



CTDOT TAP & RIDE PILOT EVALUATION REPORT

TECHNICAL MEMORANDUM



Contents

1	Introduction.....	1
	1.1. Project Overview.....	1
	1.2. Open-Loop Pilot Goals.....	2
	1.3. Document Purpose.....	3
2	Pilot Demonstration Setup and Testing	4
	2.1. Pilot Overview	4
	2.2. Vendors	5
	2.3. Installation and Setup.....	6
	2.4. Testing	6
3	Evaluation Considerations.....	8
	3.1. Metrics and Data Sources	8
	3.2. Technical Challenges.....	9
	3.3. Performance Reporting Challenges	10
	3.3.1 Vendor reporting.....	10
	3.3.2 Transaction metrics availability	10
4	Analysis and Findings	12
	4.1. Customer Adoption.....	12
	4.2. Fare Payment System Usage.....	14
	4.3. Fare Collection and System Performance	16
	4.4. Route-Level Data	20
5	Roadmap Considerations	22
	5.1. Technical Recommendations.....	22
	5.2. Vendor Performance	24
	5.3. Statewide Implementation.....	25

List of Tables

Table 1: Participating Agencies 4

Table 2: Participating Vendors..... 6

Table 3: Data sources and format..... 8

Table 4 : Technical Challenges, Solution and impact on Statewide rollout 9

Table 5: CT*transit* – NETCO Customers21

Table 6: RVT Ridership21

List of Figures

Figure 1: New and Returning Users13

Figure 2: Fare Payment Device Accepted and Declined Taps15

Figure 3. Fare Payment Media15

Figure 4: Bank Card Transactions.....16

Figure 5: Tap & Ride Payment Transactions.....17

Figure 6: Tap & Ride Transfers Utilized18

Figure 7: Number of Customers that Achieved their Daily Cap19

Figure 8: Revenue Collected20

1 Introduction

The advent of contactless fare payment systems has revolutionized the way transit agencies operate, providing a seamless and efficient experience for both passengers and operators. In an era where convenience and speed are paramount, these systems have emerged as a critical component in modernizing public transportation infrastructure. As such, the Connecticut Department of Transportation (CTDOT) is pursuing statewide implementation of contactless fare payments.

As part of this process, CTDOT is partnering with CT*transit* – Meriden Division operated by Northeast Transportation Company (NETCO) and River Valley Transit (RVT) to pilot open-loop contactless fare payments with multiple pass types and transfers between agencies. On October 8, 2024, as part of the Connecticut Integrated Transit Mobility (CT-ITMP) project, open-loop contactless payments was rolled out to transit customers for the first time. This new payment method was introduced as a pilot (Tap & Ride) and was deployed on fixed route vehicles at NETCO and RVT. The pilot was anticipated to run for a period of six months.

The evaluation process encompasses a comprehensive analysis of data collected from multiple sources including transaction data, and operational metrics during the pilot period from October 2024 through January 2025. The findings presented in this memo offer insights into the performance and adoption of contactless fare systems, highlighting both the successes and areas needing improvement and considerations for statewide implementation.

1.1. Project Overview

The goal of the CT-ITMP is to create a modern, integrated statewide transportation system while making fare payment simple and affordable. This includes identifying a mobility application platform to unify the system, implementing contactless open payments with fare capping, and digital discount verification.

Implementing open payment with fare capping aims to provide transit users with a new, convenient and user-friendly method of transit fare payment while allowing users to enjoy benefits associated with legacy fare payment options. Key elements of an open-loop fare payment system include:

- Tap-to-Pay Experience – Riders simply hold their contactless payment method close to the reader, and the system deducts the fare automatically. This can be achieved through open-loop payments or closed-loop payment systems. For the purposes of this pilot, only open-loop payments were tested, including credit/debit cards, prepaid debit cards, and mobile wallets.

- **Contactless Technology** – Uses NFC (Near Field Communication) or RFID (Radio Frequency Identification) to communicate between the card/mobile device and the fare reader.
- **Payment Acceptance Device (PAD)** – Typically installed at turnstiles, onboard buses, or at station entry points to detect and process taps. For this pilot, they were all installed near the front entrance of the buses.
- **Mass Transit Transaction Model** – This secure contactless payment acceptance at turnstiles and validators onboard transit vehicles in a manner that processes faster than traditional credit card validation. It ensures reliable, scalable, and secure EMV contactless fare collection, adhering to global standards established by card schemes to more efficiently support transit boarding. This model supports two types of transactions: aggregated and debt recovery, to efficiently manage fare collection and processing. In this pilot, the payment processor was selected because it is certified to meet these standards.
- **Back-End Fare Calculation** – The system determines the fare based on factors such as distance traveled, time of day, and transfer and discount eligibility. In this pilot, fare capping was limited to three products, a 2-hour pass, a day pass, and a 31-day pass where fare capping was calculated.

This tap-based approach improves speed, convenience, and efficiency by reducing cash handling, speeding up boarding, and enabling seamless travel across different transit services. For the purposes of this memo, “taps” refers to taps made with credit, debit, and prepaid debit cards through the open-loop contactless system.

1.2. Open-Loop Pilot Goals

The CT-ITMP conducted a pilot project for open-loop fare payments between October 2024 and March 2025. The Project team collaborated with River Valley Transit (RVT) and CT*transit* Meriden to install 43 card validators on fixed route buses – 35 on RVT vehicles and 8 on CT*transit* vehicles. Agreements were entered into with three private vendors for the card validator hardware, fare calculation software, and payment processing software pilot components through the California Integrated Travel Project (Cal-ITP) mobility marketplace.

The goal of this pilot was to test the proof-of-concept for an open-loop contactless fare payment solution across multiple transit service providers in the state of Connecticut. Over the course of the pilot, key areas tested included:

- Integration across vendors
- Fare capping and settlements
- Various credit/debit card scenarios, including mobile wallets on smartphones and watches
- Transfers (inter agency and intra agency)

This new fare collection solution was monitored via continuous data collection and reporting. Regular evaluations were used to document the overall impact of the process, proposed changes to the system components and the project's long-term benefits are documented through regular evaluations.

1.3. Document Purpose

The purpose of this document is to review performance metrics of the pilot and evaluate the proof of concept for statewide rollout of open-loop contactless fare payments in Connecticut.

2 Pilot Demonstration Setup and Testing

The Tap & Ride Pilot demonstration was open to the public on October 8, 2024, across 18 local service fixed routes operated by two different service providers. These two agencies were selected due to connecting service areas and to reduce the procurement timetable to fit within the period of performance for the SMART grant. Procurement through RVT allowed a faster implementation, and partnering with CTtransit Meriden allowed for the testing of transfers across systems. This section provides an overview of the preparation and monitoring of the pilot. Table 1 provide details on the agencies that participated in the pilot.

Table 1: Participating Agencies

Participating Agency	Agency Type	Operator	Number of Vehicles	Number of Routes
CTtransit Meriden	CTtransit Division	NETCO	8	5
River Valley Transit	Private Transit Agency	Directly Operated	38	13

The statewide implementation of Tap & Ride will include agencies that are under the CTtransit brand as well as other regional agencies. The purpose of having two agencies participate was to test the functionality of the system including:

- All agencies having a common fare policy and common discount groups for customers.
- The capability of having one (or multiple) merchant IDs for each agency. Limitations on the period of performance precluded being able to test individual merchant IDs for each agency to simplify revenue allocations.
- The customers' experience of being able to use one fare payment medium across multiple agencies.

2.1. Pilot Overview

For the Tap & Ride pilot, payment acceptance devices (PADs) were installed on 43 fixed route vehicles from both NETCO and RVT. This fare payment service was initially for adult/regular fare paying customers only to simplify scenarios on the back end.

To pay for transit, customers tap their credit or debit cards (physical or virtual) on the PADs at the time of boarding. The pilot also provided a two-hour fare free transfer from one transit route to another irrespective of the service provider within pilot routes. Therefore, if the customers use the same fare payment media the second time, the system recognized the subsequent tap and does not charge applicable customers for

the transfer. This free transfer is valid for a two-hour period from the initial tap and enables the customer to ride transit at no additional cost within the two-hour transfer window. In addition to the two-hour free transfers, the pilot also capped the total daily and 31-day cumulative fare. For customers who used transit service multiple times on the same day, the system recognizes all subsequent taps from the same payment media and capped the fare at the cost of a day pass on each transit agency. For clarity, this included:

- two-hour free transfers (inclusive of agency-to-agency transfers)
- day cap (if the customer took more than two trips during the service day outside of the two-hour transfer window)
- a 31-day cap (which capped the amount a customer would pay for all travel within a thirty-one-day period)

At the end of each service day, the customer charges for fare transit usage are aggregated, sent to the processor for authorization and, if authorized, sent for settlement. Settlement is the transfer of fare fees from the payment fare media issuing bank to the merchant deposit account (RVT's bank account for the pilot).

The fare payment collection metrics provided key insights as discussed in Section 5 with regards to the system functionality and its ability to provide a stable form of fare payments for customers.

2.2. Vendors

Open-loop fare payment systems have several components both customer-facing and on the back end to calculate fares, settle payments and keep data secure. Piloting an open-loop system required purchasing Payment Acceptance Devices (PADs) for each pilot vehicle, fare calculation software, and payment processing software. The three vendors listed in Table 2 were selected from the Cal-ITP marketplace and entered into contracts directly with RVT.

Table 2: Participating Vendors

Vendor	Service provided	Cal-ITP Categories
SC Soft	<ul style="list-style-type: none">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	<ul style="list-style-type: none">Fare calculation software that calculates fares based on established fare products,Implements fare cappingHosts customer transaction portal (tap history)	B.: Fare calculation software integrated with Cat A PADs
Elavon	<ul style="list-style-type: none">Payment ProcessingMeeting mass transit merchant standards for processing time	C.: Merchant payment processing services capable of processing MTT transactions

The Cal-ITP Mobility Marketplace is a platform that connects transit agencies with pre-qualified vendors to streamline the implementation of contactless payment systems. Vendors within this marketplace have integrations in place that streamline rollout and was important for this pilot project so that no additional time was required to develop new integrations between vendors.

2.3. Installation and Setup

All device installations were completed by RVT maintenance staff and SC Soft. SC Soft provided training for installation to RVT staff. RVT maintenance staff supplied and installed the required cabling as well as the PADs on all RVT vehicles. For NETCO vehicles, SC Soft was on site to support installation.

The main challenge with the installation was a significant amount of device failure on RVT buses but not on NETCO buses. The PADs that failed were sent to SC Soft, and some devices were returned while others were replaced with spares. While the RVT maintenance staff and SC Soft were able to get all PADs installed and eventually working, for statewide rollout it will be critical to have a certified 3rd party contractor responsible for the installation.

2.4. Testing

Prior to rolling out the new contactless payment system to the public, a comprehensive set of test cases were defined and conducted to validate the system responsiveness and conformance. This included the following test cases:

- Physical valid VISA credit card being used on the AFC for the very first and subsequent taps.
- Physical valid Mastercard credit card being used on the AFC for the very first and subsequent taps.

- Virtual valid Mastercard credit card being used on the AFC for the very first and subsequent taps.
- Physical invalid Mastercard credit card being used on the AFC for the very first and subsequent taps.
- Physical valid VISA debit card being used on the AFC for the very first and subsequent taps.
- Virtual valid VISA debit card being used on the AFC for the very first and subsequent taps.
- Physical valid Mastercard debit card being used on the AFC for the very first and subsequent taps.
- Physical invalid VISA debit card being used on the AFC for the very first and subsequent taps.
- Virtual invalid VISA debit card being used on the AFC for the very first and subsequent taps.
- American Express credit (this test failed as expected as American Express is not supported).
- Discover credit card (this test failed as expected as Discover is not supported).

American Express and Discover branded cards were not in scope for this pilot demonstration but were tested to ensure rejection by the system.

Through the testing process, all listed cases were successfully completed prior to rollout of the pilot to customers.

3 Evaluation Considerations

Evaluation of the pilot is critical to establish a road map and action plan for statewide rollout to understand:

- Performance of the technology and establish future protocols and necessary training.
- Customer usage and experience to identify policies such as capping and interagency transfers to increase transit usage.
- System Management needs to establish a right-sized workforce, technology, and oversight needs of the future statewide system.

Key performance indicators (KPIs) and measures of effectiveness were collected at regular intervals during the pilot to monitor and summarize the ongoing performance.

3.1. Metrics and Data Sources

Datasets used to derive the KPIs discussed in Section 5 are listed in Table 3 below. The metrics gathered in the identified data sources in section 3.1 was extracted, scrubbed, reviewed and analyzed. These outputs were then used to derive the measures required for the evaluation. The performance measures provide a synopsis of customer adoption, system functionality and versatility, application of fare policy, and revenue collection.

The limited availability of the full data set from the vendor(s) is a constraint to deriving all the intended performance measures. As described in Table 3, there was significant manipulation required of the data to evaluate the desired KPIs, and future state rollout should include work with vendors to provide KPIs directly. The evaluation is based on data collected since the start of the pilot on October 8, 2024. Data sources for the performance data include:

Table 3: Data sources and format

Data Set	Source	Format	Notes
Installed device inventory list	RVT installation inventory	Excel list	List provided by agencies
Taps recorded on PADs	SC Soft Back-office portal	Exported CSV table, Exported PDF report	Manual export Format changed mid-way through the pilot.
List of transactions	Littlepay control portal	Exported CSV table	Manual export. Format changed mid-way through the pilot.
List of settlements	Littlepay control portal	Exported CSV table	Manual export
Settlements report	Elavon's "Payments Insider" reporting service portal	Exported Excel table	Manual export Dependency on CT-DOT to provide the report.

3.2. Technical Challenges

In the pursuit of innovation, every pilot demonstration inevitably encounters a series of technical challenges that must be navigated with precision and ingenuity. These challenges arise from the complexities inherent in integrating new technologies, the need for seamless interoperability with existing systems, and the rigorous demands of ensuring reliability and performance under real-world conditions. Addressing these technical hurdles is crucial not only for the success of the pilot but also for paving the way for scalable and sustainable implementation in the future. This section delves into the key technical challenges encountered during the pilot demonstration, highlighting the obstacles faced and the strategies employed to overcome them. Table 4 below describes the technical challenges faced by the transit agencies during this pilot. It also provides recommended solution and its impact on Statewide rollout.

Table 4 : Technical Challenges, Solution and impact on Statewide rollout

Challenge	Solution	Implications for Statewide Rollout
Connectivity of the PADs with the fare calculation engine	Initial tests conducted on the system were unsuccessful as the transactions at the PAD interface were not being transmitted through 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. Transactions from the problematic PADs were transmitted through to the backend at a later time. These transactions were passed through to the Littlepay fare calculation engine more than four days later and identified by the fare calculation engine as "late" and were not processed in accordance with the rule that credit and debit transactions need to be processed through the system within four (4) days. The card brand processing requirement to not process transactions older than 4 days was observed as working correctly albeit not an intentional test case. The test team was not originally aware of this late transaction rule that resulted in these initial transactions being correctly discarded.	Failed PADs that are never able to forward stored transactions could result in some amount of lost revenue if not resolved within the 4-day rule.
Installation	The RVT PADs were installed with network connectivity flowing through the on-board router as per the installation procedure. The NETCO 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 NETCO on-board routers. The removal of this interdependency allowed the pilot to proceed as scheduled.	It is expected that the NETCO PADs will be connected to the on-board routers in the future. Statewide rollout may require the preferred on-board routers depending on the PAD vendor.

Challenge	Solution	Implications for Statewide Rollout
Anti-passback	An anti-passback measure that prevents multiple taps of a card or mobile wallet on the same validator was implemented. This prevents a customer from tapping a device after the first tap, within the 2-hour cap period, to allow other customers to board while evading the fare.	Anti-passback and rules will need to be clearly communicated for those boarding and paying multiple fares.
Adding users to concession groups	Discount fares were created for seniors and disabled users. During testing it was observed that users added to the concession group, were not being charged the correct fare when they tapped their credit/debit card on the PADs. The investigation revealed that this may be a bug. The vendor is looking into this issue to identify the root cause and resolve it.	Although the statewide rollout aims to not use this procedure and have a benefits portal associated with it, a similar manual process may need to be implemented in the beginning.
Differing fare structure and policies between transit agencies	Although RVT and CTtransit Meriden have the same price for 2-hour and day passes, the agencies have monthly/31-day passes that are priced differently. RVT day passes are valid for 24-hours upon activation, while CTtransit Meriden day passes expire at 2:00am the next calendar day after validation. CTDOT elected to establish a 24-hour day cap and adopt River Valley Transit's price of the 31-day cap for the Tap & Ride pilot, to ensure both systems had the same fare rules which would provide a positive customer experience for individuals traveling between systems.	A statewide unified fare structure and policy will be necessary for all participating agencies in the statewide rollout.

3.3. Performance Reporting Challenges

While vendors provided pilot data on usage, payments, recovery, and the overall system, significant manipulation was needed, and monthly reports were incomplete as per the MSAs. These challenges indicate that future vendor coordination will be necessary to streamline data analysis and review for the statewide rollout.

3.3.1 Vendor reporting

In conformance with the Master Services Agreements (MSAs) 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 for the statewide rollout to confirm that the vendors are reporting the required performance metrics at the agreed upon cadence as per the MSAs.

3.3.2 Transaction metrics availability

Standard reporting related to transactional activity recorded was available via reports and dashboards accessible through vendor reporting portals. These vendor reporting

portals provide a reasonable snapshot of fare collection related information however, no single portal or extract of the customer data points are sufficient to compile comprehensive evaluation reports. Reporting portals provided by the vendors provide a set of standard dashboard and data reports. In particular, the Littlepay data reports contained a limited amount of data tables that could be extracted and analyzed. The manual exercise to extract this data and reconcile it to data from other sources was a tedious process which is not scalable. The resulting reconciliation effort is significant and for statewide rollout would require dedicated staff or further refinement of the outputs and dashboards by selected vendors.

4 Analysis and Findings

This section provides an assessment based on the data provided by the vendors. Some of the datasets required manual review and reconciliation. An important consideration for statewide rollout will be clearly identifying the format and access to data for CTDOT and partnering agencies to view data, track adoption, and monitor performance. The analysis of the pilot demonstration delves into several key areas:

- Customer Adoption: Study of adoption rates among passengers, frequency of use, and any barriers to widespread adoption
- Fare Payment system Usage: Analysis of device taps, media usage and number of transactions.
- Financial Performance: Analysis of revenue generation, transfers, transaction costs, and overall financial viability compared to legacy systems.
- Usage Analysis: Analysis of Tap & Ride usage by each service provider by route.

4.1. Customer Adoption

Customer adoption is defined by counting the new and returning users of the transit system. The count of new users is determined by observing the new credit/debit cards in the system. This count may be slightly overstated should existing users choose to use a different credit/debit card for fare payment purposes. This would be a small overestimate as fare capping discourages users from changing media for transit fare payment purposes.

New users between October 8, 2024, and February 2, 2025, were analyzed. A total of 685 new users opted to use the system during this analysis period. Based on this data, the new user counts went gradually up for first 3-week period, whereas the data slightly went down after that and stayed consistent until the Christmas and New Year holiday weeks. This is indicative that adoption of open loop contactless fare payments as a replacement of other means to pay is trending towards a steady state.

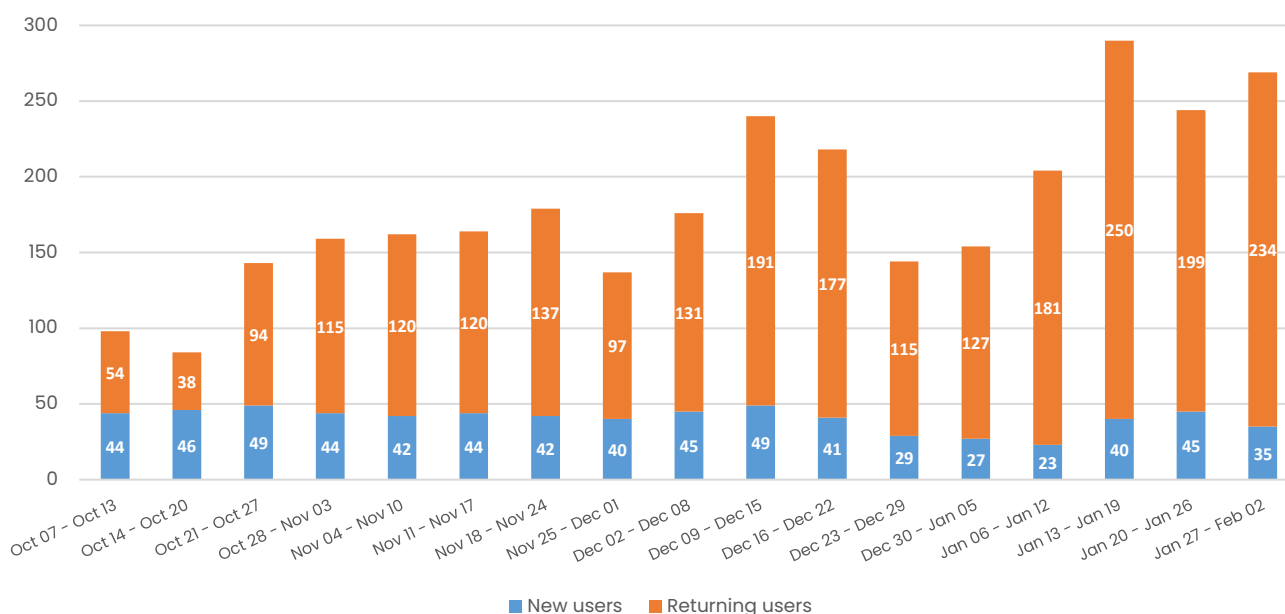
The number of returning contactless fare payment customers has increased each week to a total of 2,340 for the study period. Figure 1 below shows the growth in new and returning users over the evaluation period. It demonstrates a gradual increase of repeat users indicating that the new users are becoming repeat customers and not only trying open loop payments once.

- On an average, there are approximately 40 new transit users weekly who opted to use the contactless fare payment system through mid-December. It decreased during the holiday weeks and again picked up after the holidays. The 50th percentile for the new user within this time is 42 and the mode is 44.
- The number of returning contactless fare payment customers follow the same pattern as new user and has increased week over week except during the

holidays. The 50th percentile for the returning users is 127 and the mode is 115 with an average of 140 users per week.

- A drop in ridership (new and returning) was observed during Thanksgiving, Christmas and New Year holiday weeks.
- These graphs show that additional new users are on a slow gradual decline from the peak numbers. This is indicative that adoption of open loop contactless fare payments as a replacement of other means to pay is trending towards a steady state for the pilot. Opportunities to increase potential users such as connections to other systems and bringing in different fare products or increasing usage by those who qualify for discount fares could increase this overall number.
- The returning users graph shows a gradual increase of repeat customers indicating that the new users are becoming repeat customers and not simply trying open loop payments once.

Figure 1: New and Returning Users



Overall, based on total trips taken on RVT and NETCO 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.

4.2. Fare Payment System Usage

A fare payment device tap refers to the action of a customer tapping their contactless card, mobile wallet (e.g., Apple Pay, Google Pay), or transit-specific smartcard on a fare validation device (e.g., a card reader or turnstile) to pay for their ride. For this pilot, only the listed payment types were accepted and considered as “taps” in the evaluation:

- Contactless Bank Cards (Open-Loop Payments)
 - Credit & Debit Cards – Visa and Mastercard
 - Prepaid Debit Cards – Visa and MasterCard
- Mobile Payments & Wearables
 - Mobile Wallets – Apple Pay, Google Pay, Samsung Pay
 - Smartwatches & Wearables – Devices like Apple Watch, Fitbit Pay, and Garmin Pay enable tap-to-pay functionality
 - QR Codes & Digital Barcodes – Some agencies support scanning QR codes from mobile apps (e.g., NYC's OMNY system for subway riders without NFC cards) – *Note, this was not included during the pilot evaluation period described herein but will be tested at a later date in the pilot.*

Accepted taps refer to taps that were locally accepted. In general, a majority of the customers (97%) were able to use the contactless fare payment without issue. The first time a customer taps the card will always be accepted so long as it is a valid card, regardless of funds. If the card has insufficient funds, it will then be added to a deny list and will no longer be accepted at any validators within the system. Subsequent taps on the contactless fare payment system for boarding are dependent on successful authorizations completed (the same day of travel), or successful settlement of transit fare from the previous day(s).

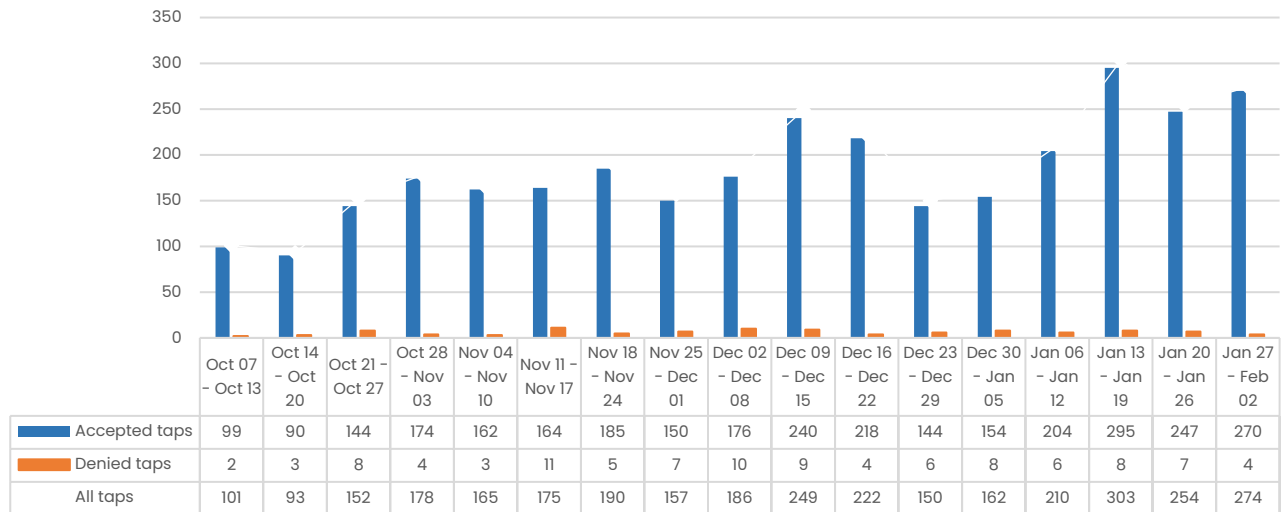
While the initial testing for the QR codes is underway, initial tests with the SC Soft PADs are unreliable. Initial testing has resulted in unclear instructions on how to angle or place mobile devices near the readers, and longer times to be able to read – potentially impacting boarding times. These are still under testing at the time of this memo development.

The 3% declined taps refer to the local checks performed at the device level. This happens when:

- The tapped card is invalid meaning it has either expired, reported lost or stolen.
- The tapped card could not be charged during a previous travel.

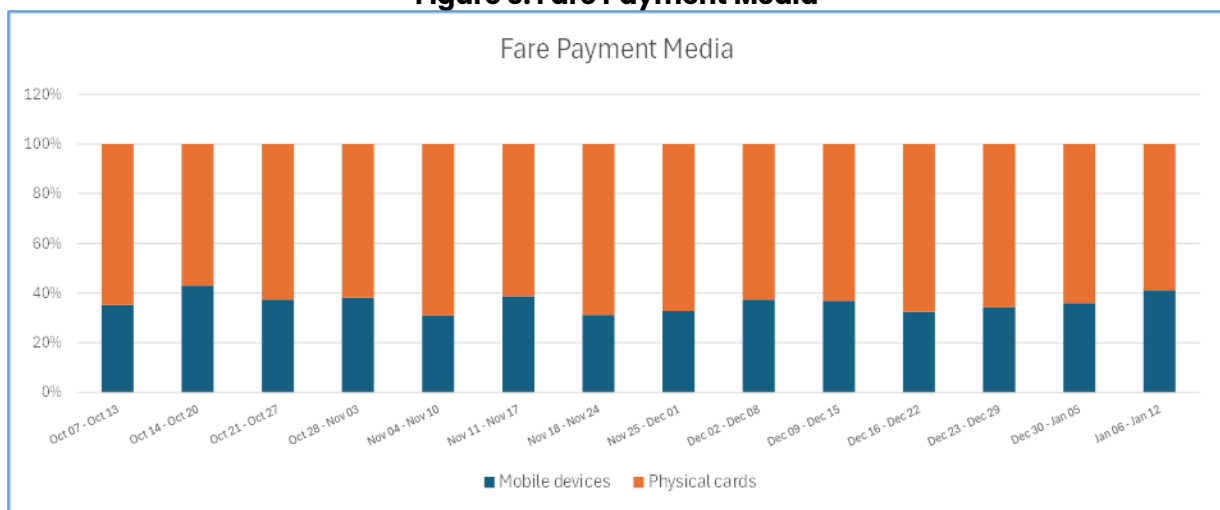
Figure 2 shows the weekly accepted and denied taps from the pilot during the analysis period. Notably, the total number of taps recorded each week has continued to trend upward week over week except during Thanksgiving, Christmas and New Year holiday weeks. This 97% acceptance rate is typical for such systems and underscores the reliability and efficiency of the contactless payment infrastructure deployed.

Figure 2: Fare Payment Device Accepted and Declined Taps



In addition to evaluating the success of the taps, the breakdown between contactless bank cards and mobile payments and wearables were also analyzed. On an average, 36% of payments were made using mobile devices (virtual cards and/or wearables, as shown in Figure 3. The higher usage of physical cards compared to digital wallets indicates a prevailing preference for traditional payment methods among users. This preference could be attributed to the familiarity and ease of use associated with physical cards. Nonetheless, the substantial portion of transactions made using mobile devices and wearables demonstrates a growing trend towards digital payments, suggesting that a segment of users is increasingly comfortable with and inclined towards using advanced payment technologies. Notably, mobile ticketing use has been growing since introduced, also indicating a growing trend toward the desire and convenience of paying with a mobile device.

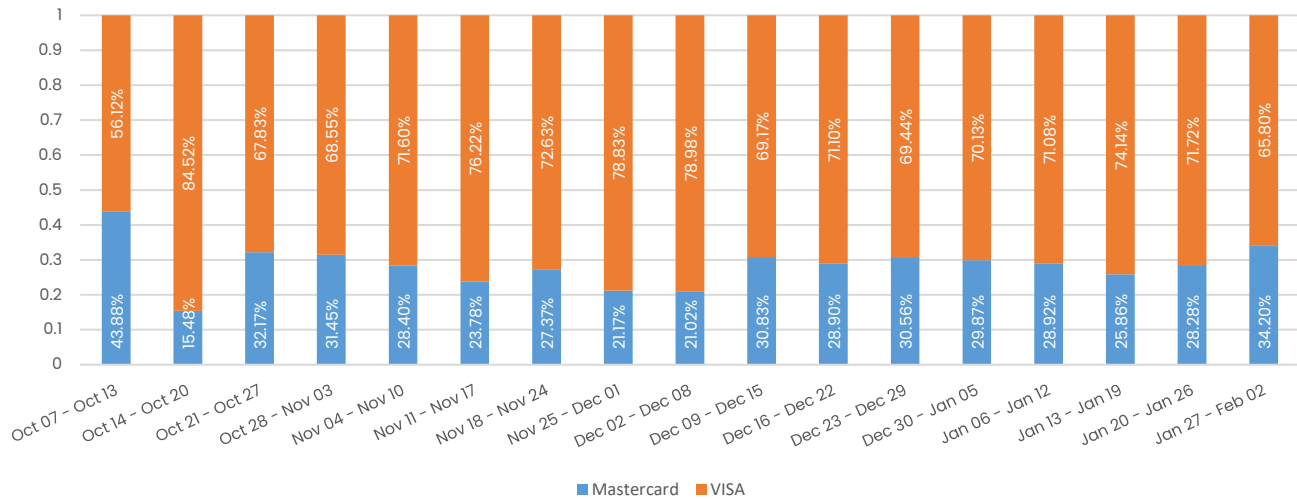
Figure 3. Fare Payment Media



The use of accepted bank cards Visa and Mastercard were also evaluated, and the breakdown is shown in Figure 4. VISA card transactions were significantly higher than Master card transactions. On an average, approximately 70% of contactless fare

payments are processed through VISA and the rest through Mastercard. This is slightly higher than average 60% Visa card transaction 40% Mastercard transactions of all US transactions. This finding points to a potential preference for VISA cards among the transit user base, which could be leveraged for strategic partnerships and promotional campaigns.

Figure 4: Bank Card Transactions



In summary, the findings from the pilot study indicate a successful implementation of the contactless fare payment system, with user adoption rates within a reasonable level for a pilot and the short time duration, a preference for physical card payments, and a reliable tap acceptance rate. These insights provide a strong foundation for further enhancements and scaling of the system to improve the transit experience for customers across Connecticut.

4.3. Fare Collection and System Performance

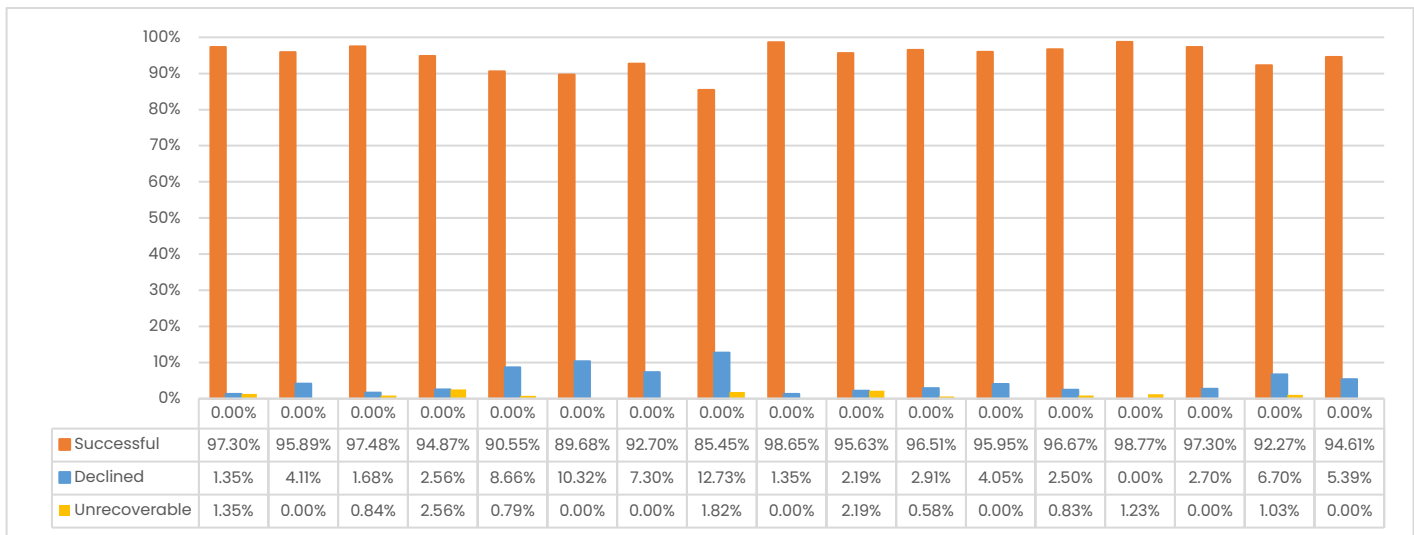
As previously stated, the contactless fare payment approach improves speed, convenience, and efficiency by reducing cash handling, speeding up boarding, and enabling seamless travel across different transit services. This section provides an evaluation of the pilot on fare collection and system performance.

- **Increased Revenue Collection Efficiency:** In the case of first tap risk where there are insufficient funds, the pilot showed that automatic debt recovery was effective.
- **Reduced Cash Handling Costs:** Minimizing cash transactions lowers operational costs related to cash collection, counting, and security.
- **Flexible Fare Structures:** Taps allow for dynamic pricing models like distance-based fares, fare capping, and time-based passes.
- **Open-Loop Payments:** Accepting credit/debit cards and mobile wallets expands payment options and can attract new customers who do not have mobile tickets or Go CT cards.

Credit card payment transactions between October 07, 2024, and February 2, 2025, were analyzed. The credit card payment data (see Figure 5) 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. Unrecoverable transactions were the transactions potentially containing transactions with billing disputes or claims or any other reasons by which they cannot be classified with the users. This is consistent with average credit card transaction data processed in US.

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 is an effective function. The automatic fare recovery resulting from potential fare evasion could be more cost effective than manual efforts.

Figure 5: Tap & Ride Payment Transactions



The total number of customers utilizing free transfers was low in the first three weeks of the pilot but has remained relatively consistent since then. 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. A summary of the transfers is shown in Figure 6.

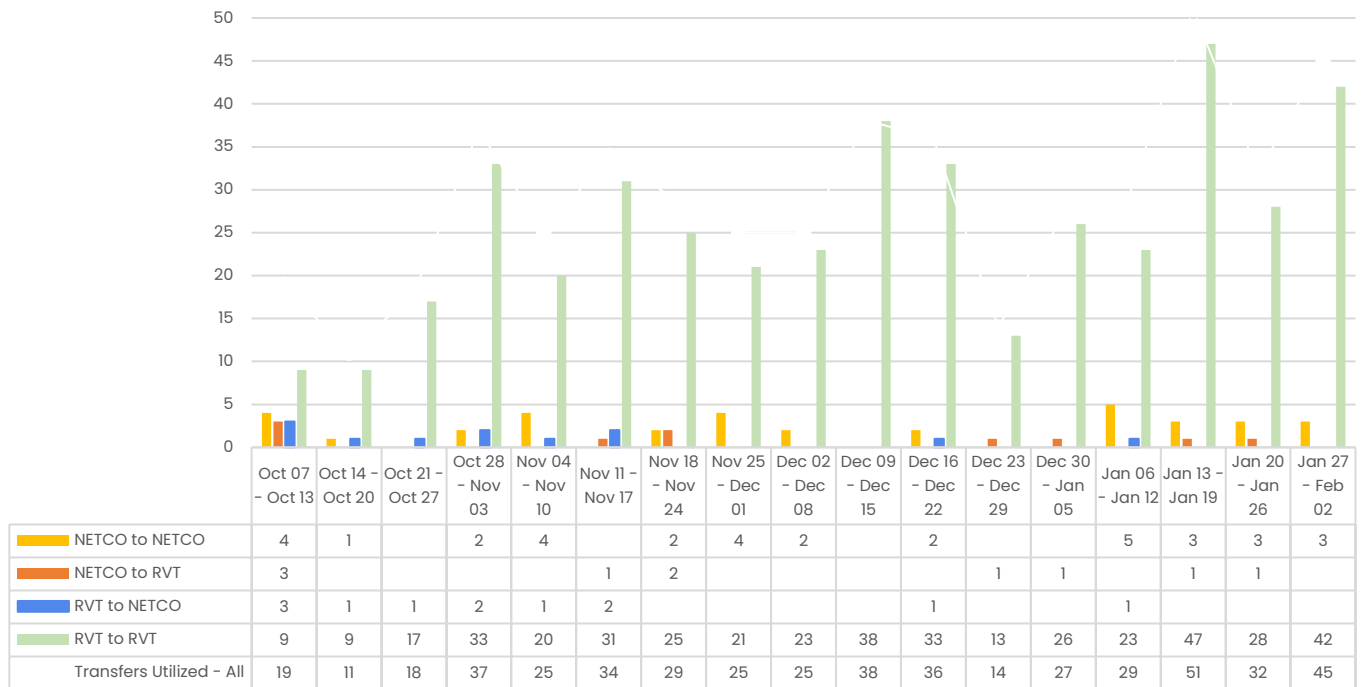
On average, 25 contactless payment taps each week accounted for free transfers during the pilot. These transfer taps represent 17.1% of all contactless fare payments, meaning that roughly one in six contactless riders took advantage of free electronic transfers. Of those transfers, 8.5% occurred between different transit agencies.

Approximately 16.5% of taps on the devices were from users transferring to a different route. See Figure 6 for breakdown of transfers by service provider. While the number of transfers was low, takeaways from this data include:

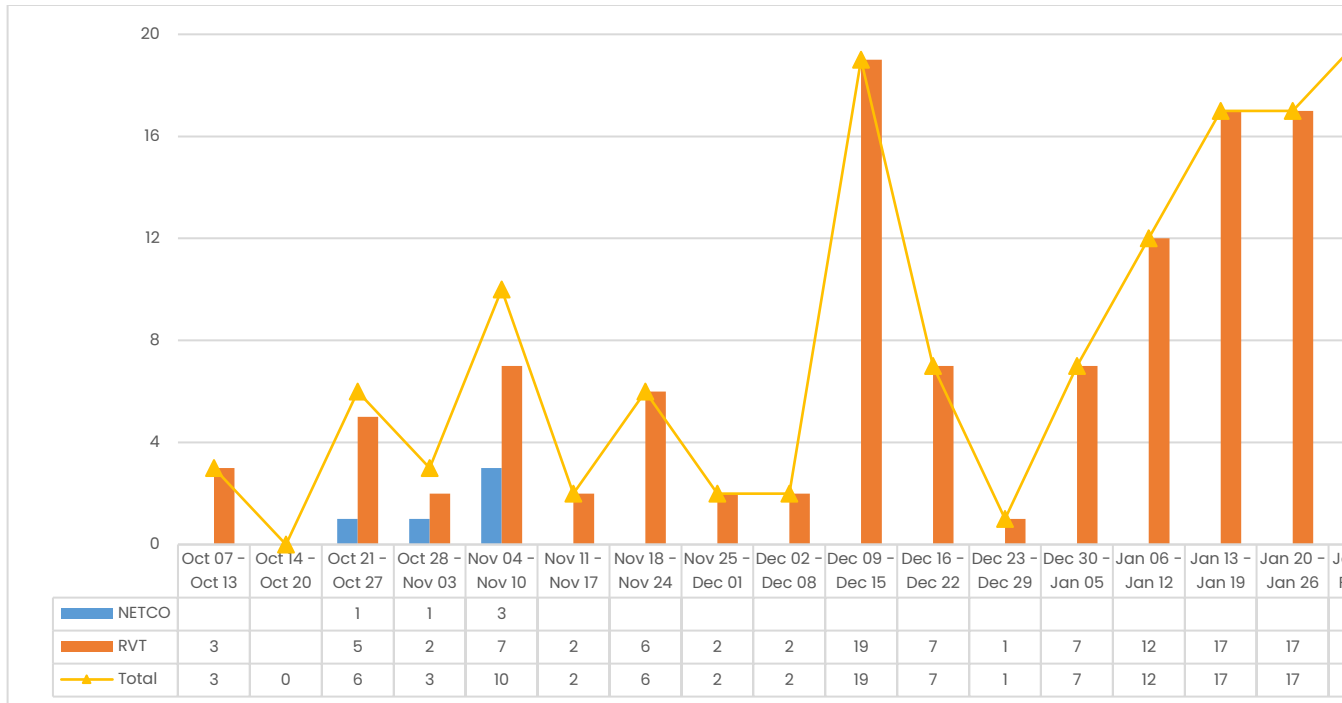
- Most Tap & Ride transfers were observed between various RVT routes.
- On an average, 14.5% of Tap & Ride customers transferred from one RVT route to another RVT route.

- 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.
- Transfers within CTtransit Meriden routes was 1.2%, lower than RVT. Notably, not all CTtransit routes were included in the pilot, therefore for customers transferring to other CTtransit routes, Tap & Ride may not have been the most cost-efficient fare product for them.
- Only 0.9% customers transferred between the two agency routes (RVT to CTtransit Meriden or vice versa) via Tap & Ride.

Figure 6: Tap & Ride Transfers Utilized

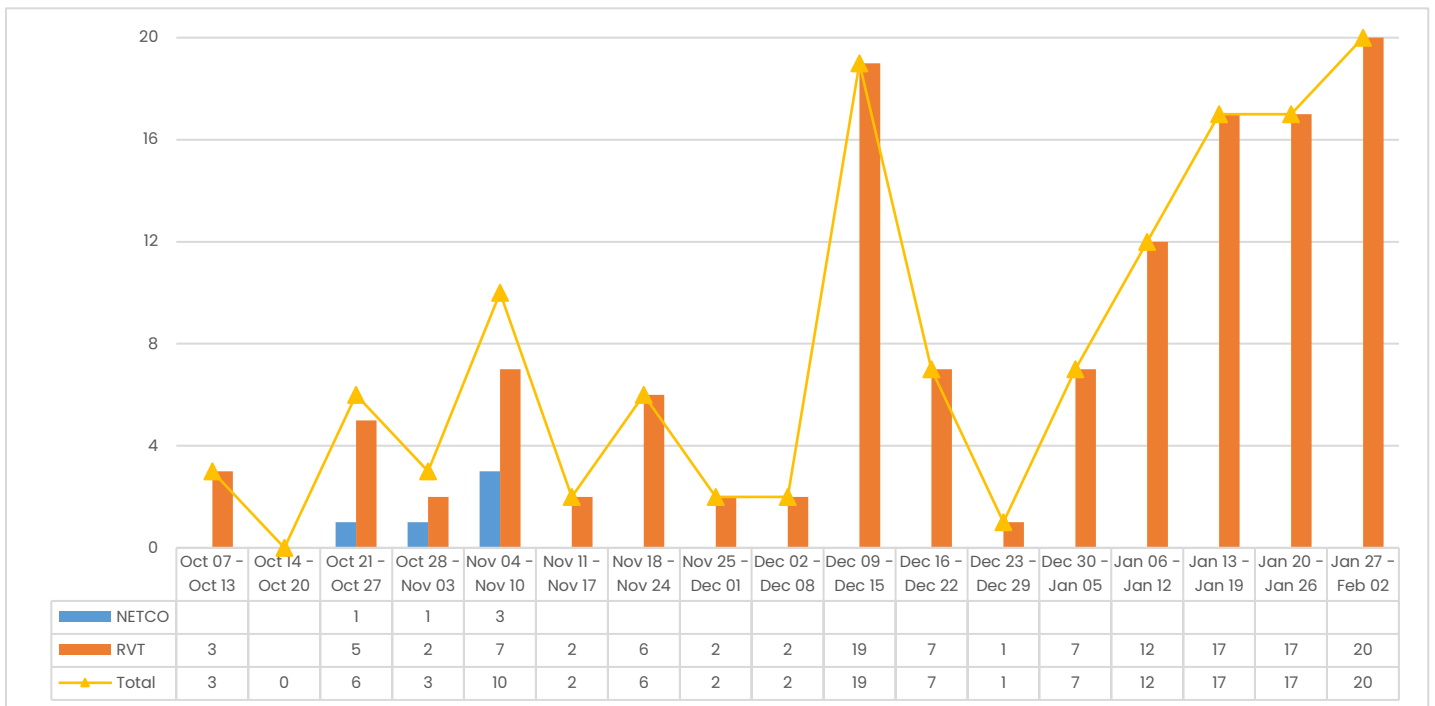


In addition to tracking transfers, the number of customers who paid for enough trips via Tap & Ride to qualify for one of the fare capping products was also tracked, as shown in Figure 7



. Notably, after the fifth week, no customers on CTtransit Meriden paid for enough rides via Tap & Ride to qualify for a capped fare. On the other hand, fare capping for the daily cap increased for RVT and remained relatively higher after mid-December. No customers reached the amount to qualify for a 31-day cap throughout the pilot.

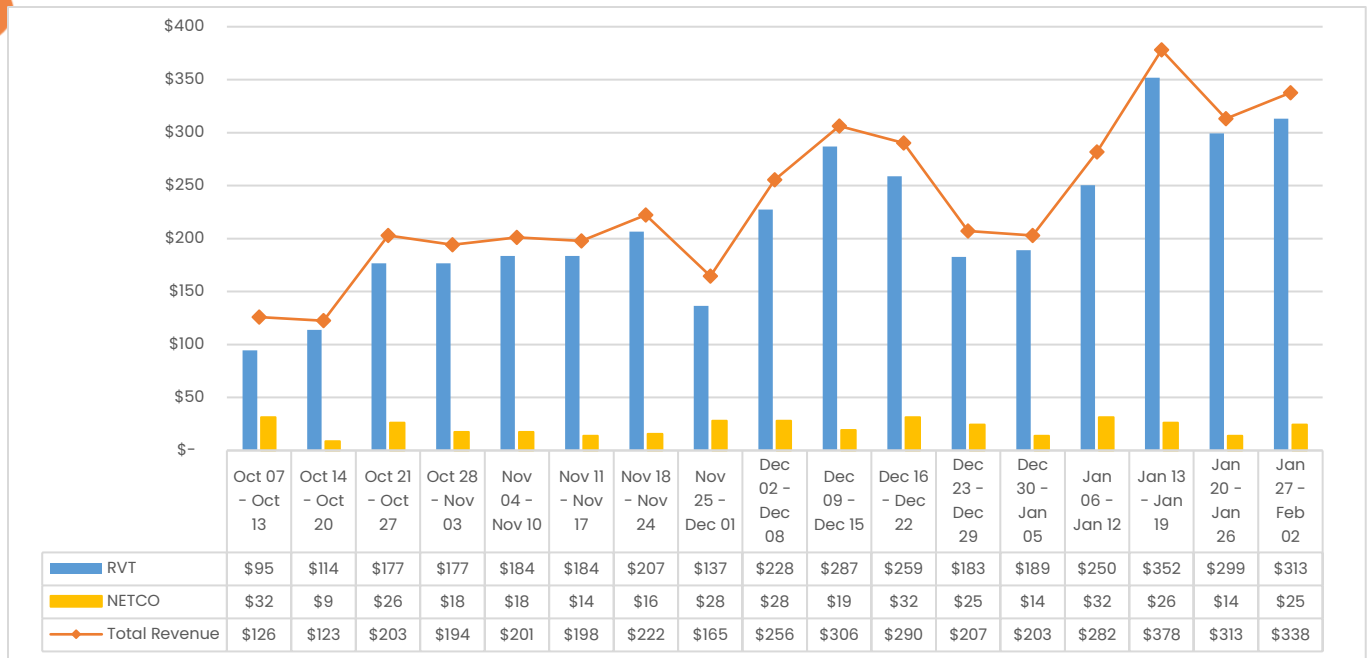
Figure 7: Number of Customers that Achieved their Daily Cap



Revenue collected through Tap & Ride steadily increased throughout the pilot period. See Figure 8 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.

Figure 8: Revenue Collected



The fare collection system performance, usage, and revenue collected has demonstrated general proof-of-concept for contactless payments. The consistency of revenue collection across different agencies aligns with the distribution of validators on their vehicles, suggesting no unexpected deviations or findings.

Real-time passenger data generated through taps can enhance the understanding of travel patterns, including peak times, travel frequency, and transfer behavior with higher adoption rates. This data could be used to improve demand forecasting, enabling agencies to analyze travel trends and optimize service planning accordingly with high adoption rates. This is a future data consideration for later stages of statewide rollout.

4.4. Route-Level Data

One of the critical challenges faced was the automatic assignment of Tap & Ride customers to specific routes. This was done using vehicle location and general transit feed specification (GTFS) data, and the inconsistencies and data unable to be assigned indicate a need for consistent vehicle location data and GTFS-RT (real-time). Taps that were unable to be assigned are under investigation and with some manual review can be assigned, but this is not true for all unassigned taps and is not scalable for statewide rollout. Table 5 and Table 6 below shows the number of unique fare media taps by route for both CTtransit Meriden and RVT routes between October 8, 2024 and February 2, 2025.

In CTtransit Meriden– NETCO, two fixed routes showed notably less usage. In RVT, 4 of the assigned 21 fixed routes had significantly lower usage of Tap & Ride than the rest of the system over the same period.

Table 5: CTtransit – NETCO Tap & Ride Taps

CTtransit Bus Routes	556	561	565	564	563	567	Route Undetermined	479
Contactless Fare Payment Taps	57	50	40	31	29	27	9	1

Table 6: RVT Tap & Ride Taps

RVT Bus Routes	585	590	581	583		584	584/585	641 B	582	641 A	584/585	581/582	643	644	645	642	586	640	Xtraville
Contactless Fare Payment Taps	328	282	269	204	176	134	91	77	73	72	63	54	61	56	35	33	28	22	3

Notably, through this pilot, detailed data regarding taps, time of day, detailed usage, and additional data about Tap & Ride users. However, there is additional Tap data, if provided to CTDOT in a manner that is by clearly identified route, and time of day, could provide insights into service planning, particularly if contactless fare payments adoption rates increase and are more indicative of the overall customer base.

The analysis and findings presented in this evaluation report underscore the potential of contactless fare payment systems throughout Connecticut and considerations for statewide rollout. While the benefits are clear, ongoing evaluation and improvement are essential to address remaining challenges and fully capitalize on the advantages of this technology as well as support customers in their fare payment transition.

5 Roadmap Considerations

As CTDOT looks to the future of contactless fare payment systems, it is crucial to build on the insights gained from the Tap & Ride pilot program and its evaluation. The implementation of a statewide rollout demands careful consideration of various technical, operational, and governance aspects to ensure a smooth and effective deployment. The following recommendations and considerations are derived from the observations made during the contactless payment pilot and serve as a guide for optimizing the system's performance and user experience across the transit network. They address key technical setups, multi-rider scenarios, change management, and performance reporting, aiming to create a robust framework for statewide adoption.

5.1. Technical Recommendations

Installation Setup

It is critical that all PADs are seamlessly connected via the on-board routers. This will allow efficient flow of network traffic from the vehicle, including fare payment information, through the on-board router. For any transit agencies participating in a future statewide rollout, it is important to address scenario where the onboard router might not be available. In such cases, a proven workaround of using a SIM card within the PAD could be used. Therefore, it is recommended that the PADs be equipped to support configuration that allow for the temporary use of an internal SIM, or the SIM provided via the on-board vehicle router.

Implementing these technical recommendations, will enable transit agencies with a reliable and adaptable installation setup, paving the way for a successful statewide adoption of contactless fare payment systems.

Multiple Customers

To effectively accommodate customers paying for multiple customers in the statewide rollout of contactless fare payment systems, it is essential to address the limitations of the current anti-passback mechanism. The existing implementation only allows a single payment per customer at the time of boarding, which may not be sufficient for group travel or families. Following are a few recommendations for improvement during the Statewide rollout:

- **Investigate Future Enabling of Multiple Payments:** While the technology and capability is available, this is a complex feature to communicate and enable. Due to the use of customers paying for multiple riders within CT based on the surveys, further investigation would be required prior to deployment. This would also require validator and/or fare payment processing vendor coordination.
- **Seamless Integration:** Enable the updated system to integrate with the existing infrastructure, maintaining the efficiency and speed of the contactless transactions.

- **User Interface:** Implement a user-friendly interface to guide the user through the process of adding multiple customers, making it intuitive and straightforward.
- **Testing and Validation:** Conduct thorough testing and validation of the multi-rider payment feature for reliability and accuracy in diverse scenarios, including different types and sizes of groups.

By considering these recommendations, the contactless fare payment system will be better equipped to handle multi-rider scenarios, enhancing convenience and accessibility for all users.

Multiple Merchant IDS

The limited pilot period of performance precluded being able to verify that each agency can have their own Merchant ID (MID). This needs to be specified for the statewide rollout so that there is no need for manual reconciliation of revenue for each agency.

Inter-agency business agreements can be implemented to determine how intra-agency transfers are managed and the associated revenue for intra-agency trips are managed and allocated. This is for the equitable allocation of revenue. The manual assessment to allocate revenue between agencies which occurred during the pilot is not scalable statewide.

Comprehensive Testing and Validation

Before full-scale implementation, all system changes, especially those related to the fare policy, should undergo rigorous testing and validation. This process should include:

- Simulated real-world scenarios to uncover potential issues.
- User acceptance testing (UAT) to confirm that the system meets the needs of diverse user groups.
- Load testing to confirm that the system can handle peak usage times without degradation in performance.

Stakeholder Engagement

Engage all relevant stakeholders, including transit agencies, vendors, and end-users, in the change management process. This can be achieved through:

- Regular meetings and workshops to gather feedback and address concerns.
- Transparent communication about the progress and impact of system changes.
- Inclusion of end-users in the testing phases to ensure practical usability.

Training and Support

Provide comprehensive training and support to all users and operators of the new system including:

- Detailed training sessions for transit staff on system functionalities and troubleshooting.
- User guides and manuals available online and in print.
- Help desks and hotlines for real-time assistance during and after the rollout.

Documentation and Compliance

Confirm that all changes are thoroughly documented, and compliance with regulatory standards is maintained. This will involve:

- Maintaining detailed records of all system modifications and updates.
- Regular audits for adherence to compliance requirements.
- Updating policies and procedures to reflect new system capabilities and workflows.

Continuous Monitoring and Improvement

Establish a mechanism for continuous monitoring and improvement of the contactless fare payment system including:

- Vendor reporting requirements must be clear and enforced. While vendors in the pilot were required to provide monthly reports, their interpretation was different. Some provided dashboards where CTDOT could view data but not manipulate it in various ways easily. Going forward, for CTDOT to monitor adoption and performance, vendor reporting and data requirements will be required.
- Regular performance reviews and reporting to identify areas for enhancement.
- Feedback loops to capture user experiences and implement necessary changes.
- Periodic system upgrades to incorporate technological advancements and user needs.

By implementing these recommendations, the statewide rollout of the contactless fare payment system will be more efficient, user-friendly, and adaptable to future requirements.

5.2. Vendor Performance

The statewide rollout of the contactless fare payment system necessitates a robust framework for vendor performance reporting. Central to this framework is the accurate and comprehensive collection of transaction metrics. The following recommendations outline the essential transaction metrics and methodologies to ensure effective performance reporting and vendor accountability:

- Detailed SLA Documentation – All Service Level Agreements (SLAs) should be thoroughly documented and agreed upon before the commencement of the project. This should include specific performance metrics and reporting

requirements to be adhered to by the vendors including the frequency of reporting.

- **Real-time Data Access** – Implement an application programming interface (API) that allows for real-time access to all required transactional data points. This will enable continuous monitoring and immediate correlation of data without manual intervention.
- **Regular Data Push** – In cases where real-time API access is not feasible, require vendors to provide regular data pushes in a standardized format. This data should be comprehensive and organized to facilitate easy storage, analysis, and reporting.
- **Automated Performance Metrics** – Invest in automation tools that can generate performance measures from the provided data. This will enhance efficiency and accuracy, allowing stakeholders to pull the required reports on demand.
- **Feedback Mechanism** – Establish a robust feedback mechanism where vendors can receive and act upon user experiences and system performance data. This will help with continuous improvement and adaptation to user needs and technological advancements.

By adhering to these recommendations, the statewide rollout will benefit from improved vendor accountability, enhanced data accessibility, and more efficient performance reporting, ultimately leading to a more reliable and user-friendly contactless fare payment system.

5.3. Statewide Implementation

Evaluation of the contactless fare payment pilot included a comprehensive analysis of vendor performance and system functionality during initial implementation phases. A thorough evaluation of the pilot helped stakeholders to identify any potential issues early on and take corrective actions for a successful statewide rollout. Based on the evaluation, the following recommendations are proposed for the statewide rollout of the contactless fare payment system:

- **Scalability:** The system should be scalable to handle increased transaction volumes and user numbers as the rollout progresses. This will include robust infrastructure capable of supporting expanded service areas. Vendor selection and project scheduling should consider vendor availability and capacity.
- **Vendor Accountability:** 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 service. Regularly scheduled reviews and audits will safeguard that vendors meet the agreed-upon standards and can promptly address any issues that arise.
- **Phased Implementation:** Consider a phased approach to implementation, starting with high-traffic areas before expanding to other regions. This will allow

for adjustments based on initial performance and customer feedback and education.

- **Continuous Monitoring:** Implement real-time data access via APIs and regular data pushes to facilitate continuous monitoring of system performance. Automate performance metrics reporting to provide stakeholders with on-demand insights, enabling quick identification and resolution of any issues. This real-time visibility into system operations will be critical in maintaining high service levels and enabling user satisfaction.
- **User Experience Enhancements:** It is vital to establish a feedback mechanism for users to report their experiences and any issues they encounter. This feedback should be systematically collected and analyzed to identify common pain points and areas for improvement. By continuously refining the system based on user feedback, CTDOT can meet the evolving needs of its users and delivers a superior experience through the contactless fare payment system. While these were collected via focus groups and anecdotally, a formal customer-feedback option to track could facilitate addressing questions and needs.
- **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.

By carefully considering and addressing these factors, CTDOT can implement a smooth and successful statewide rollout of the contactless fare payment system. This will not only enhance the overall user experience but also improve the efficiency and effectiveness of transit operations, leading to a more sustainable and user-friendly public transportation system.