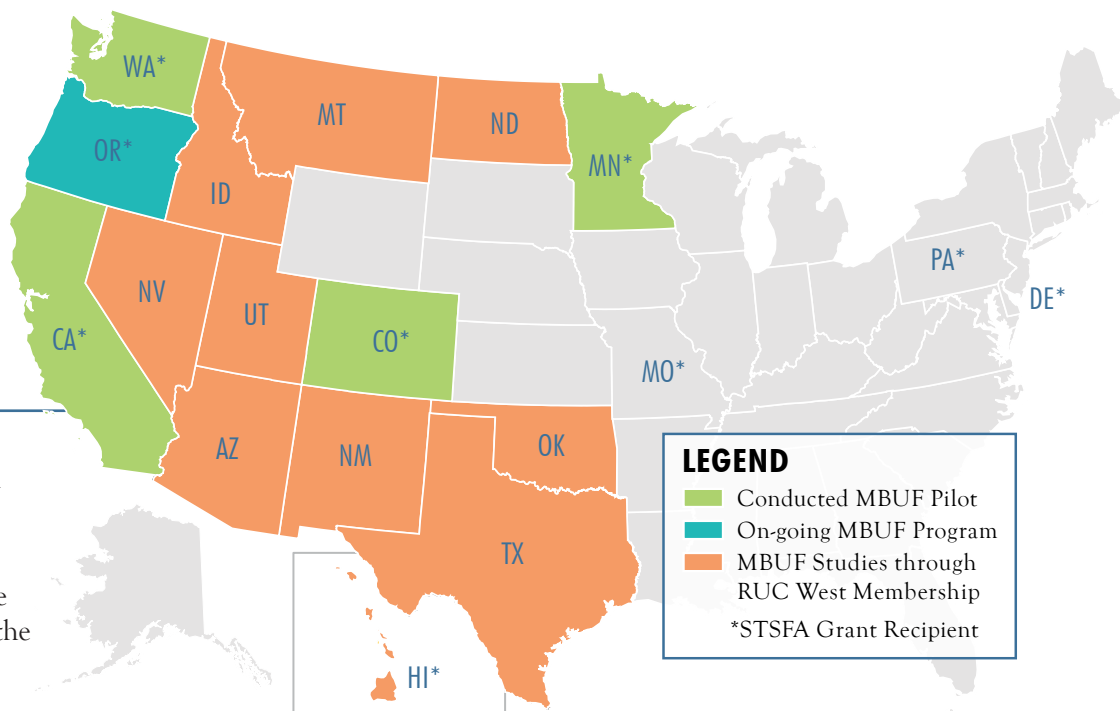
Congress recognized the need to explore alternative systems of transportation funding and authorized up to \$95 million in federal grants over a five-year period to further explore usage-based funding approaches. The I-95 Corridor Coalition, with the Delaware Department of Transportation as the lead, took advantage of this opportunity by applying for and winning funding for two phases of a multi-year pilot (\$1.16 million Phase 1 and \$1.95 million Phase 2).



## EAST COAST

voice is needed.

As the map shows, the majority of MBUF exploration has occurred in western states. Therefore, it is vital to bring the perspective of the east coast to the national evaluation of MBUF where the unique challenges of out-of-state mileage and interoperability with toll authorities can be addressed. In addition, Phase II of the I-95 Corridor Coalition effort will include a multi-state truck pilot in partnership with a private company to assess the synergy between current reporting requirements on commercial vehicles and MBUF.

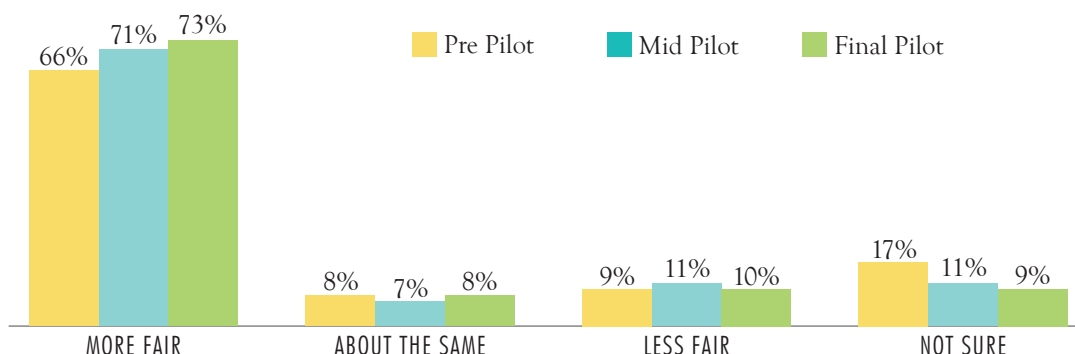


## PHASE 1 PILOT OBJECTIVES

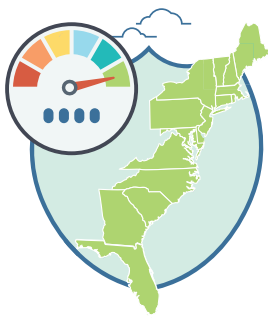
The centerpiece of the I-95 Corridor Coalition MBUF exploration is a focused pilot in Delaware with regional stakeholders. The main purpose of the focused pilot is to provide a better understanding of how a mileage-based user fee might work. Pilot participants likely include senior staff from Departments of Transportation; project steering committee members; state legislators; local officials; and other regional stakeholders.

Previous pilots have been an integral part of the MBUF education and outreach effort, with an increase in positive perception of MBUF and the notion of “fairness” as shown in the California data below. Similarly in Oregon, MBUF pilot participants were twice as likely to support MBUF (69%) as compared to statewide public perception.

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







# I-95 CORRIDOR COALITION

## MILEAGE-BASED USER FEE - PHASE 1 PILOT

[www.i95coalitionmbuf.org](http://www.i95coalitionmbuf.org)

### EXPLORING

*How to pay for our roads in the future*

This year, the I-95 Corridor Coalition led the first-ever mileage-based user fee (MBUF) Pilot on the East Coast, gaining real-world experience to better understand how a user fee might work in a multi-state environment. The Pilot ran from May through July, with a few participants continuing through August. The Pilot is one component of the study the Coalition is conducting through two grants received from the USDOT's "Surface Transportation System Funding Alternatives" program.

The I-95 Corridor Coalition is neutral if MBUF is the ultimate solution to establishing a sustainable and equitable transportation funding approach. This is just a pilot. No decisions have been made about the future of mileage-based fees.



#### FOCUS AREAS FOR THE PILOT:

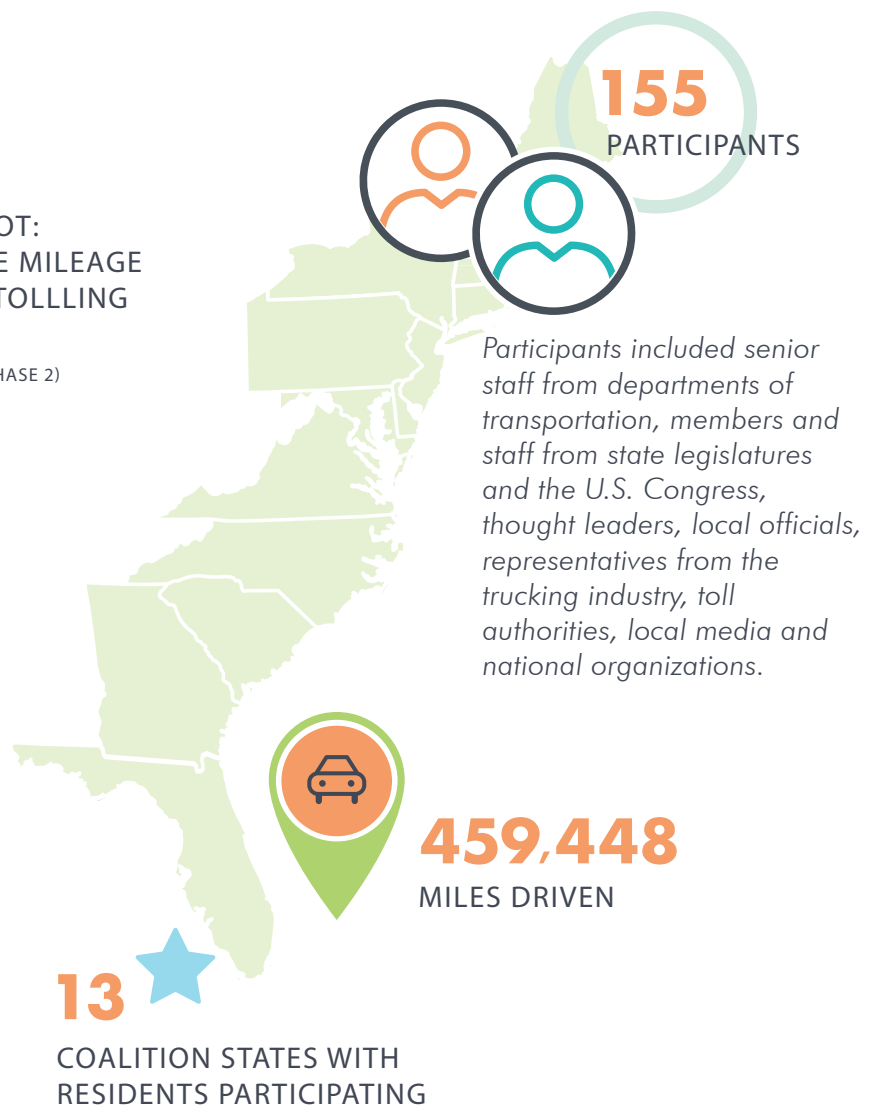
- MANAGING OUT-OF-STATE MILEAGE
- INTEROPERABILITY WITH TOLLING
- VALUE-ADDED BENEFITS
- MULTI-STATE TRUCKING (PHASE 2)

# >20%

OF THE MILES DRIVEN DURING THE PILOT WERE OUTSIDE THE STATE WHERE THE PARTICIPANT LIVED – CONFIRMING THAT DEALING WITH OUT-OF-STATE MILEAGE IS IMPORTANT.



THE TOLLING PROOF OF CONCEPT PILOT SHOWS THAT  
**IT IS FEASIBLE**  
FOR MBUF TECHNOLOGY TO COLLECT TOLLS.



# MILEAGE REPORTING DEVICES

What devices did participants select?

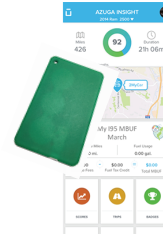
76%

PLUG-IN DEVICE  
WITH LOCATION



16%

PLUG-IN DEVICE  
WITHOUT LOCATION



8%

ANDROID PHONE  
WITH LOCATION

## PHASE 1 PILOT

What have we learned?



PRIVACY AND SECURITY ARE COMMON CONCERNS WITH MBUF, BUT PARTICIPATION IN THE PILOT REDUCED THOSE CONCERNS.

PARTICIPANTS RANKING "PRIVACY OF MY PERSONAL DATA" AS A HIGH CONCERN **DROPPED FROM 57% TO 30%** AFTER THE PILOT.

65%

OF PARTICIPANTS HAD A HIGH LEVEL OF AGREEMENT THAT AFTER THE PILOT THEY ARE MORE AWARE OF THE AMOUNT THEY PAY IN STATE FUEL TAXES TO MAINTAIN AND OPERATE THE ROADS.



OF THE VALUE-ADDED AMENITIES OFFERED, **PARTICIPANTS VALUED THOSE FOR VEHICLE AND BATTERY HEALTH THE MOST.**

VALUE-ADDED AMENITIES INCLUDED TRIP LOGS, VEHICLE HEALTH MONITORING, BATTERY VOLTAGE MONITORING, DRIVER SCORING, ACHIEVEMENTS AND SAFE ZONES.

94%

OF PARTICIPANTS SUPPORT DOING MORE RESEARCH ON MBUF.

90%

WOULD BE WILLING TO PARTICIPATE IN ANOTHER PILOT.

AFTER RECEIVING THEIR MBUF INVOICE, WHICH SHOWED THE ESTIMATED AMOUNT OF STATE FUEL TAX THEY HAD PAID,



31%

OF PARTICIPANTS THOUGHT THEY ACTUALLY PAID MORE IN STATE FUEL TAXES.



4.5/5

PARTICIPANTS WERE SATISFIED WITH THE PILOT, WITH AN AVERAGE RANKING OF 4.5 ON A SCALE OF 1 – 5, WITH 5 BEING VERY SATISFIED.

**PARTICIPATING IN THE PILOT INCREASED PEOPLES' OPINION OF MBUF.**

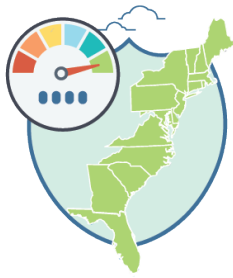
PARTICIPANTS WHO LIKED THE MBUF CONCEPT:

BEGINNING – **75%**

END – **80%**

## NEXT STEPS - PHASE 2

- MULTI-STATE TRUCK PILOT
- HEAR FROM THE PUBLIC THROUGH AN EXPANDED MULTI-STATE PILOT WITH UP TO 1,000 VOLUNTEERS
- FURTHER TESTING OF THE TOLL CONCEPT
- EXPLORE PRIVACY CONCERNS AND EQUITY ACROSS URBAN AND RURAL AREAS

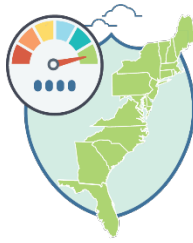


I-95 COALITION

**MILEAGE-BASED USER FEE STUDY**

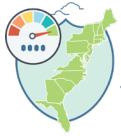
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## Appendix C: Frequently Asked Questions



## Frequently Asked Questions

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## *Mileage-Based User Fee Concept*

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### What is a Mileage-Based User Fee?

A Mileage-Based User Fee (MBUF):

- Charges motorists for the number of miles traveled, not how much fuel is consumed
- Would replace the fuel tax
- Creates a link between how much you pay and how much you drive instead of basing it on your vehicle's fuel efficiency

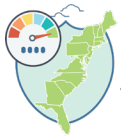
### Why is an MBUF being considered?

Currently, Americans pay for building, maintaining, and operating the transportation network primarily with a tax on fuel that is paid each time they fill their tank. As vehicle fuel efficiency increases and more electric and hybrid vehicles are on the road, the amount motorists pay to use our transportation system becomes more linked to the type of car they drive versus the number of miles they drive, with drivers of hybrid or electric vehicles paying little or nothing at all in the way of a fuel tax. The widening gap between the most and least fuel-efficient vehicles has led to an issue of equity. A mileage-based usage fee levels the playing field by creating a direct connection between the amount you pay and the amount you use (the “user pays” principle) thereby appealing to a fundamental notion of fairness widely accepted by consumers in other marketplaces.

Another concern is that the purchasing power of pay-at-the-pump fuel tax revenues has been eroding over the past two decades. As a result, the transportation system in most states is facing a serious problem. The money collected to pay for roadway maintenance, repair, and operations has been on a steady decline. Having less money to maintain and manage roadways means that the transportation system will continue to worsen each year, while the demand on the network increases. To address these issues, states are exploring alternative funding mechanisms, like mileage-based user fees (MBUF), to figure out a more sustainable long-term transportation funding approach.

### What is the I-95 Corridor Coalition studying?

The Coalition is studying the feasibility of replacing the fuel tax with a mileage-based user fee (MBUF). The Coalition will explore how out-of-state mileage can be handled, interoperability across states, collaboration with toll authorities, financial implications of MBUF, potential synergies with current commercial vehicle reporting requirements, and concerns about privacy and equity. The pilot will also explore some of the value-added amenities available to drivers through the MBUF reporting technologies.



## Why is it important for the I-95 Corridor Coalition to conduct this project?

The I-95 Corridor Coalition is neutral if MBUF is the ultimate solution to providing a long-term sustainable funding mechanism for the transportation network. However, to date, the majority of MBUF exploration has occurred in western states. Therefore, it is vital to bring the perspective of the east coast to the national evaluation of MBUF where unique issues can be addressed, most notably travel across multiple state lines and interoperability with the numerous toll facilities along the eastern seaboard. The I-95 Corridor Coalition recognizes our transportation funding challenges and the opportunity the current federal grant program provides to explore the potential and issues associated with MBUF. Results of an east-coast pilot will help national and state policy-makers decide on next steps.

## What does this project involve?

The centerpiece of the Coalition's MBUF pilot involves gathering real-world experience through three (and possibly more) pilots.

[Phase I](#) of the project included a focused pilot in Delaware with regional stakeholders, such as senior staff from departments of transportation, members and staff from state legislature and the U.S. Congress, and representatives from the trucking industry, toll authorities, and national organizations. This 3-month pilot included 155 participants from 13 states. Pilot participants did not make any actual payments. Rather, simulated monthly statements were sent showing what participants would have been charged under a mileage-based system. The main purpose of the pilot was education – to provide a better understanding of how a mileage-based user fee might work in real life. Phase 1 also included in-depth analyses of key MBUF issues, such as out-of-state mileage, interoperability with tolls, administration costs, fairness and equity, and privacy and data security.

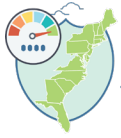
Phase II of the project will include two additional pilots: a larger [multi-state pilot](#) – starting on July 1, 2019 – including about 1,000 volunteer participants (mostly from Delaware and Pennsylvania) so the Coalition can hear from the driving public; and a multi-state truck pilot focusing on commercial vehicles with about 55 heavy trucks carrying interstate freight.

A third Phase is anticipated to start in late 2019 and will expand the MBUF exploration to additional states.

## Is MBUF actually being implemented in I-95 Coalition states?

No, this is just a pilot. No decisions have been made about the future of mileage-based fees. Results from this project will help national and state policy-makers decide on next-steps. The pilots – along the eastern seaboard and in other states throughout the country – provide the opportunity to experience how mileage-based fees might work in real life.





## Is MBUF a tax on top of the state fuel tax?

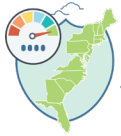
No, if implemented, MBUF would likely be a replacement to the state fuel tax. During the pilot, the simulated monthly statements show a credit for the estimated state fuel tax paid at the pump.

## Is MBUF unfair to rural drivers?

Some perceive MBUF as being unfair to rural drivers because they often travel further on a trip-by-trip basis and would therefore be charged more per trip. Previous MBUF studies have found that while rural drivers tend to drive slightly more miles per trip than urban residents, they tend to make fewer trips. Additionally, rural drivers are generally driving older and less fuel-efficient vehicles than their urban counterparts. These studies have concluded that rural households could *benefit* with a MBUF system relative to urban households. The Coalition will be examining this issue further in the context of east coast states.

## Does an MBUF system create a disincentive for people to buy high-fuel-efficiency vehicles?

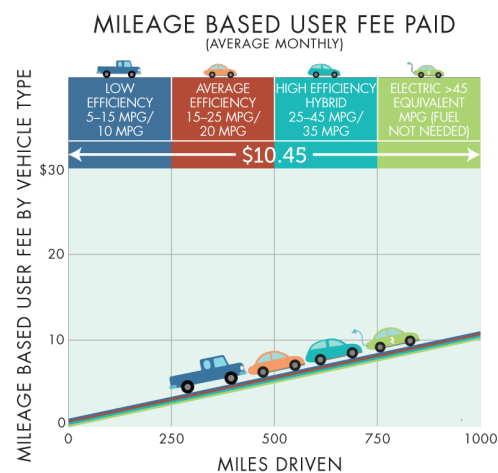
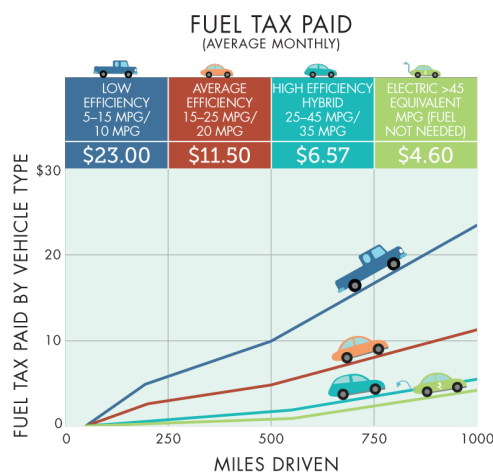
MBUF pilot programs in California and Oregon have found that people who drive high-fuel-efficiency vehicles are in favor of a mileage-based user fee because they recognize their driving is contributing to congestion and the wear-and-tear on the road but they are not paying for fuel tax to keep the transportation network working. It is also important to keep in mind that the fuel tax is a minor component of the total costs associated with owning and operating a vehicle (e.g., federal and state fuel tax ranges between 20 – 25% of the total fuel cost). Drivers have also noted they bought high-fuel-efficiency vehicles for other benefits beyond saving money on fuel tax.

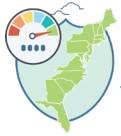


## How much would MBUF cost me each year? Under MBUF, will people pay more than they do today with the fuel tax?

For the I-95 Corridor Coalition MBUF Project, all MBUF payments are simulated, no actual monies are being used. However, the project will help participants understand the potential differences under a MBUF system versus the current fuel tax. A key factor is your vehicle's fuel economy—how many miles you can drive on a gallon of fuel. For example, an electric vehicle owner would pay more under an MBUF program because they currently pay for only a little (or no) fuel tax. However, an owner of an older vehicle (and likely less fuel-efficient vehicle) will pay less under a MBUF program. The figures below provide some comparisons between the fuel tax and MBUF for Delaware vehicles with different average fuel economies.

A calculator tool has also been developed as part of this project to help Delaware and Pennsylvania residents understand how they might be affected by an MBUF system. [You can use these calculator to find your estimated payment under the current fuel tax approach compared to a MBUF approach.](#)





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## *I-95 Corridor Coalition MBUF Phase 1 Pilot*

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### What is the Phase2 pilot and how will it work?

Starting in July 2019, the I-95 Corridor Coalition is launching Phase 2 of the Mileage-Based User Fee (MBUF Pilot)- an expanded multi-state pilot that will include around 1,000 participants from the general driving public, primarily in Delaware and Pennsylvania, plus key stakeholders from other states and national thought leaders. The main purpose of the Phase 2 pilot is to further test the MBUF technology and process with a broader group of participants and build on the findings from Phase 1. The selected participants will pick a mileage reporting device to measure their miles driven and fuel usage over the four-month pilot. They will receive a simulated monthly statement showing what they currently pay in fuel taxes and what their estimated payment would be under an MBUF system, and the net difference. The monthly MBUF statements will be simulated, and no actual monies will be involved as part of the Phase 2 pilot.

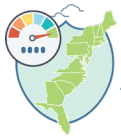
### Who is participating in the pilot?

Interested residents of Delaware and Pennsylvania can sign up [here](#). Participants will be selected based on several considerations – urban / rural, location within the state, type of vehicle – so as to best match the demographics in each state.

### How are the miles driven and fuel usage calculated? How accurate is the information?

With a plug-in device – either with or without location – mileage and fuel usage is based on vehicle data obtained via the on-board diagnostics II (OBD-II) port. Location information is used to differentiate the mileage by the state in which the vehicle was driven, and also provides enhanced driver amenities. For a few vehicle types – some electric vehicle, older vehicles, and diesel-powered vehicles – the miles driven will be calculated using GPS, with the fuel use estimated based on the number of miles driven and the average MPG rating for the car make, model, and year.

The mileage recorded through the plug-in device should be very close to, but not necessarily the same as, the mileage recorded on the car's trip odometer.



## What are the mileage reporting options available?

For the Phase 2 pilot, two primary mileage-reporting options are being used. Each pilot participant will select one of these options:

### Plug-In Device with Location

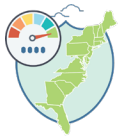
A device designed to plug in to a vehicle's OBD-II port that automatically calculates the mileage-based user fee (MBUF) based on the state(s) where the vehicle was actually driven. The device combines the mileage data and fuel consumption data stored in the vehicle's computer with the location of the miles driven using a GPS chip. Taking the recorded mileage and location data, along with the amount of fuel consumed, drivers pay for their miles driven based on the actual state(s) in which they drove and receive credits for fuel taxes paid. A location-based MBUF enables funds collected to be accurately distributed to where road wear and tear occurs. In addition, location capability provides the widest array of value-added amenities for drivers.



### Plug-In Device without Location

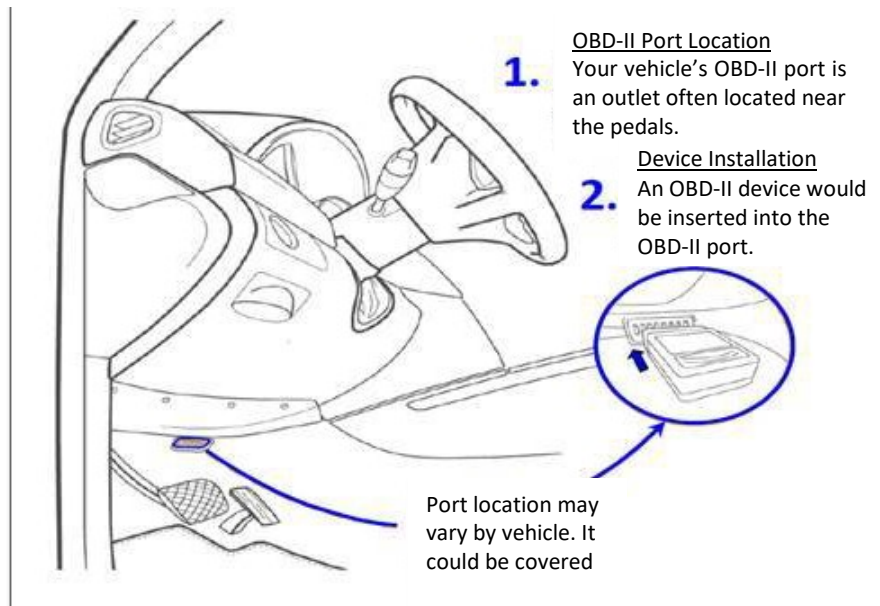
A device designed to plug in to a vehicle's OBD-II port that automatically calculates the mileage-based user fee (MBUF) based on estimates of the state(s) where the vehicle was driven. The device accesses mileage data and fuel consumption data stored in the vehicle's computer and applies assumptions about the percentage of in-state and out-of-state travel. Without location data, drivers pay for miles driven and receive credits for fuel taxes paid based on estimates of where the travel occurred. The non-location MBUF reduces privacy concerns regarding trip data, but does not provide an accurate connection between the funds collected and where the road wear and tear happens. Not having the location technology also limits the number of value-added amenities available for drivers.





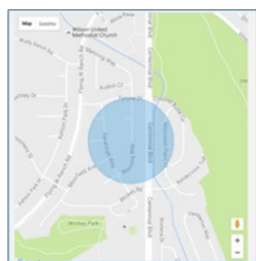
## What is an OBD-II port?

OBD stands for on-board diagnostics. The OBD-II port enables external devices to access data on mileage, emissions, speed and other subsystems that are already stored in a vehicle's computer. The port is most often on the driver's side of the vehicle either on or under the dash. The OBD-II port is typically available on any vehicle made after 1996. While it's most often used by mechanics to diagnose problems with a vehicle, there are a growing number of devices that drivers can install to monitor their vehicle's performance. One potential capability of these new devices is the calculation of a mileage-based user fee.

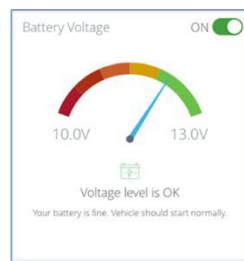


## What are value-added amenities?

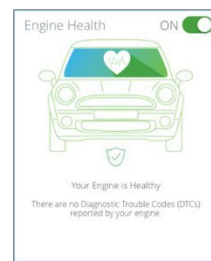
With watches, phones, ride hailing apps, and on-demand services, we are more connected and more demanding than ever before. Currently, tons of information is sitting within our vehicle, but remains out of reach for most drivers. Value-added amenities break down the barrier between the vehicle and driver by creating tools such as a battery life monitor, check engine message decoder, trip logs, vehicle safe zones, and an overview of your carbon footprint (value of pounds of CO2 per trip). The same technology used to create these value-added amenities can also calculate a mileage-based user fee. The relationship between value-added amenities and MBUF is being explored in pilot studies.



Safe Zones



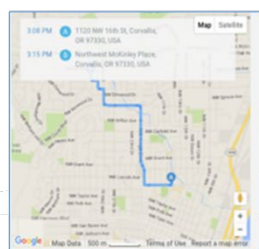
Battery Health



Engine Health



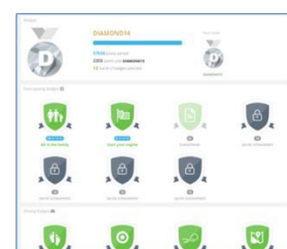
Find My Car



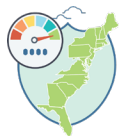
Trip Log



Driver Scores



Gamification



## What are the value-added amenities available?

The following table describes the value-added amenities and which mileage-reporting option they are available with.

	Plug-In Device with Location	Plug-In Device without Location
<b>Device Operations</b>		
Location: Uses GPS to determine where you traveled	X	
Uses a device that plugs in to your vehicle	X	X
<b>Value-Added Amenities</b>		
<b>MBUF Details:</b> View all the data pertaining to MBUF charges, including your miles traveled and fuel tax credit.	X	X
<b>Trip Logs:</b> Detailed trip logs remember each trip you've taken, so you can see details about your trips like duration, cost, and carbon footprint.	X	X
<b>Vehicle Health:</b> Get valuable information about what's really happening with your vehicle when the Check Engine light goes on, or when the plug-in device provides a diagnostic trouble code (DTC). When this occurs, an email is sent identifying the DTC code along with a link to a web page that provides a detailed description of the code.	X	X
<b>Battery Voltage:</b> See how well your battery is performing and see right away if your battery is dead or getting old. This includes automatically receiving an email when the battery level drops below a specified level.	X	X
<b>Driver Scoring:</b> Driver scoring that shows how smooth you drive. Driving factors that are scored: high speed, acceleration, braking and idling.	X	X
<b>Achievements:</b> Earn badges that unlock for good driving behavior. Compete with friends and family to see who can unlock the most badges. A great tool for drivers to stay engaged and connected with their driving.	X	X
<b>Safe Zones:</b> Offers peace of mind that anyone driving your car (such as a teenager) is safe by allowing you to set up geographical zones on a map and be notified when the vehicle has entered and / or exited those zones.	X	
<b>Enhanced Visual Trip Logs:</b> Trip logs that show individual trips on a map and are shareable with friends.	X	



## How is my privacy protected?

Privacy concerns are among the most commonly cited concerns with MBUF, especially in terms of what data are collected and who has access to the data. The I-95 Corridor Coalition takes these concerns seriously and this pilot will respect the privacy of drivers and protect personal information.

For the Phase 2 pilot, there are two mileage reporting options, including one that collects ZERO location information. The Coalition has also partnered with Azuga, a well-established industry-leading account manager, which has provided MBUF account management services for the Phase 1 Pilot and in California, Colorado, and Oregon.

In volunteering for the pilot, and then subsequently setting up a MBUF account, participants will provide the following information, which is very similar to the information provided to the DMV when registering a vehicle:

- Name and address, including zip code
- Email address and phone number
- Year, make and model of the vehicle
- The Vehicle Identification Number (VIN), and license plate number and state of the vehicle
- The state of employment

Through the mileage-reporting option that pilot participants choose, Azuga will also collect the following information:

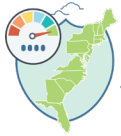
- Speed
- Time
- When the device is plugged in or unplugged from the vehicle
- Location and routes driven (only for options using GPS)
- Estimated toll charges for toll facilities within Delaware (only for options using GPS)
- G force (i.e., an indicator of acceleration and braking)
- Fuel usage (for plug-in devices)
- Mileage, braking and acceleration are calculated using speed and time

This information is used to calculate MBUF and the fuel tax credits and is also used to support the various value-added amenities. However, none of the route information and driving behavior information is shared with the Coalition or the participating State DOT's. Moreover, any location information is aggregated such that Coalition and participating State DOTs will only know how many miles your vehicle was driven in each state for the entire month. No daily route information is shared.

Every month, the I-95 Corridor Coalition and the participating State DOTs will receive aggregated vehicle mileage reports from Azuga that protect the privacy of individual participants. The I-95 Corridor Coalition and participating State DOTs do NOT receive any participant-specific routing or driving behavior information.

The monthly aggregated reports will only contain the following information:

- Total miles traveled by each vehicle (identified by the VIN) for the month.



- Total miles traveled in each I-95 Corridor State (for location-based approaches) for the month.
- The amount of simulated MBUF less a credit for estimated state fuel taxes paid.
- Equipment errors or malfunctions.

Additionally, pilot participants will be asked to fill in a web-based survey form at the start of the pilot, and then again at the end of the pilot. The collected data and survey information will be used for the evaluation portion of the project. Following are examples of how the information might be used:

- Analysis of difficulties participants have in setting up their MBUF mileage accounts, so that this process can be improved for any future MBUF system.
- Changing attitudes of participants of MBUF with respect to accuracy, fairness, and privacy of MBUF
- Analysis of MBUF by different makes and models of vehicles, to gain insight into how a MBUF system might address inequities in the current fuel tax approach.
- Analysis of the amount of cross-state mileage that would need to be managed in a multi-state environment.
- Analysis of mileage by a certain area of a state, to gain a better understanding of how MBUF might impact drivers differently, depending on where they live.

The data used for these purposes will not contain any participant specific information and will only be used at the aggregated level (combined with other participants' data). Individual participants' data will not be shared with the participating states or with the Coalition. Additionally, no detailed location information (e.g., routes taken) nor information on driving behavior is provided to the I-95 Corridor Coalition, the I-95 Corridor Coalition member states, or any third party by Azuga.

All detailed participant-specific data collected during the pilot will be deleted within 60 days following the completion of the pilot.

## Will people know where I'm driving?

For pilot participants who select a mileage reporting option that uses "location" or GPS, the location of their miles and the routes driven will be collected by the account manager. This is done so that their MBUF can be calculated based on the actual state(s) where they drove. The location data is also used to support a number of value-added amenities offered by Azuga, the account manager selected for the I-95 Corridor Coalition pilot. Information on individual trips and routes is not shared with anyone and is only retained by Azuga for 60 days. During that time, pilot participants can view the information about their trips. Location information is not actively monitored or provided to any other private entity or government agency.

## What are the current state fuel taxes in the I-95 Coalition states?

Following is a table of the fuel taxes (both gas and diesel) for each of the I-95 Corridor Coalition states. In addition, there is a federal tax of 18.4¢ per gallon on gas and 24.2¢ per gallon on diesel. The current Phase 2 of the I-95 Corridor Coalition pilot is only studying MBUF as a replacement to the state gas tax.



Federal fuel taxes are not addressed. See the FAQ [“What if a vehicle uses diesel, does that make a difference?”](#) for more information on diesel vehicles in the Phase 1 pilot.

Current State Fuel Taxes

State	State Gas Tax (cents per gallon)	State Diesel Tax (cents per gallon)
Connecticut	36.85	43.9
Delaware	23.00	22.00
District of Columbia	23.50	23.50
Florida	41.99	34.97
Georgia	35.28	40.07
Maine	30.01	31.20
Maryland	35.30	36.05
Massachusetts	26.54	26.54
New Hampshire	23.83	23.83
New Jersey	41.40	48.50
New York	44.10	44.61
North Carolina	36.45	36.45
Pennsylvania	58.70	75.20
Rhode Island	34.00	34.00
South Carolina	20.75	20.75
Vermont	31.19	32.00
Virginia	20.66	24.71



## How much would be charged per mile under MBUF and how were the rates developed? Will the rates change over time?

The per-mile rates developed for the Phase I pilot are calculated based on each state's gas taxes to be "net revenue neutral"—that is, a vehicle getting the national average of 22 miles per gallon (MPG) will pay an MBUF that is equal to the amount paid for the state gas taxes, plus the additional amount to cover the increased administration costs estimated to occur with MBUF implementation. The per mile rates and gas tax credits for the Phase 2 pilot for each of the Coalition states are listed in the Table below.

Per Mile Rates and Gas Taxes to Be Used in the Phase 2 MBUF Pilots

State	Per Mile Rate (cents per mile)	Gas Tax Credit (cents per gallon)
Connecticut	1.99	36.85
Delaware	1.25	23.00
District of Columbia	1.27	23.50
Florida	2.27	41.99
Georgia	1.90	35.28
Maine	1.62	30.01
Maryland	1.91	35.30
Massachusetts	1.44	26.54
New Hampshire	1.29	23.83
New Jersey	2.24	41.40
New York	2.39	44.10
North Carolina	1.97	36.45
Pennsylvania	3.18	58.70
Rhode Island	1.84	34.00
South Carolina	1.12	20.75
Vermont	1.69	31.19
Virginia	1.12	20.66

The rates being explored in this pilot are solely for research purposes. Ultimately, each state, and possibly its legislature, would determine the per-mile rates, which could conceivably vary by vehicle type, location, or other considerations. Each state would also determine any changes to the per-mile rates.

## How is MBUF calculated?

In general, MBUF is calculated as follows:

$$(\text{\# of miles driven} \times \text{per mile rate}) - \text{state fuel tax paid} = \text{Net MBUF}$$

## How is MBUF calculated if you drive in more than one state?

The way that the MBUF is calculated depends on the mileage reporting option the driver selects.

If the driver selects a device with location (meaning that GPS is used to record in which states the miles were driven), the MBUF is calculated based on how many miles were driven in each of the states within the I-95 Corridor Coalition.

[Click here to see the per mile rates for each state.](#)

[Click here to see the current state fuel taxes.](#)

**Example:** A vehicle is driven 1,800 miles in a month, using 60 gallons of fuel (i.e., 30 miles per gallon). This vehicle uses a location-based mileage-reporting device, and the breakdown of miles driven in each state is as follows:

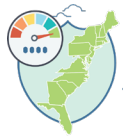
Delaware – 1,000 miles

Pennsylvania – 600 miles

New Jersey - 200 miles

The MBUF invoice calculations would be as follows:

State	Miles Driven	Per-Mile rate	MBUF	Fuel Used (Gallons)	State Fuel Tax (cents per gallon)	Fuel Tax Credit	Net Difference
DE	1,000	\$ 0.0125	\$ 12.50	33.33	\$ 0.23	\$ 7.67	\$ 4.83
PA	600	\$ 0.0318	\$ 19.08	20.00	\$ 0.587	\$ 11.74	\$ 7.34
NJ	200	\$ 0.0224	\$ 4.48	6.67	\$ 0.414	\$ 2.76	\$ 1.72
<b>TOTALS</b>	<b>1,800</b>		<b>\$36.06</b>	<b>60</b>		<b>\$22.17</b>	<b>\$ 13.89</b>
Notes <ul style="list-style-type: none"> <li>Where the fuel was purchased, and the actual amount of fuel tax paid, is unknown, even with location technology. Accordingly, the number of gallons is apportioned between states based on the number of miles driven in each state – for example, the 600 miles in Pennsylvania represents one-third of all miles</li> </ul>							



driven (600 / 1800), which is applied to the total 60 gallons resulting in an estimate of 20 gallons of fuel within Pennsylvania)

- The fuel tax credit does not include the federal fuel tax of 18.4 cents per gallon

If the driver is using a mileage-reporting device without location, there is not a way to determine the state(s) where the vehicle was driven. For the Phase 1 pilot, we will assume that a specified percentage of mileage and fuel tax payments have occurred in the vehicle's home state, and the MBUF will be calculated using that state's per-mile rate and state fuel tax. The remaining percentage of the vehicle's mileage will be assumed to have occurred outside of the vehicle's home state, using an average per-mile fee and average fuel tax for all out-of-state mileage.

[Click here to see the preliminary percentages and out-of-state per-mile rates and fuel taxes for each home state.](#)

Here is the Table

Table 3-5. Assumed Percentages of Out-of-State Mileage by In-State Vehicles and Associated Out-of-State Per-Mile Rates and Gas Taxes to Be Used during Phase 1 MBUF Pilots

State	Out of State Mileage by Resident Drivers	Out of State Per Mile Rate (cents per mile)	Out of State Gas Tax Credit (cents per gallon)	Out of State Rates and Gas Taxes Based On :
Connecticut	8 %	2.01	37.19	NY (50%), RI, MA
Delaware	18 %	2.63	48.53	PA (50%), NJ, MD
District of Columbia	30 %	1.51	27.98	VA, MD
Florida	1 %	1.91	35.28	GA
Georgia	3 %	1.70	31.37	SC, FL
Maine	5 %	1.36	25.19	NH, MA
Maryland	20%	1.50	27.71	DC (35%), VA (35%), PA, DE
Massachusetts	5 %	1.88	34.70	CT, NH, RI, NY
New Hampshire	18 %	1.55	28.57	MA (50%), VT, ME
New Jersey	15 %	2.78	51.40	NY, PA
New York	4 %	2.12	39.13	NJ, CT
North Carolina	3 %	1.12	20.71	VA, SC
Pennsylvania	6 %	1.95	35.95	DE, MD, NJ, NY
Rhode Island	16 %	1.72	31.70	CT, MA
South Carolina	5 %	1.94	35.87	GA, NC



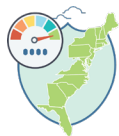


Table 3-5. Assumed Percentages of Out-of-State Mileage by In-State Vehicles and Associated Out-of-State Per-Mile Rates and Gas Taxes to Be Used during Phase 1 MBUF Pilots

State	Out of State Mileage by Resident Drivers	Out of State Per Mile Rate (cents per mile)	Out of State Gas Tax Credit (cents per gallon)	Out of State Rates and Gas Taxes Based On :
Vermont	8 %	1.84	33.97	NH, NY
Virginia	10 %	1.59	29.40	DC, MD

*Note: This table is used only for vehicles that do NOT choose a location-based mileage reporting option*

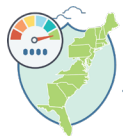
**Example:** A vehicle from Delaware is driven 1,800 miles in a month, using 60 gallons of fuel (i.e., 30 miles per gallon). This vehicle does not use a location-based technology.

The MBUF invoice calculations would be as follows:

State	Percent	Assumed Mileage	Per-Mile Rate	MBUF	Fuel Used (Gallons)	State Fuel Tax (cents per gallon)	Fuel Tax Credit	Net Difference
DE (Home)	82%	1,476	\$ 0.0125	\$ 18.45	49.2	\$ 0.23	\$ 11.32	\$ 7.13
Out of State	18 %	324	\$ 0.0263	\$8.52	10.8	\$ 0.4833	\$ 5.22	\$ 3.30
<b>TOTALS</b>	<b>100 %</b>	<b>1,800</b>		<b>\$26.97</b>	<b>60</b>		<b>\$16.54</b>	<b>\$10.43</b>

## How was the “other state” rate calculated for non-location participants?

If the pilot participant is using a device without location, there is not a way to determine the state(s) where the vehicle was driven. For the Phase 2 pilot, a specified percentage of mileage and fuel tax payments will be assumed to have occurred in the vehicle’s home state – based on census statistics on levels of work-related cross-state travel – and the MBUF will be calculated using that state’s per-mile rate and state fuel tax. The remaining percentage of the vehicle’s mileage will be assumed to have occurred outside of the vehicle’s home state, with an average per-mile fee and average fuel tax for all out-of-state mileage based on the per-mile rates and state fuel taxes in adjacent states.



## How is the fuel tax credit calculated?

It varies depending on the mileage reporting option the pilot participant chooses. With a plug-in device – either with or without location – fuel usage is based on vehicle data obtained via the OBD-II port for most vehicles. For vehicles where this information cannot be obtained from the OBD-II port (i.e. diesel vehicles) or vehicles that do not have an OBD-II port (i.e. some electric vehicles), the fuel is estimated based on the miles driven and the average MPG rating for the vehicle make, model, year and engine type, as identified by the EPA. This information is available at [www.fueleconomy.gov](http://www.fueleconomy.gov), and clicking on the “Find a Car” tab.

## What if a vehicle uses diesel, does that make a difference?

Participants with diesel-powered vehicles will receive an MBUF statement showing the miles traveled (by state, if a location-based approach is selected), the amount of fuel used (based on the vehicles average MPG per the EPA), and a credit for the estimated state diesel tax paid. For diesel vehicle owners who choose a non-location device, the calculation will be based using the table Assumed Percentages of Out-of-State Mileage by In-State Vehicles and Associated Out-of-State Per-Mile Rates and Gas Taxes to Be Used during Phase 1 MBUF Pilots

## What if it’s an electric vehicle, does that make a difference?

Drivers with an electric vehicle will receive a location-based device, either a Plug-In Device with location or (for those vehicles without an OBD-II port) a device that plugs into the vehicle’s USB port .

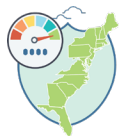
The reason a location-based option is required for electric vehicles is because the port in electric vehicles does not provide the necessary data for calculating miles. Under these circumstances, the - devices’ location capability is used to measure mileage.

## How will people be charged for driving on roads outside of the I-95 Coalition states?

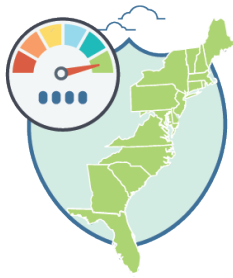
It depends on which mileage-reporting option the participant chooses. If a participant chooses a GPS-enabled approach, it will identify any miles driven outside of the I-95 Coalition states, and those miles will not be assessed MBUF on their faux invoice. The I-95 Corridor Coalition covers the following:

Connecticut  
Delaware  
District of Columbia  
Florida  
Georgia  
Maine  
Maryland  
Massachusetts  
New Hampshire

New Jersey  
New York  
North Carolina  
Pennsylvania  
Rhode Island  
South Carolina  
Vermont  
Virginia



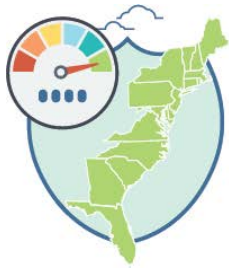
For a device without location, the mileage will be assessed as discussed in the FAQ entitled [“How is MBUF calculated if you drive in more than one state?”](#) – that is, all mileage will be billed.



I-95 COALITION  
**MILEAGE-BASED USER FEE STUDY**

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## Appendix D: Participant Agreement



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### Phase 1 Mileage-Based User Fee Pilot

#### Policies and Participation Agreement

To ensure the voices of citizens along the I-95 corridor are a part of the critical national discussion of how to establish a sustainable and equitable transportation funding approach, the I-95 Corridor Coalition applied for and received funding through the USDOT “Surface Transportation System Funding Alternatives” (STSFA) program to operate a Mileage-Based Usage Fee (MBUF) Pilot beginning in May 2018. The purpose of the MBUF Pilot is to explore the feasibility of replacing the fuel tax with a MBUF approach in a multi-state environment through a focused pilot in Delaware and with regional stakeholders. We are particularly interested in receiving feedback on the technologies used in the pilot and the other driver amenities provided, reactions to receiving a road “invoice” for usage, any concerns with privacy and data security, and the fairness of the MBUF system.

#### MBUF Pilot Data Collection and Use

To set up and properly manage your MBUF account during the 3-month Pilot the account manager<sup>1</sup> will collect the following information:

- Your full name and address, including zip code
- Your email address and phone number
- Year, make and model of vehicles you own or lease
- The Vehicle Identification Number (VIN) for the vehicle(s) you will enroll in the Pilot
- The state you work in

The account manager is responsible for setting up your MBUF account and processing your mileage reports, delivering mileage reporting devices to persons who choose to test those devices, and providing customer services.

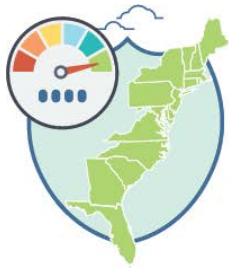
Occasionally I-95 Corridor Coalition or your account manager may use your personal information to contact you or send important notices about your account, changes in the MBUF Pilot, surveys, or changes to these policies.

#### Location-Based Services are Entirely Optional

Your vehicle location details are not required to participate in the Phase 1 MBUF Pilot. If you do not want location information collected by your account manager, you simply select a mileage reporting option that does not use location-based services during the pilot registration. It is important to note that if you choose the non-location technology option, a portion of your total miles will be allocated to neighboring states based on default estimates. In addition, some value-added amenities offered by the account manager will not function without location data. No detailed location information (e.g., routes taken) is provided to the Coalition, the Coalition member states, or any third party by the account manager.

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<sup>1</sup> A private entity that collects mileage-based user fee data, distributes faux invoices, and collects simulated payments (no actual funds will be paid by participants).



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### Collection and Use of Non-Personal Information

The account manager will also produce non-personal data reports that do not reveal the identity, activities or contact details of any specific person. The collected information will be securely stored and only accessible to researchers. Below are examples of non-personal information and how it might be used:

- Analysis of mileage by persons living in a certain area, to gain a better understanding of how MBUF might impact drivers differently, depending upon where they live.
- Analysis of difficulties participants have in setting up their MBUF mileage accounts, so that these services can be improved for any future MBUF system.
- Analysis of MBUF by drivers of different makes and models of vehicles, to gain insight into how a MBUF system compares against the gas tax system.

The data used for these purposes will not contain any participant specific information and will only be used at the aggregated level (combined with other participants' data).

### Disclosure of Personal Information to Third Parties

Given a key purpose of the Phase I pilot is to gather feedback from participants, you will be asked to participate in three brief surveys: Pre-Pilot, Mid-Pilot and Post-Pilot. Another third-party company will be conducting these surveys and reach out to you via email. The third-party survey company will not have access to the pilot data collected by the account manager and is legally required to adhere to this privacy policy and protect your personal information.

### Your Right to Inspect Your information and Records

Your account manager will provide you the opportunity to view all of your personal information and data collected and stored as part of the Phase 1 MBUF Pilot to ensure only information and data you have authorized is being collected. To view your information, please contact your account manager using the email address or telephone number provided below.

Email: [I95mbufsupport@azuga.com](mailto:I95mbufsupport@azuga.com)

Telephone (for Account Manager related questions): 1-888-229-0466

If you notice anything in your account that seems to be a mistake, you may request a review by your account manager, and a prompt correction of any errors discovered will be made.

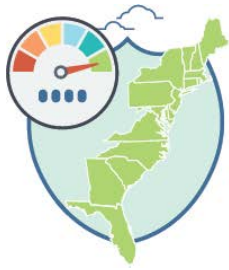
### Retention of Your Information and Records

All personally identifiable information<sup>2</sup> that is collected to set up and manage your mileage account, including mileage and other data collected during the 3-month pilot, will be destroyed within 30 days of the completion of the Phase 1 MBUF Pilot. Non-personal information (i.e. total mileage, vehicle make and model, etc.) may be retained indefinitely and used for other MBUF research purposes. All data will be anonymized, securely stored, and only individuals involved in the research study will have access to the data. All individuals that will have access to personally identifiable information as part of this study

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<sup>2</sup> Personal information means any information about an individual which, on its own or when combined with other information, is reasonably capable of revealing the identity or activities of a specific person (i.e. address, phone number, email address).





## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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will sign a non-disclosure agreement to ensure that they do not disclose personally identifiable information.

### Other Optional Participant Activities

As part of the evaluation, it is desired that some participants provide the following information during the pilot:

- Copies of monthly E-Zpass account information for comparison with tolls as calculated by the location-based MBUF technologies
- Log of mileage driven by state by day for comparison with mileage collected by the location-based MBUF technologies

All of this information will be protected and destroyed in accordance with the privacy provisions contained herein. **Please indicate below whether you are willing to participate in this aspect of the study:**

- ☐ YES, I am willing to provide E-Zpass account information for comparison with tolls calculated by the location-based MBUF technologies
- ☐ YES, I am willing to provide mileage logs by state by day during the course of the pilot
- ☐ NO, I am NOT willing to provide E-ZPass information or mileage logs

### Participant Resources

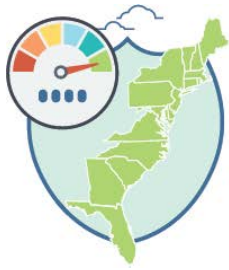
The following website contains detailed information about the pilot program, frequently asked questions, a help desk, and contacts for specific information.

Website: [www.I95coalitionMBUF.org](http://www.I95coalitionMBUF.org)

Email (for Account Manager related questions): [I95mbufsupport@azuga.com](mailto:I95mbufsupport@azuga.com)

Email (for general program/pilot questions): [info@i95coalition.org](mailto:info@i95coalition.org)

The I-95 MBUF Pilot falls under the University of Maryland standard research protocols. For more information about these protocols, contact UMD Institutional Review Board at: [irb@umd.edu](mailto:irb@umd.edu).



## I-95 CORRIDOR COALITION MILEAGE-BASED USER FEE STUDY

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### Pilot Agreement

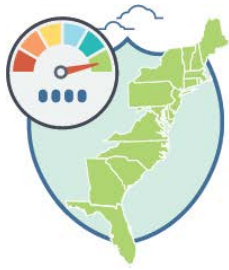
Volunteer participants in the I-95 Corridor Coalition MBUF Phase 1 Pilot will evaluate the feasibility of MBUF as a potential replacement of the fuel tax. All MBUF payments and fuel tax credits will be simulated and no actual monies will be paid to a participant – or received from a participant as part of the Phase 1 MBUF Pilot.

#### ***Participant Agreement***

To participate in the I-95 Corridor Coalition MBUF Phase 1 Pilot, I understand and agree to the following:

1. I agree to participate in the Phase 1 Pilot for a period of three (3) months, beginning May 1, 2018 and ending July 31, 2018.
2. By enrolling in the Phase 1 Pilot, I agree to set up an account, install a mileage reporting device in my designated vehicle(s), and to download a mobile smartphone app (if applicable) provided by the account manager.
3. Volunteers will be given a choice of several MBUF mileage reporting options. I agree to choose one of the mileage reporting options and provide MBUF Pilot monthly mileage data via the approach appropriate to the reporting option chosen.
4. I agree to return the mileage reporting device upon withdrawal of my vehicle from the pilot, including recording the vehicle's odometer reading when the device is removed.
5. I understand that I will receive (via e-mail) a monthly statement outlining the amount of the usage fee (based on miles reported), less any credits for the estimated amount of fuel taxes paid. I further understand that the estimated amounts will be calculated accurately but as part of the Phase 1 MBUF Pilot are not due and payable.
6. I will report all difficulties or malfunctions in the mileage reporting device or statement errors to my account manager in a timely manner, and allow the account manager the opportunity to correct them.
7. I will notify the account manager upon selling any vehicle enrolled in the Phase 1 MBUF Pilot or if I lose the mileage reporting device (such as by theft or accident), so the account manager may arrange for a replacement mileage reporting device.
8. I agree not to tamper with the mileage reporting device, provide inaccurate odometer readings (where appropriate), or otherwise purposefully attempt to defraud the pilot.
9. I understand that participation in periodic surveys is important to the Phase 1 MBUF Pilot and to provide accurate answers to questions related to my experience as a participant in the MBUF Pilot. There will be three surveys, occurring before, during and after the pilot; each taking approximately 10-15 minutes to complete. I authorize my email address, provided at enrollment to be used by I-95 Corridor Coalition or their authorized representatives to disseminate the surveys.

I acknowledge and agree to the conditions provided in the MBUF Pilot Privacy Policy.



## I-95 CORRIDOR COALITION **MILEAGE-BASED USER FEE STUDY**

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### *Phase 1 MBUF Pilot Agreement:*

The Phase 1 MBUF Pilot will provide material to assist the participant with enrollment, account setup, device installation and account closeout, and will assist the participant with any or all of these activities as needed.

The I-95 Corridor Coalition may cancel the Phase 1 MBUF Pilot or the participant's involvement in the pilot at any time. Should the participant wish to leave the pilot prior to the conclusion of the three-month term of the pilot, the participant may do so by providing notice to the account manager and returning the mileage reporting device.

### **Signature**

By signing below, I agree to the above conditions for participation in the Phase 1 MBUF Pilot.

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*Participant Signature*