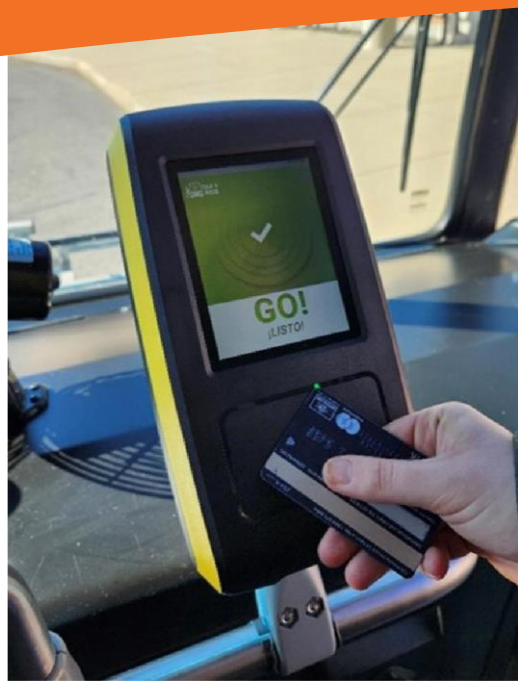
Connecticut Integrated Transit Mobility Project (CT-ITMP)

Final Implementation Report

Fiscal Year 2022



Strengthening Mobility and Revolutionizing Transportation (SMART) Grant Program

RECIPIENT NAME
Connecticut Department of Transportation (CTDOT)

FISCAL YEAR OF AWARD
FY 2022

PERIOD OF PERFORMANCE
September 15, 2023, to March 14, 2025

ORGANIZATION(S) PREPARING THE IMPLEMENTATION REPORT
CTDOT

Part 1 of 7: Executive Summary

The Connecticut Department of Transportation (CTDOT), through the Connecticut Integrated Transit Mobility Project (CT-ITMP) piloted an integrated open-loop contactless payment system (Tap & Ride) on-board transit vehicles for the first time. Throughout this Stage 1 SMART grant project, CTDOT also evaluated options for digital verification of discounted fares and investigated the necessary hardware and software upgrades required to deploy a unified mobility application that could integrate real-time information for all transit services statewide.

The Tap & Ride Stage 1 pilot was conducted across two service providers, River Valley Transit and the CT*transit* Meriden Division. The service area for the pilot spanned 16 different municipalities throughout the state and 18 different bus routes. A key partner throughout CTDOT's project was the California Integrated Travel Project (Cal-ITP), who provided technical assistance and the procurement pathway for CTDOT to deploy and evaluate a contactless fare payment system quickly and cost-effectively. Other key partners include River Valley Transit and North East Transportation Company (NETCO), operator of the CT*transit* Meriden Division.

CTDOT's primary goal through the CT-ITMP was to test the proof of concept for an integrated contactless payment system across multiple service providers, before an at-scale implementation of Tap & Ride Statewide. With over 15 different transit service providers throughout the state, there are a significant number of different fare systems that customers need to navigate when riding multiple services. CTDOT's vision is that any transit customer would be able to tap their debit card, credit card, or mobile wallet on any fixed route bus in the state and have a seamless experience while receiving transfer and fare capping benefits.

Key outcomes and lessons learned following completion of CTDOT's Tap & Ride pilot include:

- Customer satisfaction with the fare payment experience increased after Tap & Ride was introduced. Bus operators were excited about Tap & Ride with its potential to speed up customer boarding times and eventually remove them from visually validating certain fares.
- State Purchasing Schedules, such as the Cal-ITP Mobility Marketplace, were an effective procurement pathway for agencies to quickly deploy modern transit technology without having to run their own procurements.
- Fare policy considerations are extremely important when deploying an integrated Tap & Ride system across multiple providers. It is much easier to deploy if agencies have the same fare products, pricing, and policies.
- Digital eligibility verification for reduced transit fares, linked directly to Tap & Ride customer bank cards, requires additional development and work. Manual verification is not scalable statewide nor customer-friendly, and agencies should be prepared to dedicate resources and time to investigating digital eligibility verification options.

After deploying Tap & Ride on approximately 5% of its fixed route fleet in the state, CTDOT is prepared to take Tap & Ride Statewide. A fully integrated modern payment system on all transit services in the state will result in a more connected transit system, improving mobility and quality of life for everyone in Connecticut.

Part 2 of 7: Introduction and Project Overview

- Project title: **Connecticut Integrated Transit Mobility Project (CT-ITMP)**
- Recipient name: **Connecticut Department of Transportation (CTDOT)**
- Fiscal year of award: **FY 2022**
- Period of performance: **September 15, 2023, to March 14, 2025**
- Organization(s) preparing the Implementation Report: **CTDOT**
- Date the Implementation Report is submitted: **July 11, 2025**

1) The Connecticut Department of Transportation (CTDOT) envisions a modern, integrated, statewide transit system that makes fare payment simple, affordable, and consistent, where paying for a transit trip is as easy as paying for a cup of coffee.

Today, transit customers throughout Connecticut must navigate complex fare structures, transfer rules, and varying ways to pay for their fares across over 15 different transit service providers. They also cannot easily access all real-time transit information in one location. Customers are required to navigate multiple mobile applications or transit provider websites to determine schedule information, real-time vehicle locations, or multi-modal options such as fixed-route bus, rail or microtransit services. This fragmented system causes confusion for existing and potential transit customers and makes bus operator jobs more challenging by requiring them to explain and enforce complex fare rules. An at-scale implementation of the same contactless fare payment system, in coordination with CTDOT's efforts to implement a statewide unified fare policy across bus service providers in Connecticut, would simplify and enhance the transit customer experience.

To achieve this, the Connecticut Integrated Transit Mobility Project (CT-ITMP) tested the proof-of-concept for statewide open-loop, contactless fare payments that meet the needs of the customers, including fare capping, new fare structures, integration with existing fare media, and discounted fares. Efforts conducted under this project include:

- **Conducting an open-loop contactless fare payments pilot (Tap & Ride) across multiple providers**
    - Payment acceptance devices (PADs) were installed on 43 fixed route vehicles from River Valley Transit (RVT) and the CT*transit* Meriden division., Customers could tap their credit or debit cards (physical or virtual) on the PADs upon boarding to pay. The pilot offered the following fare caps regardless of the service provider, as long as the same payment media was used:
        - Two-hour free transfers (including interagency transfers)
        - 24-hour day cap (if more than two trips were taken outside the two-hour transfer window)
        - 31-day cap (limiting the amount paid for all travel within a thirty-one-day period)

      At the end of each service day, fare charges were aggregated, sent for authorization, and, if approved, settled by transferring fees from the payment media issuing bank to RVT's bank account. Public engagement, which was conducted prior to and during the pilot, included customer focus groups, surveys, pop-up events at terminals, and bus ride-alongs.

- **Testing the administration of discounted fares**
    - Seniors and customers with disabilities qualify for discounted fares in Connecticut and represent approximately 20% of customers within the pilot area, making it critical to test discounted fares associated with their personal bank cards. The project team rolled out a pilot registration digital form to allow eligible customer groups to try Tap & Ride at a reduced fare.
- **Investigating the potential for a unified mobility application (UMA)**
    - With the number of transit service providers across Connecticut and variance among schedules, provision of real-time information, and service alerts provided, a statewide UMA was considered. As part of this effort, the team conducted a request for information (RFI) and received responses from multiple vendors regarding the scope and range of costs to implement a UMA at-scale. Potential requirements in the RFI included open-loop contactless fare payments integration, real-time information, service alerts, integrated mobile payments, and the future potential to connect with other services such as rideshare apps (Uber, Lyft), microtransit, and/or scooters and other local mobility services.

Outcomes from these efforts were used to develop a statewide roadmap to at-scale implementation of an open-loop contactless fare payment system.

The at-scale implementation, referred in this report as 'Tap & Ride Statewide', will include all fixed route bus service in Connecticut, serving approximately 111 of 169 municipalities. The contactless fare payment system will include approximately 800 vehicles. If implemented at-scale, Connecticut will be the first state in the U.S. with all fixed-route transit services integrated through a single open-loop payment system, making it the easiest regionally connected transit system to pay for and navigate.

This SMART project addresses the **Systems Integration** technology area, as described below:

> **Contactless Fare Payment System:** The Stage 1 project provided systems integration between payment acceptance devices and fare calculation software across multiple providers. The fare system envisioned for Stage 2 may be made up of different hardware vendors for PADs, while the fare calculation software and payment processing services will be the same to provide a seamless experience for customers. This will require established fare policies and rules to inform the software functionality and requirements that will allow transit customers to navigate across systems when using the same payment media. Transfers will be simpler and easier to track, while fare capping could be established across all local service providers. Table 1 below identifies the technology types and vendors used to deliver the hardware and software for the system tested during the Stage 1 pilot:

Table 1: Vendors used in CTDOT's Tap & Ride Pilot

Vendor	Service provided	Categories
SC Soft	• Provides the validators/payment acceptance devices (PADs) and associated PAD back-end services	A.: Payment acceptance devices (PADs) deployed across all operators, including associated PAD back-end services
Littlepay	• Calculates fare based on established fare products • Implements fare capping • Hosts customer transaction portal (tap history)	B.: Fare calculation software integrated with Cat A PADs
Elavon	• Payment processing • Meets mass transit merchant standards for processing time	C.: Merchant payment processing services capable of processing MTT transactions

***Goals and desired outcomes for at-scale implementation*:**

At-scale, this project has the potential to:

- Reduce traffic congestion by speeding up transit customer boarding times and reducing bus dwell times. Reduced dwell times also improve reliability and reduce pollution.
- Improve integration of fare technology across currently fragmented systems
- Connect and expand access for underserved or disadvantaged populations and reduce transportation costs for individuals by expanding fare capping policies and allowing customers to use a single form of fare media to travel across separate systems.
- Contribute to medium and long-term economic competitiveness by lowering barriers to entry for new transit customers if inexperienced riders can simply 'Tap & Ride'. New customers can result in increased ridership and increased fare revenue.
- Improve the reliability of transit systems by speeding up transit customer boarding times and reducing bus dwell times, making buses more reliable an on-time
- Promote connectivity between and among transit systems by creating a fare payment system that provides seamless transfers
- Incentivize private sector partnerships by bringing new technology vendors into the transit industry. If less customers pay with cash, and more customers are paying with digital forms of payment, it creates opportunities for transit rewards programs and potential partnerships with local private businesses.
- Reduce pollution by attracting new customers through an improved customer experience, thereby reducing the use of single occupancy vehicles.

2) The urban, suburban, and rural communities throughout Connecticut will be positively impacted by an at-scale implementation. According to the latest US Census data, 14.1% of all households within 2.5 miles of a fixed route within Connecticut are below the poverty level. Within that same area, 12.6% of households do not have access to a private vehicle, 25% of the households include a person with disabilities, and 43.3% of households include persons over 65 years of age. 13 different branded services deliver fixed route and on demand services to these areas. According to the 2022 CT*transit* Customer Satisfaction Survey, which was conducted throughout all 8 CT*transit* divisions in the state:

- 28% of CT*transit* customers earn less than $15,000 annually and 67% earn less than $50,000 annually
- 73% of CT*transit* customers identified as African-American or Hispanic
- 21% of CT*transit* customers are not proficient in English
- 53% of CT*transit* customers live in zero-car households

The communities that are most reliant on public transit are the same communities that will be positively impacted by improved fare payment options. A statewide contactless fare payment system may allow CTDOT to introduce a fare capping policy to all service providers in the state of Connecticut. A statewide fare capping policy is only achievable when the same fare technology is available on all services. If implemented at-scale, fare capping would ensure that all users, including members of underserved or disadvantaged communities, will be able to receive equal value when paying for trips individually compared to purchasing a 31-day pass. This reduces the financial burden of paying upfront costs for the 31-day pass and allows individuals to achieve the benefit of a 31-day pass while only paying for transportation as needed. According to the 2022 CT*transit* Customer Satisfaction Survey, short-term (2-hour) passes were the most common fare type, utilized by 39% of customers. Fare capping on all transit services will provide all customers with the most cost-efficient pass without having to purchase other fare products up front.

The 2022 CT*transit* Customer Satisfaction Customer Survey also identified that 87% of CT*transit* customers have access to a smart phone. While mobile ticketing is available, open-loop contactless systems can also accept mobile wallets and would allow customers to pay this way. Additionally, establishing GTFS-RT data for all transit service providers in the state will enhance the information available in real time to customers.

3) The contactless fare payment pilot system deployed in Stage 1 included 43 pole-mounted validators installed on 43 buses across two different service providers. The validators were installed at front doors only, resulting in a time-based, tap-on system for transit customers. For the Stage 1 pilot, SC Soft (Auro Transit) was the hardware vendor for the fare validators and Littlepay was the software vendor providing the backend fare calculation services to enable multi-operator fare-capping benefits for customers. The two service provider partners for the pilot were River Valley Transit (RVT), an independent transit district in Connecticut that serves 183,145 residents, and North East Transportation Company (NETCO), the operator for the CT*transit* Meriden division which serves approximately 60,000 residents. An additional partner was Cal-ITP, who provided technical assistance to CTDOT. The fare validators and fare calculation software for the Stage 1 pilot were procured from the

California Mobility Marketplace, which includes state purchasing schedules established by California that are open to all U.S. transit agencies. The fare validators procured for the Stage 1 pilot can integrate with mobile-ticketing vendors to scan and validate QR codes.

At-scale implementation will include up to 800 validators installed on every fixed route bus in the state of Connecticut. Stage 2 will include all CT*transit* branded services (3 different service providers across 8 divisions including CT*fastrak*), CT*transit* branded express services (3 different service providers), and all transit district fixed route services (9 different service providers). In Stage 2, the project team plans to implement more open architecture standards to provide the best options for both hardware and software systems and continue to innovate the transit systems in Connecticut. Stage 2 will also be coordinated with the rollout of the statewide unified fare policy, establishing consistent fares and fare products as well as transfer policies across various service providers in a more seamless manner, particularly through open-loop payments and fare capping.

An at-scale implementation of an online eligibility portal for reduced transit fares will be easier for the transit customer and agency staff. Operators will be removed from the current on-board visual verification process, while agency staff will not have to review paperwork to approve eligibility. Any potential stigma associated with receiving a reduced fare may also be removed, since customers will be able to tap their personal card and automatically receive the benefit to which they are entitled.

Finally, to expand access to the pilot, CTDOT identified pathways for unbanked and underbanked customers to use the system. Through a partnership with the Connecticut chapter of Bank-On, a non-profit organization that connects consumers to safe, affordable bank accounts, customers could identify options to establishing a bank account with a debit card that is supports contactless payments. According to the 2021 FDIC National Survey of Unbanked and Underbanked Households, approximately 20% of Connecticut residents are identified as unbanked or underbanked. By partnering with Bank-On, the project aims to increase the number of potential public transportation customers who can take advantage of contactless payments and reduce the amount of cash that must be managed within the system.

4) This project included the following major activities:

Open-Loop Contactless Fare Payments Pilot (Tap & Ride)

In support of the Stage 1 pilot, CTDOT and the project team conducted the following activities:

a. **Existing Conditions and Back End Readiness Evaluation:** The project team evaluated the existing conditions of the various transit systems within Connecticut and identified critical needs to support open-loop contactless fare payments. One key finding was that across the state, the inconsistency in available GTFS-RT data could impact different local service providers and that a statewide standard will be necessary for at-scale implementation. Additionally, the project team identified that all vehicles may need a better solution than existing AVL systems for vehicle location.

b. **Peer Review and Interviews:** The project team conducted a national best practice review and interviewed five peer systems and three UMA vendors about their experiences procuring, launching, and managing these systems.

c. **Pilot Procurement:** The project team procured hardware and software for a contactless fare payment system from the California Mobility Marketplace.

d. **Pilot Testing and Ongoing Evaluation:** The project team spent time in person with vendors and RVT vehicle maintenance staff to oversee installation and test a range of scenarios prior to rollout of the pilot. The team identified training and installation lessons learned that will inform statewide rollout, such as the appropriate placement of the PADs and that all staff – operations, maintenance and administrative- will require various training to support installation, oversight, and ongoing management of the systems.

e. **Data Management Plan and Concept of Operations:** The project team developed these living documents that include a proposed architecture of how the systems would integrate with each other and existing fare payment methods. These documents reflect coordination throughout various departments within CTDOT and can be used as CTDOT moves toward at-scale implementation to guide requirements for vendors.

Major pilot milestones:

- April 2024: Procurement of the hardware and software, and selection of vendors
- October 2024: Public launch of CTDOT's Tap & Ride pilot
- January 2025: Rollout of discounted fares acceptance for CTDOT's Tap & Ride pilot

Discounted Fares

Integration of senior/disabled reduced fares and Tap & Ride technology was pursued during the Stage 1 pilot. CTDOT examined how the statewide system for verifying reduced fare eligibility could be streamlined and digitized. With existing fare payment systems and policies, customers access reduced fares by printing and filling out forms, photocopying verification documents, and mailing or dropping off all paperwork to CT*transit*. A CT*transit* representative must then process the submission and issue a Reduced Fare Photo ID Card to the customer to be shown during fare purchase or boarding. During Stage 1, CTDOT performed outreach to local senior centers and social service organizations to solicit feedback and understand the receptiveness of reduced fare eligible customers towards trying Tap & Ride.

Shortly after the initial launch, pilot customers seeking reduced fares were directed to complete an online eligibility form and submit a digital copy of their identification. Once RVT staff reviewed and verified, RVT would manually pass on the eligible customers' truncated payment card number and expiration date to Littlepay. After being added to the Littlepay system, customers were able to then discreetly receive reduced fares by tapping their registered card. The most recent iteration of the Tap & Ride reduced fare system allows RVT to manually add customers who fill out the online form to a reduced fare product category in the Littlepay system. While the number of reduced fare users using Tap & Ride increased later in the pilot, this process is not scalable statewide. Implementation statewide would require development of a benefits portal, like the Cal-ITP Benefits Portal, to facilitate the digital eligibility verification and application of benefits to an identified payment method. A critical outcome of this process was coordination with staff under the state's Chief Information Officer to identify a path toward a potential future benefits portal for Connecticut.

Public Engagement

To inform customers within the pilot service area, as well as gather feedback, the project team conducted several public engagement activities. A timeline of engagement activities is shown in Figure 1. Throughout the period of performance, this included:

a. Public web page

b. Operator Focus Groups and Break-Room Chats – before and after launch, which provided insights into how Tap & Ride was working for operators. Operators also provided feedback on how customers interacted with the PADs and questions they asked operators while boarding and using the system.

c. Customer Focus Groups – before and after launch, which resulted in a key takeaway that the system would need to address customers who qualify for discounted fares. Most focus group participants did not know what fare capping was or how it worked, and participants also raised questions about when they would see the credit card charge after they tapped since the system waits until the end of the day to charge each card.

d. Surveys – before and after launch, that captured mostly responses from customers who were planning to try and did use Tap & Ride. Customers who used the system were generally supportive of it. However, customers who did not use the system were less responsive and did not provide statistically significant responses.

e. Pop-Up Events and Bus Ride-Alongs – CTDOT staff provided in-person information at various transit hubs and rode routes in the pilot service area to observe and interview customers about their experience.

As a major outcome of the engagement effort, the project team identified that a robust engagement plan must be developed and deployed for statewide at-scale rollout to provide education about the service, how to use it, and how fare capping works and benefits customers.

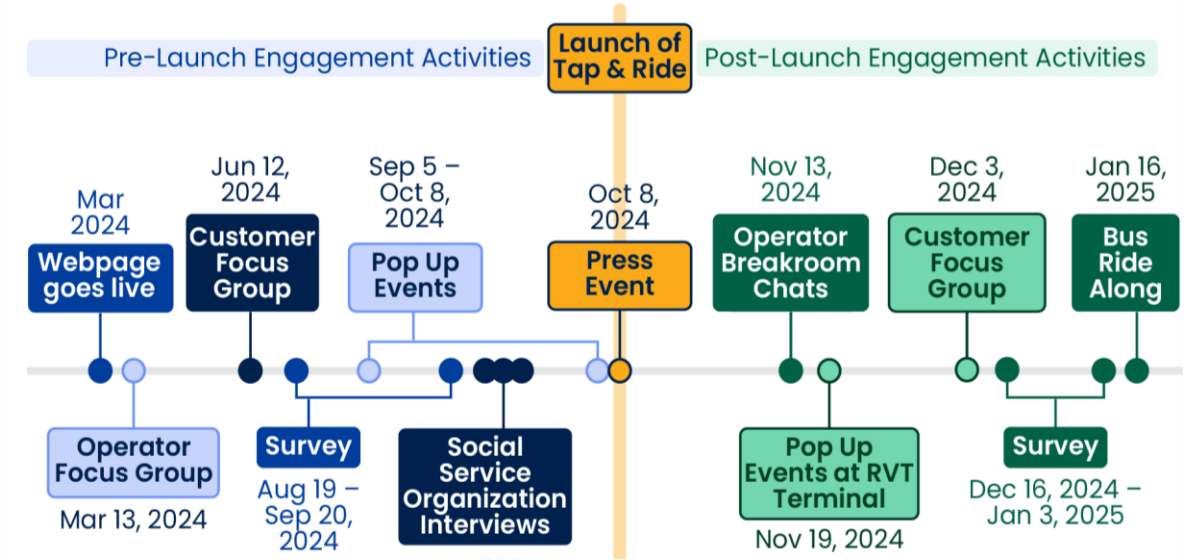


Figure 1: Timeline of Engagement Activities

UMA Investigation and Request for Information

Currently, throughout Connecticut, customers can pay for transit fares with cash, magnetic stripe paper fare products, the Go CT card on CT*transit* services only, and Token Transit mobile ticketing on some services. Service alerts and real-time information are not consistently available across different service providers. CTDOT provides a premium version of the *Transit* app for customers to use to navigate information across the state. The Transit app is a mobile app that helps customers plan and track their bus and train trips using schedule information and real-time vehicle locations, where available. In certain parts of Connecticut, riders can also use mobile ticketing in the Transit app. While Transit app does not integrate with the Go CT card, its connection to mobile ticketing powered by Token Transit is important for customer ease of use. While a UMA was not piloted as part of this project, a Request for Information (RFI) was conducted to gather information on costs, integrations required, and vendors that provide this service for CTDOT to consider. Based on the responses gathered as part of the RFI and positive customer reaction to the pilot, a UMA was not determined to be the most cost-efficient path forward at this time. CTDOT recently renewed its contract with the Transit app for transit customers throughout Connecticut to continue to receive the premium version for free. It was determined that integrating existing mobile payments with open-loop payments would be more cost-effective and an easier transition for customers moving forward for at-scale implementation.

5) This project has received attention via media, industry conferences, and webinars. This has included the following:

Media

Multiple media outlets covered the pilot with press releases, news coverage, and articles surrounding the pilot launch, including:

- Mass Transit, October 9, 2024
- CT Insider, October 8, 2024
- Hartford Business Journal, October 8, 2024
- WTNH 8 New Coverage October 8, 2024

Launch Event

The CT-ITMP conducted a press event around the launch of the Stage 1 pilot on October 8, 2024 at the Hartford Line Meriden Station bus hub highlighting multimodal connectivity. Local elected officials, CTDOT Bureau Chief of Public Transportation Ben Limmer, USDOT Deputy Assistant Secretary for Research and Technology Ben Levine, and RVT General Manager Joe Comerford spoke with local media in attendance.

Conferences

In August 2024, the CT-ITMP project manager participated on an American Public Transportation Association (APTA) APTAtech 2024 panel presentation titled *'Tap and Go: The Future of Transit Payment with Open Loop'*, which helped raise awareness about the CT-ITMP and SMART grant program with the public transit technology industry. In addition, the project manager for the CT-ITMP appeared on the podcast 'The Overhead Wire' to discuss the Stage 1 pilot and CTDOT's Stage 2 vision.

In October 2024, the CT-ITMP project manager presented at the annual statewide expo for the Connecticut Association for Community Transportation. This presentation helped raise awareness for the Stage 1 pilot and SMART grant program with transit service providers and stakeholders throughout the state.

Also in October 2024, the CT-ITMP public outreach leads presented at the Women in Transportation (WTS) Connecticut 18th Annual Transportation Miniseries. The presentation titled 'Tap & Ride: How CTDOT is Modernizing Bus Fare Technology for a Better Customer Experience' highlighted the planning, challenges, and early successes of CTDOT's Stage 1 SMART grant project.

In November 2024, the CT-ITMP project manager presented at the Southern New England American Planning Association Conference. The panel presentation titled 'What's Trending in Bus Service?' included information on CTDOT's Stage 1 SMART grant project and Stage 2 vision.

In March 2025, the CT-ITMP project manager presented CTDOT's Stage 1 SMART grant project during an AASHTO/SUMC Transit Innovation virtual workshop, sharing lessons learned from the Tap & Ride pilot. Over 65 practitioners from state DOTs attended the virtual workshop.

In May 2025, the CT-ITMP project team led a panel presentation at WTS International titled 'Transforming Transit: Modernizing Bus Fare Technology for a Better Customer Experience, Lessons Learned on the Tap & Ride Pilot.' This presentation covered CTDOT's engagement approach and lessons learned for at-scale implementation, public engagement, a technical review of the pilot outcomes, and a discussion of the various procurement pathways evaluated and pursued by the project team to balance cost-efficiency, vendor oversight, and implementation timelines.

Data Sharing

After the Stage 1 pilot, CTDOT published the analysis data from the contactless fare payment system and engagement summary data within the ROSA P repository and open science portal.

6) There were no major deviations or changes from the original proposal. After exploring the feasibility of a statewide UMA in Stage 1, CTDOT is shifting its focus for Stage 2 to Tap & Ride Statewide and establishing digital eligibility verification methods for reduced fares of Tap & Ride customers.

Part 3 of 7 Proof-of-Concept or Prototype Evaluation Findings

7) The Stage 1 Pilot demonstrated proof-of-concept in multiple ways and helped CTDOT identify critical areas that will need to be addressed for statewide, at-scale implementation. The Stage 1 Pilot included two service providers- one under the CT*transit* brand and River Valley Transit. The purpose of having two local service providers participate was to test key functionalities of the system including:

a. Each agency having its own fare policy and fare structure.

i. During the testing phase of the pilot, the team realized the need for simplified and clear fare structures. To achieve this, the fare structure of RVT was adopted for all the routes included in the pilot, including routes from CT*transit* Meriden. For at-scale implementation, there will be a statewide fare policy in place so the technology will not have to account for multiple fare structures for different service providers. While there may be more than 3 fare products, all fare products are anticipated to be the same across the state in Stage 2.

b. Each agency providing different discounts for separate customer groups.

i. Similar to the fare structure, limitations of the pilot required only one type of discount to be rolled out within the period of performance. This required manual inputs after verification, but did expand the number of potential customers that would opt to use Tap & Ride. This identified the need for statewide rollout to have a digital eligibility verification and benefits portal to best serve customers. Similar to the fare structures, when this is rolled out at-scale, consistent discounted fares are anticipated across the state.

c. The capability of having one (or multiple) merchant IDs for each agency.

i. Full at-scale implementation will require at least one merchant ID for each service provider (15+). While two service providers were engaged in the pilot, within the period of performance, only one merchant ID was utilized for the pilot across two service providers. This required manual reconciliation between the two local service providers, something that is not viable for statewide rollout.

The pilot included multiple vendors for the hardware and software for the open-loop contactless fare payment system. While there were multiple datasets available, none of the vendors had datasets that were simple to export, analyze, and manipulate. Analysis of the data required significant manipulation on the part of the CTDOT team. In order to track these metrics for at-scale implementation, CTDOT will have to provide clear direction to vendors for how the data are provided.

Adoption Rate

Overall, based on total trips taken on RVT and the CT*transit* Meriden division during this time, contactless fare payments accounted for 4% of total fares collected. An overall adoption rate of 4% is considered a success for this short pilot, considering during the initial months customers eligible for discounted fares were unable to receive reduced fares through use of the system. Based on our nationwide research, successful systems upon full system rollout are

seeing rates of 12% - 20% adoption. This adoption rate, along with the anticipated future eligible customers who would be able to pay via contactless payments indicate the potential for growth opportunity upon full implementation. New and returning pilot customers by week are charted in Figure 2.

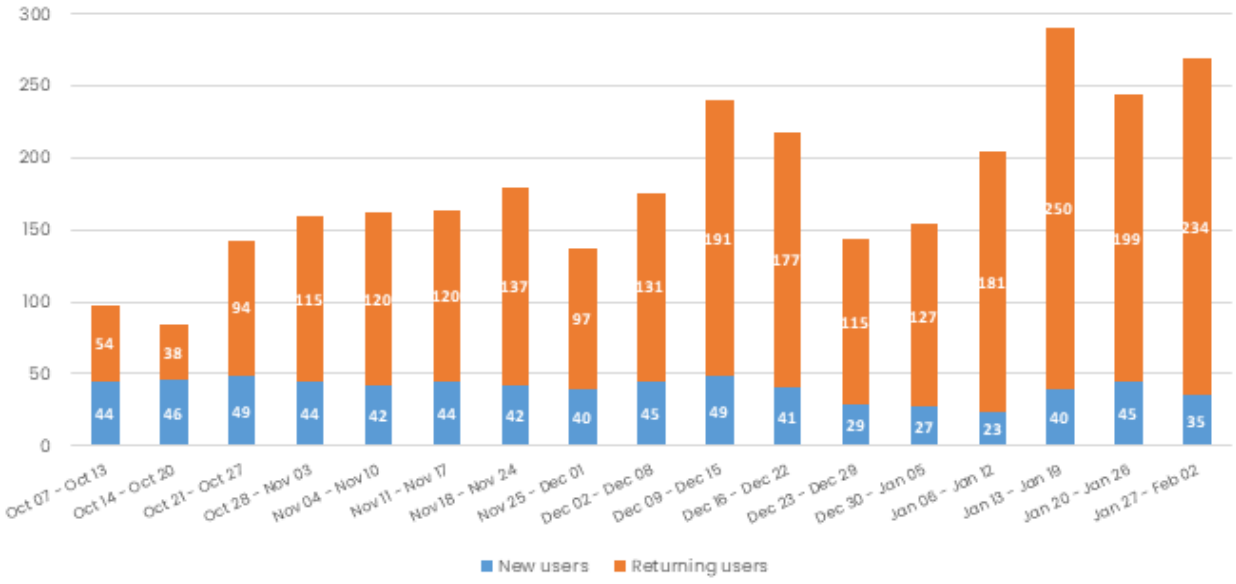
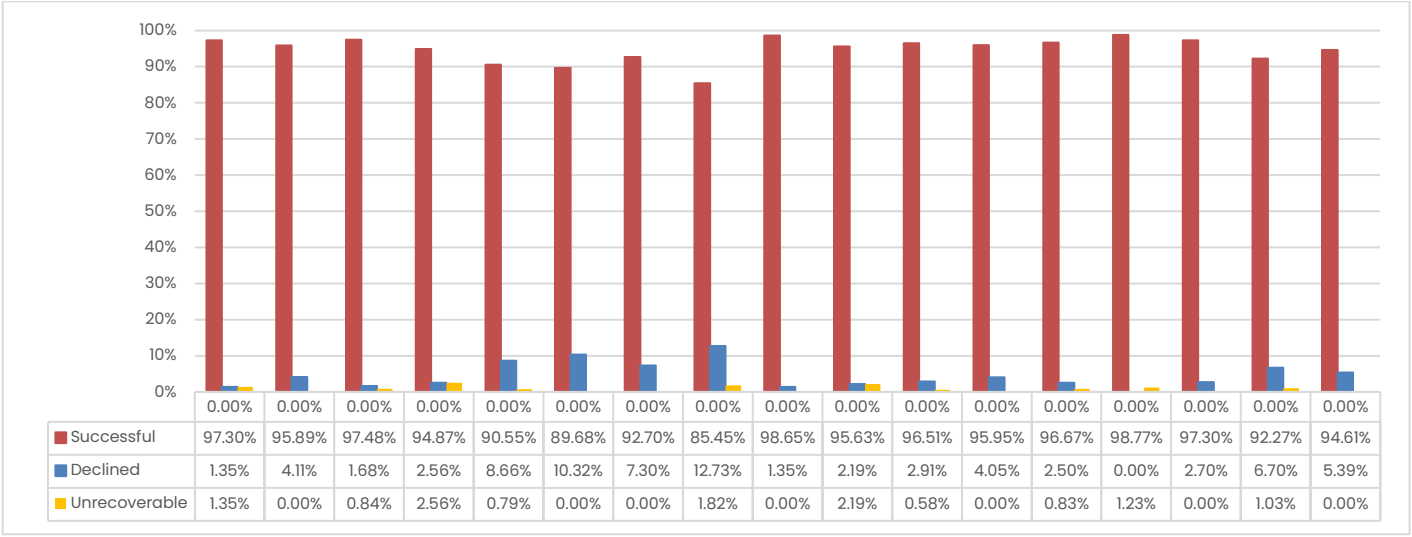


Figure 2: Tap & Ride Customers

Transaction Volume and Success

Credit card payment transactions between October 07, 2024, and February 2, 2025, were analyzed. The credit card payment data (see Figure 3) shows that 94% of all transactions made during the analysis period were successful (payment remitted). The remaining 6% were declined and resulted in automatic debt recovery actions being initiated. Overall, only 1.3% of transactions were unrecoverable. This is consistent with average credit card transaction data processed in the U.S.

Overall, less than 2% of revenue is "lost" or unrecoverable via the automatic contactless fare payment system. The automatic debt recovery feature in the system proved to be an effective function. The automatic fare recovery resulting from potential fare evasion could be more cost effective than manual efforts. Notably, this is something that CTDOT would want to work with payment processor vendors to conduct regularly, as this was something that required constant oversight with the pilot vendor.



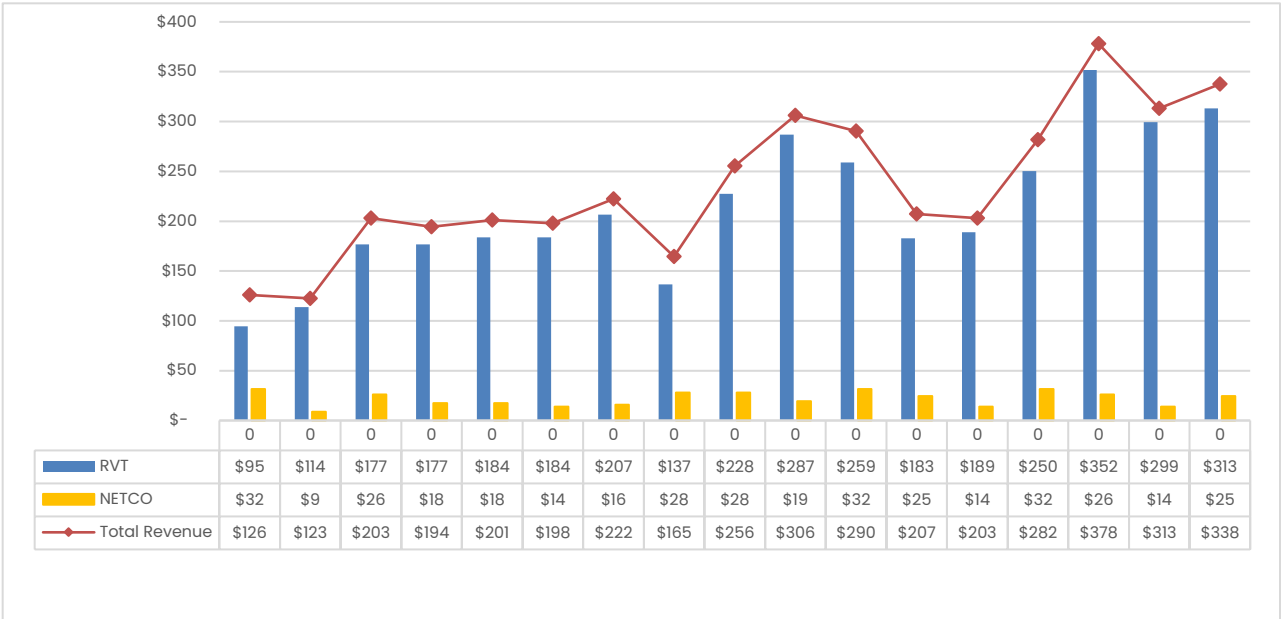
	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Successful	97.30%	95.89%	97.48%	94.87%	90.55%	89.68%	92.70%	85.45%	98.65%	95.63%	96.51%	95.95%	96.67%	98.77%	97.30%	92.27%	94.61%
Declined	1.35%	4.11%	1.68%	2.56%	8.66%	10.32%	7.30%	12.73%	1.35%	2.19%	2.91%	4.05%	2.50%	0.00%	2.70%	6.70%	5.39%
Unrecoverable	1.35%	0.00%	0.84%	2.56%	0.79%	0.00%	0.00%	1.82%	0.00%	2.19%	0.58%	0.00%	0.83%	1.23%	0.00%	1.03%	0.00%

Figure 3: Tap & Ride Transactions

An evaluation of fare payment media and card type revealed contactless payment systems on pilot routes were able to accept Mastercard and Visa cards as well as mobile device payments via phone or smart watch, as advertised. A reasonable blend of media types with physical cards being favored over mobile devices was identified. Visa cards consistently represented 70-80% of cards used throughout the pilot.

Revenue Generation

Revenue collected through Tap & Ride steadily increased throughout the pilot period. See Figure 4 for detail of revenue generation by week by transit agency. A total of $4,004.67 was collected in fare revenue via the contactless payment fare system. Of this, 91% was on RVT totaling to $3,631.92. This amounted to an average weekly fare revenue of $235.57.



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RVT	$95	$114	$177	$177	$184	$184	$207	$137	$228	$287	$259	$183	$189	$250	$352	$299	$313
NETCO	$32	$9	$26	$18	$18	$14	$16	$28	$28	$19	$32	$25	$14	$32	$26	$14	$25
Total Revenue	$126	$123	$203	$194	$201	$198	$222	$165	$256	$306	$290	$207	$203	$282	$378	$313	$338

Figure 4: Tap & Ride Revenue Generation

In addition to tracking transfers, the number of customers who paid for enough trips via Tap & Ride to qualify for one of the fare capping products was also tracked. Notably, after the fifth

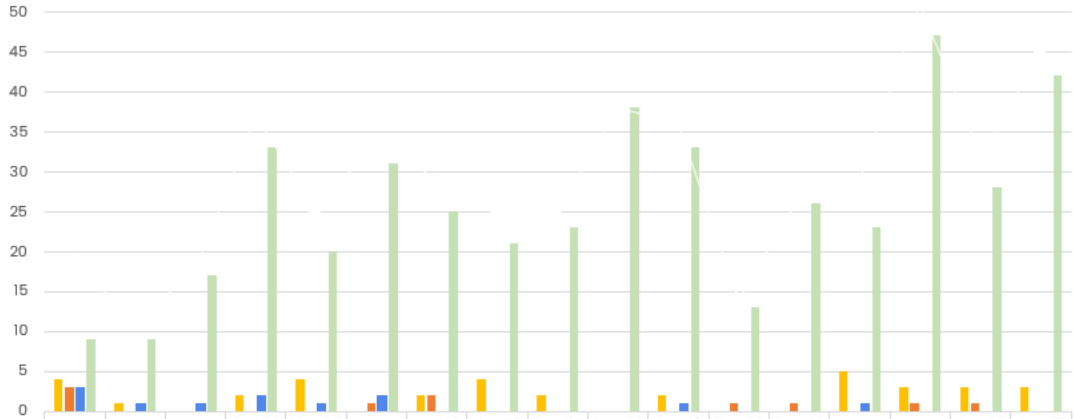
week, no customers in the CT*transit* Meriden Division paid for enough rides via Tap & Ride to qualify for a capped fare. On RVT services, there was an increasing number of customers who reached fare caps, ranging from 12-20 per week in January 2025.

Transfers Utilized

The total number of customers utilizing free transfers was low in the first three weeks of the pilot but has remained relatively consistent since. This stability may not be significantly influenced by open loop payments, but rather by the necessity for transfers. When customers need to transfer, they use the same payment media, allowing them to benefit from free transfers within a 2-hour window. On average, 25 contactless payment taps each week accounted for transfers on transit vehicles. Out of these, 8.5% of these were interagency transfers.

Approximately 16.5% of taps on the devices were from customers transferring to a different route. See Figure 5 for breakdown of transfers by service provider. While the number of transfers was low, takeaways from this data include:

- Most Tap & Ride transfers observed were intra-agency transfers between various RVT routes.
- On an average, 14.5% of all Tap & Ride customers transferred from one RVT route to another RVT route.
- The number of Tap & Ride transfers between various RVT routes decreased during Thanksgiving, Christmas and New Year holiday weeks, when ridership typically also declines seasonally.
- Intra-agency transfers within NETCO routes was 1.2%, lower than RVT. Notably, not all CT*transit* routes were included in the pilot, therefore for customers transferring to other routes outside of the Meriden division, Tap & Ride may not have been the most cost-efficient fare product for them.
- Only 0.9% of all Tap & Ride customers completed interagency transfers between the two agency routes (RVT to CT*transit* Meriden or vice versa).



	Oct 07 - Oct 13	Oct 14 - Oct 20	Oct 21 - Oct 27	Oct 28 - Nov 03	Nov 04 - Nov 10	Nov 11 - Nov 17	Nov 18 - Nov 24	Nov 25 - Dec 01	Dec 02 - Dec 08	Dec 09 - Dec 15	Dec 16 - Dec 22	Dec 23 - Dec 29	Dec 30 - Jan 05	Jan 06 - Jan 12	Jan 13 - Jan 19	Jan 20 - Jan 26	Jan 27 - Feb 02
NETCO to NETCO	4	1		2	4		2	4	2		2			5	3	3	3
NETCO to RVT	3					1	2					1	1		1	1	
RVT to NETCO	3	1	1	2	1	2					1			1			
RVT to RVT	9	9	17	33	20	31	25	21	23	38	33	13	26	23	47	28	42
Transfers Utilized - All	19	11	18	37	25	34	29	25	25	38	36	14	27	29	51	32	45

Figure 5: Tap & Ride Transfers

Boarding Time

A comparison of average boarding times before and during the pilot revealed no detectable savings in boarding times. This outcome was attributed to relatively low customer participation in the pilot, limiting the effectiveness of the data collected. Detailed stop-by-stop dwell data were only available for the CT*transit* routes, which were much less utilized as part of the Tap & Ride pilot. For these 5 routes, dwell times were analyzed using the Swiftly dashboard before and during the pilot but saw no statistical changes at the stop or route level.

Customer Satisfaction

After Tap & Ride was rolled out, a customer survey was conducted between November 2024 and January 2025. The survey collected 308 responses, the majority of which were customers who regularly now use Tap & Ride to pay their fares. From this survey, the following responses indicated customer satisfaction with this payment method:

- 83% Agree or strongly agree that Tap & Ride is easier to use than other fare payment methods
- 72% Agree or strongly agree that paying with Tap & Ride means they do not need to plan ahead to pay their fare
- 82% Agree or strongly agree that Tap & Ride saves time while boarding
- 72% Agree or strongly agree that Tap & Ride saves money
- 77% Agree or strongly agree that Tap & Ride feels secure

8) The contactless fare payment pilot ran from October 2024 through March 2025, but for evaluation and reporting purposes, data up until February 2, 2025 was analyzed. The project assessed the performance of the pilot system against baseline measurements established prior to deployment. Listed as a desired outcome, the project is continuing to pursue digital eligibility verification for discounted fares. Interim solutions to link reduced fare benefits to

eligible customers' bank cards following manual verification were established during the pilot, while the project team seeks to establish a more complex architecture to support the at-scale rollout utilizing third-party identity verification services. The Stage 1 pilot was assessed on how it met the following goals set in the initial project proposal:

a. Increased customer satisfaction - Yes. Before the Tap & Ride pilot, 74% of 319 survey respondents were satisfied with their fare payment experience. After the Tap & Ride pilot launched, 90% of 306 survey respondents were satisfied with their fare payment experience.

b. Reduced boarding time – Undetermined, more data is necessary. The Tap & Ride pilot demonstrated that the fare payment process takes approximately 1-2 seconds when a customer uses contactless payments. At-scale implementation in higher ridership service areas is expected to result in reduced boarding times. The average transaction time for a cash-paying customer is approximately 15 seconds.

c. Increased cost savings – Yes. The Tap & Ride pilot increased cost savings for both transit customers and transit agencies. Customers that used Tap & Ride were able to benefit from fare capping over time. The customers who completed interagency transfers were able to save money by using the same payment method and no longer needing to purchase separate fares. On the agency side, the fees associated with accepting contactless payments were around 7% of revenue collected. This figure is lower than current mobile ticketing vendor fees and the total cost of cash fare collection.

d. Expanded accessibility – Yes. The Tap & Ride pilot introduced the ability for unbanked and underbanked customers who utilize services such as the Cash App to pay for their fares digitally and receive fare capping benefits. Additionally, seniors and persons with disabilities were able to receive reduced fares automatically linked to their debit or credit cards beginning in January 2025, after completing an application process and showing proof of eligibility.

e. Reduced fare evasion – Undetermined, more data is necessary. By expanding ways for transit customers to through contactless methods, it is anticipated that at-scale implementation will result in decreased fare evasion.

f. Increased transit users – Undetermined, more data is necessary. At-scale implementation of Tap & Ride is anticipated to bring new users into the system making paying for transit easier than ever before on a statewide level.

The Tap & Ride pilot reduced barriers and improved access to jobs, education, or various essential services by reducing costs to transit customers in the pilot service area. For the first time in Connecticut, transit customers were able to use the same contactless payment media to travel across a state-owned service (CT*transit* Meriden Division) and independent transit district service (River Valley Transit). This pilot demonstrated that an integrated contactless fare payment system across multiple service providers can enhance mobility, access, and improve the lives of transit customers.

9) The contactless fare payment pilot demonstrated improvement in the statutory areas discussed below:

- Integrated fare collection technology systems cross state-owned CT*transit*

services and an independent transit district for the first time in Connecticut.

- Connected and expanded access for underserved or disadvantaged populations and reduce transportation costs for individuals by expanding fare capping policies and allowing customers to use a single form of fare media travel across separate systems.
- Contributed to medium and long-term economic competitiveness by lowering barriers to entry for new transit customers if inexperienced riders can simply 'Tap & Ride'. New customers can result in increased ridership and increased fare revenue.
- Promoted connectivity between and among two distinct transit systems by creating a fare payment system that provides seamless transfers.
- Incentivized private sector partnerships by bringing new technology vendors into the transit ecosystem in Connecticut.

Part 4 of 7: Anticipated Costs and Benefits of At-Scale Implementation

9) The anticipated impacts of at-scale implementation for key goal areas include:

- **Reducing congestion and delays for commerce and the traveling public**
  - Reduce traffic congestion by speeding up transit customer boarding times and reduce bus dwell times.
- **Improving the safety and integration of transportation facilities and systems for pedestrians, bicyclists, and the broader traveling public**
  - Improve integration by integrating fare technology across currently fragmented systems
- **Improving access to jobs, education, and essential services, including healthcare**
  - Improve access to jobs, education, or essential services by reducing costs to transit customers statewide. Transit customers will be able to use the same contactless payment media to travel across any public transit bus in the state which will enhance mobility, access, and improve lives.
- **Connecting or expanding access to underserved or disadvantaged populations and reduce transportation costs**
  - Connect and expand access for underserved or disadvantaged populations and reduce transportation costs for individuals by expanding fare capping policies and allowing customers to use a single form of fare media travel across separate systems.
- **Contributing to medium- and long-term economic competitiveness**
  - Contribute to medium and long-term economic competitiveness by lowering barriers to entry for new transit customers if inexperienced riders can simply 'Tap & Ride'. New customers can result in increased ridership and increased fare revenue.
- **Improving the reliability of existing transportation facilities and systems**
  - Improve the reliability of transit systems by speeding up transit customer boarding times and reduce bus dwell times, making buses more reliable and on-time.
- **Promoting connectivity between and among connected vehicles, roadway infrastructure, pedestrians, bicyclists, the public, and transportation systems**
  - Promote connectivity between and among transit systems by creating a fare payment system that provides seamless interagency transfers.
- **Incentivizing private sector investments or partnerships, including by working with mobile and fixed telecommunication service providers, to the extent practicable**
  - Incentivize private sector partnerships by bringing new technology vendors into the transit ecosystem in Connecticut. If less customers pay with cash, and more customers are paying with digital forms of payment, it creates future opportunities for transit rewards programs and potential partnerships with local private businesses.
- **Improving energy efficiency or reduce pollution**
  - Reduce pollution by making transit easier than ever before, attracting new customers and reducing the use of single occupancy vehicles throughout Connecticut.

- **Increasing the resiliency of the transportation system**
  - The project does not anticipate impacts in this area.
- **Improve emergency response.**
  - The project does not anticipate impacts in this area.

10) CTDOT is considering multiple pathways to contracting the vendors for PADs, fare calculation software, and payment processing services in Stage 2. These various procurement pathways may vary in price due to their bundling, economies of scale, and differences between vendors and options.

Table 2 below provides a high-level summary of the capital and operational costs for the different procurement approaches. These are based on cost estimates from the vendors CTDOT is actively working with, known costs through the Cal-ITP Mobility Marketplace, and estimates from other vendors based on market research. Based on the work completed throughout the pilot, there are other capital investments required for at-scale implementation that should also be accounted for, and are not included below, beyond the cost of the PADs and their installation.

Table 2: Contactless Payment System Estimated Total Costs (800 validators)

Procurement Pathway	Cal-ITP Vendors (multiple)	Mobile Ticketing Vendor (one)
Capital Costs		
Hardware & Installation	$1,456,000	$2,616,000
Operating Costs		
Fare Processing Fees (assumes $2M revenue in Year 1	$144,000	$160,000
Fare Processing Effective Rate	7.20%	8%
Mobile Ticketing - 3rd party integration (annual)	$520,000	$0
Support & Maintenance	$336,000	$400,000
Operating Subtotal (Year 1)	$1,000,000	$560,000
Year 1 Costs (Capital + Operating)	$2,456,000	$3,176,000
Year 2 Costs (Operating Only)	$1,144,000	$720,000
Year 3 Costs (Operating Only)	$1,288,000	$880,000
Year 4 Costs (Operating Only)	$1,432,000	$1,040,000
Year 5 Costs (Operating Only)	$1,576,000	$1,200,000
Total System Costs through 5 Years	**$7,896,000**	**$7,016,000**

To estimate total costs of the Tap & Ride Statewide system over 5 years, the following revenue projections were utilized:

- Year 1: $2 million fare revenue collected
- Year 2: $4 million fare revenue collected
- Year 3: $6 million fare revenue collected
- Year 4: $8 million fare revenue collected
- Year 5: $10 million fare revenue collected

Table 3 highlights the unit costs used to calculate the Tap & Ride Statewide system estimate. The unit costs are anticipated costs based on the Cal-ITP Mobility Marketplace negotiated unit costs for contactless payment system components, industry outreach, and communication with vendors.

Table 3: Contactless Payment System Estimated Unit Costs

Procurement Pathway	Cal-ITP Vendors	Mobile Ticketing Vendor
Validator (including mounting kits)	$1,200	$2,000
Installation	$350	$1,000
Charge guard Power Delay Unit Purchase and Install	$270	$270
QR integration with Mobile Ticketing Vendor*	$7,500	N/A
Mobile Ticketing Vendor Annual Integration Fee (Per Validator) *	$650	N/A

**Cost not applicable for CTDOT's mobile ticketing vendor.*

11) As more transit customers transition to digital forms of payment, the system will handle less cash, reducing expenses related to cash counting, handling, and management. Additionally, savings could be realized through decreased demand for ticket supply stock and lower farebox maintenance costs, as customers who traditionally interacted with the farebox will now be tapping at the validators. At scale, the project will shift operational and maintenance costs for local service providers and partners by phasing out costly legacy closed loop systems. Customers will also directly benefit from a more simplified fare payment experience and always be charged the most cost-efficient fare through fare capping.

The following benefits could be quantified if additional data becomes available, and adoption increases:

- **Travel Time Savings** could be quantified if an analysis shows there are dwell time reductions from Tap & Ride. Stop-level dwell time data are available through Swiftly for CT*transit* services. Adoption during the pilot showed no statistically significant changes but could if there is an increase in usage of Tap & Ride at major stops.
- **Operating Cost Savings** and **Emissions Reductions** could be quantified if the new fare system increases transit ridership, reducing vehicle miles traveled (VMT). This benefit requires an estimated mode shift for calculation.

12) As previously described, management of the vendors and data outputs required significant hands-on review and data manipulation by the project team. As the at-scale implementation

is rolled out, the following performance measures in Table 4 will continue to be measured beyond the pilot and used to evaluate success:

Table 4: Key Evaluation Metrics

Performance Measure	**Data Source**	**At-Scale Consideration**
Adoption rate, percent of trips paid for using open-loop contactless fare payment system	Fare calculation vendor, Local service providers	Goal of 10% adoption rate within the first year after all validators are installed.
Number of transfers recorded within open-loop system	Fare calculation vendor	Tracking transfers across local service providers to use to evaluate revenue for each local service provider.
Overall ridership	Local service providers	Track changes in overall ridership after rollout
Dwell Time	CT*transit* Swiftly data and Local service providers	Evaluate the level of dwell time changes, particularly at high ridership stops.
Percent of riders using discounted fares out of all riders	Fare calculation vendor	Goal: navigate all eligible customers to digital eligibility verification within 2 years of rollout.
Percentage of riders qualifying for various fare caps	Fare calculation vendor	Assess and right-size fare product prices through transition years.

Part 5 of 7: Challenges & Lessons Learned

14) During the planning and execution of the Stage 1 pilot, several project challenges were encountered that will influence future at-scale implementation by CTDOT. Challenges described in the following section speak to the breadth and variety of partners, vendors, and stakeholders involved. These findings will guide how CTDOT plans to manage vendors, schedules, and stakeholder/customer communication for Tap & Ride Statewide implementation.

a. Procurement and Budget Considerations: The CTDOT plan for at-scale implementation requires coordination with various agencies and local service providers across the state to execute a statewide procurement effort.

i. *State Purchasing Schedules*: A lesson learned from the Stage 1 pilot is that state purchasing schedules proved to be an efficient and cost-effective way to procure transit technology hardware and software. CTDOT partnered with Cal-ITP on its Stage 1 SMART grant and was able to introduce a Tap & Ride payment system to the public in less than 8 months after reaching out to vendors on the Cal-ITP Mobility Marketplace. Had CTDOT developed its own scope of work and issued a procurement through traditional methods, the system would not have been able to be launched as quickly or allow adequate time for evaluation during the Stage 1 period of performance of 18 months. It is also likely that CTDOT would not have received as favorable pricing from vendors compared to the pricing available on the Cal-ITP Mobility Marketplace.

The use of state purchasing schedules allows for broader standardization and provides an opportunity for more cost competitive solutions for small and medium sized service providers to benefit from. The Stage 1 pilot faced challenges in the beginning of the pilot regarding the use of state purchasing schedules which resulted in minor delays as procurement staff learned and understood the process. A key lesson learned is to ensure that procurement departments are aware of the means and methods for the use of state purchasing schedules and their permissibility within their own rules.

A separate challenge with state purchasing schedules surfaced in January 2025 when the previous administration updated the Third-Party Contracting Guidance Circular (4220.1G) and provided guidance that state purchasing schedules are only permissible for the purchase of rolling stock and related equipment, but not transit technology such as fare payment hardware and software, effective March 20, 2025. This new guidance will make it more difficult, more costly, and introduce longer implementation timelines for agencies around the country to implement modern contactless payment systems.

ii. *Budget Considerations*: Through coordination with potential vendors and peer agencies undergoing similar efforts, the approach to developing cost estimates and vendor interest is highly dependent on the at-scale implementation and the size of the phases in between. Learning from coordination with Cal-ITP, a statewide implementation could get better unit pricing from vendors due to the size, particularly if all service providers are included. As envisioned, at-scale, this

project will include all transit service providers within the state, therefore negotiations considering the scale and number of trips, transactions, and customers will be critical to delivering a cost-effective implementation for CTDOT and is likely to produce better prices than if service providers pursued these contracts individually. Even considering the scale, there are several procurement pathways that would have different capital costs for implementation. These costs consider the different PADs available, connectivity requirements, and costs for either bundling services or utilizing separate vendors for each part of the system.

b. **Partnerships:** One of the overarching challenges in this Stage 1 project was the range of vendors, stakeholders, and partners. Each of them had a different role, focus area, and understanding of the technical aspects of implementing an integrated open-loop contactless fare payment system. Challenges arose in managing the partnerships and establishing understanding, roles and trust. Below, key challenges and lessons learned from partnerships are provided.

   i. *Vendor Relationships and Communication*: Through Stage 1, while the vendors were collaborative to work with and responsive, they did require active management to stick to established schedules and provide access to all the data the team was interested in to assist with pilot evaluation and grant reporting. While the team had regular check-ins leading up to the rollout, some of the communication levels went down after rollout of the pilot. However, there were routine corrections on invoices needed, especially for payment processor charges, and manual aggregation of data was required. Establishing a regular check-in that goes beyond rollout will be important to hold vendors to contract requirements.

   ii. *Service Provider Relationships*: The number of local service providers within the umbrella of the at-scale implementation is significant. Each of these have staff with different levels of experience with payment technology and software. Through surveys, communication, and an interactive roadshow workshop in February 2025, CTDOT is establishing relationships with all providers and assessing their staff and financial capacity to take on this statewide implementation. Right-sizing the approach for each service provider will be critical. Notably, CTDOT is working to establish subject matter expertise internally on the technical side to facilitate this and support local service providers in rollout so that the result is consistent for customers statewide. Moving forward, all service providers will be engaged in the process of the statewide implementation plan development and public engagement strategy.

   iii. *Public Partners*: Through Stage 1, the project team recognized the importance of communicating clearly with customers to continuously provide program information and education as well as receive useful feedback. While online marketing and engagement was held throughout the pilot area, additional focus groups and outreach to customers was conducted in the RVT service area because the entire fixed route system was included. Just over 90% of taps for the

Stage 1 Pilot were conducted on board RVT buses between October 8, 2024 and February 2, 2025. While RVT had more routes and vehicles in the pilot, it also had additional engagement conducted by the agency reaching out to customers, demonstrating the impact that targeted outreach can have. At-scale implementation will require such relationships with local service providers in all parts of the state to interface with customers at the local level.

c. **Technology Integration:** Technology integration was known from the outset as a challenge in this project, both due to the number of local service providers that will be involved as well as the potential number of vendors that could be involved in the at-scale rollout.

i. *Connectivity of the PADs with the fare calculation engine*: One of the benefits of leveraging the Cal-ITP Mobility Marketplace is that the vendors already have integrations with each other. Through initial testing prior to the launch of the pilot, multiple PADs were unsuccessful transmitting transactions from the SC Soft interface to Littlepay's backend system. The investigation into this failure identified an issue with two PADs. These two failed PADs were swapped out and the replacement PADs worked as expected. No new integrations were required. While transactions from the problematic PADs were transmitted through to the backend at a later time, it occurred more than 4 days later. Therefore, they were not processed in accordance with the rule that credit and debit transactions need to be processed through the system within 4 days. Notably, failed PADs that are not able to forward stored transactions could result in some amount of lost revenue if not resolved within the 4-day rule. Therefore, for at-scale implementation, CTDOT will have to manage vendors to ensure this rule is enforced to minimize lost transactions.

ii. *Installation of the PADs:* PAD installation resulted in two important lessons learned – the connectivity and the physical placement.

1. The majority of the RVT PADs were installed with network connectivity flowing through the on-board router as per the installation procedure. The CT*transit* Meriden PADs were installed with SIMs. Using PADs with SIMs was a temporary measure to accommodate the ongoing and not yet complete asset refresh related to the CT*transit* Meriden on-board routers. The removal of this interdependency allowed the pilot to proceed as scheduled. Statewide rollout may require the preferred on-board routers depending on the PAD vendor. Throughout the pilot, it was noted that the router connectivity and location was preferable and had better data. Location is critical for taps to be automatically associated with a particular stop for data analysis. Notably, SIMs may not be as cost effective in the long-term due to the monthly fee for each one. The pilot team also learned that some PAD vendors in the industry require connectivity to the on-board routers and do not offer connectivity through SIMs.

2. Based on feedback from operators and customers in focus groups, it was noted throughout the pilot that the physical placement of the PAD is critical to facilitate ease for customers but also ease of operators should customers have questions. A challenge faced in many vehicle installations in the pilot was the physical space constraints for mounting locations due to the amount of existing equipment on each bus. It was also critical not to mount the validators on certain handrails parallel to the windshield, which could result in a line-of-sight and safety issue for the operators. As a result, operators could not see validators well enough when mounted in some locations. Operators expressed that when the PAD was mounted in a place not easily visible, they have more trouble helping customers when cards are declined. At-scale implementation placement of the PADs will have to consider operator visibility and how long the codes/information displays on the screen. Operators noted they would prefer additional training on helping customers. However, as one goal is to facilitate faster boarding, a better solution may be additional information on board vehicles clearly explaining the reasoning for declines and potential solutions – whether to tap the same card again or try a different card.

d. Data Governance and Management:

i. *Privacy and Data Concerns:* Compliance with data protection regulations and safeguarding customer information collected through contactless fare payments is essential to maintain public trust. Vendors providing systems or services must adhere to stringent privacy requirements to protect user data. Building and maintaining user trust is essential to encourage adoption and use of the system. During the post-launch pilot survey, of the respondents who did not use Tap & Ride, 14% noted it was because of data security concerns. Clearly demonstrating this security and acknowledging concern during public engagement will be a strategy used for at-scale implementation. This will also be critical for the application of discounted fares, as customers will have to provide their credit card information through online portals to automatically receive the discount.

ii. *System Performance Metric Data:* While vendors provided pilot data on usage, payments, recovery, and the overall system, significant manipulation was needed to measure results for this pilot, and monthly reports were incomplete. These challenges indicate that future vendor coordination will be necessary to streamline data analysis and establish reporting requirements in advance of the Tap & Ride Statewide rollout.

In conformance with the Cal-ITP contracts, each vendor is required to provide monthly reports indicating their performance related to key service level metrics. This topic needs to be addressed with the vendors, or the future Tap & Ride Statewide vendor, for the statewide rollout to confirm that the vendors are reporting the required performance metrics at the agreed upon cadence as per

the Cal-ITP contracts. For at-scale implementation, CTDOT will seek to establish detailed Service Level Agreements (SLAs) under the MSAs that establish the data, performance metrics, and reporting requirements clearly after communicating with the selected vendor. Additionally, real-time data access will be requested through an application programming interface (API) to allow for real-time access to all required transactional data. Should this not be feasible, CTDOT will work with vendors for a reasonable frequency to push data to an API for reporting.

iii. *Digital Eligibility Verification*: Setting up a digital eligibility verification process and benefits portal for reduced transit fares proved to be a lot more challenging than originally anticipated. CTDOT scheduled a knowledge transfer session with the California Department of Technology (CDT), who were instrumental in setting up the Cal-ITP Benefits Portal. CDT staff shared that getting contracts established at the state-level with federal data sources such as Login.Gov, Veterans Affairs, or Medicare was a multi-year process. It became clear that CTDOT would not be able to launch digital eligibility verification for Tap & Ride within the Stage 1 pilot.

Following discussions with CDT, CTDOT initiated conversations with the equivalent of the CDT in Connecticut: the Connecticut Department of Administrative Services, Bureau of Information Technology Solutions (BITS). CTDOT was able to share CDT system architecture diagrams, lessons learned, and potential realization options for Connecticut with BITS staff responsible for digital identity programs in Connecticut. During Stage 1, CTDOT established a strong partnership with BITS that sets the stage for making significant progress on digital eligibility verification efforts throughout the Stage 2 implementation of Tap & Ride Statewide.

e. Workforce Capacity: The skills and organizational capacity required to manage an open-loop contactless fare payment system have proven to be more hands on than CTDOT initially anticipated, due to the complexity of managing multiple vendors and novelty of the payments industry. The key aspects of this challenge and lessons for at-scale implementation include:

i. *Organizational Capacity*: Conducting and managing the pilot required staff capacity and specific subject matter expertise (SME). For at-scale implementation CTDOT will continue to act as an SME, providing oversight and support to local service providers who may not the capacity or expertise. To address this challenge, CTDOT anticipates acting as a program manager and either creating internal staff capacity or leveraging consulting services to provide this oversight and management, particularly through the implementation, testing, and rollout phases.

ii. *Established Training Curriculum*: It became clear that state and local service providers need additional training support during system implementation. Vendor training was provided, but for at-scale implementation, more substantial, hands-on training is required. RVT and CT*transit* Meriden staff emphasized the need for a new curriculum for onboarding operators and suggested in-person training for

administrative staff. CTDOT plans to include these elements in vendor requirements and create consistent training for operators, administrative, and customer-facing staff.

f. Internal Project Coordination: The statewide approach to at-scale implementation will require coordination with other efforts regarding fare products and policies internal to CTDOT and with local service providers.

i. *Stakeholder Alignment*: As part of the Stage 1 Pilot, the team is not only piloting the technology but also the approach and strategies for engaging the two local service providers involved in it. The team is learning about the best ways to schedule trainings with key personnel and understand the additional staff support and capacity that local service providers will need. This will inform how the collaboration, training, and rollout is structured statewide. Ensuring alignment among various internal stakeholders, including IT, finance, operations, and marketing departments, is crucial for successful implementation. CTDOT's focus on communication with the pilot stakeholders will drive the eventual statewide structure for rollout and management of the program.

ii. *Unified Fare Policy*: In parallel to this effort, CTDOT is pursuing a statewide Unified Fare Policy, that establishes consistent fare products, fare structure and fare policies across all fixed-route transit agencies in the state and is anticipated to roll out in 2026. Based on the Stage 1 pilot, CTDOT anticipates a collaborative engagement plan for both so that customers can see how the fare products, prices, media, and technology all go together and provide an easier transition for customers. The fare technology and fare policy transformation initiatives will be managed by the Customer Experience Unit at CTDOT to ensure both efforts are fully aligned.

g. Public Acceptance:

i. *Trust Building*: Prior to rollout, the number two reason customers cited for not trying Tap & Ride was due to security concerns regarding the technology. In the post-launch survey, of the respondents who did not try Tap & Ride, 14% noted because of these same concerns. Building public trust in the security and reliability of the contactless fare payment system will require time and an approach that appeals to those who use tap to pay elsewhere, customers who use pre-paid debit cards without a bank account, or those who have a debit card, but may be concerned about when the charge will occur due to fluctuating amounts within their account. Each of these types of customers will need to be addressed in the engagement and education strategy for at-scale implementation.

ii. *Education and Outreach*: Engagement was a challenge not just for how to interact with customers, but also how to reach them directly. While there were over 300 survey responses for each survey – prior to rollout and post launch, based on the demographics and responses for how they use their phones and mobile wallets,

not all demographics of customers were captured. For at-scale implementation, multiple demographic groups will need tailored plans, and the team will have to meet customers where they are – like the bus ride-along efforts and pop-ups at higher ridership transfer locations and stops during Stage 1. As with many transit projects, age and income disparities are challenges to accepting new technologies. The education and outreach program should be customized with each local service provider to promote acceptance and adoption statewide.

iii. *Fare Capping*: Fare capping and end-of-day aggregation presents an inherent challenge for customers for multiple reasons. Throughout the pilot, it was difficult for customers to understand how it affects both the price they pay, and the timing of when their account gets charged. For customers who track purchases or receive push notifications to their mobile devices, the aggregation and charging does not happen until the next day. Multiple customers called the customer service line and required attention of RVT management to walk through calculations and time of charges on an individual basis to understand it. For example, during the pilot, if customers tapped the same debit or credit card three times in one day, they would only be charged for two rides as the daily limit fare cap for local buses was $3.50. As a result, charges to customer bank accounts were delayed, often showing up the following morning, prompting inquiries and suspicion of erroneous charges. This will be a significant piece of the education and engagement for at-scale implementation.

An important lesson learned was that all Tap & Ride customers should know about the Customer Transactions Inquiry Page (or online customer portal) which shows the tap history and charge history for each card in the system. If customers know this portal exists and know how to navigate it, it can minimize the number of customer service inquiries to transit agency staff.

h. Cybersecurity:

i. *Threat Detection*: in addition to working to combat the perception of security, it is critical to select vendors that have demonstrated certifications and have secure systems that can integrate with other vendors. At-scale implementation will require vendors to meet the requirements in the Concept of Operations document produced as part of this effort and have L3 certification. L3 certification is crucial for tap-to-pay merchants and open-loop fare systems as it ensures the highest level of security and reliability in transactions. This certification helps protect sensitive customer data and reduces the risk of fraud, fostering trust and confidence among users. L3 certification supports integration and interoperability across different payment platforms, enhancing the overall efficiency and customer experience.

Part 6 of 7: Deployment Readiness

15) CTDOT identified potential obstacles and risks through the Stage 1 Tap & Ride pilot

and refined the approach to at-scale implementation to mitigate the potential impacts.

a. **Procurement and Budget**: After receiving the updated federal guidance on Third Party Contracting, CTDOT's original plan of leveraging the Cal-ITP Mobility Marketplace contracts for at-scale implementation needed to be revised. CTDOT staff have been actively developing a scope of work for a future statewide procurement, based on lessons learned from the Stage 1 pilot, best practices, and industry standards. CTDOT is prepared to move forward with procurement in late 2025 for at-scale implementation. The eventual procurement pathway for CTDOT may be subject to funding availability and funding source.

b. **Partnerships**: Success for statewide rollout will be dependent on local service providers, therefore CTDOT plans to provide staffing support and subject matter expertise for all phases of the at-scale implementation. This began with a roadshow to engage all local service providers throughout Connecticut and will continue with a working group for development of technical requirements, supporting GTFS-RT data feeds, and management of vendors. As previously noted, partnerships within local communities and organizations that support transit-dependent customers will be included as part of the statewide engagement plan and strategy for at-scale implementation.

c. **Technology Suitability / Integration with Incumbent Systems**: The state has a variety of systems within the existing transit network generating data and providing fare payment services. Notably one of the most popular forms of payment is through the mobile ticketing application, currently provided by Token Transit. Whichever vendors are selected for at-scale implementation will have to integrate with this system for CTDOT and local service providers to track overall payment and ridership data as well as consistently collect and manage revenue data. This was tested in the later stages of the pilot and initial findings are that the optical QR-code readers from the PADs used during the pilot are not always successful reading and validating mobile ticketing. Including this integration as a requirement for the future RFP will be critical to facilitate a transition for customers and to track data on the back end. While CTDOT is still considering multiple procurement pathways, should it pursue one that is not leveraging the Cal-ITP Mobility Marketplace, integration requirements will be carried in the RFP since some vendors may not have existing integrations.

d. **Workforce Capacity (e.g., impacts on jobs)**: For the workforce, obstacles to an at-scale implementation include the impacts to existing union contracts for labor. While the pilot was conducted with two service providers, additional coordination will be held with management at local service providers in Connecticut and labor unions supporting transit workers to address any concerns and if required, negotiate fair labor practices related to the on-board installation and introduction of new technologies.

e. **Internal Project Coordination**: Stakeholder engagement with service providers

during the pilot reiterated the importance of proper sequencing of the Unified Fare Policy changes and Tap & Ride Statewide implementation. Although these are two separate activities, stakeholders also felt it is critical to communicate both the fare policy and fare technology changes together during public engagement to highlight the value to transit customers and encourage Tap & Ride Statewide adoption. To mitigate risks typical of project management and technology deployments, coordination of cross-functional teams responsible for procurement, technology integration, operations, marketing, and customer support will be developed. Effective communication and collaboration between internal stakeholders are essential to ensure alignment with project goals and objectives.

f. **Community Impact**: Customer focus group conversations shined a light on how many transit customers still prefer traditional fare products, such as monthly and 10-ride paper tickets. As discussed in previous sections, customer education materials will be designed to highlight the benefits of fare capping and digital payments to encourage customers to transition from paper fare products to digital payments. Even though customers would always pay the most efficient fare for their travel with Tap & Ride, it is difficult to convey this to them as a discount, such as the existing 10-trip tickets, where the cost of 10 rides is that of 9 if paid up front. Additionally, a significant number of customers note that they pay for multiple riders regularly, such as children or an adult under their supervision. This would need to be addressed as part of an at-scale rollout and communicated to customers about the benefits for the approach to increase adoption rates.

   CTDOT has already begun to receive buy-in from transit customers in the Stage 1 pilot service area to expand the Tap & Ride pilot onto other services. Additionally, CTDOT has buy-in from many local service providers in the state to move toward a Unified Fare Policy, which demonstrates deployment readiness for an at-scale implementation of Tap & Ride Statewide.

g. **Public Acceptance**: For the pilot, Tap & Ride saw an adoption rate of approximately 4% of overall trips within the service area through the first 4 months of usage. Similar systems at-scale in the US have adoption rates of 12-20%. For project success, the system will have to be easily offer reduced fares to eligible customers, and potentially the ability to allow someone to pay for others using the same payment method. To manage public acceptance and adoption, CTDOT anticipates tracking monthly progress of new users, returning users, and how many had previously used Tap & Ride, but stopped. In a pre-launch survey with 319 respondents, 74% expressed satisfaction with their current fare payment experience. In response to this, CTDOT may consider some initial promotional discounts to entice customers to change their fare payment method. This will be considered as part of the rollout plan.

h. **Cybersecurity**: For project readiness, it is crucial to implement robust security measures to protect customer payment data and ensure compliance with relevant regulations, such as Payment Card Industry Data Security Standard (PCI DSS) requirements. By including these requirements, the risk of security will

fall to vendors instead of CTDOT or any of the local service providers.

16) The Stage 1 pilot provided CTDOT and its participating local service providers valuable insights into the complexities, challenges, and nuances of implementing open loop systems. While training was generally provided by vendors, participating service providers noted a desire for additional training and testing. CTDOT as well as RVT and NETCO have identified training as critical – both at the outset and ongoing -for success. This includes:

a. Standard Operating Procedures for drivers and maintenance teams need to be developed and continually maintained. This includes procedures for equipment failures, warranty procedures, administration of backend systems, and coordination for scheduled system updates and continual system testing for operations.

b. System hardware maintenance needs to be accounted for and integrated into regular maintenance and repair training/schedules.

c. Since the at-scale implementation aims to coincide with a statewide policy for fare capping, interlocal agreements for revenue sharing between local service providers with transfers will need to be established.

d. Long term operations and maintenance budgets will need to be established and programmed into transit subsidy programs where necessary. While in the long-term there may be some cost savings due to a reduction in the amount of cash handled, new costs such as credit card processing fees will now be a part of the equation.

The hardware and software deployed in the Stage 1 pilot have proved to be relatively low maintenance. Routine updates to the systems are managed remotely by the vendors when the vehicles are not in service. If any hardware (PADs) needs to be replaced in the future, the replacement should be relatively easy for maintenance staff since the power wiring and mounting brackets have already been installed. Clear training materials outlined above will help prevent technical debt due to future employee turnover at CTDOT and local service providers statewide.

17) Implementation of Tap & Ride Statewide will benefit customers and positively impact unionized bus operators. While the goal of this project is to make payments more convenient and boarding faster for customers, it also makes the job for operators easier and safer without affecting the availability of operator jobs.

A focus group conducted with RVT operators identified that sometimes operators were faced with confrontation when validating payments or IDs for discounts. The contactless fare payment system would provide an opportunity to remove the burden of validation from the operator, decreasing their workload and potential interactions with frustrated customers, allowing operators to focus on safely operating the vehicle. Beyond the operator, the systems required to implement, manage, and maintain this system will still require support from administrative and maintenance staff at the local service providers.

Part 7 of 7: Wrap-Up

18) Overall, the proposed solution for the Tap & Ride pilot met CTDOT's expectations. The hardware and software procured via the Cal-ITP Mobility Marketplace helped CTDOT launch an open-loop payments pilot in a relatively short time frame, meeting the needs and expectations of modern transit customers. Additional development is needed on the digital eligibility verification process for reduced fares, which will be critical to implementing to ensure that eligible customers can easily access their transit benefits using Tap & Ride while removing the burden of eligibility verification from transit agency staff.

There are a few key items that CTDOT would share and advise other agencies that are considering pursuing statewide contactless fare payment systems:

a. **Develop a Pilot that is Right-sized**: It is critically important to start small (CTDOT piloted contactless fare payment devices on approximately 5% of its statewide fixed-route bus fleet). This size allowed CTDOT to test multiple routes and service providers and reach different customers but was small enough that the team could be nimble and flexible to quickly react to challenges and issues. It also allowed the team to respond to individual customer questions and issues case by case. This size was appropriate and identified key areas that were not scalable and allowed the team to continue testing additional features such as integration of QR codes for mobile ticketing and a manual process for linking discounted fares to eligible Tap & Ride customers.

b. **Develop a Pilot to Test the Right Requirements:** While this pilot was developed to fit into the grant period of performance schedule, there were some outstanding technical requirements that were not able to be tested within the timeline, notably having multiple merchant IDs established for the two separate service providers. As public transportation in Connecticut is made up of over 15 different service providers who will be included in at-scale implementation, back-end management of directing revenue is critical to success. It is critical for agencies pursuing similar pilot programs to identify key scenarios that a pilot needs to test, so that the pilot development can be appropriately customized to answer critical questions that will drive the development process, instead of developing work arounds as part of the pilot.

c. **Engage Procurement and Finance Staff Early:** The payments processing industry is a new and complex landscape for many staff at transit agencies who will be required to navigate technical terms and different categories of fees throughout the planning and implementation of a contactless fare payment system. There will be a significant learning curve for staff to become familiar with the hardware, software, and payment processing vendor requirements. Each vendor involved in the Stage 1 pilot has its own administrative portal. New procedures will need to be established throughout transit agencies to determine portal permission and access, as well as responsibilities for system monitoring and reporting.

d. **Vendor Accountability and Management:** Maintain stringent SLAs with vendors, detailing specific performance metrics and regular reporting requirements. This will help with holding the vendors accountable for delivering consistent and reliable services. Regularly scheduled reviews and audits will safeguard that vendors meet the agreed-upon standards and can promptly address any issues that arise.

e. **Training and Support:** Provide comprehensive training for transit staff and users for smooth adoption of the new system. Training programs should cover all aspects of the contactless fare payment system, including its functionalities, benefits, and troubleshooting procedures. Additionally, offering ongoing technical support will help with promptly addressing any issues encountered, minimizing disruptions and maintaining user confidence in the system.

f. **Dedicated Staff at the Overseeing Agency:** One of the lessons learned through the pilot was the amount of active vendor management that was necessary not just for the pilot because it was new, but also in overseeing this type of system that could potentially be rolled out with multiple vendors. CTDOT recognized that there is a need for procurement and technical subject-matter experts to support and manage the implementation and potentially beyond to support customers and service providers. The end goal is a seamless experience for customers statewide, which will require oversight and constant collaboration between CTDOT and service providers over the entire technology transition period and beyond.

g. **Significant Public Engagement and Education is Essential:** While Tap & Ride for some may be more convenient, the convenience may not outweigh perceptions of data security, the preference for and reliance on cash, and discounted fare products that exist today. Additionally, while Tap & Ride allows customers to take advantage of fare capping and reducing upfront investments in passes, there is a severe lack in understanding of how fare capping works and benefits customers. Education, awareness, communication, and marketing initiatives are critical for program expansion and to increase adoption rates.