A Guide to Payment Processing

Information for transit agencies implementing contactless payments

CALIFORNIA INTEGRATED TRAVEL PROJECT (CAL-ITP)

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Part I: Background

1.1   Purpose of this guide

This document is intended to guide transit agency staff through working with a payment processor to implement contactless payments. It is divided into three sections: **background**, **contracting**, **implementation**, and a supplementary section outlining the key features of the **Mass Transit Transaction** model. The guide covers a diverse range of topics, including contracting processes, expected fees, implementation aspects such as testing, and the role of being a merchant of record. Additionally, it provides definitions and rules around the Mass Transit Transaction model.

1.2   An Introduction to Cal-ITP and the Payment Networks

Supported by the California State Transportation Agency (CalSTA) and managed by the California Department of Transportation (Caltrans), California Integrated Travel Project (Cal-ITP) is a statewide initiative designed to unify transit in California through a common fare payment system (built on EMV open loop standards), a real-time data standard, and seamless verification of eligibility for transit discounts. Ultimately, the aim of Cal-ITP is to ensure optimal rider experience while promoting equitable and sustainable travel throughout the state.

For the purposes of this document, EMV is defined as a payment method based upon a technical standard for smart payment cards and for payment terminals and automated teller machines that can accept them (EMV stands for "Europay, Mastercard, and Visa", the three companies that originally created the standard). A payment network is the organizations that enable the electronic transfer of funds between individuals, businesses, or financial institutions, such as American Express, Discover, Mastercard, and Visa. A full list of terms and definitions is provided in the Appendix.

To enable acceptance of contactless credit and debit cards in transit,[1] California has negotiated three Master Service Agreements (MSAs) with industry providers for the elements required to process these transactions; specifically:

- **Payment Acceptance Devices (PADs)** – also known as validators or terminals, riders "tap" their contactless credit or debit card on these devices, which are located on vehicles or at platforms/stops.
- **Transit Processing Services** – a software "layer" that determines the correct fare for a trip based on fare rules, any applicable discounts, and frequency of travel.

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[1] To facilitate accessibility and interoperability, Cal-ITP is working with its partners to enable acceptance of all four major payment brands: American Express, Discover, Mastercard and Visa, across the Cal-ITP network.

- **Payment Processing Service** – the service provider responsible for authorizing and settling the fares received from the transit processor, ensuring the net amount, after applicable fees, is deposited into the transit agency's bank account

The guidance in this document is focused on payment processing services, although the other "building blocks" (payment acceptance devices and transit processing services) are referred to throughout.

If you have any questions or need further assistance at any stage of implementing contactless payments, please contact the Cal-ITP team at hello@calitp.org.

Part II. Contracting

To accept contactless payments, transit agencies must secure the services of a payment processor (also known as an "acquirer"). A payment processor securely transmits the information associated with a rider's "tap" to the financial institutions involved in the transaction and subsequently deposits the revenues with the transit agency (minus any fees). In California, there are two contracting routes available to agencies:

- Via the state-negotiated Electronic Payment Acceptance Services (EPAY) agreement (with the option to contract with either Elavon or Fiserv); or
- Via an existing relationship with a payment processor. Agencies must check and confirm that their existing provider can process mass transit transactions.

2.1   The California Electronic Payment Acceptance Services (EPAY) agreement

The State of California's EPAY agreement is a Master Service Agreement (MSA). MSAs are examples of "state purchasing schedules": agreements between a state or related entity and vendor(s) to provide goods or services at agreed-upon prices.

There are two suppliers providing payment processing services via the EPAY contract: Elavon and First Data (Fiserv). Links to the individual contracts, available via Cal eProcure, are listed below:

- [Contract ID 5-22-70-22-01 (Elavon)](#)
- [Contract ID 5-22-70-22-02 (Fiserv)](#)

Through either of these contracts, transit agencies can accept Visa, Mastercard, and Discover contactless payments on their services. While American Express is also accepted, transit agencies are required to sign both an EPAY agreement *and* a separate agreement to enable American Express functionality. The separate agreement is can be found at the link below:

- [Contract ID 5-09-99-01 (American Express)](#)

2.2   Fees

Regardless of which contracting method an agency chooses to pursue for payment processing, there will be costs associated with processing contactless payments. Agencies should expect ongoing operational costs[2] paid to different vendors/suppliers.

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[2] In addition to merchant service charge fees, these costs can include 1) **operations** and **maintenance fees** to the **payment acceptance device vendor**, typically on a monthly basis at a set rate. And 2) **service**

The fee that we focus on in this guidance is the **merchant service charge** paid to the **payment processor,** which is deducted from the contactless tap revenue before being deposited in the transit agency's bank account. The merchant service charge is uniquely associated with the payment processor.

In the next section, we describe the three primary fee types that constitute the merchant service charge, who they're paid to, and why.

2.3   Merchant Service Charge

Transit agencies pay fees for the secure processing of tap-to-pay transit transactions, known collectively as a merchant service charge. These charges include:

- **Payment processing fees**: retained by a transit agency's payment processor (the acquiring bank) for its services.
- **Scheme fees**: paid to card brands (e.g., Visa, Mastercard, etc.) for access to, and maintenance of, their payment network; and
- **Interchange fees**[3]: paid to the rider's bank to cover costs and assessed risks in approving the payment.

Under the EPAY agreement with the State of California, transit agencies accepting Visa, Mastercard and Discover cards pay a fixed **payment processing fee** of either $0.03 per settled transaction (with Elavon, via Cybersource – the payment gateway that facilitates the application of MTT rules) or $0.014 per settled transaction (with Fiserv, directly). To accept American Express, a separate agreement will need to be signed directly with AMEX to be able to accept their cards. AMEX implements a direct integration with the transit processor. Transit agencies accepting American Express pay 2.15% per transaction.

Scheme fees and **interchange fees** are then added on top. All three fees – known collectively as the **merchant service charge** – are collected and distributed by the agency's chosen payment processor under the EPAY agreement. Merchant service charges are reflected on monthly statements sent to the transit agency along with transaction information.

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fees to the **transit processor vendor** - typically monthly as a proportion of revenue - for back-office functions such as fare calculation, fare capping and tap aggregation.

[3] Interchange fees vary by card type, including whether a card is debit, credit or prepaid. On behalf of California transit agencies, Cal-ITP has negotiated lower interchange rates for a class of debit transactions known as "regulated debit". Regulated debit means that the bank issuing the consumer's debit or prepaid card has over $10 billion in assets.

Merchant service charges will vary from agency to agency and from month to month depending on a range of factors. The total merchant service charge to a transit agency depends on:

- Card scheme mix (proportion of Visa, Mastercard, Discover, Amex used by riders etc.),
- Card type mix (e.g., debit/credit/prepaid, domestic/international, consumer/business, etc.)
- Rate of debt recovery (how many transactions cannot be settled on the first attempt and therefore require subsequent authorization requests), and
- Average transaction value (some low-value transactions receive preferential interchange rates with some schemes)

In general, transit agencies can expect merchant service charges to range between 4% and 5% of tap-to-pay revenue.
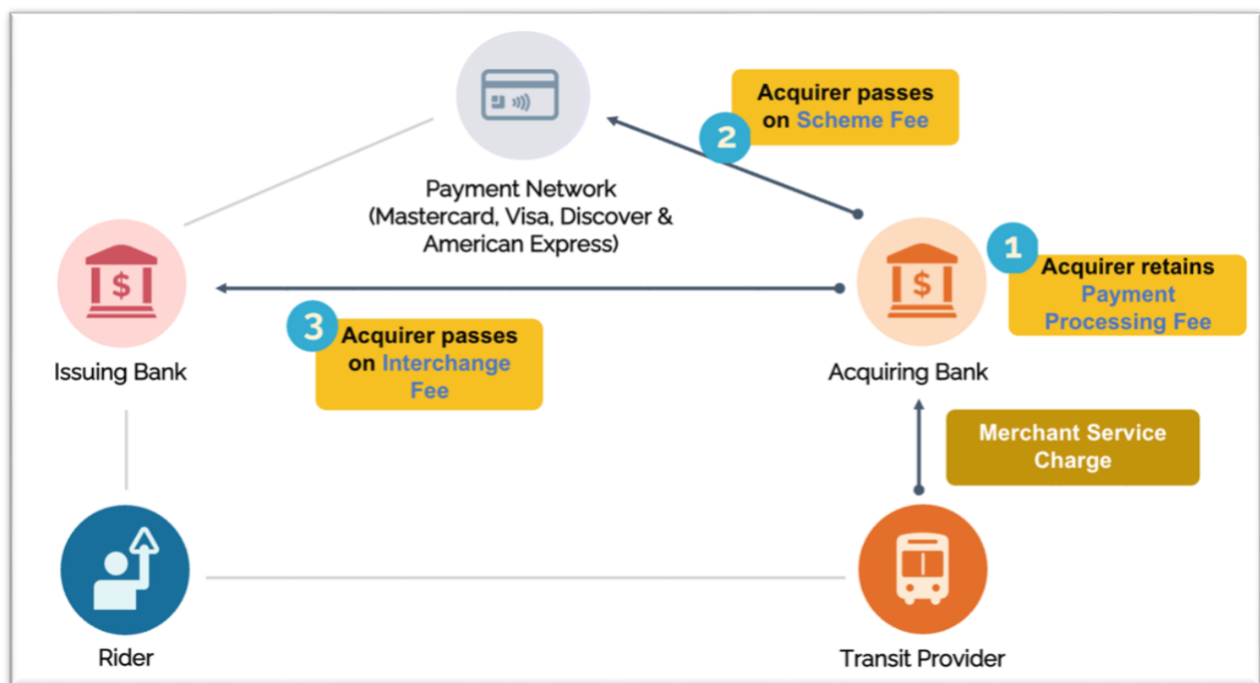
Figure 1: Three Components to a Merchant Service Charge

2.4 Merchant Service Charge "Watch Points"

Transit agencies will receive a monthly statement from their payment processor (plus American Express, if accepted by the agency). The statement will detail the "sales" (revenue), refunds (returns), and associated fees. The net amount, which may be split across several payment batches during the month, is deposited directly into the transit agency's bank account.

Depending on the level of detail provided, payment processing statements can be complex to interpret. Here are some elements to watch out for:

- Newly introduced interchange categories (if explicitly listed),
- High or increasing proportions of transactions receiving high interchange rates, which could indicate downgrades for timeliness etc.,
- High "integrity" fees, which could indicate problems with data flows, and
- Any other fees not seen in previous months.

If you are having trouble interpreting your statement, and would like a payments specialist to review it, please reach out to the Cal-ITP team for support at hello@calitp.org.

2.5   Merchant of Record

When a transit agency signs a contract with a payment processor, the agency becomes a Merchant of Record. In practice, this does not add significant additional responsibilities beyond those that an agency may already be performing for their other sales channels. For example, a transit agency that accepts credit and debit cards in their transit office or on their website are already considered a Merchant. The key responsibility specific to accepting contactless payments onboard vehicles is to ensure PCI compliance (see note for definition).[4] For a transit agency, this means:

1. Ensuring that regular visual checks are conducted of the payment acceptance devices (typically by drivers or inspectors at the start of their shift) to confirm that there is no evidence of vandalism or tampering; and
2. Conducting and delivering to the payment processor a PCI-DSS self-assessment questionnaire (SAQ). If an agency's annual number of transactions exceeds 6 million, they are required to hire a qualified security assessor (QSA) to complete a report for the payment processor.

Overall, it is the role of the payment processor to build and maintain PCI compliance, so please check with your payment processor for explicit guidance so they can provide a risk assessment and clear guidance to ensure your agency meets all necessary security standards. In some situations, payment processors may consider transit agencies to be exempt from PCI compliance responsibilities.

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[4] PCI compliance is compliance with The Payment Card Industry Data Security Standard (PCI DSS), a set of requirements intended to ensure that all companies that process, store, or transmit credit card information maintain a secure environment. Most of these requirements are the responsibility of the payment acceptance device vendor, the transit processor, and the payment processor. However, there are some "in the field" checks that remain the responsibility of the transit agency.

Part III. Implementation

This section details the steps undertaken with the payment processor prior to launch, including testing and staff readiness, to ensure the agency and its customers are fully informed and prepared for using the new payment system. These steps can only proceed once the transit processor and the payment acceptance device provider are already in place.

3.1   Key steps

The table below outlines the key steps necessary for an agency to accept contactless payments.

	Description	Lead	Additional information
1a.	Complete all onboarding tasks with your chosen payment processor, including submission of contracting documents and merchant account set-up	Payment processor	The key contracting documents include: 1. The State Agency Standard Agreement Contract Form (Std. 213) 2. Authorized User Set-Up Form 3. Authorized User Addendum 4. W-9 Tax Form
1b.	Finalize the card brands that your agency wants to accept. Visa and Mastercard are likely provided by default. Agencies should confirm with their vendors whether Discover and American Express acceptance is enabled and, if not, what is required to facilitate it.	Transit agency	Note that as of the publication of this document, American Express may not yet be available.
2.	Ensure all payment acceptance devices are updated with the card brand logos, plus Google Pay and Apple Pay, on their display screen	Payment acceptance device provider	This action will give riders a visual cue that major payment networks are accepted on-board.
3.	Conduct testing to ensure transactions are properly transmitted and settled to the agency's bank account	Transit agency	See section 3.2 for more information.

3a.	[Optional] Conduct Friends and Family testing	Transit agency	This could also be described as a "soft launch" depending on your preferred marketing and communications approach.
4.	Develop and implement a marketing and communications plan. Update websites, FAQs, Standard Operating Procedures, and train agency staff on the system.	Transit agency Cal-ITP provides templates and materials that can be customized.	See section 3.3 for more information.
5.	**Launch!**		

Table 1: Key Steps to Implement Contactless Payments

3.2 Testing

The primary purpose of testing payment processing is to ensure end-to-end connections for different card schemes (American Express, Discover, Mastercard, and Visa) to verify that a card tapped on the payment acceptance device (validator) is connecting to the payment processor and the banking network (this is known as EMV Level 3 testing).

Testing will also verify that the different business rules (ticket values, implementation of different transfer and capping rules) on offer are properly implemented. Typically, the transit processor will provide a comprehensive suite of tests aimed at validating various scenarios to ensure customers are charged the correct fare for their trip.

Testing typically happens once installation of devices is complete, and the fare tables are finalized with the transit processor, so it requires coordination with all three vendors involved in the payment flow: payment acceptance device vendor, transit processor, and payment processor.

To ensure a smooth implementation of contactless payments, transit agencies can start with **end-to-end testing**, which focuses on basic transaction validation. The transit agency should coordinate with the transit processor to verify that taps on the validator are being received successfully and that they can pass the information on to the payment processor. A successful test would entail tapping a valid contactless bank card from several card brands and seeing the equivalent amount in the transit agency's bank account the next day. These tests can also be used to ensure the transit processor dashboards or agency portals reflect the expected amounts.

Once end-to-end testing is complete, the agency can proceed to validate their **business rules**, which may require more time and additional testers based on the complexity of the scenario. The scenarios are entirely dependent on an agency's fare structure but should ensure that the different fare products and use cases are implemented correctly and riders are charged the correct amount. Cal-ITP provides support to review test scenarios, curating a concise selection of test cases, and providing guidance on determining the scope of testing.

After agencies have confirmed that some of the basic scenarios are successful, they may choose to do a soft launch on a small subset of vehicles to ensure accuracy of data and payment flows prior to full fleet launch.

Agencies often recruit a small number of staff and riders to conduct the testing. The testing protocol should encompass a range of complexities, from basic single-tap transactions to more intricate processes such as merchant-initiated debt recovery. Additionally, it should include examinations of deny list functionality to block specific cards and, where applicable, the implementation of capping and aggregation tests. Individual tests can take a couple days and the entire process can take up to a month depending on the vendor or agency. For detailed reference, please consult the Appendix for an example list of test case scenarios.

3.3   Staff Readiness

Ensuring operational readiness among agency staff is crucial for implementation of contactless payments. Preparing teams for their new roles and responsibilities does not stop at implementation; it is an ongoing process that incorporates lessons learned even after launch and throughout live operations.

Staff readiness should be structured by departmental levels to effectively address workflow changes. Key departments, such as Operations, IT, Marketing, Customer Care, and Finance, should meet regularly to outline essential activities needed for launch and functions that will change once the system is launched. For example, the Finance team will need to integrate contactless payments as a new revenue stream and learn how to review monthly statements from payment processors. Customer service teams must be fully trained to handle inquiries about the new system, including how to assist customers with issues like expired contactless bank cards.

Developing a program plan with key milestones is recommended. Best practices for tracking progress include simplifying workstreams, breaking down goals into milestones, setting firm deadlines, and maintaining open communication on milestone completion or potential blockers.

3.4   Reporting

Transit agencies will be provided with access to customer portals via their chosen payment processor. These portals can be used to view statements, reports, and batch payment information. In addition, Cal-ITP provides California agencies with dashboards to help them efficiently manage various financial aspects of their open loop payment system.

These dashboards ingest information from a transit agency's transit processor and their payment processor through daily data feeds, providing a useful audit tool and additional comfort to finance teams. By using these tools, agencies can ensure accurate financial reporting, minimize losses and costs, and make data-driven decisions regarding fees, debts, and payment aggregation. Overall, this reporting structure ensures that agencies have the transparency and control needed to manage their open loop payment operations effectively.

California agencies have access to four dashboards focused on fee monitoring, debt management, reconciliation, and aggregated payment insights. Further detail is provided below.

3.4.1 Fee Monitoring

Transit agencies need a transparent overview of interchange fees, scheme fees, and acquirer fees to ensure accuracy and efficiency. Monitoring and validating these fee details allows agencies to quickly identify anomalies such as incorrect charges or processing issues. Given that acquirer statements can often appear complex and overwhelming, the Cal-ITP payment dashboard tool simplifies the monitoring process by breaking down fee structures and validating them against expected charges. The state of California conducts monthly frequency monitoring of fees on a central level, investigating outliers and requesting reimbursements from vendors when applicable. Agencies also have access to this dashboard and can monitor their fees.
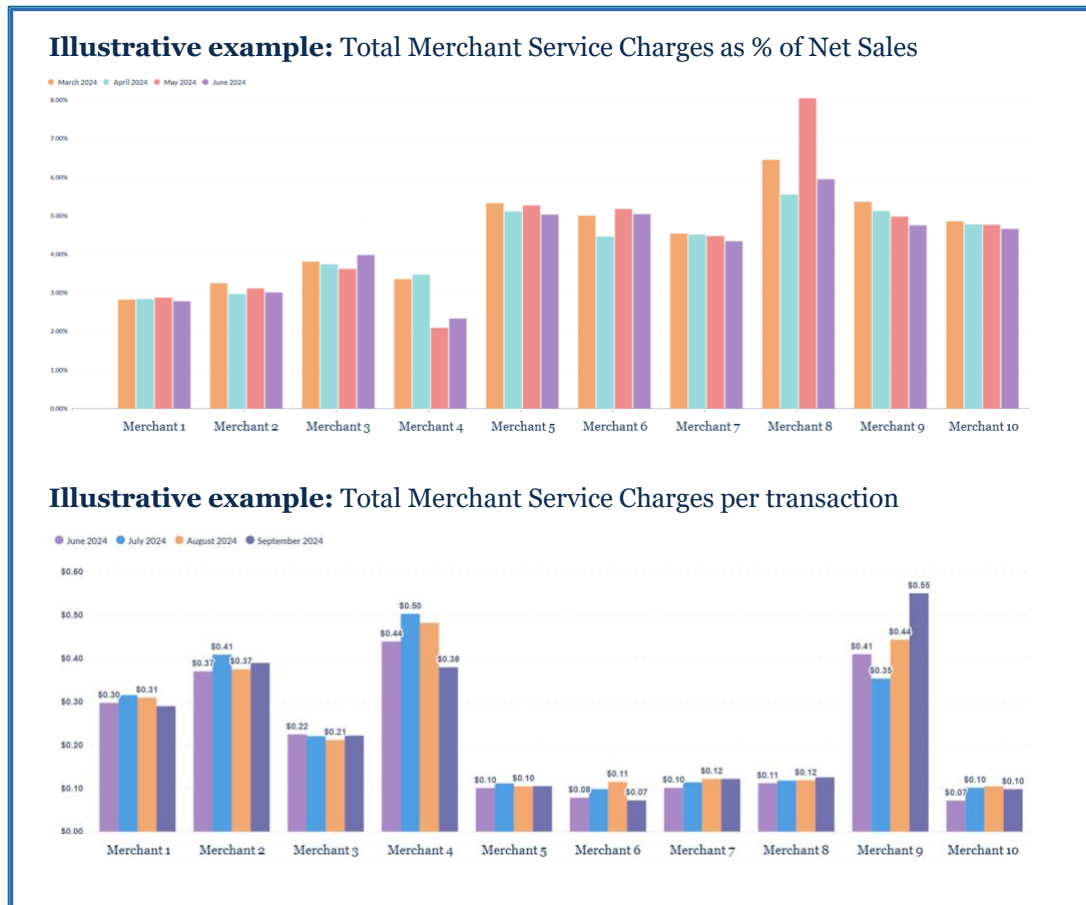
Figure 2: Fee Monitoring Dashboard

3.4.2 Debt Management

Understanding declined payments is crucial in minimizing losses. The Cal-ITP payment dashboard tool for debt management monitors declined transactions by analyzing response codes and issuing banks to promptly identify potential issues, such as fraud from retokenization (re-loading a card into a wallet). By tracking declined transactions, agencies can quickly spot anomalies and maintain a low rate of unrecoverable debt. The state of California performs monthly monitoring of declined transactions on a central level, investigating any anomalies or high levels of declined transactions and working with the transit processor(s) and payment processor(s) to solve issues; agencies also have access to this dashboard and can monitor their declined payments.
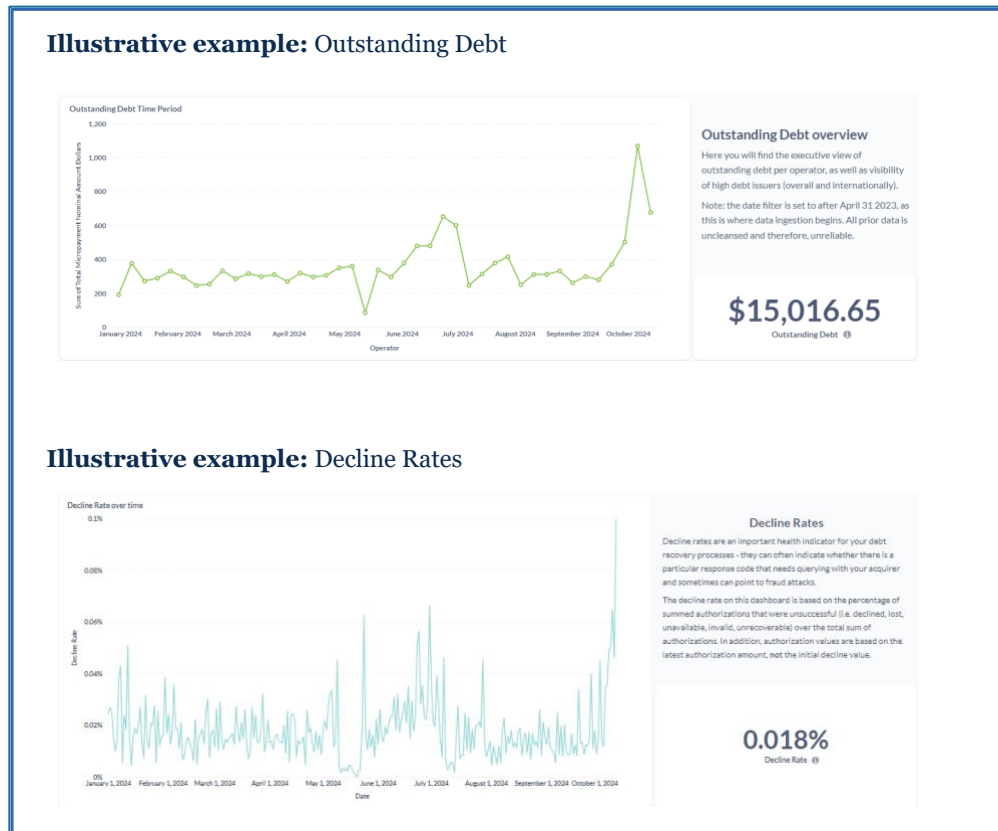
Figure 3: Debt Management Dashboard

3.4.3 Journey-to-Cash Financial Reconciliation

Finance teams at transit agencies new to open loop payments often need help with reconciling transit journeys (taps) with cash in the bank. The automated, transaction-level reconciliation tool provides agencies with a clear view of each journey, ensuring that funds collected from customer journeys are accurately deposited in their accounts. It also allows agencies to streamline their reconciliation process, reducing manual errors, increasing efficiency and improving financial oversight. This tool can assist agencies in automating their reconciliation tasks, ensuring greater transparency and accuracy in financial operations.
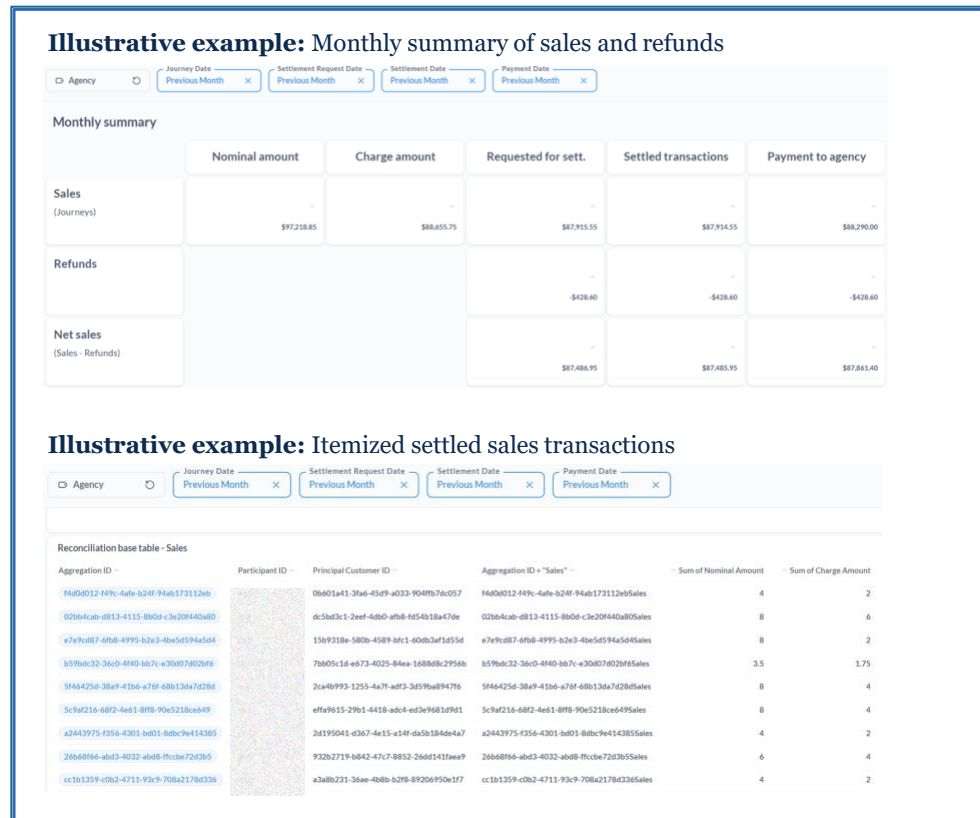
Figure 4: Reconciliation Dashboard[5]

3.4.4 Payment Aggregation Insights

Aggregating several trips into one payment transaction helps reduce fixed processing costs for transit agencies, but it also introduces potential risks, such as increased bad debt and variations in customer experience. The Cal-ITP tool evaluates the benefits of aggregation, allowing agencies to weigh the cost-saving benefits against any operational risks. This tool can provide detailed insights into how much agencies are saving on transaction fees through payment aggregation.

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[5] For confidentiality, certain values have been obscured.

Illustrative example: Average number of trips in aggregations with more than one trip

Illustrative example: Estimated aggregation savings
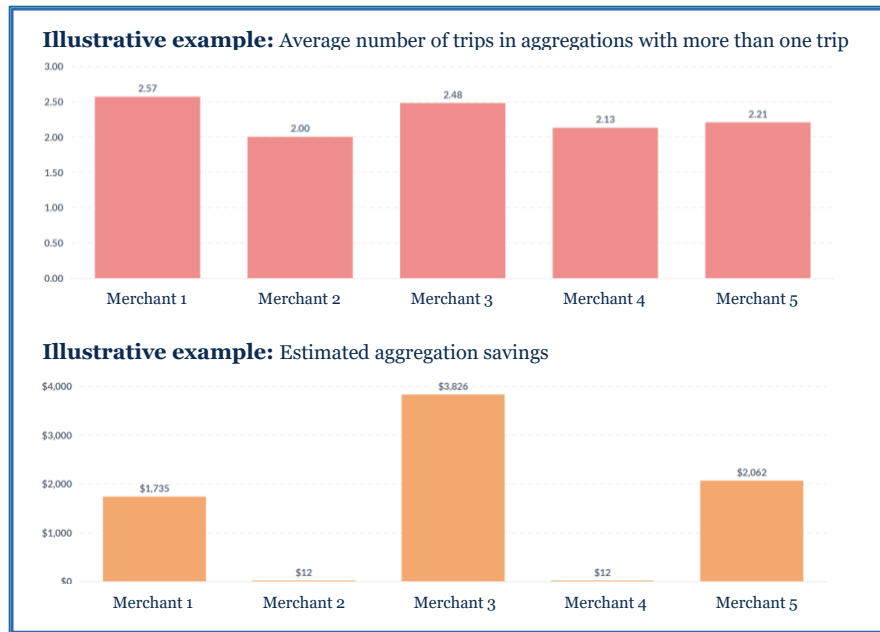
Figure 5: Payments Aggregation Insights Tool

For questions or support, please reach out to a Cal-ITP payment specialist at hello@calitp.org.

Part IV. Mass Transit Transaction Model

The Mass Transit Transaction Model (MTT) describes the standards for secure contactless payment acceptance at turnstiles and validators onboard transit vehicles such as buses and streetcars. MTT was created by the payment networks to ensure alignment of the industry stakeholders; establish rules of engagement; and address specific requirements of the transit industry, such as fare policy, processing speed, and fare inspection.

Each payment network has their own mass transit transaction model (documentation is available after registration on their respective sites) with different levels of details and topics covered. It is the responsibility of the payment processors and acquirers to harmonize the rules and requirements of all networks to provide a consistent service to transit agencies. Nonetheless, the exact implementation is also dependent on transit agency requirements and allocation of roles and responsibilities between other participants in the system architecture. Agencies have the flexibility to decide on key aspects such as whether to use aggregation, appoint a systems integrator (SI) to serve as the merchant of record, or adopt a modular approach.

The main differences between transit payment processing (in a contactless environment) and standard retail payment processing are delayed full authorization, first ride risk, debt recovery, usage of PAR (Payment Account Reference), and aggregation.

4.1 Delayed Full Authorization

A standard retail authorization usually takes about 2 seconds. During this time, the payment processor sends the authorization request to the payment network; the payment network sends it to issuer; and relays the issuer's response back following the same route. As a result, there is often a short delay when tapping your bank card at the supermarket before you hear the "approved" beep from the terminal.

This time delay can be problematic in transit operations, for example when passengers are attempting to board a bus or pass through a subway turnstile during rush hour. Thus, instead of full authorization a "basic" check of the card at the terminal is performed (typically consisting of verifying the Payments Account Number (PAN), card expiration date, and checking against the deny list).

While this approach provides an optimal rider experience, it introduces risk since the transit agency has not received issuer approval for the authorization. The deferred authorization of funds typically happens at the end of a travel period (either shortly after the tap or at the end of a 24-hour period if an agency aggregates transactions). This risk is called First Ride Risk (FRR) and is described in further detail in the next section

4.2 First-ride risk (FRR)

In the card networks' transaction processing rules, the issuer will only pay the merchant for approved authorizations, so transit agencies are fully responsible for FRR. However, given that a better rider experience benefits everyone, including payment networks and issuers, payment networks have introduced a shared liability framework.

Shared liability enables transit agencies to recover a portion of the fare from a single journey or transaction if authorization is declined by the issuer. In such cases, the issuer compensates the agency for the loss up to a set amount. It's crucial for agencies to understand the shared liability threshold, which is determined by payment networks and varies across jurisdictions. In the U.S., the threshold is currently set to "0" for Visa and Mastercard. Cal-ITP is actively collaborating with the payment ecosystem to reduce financial risks for agencies.

4.3 Debt recovery framework

When there is an outstanding unpaid fare, a card is added to a "deny list" by the transit processor and the card cannot be used to enter the transit system. Removing the card from that list can be done through a debt recovery process two ways.

Cardholder-initiated debt recovery:

Cardholder-initiated debt recovery occurs when a rider attempts to use a card at a reader/terminal that is on the deny list. While access to the system or service won't be granted, the tap itself triggers an authorization for the amount of the unpaid debt. If the authorization is successful, the rider may need to wait for a period of time before the deny list is updated; their card is removed from the list; and they're permitted to travel again. The amount of time they will need to wait can range from 15 minutes to a couple of hours.

Merchant-initiated debt recovery:

Merchant-initiated debt recovery involves authorizations that are sent automatically, up to a defined limit (e.g. 4 authorization attempts permitted within 14 days), until an unpaid fare is recovered, or the number of permitted attempts is reached. Like cardholder-initiated debt recovery, once the unpaid fare is collected the card is removed from the deny list. It is important that the transit processor does not exceed the number of permitted authorization attempts, otherwise an agency risks receiving excessive authorization/reattempt fees.

Transit agencies should be aware of how the debt recovery process works to inform decision-making and provide better customer experience; understand how they can improve bad debt recovery rates; and to avoid unnecessary scheme fees.

4.4   Aggregation

Aggregation, also referred to as "accumulation," means combining all the fare "taps" (or rides) for each unique card used in a system into one payment.

 Instead of sending a transaction each time the customer's contactless EMV card (physical or virtual) is tapped against a payment acceptance device, the system combines the transactions across a preset threshold. The threshold could be set for a period of time or for a dollar value cap. When that threshold is reached, a total fare is calculated and a payment request is submitted to the system (to the payment processor, to the network, and then to the issuing bank) and the clock/dollar value is reset to zero.

Agrregating individual rides reduces the total number of payments that are processed and reduces fixed fees. While aggregation models have varied somewhat in the past, the standard approach is a 1-day / end-of-day model.

Transit agencies should carefully consider the pros and cons of aggregating transactions. It can reduce interchange, scheme fees, and payment processing fees, but it also increases the risk of uncollectable fares since average payment transaction values will increase. Another factor is the impact on customer experience. Without aggregation, the "one-tap-equals-one bank charge" model resembles retail transactions, providing customers with immediate, detailed transit spending information. In contrast, aggregation delays fare processing until the end of the day, with transactions appearing in bank accounts well after the transit trip was taken.

Educating customers about the use of aggregation is crucial to managing expectations and ensuring a smooth transition.

Appendix A – Test Case Scenario Examples

Please note that Use Cases #1-5 are generally applicable across various transit agencies to validate end-to-end connections. Use Cases #6-9 are examples of test cases that are tailored to an agency's business rules.

The examples below are not exhaustive but include common business rules for testing zone-based or distance-based fares, group travel, fare capping, or other variations based on the mode of transport (e.g. number of readers on a vehicle).

Cal-ITP is available to assist agencies in preparing scenarios that align with their specific needs as the list of scenarios will be unique to each agency.

Use Case	Preconditions	Test Steps	Expected Result
End-to-End Use Cases			
1. To validate a contactless card tap is successfully accepted	Tester to ensure the card has enough funds to cover the transaction.	Tap the card on the reader	Approved message will appear on validator screen
		Wait for 'x' mins and check the tap *(time can be configured by device vendor)*	Tap data can be seen on a transactions page (if the fare is supplied by device then you will see the transaction authorized)
		Confirm the correct fare has been deducted from the card	Account should be debited successfully
2. To test tap-based debt recovery using a US bank contactless card	Card has insufficient funds (e.g. zero amount)	Tap the card on the reader with a valid US bank issued card with insufficient funds for the full fare	Approved message will appear on validator screen
		Wait for 'x' mins and check the tap data *(The time can be configured by device vendor)*	You should see the tap with a declined status.

Check if the card is placed under a 'deny status' |
| | | Check if a fare has been deducted from the card | Account should not be debited with the fare amount |
| | | Load card with sufficient funds to cover the transactions. After 'x' mins, tap the same card once again on the reader *(time can be reconfigured by device vendor)* | This time the tap should be declined on the validator |

		Wait for 'x' mins and check the tap data *(time can be configured by device vendor)*	Tap should be accepted and the card out of 'Deny status'
		Wait about 'x' mins and tap again (use the same card)	Tap should be accepted this time on the validator in 'x' mins (configurable by device vendor)
		Check if a fare has been deducted from the card	Account should not be debited again
3. To test Merchant initiated debt recovery using a contactless card	Card has insufficient funds (e.g. zero amount)	Perform a Tap on the validator with a valid card. This should be done with a card that doesn't have sufficient funds for the full fare	Approved message will appear on validator screen
		After 'x' mins *(configurable by Device vendor),* check the tap in the online portal	Under transactions page in the portal, you should see tap in declined status Now check if the card is placed under 'Deny status'
		Check if a fare has been deducted from the card	Account should not be debited with the fare amount
		Check the same transaction after 24 hours (based on end of the aggregation)	The status of transaction should have changed from Declined to Authorize if the debt recovery was successful
4. To refund a settled transaction	Settled status should be indicated	Submit a refund request	Refund request is raised successfully
		After about 'x' mins (configurable), check the status of the transaction	The transaction should be reflected as refunded successfully on transactions page
		After about 'x' mins (configurable), check the funds are visible in the bank account of the card	The refunded amount should be visible in the bank account of the card used.

5. To test unsupported cards or schemes (negative test)	Tap a EMV card or scheme which is not supported by the vendor	Tap the card on the reader	The tap should not be accepted, and reader should show a decline message

Use Cases to Accommodate Business Rules			
6. For distance-based fare structures only: tap on without tapping off	Card should on the accept list, and not on the deny list.	Tap the card on the reader	a. The tap should be accepted, and validator should show an approve message on the screen. b. After waiting "x" hours, the tap will be processed with the initial fare value and the transaction should show on the transactions screen with an incomplete charge

7a. To test passback rule, for a vehicle with multiple readers onboard: Tap on and off at same stop within 2 minutes, different validators	Card should on the accept list, and not on the deny list Two different readers should be used. One should be configured as the primary	Tap the card on reader #1 - approved. Tap the card on reader #2 (within 2 minutes) - pass back message	The first tap should be approved. The second tap results in an "Error" message

7b. To test passback rule, for a vehicle with a single reader onboard: Tap on and off at same stop within 2 minutes, different validators	Card should on the accept list, and not on the deny list	Tap the card on the reader - approved. Tap the same card on reader again within a few seconds - pass back message.	The first tap should be approved. The second tap results in an "Error" message

8. To test group travel: to validate a contactless card is successfully accepted	Tester to ensure the card has enough funds to cover the transaction	Tap the card in the reader. Wait for a few seconds. Tap the same card on the reader	The first tap should be accepted. The second tap should also be accepted

9a. To test the fare cap (daily cap)	Tester to ensure the card has enough funds to cover the transaction Full test cycle should be completed using the same PAN or card.	Tap the card according to the 1-day limit to reach the capping limit	The maximum fare should be charged once the desired fare cap value or the specified number of journeys for the day is reached. After this cap is activated, any additional journeys will be charged at $0
9b. To test the fare cap (weekly cap)	Tester to ensure the card has enough funds to cover the transaction Full test cycle should be completed using the same PAN or card.	Tap the card for 7 days based on the applied rules (e.g. Monday – Sunday)	The maximum fare should be charged once the desired fare cap value or the specified number of journeys for the week is reached. After this cap is activated, any additional journeys will be charged at $0
9c. To test the fare cap (monthly cap)	Tester to ensure the card has enough funds to cover the transaction Full test cycle should be completed using the same PAN or card	Tap the card for e.g., 31 days based on the applied rules	The maximum fare should be charged once the desired fare cap value or the specified number of journeys for the month is reached. After this cap is activated, any additional journeys will be charged at $0

Table 2: Appendix | Testing Scenarios

Appendix B – Definitions

Term	Definition
Aggregation	Also referred to as "accumulation", this is the term given to combining payment purchase transactions (in transit these would be fare "taps") for each unique bank card/token used in a system.
Bank card	A bank card refers to any card issued by a bank, such as an ATM card, debit card, credit card, or prepaid card.
Capping	A method to limit or "cap" the fares paid by a customer in a certain time-period, typically at the price of an existing pass (e.g. daily or weekly pass).
Closed payment (closed loop) system	A transit fare payment system that uses fare media that can only be used within a single transit system or partnership of transit systems. All proprietary fare payment systems are closed loop systems.[6]
Contactless card	Credit or debit card that use radio-frequency identification (RFID) or near-field communication (NFC) for making secure payments, allowing customers to 'tap' their card for payment.
Deny list	A list of cards (including PANs, tokens, PARs etc.) that must not be accepted for travel due to an outstanding debt or other reasons (e.g. card previously noted as lost or stolen.)
EMV	EMV is a payment method based upon a technical standard for smart payment cards and for payment terminals and automated teller machines that can accept them (EMV stands for "Europay, Mastercard, and Visa", the three companies that originally created the standard).
Interchange fee	Interchange is a fee exchanged between banks for processing card-based transactions. This fee is typically paid by the merchant's payment processor (the "payment processor") to the cardholder's bank (the "issuer"). Interchange rates are published twice yearly by the payment schemes in coordination with the largest issuing banks.
Issuer	The bank or financial institution associated with the cardholder ("the customer").

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[6] Wallischeck et al. "Preliminary Strategic Analysis of Next Generation Fare Payment Systems for Public Transportation" (2015)

Term	Definition
Merchant service charge (MSC)	The collective term for three fees that are gathered and distributed by a transit agency's payment processor. • **Payment processing fees**: Retained by the payment processor for their services • **Scheme fees**: Paid to the payment networks (e.g., Visa, Mastercard, etc.) • **Interchange fees**: Paid to the customer's bank (issuer) to cover costs and assessed risks in approving payments
Open payment (open loop) system	An account-based transit fare payment system that can accept third-party payment media such as bank cards and mobile device as its fare media.
Pay-as-you-go (PAYG)	Customers only pay for actual use, by tapping their card or mobile phone upon entering public transport (can be either through open-loop payments, which charges the rider's credit or debit card for the journey, or through a closed loop fare card, which deducts the single fare amount from the rider's stored-value card).
Payment account reference (PAR)	The unique non-financial identifier assigned to a cardholder's payment account.
Payment network	Organizations that enable the electronic transfer of funds between individuals, businesses, or financial institutions, including American Express, Discover, Mastercard, and Visa.
Payment processor	Also referred to as the "payment processor," a bank or financial institution that processes credit or debit card payments on behalf of a merchant.
Payment Processing Fee	Transit agencies are charged a fixed fee per transaction for payment processing. These fees are retained by the payment processor for their services.
Scheme Fees	Scheme fees are paid by payment processors to payment networks like Visa, Mastercard, American Express and Discover for accepting and processing debit and credit card payments. Scheme fees can either be a percentage of overall transaction value, or a fixed cost related to transaction volumes.

Term	Definition
Token	A token is a unique, non-financial identifier for a rider's chosen payment method. Tokenization helps to prevent sensitive financial information being revealed if a fare payment system happens to get compromised.
Validator	Equipment for accepting and processing contactless EMV payments.

Table 3: Appendix | Definitions